# CITY AND COUNTY OF DENVER

## STATE OF COLORADO

DENVER
THE MILE HIGH CITY

## DEPARTMENT OF PUBLIC WORKS

**Contract Documents**

**Contract Number: 201950389**

**27th Street Storm Interceptor, Phase 2**

**May 29, 2019**

DENVER
THE MILE HIGH CITY

# NOTICE OF APPARENT LOW BIDDER

**CONCRETE WORKS OF COLORADO, INC.**
**1260 Rock Creek Circle,**
**Lafayette, Colorado 80026**

The EXECUTIVE DIRECTOR OF PUBLIC WORKS has considered the Bids submitted on **July 18, 2019,** for work to be done and materials to be furnished in and for:

**CONTRACT NO: 201950389, 27th STREET STORM INTERCEPTOR, PHASE 2**

as set forth in detail in the Contract Documents for the City and County of Denver, Colorado. It appears that your Bid is fair, equitable, and to the best interest of the City and County; therefore, said Bid is hereby accepted at the bid price contained herein, subject to the approval and execution of the Contract Documents by the City in accordance with the Charter of the City and County of Denver, and to your furnishing the items specified below. The award is based on the total bid items: **(01-21.16.01 through 50-1: Ninety Four (94) total bid items,** the total estimated cost thereof being: **Five Million, One Hundred Thirty-Five Thousand, Nine Hundred Ninety-Eight Dollars, and No Cents ($5,135,998.00).**

It will be necessary for you to appear forthwith at the office of the Department of Public Works, Contract Administration, 201 W. Colfax Ave., Dept 614, Denver, Colorado 80202, to receive the said Contract Documents, execute the same and return them to the Department of Public Works, Contract Administration within the time limit set forth in the Bid Package Documents.

In accordance with the requirements set forth in the Contract Documents, you are required to furnish the following documents:

a. Insurance Certificates: General Liability and Automotive Liability, Workman's Compensation and Employer Liability;
b. Payment and Performance Bond along with One original Power of Attorney relative to Performance and/or Payment Bond; and,

All construction Contracts made and entered into by the City and County of Denver are subject to Affirmative Action and Equal Opportunity Rules and Regulations, as adopted by the Manager of Public Works, and each contract requiring payment by the City of one-half million dollars ($500,000.00) or more shall first be approved by the City Council acting by ordinance and in accordance with Section 3.2.6 of the Charter of the City and County of Denver.

Prior to issuance of Notice to Proceed, all Equal Opportunity requirements must be completed. Additional information may be obtained by contacting the Director of Contract Compliance at (720-913-1700).

DENVER
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**NOTICE OF APPARENT LOW BIDDER**
CONTRACT NO. 201950389
Page 2

The Bid Security submitted with your Bid, will be returned upon execution of the Contract and furnishing of the Performance Bond. In the event you should fail to execute the Contract and to furnish the performance Bond within the time limit specified, said Bid Security will be retained by the City and County of Denver as liquidated damages, and not as a penalty for the delay and extra work caused thereby.

Dated at Denver, Colorado this 31st day of July 2019.

CITY AND COUNTY OF DENVER

By Eulois Cleckley
Eulois Cleckley
Executive Director of Public Works

cc: (CAO), Treasury (taxauditadmin@denvergov.org), DSBO Inbox (dsbo@denvergov.org), KellyCrum, Prevailing Wage(prevailingwage@denvergov.org), File.

# CITY AND COUNTY OF DENVER

## STATE OF COLORADO

DENVER
THE MILE HIGH CITY

## DEPARTMENT OF PUBLIC WORKS

**Bid Form Package**

**Contract Number: 201950389**

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**27th Street Storm Interceptor, Phase 2**

**May 29, 2019**

# CITY AND COUNTY OF DENVER
## DEPARTMENT OF PUBLIC WORKS

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DENVER
THE MILE HIGH CITY

***This Checklist is provided solely for the assistance of the bidders, and need not be returned by Bidders with your BID FORM PACKAGE.***

## BIDDER'S CHECKLIST

These forms comprise the Bid Form and Submittal Package. Designated forms must be completed and turned in at the time of Bid Opening. Bidders should refer to the Contract Documents, particularly the Instructions to Bidders, accompanying this package, in completing these forms.

| FORM/ PAGE NO. | COMMENTS | COMPLETE |
|---|---|---|
| BF-4 – BF-5 | a.) Legal name, address, Acknowledgment signature and attestation (if required.) | ☐ |
| BF-6+ | a.) Fill in individual bid item dollars and totals in Numerical figures only<br>b.) Complete all blanks<br>c.) Legal name required | ☐<br>☐ |
| BF-7 | a.) Write out bid total or bid totals in words and figures in the blank form space(s) provided<br>b.) Calculate Textura® Construction Payment Management System Fee from chart on pg. BF-3 and write fee in the space provided | ☐ |
| BF-8 | a.) List all subcontractors who are performing work on this project | ☐ |
| BF-9 – BF-10 | a.) Fully complete List of Proposed Minority /Woman Business Enterprise Bidders, Subcontractors, Suppliers, Manufacturers, or Brokers – check appropriate boxes. | ☐ |
| BF-11 | a.) Complete all blanks<br>b.) If Addenda have been issued, complete bottom section. | ☐<br>☐ |
| BF-12 | a.) Complete appropriate sections - signature(s) required.<br>b.) If corporation, then corporate seal required. | ☐<br>☐ |
| BF-13 | a.) Fully complete Commitment to Participation | ☐ |
| BF-16 | a.) If applicable, fully complete Joint Venture Affidavit (Submit 10 days prior to Bid Opening date) | ☐ |
| BF-17 – BF-19 | a.) If applicable, fully complete Joint Venture Eligibility Form (Submit 10 days prior to Bid Opening date) | ☐ |
| BF-20 | a.) Fill in all Bid Bond blanks<br>b.) Signatures required<br>c.) Corporate Seal if required<br>d.) Dated<br>e.) Attach Surety Agents Power of Attorney<br>or<br>Certified or cashier's check made out to the Manager of Revenue referencing Bidder's Company and Contract Number. | ☐<br>☐<br>☐<br>☐<br>☐ |
| BF-21- BF-24 | a.) Each bidder, as a condition of responsiveness to this solicitation, shall complete and return the "Diversity and Inclusiveness in City Solicitations Information Request Form" with their Bid. | ☐ |

**Textura ® Construction Payment Management System ("Textura")**

**Bidder recognizes and agrees that it shall be required to use the Textura® Construction Payment Management System ("Textura") for this Project to request payment from the City and to pay subcontractors. All certified subcontractors or suppliers who are listed for participation towards any assigned program goal must be paid via Textura. All fees associated with Textura are to be paid by the bidder for billings for work performed. Bidders are required, when preparing a bid, to enter the price of Textura on the line provided for the service. The fee is all inclusive of all subcontractor, project and subscription fees associated with Textura. The bidder will calculate the fee based on their total bid (not including any alternates, if applicable) and the table below, and then include it on the line item provided in the bid form labeled "Textura® Construction Payment Management System Fee". This expense becomes part of the contract and billable to the City. All costs including, but not limited to, costs associated with training, entering data, and/or utilizing Textura other than the Textura Construction Payment Management System Fee are overhead and shall not be reimbursed by the City. Bidder will be responsible for any tax on the Textura fee. As with other taxes, the City will not reimburse bidder for this cost and therefore this cost should be included in bidder's bid. Textura will invoice the awarded bidder directly.**

| Project Value | Project Fee (GC + Sub Usage) |
|---|---|
| $100,000 – 249,999.99 | $780 |
| $250,000 - $499,999.99 | $1,625 |
| $500,000 - $999,999.99 | $3,250 |
| $1,000,000 - $2,999,999.99 | $5,850 |
| $3,000,000 - $4,999,999.99 | $9,100 |
| $5,000,000 - $9,999,999.99 | $12,220 |
| $10,000,000 - $19,999,999.99 | $20,345 |
| $20,000,000 - $49,999,999.99 | $32,500 |
| $50,000,000 - $99,999,999.99 | $48,750 |
| $100,000,000 - $199,999,999.99 | $69,095 |
| $200,000,000 - $299,999,999.99 | $85,345 |
| $300,000,000 - $399,999,999.99 | $109,720 |
| $400,000,000 - $499,999,999.99 | $142,220 |
| $500,000,000 - $999,999,999.99 | $162,500 |
| $1,000,000,000 - $1,999,999,999.99 | $345,345 |
| $2,000,000,000 - $4,999,999,999.99 | $650,000 |
| $5,000,000,000 - $9,999,999,999.99 | $1,015,625 |
| $10,000,000,000 or greater | $1,503,125 |

**For more information:**

http://www.denvergov.org/content/denvergov/en/contract-administration/bidding-process.html

# CITY AND COUNTY OF DENVER
# DEPARTMENT OF PUBLIC WORKS

## BID FORM AND SUBMITTAL PACKAGE ACKNOWLEDGMENT

**CONTRACT NO. 201950389**

**27th STREET STORM INTERCEPTOR, PHASE 2**

**BIDDER:** Concrete Works of Colorado, Inc.
**(Legal Name per Colorado Secretary of State)**

**ADDRESS:** 1260 Rock Creek Circle
Lafayette, CO 80026

**CONTACT PERSON FOR ALL MATTERS RELATING TO THIS DOCUMENT:**

**NAME:** ReaAnn Fletcher **TITLE:** Contracts Manager

**EMAIL:** reaannf@cwc-email.com **PHONE NUMBER:** 303-665-2933, EXT 110

The undersigned bidder states that the undersigned bidder has received and had an opportunity to fully and thoroughly examine a complete set of the Contract Documents for **Contract No. 201950389, 27th STREET STORM INTERCEPTOR, PHASE 2,** made available to the undersigned bidder pursuant to Notice of Invitation for Bids dated May 29, 2019.

The undersigned bidder acknowledges that a complete and final set of the Contract Documents for the referenced Project, the components of which are identified below, are bound and maintained as the record set of Contract Documents by the Contract Administration Division of the Department of Public Works and that this Record Set is available for examination by the undersigned bidder.

The undersigned bidder, having thoroughly examined each of the components identified below and contained in Contract Documents, HEREBY SUBMITS THIS BID FORM AND SUBMITTAL PACKAGE, fully understanding that the Contract Documents, as defined in Paragraph 1 of the contract, including this executed Bid Form and Submittal Package, constitute all of the terms, conditions and requirements upon which this submission is based and further understanding that, by submission of this Bid Form and Submittal Package, the City shall rely on the representations and commitments of the undersigned bidder contained herein.

The following completed documents comprising this Bid Form and Submittal Package will be included with and, by this reference, are expressly incorporated into the Contract Documents specified at Paragraph 1 of the Contract:

Bid Form and Submittal Package Acknowledgment Form
Bid Form
List of Proposed Minority/Woman Owned Business Enterprise(s)
Commitment to Minority/Woman Owned Business Enterprise Participation
Minority/Woman Owned Business Enterprise(s) of Intent
Joint Venture Affidavit (if applicable)
Joint Venture Eligibility Form (if applicable)
Bid Bond
Certificate of Insurance

The following designated documents constitute that portion of the Contract Documents made available by the Notice of Invitation for Bids, but not included in the Bid Form and Submittal Package:

Notice of Invitation for Bids
Instructions to Bidders
Addenda (as applicable)
Equal Employment Opportunity Provisions (Appendix A and Appendix F)
Contract Form
General Contract Conditions
Special Contract Conditions
Performance and Payment Bond
Notice to Apparent Low Bidder
Notice to Proceed
Contractor's Certification of Payment Form
Final/Partial Lien Release Form
Final Receipt
Change Orders (as applicable)
Federal Requirements (as applicable)
Prevailing Wage Rate Schedule(s)
Technical Specifications
Contract Drawings
Accepted Shop Drawings

The undersigned bidder expressly assumes responsibility for the complete contents of these designated documents as bound together with the Bid Form and Submittal Package submitted herewith and designated the Contract Documents.

IN WITNESS WHEREOF, the undersigned bidder has signed personally or by duly authorized officer or agent and duly attested.

**BIDDER:**

**Name:** Concrete Works of Colorado, Inc.

**By:** ReaAnn Fletcher
ReaAnn Fletcher

**Title:** Contracts Manager

**ATTEST:**

**By:** Monica Olson

[SEAL]

Concrete Works of Colorado, Inc.
A Colorado Corporation

# CITY AND COUNTY OF DENVER
# DEPARTMENT OF PUBLIC WORKS

## BID FORM

**CONTRACT NO. 201950389**
**27th STREET STORM INTERCEPTOR, PHASE 2**

**BIDDER** Concrete Works of Colorado, Inc.
**(Legal Name per Colorado Secretary of State)**

**TO:** The Manager of Public Works
City and County of Denver
c/o Contract Administration
201 West Colfax, Dept. 614
Denver, Colorado 80202

The Undersigned Bidder, having examined the plans, technical specifications, and remainder of the proposed Contract Documents as designated and enumerated in the General and Special Contract Conditions and any and all addenda thereto; having investigated the location of and conditions affecting the proposed Work; and being acquainted with and fully understanding the extent and character of the Work covered by this bid, and all factors and conditions affecting or which may be affected by Work, HEREBY SUBMITS THIS BID, pursuant to an advertisement of a Notice of Invitation for Bids as published on **May 29, 2019**, to furnish all required materials, tools, appliances, equipment and plant; to perform all necessary labor and to undertake and complete: **CONTRACT NO. 201950389, 27th STREET STORM INTERCEPTOR, PHASE 2,** in Denver, Colorado, in full accordance with and conformity to the Plans, Technical Specifications, and Contract Documents hereto attached or by reference made a part hereof, at and for the following price(s) set forth on this Bid Form.

The following documents, which taken as a whole constitute the Contract Documents for this Project, and which are incorporated herein, by reference, were made available to the Bidder as provided in the Advertisement of Notice of Invitation for Bids, were received by the bidder, and form the basis for this bid:

*Advertisement of Notice of Invitation for Bids*
*Instructions to Bidders*
*Commitment to M/WBE Participation*
*Article III, Divisions 1 and 3 of Chapter 28, D.R.M.C.*
*Bid Bond*
*Addenda (as applicable)*
*Equal Employment Opportunity Provisions (Appendix A and Appendix F)*
*Bid Form*
*Contract Form*
*General Contract Conditions*
*Special Contract Conditions*
*Performance and Payment Bond*
*Notice to Apparent Low Bidder*
*Notice to Proceed*
*Contractor's Certification of Payment Form*
*Final/Partial Lien Release Form*
*Final Receipt*
*Change Orders (as applicable)*
*Federal Requirements (as applicable)*
*Prevailing Wage Rate Schedule(s)*
*Technical Specifications*
*Contract Drawing*
*Accepted Shop Drawings*
*Certificate of Insurance*

## *Bid Form*

### *27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | | Estimated Cost |
|---|---|---|---|---|---|
| 01-21.16.01 | **ALLOWANCE FOR TREE REMOVAL, TRIMMING/ REPLACEMENT AND DISPOSAL - SEE PROJECT SPECIAL PROVISIONS** | | | | |
| | at the unit price of $ Twenty Thousand Dollars and No Cents | 1 | A/A | $ | 20,000.00 |
| | true and verifiable costs + mark up | | | | |
| 01-21.19.01 | **ALLOWANCE FOR CERTIFIED ASBESTOS BUILDING INSPECTOR (CABI)/AIR MONITOR(HOURLY) - SEE PROJECT SPECIAL PROVISIONS** | | | | |
| | at the unit price of $ Twenty Thousand Dollars and No Cents | 1 | A/A | $ | 20,000.00 |
| | true and verifiable costs + mark up | | | | |
| 01-52.13 | **TEMPORARY OFFICE FACILITIES** | | | | |
| | at the unit price of 34,150.00 | 1 | LS | $ | 34,150.00 |
| | lump sum | | | | |
| 2-1.2a | **REMOVE 6" CONCRETE CURB AND/OR GUTTER** | | | | |
| | at the unit price of 5.00 | 2,279 | LF | $ | 11,395.00 |
| | per linear foot | | | | |
| 2-1.4 | **REMOVE SIDEWALK ACCESSIBILITY CONCRETE CURB RAMP** | | | | |
| | at the unit price of 5.00 | 5,060 | SF | $ | 25,300.00 |
| | per square foot | | | | |
| 2-2.1 | **REMOVE CONCRETE SIDEWALK** | | | | |
| | at the unit price of 3.00 | 2,220 | SF | $ | 6,660.00 |
| | per square foot | | | | |
| 2-2.2 | **REMOVE CONCRETE DRIVEWAY PAVING** | | | | |
| | at the unit price of 4.00 | 800 | SF | $ | 3,200.00 |
| | per square foot | | | | |
| 2-3.3 | **REMOVE CONCRETE ALLEY PAVING** | | | | |
| | at the unit price of 4.00 | 2,937 | SF | $ | 11,748.00 |
| | per square foot | | | | |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | | Estimated Cost |
|---|---|---|---|---|---|
| 2-5 | **REMOVE CONCRETE RETAINING WALL**<br>*Add'l Info: FOR RAMP AT 27TH & CURTIS*<br>at the unit price of 10.00<br>per linear foot | 100 | LF | $ | 1,000.00 |
| 2-11.2b | **REMOVE EXISTING 10" STORM SEWER PIPE**<br>*Add'l Info: VCP*<br>at the unit price of 39.00<br>per linear foot | 248 | LF | $ | 9,672.00 |
| 2-11.2d | **REMOVE EXISTING 15" STORM SEWER PIPE**<br>*Add'l Info: VCP*<br>at the unit price of 39.00<br>per linear foot | 409 | LF | $ | 15,951.00 |
| 2-11.2q | **REMOVE EXISTING 66" STORM SEWER PIPE**<br>*Add'l Info: 63x42 OVOID BRICK*<br>at the unit price of 98.00<br>per linear foot | 77 | LF | $ | 7,546.00 |
| 2-11.2s | **REMOVE EXISTING 78" STORM SEWER PIPE**<br>*Add'l Info: 75" VCP*<br>at the unit price of 70.00<br>per linear foot | 983 | LF | $ | 68,810.00 |
| 2-11.5a | **ABANDON EXISTING 8" SEWER PIPE**<br>*Add'l Info: 6" DIP WATER LINE*<br>at the unit price of 13.00<br>per linear foot | 20 | LF | $ | 260.00 |
| 2-11.5a | **ABANDON EXISTING 8" SEWER PIPE**<br>*Add'l Info: 8" PVC WATER LINE*<br>at the unit price of 13.00<br>per linear foot | 60 | LF | $ | 780.00 |
| 2-12.2 | **REMOVE EXISTING STORM MANHOLE**<br>at the unit price of 598.00<br>each | 6 | EA | $ | 3,588.00 |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 2-13.1 | **REMOVE EXISTING STORM INLET**<br>at the unit price of 927.00 each | 14 | EA | $ 12,978.00 |
| 2-17.1 | **REMOVE AND REPLACE/RELOCATE UTILITY POLES**<br>*Add'l Info: INCLUDES SUPPORT OF POLES*<br>at the unit price of 26,960.00 each | 4 | EA | $ 107,840.00 |
| 2-17.3 | **REMOVE AND REPLACE/RELOCATE SIGN**<br>at the unit price of 370.00 each | 25 | EA | $ 9,250.00 |
| 2-17.3 | **REMOVE AND REPLACE/RELOCATE SIGN**<br>*Add'l Info: REMOVE AND RESET BOLLARD*<br>at the unit price of 1,090.00 each | 2 | EA | $ 2,180.00 |
| 2-17.7 | **RELOCATE EXISTING UTILITY**<br>*Add'l Info: COORDINATION WITH UTILITY COMPANIES*<br>at the unit price of 29,000.00 lump sum | 1 | LS | $ 29,000.00 |
| 2-17.7 | **RELOCATE EXISTING UTILITY**<br>*Add'l Info: RELOCATE TRAFFIC OVERHEAD. CONTRACTOR TO PROVIDE SUPPORT POLES.*<br>at the unit price of 31,550.00 lump sum | 1 | LS | $ 31,550.00 |
| 2-20a | **REMOVE TROLLEY TRACKS**<br>at the unit price of 40.00 per linear foot | 180 | LF | $ 7,200.00 |
| 02-22.13 | **VIBRATION ASSESSMENT**<br>at the unit price of 32,290.00 lump sum | 1 | LS | $ 32,290.00 |
| 2-23 | **REMOVE DECORATIVE LANDSCAPING**<br>at the unit price of 17,550.00 lump sum | 1 | LS | $ 17,550.00 |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | | Estimated Quantity | | | Estimated Cost |
|---|---|---|---|---|---|---|
| 3-2 | **HAULING OF CONTAMINATED MATERIALS TO DENVER/ARAPAHOE DISPOSAL SITE (DADS)*LICENSED PER D.R.M.C. 48-62** | | | | | |
| | at the unit price of | 15.00 | 2,000 | TON | $ | 30,000.00 |
| | per ton | | | | | |
| 3-7a | **HEALTH & SAFETY PLAN** | | | | | |
| | at the unit price of | 2,640.00 | 1 | LS | $ | 2,640.00 |
| | lump sum | | | | | |
| 3-7b | **MATERIAL MANAGEMENT PLAN** | | | | | |
| | at the unit price of | 21,040.00 | 1 | LS | $ | 21,040.00 |
| | lump sum | | | | | |
| 5-2a | **SUBGRADE MATERIAL (SELECT BACKFILL)** | | | | | |
| | at the unit price of | 21.00 | 2,000 | TON | $ | 42,000.00 |
| | per ton | | | | | |
| 5-7 | **CONTROLLED LOW STRENGTH MATERIALS (CLSM)** | | | | | |
| | at the unit price of | 158.00 | 100 | CY | $ | 15,800.00 |
| | per cubic yard | | | | | |
| 5-8 | **CRUSHED GRAVEL BASE COURSE (CDOT CLASS 6 ROAD BASE)** | | | | | |
| | at the unit price of | 41.00 | 300 | TON | $ | 12,300.00 |
| | per ton | | | | | |
| 8-1.1b | **6" DIP AWWA C151, CLASS 50 WATER LINE** | | | | | |
| | at the unit price of | 237.00 | 60 | LF | $ | 14,220.00 |
| | per linear foot | | | | | |
| 8-1.1c | **8" DIP AWWA C151, CLASS 50 WATER LINE** | | | | | |
| | at the unit price of | 291.00 | 170 | LF | $ | 49,470.00 |
| | per linear foot | | | | | |
| 8-1.1d | **10" DIP AWWA C151, CLASS 50 WATER LINE** | | | | | |
| | at the unit price of | 411.00 | 40 | LF | $ | 16,440.00 |
| | per linear foot | | | | | |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 8-1.1e | **12" DIP AWWA C151, CLASS 50 WATER LINE**<br>at the unit price of 522.00 per linear foot | 20 | LF | $ 10,440.00 |
| 8-1.1h | **16" DIP AWWA C151, CLASS 50 WATER LINE**<br>at the unit price of 691.00 per linear foot | 20 | LF | $ 13,820.00 |
| 8-1.2b | **INSTALL 6" WATER VALVE**<br>at the unit price of 2,460.00 each | 3 | EA | $ 7,380.00 |
| 8-1.2c | **INSTALL 8" WATER VALVE**<br>at the unit price of 3,000.00 each | 3 | EA | $ 9,000.00 |
| 8-1.3a | **4" PVC AWWA C900, CLASS 200**<br>*Add'l Info: REMOVE AND REPLACE SANITARY SERVICE LINE*<br>at the unit price of 231.00 per linear foot | 50 | LF | $ 11,550.00 |
| 8-1.3b | **6" PVC AWWA C900, CLASS 150**<br>*Add'l Info: SANITARY REPLACEMENT*<br>at the unit price of 130.00 per linear foot | 50 | LF | $ 6,500.00 |
| 8-1.5a | **LEAD SERVICE LINE REPLACEMENT, <2" ID**<br>at the unit price of 130.00 per linear foot | 90 | LF | $ 11,700.00 |
| 8-2 | **REMOVE FIRE HYDRANT ASSEMBLY**<br>at the unit price of 1,900.00 each | 3 | EA | $ 5,700.00 |
| 8-3 | **RESET OR INSTALL FIRE HYDRANT ASSEMBLY**<br>at the unit price of 5,420.00 each | 3 | EA | $ 16,260.00 |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | | Estimated Quantity | | | Estimated Cost |
|---|---|---|---|---|---|---|
| 8-4 | **REMOVE EXISTING WATER LINE**<br>*Add'l Info: REMOVE 6" CML WATER LINE*<br>at the unit price of | 141.00<br>per linear foot | 30 | LF | $ | 4,230.00 |
| 8-4 | **REMOVE EXISTING WATER LINE**<br>*Add'l Info: REMOVE 8" DIP & PVC WATER LINE*<br>at the unit price of | 141.00<br>per linear foot | 100 | LF | $ | 14,100.00 |
| 8-4 | **REMOVE EXISTING WATER LINE**<br>*Add'l Info: REMOVE 10" CIP WATER LINE*<br>at the unit price of | 146.00<br>per linear foot | 40 | LF | $ | 5,840.00 |
| 12-1.1 | **6" CURB AND GUTTER 2' PAN (CD0T T2, IIB)**<br>at the unit price of | 28.00<br>per linear foot | 2,279 | LF | $ | 63,812.00 |
| 12-1.7 | **6" CONCRETE CURB HEAD**<br>*Add'l Info: FOR RAMP AT 27TH & CURTIS*<br>at the unit price of | 28.00<br>per linear foot | 60 | LF | $ | 1,680.00 |
| 12-1.8 | **SIDEWALK ACCESSIBILITY CONCRETE CURB RAMP**<br>at the unit price of | 18.00<br>per square foot | 5,060 | SF | $ | 91,080.00 |
| 12-1.9 | **GUTTER OVERLAY**<br>*Add'l Info: CDOT CLASS D CONCRETE GUTTER OVERLAY WITH FIBER MESH REINFORCEMENT*<br>at the unit price of | 22.00<br>per linear foot | 1,500 | LF | $ | 33,000.00 |
| 12-2.1 | **CONCRETE SIDEWALK**<br>at the unit price of | 12.00<br>per square foot | 1,000 | SF | $ | 12,000.00 |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | | Estimated Quantity | | | Estimated Cost |
|---|---|---|---|---|---|---|
| 12-2.1 | **CONCRETE SIDEWALK**<br>*Add'l Info: PIGMENTED*<br>at the unit price of | 13.00<br>per square foot | 2,000 | SF | $ | 26,000.00 |
| 12-2.1 | **CONCRETE SIDEWALK**<br>*Add'l Info: 8" PIGMENTED FOR RAMP AT 27TH & CURTIS*<br>at the unit price of | 13.00<br>per square foot | 220 | SF | $ | 2,860.00 |
| 12-5.1 | **CONCRETE DRIVEWAY PAVING**<br>at the unit price of | 18.00<br>per square foot | 800 | SF | $ | 14,400.00 |
| 12-5.5 | **CONCRETE ALLEY PAVING**<br>at the unit price of | 17.00<br>per square foot | 2,937 | SF | $ | 49,929.00 |
| 12-16a | **CONCRETE RETAINING WALL**<br>*Add'l Info: FOR RAMP AT 27TH & CURTIS*<br>at the unit price of | 1,710.00<br>lump sum | 1 | LS | $ | 1,710.00 |
| 16-3 | **CHAIN LINK FENCE**<br>*Add'l Info: TREE PROTECTION, INCLUDES TREE WRAP. ALSO INCLUDES FENCE FOR MAINTAINING PEDESTRIAN ACCESS.*<br>at the unit price of | 16.00<br>per linear foot | 2,500 | LF | $ | 40,000.00 |
| 20-2ce | **ASPHALT SURFACE COURSE, SX, RAP 20%, N=100, 64-22.**<br>at the unit price of | 7.00<br>per square yard inch | 17,258 | SY-IN | $ | 120,806.00 |
| 20-3ce | **ASPHALT BASE COURSE, S, RAP 20%, N=100, 64-22.**<br>at the unit price of | 8.00<br>per square yard inch | 47,459 | SY-IN | $ | 379,672.00 |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | | Estimated Quantity | | | Estimated Cost |
|---|---|---|---|---|---|---|
| 20-4 | **ASPHALT ROTOMILL** | | | | | |
| | at the unit price of | 3.00 | 2,000 | SY-IN | $ | 6,000.00 |
| | | per square yard inch | | | | |
| 20-5 | **ASPHALT PATCH** | | | | | |
| | at the unit price of | 7.00 | 6,903 | SY-IN | $ | 48,321.00 |
| | | per square yard inch | | | | |
| 34-2.3d | **15" DIAMETER C-76 RCP, CLASS III** | | | | | |
| | at the unit price of | 174.00 | 115 | LF | $ | 20,010.00 |
| | | per linear foot | | | | |
| 34-2.3e | **18" DIAMETER C-76 RCP, CLASS III** | | | | | |
| | at the unit price of | 176.00 | 292 | LF | $ | 51,392.00 |
| | | per linear foot | | | | |
| 34-2.3g | **24" DIAMETER C-76 RCP, CLASS III** | | | | | |
| | at the unit price of | 215.00 | 17 | LF | $ | 3,655.00 |
| | | per linear foot | | | | |
| 34-2.3p | **60" DIAMETER C-76 RCP, CLASS III** | | | | | |
| | at the unit price of | 1,000.00 | 60 | LF | $ | 60,000.00 |
| | | per linear foot | | | | |
| 34-2.3u | **90" DIAMETER C-76 RCP, CLASS III** | | | | | |
| | at the unit price of | 1,290.00 | 1,500 | LF | $ | 1,935,000.00 |
| | | per linear foot | | | | |
| 34-7.1c | **12" DIAMETER PVC PIPE** | | | | | |
| | *Add'l Info: FOR ROOF DRAIN 1031+05* | | | | | |
| | at the unit price of | 139.00 | 30 | LF | $ | 4,170.00 |
| | | per linear foot | | | | |
| 34-12.4a | **CAST-IN-PLACE TYPE B MANHOLE WITH TYPE A TOP SLAB** | | | | | |
| | at the unit price of | 34,840.00 | 4 | EA | $ | 139,360.00 |
| | | each | | | | |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | | Estimated Quantity | | | Estimated Cost |
|---|---|---|---|---|---|---|
| 34-12.5b | **CAST-IN-PLACE TYPE P MANHOLE WITH TOP SLAB FOR H>2' DEPTH** | | | | | |
| | at the unit price of | 45,370.00 | 2 | EA | $ | 90,740.00 |
| | each | | | | | |
| 34-12.7 | **CAST-IN-PLACE SPECIAL STRUCTURE** | | | | | |
| | *Add'l Info: MH-9* | | | | | |
| | at the unit price of | 101,800.00 | 1 | EA | $ | 101,800.00 |
| | each | | | | | |
| 34-12.7 | **CAST-IN-PLACE SPECIAL STRUCTURE** | | | | | |
| | *Add'l Info: PRECAST CONCRETE PLUG* | | | | | |
| | at the unit price of | 3,220.00 | 1 | EA | $ | 3,220.00 |
| | each | | | | | |
| 34-12.7 | **CAST-IN-PLACE SPECIAL STRUCTURE** | | | | | |
| | *Add'l Info: MH-13* | | | | | |
| | at the unit price of | 187,400.00 | 1 | EA | $ | 187,400.00 |
| | each | | | | | |
| 34-12.8 | **UNCOVER AND RAISE (ADJUST) MANHOLE** | | | | | |
| | *Add'l Info: MEASUREMENT IS EACH* | | | | | |
| | at the unit price of | 1,380.00 | 4 | VF | $ | 5,520.00 |
| | vertical feet | | | | | |
| 34-12.9 | **ADJUST UTILITY LIDS** | | | | | |
| | at the unit price of | 292.00 | 5 | EA | $ | 1,460.00 |
| | each | | | | | |
| 34-15.3 | **UTILITY EXPLORATORY INVESTIGATION** | | | | | |
| | at the unit price of | 512.00 | 20 | EA | $ | 10,240.00 |
| | each | | | | | |
| 34-16.1a | **#14 INLET (L=6')** | | | | | |
| | at the unit price of | 5,260.00 | 4 | EA | $ | 21,040.00 |
| | each | | | | | |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | | Estimated Quantity | | | Estimated Cost |
|---|---|---|---|---|---|---|
| 34-16.1a | **#14 INLET (L=6')**<br>*Add'l Info: SPECIAL(DEEPER THAN 6')*<br>at the unit price of | 6,140.00<br>each | 5 | EA | $ | 30,700.00 |
| 34-16.1b | **#14 INLET (L=9')**<br>at the unit price of | 7,010.00<br>each | 3 | EA | $ | 21,030.00 |
| 34-16.1b | **#14 INLET (L=9')**<br>*Add'l Info: SPECIAL(DEEPER THAN 6')*<br>at the unit price of | 8,040.00<br>each | 4 | EA | $ | 32,160.00 |
| 34-16.2a | **SINGLE #16 INLET WITH OPEN THROAT**<br>at the unit price of | 5,660.00<br>each | 2 | EA | $ | 11,320.00 |
| 40-3 | **SODDING**<br>at the unit price of | 2.00<br>per square foot | 10,000 | SF | $ | 20,000.00 |
| 40-4b | **RELOCATE EXISITING SPRINKLER LINE**<br>at the unit price of | 6.00<br>per linear foot | 3,000 | LF | $ | 18,000.00 |
| 40-6 | **DECORATIVE LANDSCAPING**<br>*Add'l Info: INCLUDES REMOVAL AND REPLACEMENT OF PLANTERS, DECORATIVE BRICK PAVING AND FLAGSTONE, AND GRADING AROUND RAMPS AND SIDEWALK*<br>at the unit price of | 69,770.00<br>lump sum | 1 | LS | $ | 69,770.00 |
| 41-1 | **TRAFFIC CONTROL**<br>*Add'l Info: TO INCLUDE POTENTIAL TEMPORARY 2-WAY CONVERSION OF CHAMPA, STOUT, 27TH STREET*<br>at the unit price of | 198,800.00<br>lump sum | 1 | LS | $ | 198,800.00 |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | | Estimated Quantity | | | Estimated Cost |
|---|---|---|---|---|---|---|
| 43-1d | **STORM WATER MANAGEMENT (SCENARIO 4) See SCS 23.0** | | | | | |
| | at the unit price of | 35,240.00 | 1 | LS | $ | 35,240.00 |
| | lump sum | | | | | |
| 44-1 | **DEWATERING** | | | | | |
| | at the unit price of | 51,700.00 | 1 | LS | $ | 51,700.00 |
| | lump sum | | | | | |
| 45-2 | **QUALITY CONTROL TESTING** | | | | | |
| | at the unit price of | 53,660.00 | 1 | LS | $ | 53,660.00 |
| | lump sum | | | | | |
| 46-1 | **PAVEMENT MARKING (PAINT)** | | | | | |
| | at the unit price of | 2.00 | 470 | SF | $ | 940.00 |
| | per square foot | | | | | |
| 46-4 | **PREFORMED PLASTIC PAVEMENT MARKING** | | | | | |
| | at the unit price of | 12.00 | 500 | SF | $ | 6,000.00 |
| | per square foot | | | | | |
| 47-1 | **CONSTRUCTION SURVEYING** | | | | | |
| | at the unit price of | 42,290.00 | 1 | LS | $ | 42,290.00 |
| | lump sum | | | | | |
| 47-2 | **SURVEY MONUMENTATION** | | | | | |
| | *Add'l Info: RESET RANGE POINT* | | | | | |
| | at the unit price of | 846.00 | 3 | EA | $ | 2,538.00 |
| | each | | | | | |
| 47-2 | **SURVEY MONUMENTATION** | | | | | |
| | *Add'l Info: FOR SURVEY MARKING (OTHER THAN RANGE POINT) TO BE TIED OUT* | | | | | |
| | at the unit price of | 793.00 | 25 | EA | $ | 19,825.00 |
| | each | | | | | |
| 50-1 | **MOBILIZATION** | | | | | |
| | at the unit price of | 173,200.00 | 1 | LS | $ | 173,200.00 |
| | lump sum | | | | | |

| | |
|---|---|
| **Bid Items Total Amount (01-21.16.01 through 50-1 (Ninety-Four[94]) total bid items, with two of them being Allowance Accounts.)** | **$** 5,123,778.00 |
| **Textura ® Fee from table on Page BF-3 (based on Bid Items Total Amount)** | **$** 12,220.00 |
| **Bid Items Total Amount plus Textura® Fee equals Total Bid Amount** | **$** 5,135,998.00 |

**Total Bid Amount:**
Five Million, One Hundred Thirty-five Thousand, Nine Hundred Ninety-eight Dollars and Zero Cents
**Dollars ($** 5,135,998.00 **)**

If the Manager mails a written Notice of Apparent Low Bidder, addressed to the Bidder's business address stated on this Bid Form, the Undersigned Bidder shall, in accordance with the Contract Documents, be ready to, and shall, within five (5) days after the date of the Notice: (i) execute the attached form of Contract in conformity with this bid; (ii) furnish the required proofs of insurance; and (iii) furnish the required bond or bonds in the sum of the full amount of this bid, executed by a surety company acceptable to the Manager.

The Hartford Fire Insurance Co., a corporation of the State of Connecticut, is hereby offered as Surety on said bond. If such surety is not approved by the Manager, another and satisfactory surety company shall be furnished.

Enclosed with this bid is a bid guarantee, as defined in the attached Instructions to Bidders, in the amount of 5% of Total Bid. The Undersigned Bidder agrees that the entire amount of this bid guarantee is to be paid to and become the property of the City as liquidated damages, and not as a penalty, if: (i) the bid is considered to be the best by the City; (ii) the City notifies the Undersigned Bidder that it is the Apparent Low Bidder; and (iii) the Undersigned Bidder fails to execute the Contract in the form prescribed or to furnish the required bond and proofs of insurance, within five (5) days after the date of such notification.

The following persons, firms or corporations are interested with the Undersigned Bidder in this bid:

Name: _____ Name: _____

Address: _____ Address: _____

If there are no such persons, firms, or corporations, please so state in the following space: None.

The Undersigned Bidder proposes to subcontract the following Work in accordance with General Contract Conditions, Title 5, SUBCONTRACTS, and represents that, to the greatest degree practical, all subcontractors known at the time of bid submittal have been identified.

| Item of Work | Percent (%) of Total; Work | Proposed Subcontractor and Address |
|---|---|---|
| Asphalt Paving | 10.17% | Chacon Paving, Inc.<br>1701 E. 114th Place, Northglenn, CO 80233 |
| Trucking | 3.25% | Ralph Martinez Trucking, Inc.<br>7255 Ivanhoe St., Commerce City, CO 80022 |
| QC Testing, Vibration Monitoring | 1.58% | Martinez Associates, Inc.<br>14828 West 6th Ave., Unit 9-B, Golden, CO 80204 |
| Sod, Landscape, Irrigation | 2.21% | Environmental Logistics, Inc.<br>1101 E. 64th Ave., Denver, CO 80229 |
| Pavement Marking | 0.17% | American Striping Co.<br>3075 South Tejon St., Englewood, CO 80110 |
| Health & Safety, Mat'l Mgmt, SWMP Plans | 0.17% | Smith Environmental & Engineering<br>250 Perry Lane, Dacono, CO 80514 |
| | | |
| | | |
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| | | |
| | | |

(Copy this page if additional room is required.)

DENVER
OFFICE OF ECONOMIC DEVELOPMENT

**List of Proposed MWBE Bidders, Subcontractors, Suppliers (Manufacturers) or Brokers**

Office of Economic Development
Division of Small Business Opportunity
Compliance Unit
201 W. Colfax Ave. Dept. 907
Denver, CO 80202
Phone: 720-913-1999
DSBO@denvergov.org

**City & County of Denver Contract No.:** 201950389

The undersigned Bidder proposes to utilize all listed firms. The following MWBE(s) firms listed are **CURRENTLY** certified by the City and County of Denver. Only the level of MWBE participation listed at the bid opening will count toward satisfaction of the project goal. Only bona fide commisions may be counted for Brokers. MWBE prime bidders must detail their bid information below. Please copy and attach this page to list additional MWBE.

**Prime Bidder**

| | | |
|---|---|---|
| Business Name: Concrete Works of Colorado, Inc. | | |
| Address: 1260 Rock Creek Circle, Lafayette, CO 80026 | Contact Person: ReaAnn Fletcher | |
| Type of Service: Prime contractor - concrete & pipe | Dollar Amount: $: N/A | Percent of Project: N/A |

**Certified MWBE Prime Bidder**

| | | |
|---|---|---|
| Business Name: | | |
| Address: | Contact Person: | |
| Type of Service: | Dollar Amount: $: | Percent of Project: |

**Subcontractors, Suppliers Manufacturers or Brokers** (check one box)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| X | Subcontractor (√) | | Supplier (√) | | Manufacturer (√) | | Broker (√) |

| | | |
|---|---|---|
| Business Name: Chacon Paving, Inc. | | |
| Address: 1701 E. 114th Place, Northglenn, CO 80233 | Type of Service: Asphalt Paving | |
| Contact Person: Jose Chacon | Dollar Amount: $: 522,752.00 | Percent of Project: 10.17% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| X | Subcontractor (√) | | Supplier (√) | | Manufacturer (√) | | Broker (√) |

| | | |
|---|---|---|
| Business Name: Ralph Martinez Trucking, Inc. | | |
| Address: 7255 Ivanhoe St., Commerce City, CO 80022 | Type of Service: Trucking | |
| Contact Person: Dianna Martinez | Dollar Amount: $: 167,000.00 | Percent of Project: 3.25% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| X | Subcontractor (√) | | Supplier (√) | | Manufacturer (√) | | Broker (√) |

| | | |
|---|---|---|
| Business Name: Martinez Associates, Inc. | | |
| Address: 14828 W. 6th Ave., Unit 9-B, Golden, CO 80401 | Type of Service: QC Testing & Vibration Monitoring | |
| Contact Person: James Martinez | Dollar Amount: $: 81,304.00 | Percent of Project: 1.58% |

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| Subcontractors, Suppliers Manufacturers or Brokers (check one box) | | | |
|---|---|---|---|
| ☐ Subcontractor (√) | ☐ Supplier (√) | ☐ Manufacturer (√) | ☐ Broker (√) |
| Business Name: | | | |
| Address: | Type of Service: | | |
| Contact Person: | Dollar Amount: $: | Percent of Project: | |
| ☐ Subcontractor (√) | ☐ Supplier (√) | ☐ Manufacturer (√) | ☐ Broker (√) |
| Business Name: | | | |
| Address: | Type of Service: | | |
| Contact Person: | Dollar Amount: $: | Percent of Project: | |
| ☐ Subcontractor (√) | ☐ Supplier (√) | ☐ Manufacturer (√) | ☐ Broker (√) |
| Business Name: | | | |
| Address: | Type of Service: | | |
| Contact Person: | Dollar Amount: $: | Percent of Project: | |
| ☐ Subcontractor (√) | ☐ Supplier (√) | ☐ Manufacturer (√) | ☐ Broker (√) |
| Business Name: | | | |
| Address: | Type of Service: | | |
| Contact Person: | Dollar Amount: $: | Percent of Project: | |
| ☐ Subcontractor (√) | ☐ Supplier (√) | ☐ Manufacturer (√) | ☐ Broker (√) |
| Business Name: | | | |
| Address: | Type of Service: | | |
| Contact Person: | Dollar Amount: $: | Percent of Project: | |
| ☐ Subcontractor (√) | ☐ Supplier (√) | ☐ Manufacturer (√) | ☐ Broker (√) |
| Business Name: | | | |
| Address: | Type of Service: | | |
| Contact Person: | Dollar Amount: $: | Percent of Project: | |
| ☐ Subcontractor (√) | ☐ Supplier (√) | ☐ Manufacturer (√) | ☐ Broker (√) |
| Business Name: | | | |
| Address: | Type of Service: | | |
| Contact Person: | Dollar Amount: $: | Percent of Project: | |

Rev 031816JE

The undersigned Bidder hereby certifies that the aforementioned subcontractors and suppliers have full knowledge that their names have been offered as subcontractors and suppliers for the work, and the Bidder further certifies that the dollar amount of work to be performed by the aforementioned M/WBE(s) was furnished to the Bidder prior to the bid opening. The undersigned Bidder agrees that after the bid opening, it shall submit to the City an executed and completed W/MBE "Letter of Intent" in three working days (3) on each of its M/WBE subcontractors. The "Letter of Intent" form is contained in the Contract Documents.

The undersigned Bidder acknowledges the right of the City to reject any or all bids submitted, to waive informalities in bids and to re-advertise this Project for bids.

The undersigned certifies that it has carefully checked all works and figures and all statements made in these Bid Forms.

This bid is submitted upon the declaration that neither, I (we), nor, to the best of my (our) knowledge, none of the members of my (our) firm or company have either directly or indirectly entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this bid.

Business Address of Bidder: 1260 Rock Creek Circle

City, State, Zip Code: Lafayette, CO 80026

Telephone Number of Bidder: 303-665-2933, EXT 110 Fax No. 303-665-2996

Social Security or Federal Employer ID Number of Bidder: 84-0819993

Name and location of the last work of this kind herein contemplated upon which the Bidder was engaged:
City and County of Denver - 33rd St. Outfall - Curtis St. to Lafayette St.

For information relative thereto, please refer to:

Name: Dave Shaw 720-271-8125

Title: Project Manager

Address: City and County of Denver, Wastewater Capital Projects Management
2000 W. 3rd Ave., Denver, CO 80223

The undersigned acknowledges receipt, understanding, and full consideration of the following addenda to the Contract Documents:

Addenda Number 1 Date 6/4/19
Addenda Number 2 Date 6/18/19
Addenda Number 3 Date 6/25/19
Addenda Number 4 Date 6/28/19
Addenda Number 5 Date 7/10/19

Dated this 18th day of July, 20 19.

**Signature of Bidder:**

If an Individual: _____ doing business

as _____.

If a Partnership: _____

by: _____ General Partner.

If a Corporation: Concrete Works of Colorado, Inc.

a Colorado Corporation,

by: ReaAnn Fletcher, its President.
ReaAnn Fletcher, Contracts Manager, for: Marc Lenart, President

Attest:

Secretary (Corporate Seal)

Concrete Works of Colorado, Inc. A Colorado Corporation

**If a Joint Venture, signature of all Joint Venture participants.**

Firm: _____

Corporation ( ), Partnership ( ) or ( ) Limited Liability Company

By: _____ (If a Corporation)
Attest:

Title: _____

Secretary (Corporate Seal)

Firm: _____

Corporation ( ), Partnership ( ) or ( ) Limited Liability Company

By: _____ (If a Corporation)
Attest:

Title: _____

Secretary (Corporate Seal)

Firm: _____

Corporation ( ), Partnership ( ) or ( ) Limited Liability Company

By: _____ (If a Corporation)
Attest:

Title: _____

Secretary (Corporate Seal)

DENVER
OFFICE OF ECONOMIC DEVELOPMENT

Office of Economic Development
**Division of Small Business Opportunity**
**Compliance Unit**
201 W. Colfax Ave. Dept. 907
Denver, CO 80202
Phone: 720-913-1999
DSBO@denvergov.org

# COMMITMENT TO MWBE PARTICIPATION

***The undersigned has satisfied the MWBE participant requirements in the following manner (Please check the appropriate box):***

☒ The Bidder/Proposer is committed to the minimum 15 % **MWBE** utilization on the project, and will submit Letters of Intent (LOI) for each subcontractor/subconsultant listed in the Bid Forms as follows:
**Hard Bids**: **Three (3)** business days after the bid opening.
**Request for Proposals/Qualifications**: With the proposal when due.
**Compliance Plans**: With each task/work order

☐ The Bidder/Proposer is unable to meet the project goal of _____% **MWBE,** but is committed to a minimum of _____% **MWBE** utilization on the project. The Bidder/Proposer understands that they must submit a detailed statement of their good faith effort under sealed bid procedures, as a matter of responsiveness, or with initial proposals, under contract negotiation procedures; or no later than **three (3)** days after bid opening as a matter of responsibility as in accordance with DRMC Section 28-62 and 28-67 of Ordinance 85 to the Division of Small Business Opportunity.

☐ The Bidder/Proposer is a certified **MWBE** in good standing with the City and is committed to self-perform a minimum of _____% of the work on the contract.

| | | | |
|---|---|---|---|
| Bidder/Proposer (Name of Firm): Concrete Works of Colorado, Inc. | | | |
| Firm's Representative (Please print): ReaAnn Fletcher | | | |
| Signature (Firm's Representative): ReaAnn Fletcher | | | |
| Title: Contracts Manager | | | |
| Address: 1260 Rock Creek Circle | | | |
| City: Lafayette | | State: CO | Zip: 80026 |
| Phone: 303-665-2933, EXT 110 | Fax: 303-665-2996 | Email: reaannf@cwc-email.com | |

**A copy of the MWBE Certification letter must be attached to each Letter of Intent (LOI).**

**DENVER**
**OFFICE OF ECONOMIC DEVELOPMENT**

Office of Economic Development
Division of Small Business Opportunity
Compliance Unit
201 West Colfax Ave., Dept. 907
Denver, CO 80202
Phone: 720-913-1999

## LETTER OF INTENT (LOI)

***INSTRUCTIONS FOR COMPLETION & SUBMISSION:***

- *All lines must be completed or marked N/A for Not Applicable*
- *Certification Letter must be submitted with LOI*
- *Submit the attached completed checklist with this letter*
- *Email to dsbo@denvergov.org ,*
- *FOR RFPs and RFQs: LOIs should be included with Submittal*

| Contract No.: | Project Name: |
|---|---|

**A. The Following Section Is To Be Completed by the Bidder/Consultant**
**This Letter of Intent Must be Signed by the Bidder/Consultant and M/WBE, SBE, EBE or DBE**

| | | | |
|---|---|---|---|
| Name of Bidder/Consultant: | Self-Performing: ☐ Yes ☐ No | Phone: | |
| Contact Person: | Email: | Fax: | |
| Address: | City: | State: | Zip: |

**B. The Following Section is To Be Completed by the M/WBE, SBE, EBE or DBE, at any Tier**
**This Letter of Intent Must be Signed by the M/WBE, SBE, EBE or DBE and Bidder/Consultant**

| | | | |
|---|---|---|---|
| Name of Certified Firm: | | Phone: | |
| Contact Person: | Email: | Fax: | |
| Address: | City: | State: | Zip: |

| Please check the designation which applies to the certified firm. | M/WBE (√) | | SBE (√) | | EBE (√) | | DBE (√) | |
|---|---|---|---|---|---|---|---|---|

**Indirect Utilization:** If this M/WBE, SBE, EBE or DBE is not a direct first tier subcontractor/subconsultant, supplier or broker to the Bidder/ Consultant, please indicate the name of the subcontractor/subconsultant, supplier or broker which is utilizing the participation of this firm:

**A Copy of the M/WBE, SBE, EBE or DBE Letter of Certification must be Attached**

Identify the scope of the work to be performed or supply item that will be provided by the M/WBE/SBE/DBE. **On unit price bids only, identify which bid line items the M/WBE/SBE/EBE/DBEs scope of work or supply corresponds to.**

| | Subcontractor/Subconsultant (√) | | Supplier (√) | | Broker (√) |
|---|---|---|---|---|---|

**Bidder** intends to utilize the aforementioned M/WBE, SBE, EBE or DBE for the Work/Supply described above. The cost of the work and percentage of the total subcontractor M/WBE, SBE, EBE or DBE bid amount is:

| | |
|---|---|
| $ | % |
| **Consultant** intends to utilize the aforementioned M/WBE, SBE, EBE or DBE for the Work/Supply described above. The percentage of the work of the total sub consultant M/WBE, SBE, EBE or DBE will perform is: | % |
| If the fee amount of the work to be performed is requested, the fee amount, is: | $ |

| | |
|---|---|
| Bidder/Consultant's Signature: | Date: |
| Title: | |
| M/WBE, SBE, EBE or DBE or Self-Performing Firm's Signature: | Date: |
| Title: | |

If the above named Bidder/Consultant is not determined to be the successful Bidder/Consultant, this Letter of Intent shall be null and void.

## Letter of Intent (LOI) Checklist

***All lines must be completed or marked N/A for Not Applicable***

***Submit the attached completed checklist with this letter.***

| Completed ✓ | |
|---|---|
| ☐ | Project Number & Project Name |
| ☐ | Section A: Name of Bidder/Consultant, Contact Person, Address, City, State, Zip, Phone, Email |
| ☐ | Section B: Name of Certified Firm, Contact Person, Address, City, State, Zip, Phone, Email |
| ☐ | Designation checked for MBE/WBE, SBE, EBE or DBE |
| ☐ | Indirect Utilization: Name of subcontractor/subconsultant, supplier or broker is indicated if using the participation of a 2nd tier subcontractor/subconsultant, supplier or broker. |
| ☐ | Scope of work performed or item supplied by M/WBE, SBE, EBE or DBE |
| ☐ | Line items performed, if line-item bid. |
| ☐ | Copy of M/WBE, SBE, EBE or DBE Letter of Certification Attached |
| ☐ | Designation checked for Subcontractor/Subconsultant, Supplier or Broker |
| | If project is a hard bid... |
| ☐ | Bidder has indicated dollar amount for value of work going to Subcontractor/ Subconsultant, Supplier or Broker |
| ☐ | Bidder has indicated percentage for value of work going to Subcontractor/ Subconsultant, Supplier or Broker |
| | If project is an RFP/RFQ... |
| ☐ | Consultant has indicated percentage for value of work going to Subcontractor/ Subconsultant, Supplier or Broker Name & contact name for MWBE. |
| ☐ | Fee amount if fee amount of work to be performed is requested. |
| ☐ | Bidder/Consultant's Signature, Title & Date |
| ☐ | M/WBE, SBE, EBE or DBE Firm's Signature, Title and Date |

| Select One ✓ | SUBMITTED VIA... For Construction Hard Bids ONLY, Bidders are strongly urged to deliver the LOI via one of the methods below. (The preferred method is to scan/email completed forms to email address below. Delivery to any other point cannot be guaranteed timely delivery.) |
|---|---|
| ☐ | Email to DSBO@denvergov.org |

**The complete and accurate information that is required for the Letter of Intent is based on the following sections of the Ordinance 85: Section 28-63 and Section 28-68. Failure to complete this information on the Letter of Intent (LOI) may automatically deem a bid or proposal non-responsive.**

DENVER
OFFICE OF ECONOMIC DEVELOPMENT

# Joint Venture Affidavit

Office of Economic Development
Division of Small Business Opportunity
Compliance Unit
201 W. Colfax Ave. Dept. 907
Denver, CO 80202
Phone: 720-913-1999
DSBO@denvergov.org

The Undersigned swears that the foregoing statements are correct and include all material information necessary to identify and explain the terms and operation of our joint venture and the intended participation by each joint venturer in the undertaking. Further, the Undersigned covenant and agree to provide the City current, complete, and accurate information regarding actual joint venture work and the payment thereof and any proposed changes in any of the joint venture arrangements and to permit the audit and examination of the books, records, and files of the joint venture, by authorized representatives of the City or Federal funding agency, if applicable. Any material misrepresentation will be grounds for terminating any contract which may be awarded and for initiating action under Federal or State laws concerning false statements.

Name of Firm:

Print Name: | Title

Signature: | Date:

## Notary Public

County of | State of | My Commission Expires:

Subscribed and sworn before me this

_____ day of _____, 20_____

Notary Signature: _____

Notary Commission #: _____

Address: _____

Notary Seal

Name of Firm:

Print Name: | Title

Signature: | Date:

## Notary Public

County of | State of | My Commission Expires:

Subscribed and sworn before me this

_____ day of _____, 20_____

Notary Signature: _____

Notary Commission #: _____

Address: _____

Notary Seal

DENVER
OFFICE OF ECONOMIC DEVELOPMENT

# JOINT VENTURE ELIGIBILITY FORM

Office of Economic Development
Division of Small Business Opportunity
Compliance Unit
201 W. Colfax Ave. Dept. 907
Denver, CO 80202
Phone: 720-913-1999
DSBO@denvergov.org

**Joint Venture means** an association of two (2) or more business enterprises to constitute a single business enterprise to perform a City construction or professional design and construction services contract for which purpose they combine their property, capital, efforts, skills and knowledge, and in which each joint venturer is responsible for a distinct, clearly defined portion of the work of the contract, performs a commercially useful function, and whose share in the capital contribution, control, management responsibilities, risks and profits of the joint venture are equal to its ownership interest. Joint ventures must have an agreement in writing specifying the terms and conditions of the relationships between the joint venturers and their relationship and responsibility to the contract.

The Division of Small Business Opportunity (DSBO) requires the following information be provided from participants of a prospective joint venture, to assist DSBO in evaluating the proposed joint venture. This Joint Venture Eligibility form and the Joint Venture Affidavit apply if SBEs, EBEs, MBEs, WBEs or DBEs participate in this joint venture.

Please return this form, the Joint Venture Affidavit, and a copy of your Joint Venture Agreement to: Division of Small Business Opportunity, 201 West Colfax Avenue, Denver, CO 80202, at least ten (10) working days prior to bid opening or proposal.

If you have questions regarding this process, please contact DSBO at 720-913-1999.

## Joint Venture Information

Name: | Contact Person:

Address:

City: | State: | Zip: | Phone:

## Joint Venture Participants

Name: | Contact Person:

Address:

City: | State: | Zip: | Phone:

% Ownership: | Certifying Entity: | Type Certification & Date: (S/E/M/W or DBE)

Type of Work for which Certification was granted:

Name: | Contact Person:

Address:

City: | State: | Zip: | Phone:

% Ownership: | Certifying Entity: | Type Certification & Date: (S/E/M/W or DBE)

Type of Work for which Certification was granted:

## General Information

SBE/EBE/MBE/WBE/DBE Initial Capital Contributions: $ %

Future capital contributions (explain requirements) (attach additional sheets if necessary):

Source of Funds for the SBE/EBE/MBE/WBE/DBE Capital Contributions:

Describe the portion of the work or elements of the business controlled by the SBE/EBE/MBE/WBE or DBE: (attach additional sheets if necessary)

| Describe the portion of the work or elements of the business controlled by non-SBE/EBE/MBE/WBE or DBE: (attach additional sheets if necessary) |
|---|
| |
| |
| |

## JOINT VENTURE ELIGIBILITY FORM

### General information

| Describe the SBE/EBE/MBE/WBE or DBE's involvement in the overall management of the joint venture (e.g., participation on a management committee or managing board voting rights, etc.) (attach additional sheets if necessary) |
|---|
| |
| |
| |

| Describe the SBE/EBE/MBE/WBE or DBE's share in the profits of the joint venture: |
|---|
| |
| |
| |

| Describe the SBE/EBE/MBE/WBE or DBE's share in the risks of the joint venture: |
|---|
| |
| |
| |

| Describe there roles and responsibilities of each joint venture participant with respect to managing the joint venture (use additional sheets if necessary): |
|---|
| a. SBE/EBE/MBE/WBE or DBE joint venture participant: |
| |
| |
| |
| b. Non- SBE/EBE/MBE/WBE or DBE joint venture participant: |
| |
| |
| |

| Describe the roles and responsibilities of each joint venture participant with respect to operation of the joint venture (use additional sheets if necessary): |
|---|
| a. SBE/EBE/MBE/WBE or DBE joint venture participant: |
| |
| |
| |
| b. Non- SBE/EBE/MBE/WBE or DBE joint venture participant: |
| |
| |
| |

Which firm will be responsible for accounting functions relative to the joint venture's business?

Explain what authority each party will have to commit or obligate the other to insurance and bonding companies, financing institutions, suppliers, subcontractors, and/or other parties?

Please provide information relating to the approximate number of management, administrative, support and non-management employees that will be required to operate the business and indicate whether they will be employees of the S/E/MWBE/DBE, non- S/E/MWBE/DBE or joint venture:

| | Non- SBE/EBE/M/WBE/DBE | SBE/EBE/M/WBE/DBE | Joint Venture |
|---|---|---|---|
| Management | | | |
| Administrative | | | |
| Support | | | |
| Hourly Employees | | | |

## JOINT VENTURE ELIGIBILITY FORM

### General Information

Please provide the name of the person who will be responsible for hiring employees for the joint venture.

Who will they be employed by?

| Are any of the proposed joint venture employees currently employees of any of the joint venture partners? | | Yes (√) | | No (√) |
|---|---|---|---|---|

If yes, please list the number and positions and indicate which firm currently employs the individual(s), (use additional sheets if necessary)

| Number of employees | | Position | Employed By |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Attach a copy of the proposed joint venture agreement, promissory note or loan agreement (if applicable), and any and all written agreements between the joint venture partners.

List all other business relationships between the joint venture participants, including other joint venture agreements in which the parties are jointly involved.

If there are any significant changes in or pertaining to this submittal, the joint venture members must immediately notify the Division of Small Business Opportunity.

COMP-FRM-015

# CITY AND COUNTY OF DENVER
# DEPARTMENT OF PUBLIC WORKS

## BID BOND

KNOW ALL MEN BY THESE PRESENTS:

THAT CONCRETE WORKS OF COLORADO, INC., 1260 Rock Creek Circle, Lafayette, Colorado 80026, as Principal, and HARTFORD FIRE INSURANCE COMPANY, a corporation organized and existing under and by virtue of the laws of the State of Connecticut, and authorized to do business within the State of Colorado, as Surety, are held and firmly bound unto the City and County of Denver, Colorado, as Obligee, in full and just sum of Five Percent (5%) of the Total Amount of the Bid Dollars, ($_____), lawful money of the United States, for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents:

WHEREAS, the said Principal is herewith submitting its bid, dated July 18, 2019, for the construction of: **Contract No. 201950389, 27th STREET STORM INTERCEPTOR, PHASE 2,** as set forth in detail in the Contract Documents for the City and County of Denver, Colorado, and said Obligee has required as a condition for receiving said bid that the Principal deposit specified bid security in the amount of not less than five percent (5%) of the amount of said bid, as it relates to work to be performed for the City, conditioned that in event of failure of the Principal to execute the Contract, for such construction and furnish required Performance and Payment Bond if the contract is offered him that said sum be paid immediately to the Obligee as liquidated damages, and not as a penalty, for the Principal's failure to perform.

The condition of this obligation is such that if the aforesaid Principal shall, within the period specified therefore, on the prescribed form presented to him for signature, enter into a written contract with the Obligee in accordance with his bid as accepted and give Performance and Payment Bond with good and sufficient surety or sureties, upon the form prescribed by the Obligee, for the faithful performance and the proper fulfillment of said Contract, or in the event of withdrawal of said bid within the time specified, or upon the payment to the Obligee of the sum determined upon herein, as liquidated damages and not as penalty, in the event the Principal fails to enter into said contract and give such Performance and Payment Bond within the time specified, then this Obligation shall be null and void, otherwise to remain in full force and effect.

Signed, sealed and delivered this 18th day of July, 2019.

ATTEST

By [signature]
Secretary Project Admin.

Concrete Works of Colorado, Inc. A Colorado Corporation

Seal if Bidder is Corporation
(Attach Power of Attorney)

CONCRETE WORKS OF COLORADO, INC.

Principal
By [signature]
Rea Ann Fletcher,
Title Contracts Manager

HARTFORD FIRE INSURANCE COMPANY

Surety
By [signature]
Cynthia M. Burnett, Attorney-in-Fact

[SEAL]

# POWER OF ATTORNEY

*Direct Inquiries/Claims to:*
THE HARTFORD
**BOND, T-4**
**One Hartford Plaza**
**Hartford, Connecticut 06155**
*call:* **888-266-3488** *or fax:* **860-757-5835**

**KNOW ALL PERSONS BY THESE PRESENTS THAT:** **Agency Code: 34-344525**

- [X] **Hartford Fire Insurance Company**, a corporation duly organized under the laws of the State of Connecticut
- [X] **Hartford Casualty Insurance Company**, a corporation duly organized under the laws of the State of Indiana
- [X] **Hartford Accident and Indemnity Company**, a corporation duly organized under the laws of the State of Connecticut
- [ ] **Hartford Underwriters Insurance Company**, a corporation duly organized under the laws of the State of Connecticut
- [ ] **Twin City Fire Insurance Company**, a corporation duly organized under the laws of the State of Indiana
- [ ] **Hartford Insurance Company of Illinois**, a corporation duly organized under the laws of the State of Illinois
- [ ] **Hartford Insurance Company of the Midwest**, a corporation duly organized under the laws of the State of Indiana
- [ ] **Hartford Insurance Company of the Southeast,** a corporation duly organized under the laws of the State of Florida

having their home office in Hartford, Connecticut, (hereinafter collectively referred to as the "Companies") do hereby make, constitute and appoint, ***up to the amount of unlimited:***

*Douglas J. Rothey, Cynthia M. Burnett*
*of*
*Littleton, CO*

their true and lawful Attorney(s)-in-Fact, each in their separate capacity if more than one is named above, to sign its name as surety(ies) only as delineated above by ☒, and to execute, seal and acknowledge any and all bonds, undertakings, contracts and other written instruments in the nature thereof, on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

**In Witness Whereof**, and as authorized by a Resolution of the Board of Directors of the Companies on January 22, 2004 the Companies have caused these presents to be signed by its Assistant Vice President and its corporate seals to be hereto affixed, duly attested by its Assistant Secretary. Further, pursuant to Resolution of the Board of Directors of the Companies, the Companies hereby unambiguously affirm that they are and will be bound by any mechanically applied signatures applied to this Power of Attorney.

Wesley W. Cowling, Assistant Secretary

M. Ross Fisher, Assistant Vice President

**STATE OF CONNECTICUT**
**COUNTY OF HARTFORD** } ss. Hartford

On this 3rd day of March, 2008, before me personally came M. Ross Fisher, to me known, who being by me duly sworn, did depose and say: that he resides in the County of Hartford, State of Connecticut; that he is the Assistant Vice President of the Companies, the corporations described in and which executed the above instrument; that he knows the seals of the said corporations; that the seals affixed to the said instrument are such corporate seals; that they were so affixed by authority of the Boards of Directors of said corporations and that he signed his name thereto by like authority.

Scott E. Paseka
Notary Public
My Commission Expires October 31, 2012

**CERTIFICATE**

I, the undersigned, Assistant Vice President of the Companies, DO HEREBY CERTIFY that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which is still in full force effective as of July 18, 2019 .

Signed and sealed at the City of Hartford.

Gary W. Stumper, Assistant Vice President

DENVER
OFFICE OF ECONOMIC DEVELOPMENT

Office of Economic Development
Division of Small Business Opportunity
201 W. Colfax Ave, Dept. 907
Denver, CO 80202
p: 720.913.1999
f: 720.913.1809
www.denvergov.org/dsbo

# Diversity and Inclusiveness * in City Solicitations
# Information Request Form

Type in your response, print out, sign and date; or print out and complete manually. Please print legibly.

Denver Executive Order No. 101 establishes strategies between the City and private industry to use diversity and inclusiveness to promote economic development in the City and County of Denver and to encourage more businesses to compete for City contracts and procurements. The Executive Order requires, among other things, the collection of certain information regarding the practices of the City's contractors and consultants toward diversity and inclusiveness and encourages/requires City agencies to include diversity and inclusiveness policies in selection criteria where legally permitted in solicitations for City services or goods.

Answer each question below. Missing or incomplete responses will be recorded as "no", "not applicable", or "none". **A proposal or response to a solicitation by a contractor/consultant that does not include this completed form shall be deemed non-responsive and rejected.**

Business Email Address: reaannf@cwc-email.com

Please include the Email address of the contact person facilitating this solicitation for the City and County of Denver: reaannf@cwc-email.com

Agency Name:

__Arts and Venue
__Auditor Office
__Community Planning
__Denver International Airport
__Environmental Health
__Fire Department
__Purchasing Division
__Human Services
__Economic Development
__Parks and Recreation
__Police Department
X Public Works
__Sheriff Department
__Technology Services
__Other

Project Name: 27th Street Storm Interceptor, Phase 2
BID / RFP No.: 201950389
Name of Contractor/Consultant: Concrete Works of Colorado, Inc.
What industry is your business? Heavy/Highway Construction
Address:
1260 Rock Creek Circle
Lafayette, CO 80026

Business Phone No.: 303-665-2933, EXT 110
Business Facsimile No.: 303-665-2996

OED – Executive Order No. 101
Diversity and Inclusiveness in City Solicitations Information Request Form
Rev. 12/29/2015

1. How many employees does your company employ?

- [ ] 1-10
- [ ] 11-50
- [x] 51-100
- [ ] over 100

1.1. How many of your company's employees are:

Full-time 100% Part-Time _____

2. Do you have a Diversity and Inclusiveness Program? [ ] Yes [x] No

If No, and your company size is less than 10 employees continue to question 11. Complete and sign the form.

If Yes, does it address:

| | | |
|---|---|---|
| 2.1 Employment and retention? | [ ] Yes | [ ] No |
| 2.2 Procurement and supply chain activities? | [ ] Yes | [ ] No |
| 2.3 Customer service? | [ ] Yes | [ ] No |

3. Provide a detailed narrative of your company's diversity and inclusiveness principles and programs. This may include, for example, (i) diversity and inclusiveness employee training programs, equal opportunity policies, and the budget amount spent on an annual basis for workplace diversity; or (ii) diversity and inclusiveness training and information to improve customer service.

Concrete Works follows all State and Federal employment laws including posting all required EEO materials on bulletin boards in company common areas and on jobsites. All new CWC employees are given a company handbook which includes the company EEO policies.

4. Does your company regularly communicate its diversity and inclusiveness policies to employees?

If Yes, how does your company regularly communicate its diversity and inclusiveness policies to employees? (select all that apply)

- [ ] Employee Training
- [ ] Pamphlets
- [x] Public EEO postings
- [x] Other - Employee Handbook
- [ ] Not Applicable

5. If you responded that you do not have a diversity and inclusiveness program, describe any plans your company may have to adopt such a program.

Concrete Works has a written company EEO policy and we consistently seek out opportunities to include all groups and to be diverse in our employee, vendor and subcontractor selection.

6. How often do you provide training in diversity and inclusiveness principles?

- ☐ Monthly
- ☐ Quarterly
- ☐ Annually
- ☒ Not Applicable
- ☐ Other_____

6.1 What percentage of the total number of employees generally participate?

- ☐ 0 – 25%
- ☐ 26 – 50%
- ☐ 51 – 75%
- ☐ 76 – 100%
- ☒ Not Applicable

7. State how you achieve diversity and inclusiveness in supply and procurement activities. This may include, for example, narratives of training programs, equal opportunity policies, diversity or inclusiveness partnership programs, mentoring and outreach programs, and the amount and description of budget spent on an annual basis for procurement and supplier diversity and inclusiveness.

Concrete Works actively utilizes the State and various municipalities' MWBE and DBE programs for all of our projects. On average, 10-20% of our projects' total values are routinely awarded to subcontractors and suppliers from the MWBE and DBE programs.

8. Do you have a diversity and inclusiveness committee? ☐ Yes ☒ No

8.1 If Yes, how often does it meet?

- ☐ Monthly
- ☐ Quarterly
- ☐ Annually
- ☐ Other _____
- ☒ No Committee

8.2 If you responded that you do not have a diversity and inclusiveness committee, describe any plans your company may have to establish such a committee.

Concrete Works has diversity at every level of operation. Our EEO policy encourages diversity and inclusivity.

9. Do you have a budget for diversity and inclusiveness efforts? ☐ Yes ☒ No

10. Does your company integrate diversity and inclusion competencies into executive/manager performance evaluation plans? ☐ Yes ☒ No

11. Would you like information detailing how to implement a Diversity and Inclusiveness program?

☐ Yes ☒ No

If yes, please email XO101@denvergov.org.

I attest that the information represented herein is true, correct and complete, to the best of my knowledge.

Signature of Person Completing Form

July 18, 2019
Date

ReaAnn Fletcher, Contracts Manager
Printed Name of Person Completing Form

**NOTE: Attach additional sheets or documentation as necessary for a complete response.**

*"Diversity and inclusiveness program" means a program that invites values, perspectives and contributions of people from diverse backgrounds, and integrates diversity into its hiring and retention policies, training opportunities, and business development methods to provide an equal opportunity for each person to participate, contribute, and succeed within the organization's workplace. "Diversity" encompasses a wide variety of human differences, including differences such as race, age, gender, gender identity, sexual orientation, ethnicity, physical disabilities, appearance, historically underutilized and disadvantaged persons, as well as social identities such as religion, marital status, socio-economic status, lifestyle, education, parental status, geographic background, language ability, and veteran status."

# CITY AND COUNTY OF DENVER

## STATE OF COLORADO

DENVER
THE MILE HIGH CITY

## DEPARTMENT OF PUBLIC WORKS

**Bid Documents Package**

**Contract Number: 201950389**

● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ●

**27th Street Storm Interceptor, Phase 2**

**May 29, 2019**

# CITY AND COUNTY OF DENVER
## DEPARTMENT OF PUBLIC WORKS

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| Technical Specifications | 307 pages |
| Project Specifications | 1,140 pages |
| Regulated Asbestos Contaminated Soil SOP & Clarification on Guidance for Reuse of Soil | 82 pages |
| Required Tree Protection and Associated Penalties | 2 pages |
| Contract Drawings | 47 pages |

DENVER
THE MILE HIGH CITY

**CITY AND COUNTY OF DENVER**
**DEPARTMENT OF PUBLIC WORKS**

**STATEMENT OF QUANTITIES**

| Item No. | Description | Estimated | Quantity |
|---|---|---|---|
| 01-21.16.01 | ALLOWANCE FOR TREE REMOVAL, TRIMMING/ REPLACEMENT AND DISPOSAL - SEE PROJECT SPECIAL PROVISIONS | 1 | A/A |
| 01-21.19.01 | ALLOWANCE FOR CERTIFIED ASBESTOS BUILDING INSPECTOR (CABI)/AIR MONITOR(HOURLY) - SEE PROJECT SPECIAL PROVISIONS | 1 | A/A |
| 01-52.13 | TEMPORARY OFFICE FACILITIES | 1 | LS |
| 2-1.2a | REMOVE 6" CONCRETE CURB AND/OR GUTTER | 2,279 | LF |
| 2-1.4 | REMOVE SIDEWALK ACCESSIBILITY CONCRETE CURB RAMP | 5,060 | SF |
| 2-2.1 | REMOVE CONCRETE SIDEWALK | 2,220 | SF |
| 2-2.2 | REMOVE CONCRETE DRIVEWAY PAVING | 800 | SF |
| 2-3.3 | REMOVE CONCRETE ALLEY PAVING | 2,937 | SF |
| 2-5 | REMOVE CONCRETE RETAINING WALL (FOR RAMP AT 27TH & CURTIS) | 60 | LF |
| 2-11.2b | REMOVE EXISTING 10" STORM SEWER PIPE (VCP) | 248 | LF |
| 2-11.2d | REMOVE EXISTING 15" STORM SEWER PIPE (VCP) | 409 | LF |
| 2-11.2q | REMOVE EXISTING 66" STORM SEWER PIPE (63x42 OVOID BRICK) | 77 | LF |
| 2-11.2s | REMOVE EXISTING 78" STORM SEWER PIPE (75" VCP) | 983 | LF |
| 2-11.5a | ABANDON EXISTING 8" SEWER PIPE (6" DIP WATER LINE) | 20 | LF |

DENVER
THE MILE HIGH CITY

**CITY AND COUNTY OF DENVER**
**DEPARTMENT OF PUBLIC WORKS**

**STATEMENT OF QUANTITIES**

| Item No. | Description | Estimated | Quantity |
|---|---|---|---|
| 2-11.5a | ABANDON EXISTING 8" SEWER PIPE (8" PVC WATER LINE) | 60 | LF |
| 2-12.2 | REMOVE EXISTING STORM MANHOLE | 6 | EA |
| 2-13.1 | REMOVE EXISTING STORM INLET | 14 | EA |
| 2-17.1 | REMOVE AND REPLACE/RELOCATE UTILITY POLES (INCLUDES SUPPORT OF POLES) | 4 | EA |
| 2-17.3 | REMOVE AND REPLACE/RELOCATE SIGN | 25 | EA |
| 2-17.3 | REMOVE AND REPLACE/RELOCATE SIGN REMOVE AND RESET BOLLARD | 2 | EA |
| 2-17.7 | RELOCATE EXISTING UTILITY COORDINATION WITH UTILITY COMPANIES | 1 | LS |
| 2-17.7 | RELOCATE EXISTING UTILITY RELOCATE TRAFFIC OVERHEAD. CONTRACTOR TO PROVIDE SUPPORT POLES. | 1 | LS |
| 2-20a | REMOVE TROLLEY TRACKS | 180 | LF |
| 02-22.13 | VIBRATION ASSESSMENT | 1 | LS |
| 2-23 | REMOVE DECORATIVE LANDSCAPING | 1 | LS |
| 3-2 | HAULING OF CONTAMINATED MATERIALS TO DENVER/ARAPAHOE DISPOSAL SITE (DADS)*LICENSED PER D.R.M.C. 48-62 | 2,000 | TON |
| 3-7a | HEALTH & SAFETY PLAN | 1 | LS |
| 3-7b | MATERIAL MANAGEMENT PLAN | 1 | LS |
| 5-2a | SUBGRADE MATERIAL (SELECT BACKFILL) | 2,000 | TON |

DENVER
THE MILE HIGH CITY

**CITY AND COUNTY OF DENVER**
**DEPARTMENT OF PUBLIC WORKS**

**STATEMENT OF QUANTITIES**

| Item No. | Description | Estimated | Quantity |
|---|---|---|---|
| 5-7 | CONTROLLED LOW STRENGTH MATERIALS (CLSM) | 100 | CY |
| 5-8 | CRUSHED GRAVEL BASE COURSE (CDOT CLASS 6 ROAD BASE) | 300 | TON |
| 8-1.1b | 6" DIP AWWA C151, CLASS 50 WATER LINE | 60 | LF |
| 8-1.1c | 8" DIP AWWA C151, CLASS 50 WATER LINE | 170 | LF |
| 8-1.1d | 10" DIP AWWA C151, CLASS 50 WATER LINE | 40 | LF |
| 8-1.1e | 12" DIP AWWA C151, CLASS 50 WATER LINE | 20 | LF |
| 8-1.1h | 16" DIP AWWA C151, CLASS 50 WATER LINE | 20 | LF |
| 8-1.2b | INSTALL 6" WATER VALVE | 3 | EA |
| 8-1.2c | INSTALL 8" WATER VALVE | 3 | EA |
| 8-1.3a | 4" PVC AWWA C900, CLASS 200 (REMOVE AND REPLACE SANITARY SERVICE LINE) | 50 | LF |
| 8-1.3b | 6" PVC AWWA C900, CLASS 150 (SANITARY REPLACEMENT) | 50 | LF |
| 8-1.5a | LEAD SERVICE LINE REPLACEMENT, <2" ID | 90 | LF |
| 8-2 | REMOVE FIRE HYDRANT ASSEMBLY | 3 | EA |
| 8-3 | RESET OR INSTALL FIRE HYDRANT ASSEMBLY | 3 | EA |
| 8-4 | REMOVE EXISTING WATER LINE (REMOVE 6" CML WATER LINE) | 30 | LF |
| 8-4 | REMOVE EXISTING WATER LINE (REMOVE 8" DIP & PVC WATER LINE) | 100 | LF |

DENVER
THE MILE HIGH CITY

**CITY AND COUNTY OF DENVER**
**DEPARTMENT OF PUBLIC WORKS**

**STATEMENT OF QUANTITIES**

| Item No. | Description | Estimated | Quantity |
|---|---|---|---|
| 8-4 | REMOVE EXISTING WATER LINE (REMOVE 10" CIP WATER LINE) | 40 | LF |
| 12-1.1 | 6" CURB AND GUTTER 2' PAN (CD0T T2, IIB) | 2,279 | LF |
| 12-1.7 | 6" CONCRETE CURB HEAD (FOR RAMP AT 27TH & CURTIS) | 60 | LF |
| 12-1.8 | SIDEWALK ACCESSIBILITY CONCRETE CURB RAMP | 5,060 | SF |
| 12-1.9 | GUTTER OVERLAY (CDOT CLASS D CONCRETE GUTTER OVERLAY WITH FIBER MESH REINFORCEMENT) | 1,500 | LF |
| 12-2.1 | CONCRETE SIDEWALK | 1,000 | SF |
| 12-2.1 | CONCRETE SIDEWALK (PIGMENTED) | 2,000 | SF |
| 12-2.1 | CONCRETE SIDEWALK (8" PIGMENTED FOR RAMP AT 27TH & CURTIS) | 220 | SF |
| 12-5.1 | CONCRETE DRIVEWAY PAVING | 800 | SF |
| 12-5.5 | CONCRETE ALLEY PAVING | 2,937 | SF |
| 12-16a | CONCRETE RETAINING WALL FOR RAMP AT 27TH & CURTIS | 1 | LS |
| 16-3 | CHAIN LINK FENCE (TREE PROTECTION, INCLUDES TREE WRAP. ALSO INCLUDES FENCE FOR MAINTAINING PEDESTRIAN ACCESS) | 2,500 | LF |
| 20-2ce | ASPHALT SURFACE COURSE, SX, RAP 20%, N=100, 64-22. | 17,258 | SY-IN |
| 20-3ce | ASPHALT BASE COURSE, S, RAP 20%, N=100, 64-22. | 47,459 | SY-IN |

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**STATEMENT OF QUANTITIES**

| Item No. | Description | Estimated | Quantity |
|---|---|---|---|
| 20-4 | ASPHALT ROTOMILL | 2,000 | SY-IN |
| 20-5 | ASPHALT PATCH | 6,903 | SY-IN |
| 34-2.3d | 15" DIAMETER C-76 RCP, CLASS III | 115 | LF |
| 34-2.3e | 18" DIAMETER C-76 RCP, CLASS III | 315 | LF |
| 34-2.3g | 24" DIAMETER C-76 RCP, CLASS III | 17 | LF |
| 34-2.3p | 60" DIAMETER C-76 RCP, CLASS III | 60 | LF |
| 34-2.3s | 78" DIAMETER C-76 RCP, CLASS III | 30 | LF |
| 34-2.3t | 84" DIAMETER C-76 RCP, CLASS III | 220 | LF |
| 34-2.3u | 90" DIAMETER C-76 RCP, CLASS III | 1,349 | LF |
| 34-7.1c | 12" DIAMETER PVC PIPE (FOR ROOF DRAIN 1031+05) | 30 | LF |
| 34-12.4a | CAST-IN-PLACE TYPE B MANHOLE WITH TYPE A TOP SLAB | 5 | EA |
| 34-12.5b | CAST-IN-PLACE TYPE P MANHOLE WITH TOP SLAB FOR H>2' DEPTH | 1 | EA |
| 34-12.7 | CAST-IN-PLACE SPECIAL STRUCTURE MH-9 | 1 | EA |
| 34-12.7 | CAST-IN-PLACE SPECIAL STRUCTURE (CONCRETE COLLAR) | 2 | EA |
| 34-12.8 | UNCOVER AND RAISE (ADJUST) MANHOLE (MEASUREMENT IS EACH) | 4 | VF |
| 34-12.9 | ADJUST UTILITY LIDS | 5 | EA |
| 34-15.3 | UTILITY EXPLORATORY INVESTIGATION | 20 | EA |

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**STATEMENT OF QUANTITIES**

| Item No. | Description | Estimated | Quantity |
|---|---|---|---|
| 34-16.1a | #14 INLET (L=6') | 4 | EA |
| 34-16.1a | #14 INLET (L=6') (SPECIAL(DEEPER THAN 6')) | 5 | EA |
| 34-16.1b | #14 INLET (L=9') | 3 | EA |
| 34-16.1b | #14 INLET (L=9') (SPECIAL(DEEPER THAN 6')) | 4 | EA |
| 34-16.2a | SINGLE #16 INLET WITH OPEN THROAT | 2 | EA |
| 40-3 | SODDING | 10,000 | SF |
| 40-4b | RELOCATE EXISITING SPRINKLER LINE | 3,000 | LF |
| 40-6 | DECORATIVE LANDSCAPING (INCLUDES REMOVAL AND REPLACEMENT OF PLANTERS, DECORATIVE BRICK PAVING AND FLAGSTONE, AND GRADING AROUND RAMPS AND SIDEWALK) | 1 | LS |
| 41-1 | TRAFFIC CONTROL (TO INCLUDE POTENTIAL TEMPORARY 2-WAY CONVERSION OF CHAMPA, STOUT, 27TH STREET) | 1 | LS |
| 43-1d | STORM WATER MANAGEMENT (SCENARIO 4) See SCS 23.0 | 1 | LS |
| 44-1 | DEWATERING | 1 | LS |
| 45-2 | QUALITY CONTROL TESTING | 1 | LS |
| 46-1 | PAVEMENT MARKING (PAINT) | 470 | SF |
| 46-4 | PREFORMED PLASTIC PAVEMENT MARKING | 500 | SF |

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**STATEMENT OF QUANTITIES**

| Item No. | Description | Estimated | Quantity |
|---|---|---|---|
| 47-1 | CONSTRUCTION SURVEYING | 1 | LS |
| 47-2 | SURVEY MONUMENTATION (RESET RANGE POINT) | 3 | EA |
| 47-2 | SURVEY MONUMENTATION (FOR SURVEY MARKING (OTHER THAN RANGE POINT) TO BE TIED OUT) | 25 | EA |
| 50-1 | MOBILIZATION | 1 | LS |

# CITY AND COUNTY OF DENVER
## DEPARTMENT OF PUBLIC WORKS

**NOTICE FOR INVITATION FOR BIDS**
**FOR CONTRACT NO. 201950389**

**27th STREET STORM INTERCEPTOR, PHASE 2**

**BID SCHEDULE:**
**11:00 a.m., Local Time**
**June 27, 2019**

Sealed bids will be received in Room 6.G.7, 201 W. Colfax Ave., Denver, CO 80202, beginning at 10:30 a.m., no later than 11:00 a.m., on bid day. All properly delivered bids will then be publicly opened and read aloud.

Bids submitted prior to 10:30 a.m. on the specified bid opening date/time shall be presented at the Office of Contract Administration, Attention: Public Works Contract Administration, 201 W. Colfax Ave., Department 614, Denver, CO 80202.

Prior to submitting a bid, the bidder shall consult the Contractor's Bulletin Board located at 201 W. Colfax Ave., 2nd Floor, Denver, CO 80202 and/or www.work4denver.com.

**GENERAL STATEMENT OF WORK:**
The 27th Street Interceptor Project will improve drainage conditions in Basin 0062-1 by utilizing an existing 108" diameter storm system approximately 200' west of the 27th St. and Blake St. intersection in the Coors Field Parking lot. Phase 2 extends from the 27th and Arapahoe St southeast to 27th and Welton St. construction includes open cut of large diameter storm sewer and its associated facilities.

**ESTIMATED CONSTRUCTION COST:**
The estimated cost of construction for this project is between $4,900,000 and $5,400,000.

**TEXTURA CONSTRUCTION PAYMENT MANAGEMENT:**
Bidders are required, when preparing a bid, to agree it shall use the Textura® Construction Payment Management System ("Textura") to request payment from the City and to pay subcontractors. All certified subcontractors or suppliers who are listed for participation towards any assigned program goal must be paid via Textura. All fees associated with Textura are to be paid by the awarded Contractor. Bidders shall use the pricing scale provided in Instructions to Bidders to price the Textura service appropriately. For details on the company and service, contact the Textura® Corporation at 866-TEXTURA or www.texturacorp.com.

**DOCUMENTS AND BID INFORMATION AVAILABLE:**
Contract Documents complete with Technical Specifications and, if applicable, construction drawings will be available on the first day of publication at: www.work4denver.com. To download digital Contract Documents at a cost of $15 per download, reference eBid Document Number **#6359732** Contact QuestCDN at 952-233-1632 or info@questcdn.com for assistance.

**PRE-BID CONFERENCE:**
A pre-bid conference will be held for this project at 11:00 a.m., local time, on June 5, 2019. This meeting will take place at: 201 W. Colfax Ave., Denver, CO 80202, 4th floor, Room 4.I.4.

**DEADLINE TO SUBMIT QUESTIONS:** June 13, 2019 by 10:00 a.m. local time.

**PREQUALIFICATION REQUIREMENTS:**
Each bidder must be prequalified as a 1E(4) - PIPED SEWER at or above the $6,000,000 monetary level in accordance with the City's Rules and Regulations Governing Prequalification of Contractors. Each bidder must have submitted a prequalification application a minimum of ten (10) calendar days prior to the bid opening date. Applications must be

submitted to the Department of Public Works, Prequalification Section, 201 W. Colfax Ave., Department 614, Denver, CO 80202. To view the Rules and Regulations and to obtain a prequalification application, please visit our website at www.denvergov.org/prequalification or call 720-865-2539 for prequalification information ONLY.

**MINORITY AND WOMAN BUSINESS ENTERPRISE PARTICIPATION:**
Construction, reconstruction and remodeling contracts made and entered into by the City and County of Denver are subject to Article III, Divisions 1 and 3 of Chapter 28 of the Denver Revised Municipal Code, (Sections 28-31 to 28-36 and 28-52 to 28-90 D.R.M.C) and all Minority and Woman Business Enterprise and Equal Employment Opportunity Rules and Regulations adopted by the Director of the Division of Small Business Opportunity.

Article III, Division 3 of Chapter 28 of the D.R.M.C. directs the Director of the Division of Small Business Opportunity to establish a project goal for expenditures on construction, reconstruction, and remodeling work contracted by the City and County of Denver. The specific goal for this project is:

**15% Minority and Woman Business Enterprise (M/WBE) Participation**

Project goals must be met with certified participants as set forth in Section 28-60, D.R.M.C. or through the demonstration of a sufficient good faith effort under Section 28-62 D.R.M.C. For compliance with good faith requirements under Section 28-62(b), **the M/WBE percentage solicitation level required for this project is 100%.**

The Director of the Division of Small Business Opportunity urges all participants in City construction, reconstruction and remodeling projects to assist in achieving these goals.

**MISCELLANEOUS:**
Contracts for construction, reconstruction, and remodeling are subject to the City prevailing wage rate requirements established pursuant to Section 20-76, D.R.M.C.

City contracts are subject to payment of City Minimum Wage established pursuant to Section 20-82 through 20-84 D.R.M.C.

As its best interest may appear, the City and County of Denver reserves the right to reject any or all bids and to waive informalities in bids.

A modified version of this Notice of Invitation for Bids and the project's Statement of Quantities is available on the City and County of Denver's website at: www.work4denver.com.

Publication Dates: May 29, 30, 31, 2019
Published In: The Daily Journal

# CITY AND COUNTY OF DENVER
## DEPARTMENT OF PUBLIC WORKS

### INSTRUCTIONS TO BIDDERS

**IB-1 INSTRUCTION TO BIDDERS**

These Instructions to Bidders are a part of the Contract Documents and are intended to serve as a guide to bidders. They are general in nature and may be amended or supplemented as needed to support any one specific invitation to bid. Each bidder shall prepare its bid in strict compliance with all requirements of the Contract Documents and by careful application of these instructions.

**IB-2 BIDDING**

The copy of the Contract Documents contains the Bid Form and Submittal Package for this Project, which must be used to submit a bid hereunder. The bidder must fully complete, execute and submit this Bid Form and Submittal Package, along with any other specified components of the Contract Documents, as its bid for the referenced Project.

A bidder is not required to submit as part of its bid the entire set of Contract Documents distributed by the City pursuant to the Notice of Invitation for Bids, if the bidder executes and submits the Bidder Acknowledgment Form included with the Bid Form and Submittal Package as part of its bid. However, each bidder, by submitting its bid, shall be conclusively presumed to have received and reviewed all the information contained in the Contract Documents as this term is further defined herein.

Each bid must be enclosed in a sealed envelope, must be addressed to the Manager and must show on the face of the envelope the full name of the bidder, the City Project number, and descriptive title of the Project for which the bid is made.

The advertisement for Notice of Invitation for Bids will identify where and when the bid must be delivered.

**IB-3 CONTRACT DOCUMENTS AS PUBLISHED BY CITY**

Each bidder shall be responsible for, and shall be deemed to have received, all the information contained in the Contract Documents as distributed by the City pursuant to the Notice of Invitation for Bids, including addenda, whether or not such bidder has reviewed all or part of the Contract Documents in either its hard copy form or in any other format. If organizations or companies other than the City or its design professional distribute the City's Contract Documents for review by prospective bidders, whether in hard copy or via electronic or other media, neither the City nor its design professional shall be responsible for the content, completeness or accuracy of any information distributed or transmitted by any such organization or company.

**IB-4 COMPLETING AND SIGNING THE BID FORMS**

The bidder must complete the Bid Form by legibly writing or printing in ink, in words and figures as required, all the bidder's prices offered for the Work to be performed. All blank spaces, which require a response of the bidder, must be properly completed in full. If in the process of evaluating a bid, words and figures, as written on the Bid Form by the bidder, do not agree, the written words will govern.

For Bid Forms requiring unit price bids, the bidder shall write in the Bid Form spaces provided a unit price for each item for which a quantity is given and shall also write the product of each unit price and the quantity specified in the "Amount" or "Total" space provided.

Each bidder must sign the Bid Form and give the bidder's current business address. If an individual, the signature must be of the individual offering the bid; if a partnership, the signature must be that of a general partner; and if a corporation, both the president and the secretary must sign and the seal of the corporation must be affixed. Signatures of other persons may be acceptable if the bid contains sufficient evidence, satisfactory to the City in its sole discretion, to indicate that the other persons are authorized to bind the bidder.

**IB-5 UNACCEPTABLE BIDS**

The City will not accept bids from Bidders not prequalified with the Department of Public Works (if prequalification is required for this project), in arrears to the City upon debt or contract, or which are defaulters (as surety or otherwise) upon any obligation to the City.

**IB-6 INFORMAL AND UNBALANCED BIDS**

Any alteration, interlineations, erasure, omission, deletion or addition by the bidder to the Bid Form and Submittal Package or other parts of the Contract Documents submitted with the Bid Form and Submittal Package, as originally issued to the bidder, shall render the accompanying bid informal and may constitute cause for rejection.

Any unauthorized addition, conditional or alternate bids, failure to provide a unit price, lump sum amount or authorized alternate item specified or other irregularities of any kind which tend to render the bid incomplete, indefinite or ambiguous shall render the bid informal and may constitute cause for rejection.

Bids that are unbalanced so that each item does not reasonably carry its own proportion of cost or that contain inadequate or unreasonable prices for any item may be rejected. Bids, which have not acknowledged all addenda to the Contract Documents issued for this bid, may also be rejected.

The right is reserved by the City to reject any or all bids and to waive any informalities where it is deemed by the City to be in the best interests of the City to do so.

**IB-7 ONLY ONE BID ACCEPTED**

The City will accept only one bid for the same work from any one bidder. This includes bids that may be submitted under different names by one business enterprise.

**IB-8 BID GUARANTEE**

As a guarantee of good faith on the part of the bidder, each bid must be accompanied by a bid guarantee, consisting of either a certified or cashier's check made payable without condition to the order of the City and County of Denver or a bid bond written by an approved corporate surety in favor of the City and County of Denver. If the bid of a bidder is acceptable and the bidder is notified by the Manager that it is considered to be the Apparent Low Bidder and said bidder fails to execute a contract in the form prescribed or to furnish a performance and payment bond with a legally responsible and approved surety or to furnish the required evidence of insurance or satisfy all conditions precedent to contract execution within five (5) days after such notice is made by the City, said bid guarantee shall be forfeited to the City as liquidated damages and not as a penalty.

The bid guarantee shall be in the amount of five percent (5%) of the total bid unless otherwise specified in the Notice of Invitation for Bids and on the form appearing in the Contract Documents in the Bid Form and Submittal Package. Failure to submit a properly executed bid guarantee, on the form provided herein may, in the City's sole discretion, constitute cause for rejection.

Following award and execution of the Contract by the Apparent Low Bidder, or earlier in the sole discretion of the City, bid guarantees of all but the Apparent Low Bidder will be returned. When the Apparent Low Bidder executes the Contract and delivers to the City satisfactory performance and payment bonds, required insurance documentation, and has satisfied all conditions precedent to contract execution by the City, and after approval, if any, by the Council of the City of the proposed Contract with the Apparent Low Bidder, the bid guarantee of the Apparent Low Bidder shall be returned. Such return shall be made within one hundred twenty (120) days from date bids are opened unless otherwise specified in the Special Contract Conditions.

**IB-9 SITE INSPECTION AND INVESTIGATIONS**

Prior to submitting a bid, the bidder is invited to inspect the work site and its surroundings. Although the bidder is not required to make such an inspection before bidding, for purposes of the Contract it shall be conclusively presumed that by failing to make such an inspection, the bidder has waived the right to later claim additional compensation or time extensions for conditions which would have been evident had the site been inspected.

Drawings and Technical Specifications, defining the Work to be done, were prepared on the basis of interpretation by the design professionals of information derived from investigations of the work site. Such information and data are subject to sampling errors, and the interpretation of the information and data depends to a degree on the judgment of the design professional. In view of this, the bidder is invited to make such additional investigations as the bidder's judgment dictates the need for such investigations. Information about the degree of difficulty of the Work to be done cannot totally be derived from either the Drawings or Technical Specifications or from the Manager or his representatives.

Since the bid information cannot be guaranteed, the Contractor shall have assumed the risks attendant to successful performance of the Work and shall never make claim for additional compensation or time extensions on the grounds that the nature or amount of work to be done was not understood by the bidder at the time of the bidding.

**IB-10 INCONSISTENCIES**

Any seeming inconsistencies or ambiguities between different provisions of the Contract Documents or any point which the bidder believes requires a decision or interpretation by the City must be inquired into by the bidder by addressing a formal written communication to the Manager of Public Works and sending or delivering it to the offices of the Division of Public Works advertising this Project for bid at least forty-eight (48) hours, excluding Saturdays, Sundays, and holidays, before the time set for the opening of bids

Information about the decision or interpretation made in response to any inquiry will be posted on the Contractor's Bulletin Board (refer to IB-12 CONTRACTOR'S BULLETIN BOARD, for the location of the Contractor's Bulletin Board). If the matter raised requires, in the sole discretion of the Manager, that an addendum to the bid documents be issued, such addendum will be published and each bidder shall be required to acknowledge the addendum by signing and identifying it in the Bid Form when submitting the bid.

After bids are opened, all bidders must abide by the formal response of the Manager, as to any interpretation. The City shall not be bound and the bidder shall not rely on any oral communication, interpretation clarification or determination of the Contract Documents prior to bid opening.

**IB-11 WITHDRAWAL OF BID**

A bidder may withdraw its bid at any time prior to the time for receipt of bids set forth in the Notice of Invitation for Bids by making written request upon the Manager of Public Works. After such time, no bid may be withdrawn or modified.

Such request must be signed by the persons authorized to bind the bidder as defined in IB-3, COMPLETING AND SIGNING BID FORMS.

**IB-12 CONTRACTOR'S BULLETIN BOARD**

It shall be conclusively presumed that the bidder has, before submitting any bid, read and shall take full responsibility for all addenda, posted decisions, and other information relevant to the bid posted by the City on the Contractor's Bulletin Board. The Contractor's Bulletin Board is located at 201 W. Colfax, 2nd Floor, Denver, CO 80202, in the Wellington E. Webb Municipal Office Building.

**IB-13 PRE-BID MEETING**

Bidders are urged to attend the pre-bid meeting(s) scheduled for this Project. Attendance is not mandatory; however, bidders will be held responsible for all information presented at such meeting(s).

**IB-14 ADDENDA**

As its best interests may require, the City may issue addenda to the Contract Documents. Such addenda shall be posted on the Contractor's Bulletin Board and made available to all persons having purchased a set of Contract Documents as set forth in the Notice of Invitation for Bids contained herein. All bidders must acknowledge receipt of all addenda on the Bid Form at the time of submission of the bid.

**IB-15 BID OPENING**

Bidders are invited to be present at the bid opening. Unless otherwise suspended, delayed or canceled by posted notice from the Manager, bid opening will occur at the time and place designated in the Notice of Invitation for Bid.

## IB-16 EVALUATION OF BIDS AND BASIS OF BID SELECTION

Bids will be evaluated after being read in open meeting at the place designated for such bid opening. All low bidders' bids will be reviewed for responsiveness to the requirements of the Contract Documents and whether or not the bids contain irregularities which could give any bidder an unfair advantage.

Selection will be made on the basis of the lowest, total, responsive, qualified bid, which bid shall include the total base bid set forth on the Bid Form, plus the total of any alternates set forth on the Bid Form and selected by the City during evaluation. Alternates, if any are included in the bid, will be selected in the priority shown on the Bid Form, subject to the limits of available funds. Bid selection will be subject to all requirements and special bidder qualifications contained herein and subject to approval of such resulting Contract in accordance with the Charter and Revised Municipal Code of the City and County of Denver. In addition to all other specified requirements, the City will correct arithmetical errors in all bids and corrected totals only will be considered as the basis of selection.

Upon concluding that the bid is, in fact, the lowest, total, responsive bid to the bidding conditions and that of a responsible, qualified bidder, the City will notify the Apparent Low Bidder.

As its best interests may appear, the City and County of Denver reserves the right to waive informalities in bids, to reject any and all bids and to rebid the Project.

## IB-17 NOTICE TO APPARENT LOW BIDDER

The Notice to Apparent Low Bidder, a form of which is included in the Contract Special Conditions Section of the Contract Documents, is issued by the City directly to the selected bidder and informs the bidder that the Manager intends to seek approval of the execution of the Contract by the City in accordance with the Charter and Revised Municipal Code of the City and County of Denver. Specifically, it informs the bidder of its obligations with respect to execution of the Contract and instructs the bidder on how to proceed toward execution of the Contract. The City reserves the right to notify the Apparent Low Bidder, at any time within one hundred twenty (120) days from the date of the opening of the bids, that approval to contract with the Apparent Low Bidder shall be sought in accordance with the Charter and Revised Municipal Code of the City and County of Denver.

In accordance with the terms and conditions contained in the Bid Form and Submittal Package and any additional requirements set forth in the Notice to Apparent Low Bidder or elsewhere in the Contract Documents, the Apparent Low Bidder shall execute the Contract Form contained in the Contract Documents made available by the City for execution in the appropriate number of counterparts. The Apparent Low Bidder shall return the fully executed Contract Document sets, along with any supplemental documents required herein, to the City and shall comply with all other conditions precedent to Contract execution within five (5) days of the date of issuance of the Notice to Apparent Low Bidder by the City. Failure to comply with each of these requirements within five (5) days of the date of issuance of the Notice to Apparent Low Bidder by the City shall render the bid nonresponsive and may constitute cause for rejection.

Issuance of such Notice shall not, however, constitute a commitment on the part of the City or create any rights in the Apparent Low Bidder to any contract with the City.

## IB-18 EXECUTION OF CONTRACT

The process of executing a contract requires action by both the apparent low bidder and the City. After it notifies the Apparent Low Bidder, the City will prepare the Contract Documents by incorporating all of the documents submitted by the Apparent Low Bidder into one or more executable copies. Upon notification that contracts documents are ready for execution the Apparent Low Bidder shall execute the contract documents. At this time, the successful bidder shall also provide certain supplemental documents for incorporation into the Contract Documents. These supplemental documents shall include: the properly executed Certificate of Insurance Forms evidencing the apparent low bidder's satisfactory compliance with the insurance requirements set forth in the Contract Documents; a properly executed Payment and Performance Bond Form and appropriate Power of Attorney evidencing the Apparent Low Bidder's satisfactory compliance with the bonding requirements set forth in the Contract Documents; and documentation of compliance with any other conditions precedent to execution of the Contract by the City set forth in the Contract Documents. The insurance and bond forms contained in the Contract Special

Conditions Section of the Contract Documents must be used in satisfying these supplemental document requirements.

These documents are then delivered to the City within the prescribed time period for examination of the documents to determine whether or not the Contractor has correctly executed the Contract and has correctly provided the required supplemental documents and that these documents are satisfactorily and properly completed. From here, all of the documents are forwarded to the City Attorney who will, if the insurance and bonding offered is acceptable and if all other elements of the Contract Documents are in order, recommend that the Manager and the Mayor approve the documents and, when required by the City Charter, prepare an ordinance for submittal to City Council authorizing the execution of the Contract. The City Attorney shall in all applicable instances submit the proposed contract and ordinance to City Council. After City Council approval, the Contract shall be reviewed by the City Attorney and routed for execution by the Mayor, the Clerk for attestation and the Auditor for countersignature and registration. When the total process of contract execution is complete, a Notice to Proceed will be issued and a single executed copy of the Contract will be delivered to the Contractor. Any work performed or a material purchased prior to the issuance of Notice to Proceed is at the Contractor's risk.

**IB-19 BONDING REQUIREMENTS**

In accordance with the provisions of General Contract Conditions, Title 15, PERFORMANCE AND PAYMENT BONDS, the minimum bonding requirements for this Contract are set forth in the form **CITY AND COUNTY OF DENVER PERFORMANCE AND PAYMENT BOND** contained in the Special Conditions Section of the Contract Documents. Upon receipt of Notice to Apparent Low Bidder, the apparent low bidder must cause this form bond to be purchased, executed and furnished, along with appropriate Powers of Attorney and a surety authorization letter (in form similar to the one attached), to the City in accordance with the instructions contained herein.

**IB-20 INSURANCE REQUIREMENTS**

The minimum insurance requirements for this Contract are set forth in the Special Conditions Section of the Contract Documents. Bidders are urged to consider, in preparing a bid hereunder, that each condition, requirement or specification set forth in the form certificate must be complied with by the Contractor and all subcontractors performing Work on the Project, unless such requirements are specifically accepted in writing by the City's Risk Management Office. The Contractor must either include all subcontractors performing work hereunder as insureds under each required policy or furnish a separate certificate for each subcontractor. In either case, the Contractor shall insure that each subcontractor complies with all of the coverage requirements.

**IB-21 PERMITS AND LICENSES**

All permits, licenses and approvals required in the prosecution of the work shall be obtained and paid for by the Contractor.

**IB-22 PREVAILING WAGE REQUIREMENTS**

Contractor shall comply with, and agrees to be bound by, all requirements, conditions and City determinations regarding the Payment of Prevailing Wages Ordinance, Sections 20-76 through 20-79, D.R.M.C. including, but not limited to, the requirement that every covered worker working on a City owned or leased building or on City-owned land shall be paid no less than the prevailing wages and fringe benefits in effect on the date the bid or request for proposal was advertised. In the event a request for bids, or a request for proposal, was not advertised, Contractor shall pay every covered worker no less than the prevailing wages and fringe benefits in effect on the date funds for the contract were encumbered.

Date bid or request for qualifications/proposals was advertised: May 29, 2019.

Prevailing wage and fringe rates will adjust on, and only on, the anniversary of the date the Contract was fully executed. Unless expressly provided for in this Agreement, Contractor will receive no additional compensation for increases in prevailing wages or fringe benefits.

Contractor shall provide the Auditor with a list of all subcontractors providing any services under the contract.

Contractor shall provide the Auditor with electronically-certified payroll records for all covered workers employed under the contract.

Contractor shall prominently post at the work site the current prevailing wage and fringe benefit rates. The posting must inform workers that any complaints regarding the payment of prevailing wages or fringe benefits may be submitted to the Denver Auditor by calling 720-913-5000 or emailing auditor@denvergov.org.

If Contractor fails to pay workers as required by the Prevailing Wage Ordinance, Contractor will not be paid until documentation of payment satisfactory to the Auditor has been provided. The City may, by written notice, suspend or terminate work if Contractor fails to pay required wages and fringe benefits.

**IB-23 PAYMENT OF CITY MINIMUM WAGE**

Contractor shall comply with, and agrees to be bound by, all requirements, conditions, and City determinations regarding the City's Minimum Wage Ordinance, Sections 20-82 through 20-84 D.R.M.C, including, but not limited to, the requirement that every covered worker shall be paid no less than the City Minimum Wage in accordance with the foregoing D.R.M.C. Sections.

Instances in which a worker is covered by both Prevailing Wage rate requirements and City Minimum Wage rate requirements, Contractor shall pay every covered worker the greater of the two.

The services being requested in this solicitation may involve services that are covered pursuant to Division 3.75 of Article IV of Chapter 20 of the Denver Revised Municipal Code ("D.R.M.C."), which is designed to address the issue of wage equity and cost of living affordability in the City & County of Denver. Contractor agrees that any contract with the City shall include a requirement that Contractor will comply with the provisions of D.R.M.C. §§20-82 through 20-84, including, but not limited to, paying all covered workers no less than the City Minimum Wage for all covered services rendered in connection with the Contract. Additionally, Contractor agrees that the contract shall require compliance with all current and future federal and state laws and City ordinances.

**IB-24 TAX REQUIREMENTS**

General. Bidders are referred to the General Contract Condition 323, TAXES, as to taxes to which they may be subject in performing the Work under this Contract, including but not limited to sales and use taxes and the Denver Occupational Privilege Tax. The following instructions are to be considered along with the General Contract Conditions and not in lieu of them.

Sales and Use Tax. The City of Denver imposes consumer use tax on all construction and building materials used on any construction project located in Denver. Denver does not exempt governmental or charitable projects.

It is the responsibility of the Contractor and its subcontractors to apply to the Colorado Department of Revenue ("CDOR") for a certificate, or certificates, of exemption indicating that their purchase of construction or building materials is for a public project, and to deliver to the City copies of such applications as soon as possible after approval by the CDOR. Bidders shall include Denver sales/use tax, Occupational Privilege taxes, and shall not include in their bid amounts the exempt state, RTD, and Cultural Facilities District Sales and Use Taxes.

Denver Occupational Privilege Tax. Any employee working for a contractor, or a subcontractor, who earns $500 or more working in Denver during a calendar month, is subject to the payment of the Employee Occupational Privilege Tax. The Contractor and any subcontractor must pay the Business Occupational Privilege Tax for each of its employees who are subject to such tax.

**IB-25 DIVERSITY AND INCLUSIVENESS IN CITY SOLICITATIONS**

Each bidder shall, as a condition of responsiveness to this solicitation, complete and return the "Diversity and Inclusiveness in City Solicitations Information Request Form" with their Bid.

Using the "Diversity and Inclusiveness in City Solicitations Information Request Form" provided, please state whether you have a diversity and inclusiveness program for employment and retention, procurement

and supply chain activities, or customer service and provide the additional information requested on the form. The information provided on the "Diversity and Inclusiveness in City Solicitations Information Request Form" will provide an opportunity for City contractors to describe their own diversity and inclusiveness practices. Contractors are not expected to conduct intrusive examinations of its employees, managers, or business partners in order to describe diversity and inclusiveness measures. Rather, the City simply seeks a description of the contractor's current practices, if any.

Diversity and Inclusiveness information provided by City contractors in response to City solicitations for services or goods will be collated, analyzed, and made available in reports consistent with City Executive Order No. 101. However, no personally identifiable provided by or obtained from contractor's will be in such reports.

**IB-26 MINORITY AND WOMAN BUSINESS ENTERPRISE (M/WBE) REQUIREMENTS**

Article III, Divisions 1 and 3 of Chapter 28, Denver Revised Municipal Code (D.R.M.C.), designated as Sections 28-31 – 28-36 and 28-52 – 28-90 D.R.M.C. and referred to in these Bid Documents as the "M/WBE Ordinance" and any Rules or Regulations promulgated pursuant thereto apply to this Project and are incorporated into these Bid Documents by reference. Generally, the M/WBE Ordinance provides for the adoption of a good faith goals program, to be administered by the Division of Small Business Opportunity (DSBO), devised to provide increased bidding opportunities for Minority and Woman Business Enterprises (M/WBEs). As such, each bidder must comply with the terms and conditions of the M/WBE Ordinance in making its bid and, if awarded the Contract, in performing all Work thereunder. A bidder's failure to comply with the M/WBE Ordinance, any Rules or Regulations promulgated pursuant thereto, or any additional requirement contained herein shall render the bid non-responsive and shall constitute cause for rejection. Failure by the contractor awarded the contract to comply with M/WBE Ordinance requirements during the performance of the contract is a material breach of the contract, which may result in the in the imposition of sanctions on the Contractor, as deemed appropriate by DSBO. Copies of the M/WBE Ordinance and its accompanying Rules and Regulations are available for the use and review of bidders from DSBO. In order to comply with the bid requirements of the M/WBE Ordinance, a bidder shall either meet the established project goal or, in the alternative, demonstrate that the bidder has made sufficient good faith efforts to meet the goal in accordance with the M/WBE Ordinance.

**Meeting Established Goal**

In preparing a bid to meet the established Project goal, bidders should consider the following instructions relating to compliance with the M/WBE Ordinance:

1. Under the M/WBE Ordinance, the Director of DSBO ("Director") is directed to establish project goals for expenditures on construction, reconstruction, and remodeling work performed for the City and County of Denver. The specific goal for this project is stated in the Notice of Invitation for Bids bound herein.

2. In preparing its bid, each bidder shall list on the Bid Form pages entitled "List of Proposed MWBE Bidders, Subcontractors, Suppliers, Manufacturers, Manufacturers' Representatives or Brokers" the name, address, work description/supply, committed level of participation and other required information for each M/WBE of any tier which the bidder intends to use in performing the work on this Project. **Only the M/WBEs identified and the precise levels of participation listed for each on the Bid Form page, at the time of bid opening, will be considered in determining whether the bidder has met the designated participation goal. Additional, revised or corrected participation submitted after bid opening will not be considered.** M/WBE bidders may count self-performance or joint venture activity in meeting the M/WBE project goal, but only for the scope of work performed as a commercially useful function and at a percentage level the M/WBE will be performing itself.

3. Any agreement between a bidder or proposer and an MBE or WBE in which the bidder or proposer requires that the MBE or WBE not provide subcontracting quotations to other bidders or proposers is prohibited and shall render a bidder's bid or proposer's proposal nonresponsive. D.R.M.C. 28-63(f)

4. If a bidder/proposer is participating in a joint venture with a certified M/WBE firm, complete the Joint Venture Eligibility Form and Joint Venture Affidavit contained in this bid document/RFP.

Submit the aforementioned forms with the firm's Joint Venture Agreement, to the DSBO Director, **at least 10 working days prior to the proposal submittal.** The Joint Venture must be approved prior to the bid opening or proposal submittal by the DSBO Director. Approval by the DSBO Director includes determining the amount the Joint Venture will count towards meeting the project goal.

5. All M/WBEs listed on the Bid Form must be properly certified by the City on or before the date bids are opened in order to count towards meeting the designated goal. DSBO maintains an M/WBE Directory ("Directory"), which is a current listing of M/WBEs that have been certified by the City. A copy of the DSBO Directory is located at DSBO web site at https://www.denvergov.org/dsbo. Bidders are encouraged to use the Directory to assist in locating M/WBEs for the work and supplies required on the Project. Bidders are reminded that changes may be made to the Directory at anytime in accordance with the City's M/WBE Ordinance and procedures established to administer this program and a current copy of the Directory must always be used in preparing a bid. M/WBE certification or listing in the Directory is not a representation or warranty by the City as to the qualifications of any listed M/WBE.

6. In accordance with the provisions of the M/WBE Ordinance, DSBO will evaluate each bid to determine the responsiveness of the bid to the requirements of the M/WBE Ordinance. In determining whether a bidder's committed level of participation meets or exceeds the stated M/WBE goal, DSBO shall base its calculation of applicable amounts and percentages on the total base bid amount, not including any listed alternates, of each bid as follows:

   a. The bid information provided by the agency will be used to determine the total base bid amount of each bid. Each bidder's total base bid amount will be multiplied by the M/WBE percentage established for the project to determine the exact dollar amount of required M/WBE participation for the Project. This amount will then be compared against the exact dollar amounts for the M/WBE committed for participation by the bidder. If the total dollar amount of participation listed meets or exceeds the established M/WBE dollar amount goal listed, then DSBO will determine that the goal has been met.

   b. In addition, DSBO will determine the exact commitment percentage for each listed M/WBE by dividing the dollar amount listed for each M/WBE by the total base bid dollar amount submitted by the bidder. These individual percentages, when totaled for all listed M/WBE, will establish the total committed percentage level of M/WBE participation that the bidder must comply with during the life of the contract. In all cases, the committed percentage level of M/WBE participation must equal or exceed the assigned M/WBE goal for the Project.

   c. In providing the exact dollar amount of participation for each listed M/WBE, a bidder should take care never to round up in determining whether or not the total of these amounts meets or exceeds the established percentage goal. The goal must be met or exceeded by dollar amounts and percentages in order for DSBO to determine that the bidder has met or exceeded the applicable M/WBE goal.

   d. As previously mentioned, compliance with the M/WBE goal will be determined on the base bid alone. If a bid contains alternates, participation contained in any alternate will not count towards satisfaction of the Project goal. However, should any designated alternate be selected by the City for inclusion in the contract ultimately awarded, the M/WBE goal percentage level submitted at bid time, on the base bid, will also apply to the selected alternates and must be maintained for the life of the contract on the total contract amount, including any alternate work. Thus, even though such participation will not be considered in evaluating bids, bidders are urged to consider participation in preparing bids for designated alternates.

   d. On projects where force account or allowance bid items have been included, bidders must meet the M/WBE goal percentage based upon the total base bid, including all such items that are submitted to the City. However, when a force account or allowance is designated

by the City to be either performed or purchased from a specific company, the bidder may back out the dollar amount of the force account or allowance from the total base bid and meet the M/WBE goal on the remaining reduced amount.

e. On bids which, at the time of bid opening, are equal to or exceed Five Million Dollars ($5,000,000.00), including any alternates which may be selected, only sixty percent (60%) of the value of the commercially useful function performed by M/WBE suppliers shall count toward satisfaction of the Project goal. On Projects under Five Million ($5,000,000.00) the value of the commercially useful function of M/WBE supplier(s) will count at a one hundred percent (100%) level. Manufacturer's representatives and packagers shall be counted in the same manner as brokers.

f. In utilizing the M/WBE participation of a Broker only the bona fide commissions earned by such Broker for its performance of a commercially useful function will count toward meeting the Project goals. The bidder must separate the bona fide brokerage commissions from the actual cost of the supplies or materials provided to determine the actual dollar amount of participation that can be counted towards meeting the goal.

7. On or before the third (3rd) working day after bid opening, all of the Bidders are required to submit an executed "Letter of Intent" for each M/WBE listed on the Bid Form as a joint venture member, subcontractor, supplier, manufacturer, manufacturers' representative or broker of any tier. **An MBE or WBE Prime Bidder needs to submit a Letter of Intent for itself for self-performed work** and must identify their level of participation on the designated M/WBE participation page bound herein. A Letter of Intent shall be submitted <u>only</u> for the M/WBEs listed at the time of bid opening, since this is the only participation that will be counted toward satisfaction of the project goal. A form for the M/WBE Letter of Intent is included with the Bid Form. The M/WBE Letter of Intent is a written communication from the Bidder to the City evidencing an understanding that the Bidder has or will enter into a contractual relationship with the M/WBE or that its subcontractor(s) and supplier(s), manufacturer(s), manufacturers' representative(s) and broker(s) will do so. Each M/WBE Letter of Intent shall be accompanied by a copy of the City and County of Denver's M/WBE certification letter for each proposed M/WBE identified at bid time. Bidders are urged to carefully review these Letters before submission to the City to ensure that they are properly completed and executed by the appropriate parties.

**Good Faith Effort.**

In preparing a bid to demonstrate a good faith effort, bidders should consider the following instructions relating to compliance with the M/WBE Ordinance:

1. If the bidder or proposer has not fully met the project goal as provided in section 28-60, then it shall demonstrate that it has made good faith efforts to meet such goal. The bidder or proposer shall furnish to the director, within three (3) working days after bid opening by the City or on or before the time of the final project-specific proposal submitted to and authorized by the City pursuant to a competitive selection process, or bid selection by a private owner, a detailed statement of its good faith efforts to meet the project goal set by the director. This statement shall address each of the items in subsection (b) and any additional criteria that the director may establish by rule or regulation consistent with the purposes of this division 3. Good faith efforts must be demonstrated to be meaningful and not merely for formalistic compliance with this Division 3. The scope and intensity of the efforts will be considered in determining whether the bidder or proposer has achieved a good faith effort.

2. The statement of good faith efforts shall include a specific response and verification with respect to each of the following good faith effort categories, which may be further defined by rule or regulation. A bidder or proposer may include any additional information it believes may be relevant. Failure of a bidder or proposer to show good faith efforts as to any one (1) of the following categories shall render its overall good faith effort showing insufficient and its bid or proposal non-responsive:

   a. If prebid or preselection meetings are scheduled by the City at which MBEs and WBEs may be informed of subcontracting or joint venture opportunities under a proposed contract to be bid, or procured pursuant to the competitive selection

process, attendance at such prebid or preselection meetings is not mandatory; however, bidders and proposers are responsible for the information provided at these meetings.

b. The bidder or proposer must solicit through all reasonable and available means, the interest of all MBEs and WBEs certified in the scopes of work of the contract. The bidder or proposer must solicit the interest of such MBEs and WBEs within sufficient time, prior to the bid opening or date of final project-specific proposal in the case of a competitive selection process, to allow such MBEs and WBEs to respond to the solicitation. The bidder or proposer must determine with certainty if the MBEs and WBEs are interested by demonstrating appropriate steps to follow up initial solicitations.

c. The bidder or proposer must select portions of the work of the contract to be performed by MBEs and WBEs in order to increase the likelihood that the project goal will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate MBE and WBE participation as subcontractors or joint venturers, and for bidder or proposer self-performed work, as suppliers, manufacturers, manufacturer's representatives and brokers, all reasonably consistent with industry practice, even when the bidder or proposer would otherwise prefer to perform these work items with its own forces. The bidder or proposer must identify what portions of the contract will be self-performed and what portions of the contract will be opened to solicitation of bids, proposals and quotes from MBE and WBEs. All portions of the contract not self-performed must be solicited for MBE and WBE participation. The ability or desire of a bidder or proposer to perform the work of a contract with its own forces does not relieve the bidder or proposer of the responsibility to meet the project goal or demonstrate good faith efforts to do so.

d. The bidder or proposer, consistent with industry practice, must provide MBEs and WBEs at a clearly stated location with timely, adequate access to and information about the plans, specifications, and requirements of the contract, including bonding and insurance requirements, if any, to assist them in responding to a solicitation.

e. The bidder or proposer must negotiate in good faith with interested MBEs and WBEs and provide written documentation of such negotiation with each such MBE or WBE.

f. For each MBE or WBE which contacted the bidder or proposer or which the bidder or proposer contacted or attempted to subcontract or joint venture with, consistent with industry practice, the bidder or proposer must supply a statement giving the reasons why the bidder or proposer and the MBE or WBE did not succeed in negotiating a subcontracting, supplier, manufacturer, manufacturer's representative, broker or joint venture agreement, as applicable.

3. The bidder or proposer must provide verification that it rejected each non-utilized MBE and WBE because the MBE or WBE did not submit the lowest bid or it was not qualified. Such verification shall include a verified statement of the amounts of all bids received from potential or utilized subcontractors, suppliers, manufacturers, manufacturer's representatives, brokers or joint venturers on the contract, whether or not they are MBEs or WBEs. In making such a determination of not being qualified, the bidder or proposer shall be guided by the definition of qualified in section 28-54(42), but evidence of lack of qualification must be based on factors other than solely the amount of the MBE's or WBE's bid. For each MBE or WBE found not to be qualified by the bidder or proposer, the verification shall include a statement giving the bidder's or proposer's reasons for its conclusion. A bidder's or proposer's industry standing, or group memberships may not be the cause of rejection of an MBE or WBE. A bidder or proposer may not reject an MBE or WBE as being unqualified without sound reasons based on a reasonably thorough investigation and assessment of the MBE's or WBE's capabilities and expertise.

4. If requested by a solicited MBE or WBE, the bidder or proposer must make reasonable efforts to assist interested MBEs and WBEs in obtaining bonding, lines of credit, or insurance as required by

the City or by the bidder or proposer, provided that the bidder or proposer need not provide financial assistance toward this effort.

5. If requested by a solicited MBE or WBE, the bidder or proposer must make reasonable efforts to assist interested MBEs and WBEs in obtaining necessary and competitively priced equipment, supplies, materials, or related assistance or services for performance under the contract, provided that the bidder or proposer need not provide financial assistance toward this effort.

6. The bidder or proposer must use the DSBO MBE/WBE directories to identify, recruit, and place MBEs and WBEs.

7. In determining whether a bidder or proposer has satisfied good faith efforts as to a project goal, the success or failure of other bidders or proposers on the contract in meeting such project goal may be considered.

**Continuing Commitments.**
In accordance with the provisions of the M/WBE Ordinance, the bidder agrees that it is committed to meeting either the M/WBE participation goal or the M/WBE participation set forth in its statement of good faith. This commitment must be expressly indicated on the "Commitment to MWBE SBE Participation" form included with the Bid Form. This commitment includes the following understandings:

1. The bidder understands it must maintain M/WBE goals throughout the performance of the Contract pursuant to the requirements set out in D.R.M.C. 28-72.

2. The bidder understands that it must establish and maintain records and submit regular reports, as required, which will allow the City to assess progress in achieving the M/WBE participation goal.

3. The bidder understands that if change orders or any other contract modifications are issued under the contract, the bidder shall have a continuing obligation to immediately inform DSBO in writing of any agreed upon increase or decrease in the scope of work of such contract, upon any of the bases discussed in Section 28-73 of the M/WBE Ordinance, regardless of whether such increase or decrease in scope of work has been reduced to writing at the time of notification.

4. The bidder understands that if change orders or other contract modifications are issued under the contract, that include an increase in scope of work of a contract for construction, reconstruction, or remodeling, whether by amendment, change order, force account or otherwise which increases the dollar value of the contract, whether or not such change is within the scope of work designated for performance by an M/WBE at the time of contract award, such change orders or contract modification shall be immediately submitted to DSBO for notification purposes. Those amendments, change orders, force accounts or other contract modifications that involve a changed scope of work that cannot be performed by existing project subcontractors or by the contractor shall be subject to a goal for M/WBEs equal to the original goal on the contract which was included in the bid. The contractor shall satisfy such goal with respect to such changed scope of work by soliciting new M/WBEs in accordance with Section 28-73 of the M/WBE Ordinance as applicable, or the contractor must show each element of modified good faith set out in Section 28-75(c) of the M/WBE Ordinance. The contractor shall supply to the director the documentation described in Section 28-75(c) of the M/WBE Ordinance with respect to the increased dollar value of the contract.

All bidders are charged with knowledge of and are solely responsible for complying with each and every provision of the M/WBE Ordinance in making a bid and, if awarded, in performing the work described in the Contract Documents. Failure to comply with these provisions could constitute cause for rejection of a bid or subject the selected contractor to sanctions set forth in the M/WBE Ordinance. These instructions are intended only to generally assist the bidder in preparing and submitting a compliant bid. Should any questions arise regarding specific circumstances, bidders must consult the M/WBE Ordinance or contact the Project's designated DSBO representative at (720) 913-1999.

## IB- 27 DISCLOSURE OF INFORMATION

All submissions and other materials provided or produced pursuant to this Invitation for Bids may be subject to the Colorado Open Records Law, C.R.S. 24-72-201, et seq. As such, bidders are urged to review these

disclosure requirements and any exceptions to disclosure of information furnished by another party and, prior to submission of a bid to the City, appropriately identify materials that are not subject to disclosure. In the event of a request to the City for disclosure of such information, the City shall advise the bidder of such request to give the bidder an opportunity to object to the disclosure of designated confidential materials furnished to the City. In the event of the filing of a lawsuit to compel such disclosure, the City will tender all such material to the court for judicial determination of the issue of disclosure and each bidder agrees to intervene in such lawsuit to protect and assert its claims of privilege against disclosure of such material. Each bidder further agrees to defend, indemnify and save and hold harmless the City, its officers, agents and employees, from any claim, damages, expense, loss or costs arising out of the bidder's intervention to protect and assert its claims of privilege against disclosure under the Open Records Law including, but not limited to, prompt reimbursement to the City of all reasonable attorney fees, costs and damages that the City may incur directly or may be ordered to pay by such court.

**IB-28 GENERAL BIDDING INFORMATION**

Bidders are instructed to contact the Contract Administrator designated below for this Project for pre-bid, post-bid and general City bidding information. Bidders can also visit www.work4denver.com for information, both general and project specific. The Contract Administrator assigned to this project is David Relaford who can be reached via email at pw.procurement@denvergov.org.

**IB-29 PAYMENT PROCEDURE REQUIREMENTS**

Bidder recognizes and agrees that it shall be required to use the Textura® Construction Payment Management System ("Textura") for this Project to request payment from the City and to pay subcontractors. All certified subcontractors or suppliers who are listed for participation towards any assigned program goal must be paid via Textura. All fees associated with Textura are to be paid by the bidder for billings for work performed. Bidders are required, when preparing a bid, to enter the price of Textura on the line provided for the service. The fee is all inclusive of all subcontractor, project and subscription fees associated with Textura. The bidder will calculate the fee based on their total bid (not including any alternates, if applicable) and the table below, and then include it on the line item provided in the bid form labeled **"Textura® Construction Payment Management System Fee"**. This expense becomes part of the contract and billable to the City. All costs including, but not limited to, costs associated with training, entering data, and/or utilizing Textura other than the Textura Construction Payment Management System Fee are overhead and shall not be reimbursed by the City. Bidder will be responsible for any tax on the Textura fee. As with other taxes, the City will not reimburse bidder for this cost and therefore this cost should be included in bidder's bid. Textura will invoice the awarded bidder directly.

| Project Value | Project Fee (GC + Sub Usage) |
|---|---|
| $100,000 – 249,999.99 | $780 |
| $250,000 - $499,999.99 | $1,625 |
| $500,000 - $999,999.99 | $3,250 |
| $1,000,000 - $2,999,999.99 | $5,850 |
| $3,000,000 - $4,999,999.99 | $9,100 |
| $5,000,000 - $9,999,999.99 | $12,220 |
| $10,000,000 - $19,999,999.99 | $20,345 |
| $20,000,000 - $49,999,999.99 | $32,500 |
| $50,000,000 - $99,999,999.99 | $48,750 |
| $100,000,000 - $199,999,999.99 | $69,095 |
| $200,000,000 - $299,999,999.99 | $85,345 |
| $300,000,000 - $399,999,999.99 | $109,720 |
| $400,000,000 - $499,999,999.99 | $142,220 |
| $500,000,000 - $999,999,999.99 | $162,500 |
| $1,000,000,000 - $1,999,999,999.99 | $345,345 |
| $2,000,000,000 - $4,999,999,999.99 | $650,000 |
| $5,000,000,000 - $9,999,999,999.99 | $1,015,625 |
| $10,000,000,000 or greater | $1,503,125 |

## RULES AND REGULATIONS
## REGARDING
## EQUAL EMPLOYMENT OPPORTUNITY

Promulgated and adopted by the Manager of Public Works pursuant to and by authority of Article III, Division 2, Chapter 28 of the Revised Municipal Code of the City and County of Denver, and for the purpose of insuring that contractors, subcontractors and suppliers soliciting and receiving compensation for contract work from or through the City and County of Denver provide equal opportunity in employment without regard to race, color, creed, sex, national origin, age, religion, marital status, political opinion or affiliation or mental or physical handicap and meet certain requirements for the hiring, training, promotion, and treatment during employment of members of ethnic groups subject to differential treatment, including persons of African descent (Black), Spanish-surnamed (Hispanic), Asian-American and American Indian Groups.

### RULE I - *DEFINITIONS*

A. "City" means the City and County of Denver.

B. "Manager" shall mean the Manager of Public Works for the City and County of Denver.

C. "Contract" means a contract entered into with the City and County of Denver, financed in whole or in part by local resources or funds of the City and County of Denver, for the construction of any public building or prosecution or completion of any public work.

D. "Contractor" means the original party to a contract with the City and County of Denver, also referred to as the "general" or "prime" contractor.

E. "Director" means the Director of the Division of Small Business Opportunity.

F. "Subcontractor" means any person, company, association, partnership, corporation, or other entity, which assumes by subordinate agreement some or all of the obligations of the general or prime contractor.

G. The phrase "Bidding Specifications" as used in Article III, Division 2 of Chapter 28 of the Revised Municipal Code shall include BID CONDITION, INVITATION TO BID, and NOTICE OF PROPOSAL.

H. "Affirmative Action Program" means a set of specific and result-oriented procedures or steps to which a contractor commits himself to apply every good faith effort to employ members of ethnic minority groups, to include persons of African descent (Black), Spanish surnamed (Hispanic), Asian-American, American Indians, and persons with mental or physical handicap.

I. "Division of Small Business Opportunity" means the City agency established pursuant to Article III, Division 1 of Chapter 28 of the Denver Revised Municipal Code.

### RULE II - *NOTICE OF HEARING*

When results of conciliation efforts are unsatisfactory to the Manager and he is informed in accordance with Article III, Division 2 of Chapter 28 of the Revised Municipal code that a contractor or subcontractor has apparently failed to meet affirmative action and equal employment opportunity requirements after a reasonable period of notice to correct deficiencies, the Manager will, prior to imposition of any sanctions, afford the general contractor a hearing in order to determine whether the contractor or his subcontractors have failed to comply with the affirmative action and equal employment opportunity requirements of Article III, Division 2 of Chapter 28 of the Revised Municipal Code or of the contract. Written notice of such hearing shall be delivered personally or sent by certified mail, return receipt requested, to the contractor and to any subcontractor involved, at least ten (10) days prior to the date scheduled for the hearing.

## RULE III - *HEARING*

A. Contractors will appear at hearings and may be represented by counsel and may present testimony orally and other evidence.

B. Hearings shall be conducted by one or more hearing examiners designated as such by the Manager.

C. The Director of the Division of Small Business Opportunity may participate in hearings as a witness.

D. Hearings shall be held at the place specified in the notice of hearing.

E. All oral testimony shall be given under oath or affirmation and a record of such proceedings shall be made.

F. All hearings shall be open to the public.

G. The hearing officer shall make recommendations to the Manager who shall make a final decision.

## REGULATIONS

**REGULATION NO. 1 - ORDINANCE:**

The Rules and Regulations of the Manager shall be inserted in the bidding specifications for every contract for which bidding is required.

**REGULATION NO. 2 - EXEMPTIONS:**

Each contract and subcontract, regardless of the dollar amount, shall be subject to affirmative action requirements unless specifically exempted in writing individually by the Manager. Exemptions apply only to "affirmative action" in equal employment opportunity and are not to be construed as condonation in any manner of "discrimination" or "discriminatory practices" in employment because of race, color, creed, sex, age, national origin, religion, marital status, political opinion or mental or physical handicap.

**REGULATION NO. 3 - DIRECTOR OF CONTRACT COMPLIANCE:**

The Director of the Division of Small Business Opportunity shall perform the duties assigned to such official by Article III, Division 2 Chapter 28 of the Revised Municipal Code and by the Manager. (1) The Director of the Division of Small Business Opportunity or designated representatives shall inform bidders and contractors of affirmative action procedures, programs, and goals in accordance with the Ordinance at pre-bid and pre-construction conference; (2) make regular on-site inspections; (3) supply contractors and subcontractors with report forms to be completed by them when requested, and furnished to the Director of the Division of Small Business Opportunity; and (4) review payroll records, employment records and practices of general contractors and their subcontractors and suppliers during the performance of any contract. The Director of the Division of Small Business Opportunity shall promptly report apparent affirmative action deficiencies to the Manager.

**REGULATION NO. 4 - GOALS AND TIMETABLES:**

In general, goals and timetables should take into account anticipated vacancies and the availability of skills in the market place from which employees should be drawn. In addition, where discrimination in employment by a general contractor or any of his subcontractors is indicated, a corrective action program will take into account the need by the general contractor and his subcontractors to correct past discriminatory practices and reach goals of minority manpower utilization on a timely basis through such recruiting and advertising efforts as are necessary and appropriate.

**REGULATION NO. 5 - AWARD OF CONTRACTS:**

It shall be the responsibility of the Director of the Division of Small Business Opportunity to determine the affirmative action capability of bidders, contractors and subcontractors and to recommend to the Manager the award of contracts to those bidders, contractors and subcontractors and suppliers who demonstrate the ability and willingness to comply with the terms of their contract.

**REGULATION NO. 6 - PUBLICATION AND DUPLICATION:**

Copies of these Rules and Regulations as amended by the Manager from time to time, shall as soon as practicable and after Notice being published will be made a part of all City Contracts.

**REGULATION NO. 7 - NOTICE TO PROCEED:**

Prior to issuance of the Notice to Proceed, a sign-off will be required of the Director of the Division of Small Business Opportunity or his designee.

**REGULATION NO. 8 - CONTRACTS WITH SUBCONTRACTORS:**

To the greatest extent possible, the contractor shall make a good faith effort to contract with minority contractors, subcontractors and suppliers for services and supplies by taking affirmative actions, which include but are not limited to the following:

1. Advertise invitations for subcontractor bids in minority community news media.
2. Contact minority contractor organizations for referral of prospective subcontractors.
3. Purchase materials and supplies from minority material suppliers.

**REGULATION NO. 9 - AGENCY REFERRALS:**

It shall be no excuse that the union with which the contractor or subcontractor has an agreement providing for referral, exclusive or otherwise, failed to refer minority employees.

**REGULATION NO. 10 - CLAUSES:**

The Manager shall include the appropriate clauses in every contract and the contractor shall cause to be inserted in every subcontract the appropriate clauses:

1. APPENDIX A: City and County of Denver Equal Opportunity Clause - ALL CONTRACTS funded only with City and County of Denver monies.
2. APPENDIX B: Equal Opportunity Clause (11246) - ALL FEDERAL ASSISTED.
3. APPENDIX C: Section 3 - Assurance of Compliance - HUD ASSISTED PROJECTS.
4. APPENDIX D: Section 3 - Clause - HUD ASSISTED PROJECTS.

All amendments to the appendices shall be included by reference.

**REGULATION NO. 11 - SHOW CAUSE NOTICES:**

When the Manager has reasonable cause to believe that a contractor has violated Article III, Division 2 of Chapter 28 of the Denver Revised Municipal Code, he may issue a notice requiring the contractor to show cause, within fifteen (15) days why enforcement procedures, or other appropriate action to insure compliance, should not be instituted.

**REGULATION NO. 12 - BID CONDITIONS - AFFIRMATIVE ACTION REQUIREMENTS - EQUAL EMPLOYMENT OPPORTUNITY:**

1. APPENDIX E: The Bid Conditions - Affirmative Action Requirements - Equal Employment Opportunity as amended and published by the U.S. Department of Labor Employment Standards Administration, Office of Federal Contract Compliance, shall be inserted verbatim for bidding specification for every non-exempt contract involving the use of Federal funds.

2. APPENDIX F: The Bid Conditions - Affirmative Action Requirements - Equal Employment Opportunity as published by the Department of Public Works, City and County of Denver, shall be inserted verbatim as bidding specifications for every non-exempt contract using City funds.

compliance. The Contractor further agrees to refrain from entering into any contract or contract modification subject to Article III, Division 2 of Chapter 28 of the Revised Municipal Code with a contractor debarred from, or who has not demonstrated eligibility for, City contracts.

The Contractor will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and subcontractors by the Manager and Director. In addition, the Contractor agrees that failure or refusal to comply with these undertakings the Manager may take any or all of the following actions:

A. Cancellation, termination, or suspension in whole or in part of this contract.
B. Refrain from extending any further assistance to the applicant under the program with respect to which the failure occurred until satisfactory assurance of future compliance has been received from such applicant.
C. Refer the case to the City Attorney for appropriate legal proceedings.

**SUBCONTRACTS:** Each prime Contractor or Subcontractor shall include the equal opportunity clause in each of its subcontracts.

# CITY AND COUNTY OF DENVER
## DEPARTMENT OF PUBLIC WORKS

### APPENDIX F

### AFFIRMATIVE ACTION REQUIREMENTS

### EQUAL EMPLOYMENT OPPORTUNITY

For All Non-Exempt Construction Contracts to Be Awarded by the
City and County of Denver, Department of Public Works.

**NOTICE**

EACH BIDDER, CONTRACTOR OR SUBCONTRACTOR (HEREINAFTER THE CONTRACTOR) MUST FULLY COMPLY WITH THE REQUIREMENTS OF THESE BID CONDITIONS AS TO EACH CONSTRUCTION TRADE IT INTENDS TO USE ON THIS CONSTRUCTION CONTRACT, AND ALL OTHER CONSTRUCTION WORK (BOTH CITY AND NON-CITY) IN THE DENVER AREA DURING THE PERFORMANCE OF THIS CONTRACT OR SUBCONTRACT. THE CONTRACTOR COMMITS ITSELF TO THE GOALS FOR MINORITY MANPOWER UTILIZATION, AS APPLICABLE, AND ALL OTHER REQUIREMENTS, TERMS AND CONDITION OF THESE BID CONDITIONS BY SUBMITTING A PROPERLY SIGNED BID.

THE CONTRACTOR SHALL APPOINT A COMPANY EXECUTIVE TO ASSUME THE RESPONSIBILITY FOR THE IMPLEMENTATION OF THE REQUIREMENTS, TERMS AND CONDITIONS OF THESE BID CONDITIONS.

/s/ _____

Manager of Public Works
City and County of Denver

## A. REQUIREMENTS - AN AFFIRMATIVE ACTION PLAN:

Contractors shall be subject to the provisions and requirements of these bid conditions including the goals and timetables for minority* and female utilization, and specific affirmative action steps set forth by the Division of Small Business Opportunity (DSBO). The contractor's commitment to the goals for minority, and female utilization as required constitutes a commitment that it will make every good faith effort to meet such goals.

### 1. GOALS AND TIMETABLES:

The goals and timetables for minority and female participation, expressed in percentage terms for the contractor's aggregate workforce in each trade are as follows:

| GOALS FOR MINORITY PARTICIPATION FOR EACH TRADE | GOALS FOR FEMALE PARTICIPATION FOR EACH TRADE |
|---|---|
| From January 1, 1982 to Until Further Notice | From January 1, 1982 to Until Further Notice |
| **21.7% - 23.5%** | **6.9%** |

The goals for minority and female utilization above are expressed in terms of hours of training and employment as a proportion of the total number of hours to be worked by the contractor's aggregate workforce, which includes all supervisory personnel, in each trade, on all projects for the City and County of Denver during the performance of its contract (i.e., The period beginning with the first day of work on the City and County of Denver funded construction contract and ending with the last day of work).

The hours of minority and female employment and training must be substantially uniform throughout the length of the contract in each trade and minorities and females must be employed evenly on each of a contractor's projects. Therefore, the transfer of minority or female employees from contractor to contractor or from project to project for the purpose of meeting the contractor's goals shall be a violation of these Bid Conditions.

If the Contractor counts the nonworking hours of apprentices they must be employed by the Contractor during the training period; the Contractor must have made a commitment to employ apprentices at the completion of their training subject to the availability of employment opportunities; and the apprentices must be trained pursuant to training programs approved by the Bureau of Apprenticeship and Training.

* "Minority" is defined as including, Blacks, Spanish Surname Americans, Asian Americans, and American Indians, and includes both men and minority women.

### 2. SPECIFIC AFFIRMATIVE ACTION STEPS:

No contractor shall be found to be in noncompliance solely on account of its failure to meet its goals, but will be given an opportunity to demonstrate that the contractor has instituted all the specific affirmative action steps specified and has made every good faith effort to make these steps work toward the attainment of its goals within the timetables, all to the purpose of expanding minority and female utilization in its aggregate workforce. A contractor, who fails to comply with its obligation under the Equal Opportunity Clause of its contract and fails to achieve its commitments to the goals for minority and female utilization has the burden of proving that it has engaged in an Affirmative Action Program directed at increasing minority and female utilization and that such efforts were at least as extensive and as specific as the following:

a. The Contractor should have notified minority and female organizations when employment opportunities were available and should have maintained records of the organization's response.

b. The Contractor should have maintained a file of the names and addresses of each minority and female referred to it by any individual or organization and what action was taken with respect to each such referred individual, and if the individual was not employed by the Contractor, the reasons. If such individual was sent to the union hiring hall for referral and not referred back by the union or if referred, not employed by the Contractor, the file should have documented this and their reasons.

c. The Contractor should have promptly notified the Department of Public Works, and the Division of Small Business Opportunity when the union or unions with which the Contractor has collective bargaining agreements did not refer to the contractor a minority or female sent by the contractor, or when the Contractor has other information that the union referral process has impeded efforts to meet its goals.

d. The Contractor should have disseminated its EEO policy within its organization by including it in any employee handbook or policy manual; by publicizing it in company newspapers and annual reports and by advertising such policy at reasonable intervals in union publications. The EEO policy should be further disseminated by conducting staff meetings to explain and discuss the policy; by posting of the policy; and by review of the policy with minority and female employees.

e. The Contractor should have disseminated its EEO policy externally by informing and discussing it with all recruitment sources; by advertising in news media, specifically including minority and female news media; and by notifying and discussing it with all subcontractors.

f. The Contractor should have made both specific and reasonably recurrent written and oral recruitment efforts. Such efforts should have been directed at minority and female organizations, schools with substantial minority and female enrollment, and minority and female recruitment and training organizations within the Contractor's recruitment area.

g. The Contractor should have evidence available for inspection that all tests and other selection techniques used to select from among candidates for hire, transfer, promotion, training, or retention are being used in a manner that does not violate the OFCCP Testing Guidelines in 41 CFR Part 60-3.

h. The Contractor should have made sure that seniority practices and job classifications do not have a discriminatory effect.

i. The Contractor should have made certain that all facilities are not segregated by race.

j. The Contractor should have continually monitored all personnel activities to ensure that its EEO policy was being carried out including the evaluation of minority and female employees for promotional opportunities on a quarterly basis and the encouragement of such employees to seek those opportunities.

k. The Contractor should have solicited bids for subcontracts from available minority and female subcontractors engaged in the trades covered by these Bid Conditions, including circulation of minority and female contractor associations.

NOTE: The Director and the Division of Small Business Opportunity will provide technical assistance on questions pertaining to minority and female recruitment sources, minority and female community organizations, and minority and female news media upon receipt of a request for assistance from a contractor.

3. **NON - DISCRIMINATION:**
In no event may a contractor utilize the goals and affirmative action steps required in such a manner as to cause or result in discrimination against any person on account of race, color, religion, sex, marital status, national origin, age, mental or physical handicap, political opinion or affiliation.

4. **COMPLIANCE AND ENFORCEMENT:**
In all cases, the compliance of a contractor will be determined in accordance with its obligations under the terms of these Bid Conditions. All contractors performing or to perform work on projects subject to these Bid Conditions hereby agree to inform their subcontractors in writing of their respective obligations under the terms and requirements of these Bid Conditions, including the provisions relating to goals of minority and female employment and training.

**B. CONTRACTORS SUBJECT TO THESE BID CONDITIONS:**
In regard to these Bid Conditions, if the Contractor meets the goals set forth therein or can demonstrate that it has made every good faith effort to meet these goals, the Contractor shall be presumed to be in compliance with Article III, Division 2 of Chapter 28 of the Revised Municipal Code, the implementing regulations and its obligations under these Bid Conditions. In the event, no formal sanctions or proceedings leading toward sanctions shall be instituted unless the contracting or administering agency otherwise determines that the contractor is violating the Equal Opportunity Clause.

1. Where the Office of Contract Compliance finds that a contractor failed to comply with the requirements of Article III, Division 2 of Chapter 28 of the Revised Municipal Code or the implementing regulations and the obligations under these Bid Conditions, and so informs the Manager, the Manager shall take such action and impose such sanctions, which include suspension, termination, cancellation, and debarment, as may be appropriate under the Ordinance and its regulations. When the Manager proceeds with such formal action it has the burden of proving that the Contractor has not met the goals contained in these Bid Conditions. The Contractor's failure to meet its goals shall shift to it the requirement to come forward with evidence to show that it has met the good faith requirements of these Bid Conditions.

2. The pendency of such proceedings shall be taken into consideration by the Department of Public Works in determining whether such contractor can comply with the requirements of Article III, Division 2 of Chapter 28 of the Revised Municipal Code, and is therefore a "responsible prospective contractor".

3. The Division of Small Business Opportunity shall review the Contractor's employment practices during the performance of the contract. If the Division of Small Business Opportunity determines that the Contractor's Affirmative Action Plan is no longer an acceptable program, the Director shall notify the Manager.

**C. OBLIGATIONS APPLICABLE TO CONTRACTORS:**
It shall be no excuse that the union with which the Contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority or female employees. Discrimination in referral for employment, even if pursuant to provisions of a collective bargaining agreement, is prohibited by the National Labor Relations Act, as amended, Title VI of the Civil Rights Act of 1964, as amended, and Article III, Division 2 of Chapter 28 of the Revised Municipal Code. It is the policy of the Department of Public Works that contractors have a responsibility to provide equal employment opportunity, if they wish to participate in City and County of Denver contracts. To the extent they have delegated the responsibility for some of their employment practices to a labor organization and, as a result, are prevented from meeting their obligations pursuant to Article III, Division 2, Chapter 28 of the Revised Municipal Code, such Contractors cannot be considered to be in compliance with Article III, Division 2, Chapter 28 of the Revised Municipal Code, or its implementing rules and regulations.

**D. GENERAL REQUIREMENTS:**
Contractors are responsible for informing their subcontractors in writing regardless of tier, as to their respective obligations. Whenever a Contractor subcontracts a portion of work in any trade covered by these Bid Conditions, **it shall include these Bid Conditions in such subcontracts and each subcontractor shall be bound by these Bid Conditions to the full extent as if it were the prime contractor.** The Contractor

shall not, however, be held accountable for the failure of its subcontractors to fulfill their obligations under these Bid Conditions. However, the prime contractor shall give notice to the Director of any refusal or failure of any subcontractor to fulfill the obligations under these Bid Conditions. A subcontractor's failure to comply will be treated in the same manner as such failure by a prime contractor.

1. Contractors hereby agree to refrain from entering into any contract or contract modification subject to Article III, Division 2, Chapter 28 of the Revised Municipal Code with a contractor debarred from, or who is determined not to be a "responsive" bidder for the City and County of Denver contracts pursuant to the Ordinance.

2. The Contractor shall carry out such sanctions and penalties for violation of these Bid Conditions and the Equal Opportunity Clause including suspension, termination and cancellation of existing subcontracts and debarment from future contracts as may be ordered by the Manager pursuant to Article III, Division 2, Chapter 28 of the Revised Municipal Code and its implementing regulations.

3. Nothing herein is intended to relieve any contractor during the term of its contract from compliance with Article III, Division 2, Chapter 28 of the Revised Municipal Code, and the Equal Opportunity Clause of its contract with respect to matters not covered in these Bid Conditions.

4. Contractors must keep such records and file such reports relating to the provisions of these Bid Conditions as shall be required by the Office of Contract Compliance.

5. Requests for exemptions from these Bid Conditions must be made in writing, with justification, to the Manager of Public Works, 201 W. Colfax, Dept. 608, Denver, Colorado 80202, and shall be forwarded through and with the endorsement of the Director.

# CITY AND COUNTY OF DENVER
## DEPARTMENT OF PUBLIC WORKS

**CONTRACT NO. 201950389**

**27th STREET STORM INTERCEPTOR, PHASE 2**

# CONTRACT

**THIS CONTRACT AND AGREEMENT**, made and entered into by and between the City and County of Denver, a municipal corporation of the State of Colorado, hereinafter referred to as the "City," party of the first part, and , hereinafter referred to as the "Contractor," party of the second part,

**CONCRETE WORKS OF COLORADO, INC.**
**1260 Rock Creek Circle**
**Lafayette, CO 80026**

**WITNESSETH**, commencing on **May 29, 2019,** and for at least three (3) days the City advertised that sealed bids would be received for furnishing all labor, tools, supplies, equipment, materials, and everything necessary and required for the following:

**CONTRACT NO. 201950389**

**27th STREET STORM INTERCEPTOR, PHASE 2**

**WHEREAS**, bids pursuant to said advertisement have been received by the Manager of Public Works, who has recommended that a Contract for said work be made and entered into with the above named Contractor who was the lowest, responsive, qualified bidder therefore, and

**WHEREAS**, said Contractor is now willing and able to perform all of said work in accordance with said advertisement and its bid.

**NOW THEREFORE**, in consideration of the compensation to be paid the Contractor, the mutual agreements hereinafter contained, and subject to the terms hereinafter stated, it is mutually agreed as follows:

**1. CONTRACT DOCUMENTS**

It is agreed by the parties hereto that the following list of documents, instruments, technical specifications, plans, drawings and other materials which are attached hereto and bound herewith, incorporated herein by reference or otherwise referenced in these documents constitute and shall be referred to either as the "Contract Documents" or the "Contract," and all of said documents, instruments, technical specifications, Plans, Drawings and other materials taken together as a whole constitute the Contract between the parties hereto, and they are as fully a part of this agreement as if they were set out verbatim and in full herein:

*Advertisement of Notice of Invitation for Bids*
*Instructions to Bidders*
*Commitment to M/WBE Participation*
*Article III, Divisions 1, 2, and 3 of Chapter 28, D.R.M.C.*
*Bid Bond*
*Addenda (as applicable)*

*Equal Employment Opportunity Provisions (Appendix A and Appendix F)*
*Bid Form*
*Contract Form*
*General Contract Conditions*
*Special Contract Conditions*
*Performance and Payment Bond*
*Notice to Apparent Low Bidder*
*Notice to Proceed*
*Contractor's Certification of Payment Form*
*Final/Partial Lien Release Form*
*Certificate of Contract Release*
*Change Orders (as applicable)*
*Federal Requirements (as applicable)*
*Prevailing Wage Rate Schedule(s)*
*Technical Specifications*
*Contract Drawings*
*Accepted Shop Drawings*

**2. SCOPE OF WORK**

The Contractor agrees to and shall furnish all labor, tools, supplies, equipment, materials and everything necessary for and required to do, perform and complete all of the Work described, drawn, set forth, shown and included in said Contract Documents.

**3. TERMS OF PERFORMANCE**

The Contractor agrees to undertake the performance of the Work under this Contract within ten (10) days after being notified to commence work by issuance of a Notice to Proceed in substantially the form contained herein from the Manager and agrees to fully complete said Work within **210 days** (Two Hundred and Ten consecutive calendar days) from the effective date of said Notice, plus such extension or extensions of time as may be granted in accordance with the provisions of the General Contract Conditions and any applicable Special Contract Conditions.

**4. TERMS OF PAYMENT**

The City agrees to pay the Contractor for the performance of all of the Work required under this Contract, and the Contractor agrees to accept as the Contractor's full and only compensation therefore, such sum or sums of money as may be proper in accordance with the price or prices set forth in the Contractor's Bid Form hereto attached and made a part hereof for **bid item numbers 01-21.16.01 through 50-1 (Ninety-Four[94]) total bid items, with two of them being Allowance Accounts.**, the total estimated cost thereof being **Five Million, One Hundred Thirty-Five Thousand, Nine Hundred Ninety-Eight Dollars and Zero Cents ($5,135,998.00).** Adjustments to said Contract Amount and payment of amounts due hereunder shall be made in accordance with the provisions of the General Contract Conditions and any applicable Special Contract Conditions.

**5. NO DISCRIMINATION IN EMPLOYMENT**

In connection with the performance of work under this contract, the Contractor may not refuse to hire, discharge, promote or demote, or discriminate in matters of compensation against any person otherwise qualified, solely because of race, color, religion, national origin, gender, age, military status, sexual orientation, gender identity or gender expression, marital status, or physical or mental disability. The Contractor shall insert the foregoing provision in all subcontracts.

**6. COMPLIANCE WITH M/WBE REQUIREMENT**

This Contract is subject to all applicable provisions of Divisions 1and 3 of Article III, of Chapter 28, Denver Revised Municipal Code (D.R.M.C.), designated as Sections 28-31 – 28-36 and 28-52 – 28-90 D.R.M.C. and referred to in this Contract as the "M/WBE Ordinance". Without limiting the general applicability of the foregoing, the Contractor acknowledges its continuing duty, pursuant to Sections 28-72, 28-73 and 28-75 of the D.R.M.C., to maintain throughout the duration of this Contract, compliance with the level of minority and Woman business enterprise participation, upon which the City approved the award of this Contract to the Contractor and the Contractor further acknowledges that failure to maintain such participation commitments or otherwise comply with the requirements of the M/WBE Ordinance shall subject the Contractor to sanctions in accordance with Section 28-77 of the D.R.M.C. Nothing contained in this

provision or in the M/WBE Ordinance shall negate the City's right to prior approval of subcontractors, or substitutes therefore, under this Contract

**7. WAGE RATE REQUIREMENTS**

In performance of all Work hereunder, the Contractor agrees to comply with and be bound by all requirements and conditions of the City's Payment of Prevailing Wages Ordinance, Sections 20-76 through 20-79, D.R.M.C. and any determinations made by the City pursuant thereto as well as the City's Minimum Wage Protections Sections 20-82 through 20-84 D.R.M.C. and any determinations made by the City pursuant thereto. In the event a covered worker falls under both ordinances, Contractor shall pay the greater of the two rates.

**8. APPLICABILITY OF LAWS**

The Agreement between the Contractor and the City shall be deemed to have been made in the City and County of Denver, State of Colorado and shall be subject to, governed by, and interpreted and construed by or in accordance with the laws of the State of Colorado and the Charter, Revised Municipal Code, Rules, Regulations, Executive Orders and fiscal rules of the City. As such, the Contractor shall at all times comply with the provisions of the Charter, Revised Municipal Code, Rules, Regulations, Executive Orders and fiscal rules of the City, and those State of Colorado and Federal Laws, Rules and Regulations, which in any manner limit, control or apply to the actions or operations of the Contractor, any subcontractors, employees, agents or servants of the Contractor engaged in the Work or affecting the materials and equipment used in the performance of the Work, as the same may be, from time to time, promulgated, revised or amended. The Charter and Revised Municipal Code of the City and County of Denver, as the same may be amended from time to time, are hereby expressly incorporated into this Agreement as if fully set out herein by this reference.

**9. APPROPRIATION**

The amount of money, which has been appropriated and encumbered for the purpose of this contract, to date, is equal to or in excess of the Contract Amount. The Manager, upon reasonable written request, will advise the Contractor in writing of the total amount of appropriated and encumbered funds, which remain available for payment for all Work under the Contract.

The issuance of any change order or other form or order or directive by the City which would cause the aggregate payable under the contract to exceed the amount appropriated for the contract is expressly prohibited. In no event shall the issuance of any change order or other form of order or directive by the City be considered valid or binding if it requires additional compensable work to be performed, which work will cause the aggregate amount available under the Contract to exceed the amount appropriated and encumbered for this Contract, unless and until such time as the Contractor has been advised in writing by the Manager that a lawful appropriation, sufficient to cover the entire cost of such additional work, has been made.

It shall be the responsibility of the Contractor to verify that the amounts already appropriated for this Contract are sufficient to cover the entire cost of such work, and any work undertaken or performed in excess of the amount appropriated is undertaken or performed in violation of the terms of this contract, without the proper authorization for such work, and at the Contractor's own risk.

**10. APPROVALS**

In the event this Contract calls for the payment by the City of five hundred thousand dollars ($500,000.00) or more, approval by the Board of Councilmen of the City and County of Denver, acting by ordinance, in accordance with Section 3.2.6 of the Charter of the City and County of Denver, is and shall be an express condition precedent to the lawful and binding execution and effect and performance of this contract.

**11. ASSIGNMENT**

The Contractor shall not assign any of its rights, benefits, obligations or duties under this Contract except upon the prior written consent and approval of the Manager to such assignment.

**12. DISPUTES RESOLUTION PROCESS**

It is the express intention of the parties to this Contract that all disputes of any nature whatsoever regarding the Contract including, but not limited to, any claims for compensation or damages arising out of breach or default under this Contract, shall be resolved by administrative hearing pursuant to the provisions of Section 56-106, D.R.M.C., or, as applicable, Section 28-33 D.R.M.C. for Minority and Woman Business Enterprise

disputes. The Contractor expressly agrees that this dispute resolution process is the only dispute resolution mechanism that will be recognized by the parties for any claims put forward by the Contractor, notwithstanding any other claimed theory of entitlement on the part of the Contractor or its subcontractors or suppliers.

**13. CONTRACT BINDING**

It is agreed that this Contract shall be binding on and inure to the benefit of the parties hereto, their heirs, executors, administrators, assigns and successors.

**14. PARAGRAPH HEADINGS**

The captions and headings set forth herein are for convenience of reference only and shall not be construed so as to define or limit the terms and provisions hereof.

**15. SEVERABILITY**

It is understood and agreed by the parties hereto that, if any part, term, or provision of this Contract, except for the provisions of this Contract requiring prior appropriation and limiting the total amount to be paid by the City, is by the courts held to be illegal or in conflict with any law of the State of Colorado, the validity of the remaining portions or provisions shall not be affected, and the rights and obligations of the parties shall be construed and enforced as if the Contract did not contain the particular part, term or provision held to be invalid.

**16. ELECTRONIC SIGNATURES AND ELECTRONIC RECORDS:**

Contractor consents to the use of electronic signatures by the City. The Agreement, and any other documents requiring a signature hereunder, may be signed electronically by the City in the manner specified by the City. The Parties agree not to deny the legal effect or enforceability of the Agreement solely because it is in electronic form or because an electronic record was used in its formation. The Parties agree not to object to the admissibility of the Agreement in the form of an electronic record, or a paper copy of an electronic document, or a paper copy of a document bearing an electronic signature, on the ground that it is an electronic record or electronic signature or that it is not in its original form or is not an original.

**Contract Control Number:** PWADM-201950389
**Contractor Name:** CONCRETE WORKS OF COLORADO INC

IN WITNESS WHEREOF, the parties have set their hands and affixed their seals at Denver, Colorado as of:

**SEAL**

**CITY AND COUNTY OF DENVER:**

**ATTEST:**

By: _____

_____

**APPROVED AS TO FORM:**

Attorney for the City and County of Denver

By: _____

**REGISTERED AND COUNTERSIGNED:**

By: _____

By: _____

IN WITNESS WHEREOF, the parties have executed this agreement and affixed their seals at Denver, Colorado as of the day first above written.

**Contract Control Number: 201950389**

**Vendor Name: CONCRETE WORKS OF COLORADO, INC.**

By: _____

Name: Richard Brasher, Jr.
(please print)

Title: Vice President
(please print)

**ATTEST: [if required]**

By: _____

Name: Rea Ann Fletcher
(please print)

Title: Contracts Manager
(please print)

Concrete Works of Colorado, Inc. A Colorado Corporation

# CITY AND COUNTY OF DENVER
# DEPARTMENT OF PUBLIC WORKS

## General Contract Conditions

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# CITY AND COUNTY OF DENVER
## DEPARTMENT OF PUBLIC WORKS

### SPECIAL CONTRACT CONDITIONS

**SC-1 CONSTRUCTION SPECIFICATIONS**

Except as amended herein or in the attached Technical Specifications, all Work performed under the terms of this Contract shall be governed by the applicable provisions of the following latest editions:

City and County of Denver:

*Standard Specifications for Construction, GENERAL CONTRACT CONDITIONS,* 2011 Edition.

*Transportation Standards and Details for the Engineering Division*

*City and County of Denver Traffic Standard Drawings*

Wastewater Management Division
– *Standard Detail Drawings*
– *Public Works Wastewater Capital Projects Management Standard Construction Specifications*

Colorado Department of Transportation:

*Standard Specifications for Road and Bridge Construction*
(Sections 200 through 700 of the 2011 Edition)

Federal Highway Administration:

*Manual on Uniform Traffic Control Devices for Streets & Highways* (MUTCD)

Building & Fire Codes:

*Building Code of the City and County of Denver*
(International Building Code 2015 Series, City and County of Denver Amendments 2016)

*National Fire Protection Association Standards*
(As referenced in the Building Code of the City and County of Denver)

The aforementioned City and County of Denver documents are available for review at the Capital Projects Management Office, 201 W. Colfax Ave., Dept. 506, (5th floor), Denver, CO 80202. The *Standard Specifications for Construction, GENERAL CONTRACT CONDITIONS* is available at: https://www.denvergov.org/content/denvergov/en/contract-administration/contractor-resources.html. *Transportation Standards and Details for the Engineering Division* and the Wastewater Management Division – *Standard Detail Drawings*, are available at http://www.denvergov.org.

The "*Colorado Department* of *Transportation Standard Specifications for Road and Bridge Construction"* is available for review on CDOT's website at http://www.coloradodot.info/ and can be purchased from the Colorado Department of Transportation.

The *Manual on Uniform Traffic Control Devices for Streets & Highways* is available for review at the Federal Highway Administration Website at: www.fhwa.dot.gov, The FHWA website also contains purchasing information.

## SC-2 DEPUTY MANAGER / CITY ENGINEER

General condition 109 DEPUTY MANAGER is hereby deleted in its entirety and replaced with the following:

The "Deputy Manager" means the official who reports directly to the Manager and exercises supervisory responsibility in the City agency defined in Title 2 herein that is responsible for the Project. The Manager hereby designates the City Engineer as the Deputy Manager for purposes of this Contract. The City Engineer shall have responsibility for this Project and shall undertake all duties, responsibilities, rights and authority, including specific actions and decisions, delegated to the Deputy Manager under the various terms and conditions of this Contract.

## SC-3 ENGINEERING DIVISION / CITY ENGINEER

The Engineering Division is a unit of the Department of Public Works and is supervised by the City Engineer, who is subordinate to the Manager of Public Works. This Division is responsible for the planning, design, construction, operation and maintenance of all of the City's transportation facilities and the planning, design and construction of all of the City's wastewater facilities, except for the City's Municipal Airport System. All other references to the Transportation Division or the Deputy Manager of Public Works for Transportation are deleted and replaced with references to the Engineering Division and City Engineer, respectively.

## SC-4 WASTEWATER MANAGEMENT DIVISION

The Wastewater Management Division is a unit of the Department of Public Works and is supervised by the Deputy Manager of Public Works for Wastewater Management, who is subordinate to the Manager of Public Works. This Division is responsible for the operation and maintenance of the City's wastewater facilities.

## SC-5 CITY DELEGATION OF AUTHORITY

With reference to General Contract Condition 109, DEPUTY MANAGER and General Contract Condition 212, CITY'S CONTRACT ADMINISTRATION LINE OF AUTHORITY, the Manager hereby designates the City Engineer as the City official responsible for those certain actions and decisions designated as the responsibility of the Deputy Manager under the General Conditions and delegates to the City Engineer the authority necessary to undertake those responsibilities under this Contract. The Director shall have supervisory responsibility over the Project Manager. Additionally, Contractor questions concerning the Plans and Technical Specifications shall be directed to:

**Denver Department of Public Works,**

| City Project Manager | Telephone |
|---|---|
| Kelly Crum | 303.446.3668 |

Design Consultant
Merick

| Consultant Contact | Telephone |
|---|---|
| Brian Poling | 303.353.3672 |

## SC-6 LIQUIDATED DAMAGES

Should the Contractor fail to complete all Work within the Contract Time allocated under the Contract Form at Paragraph 3, TERMS OF PERFORMANCE, the Contractor shall become liable to the City and County of Denver for liquidated damages, and not as a penalty, at the rate of $1,000 for each Day that the Contractor exceeds the time limits herein specified, all in accordance with provisions of General Contract Condition 602, LIQUIDATED DAMAGES; ADMINISTRATIVE COSTS; ACTUAL DAMAGES.

Representative hourly rates for the City administrative costs described in General Contract Condition 602.2 shall be as follows for this Project:

| | |
|---|---|
| Project Manager | $69 per hour |
| Project Engineer | $63 per hour |
| Inspector | $49 per hour |
| Surveying, if necessary | $100 per hour |

**SC-7 SUBCONTRACTS**

In accordance with General Contract Condition 501, SUBCONTRACTS, no limit shall apply to that percentage of the Work, which may be sublet providing that the subcontractors receive prior approval in accordance with General Contract Condition 502, SUBCONTRACTOR ACCEPTANCE.

**SC-8 RESERVED**

**SC-9 PAYMENTS TO CONTRACTORS**

The application for payment shall be submitted through Textura® Corporations Construction Management Website. Contractor recognizes and agrees that it shall be required to use the Textura Construction Payment Management System for this Project to request payment from the City and to pay subcontractors. All certified subcontractors or suppliers who are listed for participation towards any assigned program goal must be paid via Textura®. Contractor further agrees that, to the fullest extent possible within Textura, the City shall be entitled to all non-Confidential records, reports, data and other information related to the project that are available to Contractor through Textura, including, but not limited to, information related to Contractor and subcontractor billings. To that end, Contractor agrees it will activate any available settings within Textura necessary to grant the City access to such non-Confidential information related to the contract and the project. Applications for payment shall be based on the Contract Unit Prices or the approved Schedule of Values described in GC 903.1

In accordance with General Contract Condition 902, PAYMENT PROCEDURE, the party(ies) responsible for review of all Pay Applications shall be:

| Agency/Firm | Name | Telephone |
|---|---|---|
| Public Works | George Murphy | 303.446.3619 |

In accordance with General Contract Condition 906, APPLICATIONS FOR PAYMENT, each Application submitted shall include the following:

1. The estimate of Work completed shall be based on the approved schedule of values or unit prices, as applicable, and the percent of the Work complete.
2. Each Application for Payment shall include each and every independent subcontractor's payroll information including pay dates and pay amounts.
3. The Contractor shall also submit to the Auditor and other appropriate officials of the City in a timely fashion, information required by General Contract Condition 1004, REPORTING WAGES PAID.
4. Applications for Payment must be accompanied by completed Partial or Final Claim Release Form, as appropriate, from EACH subcontractor and supplier, **AND** the Contractors' Certification of Payment Form (CCP), unless an exception is approved pursuant to General contract condition 907.

The forms, Final/Partial Release and Certificate of Payment (Subcontractor/Supplier) and the Contractor's Certification of Payment (CCP), both of which must be used are attached below. If subcontractor or supplier payments are disbursed via Textura® CPM, those systems generated Release and CCP forms are acceptable.

**DEPARTMENT OF PUBLIC WORKS**
**Engineering Division**

**FINAL/PARTIAL RELEASE AND CERTIFICATE OF PAYMENT**
**(SUBCONTRACTOR/SUPPLIER)**

_____ Date: _____, 20___.
(PROJECT NO. and NAME)

_____ Subcontract #:_____.
(NAME OF CONTRACTOR)

Subcontract Value: $_____.
Last Progress Payment: $_____.
Date: _____.
Total Paid to Date: $_____.
Date of Last Work: _____.

_____
(NAME OF SUBCONTRACTOR/SUPPLIER)
Check Applicable Box:
[ ] MBE [ ] WBE

The Undersigned hereby certifies that all costs, charges or expenses incurred by the undersigned or on behalf of the undersigned for any work, labor or services performed and for any materials, supplies or equipment provided on the above referenced Project or used in connection with the above referenced Subcontract (the "Work Effort") have been duly paid in full.

The Undersigned further certifies that each of the undersigned's subcontractors and suppliers that incurred or caused to be incurred, on their behalf, costs, charges or expenses in connection with the undersigned's Work Effort on the above referenced Project have been duly paid in full.

In consideration of $_____ representing the Last Progress Payment referenced above and in further consideration of the Total Paid to Date, also referenced above, and other good and valuable consideration received and accepted by the undersigned this _____ day of _____, 20__, the Undersigned hereby releases and discharges the City and County of Denver (the "City"), the above referenced City Project, the City's premises and property and the above referenced Contractor from all claims, liens, rights, liabilities, demands and obligations, whether known or unknown, of every nature arising out of or in connection with the performance of the work effort.

As additional consideration for the payments referenced above, the undersigned agrees to defend, indemnify and save and hold harmless the City, its officers, employees, agents and assigns and the above-referenced Contractor from and against all costs, losses, damages, causes of action, judgments under the subcontract and expenses arising out of or in connection with any claim or claims against the City or the Contractor which arise out of the Undersigned's performance of the Work Effort and which may be asserted by the Undersigned or any of its suppliers or subcontractors of any tier or any of their representatives, officers, agents, or employees.

It is acknowledged that this release is for the benefit of and may be relied upon by the City and the referenced Contractor.

The foregoing shall not relieve the undersigned of any obligation under the provisions of the Undersigned's subcontract, as the subcontract may have been amended, which by their nature survive completion of the Undersigned's work effort including, without limitation, warranties, guarantees, insurance requirements and indemnities.

STATE OF COLORADO )ss.
CITY OF _____)

_____
(Name of Subcontractor)

Signed and sworn before me this
day of _____, 20___.

By:_____

_____.
Notary Public/Commissioner of Oaths
My Commission Expires

Title: _____

DENVER
OFFICE OF ECONOMIC DEVELOPMENT

**City and County of Denver**

**Division of Small Business Opportunity**

**Contractor's/Consultant's Certification of Payment (CCP)**

Office of Economic Development
Compliance Unit
201 W. Colfax Ave., Dept. 907
Denver, CO 80202
Phone: 720.913.1999

| | | |
|---|---|---|
| Prime Contractor or Consultant: | Phone: | Project Manager: |
| Pay Application #: | Pay Period: | Amount Requested: $ |
| Project #: | Project Name: | |
| Current Completon Date: | Percent Complete: | Prepared By: |
| (I) - Original Contract Amount: $ | | (II) - Current Contract Amount: $ |

| | | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|---|
| Prime/Subcontractor/Supplier Name | M/W/S/E DBE/ NON | Original Contract Amount | % Bid (A/I) | Current Contract Amount including Amendments | % Revised (C/II) | Requested Amount of this Pay Application | Amount Paid on the Previous Pay Application # ____ | Net Paid To Date | Paid % Achieved (G/II) |
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| Totals | | | | | | | | | |

The undersigned certifies that the information contained in this document is true, accurate and that the payments shown have been made to all subcontractors and suppliers used on this project and listed herein. Please use an additional form, if more space is necessary.

| | |
|---|---|
| Prepared By (Signature): | Date: |

Page of

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DENVER
OFFICE OF ECONOMIC DEVELOPMENT

# Instructions for Completing the Contractor/Consultant Certification of Payment Form

Office of Economic Development
Division of Small Business Opportunity
Compliance Unit
201 W. Colfax Ave. Dept. 907
Denver, CO 80202
Phone: 720-913-1999
DSBO@denvergov.org

**Note**: The attached Contractor/Consultant Certification of Payment form must be completed by the Contractor/ Subconsultant and all subcontractors/subconsultant or suppliers used on the project at **any tier** and submitted with each pay application. The Contractor/Consultant is responsible for the accuracy of all information provided and is required to have each subcontractor/subconsultant or supplier fill out the appropriate forms. Please be sure to complete all information requested at the top of the form, including the name of the person who prepared this form.

If you reproduce this form, you must continue to list each of the originally listed firms, as well as any additional firms used during the performance period of the contract. Please complete an additional CCP if there is second tier-ing involved.

If you have any questions, please call the Compliance Unit of DSBO at 720.913.1999.

**Instructions for Completing the Contractor/Consultant Certification of Payment Form, per Column**

**Contractor/Subcontractor or Subconsultant/Supplier Name**: In the space provided, list all subcontractors/ subconsultants and suppliers used on the project. For all M/W/S/E/DBEs use the exact name listed in the DSBO Directory.

**M/W/S/E/DBE/NON**: For each name listed, indicate whether the entity is a certified M/W/S/E/DBE.

**Column A**: Provide the contract amount, as listed at bid time, for the Contractor/Consultant and each subcontractor/subconsultant or supplier.

**Column B**: Provide the percentage portion of each listed subcontractor/subconsultant or supplier contract amount (Column A) compared to the total original contract amount in (I).

**Column C**: Provide the original contract amount (Column A) for each subcontractor/subconsultant or supplier plus any awarded alternate and/or change order amounts applicable. If an alternate/change order does not apply to the listed firm, re-enter the original contract amount (Column A).

**Column D**: Provide the percent portion of each listed subcontractor/subconsultant or supplier contract amount (Column C) compare to the current total contract amount in (II).

**Column E**: Provide the amount requested for work performed or materials supplied by each listed subcontractor/subconsultant or supplier for this pay application. The sum of the items in this column should equal the estimated amount requested for this pay application.

**Column F**: Provide the amount paid to each subcontractor/subconsultant or supplier on the previous pay application. Enter the previous pay application number in the column heading. The sum of the items listed in this column should equal the warrant amount paid to the Contractor/Consultant on the previous pay application. The amounts paid to the subcontractor/subcontractor or suppliers should be the actual amount of each check issued.

**Column G**: Provide the net paid to date for the Contractor/Subconsultant and each listed subcontractor/subconsultant or supplier.

**Column H**: Provide the percent portion of the net paid to date (Column G) for the Contractor/Subconsultant and each listed subcontractor/subconsultant or supplier of the current total contract amount in (II).

Rev 031816

## SC-10 CONTRACT FORMS

In accordance with the terms and conditions of the Contract Documents, the City requires the use of certain form documents in complying with or satisfying various obligations, notifications and conditions in contracting with the City or performing Work hereunder. These form documents are referenced by title throughout the Contract Documents for mandatory use as directed. The following are the forms that shall be detached and utilized in accordance with the Contract Documents:

1. Performance and Payment Bond
2. Performance and Payment Bond Surety Authorization Letter (Sample)
3. Final/Partial Lien Release.

The following are forms that will be issued by the City during construction:

1. Notice to Apparent Low Bidder (Sample)
2. Notice to Proceed (Sample)
3. Certificate of Contract Release (Sample)

## SC-11 CONSTRUCTION INSPECTION BY THE CITY

General Condition 1701, CONSTRUCTION INSPECTION BY THE CITY, is modified as follows:

**.1** Persons who are employees of the City or who are under contract to the City or the City as lessee will be assigned to inspect and test the Work. These persons may perform any tests and observe the Work to determine whether or not designs, materials used, manufacturing and construction processes and methods applied, and equipment installed satisfy the requirements of the drawings and specifications, accepted Shop Drawings, Product Data and Samples, and the General Contractor's warranties and guarantees. The General Contractor shall permit these inspectors unlimited access to the Work and provide means of safe access to the Work, which cost shall be included as a Cost of the Work without any increase to the Guaranteed Maximum Price. In addition, General Contractor shall provide whatever access and means of access are needed to off-site facilities used to store or manufacture materials and equipment to be incorporated into the Work and shall respond to any other reasonable request to further the inspector's ability to observe or complete any tests. Such inspections shall not relieve the General Contractor of any of its quality control responsibilities or any other obligations under the Contract. All inspections and all tests conducted by the City are for the convenience and benefit of the City. These inspections and tests do not constitute acceptance of the materials or Work tested or inspected, and the City may reject or accept any Work or materials at any time prior to the inspections pursuant to G.C. 2002, whether or not previous inspections or tests were conducted by the inspector or a City representative.

**.2** Building Inspection will perform building code compliance inspections for structures designed for human occupancy. It is the General Contractor's responsibility to schedule and obtain these inspections. If a code compliance inspection results in identification of a condition which will be at variance to the Contract Documents, the General Contractor shall immediately notify the Project Manager and confirm such notification with formal correspondence no later than forty-eight (48) hours after the occurrence.

**.3** When any unit of government or political subdivision, utility or Railroad Corporation is to pay a portion of the cost of the Work, its respective representatives shall have the right to inspect the Work. This inspection shall not make any unit of government or political subdivision, utility or Railroad Corporation a party to the Contract, and shall not interfere with the rights of either party.

## SC-12 DISPOSAL OF NON-HAZARDOUS WASTE AT DADS

In accordance with the Landfill Agreement made between the City and Waste Management of Colorado, Inc., bidders will be required to haul dedicated loads (non-hazardous entire loads of waste) to the Denver-Arapahoe Disposal Site ("DADS") for disposal. DADS is located at Highway 30 and Hampden Avenue in Arapahoe County, Colorado. The City will pay all fees associated with such disposal but the bidder shall be responsible for the costs of transporting the loads. Non-hazardous waste is defined as those substances and materials not defined or classified as hazardous by the Colorado Hazardous Waste Commission pursuant to C.R.S. §25-15-101(6), as amended from time to time, and includes construction debris, soil and asbestos. Bidders shall not use Gun Club Road between I-70 and Mississippi Avenue as a means of access to DADS.

**SC-13 PROHIBITION ON USE OF CCA-TREATED WOOD PRODUCTS**

The use of any wood products pressure-treated with chromated copper arsenate (CCA) is prohibited. Examples of CCA-treated wood products include wood used in play structures, decks, picnic tables, landscaping timbers, fencing, patios, walkways and boardwalks.

**SC-14 WAIVER OF: PART 8 OF ARTICLE 20 OF TITLE 13, COLORADO REVISED STATUTES.**

The Contractor specifically waives all the provisions of Part 8 of Article 20 of Title 13, Colorado Revised Statutes regarding defects in the Work under this Construction Contract.

**SC-15 ATTORNEY'S FEES**

Colorado Revised Statute 38-26-107 requires that in the event any person or company files a verified statement of amounts due and unpaid in connection with a claim for labor and materials supplied on this project, the City shall withhold from payments to the Contractor sufficient funds to insure the payment of any such claims. Should the City and County of Denver be made a party to any lawsuit to enforce such unpaid claims or any lawsuit arising out of or relating to such withheld funds, the Contractor agrees to pay to the City its costs and a reasonable attorney's fee which cost shall be included as a Cost of the Work.

Because the City Attorney Staff does not bill the City for legal services on an hourly basis, the Contractor agrees a reasonable fee shall be computed at the rate of one hundred dollars per hour of City Attorney time.

**SC-16 INSURANCE**

General Condition 1601 is hereby deleted in its entirety and replaced with the following:

**(1)** **General Conditions:** Contractor agrees to secure, at or before the time of execution of this Agreement, the following insurance covering all operations, goods or services provided pursuant to this Agreement. Contractor shall keep the required insurance coverage in force at all times during the term of the Agreement, or any extension thereof, during any warranty period, and for eight (8) years after termination of the Agreement. The required insurance shall be underwritten by an insurer licensed or authorized to do business in Colorado and rated by A.M. Best Company as "A-"VIII or better. Each policy shall contain a valid provision or endorsement requiring notification to the City in the event any of the required policies be canceled or non-renewed before the expiration date thereof. Such written notice shall be sent to the parties identified in the Notices section of this Agreement. Such notice shall reference the City contract number listed on the signature page of this Agreement. Said notice shall be sent thirty (30) days prior to such cancellation or non-renewal unless due to non-payment of premiums for which notice shall be sent ten (10) days prior. If such written notice is unavailable from the insurer, contractor shall provide written notice of cancellation, non-renewal and any reduction in coverage to the parties identified in the Notices section by certified mail, return receipt requested within three (3) business days of such notice by its insurer(s) and referencing the City's contract number. If any policy is in excess of a deductible or self-insured retention, the City must be notified by the Contractor. Contractor shall be responsible for the payment of any deductible or self-insured retention. The insurance coverages specified in this Agreement are the minimum requirements, and these requirements do not lessen or limit the liability of the Contractor. The Contractor shall maintain, at its own expense, any additional kinds or amounts of insurance that it may deem necessary to cover its obligations and liabilities under this Agreement.

**(2)** **Proof of Insurance:** Contractor shall provide a copy of this Agreement to its insurance agent or broker. Contractor may not commence services or work relating to the Agreement prior to placement of coverage. Contractor certifies that the certificate of insurance attached as part of the Contract Documents, preferably an ACORD certificate, complies with all insurance requirements of this Agreement. The City requests that the City's contract number be referenced on the Certificate. The City's acceptance of a certificate of insurance or other proof of insurance that does not comply with all insurance requirements set forth in this Agreement shall not act as a waiver of Contractor's breach of this Agreement or of any of the City's rights or remedies under this Agreement. The City's Risk Management Office may require additional proof of insurance, including but not limited to policies and endorsements.

**(3)** **Additional Insureds:** For Commercial General Liability and Auto Liability, Contractor and subcontractor's insurer(s) shall name the City and County of Denver, its elected and appointed officials, employees and volunteers as additional insured.

**(4)** **Waiver of Subrogation:** For all coverages, Contractor's insurer shall waive subrogation rights against the City.

**(5)** **Subcontractors and Subconsultants:** All subcontractors and subconsultants (including independent contractors, suppliers or other entities providing goods or services required by this Agreement) shall be subject to all of the requirements herein and shall procure and maintain the same coverages required of the Contractor. Contractor shall include all such subcontractors as additional insured under its policies (with the exception of

Workers' Compensation) or shall ensure that all such subcontractors and subconsultants maintain the required coverages. Contractor agrees to provide proof of insurance for all such subcontractors and subconsultants upon request by the City.

**(6)** **Workers' Compensation/Employer's Liability Insurance:** Contractor shall maintain the coverage as required by statute for each work location and shall maintain Employer's Liability insurance with limits of $100,000 per occurrence for each bodily injury claim, $100,000 per occurrence for each bodily injury caused by disease claim, and $500,000 aggregate for all bodily injuries caused by disease claims. Contractor expressly represents to the City, as a material representation upon which the City is relying in entering into this Agreement, that none of the Contractor's officers or employees who may be eligible under any statute or law to reject Workers' Compensation Insurance shall effect such rejection during any part of the term of this Agreement, and that any such rejections previously effected, have been revoked as of the date Contractor executes this Agreement.

**(7)** **Commercial General Liability:** Contractor shall maintain a Commercial General Liability insurance policy with limits of $1,000,000 for each occurrence, $1,000,000 for each personal and advertising injury claim, $2,000,000 products and completed operations aggregate, and $2,000,000 policy aggregate.

**(8)** **Business Automobile Liability:** Contractor shall maintain Business Automobile Liability with limits of $1,000,000 combined single limit applicable to all owned, hired and non-owned vehicles used in performing services under this Agreement

**(9)** **Additional Provisions:**

(a) For Commercial General Liability, the policies must provide the following:

(i) That this Agreement is an Insured Contract under the policy;
(ii) Defense costs in excess of policy limits;
(iii) A severability of interests or separation of insureds provision (no insured vs. insured exclusion); and
(iv) A provision that coverage is primary and non-contributory with other coverage or self-insurance maintained by the City.

(b) For claims-made coverage:
(i) The retroactive date must be on or before the contract date or the first date when any goods or services were provided to the City, whichever is earlier

(c) Contractor shall advise the City in the event any general aggregate or other aggregate limits are reduced below the required per occurrence limits. At their own expense, and where such general aggregate or other aggregate limits have been reduced below the required per occurrence limit, the Contractor will procure such per occurrence limits and furnish a new certificate of insurance showing such coverage is in force.

## SC-17 GREENPRINT DENVER REQUIREMENTS

In accordance with the City and County of Denver Executive Order 123: Greenprint Denver Office and Sustainability Policy, as amended, Contractor shall adhere to sections of Executive Order 123 pertinent to the construction of the built environment. This includes but is not limited to: all construction and renovation of buildings shall follow instructions and memorandum for high performance buildings; horizontal projects shall include the use of fly ash concrete and recycled aggregate where possible; and, all projects shall recycle construction and demolition waste, and install materials that contain recycled content whenever possible using the U.S. Green Building Council Leadership in Energy and Environmental Design (LEED) as guidance. Non-hazardous solid waste that is eligible for reuse or recycling is not subject to the DADS disposal requirement defined in SC-12.

A completed "Greenprint Denver Closeout Form for Construction Projects" shall be delivered to the Project Manager as a submittal requirement of Final Acceptance.

http://www.denvergov.org/constructioncontracts/Home/ContractorResources/tabid/443154/Default.aspx

Bond No. 34BCSID4047

# CITY AND COUNTY OF DENVER
## DEPARTMENT OF PUBLIC WORKS

### PERFORMANCE AND PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned CONCRETE WORKS OF COLORADO, INC., 1260 Rock Creek Circle, Lafayette, Colorado 80026, a corporation organized and existing under and by virtue of the laws of the State of Colorado, hereafter referred to as the "Contractor", and HARTFORD FIRE INSURANCE COMPANY, a corporation organized and existing under and by virtue of the laws of the State of Connecticut, and authorized to transact business in the State of Colorado, as Surety, are held and firmly bound unto the CITY AND COUNTY OF DENVER, a municipal corporation of the State of Colorado, hereinafter referred to as the "City", in the penal sum of **Five Million, One Hundred Thirty-Five Thousand, Nine Hundred Ninety-Eight Dollars and Zero Cents ($5,135,998.00)**, lawful money of the United States of America, for the payment of which sum, well and truly to be made, we bind ourselves and our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents;

THE CONDITION OF THE FOREGOING OBLIGATION IS SUCH THAT:

WHEREAS, the above bounden Contractor has entered into a written contract with the aforesaid City for furnishing all labor and tools, supplies, equipment, superintendence, materials and everything necessary for and required to do, perform and complete the construction of **CONTRACT NO. 201950389 27th STREET STORM INTERCEPTOR, PHASE 2**, Denver, Colorado, and has bound itself to complete the project within the time or times specified or pay liquidated damages, all as designated, defined and described in the said Contract and Conditions thereof, and in accordance with the Plans and Technical Specifications therefore, a copy of said Contract being made a part hereof;

NOW, THEREFORE, if the said Contractor shall and will, in all particulars well and truly and faithfully observe, perform and abide by each and every Covenant, Condition and part of said Contract, and the Conditions, Technical Specifications, Plans, and other Contract Documents thereto attached, or by reference made a part thereof and any alterations in and additions thereto, according to the true intent and meaning in such case, then this obligation shall be and become null and void; otherwise, it shall remain in full force and effect;

PROVIDED FURTHER, that if the said Contractor shall satisfy all claims and demands incurred by the Contractor in the performance of said Contract, and shall fully indemnify and save harmless the City from all damages, claims, demands, expense and charge of every kind (including claims of patent infringement) arising from any act, omission, or neglect of said Contractor, its agents, or employees with relation to said work; and shall fully reimburse and repay to the City all costs, damages, and expenses which it may incur in making good any default based upon the failure of the Contractor to fulfill its obligation to furnish maintenance, repairs or replacements for the full guarantee period provided in the Contract Documents, then this obligation shall be null and void; otherwise it shall remain in full force and effect;

PROVIDED FURTHER, that if said Contractor shall at all times promptly make payments of all amounts lawfully due to all persons supplying or furnishing it or its subcontractors with labor and materials, rental machinery, tools or equipment used or performed in the prosecution of work provided for in the above Contract and that if the Contractor will indemnify and save harmless the City for the extent of any and all payments in connection with the carrying out of such Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect;

PROVIDED FURTHER, that if the said Contractor fails to duly pay for any labor, materials, team hire, sustenance, provisions, provender, gasoline, lubricating oils, fuel oils, grease, coal, or any other supplies or materials used or consumed by said Contractor or its subcontractors in performance of the work contracted to be done, or fails to pay any person who supplies rental machinery, tools or equipment, all amounts due as the result of the use of such machinery, tools or equipment in the prosecution of the work, the Surety will pay the same in any amount not exceeding the amount of this obligation, together with interest as provided by law;

PROVIDED FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract, or to contracts with others in connection with this project, or the work to be performed thereunder, or the Technical Specifications and Plans accompanying the same, shall in any way affect its obligation on this bond and it does hereby waive notice of any change, extension of time, alteration or addition to the terms of the Contract, or contracts, or to the work, or to the Technical Specifications and Plans.

IN WITNESS WHEREOF, said Contractor and said Surety have executed these presents as of this _____ day of _____, 20__.

CONCRETE WORKS OF COLORADO, INC.
**Contractor**

By: _____
~~President~~ Richard Brasher, Jr.
Vice President

HARTFORD FIRE INSURANCE COMPANY
**Surety**

By: _____
**Attorney-In-Fact** Cynthia M. Burnett

Attest:

By: _____
~~Secretary~~ ReaAnn Fletcher, Contracts Manager

Concrete Works of Colorado, Inc. A Colorado Corporation

(Accompany this bond with Attorney-in-Fact's authority from the Surety to execute bond, certified to include the date of the bond).

APPROVED AS TO FORM:
Attorney for the City and County of Denver

By: _____
**Assistant City Attorney**

APPROVED FOR THE CITY AND COUNTY OF DENVER

By: _____
**MAYOR**

By: _____
**EXECUTIVE DIRECTOR OF PUBLIC WORKS**

# POWER OF ATTORNEY

*Direct Inquiries/Claims to:*
THE HARTFORD
**BOND, T-4**
**One Hartford Plaza**
**Hartford, Connecticut 06155**
*call:* **888-266-3488** *or fax:* **860-757-5835**
**Agency Code: 34-344525**

**KNOW ALL PERSONS BY THESE PRESENTS THAT:**

- [X] **Hartford Fire Insurance Company**, a corporation duly organized under the laws of the State of Connecticut
- [X] **Hartford Casualty Insurance Company**, a corporation duly organized under the laws of the State of Indiana
- [X] **Hartford Accident and Indemnity Company**, a corporation duly organized under the laws of the State of Connecticut
- [ ] **Hartford Underwriters Insurance Company**, a corporation duly organized under the laws of the State of Connecticut
- [ ] **Twin City Fire Insurance Company**, a corporation duly organized under the laws of the State of Indiana
- [ ] **Hartford Insurance Company of Illinois**, a corporation duly organized under the laws of the State of Illinois
- [ ] **Hartford Insurance Company of the Midwest**, a corporation duly organized under the laws of the State of Indiana
- [ ] **Hartford Insurance Company of the Southeast,** a corporation duly organized under the laws of the State of Florida

having their home office in Hartford, Connecticut, (hereinafter collectively referred to as the "Companies") do hereby make, constitute and appoint, ***up to the amount of unlimited:***

*Douglas J. Rothey, Cynthia M. Burnett*
*of*
*Littleton, CO*

their true and lawful Attorney(s)-in-Fact, each in their separate capacity if more than one is named above, to sign its name as surety(ies) only as delineated above by ☒, and to execute, seal and acknowledge any and all bonds, undertakings, contracts and other written instruments in the nature thereof, on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

**In Witness Whereof**, and as authorized by a Resolution of the Board of Directors of the Companies on January 22, 2004 the Companies have caused these presents to be signed by its Assistant Vice President and its corporate seals to be hereto affixed, duly attested by its Assistant Secretary. Further, pursuant to Resolution of the Board of Directors of the Companies, the Companies hereby unambiguously affirm that they are and will be bound by any mechanically applied signatures applied to this Power of Attorney.

Wesley W. Cowling, Assistant Secretary

M. Ross Fisher, Assistant Vice President

**STATE OF CONNECTICUT**
**COUNTY OF HARTFORD** } ss. Hartford

On this 3rd day of March, 2008, before me personally came M. Ross Fisher, to me known, who being by me duly sworn, did depose and say: that he resides in the County of Hartford, State of Connecticut; that he is the Assistant Vice President of the Companies, the corporations described in and which executed the above instrument; that he knows the seals of the said corporations; that the seals affixed to the said instrument are such corporate seals; that they were so affixed by authority of the Boards of Directors of said corporations and that he signed his name thereto by like authority.

Scott E. Paseka
Notary Public
My Commission Expires October 31, 2012

**CERTIFICATE**

I, the undersigned, Assistant Vice President of the Companies, DO HEREBY CERTIFY that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which is still in full force effective as of .

Signed and sealed at the City of Hartford.

Gary W. Stumper, Assistant Vice President

# CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 8/6/2019

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

**PRODUCER**
McMillan Insurance & Bonding Inc.
6600 E. Hampden Ave
Denver CO 80224

CONTACT NAME: Heather Lee
PHONE (A/C, No, Ext): 303-918-7572 FAX (A/C, No):
E-MAIL ADDRESS: hlee@trustinnovise.com

| INSURER(S) AFFORDING COVERAGE | NAIC # |
|---|---|
| INSURER A : The Travelers Companies | |
| INSURER B : Pinnacol Assurance | 41190 |
| INSURER C : | |
| INSURER D : | |
| INSURER E : | |
| INSURER F : | |

**INSURED** CONCWOR-02
Concrete Works of Colorado, Inc.
1260 Rock Creek Circle
Lafayette CO 80026

**COVERAGES** **CERTIFICATE NUMBER:** 1438447554 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

| INSR LTR | TYPE OF INSURANCE | ADDL INSD | SUBR WVD | POLICY NUMBER | POLICY EFF (MM/DD/YYYY) | POLICY EXP (MM/DD/YYYY) | LIMITS | |
|---|---|---|---|---|---|---|---|---|
| A | X COMMERCIAL GENERAL LIABILITY | | | DTCO35D5832COF18 | 11/1/2018 | 11/1/2019 | EACH OCCURRENCE | $ 1,000,000 |
| | CLAIMS-MADE X OCCUR | | | | | | DAMAGE TO RENTED PREMISES (Ea occurrence) | $ 300,000 |
| | | | | | | | MED EXP (Any one person) | $ 5,000 |
| | | | | | | | PERSONAL & ADV INJURY | $ 1,000,000 |
| | GEN'L AGGREGATE LIMIT APPLIES PER: | | | | | | GENERAL AGGREGATE | $ 2,000,000 |
| | POLICY X PRO-JECT LOC | | | | | | PRODUCTS - COMP/OP AGG | $ 2,000,000 |
| | OTHER: | | | | | | | $ |
| A | AUTOMOBILE LIABILITY | | | 8100L7995691826G | 11/1/2018 | 11/1/2019 | COMBINED SINGLE LIMIT (Ea accident) | $ 1,000,000 |
| | X ANY AUTO | | | | | | BODILY INJURY (Per person) | $ |
| | OWNED AUTOS ONLY / SCHEDULED AUTOS | | | | | | BODILY INJURY (Per accident) | $ |
| | X HIRED AUTOS ONLY / X NON-OWNED AUTOS ONLY | | | | | | PROPERTY DAMAGE (Per accident) | $ |
| | | | | | | | | $ |
| A | X UMBRELLA LIAB X OCCUR | | | CUP9H4567391826 | 11/1/2018 | 11/1/2019 | EACH OCCURRENCE | $ 10,000,000 |
| | EXCESS LIAB CLAIMS-MADE | | | | | | AGGREGATE | $ 10,000,000 |
| | DED X RETENTION $ 10,000 | | | | | | | $ |
| B | WORKERS COMPENSATION AND EMPLOYERS' LIABILITY | | | 4062790 | 11/1/2018 | 11/1/2019 | X PER STATUTE / OTH-ER | |
| | ANYPROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) Y/N: N | N / A | | | | | E.L. EACH ACCIDENT | $ 500,000 |
| | If yes, describe under DESCRIPTION OF OPERATIONS below | | | | | | E.L. DISEASE - EA EMPLOYEE | $ 500,000 |
| | | | | | | | E.L. DISEASE - POLICY LIMIT | $ 500,000 |

**DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES** (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)
RE:201950389 27th Street Storm Interceptor, Phase 2
City and County of Denver, its elected and appointed officials, employees and volunteers are regarded as Additional Insureds for General Liability and Auto Liability per written agreement. 30 days notice of cancellation. Waivers of Subrogation in favor of Additional Insured are per written contract.

**CERTIFICATE HOLDER**

City and County of Denver c/o Contract Administration
201 West Colfax, Dept. 614
Denver CO 80202

**CANCELLATION**

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

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SURESCAPE

Surescape Insurance Services
7800 S. Elati Street, Suite 100
Littleton, CO 80120
(303) 225-8030 Phone
(303) 225-8034 Fax

August 6, 2019

FAX NUMBER (720) 913-3183
TELEPHONE NUMBER (720) 913-3267

Assistant City Attorney
City and County of Denver
201 West Colfax Avenue, Dept. 1207
Denver, Colorado 80202

Re: CONCRETE WORKS OF COLORADO, INC.

Contract No. 201950389
Project Name: 27th Street Storm Interceptor, Phase 2
Contract Amount: $5,135,998.00
Performance and Payment Bond No.: 34BCSID4047

The Performance and Payment Bonds covering the above-captioned project were executed by this agency, through Hartford Fire Insurance Company, on August 6, 2019.

We hereby authorize the City and County of Denver, Department of Public Works, to date all bonds and Powers of Attorney to coincide with the date of the contract.

If you should have any additional questions or concerns, please do not hesitate to give me a call at (303) 225-8030.

Thank you.

Sincerely,

Cynthia M. Burnett

Cynthia M. Burnett
Senior Vice President
Surety Department

DENVER
THE MILE HIGH CITY

**PERFORMANCE AND PAYMENT BOND**
**SURETY AUTHORIZATION**
**(SAMPLE)**

FAX NUMBER: 720-913-3183
TELEPHONE NUMBER: 720-913-3267

Assistant City Attorney
201 W. Colfax Ave. Dept 1207
Denver, Colorado 80202

RE: (Company name)

Contract No: 201950389
Project Name: 27th Street Storm Interceptor, Phase 2
Contract Amount:
Performance and Payment Bond No.:

Dear Assistant City Attorney,

The Performance and Payment Bonds covering the above captioned project were executed by this agency, through _____ insurance company, on _____, 20__.

We hereby authorize the City and County of Denver, Department of Public Works, to date all bonds and powers of attorney to coincide with the date of the contract.

If you should have any additional questions or concerns, please don't hesitate to give me a call at _____.

Thank you.

Sincerely,

Denver Public Works/Office of the Executive Director
201 West Colfax Avenue, Dept 608 | Denver, CO 80202
www.denvergov.org/dpw
p. 720.865.8630 | f. 720.865.8795

311 | POCKETGOV.COM | DENVERGOV.ORG | DENVER 8 TV

DENVER
THE MILE HIGH CITY

# NOTICE OF APPARENT LOW BIDDER
**(SAMPLE)**

Current Date

To:

Gentlemen:

The MANAGER OF PUBLIC WORKS has considered the Bids submitted on June 27, 2019 for work to be done and materials to be furnished in and for:

**PROJECT No. 201950389 27th STREET STORM INTERCEPTOR, PHASE 2**

as set forth in detail in the Contract Documents for the City and County of Denver, Colorado. It appears that your Bid is fair, equitable, and to the best interest of the City and County; therefore, said Bid is hereby accepted at the bid price contained herein, subject to execution of the Contract Documents and your furnishing the items specified below, the total cost thereof (Contract Amount Written), (Contract Amount Numeric).

It will be necessary for you to appear forthwith at the office of the Department of Public Works, Finance and Administration, 201 W. Colfax Ave. Dept 614, Denver, Colorado 80202, to receive the said Contract Documents, execute the same and return them to the Department of Public Works, Finance and Administration, within the time limit set forth in the Bid Proposal.

In accordance with the requirements set forth in the Contract Documents, you are required to furnish the following documents:

a. Insurance Certificates: General Liability and Automotive Liability, Workman's Compensation and Employer Liability; or any other coverage required by the contract; and
b. One original plus four copies of the Power of Attorney relative to Performance and/or Payment Bond;

All construction Contracts made and entered into by the City and County of Denver are subject to Affirmative Action and Equal Opportunity Rules and Regulations, as adopted by the Manager of Public Works, and each contract requiring payment by the City of one-half million dollars ($500,000.00) or more shall first be approved by the City Council acting by ordinance and in accordance with Section 3.2.6 of the Charter of the City and County of Denver.

Prior to issuance of Notice to Proceed, all Equal Opportunity requirements must be completed. Additional information may be obtained by contacting the Director of Contract Compliance at (720-913-1700).

**NOTICE OF APPARENT LOW BIDDER**
**(SAMPLE)**

PROJECT NO. 201950389
Page 2

The Bid Security submitted with your Bid, will be returned upon execution of the Contract and furnishing of the Performance Bond. In the event you should fail to execute the Contract and to furnish the performance Bond within the time limit specified, said Bid Security will be retained by the City and County of Denver as liquidated damages, and not as a penalty for the delay and extra work caused thereby.

Dated at Denver, Colorado this _____ day of _____20___.

CITY AND COUNTY OF DENVER

By · _____
Manager of Public Works

Denver Public Works/Office of the Executive Director
201 West Colfax Avenue, Dept 608 | Denver, CO 80202
www.denvergov.org/dpw
p. 720.865.8630 | f. 720.865.8795

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DENVER
THE MILE HIGH CITY

Current Date

**NOTICE TO PROCEED**
**(SAMPLE)**

Name
Company
Street
City/State/Zip

**CONTRACT NO. 201950389, 27th STREET STORM INTERCEPTOR, PHASE 2**

In accordance with General Contract Condition 302 of the Standard Specifications for Construction, General Contract Conditions, 2011 Edition, you are hereby authorized and directed to proceed on _____ ____ with the work of constructing contract number 201950389, as set forth in detail in the contract documents for the City and County of Denver.

With a contract time of _____ calendar days, the project must be complete on or before ___ ____.

If you have not already done so, you must submit your construction schedule, in accordance with General Contract Condition 306.2.B, to the Project Manager within 10 days. Additionally, you must submit your tax exempt certificate, and copies of your subcontractors' certificates, in accordance with General Contract Condition 323.5, to the Project Manager as soon as possible. Failure to submit these certificates will delay processing of payment applications.

Sincerely,

Lesley B. Thomas
City Engineer

cc:

Denver Public Works/Office of the Executive Director
201 West Colfax Avenue, Dept 608 | Denver, CO 80202
www.denvergov.org/dpw
p. 720.865.8630 | f. 720.865.8795

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DENVER
THE MILE HIGH CITY

Certificate of Contract Release
(SAMPLE)

Date

Name
Company
Street
City/State/Zip

RE: Certificate of Contract Release for
**201950389, 27th STREET STORM INTERCEPTOR, PHASE 2**

Received this date of the City and County of Denver, as full and final payment of the cost of the improvements provided for in the foregoing contract, _____ dollars and _____ cents ($_____), in cash, being the remainder of the full amount accruing to the undersigned by virtue of said contract; said cash also covering and including full payment for the cost of all extra work and material furnished by the undersigned in the construction of said improvements, and all incidentals thereto, and the undersigned hereby releases said City and County of Denver from any and all claims or demands whatsoever, regardless of how denominated, growing out of said contract.

And these presents are to certify that all persons performing work upon or furnishing materials for said improvements under the foregoing contract have been paid in full and this payment to be made is the last or final payment.

_____

Contractor's Signature Date Signed

If there are any questions, please contact me by telephone at (720) 913-XXXX. Please return this document via facsimile at (720) 913-1805 and mail to original to the above address.

Denver Public Works/Office of the Executive Director
201 West Colfax Avenue, Dept 608 | Denver, CO 80202
www.denvergov.org/dpw
p. 720.865.8630 | f. 720.865.8795

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# CITY AND COUNTY OF DENVER

## STATE OF COLORADO

DENVER
THE MILE HIGH CITY

## DEPARTMENT OF PUBLIC WORKS

## Addenda

## Contract Number: 201950389

● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ●

## 27th Street Storm Interceptor, Phase 2

## May 29, 2019

All Addenda Documents provided on CD with Technical Specifications and Drawings under this Contract.

**CITY AND COUNTY OF DENVER**
**DEPARTMENT OF PUBLIC WORKS**

**CONTRACT NO. 201950389**
**PROJECT NAME: 27th STREET STORM INTERCEPTOR, PHASE 2**

**ADDENDUM NO. 1 TO CONTRACT DOCUMENTS**

Bidders are hereby instructed that the drawings, specifications, and other contract documents are modified, corrected, supplemented and/or superseded for the above-mentioned project as hereinafter described in the following attachments:

**Added Documents**

**The following Two Prevailing Wage Rates Schedules shall be incorporated by reference within the Bid Documents Package.**

**Attachment A: Prevailing Wage Rates – HEAVY CONSTRUCTION PROJECTS, Modification No. 4, Publication Date: 05/10/2019 (6 pages)**

**Attachment B: Prevailing Wage Rates – HIGHWAY CONSTRUCTION PROJECTS, Modification No.1, Publication Date: 05/10/2019 (6 pages)**

This **ADDENDUM** shall be attached to, become a part of, and be returned with the Bid Proposal.

Lesley B. Thomas
City Engineer

6.4.19
Date

The undersigned bidder acknowledges receipt of this Addendum. The Proposal submitted herewith is in accordance with the stipulations set forth herein.

Concrete Works of Colorado, Inc.
Contractor

**ADDENDUM NO. 1** DATE: 6/4/19

Attachment A:

**TO:** All Users of the City and County of Denver Prevailing Wage Schedules
**FROM:** Ryland Feno, Classification & Compensation Technician II
**DATE:** May 13, 2019
**SUBJECT:** Latest Change to Prevailing Wage Schedules

The effective date for this publication will be **Friday, May 10, 2019** and applies to the City and County of Denver for **HEAVY CONSTRUCTION PROJECTS** in accordance with the Denver Revised Municipal Code, Section 20-76(c).

General Wage Decision No. CO190002
Superseded General Decision No. CO20180012
Modification No. 4
Publication Date: 05/10/2019
(6 pages)

Unless otherwise specified in this document, apprentices shall be permitted only if they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor (DOL). The employer and the individual apprentice must be registered in a program which has received prior approval by the DOL. Any employer who employs an apprentice and is found to be in violation of this provision shall be required to pay said apprentice the full journeyman scale.

Attachments as listed above.

General Decision Number: CO190002 05/10/2019 CO2

Superseded General Decision Number: CO20180012

State: Colorado

Construction Type: Heavy

Counties: Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, El Paso, Jefferson, Larimer, Mesa, Pueblo and Weld Counties in Colorado.

HEAVY CONSTRUCTION PROJECTS

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.60 for calendar year 2019 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.60 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2019. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate,if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

| Modification Number | Publication Date |
|---|---|
| 0 | 01/04/2019 |
| 1 | 02/01/2019 |
| 2 | 02/22/2019 |
| 3 | 04/12/2019 |
| 4 | 05/10/2019 |

ASBE0028-001 07/01/2018

| | Rates | Fringes |
|---|---|---|
| Asbestos Workers/Insulator (Includes application of all insulating materials, protective coverings, coatings and finishings to | | |

ELECTRICIAN.....$ 31.80 15.90

---

ELEC0969-002 01/01/2019

MESA COUNTY

| | Rates | Fringes |
|---|---|---|
| ELECTRICIAN..... | $ 24.80 | 9.84 |

---

* ENGI0009-001 05/01/2018

| | Rates | Fringes |
|---|---|---|
| Power equipment operators: | | |
| Blade: Finish..... | $ 28.57 | 10.70 |
| Blade: Rough..... | $ 28.25 | 10.70 |
| Bulldozer..... | $ 28.25 | 10.70 |
| Cranes: 50 tons and under.. | $ 28.40 | 10.70 |
| Cranes: 51 to 90 tons..... | $ 28.57 | 10.70 |
| Cranes: 91 to 140 tons..... | $ 29.55 | 10.70 |
| Cranes: 141 tons and over... | $ 31.07 | 10.70 |
| Forklift..... | $ 27.87 | 10.70 |
| Mechanic..... | $ 28.73 | 10.70 |
| Oiler..... | $ 27.49 | 10.70 |
| Scraper: Single bowl under 40 cubic yards..... | $ 28.40 | 10.70 |
| Scraper: Single bowl, including pups 40 cubic yards and over and tandem bowls..... | $ 28.57 | 10.70 |
| Trackhoe..... | $ 28.40 | 10.70 |

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IRON0024-003 01/01/2019

| | Rates | Fringes |
|---|---|---|
| Ironworkers:..... Structural | $ 29.85 | 21.76 |

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LABO0086-001 05/01/2009

| | Rates | Fringes |
|---|---|---|
| Laborers: | | |
| Pipelayer..... | $ 18.68 | 6.78 |

---

PLUM0003-005 06/01/2017

ADAMS, ARAPAHOE, BOULDER, BROOMFIELD, DENVER, DOUGLAS, JEFFERSON, LARIMER AND WELD COUNTIES

| | Rates | Fringes |
|---|---|---|
| PLUMBER..... | $ 39.08 | 16.44 |

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PLUM0058-002 07/01/2018

EL PASO COUNTY

| | Rates | Fringes |
|---|---|---|
| Plumbers and Pipefitters..... | $ 32.75 | 14.85 |

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PLUM0058-008 07/01/2018

PUEBLO COUNTY

| | Rates | Fringes |
|---|---|---|
| Plumbers and Pipefitters..... | $ 32.75 | 14.85 |

---

PLUM0145-002 07/01/2016

MESA COUNTY

| | Rates | Fringes |
|---|---|---|
| Plumbers and Pipefitters..... | $ 35.17 | 11.70 |

---

PLUM0208-004 06/01/2016

ADAMS, ARAPAHOE, BOULDER, BROOMFIELD, DENVER, DOUGLAS,
JEFFERSON, LARIMER AND WELD COUNTIES

| | Rates | Fringes |
|---|---|---|
| PIPEFITTER..... | $ 37.10 | 16.62 |

---

SHEE0009-002 07/01/2018

| | Rates | Fringes |
|---|---|---|
| Sheet metal worker..... | $ 34.02 | 17.49 |

---

TEAM0455-002 07/01/2018

| | Rates | Fringes |
|---|---|---|
| Truck drivers: | | |
| Pickup..... | $ 21.41 | 4.32 |
| Tandem/Semi and Water..... | $ 22.04 | 4.32 |

---

SUCO2001-006 12/20/2001

| | Rates | Fringes |
|---|---|---|
| BOILERMAKER..... | $ 17.60 | |
| Carpenters: | | |
| Form Building and Setting... | $ 16.97 | 2.74 |

| | | |
|---|---|---|
| All Other Work | $ 15.14 | 3.37 |
| Cement Mason/Concrete Finisher | $ 17.31 | 2.85 |
| IRONWORKER, REINFORCING | $ 18.83 | 3.90 |
| Laborers: | | |
| Common | $ 11.22 | 2.92 |
| Flagger | $ 8.91 | 3.80 |
| Landscape | $ 12.56 | 3.21 |
| Painters: | | |
| Brush, Roller & Spray | $ 15.81 | 3.26 |
| Power equipment operators: | | |
| Backhoe | $ 16.36 | 2.48 |
| Front End Loader | $ 17.24 | 3.23 |
| Skid Loader | $ 15.37 | 4.41 |

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

**Office of Human Resources**
**Supplemental Rates**
**(Specific to the Denver Projects)**
**(Supp #74, Date: 02-03-2012)**

| Classification | | Base | Fringe |
|---|---|---|---|
| Ironworker | Ornamental | $24.80 | $10.03 |
| Laborer | Group 1 | $18.18 | $8.27 |
| | Group 2 | $21.59 | $8.61 |
| Laborer (Janitor) | Janitor/Yardmen | $17.68 | $8.22 |
| Laborer (Asbestos) | Removal of Asbestos | $21.03 | $8.55 |
| Laborer (Tunnel) | Group 1 | $18.53 | $8.30 |
| | Group 2 | $18.63 | $8.31 |
| | Group 3 | $19.73 | $8.42 |
| | Group 4 | $21.59 | $8.61 |
| | Group 5 | $19.68 | $8.42 |
| Line Construction | Lineman, Gas Fitter/Welder | $36.88 | $9.55 |
| | Line Eq Operator/Line Truck Crew | $25.74 | $8.09 |
| Millwright | | $28.00 | $10.00 |
| Power Equipment Operator | Group 1 | $22.97 | $10.60 |
| | Group 2 | $23.32 | $10.63 |
| | Group 3 | $23.67 | $10.67 |
| | Group 4 | $23.82 | $10.68 |
| | Group 5 | $23.97 | $10.70 |
| | Group 6 | $24.12 | $10.71 |
| | Group 7 | $24.88 | $10.79 |
| Power Equipment Operator (Tunnels above and below ground, shafts and raises): | Group 1 | $25.12 | $10.81 |
| | Group 2 | $25.47 | $10.85 |
| | Group 3 | $25.57 | $10.86 |
| | Group 4 | $25.82 | $10.88 |
| | Group 5 | $25.97 | $10.90 |
| | Group 6 | $26.12 | $10.91 |
| | Group 7 | $26.37 | $10.94 |
| Truck Driver | Group 1 | $18.42 | $10.00 |
| | Group 2 | $19.14 | $10.07 |
| | Group 3 | $19.48 | $10.11 |
| | Group 4 | $20.01 | $10.16 |
| | Group 5 | $20.66 | $10.23 |
| | Group 6 | $21.46 | $10.31 |

Go to http://www.denvergov.org/Auditor to view the Prevailing Wage Clarification Document for a list of complete classifications used.

Attachment B

DENVER
THE MILE HIGH CITY

**TO:** All Users of the City and County of Denver Prevailing Wage Schedules
**FROM:** Ryland Feno, Classification & Compensation Technician II
**DATE:** May 13, 2019
**SUBJECT:** Latest Change to Prevailing Wage Schedules

Please be advised prevailing wage rates for some building, heavy, highway, and residential construction trades have not been updated by the United States Department of Labor (DOL) since March 1, 2002. The Career Service Board, in their meeting held on April 21, 2011, approved the use of the attached supplemental wage rates until prevailing wage rates for these classifications of work are again published by the United States Department of Labor in accordance with the Davis-Bacon Act.

The effective date for this publication will be **Friday, May 10, 2019** and applies to the City and County of Denver for **HIGHWAY CONSTRUCTION PROJECTS** in accordance with the Denver Revised Municipal Code, Section 20-76(c).

General Wage Decision No. CO190009
Superseded General Decision No. CO20180019
Modification No. 1
Publication Date: 05/10/2019
(6 pages)

Unless otherwise specified in this document, apprentices shall be permitted only if they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor (DOL). The employer and the individual apprentice must be registered in a program which has received prior approval by the DOL. Any employer who employs an apprentice and is found to be in violation of this provision shall be required to pay said apprentice the full journeyman scale.

Attachments as listed above.

**Office of Human Resources**
201 W. Colfax Ave. Dept. 412 | Denver, CO 80202
p: 720.913.5751 | f: 720.913.5720
www.denvergov.org/humanresources

General Decision Number: CO190009 05/10/2019 CO9

Superseded General Decision Number: CO20180019

State: Colorado

Construction Type: Highway

Counties: Denver and Douglas Counties in Colorado.

HIGHWAY CONSTRUCTION PROJECTS

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.60 for calendar year 2019 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.60 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2019. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate,if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

| Modification Number | Publication Date |
|---|---|
| 0 | 01/04/2019 |
| 1 | 05/10/2019 |

CARP9901-008 05/01/2018

| | Rates | Fringes |
|---|---|---|
| CARPENTER (Form Work Only)..... | $ 25.50 | 9.47 |

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ELEC0068-016 03/01/2011

| | Rates | Fringes |
|---|---|---|
| TRAFFIC SIGNALIZATION: | | |
| Traffic Signal Installation | | |
| Zone 1..... | $ 26.42 | 4.75%+8.68 |
| Zone 2..... | $ 29.42 | 4.75%+8.68 |

TRAFFIC SIGNAL INSTALLER ZONE DEFINITIONS

Zone 1 shall be a 35 mile radius, measured from the following addresses in each of the following cities:
Colorado Springs - Nevada & Bijou
Denver - Ellsworth Avenue & Broadway
Ft. Collins - Prospect & College
Grand Junction - 12th & North Avenue
Pueblo - I-25 & Highway 50
All work outside of these areas shall be paid Zone 2 rates.

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* ENGI0009-008 05/01/2018

| | Rates | Fringes |
|---|---|---|
| POWER EQUIPMENT OPERATOR: | | |
| (3)-Hydraulic Backhoe (Wheel Mounted, under 3/4 yds), Hydraulic Backhoe (Backhoe/Loader combination), Drill Rig Caisson (smaller than Watson 2500 and similar), Loader (up to and including 6 cu. yd.) | $ 28.25 | 10.70 |
| (3)-Loader (under 6 cu. yd.) | | |
| Denver County | $ 28.25 | 10.70 |
| (3)-Motor Grader (blade-rough) | | |
| Douglas County | $ 28.25 | 10.70 |
| (4)-Crane (50 tons and under), Scraper (single bowl, under 40 cu. yd) | $ 28.40 | 10.70 |
| (4)-Loader (over 6 cu. yd) | | |
| Denver County | $ 28.40 | 10.70 |
| (5)-Drill Rig Caisson (Watson 2500 similar or larger), Crane (51-90 tons), Scraper (40 cu.yd and over), | $ 28.57 | 10.70 |
| (5)-Motor Grader (blade-finish) | | |
| Douglas County | $ 28.57 | 10.70 |
| (6)-Crane (91-140 tons) | $ 29.55 | 10.70 |

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SUCO2011-004 09/15/2011

| | Rates | Fringes |
|---|---|---|
| CARPENTER (Excludes Form Work) | $ 19.27 | 5.08 |
| CEMENT MASON/CONCRETE FINISHER | | |
| Denver | $ 20.18 | 5.75 |
| Douglas | $ 18.75 | 3.00 |

| | | |
|---|---|---|
| ELECTRICIAN (Excludes Traffic Signal Installation) | $ 35.13 | 6.83 |
| FENCE ERECTOR (Excludes Link/Cyclone Fence Erection) | $ 13.02 | 3.20 |
| GUARDRAIL INSTALLER | $ 12.89 | 3.20 |
| HIGHWAY/PARKING LOT STRIPING:Painter | | |
| Denver | $ 12.62 | 3.21 |
| Douglas | $ 13.89 | 3.21 |
| IRONWORKER, REINFORCING (Excludes Guardrail Installation) | $ 16.69 | 5.45 |
| IRONWORKER, STRUCTURAL (Includes Link/Cyclone Fence Erection, Excludes Guardrail Installation) | $ 18.22 | 6.01 |
| LABORER | | |
| Asphalt Raker | $ 16.29 | 4.25 |
| Asphalt Shoveler | $ 21.21 | 4.25 |
| Asphalt Spreader | $ 18.58 | 4.65 |
| Common or General | | |
| Denver | $ 16.76 | 6.77 |
| Douglas | $ 16.29 | 4.25 |
| Concrete Saw (Hand Held) | $ 16.29 | 6.14 |
| Landscape and Irrigation | $ 12.26 | 3.16 |
| Mason Tender-Cement/Concrete | | |
| Denver | $ 16.96 | 4.04 |
| Douglas | $ 16.29 | 4.25 |
| Pipelayer | | |
| Denver | $ 13.55 | 2.41 |
| Douglas | $ 16.30 | 2.18 |
| Traffic Control (Flagger) | $ 9.55 | 3.05 |
| Traffic Control (Sets Up/Moves Barrels, Cones, Install Signs, Arrow Boards and Place Stationary Flags)(Excludes Flaggers) | $ 12.43 | 3.22 |
| PAINTER (Spray Only) | $ 16.99 | 2.87 |
| POWER EQUIPMENT OPERATOR: | | |
| Asphalt Laydown | | |
| Denver | $ 22.67 | 8.72 |
| Douglas | $ 23.67 | 8.47 |
| Asphalt Paver | | |
| Denver | $ 24.97 | 6.13 |
| Douglas | $ 25.44 | 3.50 |
| Asphalt Roller | | |
| Denver | $ 23.13 | 7.55 |

| | | |
|---|---|---|
| Douglas | $ 23.63 | 6.43 |
| Asphalt Spreader | $ 22.67 | 8.72 |
| Backhoe/Trackhoe | | |
| Douglas | $ 23.82 | 6.00 |
| Bobcat/Skid Loader | $ 15.37 | 4.28 |
| Boom | $ 22.67 | 8.72 |
| Broom/Sweeper | | |
| Denver | $ 22.47 | 8.72 |
| Douglas | $ 22.96 | 8.22 |
| Bulldozer | $ 26.90 | 5.59 |
| Concrete Pump | $ 21.60 | 5.21 |
| Drill | | |
| Denver | $ 20.48 | 4.71 |
| Douglas | $ 20.71 | 2.66 |
| Forklift | $ 15.91 | 4.68 |
| Grader/Blade | | |
| Denver | $ 22.67 | 8.72 |
| Guardrail/Post Driver | $ 16.07 | 4.41 |
| Loader (Front End) | | |
| Douglas | $ 21.67 | 8.22 |
| Mechanic | | |
| Denver | $ 22.89 | 8.72 |
| Douglas | $ 23.88 | 8.22 |
| Oiler | | |
| Denver | $ 23.73 | 8.41 |
| Douglas | $ 24.90 | 7.67 |
| Roller/Compactor (Dirt and Grade Compaction) | | |
| Denver | $ 20.30 | 5.51 |
| Douglas | $ 22.78 | 4.86 |
| Rotomill | $ 16.22 | 4.41 |
| Screed | | |
| Denver | $ 22.67 | 8.38 |
| Douglas | $ 29.99 | 1.40 |
| Tractor | $ 13.13 | 2.95 |
| **TRAFFIC SIGNALIZATION:** | | |
| Groundsman | | |
| Denver | $ 17.90 | 3.41 |
| Douglas | $ 18.67 | 7.17 |
| **TRUCK DRIVER** | | |
| Distributor | | |
| Denver | $ 17.81 | 5.82 |
| Douglas | $ 16.98 | 5.27 |
| Dump Truck | | |
| Denver | $ 15.27 | 5.27 |
| Douglas | $ 16.39 | 5.27 |
| Lowboy Truck | $ 17.25 | 5.27 |
| Mechanic | $ 26.48 | 3.50 |
| Multi-Purpose Specialty & Hoisting Truck | | |
| Denver | $ 17.49 | 3.17 |
| Douglas | $ 20.05 | 2.88 |
| Pickup and Pilot Car | | |
| Denver | $ 14.24 | 3.77 |
| Douglas | $ 16.43 | 3.68 |

| | | |
|---|---|---|
| Semi/Trailer Truck | $ 18.39 | 4.13 |
| Truck Mounted Attenuator | $ 12.43 | 3.22 |
| Water Truck | | |
| Denver | $ 26.27 | 5.27 |
| Douglas | $ 19.46 | 2.58 |

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

**Office of Human Resources**
**Supplemental Rtes**
**(Specific to the Denver Projects)**
**Revised 4/11/2017)**

| Classification | | Base | Fringe |
|---|---|---|---|
| Ironworker (Ornamental) | | $26.05 | $12.00 |
| Laborer | Removal of Asbestos | $21.03 | $8.55 |
| Line Construction | Lineman, Gas Fitter/Welder | $36.88 | $9.55 |
| | Line Eq Operator/Line Truck Crew | $25.74 | $8.09 |
| Millwright | | $28.00 | $10.00 |
| Pipefitter | | $30.45 | $12.85 |
| Plumber | | $30.19 | $13.55 |
| Power Equipment Operator (Tunnels Above and Below Ground, shafts and raises): | Group 1 | $25.12 | $10.81 |
| | Group 2 | $25.47 | $10.85 |
| | Group 3 | $25.57 | $10.86 |
| | Group 4 | $25.82 | $10.88 |
| | Group 5 | $25.97 | $10.90 |
| | Group 6 | $26.12 | $10.91 |
| | Group 7 | $26.37 | $10.94 |
| Power Equipment Operator | Group 1 | $22.97 | $10.60 |
| | Group 2 | $23.32 | $10.63 |
| | Group 3 | $23.67 | $10.67 |
| | Group 4 | $23.82 | $10.68 |
| | Group 5 | $23.97 | $10.70 |
| | Group 6 | $24.12 | $10.71 |
| | Group 7 | $24.88 | $10.79 |
| Truck Driver | Group 1 | $18.42 | $10.00 |
| | Group 2 | $19.14 | $10.07 |
| | Group 3 | $19.48 | $10.11 |
| | Group 4 | $20.01 | $10.16 |
| | Group 5 | $20.66 | $10.23 |
| | Group 6 | $21.46 | $10.31 |

Go to http://www.denvergov.org/Auditor to view the Prevailing Wage Clarification Document for a list of complete classifications used.

**CITY AND COUNTY OF DENVER**
**DEPARTMENT OF PUBLIC WORKS**

**CONTRACT NO. 201950389**
**PROJECT NAME: 27th STREET STORM INTERCEPTOR, PHASE 2**

**ADDENDUM NO. 2 TO CONTRACT DOCUMENTS**

Bidders are hereby instructed that the drawings, specifications, and other contract documents are modified, corrected, supplemented, and/or superseded for the above-mentioned project as hereinafter described in the following attachments:

**Postponement of Bid Opening**

**City and County of Denver**
**Department of Public Works**
**Bid Postponement Notice**

**Contract No. 201950389**
**27th Street Storm Interceptor Phase 2**

Notice is hereby given that the Sealed Bid Opening for Contract No. 201950389 - 27th Street Storm Interceptor Phase 2, is hereby postponed. Sealed bids will be received in Room 6.G.7., 201 W. Colfax Ave., Denver, CO 80202, no later than:

**11:00am, local time**
**July 11, 2019**

Published in the Daily Journal on June 20, 21 and 24, 2019.

**Questions and Answers**

Q1-Are there any CAD files available for this project?
**A1- CAD files will be provided to the awarded contractor.**

Q2-What is the anticipated construction schedule? What are the contract days?
**A2 – The anticipated NTP for the project is September 2019. Contract length as stated in the bid documents is 210 days.**

Q3-The Materials Management Plan specifies it is only specific to Phase 1. Will there be any changes to this plan for Phase 2?
**A3 – The MMP for Phase 1 applies to Phase 2 as well. Attached is a formal memo from the Environmental consultant (Attachment 1).**

Q4- Is it required that the vibration monitoring consultant be a licensed PE in the State of Colorado? Will extensive experience working with Denver Water and Northern Water supersede this requirement?
**A4 – Per project specifications, the vibration monitoring consultant must be a PE licensed in the state of Colorado.**

Q5- Is there a detail for #14 inlets (Special- Deeper than 6'), or is the contractor required to provide shop drawings?
**A5- Attached to this addendum is a detail for #14 inlets (Special- Deeper than 6') from Phase 1 to be used for Phase 2 construction (Attachment 2).**

This **ADDENDUM** shall be attached to, become a part of, and be returned with the Bid Proposal.

Lesley B. Thomas
City Engineer

6/18/19
Date

---

The undersigned bidder acknowledges receipt of this Addendum. The Proposal submitted herewith is in accordance with the stipulations set forth herein.

Concrete Works of Colorado, Inc.

Contractor

**ADDENDUM NO.** 2

**DATE:** 6/18/19

Attachment 1

Pinyon Environmental, Inc

Corporate Headquarters
3222 South Vance Street, Suite 200, Lakewood, CO 80227
T: 303.980.5200 F: 303.980.0089
www.pinyon-env.com

# Memorandum

**To:** Project File

**Subject:** Geographic Applicability of Materials Management Plans Prepared for the 27th Street Storm Drain Interceptor – Coors Field Parking Lot to Arapahoe Street, and the 27th Street Storm Drain Interceptor – Arapahoe Street to Welton Street Projects, City and County of Denver, Colorado

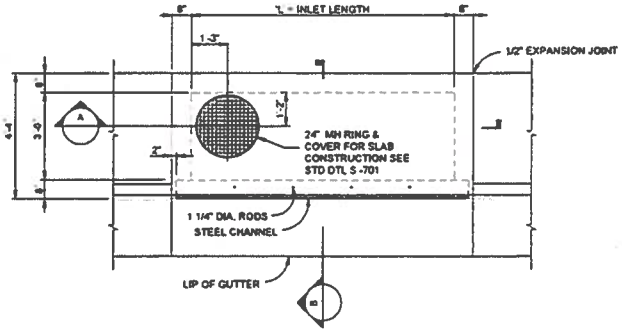
---

Suspected soil and/or groundwater impacts have not been identified by past environmental sampling and evaluations completed along the 27th Street Storm Drain Interceptor project corridor. However, impacted soil and/or groundwater, if encountered, will require special management.

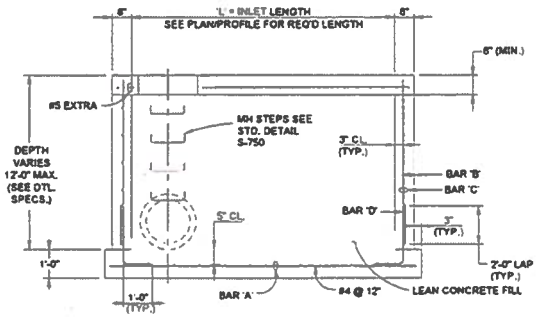
The 27th Street Storm Drain Interceptor project extends along 27th Street from the Coors Field Parking lot south to Washington Street where it extends south to East 20th Avenue. A Materials Management Plan (MMP) has been completed for Phase 1 of the project (Coors Field Parking Lot to Arapahoe Street); Phase 2 will extend from Arapahoe Street to Welton Street. Both project areas have been evaluated for environmental conditions, and a MMP has been prepared for Phase 1 to address specific conditions for each independent project. Environmental conditions between the two phases are similar; therefore, the Contractor is required to implement the MMP produced for the Phase 1 for Phase 2 of the project.

The Contractor shall be responsible for compliance with the Materials Management Plan as referenced below:

Pinyon, 2017. "Materials Management Plan, 27th Street Storm Drain Interceptor – Coors Field Parking Lot to Arapahoe Street, Denver, Colorado." Prepared by Pinyon Environmental, Inc., October 27, 2017.




PLAN
SCALE 1/2" = 1'-0"

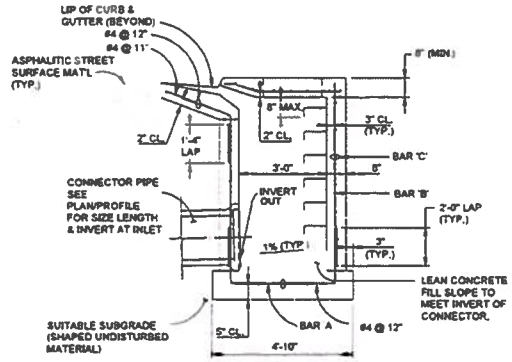



A SECTION
SCALE 1/2" = 1'-0"

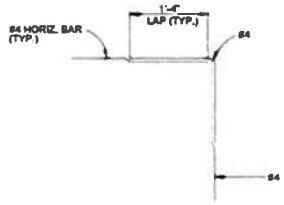
## SPECIAL TYPE 14 INLET NOTES

1. EXCEPT REINFORCING AND DIMENSIONS AS NOTED HEREIN RELATING TO INLET DEPTHS, ALL MATERIALS AND CONSTRUCTION OF SPECIAL TYPE 14 INLETS SHALL CONFORM TO CITY AND COUNTY OF DENVER STANDARD DRAWINGS S-620.1 AND S-620.2, AS WELL AS ALL PROJECT AND STANDARD CONSTRUCTION SPECIFICATIONS.
2. THESE SPECIAL TYPE 14 INLET DESIGN DETAILS HAVE BEEN DEVELOPED SPECIFICALLY FOR THE SOILS, SITE GEOMETRICS, AND LOADING CONDITIONS FOR THE PROJECT IN THIS PLAN SET - 27TH STREET STORM INTERCEPTOR, PHASE I, AND SHOULD NOT BE USED ELSEWHERE.

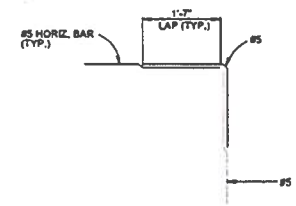
| SPECIAL INLET REINFORCING TABLE | | | | |
|---|---|---|---|---|
| DEPTH | BAR A | BAR B | BAR C | BAR D |
| 6'-0" MAX | PER STD.- S620.1 & 620.5 | | | |
| 9'-0" MAX | #4 @ 6" | #4 @ 6" | #4 @ 5 1/2" | #4 @ 6" |
| 12'-0" MAX | #5 @ 4" | #5 @ 4" | #5 @ 4 1/2" | #5 @ 4" |




B SECTION
SCALE 1/2" = 1'-0"




DETAIL - TYPICAL #4 CORNER REBAR PLACEMENT
SCALE 1" = 1'-0"




DETAIL - TYPICAL #5 CORNER REBAR PLACEMENT
SCALE 1" = 1'-0"

San Engineering LLC
Civil and Structural Engineering

| NO | DESCRIPTION OF REVISIONS | DATE | BY |
|---|---|---|---|

CALL UNCC
TWO WORKING DAYS BEFORE YOU DIG

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
CAPITAL PROJECTS MANAGEMENT
2000 W. 3RD AVE. DENVER, CO 80223
TEL (303) 446-3617 FAX (303) 446-3647

27TH STREET STORM INTERCEPTOR

PRO TRACKING NO PWWW2017-012
PROJECT MASTER NO 2017-PROJMSTR-0000343
SPECIAL TYPE 14 INLET REINFORCING DETAILS

DRAWN BY: KB
DESIGNED BY: SDD
APPROVED BY: JJM
DRAWING NAME:
DATE: March 14, 2018
SHEET NO. S17

Attachment 2

**CITY AND COUNTY OF DENVER**
**DEPARTMENT OF PUBLIC WORKS**

**CONTRACT NO. 201950389**
**PROJECT NAME: 27th STREET STORM INTERCEPTOR, PHASE 2**

**ADDENDUM NO. 3 TO CONTRACT DOCUMENTS**

Bidders are hereby instructed that the drawings, specifications, and other contract documents are modified, corrected, supplemented, and/or superseded for the above-mentioned project as hereinafter described in the following attachments:

**QUESTIONS & ANSWERS**

There is a clear variance between the plans and the bid form regarding the ADA ramp on the SW corner of 27th & Curtis and the associated retaining wall.

Q1-The demo plans call for Remove 100 LF of Concrete retaining wall and the bid form calls for Remove 60 LF Concrete Retaining wall? This need to be clarified.
**A1- Bid Item 2-5 has been increased to 100 LF.**

Q2-There is no detail for the replacement of this retaining wall. Please provide a detail or reference a detail for the restoration of the retaining wall.
**A2- Per construction plan sheet 30, refer to Transportation Standards and Details for the Engineering Division Standard Drawings 10.4.**

Q3-A portion of the retaining wall has a brick and wrought iron fence installed on top of it in such a way that it will be damaged with the removal of the retaining wall. Is restoration of this fence incidental to the retaining wall work? (please see the attached pictures for reference to the fence).
**A3- The wall is independent of the ramp, and we do not anticipate damage to the wall. The wall will be protected in place. The City installed this ramp and respective concrete walls in 2017, independently from the brick/ wrought iron wall.**

Q4-There was a story on the news about homeowners who had concerns about damage caused by vibrations from shoring installation on a city project on 33rd St and Downing St. Does the City expect the contractor to plan on using a type of shoring that is less impactful to surrounding structures? Does the City plan on implementing a vibration monitoring program?
**A4- Construction means and methods need to consider the effects of vibration on existing structures. This project is in a historic neighborhood with soft brick/masonry construction. Some of the homes are up to 140 years old. Alternative methods of shoring that cause less vibration and that are less impactful to existing structures should be considered. See bid item 02-22.13-Vibration Assessment. This bid item requires a vibration assessment and a vibration monitoring program to be implemented by the contractor through an independent vibration consultant. Details for the scope of work for the consultant are in the measurement and payment section 02-2213 and specification section 02-2213.**

Q5-At the prebid meeting, it was mentioned that Phase 3 may take an alternate alignment. How will this impact the work included in this phase?

**A5- Phase 3 is currently designed to cross through the Five Points intersection at 27th/ Welton/ Washington, but we are currently investigating another alternative which would stop at 27th and California, and head south down California to 26th Ave. We are waiting on utility information to confirm this alternative and should have this information this week. If the alternative alignment is feasible, we will issue an addendum with the design change and add an additional structure to the bid tab for 27th at California.**

Q6-Will all underground utilities in conflict with the system be relocated prior to the start of construction?

**A6- The City does our best to relocate all facilities prior to NTP. However, this does not always happen as some utility companies do not always follow through. Bid Item 2-17.1 is included in the bid for any additional coordination necessary during construction. If coordination is required, the contractor should anticipate downtime while the utility company is performing the utility re-locate work. This work should be scheduled to ensure that no time is lost for the project.**

**BID FORM SUBMITTAL PACKET:**

Replace Bid Form pages; BF-6.1 through BF-6.11 with the attached ADD #3, BF-6.1 through ADD #3, BF-6.11 Bid Form pages.

**BID DOCUMENTS PACKAGE:**

Replace Bid Documents Package pages; SQ-1 through SQ-7 with the attached ADD #3,SQ-1 through ADD#3, SQ-7.

**ADDED DOCUMENTS**

**Attachment A: 2018 to 2019 Approved Concrete for Denver**

**Attachment B: Regulated Asbestos Contaminated Soil Standard Operating Procedure**

**Attachment C: Subsurface Utility Engineering Report**

This **ADDENDUM** shall be attached to, become a part of, and be returned with the Bid Proposal.

Lesley B. Thomas
City Engineer

6/25/19
Date

The undersigned bidder acknowledges receipt of this Addendum. The Proposal submitted herewith is in accordance with the stipulations set forth herein.

Concrete Works of Colorado, Inc.
Contractor

**ADDENDUM NO.** 3 DATE: 6/25/19

## *Bid Form*

### *27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 01-21.16.01 | **ALLOWANCE FOR TREE REMOVAL, TRIMMING/ REPLACEMENT AND DISPOSAL - SEE PROJECT SPECIAL PROVISIONS** | | | |
| | at the unit price of $ Twenty Thousand Dollars and No Cents | 1 | A/A | $ 20,000.00 |
| | true and verifiable costs + mark up | | | |
| 01-21.19.01 | **ALLOWANCE FOR CERTIFIED ASBESTOS BUILDING INSPECTOR (CABI)/AIR MONITOR(HOURLY) - SEE PROJECT SPECIAL PROVISIONS** | | | |
| | at the unit price of $ Twenty Thousand Dollars and No Cents | 1 | A/A | $ 20,000.00 |
| | true and verifiable costs + mark up | | | |
| 01-52.13 | **TEMPORARY OFFICE FACILITIES** | | | |
| | at the unit price of | 1 | LS | $ |
| | lump sum | | | |
| 2-1.2a | **REMOVE 6" CONCRETE CURB AND/OR GUTTER** | | | |
| | at the unit price of | 2,279 | LF | $ |
| | per linear foot | | | |
| 2-1.4 | **REMOVE SIDEWALK ACCESSIBILITY CONCRETE CURB RAMP** | | | |
| | at the unit price of | 5,060 | SF | $ |
| | per square foot | | | |
| 2-2.1 | **REMOVE CONCRETE SIDEWALK** | | | |
| | at the unit price of | 2,220 | SF | $ |
| | per square foot | | | |
| 2-2.2 | **REMOVE CONCRETE DRIVEWAY PAVING** | | | |
| | at the unit price of | 800 | SF | $ |
| | per square foot | | | |
| 2-3.3 | **REMOVE CONCRETE ALLEY PAVING** | | | |
| | at the unit price of | 2,937 | SF | $ |
| | per square foot | | | |

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 2-5 | **REMOVE CONCRETE RETAINING WALL**<br>*Add'l Info: FOR RAMP AT 27TH & CURTIS*<br>at the unit price of _____ per linear foot | 100 | LF | $ _____ |
| 2-11.2b | **REMOVE EXISTING 10" STORM SEWER PIPE**<br>*Add'l Info: VCP*<br>at the unit price of _____ per linear foot | 248 | LF | $ _____ |
| 2-11.2d | **REMOVE EXISTING 15" STORM SEWER PIPE**<br>*Add'l Info: VCP*<br>at the unit price of _____ per linear foot | 409 | LF | $ _____ |
| 2-11.2q | **REMOVE EXISTING 66" STORM SEWER PIPE**<br>*Add'l Info: 63x42 OVOID BRICK*<br>at the unit price of _____ per linear foot | 77 | LF | $ _____ |
| 2-11.2s | **REMOVE EXISTING 78" STORM SEWER PIPE**<br>*Add'l Info: 75" VCP*<br>at the unit price of _____ per linear foot | 983 | LF | $ _____ |
| 2-11.5a | **ABANDON EXISTING 8" SEWER PIPE**<br>*Add'l Info: 6" DIP WATER LINE*<br>at the unit price of _____ per linear foot | 20 | LF | $ _____ |
| 2-11.5a | **ABANDON EXISTING 8" SEWER PIPE**<br>*Add'l Info: 8" PVC WATER LINE*<br>at the unit price of _____ per linear foot | 60 | LF | $ _____ |
| 2-12.2 | **REMOVE EXISTING STORM MANHOLE**<br>at the unit price of _____ each | 6 | EA | $ _____ |

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 2-13.1 | **REMOVE EXISTING STORM INLET**<br>at the unit price of _____ each | 14 | EA | $ _____ |
| 2-17.1 | **REMOVE AND REPLACE/RELOCATE UTILITY POLES**<br>*Add'l Info: INCLUDES SUPPORT OF POLES*<br>at the unit price of _____ each | 4 | EA | $ _____ |
| 2-17.3 | **REMOVE AND REPLACE/RELOCATE SIGN**<br>at the unit price of _____ each | 25 | EA | $ _____ |
| 2-17.3 | **REMOVE AND REPLACE/RELOCATE SIGN**<br>*Add'l Info: REMOVE AND RESET BOLLARD*<br>at the unit price of _____ each | 2 | EA | $ _____ |
| 2-17.7 | **RELOCATE EXISTING UTILITY**<br>*Add'l Info: COORDINATION WITH UTILITY COMPANIES*<br>at the unit price of _____ lump sum | 1 | LS | $ _____ |
| 2-17.7 | **RELOCATE EXISTING UTILITY**<br>*Add'l Info: RELOCATE TRAFFIC OVERHEAD. CONTRACTOR TO PROVIDE SUPPORT POLES.*<br>at the unit price of _____ lump sum | 1 | LS | $ _____ |
| 2-20a | **REMOVE TROLLEY TRACKS**<br>at the unit price of _____ per linear foot | 180 | LF | $ _____ |
| 02-22.13 | **VIBRATION ASSESSMENT**<br>at the unit price of _____ lump sum | 1 | LS | $ _____ |
| 2-23 | **REMOVE DECORATIVE LANDSCAPING**<br>at the unit price of _____ lump sum | 1 | LS | $ _____ |

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 3-2 | **HAULING OF CONTAMINATED MATERIALS TO DENVER/ARAPAHOE DISPOSAL SITE (DADS)*LICENSED PER D.R.M.C. 48-62** | | | |
| | at the unit price of _____ per ton | 2,000 | TON | $ _____ |
| 3-7a | **HEALTH & SAFETY PLAN** | | | |
| | at the unit price of _____ lump sum | 1 | LS | $ _____ |
| 3-7b | **MATERIAL MANAGEMENT PLAN** | | | |
| | at the unit price of _____ lump sum | 1 | LS | $ _____ |
| 5-2a | **SUBGRADE MATERIAL (SELECT BACKFILL)** | | | |
| | at the unit price of _____ per ton | 2,000 | TON | $ _____ |
| 5-7 | **CONTROLLED LOW STRENGTH MATERIALS (CLSM)** | | | |
| | at the unit price of _____ per cubic yard | 100 | CY | $ _____ |
| 5-8 | **CRUSHED GRAVEL BASE COURSE (CDOT CLASS 6 ROAD BASE)** | | | |
| | at the unit price of _____ per ton | 300 | TON | $ _____ |
| 8-1.1b | **6" DIP AWWA C151, CLASS 50 WATER LINE** | | | |
| | at the unit price of _____ per linear foot | 60 | LF | $ _____ |
| 8-1.1c | **8" DIP AWWA C151, CLASS 50 WATER LINE** | | | |
| | at the unit price of _____ per linear foot | 170 | LF | $ _____ |
| 8-1.1d | **10" DIP AWWA C151, CLASS 50 WATER LINE** | | | |
| | at the unit price of _____ per linear foot | 40 | LF | $ _____ |

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 8-1.1e | **12" DIP AWWA C151, CLASS 50 WATER LINE**<br>at the unit price of _____ per linear foot | 20 | LF | $ _____ |
| 8-1.1h | **16" DIP AWWA C151, CLASS 50 WATER LINE**<br>at the unit price of _____ per linear foot | 20 | LF | $ _____ |
| 8-1.2b | **INSTALL 6" WATER VALVE**<br>at the unit price of _____ each | 3 | EA | $ _____ |
| 8-1.2c | **INSTALL 8" WATER VALVE**<br>at the unit price of _____ each | 3 | EA | $ _____ |
| 8-1.3a | **4" PVC AWWA C900, CLASS 200**<br>*Add'l Info: REMOVE AND REPLACE SANITARY SERVICE LINE*<br>at the unit price of _____ per linear foot | 50 | LF | $ _____ |
| 8-1.3b | **6" PVC AWWA C900, CLASS 150**<br>*Add'l Info: SANITARY REPLACEMENT*<br>at the unit price of _____ per linear foot | 50 | LF | $ _____ |
| 8-1.5a | **LEAD SERVICE LINE REPLACEMENT, <2" ID**<br>at the unit price of _____ per linear foot | 90 | LF | $ _____ |
| 8-2 | **REMOVE FIRE HYDRANT ASSEMBLY**<br>at the unit price of _____ each | 3 | EA | $ _____ |
| 8-3 | **RESET OR INSTALL FIRE HYDRANT ASSEMBLY**<br>at the unit price of _____ each | 3 | EA | $ _____ |

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 8-4 | **REMOVE EXISTING WATER LINE**<br>*Add'l Info: REMOVE 6" CML WATER LINE*<br>at the unit price of _____ per linear foot | 30 | LF | $ _____ |
| 8-4 | **REMOVE EXISTING WATER LINE**<br>*Add'l Info: REMOVE 8" DIP & PVC WATER LINE*<br>at the unit price of _____ per linear foot | 100 | LF | $ _____ |
| 8-4 | **REMOVE EXISTING WATER LINE**<br>*Add'l Info: REMOVE 10" CIP WATER LINE*<br>at the unit price of _____ per linear foot | 40 | LF | $ _____ |
| 12-1.1 | **6" CURB AND GUTTER 2' PAN (CD0T T2, IIB)**<br>at the unit price of _____ per linear foot | 2,279 | LF | $ _____ |
| 12-1.7 | **6" CONCRETE CURB HEAD**<br>*Add'l Info: FOR RAMP AT 27TH & CURTIS*<br>at the unit price of _____ per linear foot | 60 | LF | $ _____ |
| 12-1.8 | **SIDEWALK ACCESSIBILITY CONCRETE CURB RAMP**<br>at the unit price of _____ per square foot | 5,060 | SF | $ _____ |
| 12-1.9 | **GUTTER OVERLAY**<br>*Add'l Info: CDOT CLASS D CONCRETE GUTTER OVERLAY WITH FIBER MESH REINFORCEMENT*<br>at the unit price of _____ per linear foot | 1,500 | LF | $ _____ |
| 12-2.1 | **CONCRETE SIDEWALK**<br>at the unit price of _____ per square foot | 1,000 | SF | $ _____ |

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 12-2.1 | **CONCRETE SIDEWALK**<br>*Add'l Info: PIGMENTED*<br>at the unit price of _____ per square foot | 2,000 | SF | $ _____ |
| 12-2.1 | **CONCRETE SIDEWALK**<br>*Add'l Info: 8" PIGMENTED FOR RAMP AT 27TH & CURTIS*<br>at the unit price of _____ per square foot | 220 | SF | $ _____ |
| 12-5.1 | **CONCRETE DRIVEWAY PAVING**<br>at the unit price of _____ per square foot | 800 | SF | $ _____ |
| 12-5.5 | **CONCRETE ALLEY PAVING**<br>at the unit price of _____ per square foot | 2,937 | SF | $ _____ |
| 12-16a | **CONCRETE RETAINING WALL**<br>*Add'l Info: FOR RAMP AT 27TH & CURTIS*<br>at the unit price of _____ lump sum | 1 | LS | $ _____ |
| 16-3 | **CHAIN LINK FENCE**<br>*Add'l Info: TREE PROTECTION, INCLUDES TREE WRAP. ALSO INCLUDES FENCE FOR MAINTAINING PEDESTRIAN ACCESS.*<br>at the unit price of _____ per linear foot | 2,500 | LF | $ _____ |
| 20-2ce | **ASPHALT SURFACE COURSE, SX, RAP 20%, N=100, 64-22.**<br>at the unit price of _____ per square yard inch | 17,258 | SY-IN | $ _____ |
| 20-3ce | **ASPHALT BASE COURSE, S, RAP 20%, N=100, 64-22.**<br>at the unit price of _____ per square yard inch | 47,459 | SY-IN | $ _____ |

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 20-4 | **ASPHALT ROTOMILL**<br>at the unit price of _____ per square yard inch | 2,000 | SY-IN | $ |
| 20-5 | **ASPHALT PATCH**<br>at the unit price of _____ per square yard inch | 6,903 | SY-IN | $ |
| 34-2.3d | **15" DIAMETER C-76 RCP, CLASS III**<br>at the unit price of _____ per linear foot | 115 | LF | $ |
| 34-2.3e | **18" DIAMETER C-76 RCP, CLASS III**<br>at the unit price of _____ per linear foot | 315 | LF | $ |
| 34-2.3g | **24" DIAMETER C-76 RCP, CLASS III**<br>at the unit price of _____ per linear foot | 17 | LF | $ |
| 34-2.3p | **60" DIAMETER C-76 RCP, CLASS III**<br>at the unit price of _____ per linear foot | 60 | LF | $ |
| 34-2.3s | **78" DIAMETER C-76 RCP, CLASS III**<br>at the unit price of _____ per linear foot | 30 | LF | $ |
| 34-2.3t | **84" DIAMETER C-76 RCP, CLASS III**<br>at the unit price of _____ per linear foot | 220 | LF | $ |
| 34-2.3u | **90" DIAMETER C-76 RCP, CLASS III**<br>at the unit price of _____ per linear foot | 1,349 | LF | $ |
| 34-7.1c | **12" DIAMETER PVC PIPE**<br>*Add'l Info: FOR ROOF DRAIN 1031+05*<br>at the unit price of _____ per linear foot | 30 | LF | $ |

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 34-12.4a | **CAST-IN-PLACE TYPE B MANHOLE WITH TYPE A TOP SLAB**<br>at the unit price of _____ each | 5 | EA | $ _____ |
| 34-12.5b | **CAST-IN-PLACE TYPE P MANHOLE WITH TOP SLAB FOR H>2' DEPTH**<br>at the unit price of _____ each | 1 | EA | $ _____ |
| 34-12.7 | **CAST-IN-PLACE SPECIAL STRUCTURE**<br>*Add'l Info: MH-9*<br>at the unit price of _____ each | 1 | EA | $ _____ |
| 34-12.7 | **CAST-IN-PLACE SPECIAL STRUCTURE**<br>*Add'l Info: CONCRETE COLLAR*<br>at the unit price of _____ each | 2 | EA | $ _____ |
| 34-12.8 | **UNCOVER AND RAISE (ADJUST) MANHOLE**<br>*Add'l Info: MEASUREMENT IS EACH*<br>at the unit price of _____ vertical feet | 4 | VF | $ _____ |
| 34-12.9 | **ADJUST UTILITY LIDS**<br>at the unit price of _____ each | 5 | EA | $ _____ |
| 34-15.3 | **UTILITY EXPLORATORY INVESTIGATION**<br>at the unit price of _____ each | 20 | EA | $ _____ |
| 34-16.1a | **#14 INLET (L=6')**<br>at the unit price of _____ each | 4 | EA | $ _____ |

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 34-16.1a | **#14 INLET (L=6')**<br>*Add'l Info: SPECIAL(DEEPER THAN 6')*<br>at the unit price of _____ each | 5 | EA | $ _____ |
| 34-16.1b | **#14 INLET (L=9')**<br>at the unit price of _____ each | 3 | EA | $ _____ |
| 34-16.1b | **#14 INLET (L=9')**<br>*Add'l Info: SPECIAL(DEEPER THAN 6')*<br>at the unit price of _____ each | 4 | EA | $ _____ |
| 34-16.2a | **SINGLE #16 INLET WITH OPEN THROAT**<br>at the unit price of _____ each | 2 | EA | $ _____ |
| 40-3 | **SODDING**<br>at the unit price of _____ per square foot | 10,000 | SF | $ _____ |
| 40-4b | **RELOCATE EXISITING SPRINKLER LINE**<br>at the unit price of _____ per linear foot | 3,000 | LF | $ _____ |
| 40-6 | **DECORATIVE LANDSCAPING**<br>*Add'l Info: INCLUDES REMOVAL AND REPLACEMENT OF PLANTERS, DECORATIVE BRICK PAVING AND FLAGSTONE, AND GRADING AROUND RAMPS AND SIDEWALK*<br>at the unit price of _____ lump sum | 1 | LS | $ _____ |
| 41-1 | **TRAFFIC CONTROL**<br>*Add'l Info: TO INCLUDE POTENTIAL TEMPORARY 2-WAY CONVERSION OF CHAMPA, STOUT, 27TH STREET*<br>at the unit price of _____ lump sum | 1 | LS | $ _____ |

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 43-1d | **STORM WATER MANAGEMENT (SCENARIO 4) See SCS 23.0** | | | |
| | at the unit price of _____ lump sum | 1 | LS | $ _____ |
| 44-1 | **DEWATERING** | | | |
| | at the unit price of _____ lump sum | 1 | LS | $ _____ |
| 45-2 | **QUALITY CONTROL TESTING** | | | |
| | at the unit price of _____ lump sum | 1 | LS | $ _____ |
| 46-1 | **PAVEMENT MARKING (PAINT)** | | | |
| | at the unit price of _____ per square foot | 470 | SF | $ _____ |
| 46-4 | **PREFORMED PLASTIC PAVEMENT MARKING** | | | |
| | at the unit price of _____ per square foot | 500 | SF | $ _____ |
| 47-1 | **CONSTRUCTION SURVEYING** | | | |
| | at the unit price of _____ lump sum | 1 | LS | $ _____ |
| 47-2 | **SURVEY MONUMENTATION** | | | |
| | *Add'l Info: RESET RANGE POINT* | | | |
| | at the unit price of _____ each | 3 | EA | $ _____ |
| 47-2 | **SURVEY MONUMENTATION** | | | |
| | *Add'l Info: FOR SURVEY MARKING (OTHER THAN RANGE POINT) TO BE TIED OUT* | | | |
| | at the unit price of _____ each | 25 | EA | $ _____ |
| 50-1 | **MOBILIZATION** | | | |
| | at the unit price of _____ lump sum | 1 | LS | $ _____ |

## *Statement of Quantities*

### *27th Street Storm Interceptor, Phase 2*

| Pay Item # | Description | Estimated Quantity | Units |
|---|---|---|---|
| 01-21.16.01 | ALLOWANCE FOR TREE REMOVAL, TRIMMING/ REPLACEMENT AND DISPOSAL - SEE PROJECT SPECIAL PROVISIONS | 1 | A/A |
| 01-21.19.01 | ALLOWANCE FOR CERTIFIED ASBESTOS BUILDING INSPECTOR (CABI)/AIR MONITOR(HOURLY) - SEE PROJECT SPECIAL PROVISIONS | 1 | A/A |
| 01-52.13 | TEMPORARY OFFICE FACILITIES | 1 | LS |
| 2-1.2a | REMOVE 6" CONCRETE CURB AND/OR GUTTER | 2,279 | LF |
| 2-1.4 | REMOVE SIDEWALK ACCESSIBILITY CONCRETE CURB RAMP | 5,060 | SF |
| 2-2.1 | REMOVE CONCRETE SIDEWALK | 2,220 | SF |
| 2-2.2 | REMOVE CONCRETE DRIVEWAY PAVING | 800 | SF |
| 2-3.3 | REMOVE CONCRETE ALLEY PAVING | 2,937 | SF |
| 2-5 | REMOVE CONCRETE RETAINING WALL<br>*Add'l Info: FOR RAMP AT 27TH & CURTIS* | 100 | LF |
| 2-11.2b | REMOVE EXISTING 10" STORM SEWER PIPE<br>*Add'l Info: VCP* | 248 | LF |
| 2-11.2d | REMOVE EXISTING 15" STORM SEWER PIPE<br>*Add'l Info: VCP* | 409 | LF |
| 2-11.2q | REMOVE EXISTING 66" STORM SEWER PIPE<br>*Add'l Info: 63x42 OVOID BRICK* | 77 | LF |
| 2-11.2s | REMOVE EXISTING 78" STORM SEWER PIPE<br>*Add'l Info: 75" VCP* | 983 | LF |
| 2-11.5a | ABANDON EXISTING 8" SEWER PIPE<br>*Add'l Info: 6" DIP WATER LINE* | 20 | LF |

| Pay Item # | Description | Estimated Quantity | Units |
|---|---|---|---|
| 2-11.5a | ABANDON EXISTING 8" SEWER PIPE<br>*Add'l Info: 8" PVC WATER LINE* | 60 | LF |
| 2-12.2 | REMOVE EXISTING STORM MANHOLE | 6 | EA |
| 2-13.1 | REMOVE EXISTING STORM INLET | 14 | EA |
| 2-17.1 | REMOVE AND REPLACE/RELOCATE UTILITY POLES<br>*Add'l Info: INCLUDES SUPPORT OF POLES* | 4 | EA |
| 2-17.3 | REMOVE AND REPLACE/RELOCATE SIGN | 25 | EA |
| 2-17.3 | REMOVE AND REPLACE/RELOCATE SIGN<br>*Add'l Info: REMOVE AND RESET BOLLARD* | 2 | EA |
| 2-17.7 | RELOCATE EXISTING UTILITY<br>*Add'l Info: COORDINATION WITH UTILITY COMPANIES* | 1 | LS |
| 2-17.7 | RELOCATE EXISTING UTILITY<br>*Add'l Info: RELOCATE TRAFFIC OVERHEAD. CONTRACTOR TO PROVIDE SUPPORT POLES.* | 1 | LS |
| 2-20a | REMOVE TROLLEY TRACKS | 180 | LF |
| 02-22.13 | VIBRATION ASSESSMENT | 1 | LS |
| 2-23 | REMOVE DECORATIVE LANDSCAPING | 1 | LS |
| 3-2 | HAULING OF CONTAMINATED MATERIALS TO DENVER/ARAPAHOE DISPOSAL SITE (DADS)*LICENSED PER D.R.M.C. 48-62 | 2,000 | TON |
| 3-7a | HEALTH & SAFETY PLAN | 1 | LS |
| 3-7b | MATERIAL MANAGEMENT PLAN | 1 | LS |
| 5-2a | SUBGRADE MATERIAL (SELECT BACKFILL) | 2,000 | TON |
| 5-7 | CONTROLLED LOW STRENGTH MATERIALS (CLSM) | 100 | CY |

| Pay Item # | Description | Estimated Quantity | Units |
|---|---|---|---|
| 5-8 | CRUSHED GRAVEL BASE COURSE (CDOT CLASS 6 ROAD BASE) | 300 | TON |
| 8-1.1b | 6" DIP AWWA C151, CLASS 50 WATER LINE | 60 | LF |
| 8-1.1c | 8" DIP AWWA C151, CLASS 50 WATER LINE | 170 | LF |
| 8-1.1d | 10" DIP AWWA C151, CLASS 50 WATER LINE | 40 | LF |
| 8-1.1e | 12" DIP AWWA C151, CLASS 50 WATER LINE | 20 | LF |
| 8-1.1h | 16" DIP AWWA C151, CLASS 50 WATER LINE | 20 | LF |
| 8-1.2b | INSTALL 6" WATER VALVE | 3 | EA |
| 8-1.2c | INSTALL 8" WATER VALVE | 3 | EA |
| 8-1.3a | 4" PVC AWWA C900, CLASS 200<br>*Add'l Info: REMOVE AND REPLACE SANITARY SERVICE LINE* | 50 | LF |
| 8-1.3b | 6" PVC AWWA C900, CLASS 150<br>*Add'l Info: SANITARY REPLACEMENT* | 50 | LF |
| 8-1.5a | LEAD SERVICE LINE REPLACEMENT, <2" ID | 90 | LF |
| 8-2 | REMOVE FIRE HYDRANT ASSEMBLY | 3 | EA |
| 8-3 | RESET OR INSTALL FIRE HYDRANT ASSEMBLY | 3 | EA |
| 8-4 | REMOVE EXISTING WATER LINE<br>*Add'l Info: REMOVE 6" CML WATER LINE* | 30 | LF |
| 8-4 | REMOVE EXISTING WATER LINE<br>*Add'l Info: REMOVE 8" DIP & PVC WATER LINE* | 100 | LF |
| 8-4 | REMOVE EXISTING WATER LINE<br>*Add'l Info: REMOVE 10" CIP WATER LINE* | 40 | LF |

| Pay Item # | Description | Estimated Quantity | Units |
|---|---|---|---|
| 12-1.1 | 6" CURB AND GUTTER 2' PAN (CD0T T2, IIB) | 2,279 | LF |
| 12-1.7 | 6" CONCRETE CURB HEAD<br>*Add'l Info: FOR RAMP AT 27TH & CURTIS* | 60 | LF |
| 12-1.8 | SIDEWALK ACCESSIBILITY CONCRETE CURB RAMP | 5,060 | SF |
| 12-1.9 | GUTTER OVERLAY<br>*Add'l Info: CDOT CLASS D CONCRETE GUTTER OVERLAY WITH FIBER MESH REINFORCEMENT* | 1,500 | LF |
| 12-2.1 | CONCRETE SIDEWALK | 1,000 | SF |
| 12-2.1 | CONCRETE SIDEWALK<br>*Add'l Info: PIGMENTED* | 2,000 | SF |
| 12-2.1 | CONCRETE SIDEWALK<br>*Add'l Info: 8" PIGMENTED FOR RAMP AT 27TH & CURTIS* | 220 | SF |
| 12-5.1 | CONCRETE DRIVEWAY PAVING | 800 | SF |
| 12-5.5 | CONCRETE ALLEY PAVING | 2,937 | SF |
| 12-16a | CONCRETE RETAINING WALL<br>*Add'l Info: FOR RAMP AT 27TH & CURTIS* | 1 | LS |
| 16-3 | CHAIN LINK FENCE<br>*Add'l Info: TREE PROTECTION, INCLUDES TREE WRAP. ALSO INCLUDES FENCE FOR MAINTAINING PEDESTRIAN ACCESS.* | 2,500 | LF |
| 20-2ce | ASPHALT SURFACE COURSE, SX, RAP 20%, N=100, 64-22. | 17,258 | SY-IN |
| 20-3ce | ASPHALT BASE COURSE, S, RAP 20%, N=100, 64-22. | 47,459 | SY-IN |
| 20-4 | ASPHALT ROTOMILL | 2,000 | SY-IN |

| Pay Item # | Description | Estimated Quantity | Units |
|---|---|---|---|
| 20-5 | ASPHALT PATCH | 6,903 | SY-IN |
| 34-2.3d | 15" DIAMETER C-76 RCP, CLASS III | 115 | LF |
| 34-2.3e | 18" DIAMETER C-76 RCP, CLASS III | 315 | LF |
| 34-2.3g | 24" DIAMETER C-76 RCP, CLASS III | 17 | LF |
| 34-2.3p | 60" DIAMETER C-76 RCP, CLASS III | 60 | LF |
| 34-2.3s | 78" DIAMETER C-76 RCP, CLASS III | 30 | LF |
| 34-2.3t | 84" DIAMETER C-76 RCP, CLASS III | 220 | LF |
| 34-2.3u | 90" DIAMETER C-76 RCP, CLASS III | 1,349 | LF |
| 34-7.1c | 12" DIAMETER PVC PIPE<br>*Add'l Info: FOR ROOF DRAIN 1031+05* | 30 | LF |
| 34-12.4a | CAST-IN-PLACE TYPE B MANHOLE WITH TYPE A TOP SLAB | 5 | EA |
| 34-12.5b | CAST-IN-PLACE TYPE P MANHOLE WITH TOP SLAB FOR H>2' DEPTH | 1 | EA |
| 34-12.7 | CAST-IN-PLACE SPECIAL STRUCTURE<br>*Add'l Info: MH-9* | 1 | EA |
| 34-12.7 | CAST-IN-PLACE SPECIAL STRUCTURE<br>*Add'l Info: CONCRETE COLLAR* | 2 | EA |
| 34-12.8 | UNCOVER AND RAISE (ADJUST) MANHOLE<br>*Add'l Info: MEASUREMENT IS EACH* | 4 | VF |
| 34-12.9 | ADJUST UTILITY LIDS | 5 | EA |
| 34-15.3 | UTILITY EXPLORATORY INVESTIGATION | 20 | EA |
| 34-16.1a | #14 INLET (L=6') | 4 | EA |

| Pay Item # | Description | Estimated Quantity | Units |
|---|---|---|---|
| 34-16.1a | #14 INLET (L=6')<br>*Add'l Info: SPECIAL(DEEPER THAN 6')* | 5 | EA |
| 34-16.1b | #14 INLET (L=9') | 3 | EA |
| 34-16.1b | #14 INLET (L=9')<br>*Add'l Info: SPECIAL(DEEPER THAN 6')* | 4 | EA |
| 34-16.2a | SINGLE #16 INLET WITH OPEN THROAT | 2 | EA |
| 40-3 | SODDING | 10,000 | SF |
| 40-4b | RELOCATE EXISITING SPRINKLER LINE | 3,000 | LF |
| 40-6 | DECORATIVE LANDSCAPING<br>*Add'l Info: INCLUDES REMOVAL AND REPLACEMENT OF PLANTERS, DECORATIVE BRICK PAVING AND FLAGSTONE, AND GRADING AROUND RAMPS AND SIDEWALK* | 1 | LS |
| 41-1 | TRAFFIC CONTROL<br>*Add'l Info: TO INCLUDE POTENTIAL TEMPORARY 2-WAY CONVERSION OF CHAMPA, STOUT, 27TH STREET* | 1 | LS |
| 43-1d | STORM WATER MANAGEMENT (SCENARIO 4) See SCS 23.0 | 1 | LS |
| 44-1 | DEWATERING | 1 | LS |
| 45-2 | QUALITY CONTROL TESTING | 1 | LS |
| 46-1 | PAVEMENT MARKING (PAINT) | 470 | SF |
| 46-4 | PREFORMED PLASTIC PAVEMENT MARKING | 500 | SF |
| 47-1 | CONSTRUCTION SURVEYING | 1 | LS |
| 47-2 | SURVEY MONUMENTATION<br>*Add'l Info: RESET RANGE POINT* | 3 | EA |

| Pay Item # | Description | Estimated Quantity | Units |
|---|---|---|---|
| 47-2 | SURVEY MONUMENTATION<br>*Add'l Info: FOR SURVEY MARKING (OTHER THAN RANGE POINT) TO BE TIED OUT* | 25 | EA |
| 50-1 | MOBILIZATION | 1 | LS |

# Attachment A

2018 to 2019
Approved Concrete
for Denver, expires
July 1, 2019

Quick List updated on=> updated 3-1-19 by Dave Potter

| Winter Delcer Chemical Resistance | | | | |
|---|---|---|---|---|
| Non | | | | |
| | __Local Streets | basic strength, not best resistant to magnesium chloride deicers. May need | MUST HAVE: | 4500psi at 28 day, w/cm<=0.45, air 5% |
| Med | __Collector & Arterial | basic strength and DOES meet resistant to magnesium chloride deicers | MUST HAVE: | also have minimum 20% flyash, as Clas |
| High | __CDOT = | IF Required to have or meet CDOT Class 2 sulfate mitigation in 601.04 | MUST HAVE: | MUST have only minimum 20% flyash, |

| Supplier | Mix Number | Made & Sold as CDOT Class: | Approved Only for this Site Class or lower = Sulfate Class (CDOT 601.04) | Meets Denver Spec? =4500 psi , w/cm<=0.45, air 5%-7% for 3/4" CA: Denver Flatwork - Local Streets | Denver Flatwork - Collector & Arterial | Denver Street Paving (Collector & Arterial) | Submitted for project =? | Meets CDOT Class Spec ?: CDOT Class B | CDOT Class D | CDOT Class P | CDOT Class E = High Early P | | CDOT Class BZ for caissons | QC & Design: Name QC & Design | Phone QC & Design | Owner or Executive: Name Executive | Phone Executive | Phone Office |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Maturity # open to traffic, xx°C degree-hours | | | | | | | |
| **Velocity (VRM)** | 451AF | B, D: 20 FA | 2 | yes | Yes, w/cm = 0.43 at 3 to 4" slump | No | w/cm = 0.43 per design | yes | yes | no | | | | Kevin Sobczak | 303-260-9544=cell | Tanya Marchiol | 720-588-3111=cell | 303-870-5822, x |
| **Velocity (VRM)** | CDE4212 | 18 hr high early | 0 | yes | NO = No Flyash | NO = No Flyash | w/cm = 0.40 per design | yes | No; too much cement | NO | | | | Kevin Sobczak | 303-260-9544=cell | Tanya Marchiol | 720-588-3111=cell | 5822, x 102 ext |
| **Velocity (VRM)** | CDD4500 | B, D: no FA | 0 | yes | NO = No Flyash | NO = No Flyash | w/cm = 0.44 per design | yes | yes | no | | | | Kevin Sobczak | 303-260-9544=cell | Tanya Marchiol | 720-588-3111=cell | 303-870-5822, x |
| **Velocity (VRM)** | CD4515 | B, D: 15% FA | 1 | yes | NO = Not enough Flyash | NO = Not enough Flyash | w/cm = 0.44 per design | yes | yes | no | | | | Kevin Sobczak | 303-260-9544=cell | Tanya Marchiol | 720-588-3111=cell | 303-870-5822, x |
| **Velocity (VRM)** | CDM4515 | B, D: 15% FA, low slump | 1 | yes | NO = Not enough Flyash | NO = Not enough Flyash | w/cm = 0.44 per design | yes | yes | no | | | | Kevin Sobczak | 303-260-9544=cell | Tanya Marchiol | 720-588-3111=cell | 303-870-5822, x |
| **Velocity (VRM)** | CDE4524 | 24 hr high early | 0 | yes | NO = No Flyash | NO = No Flyash | w/cm = 0.40 per design | yes | | yes | Requires M= 499 for traffic | | | Kevin Sobczak | 303-260-9544=cell | Tanya Marchiol | 720-588-3111=cell | 303-870-5822, x |
| **Metro Mix** | 450BDP-FA | B, D, P | 2 | yes | Class 2 = yes | Class 2 = yes | w/cm = 0.38 per design | yes | yes | yes | 860 for traffic | | | Russel Valerio | 720-840-5457=cell | | | |
| | | | | | | | | | | | | | | | 720-840-5457=cell | | | |
| **Martin Marietta** | CD4525 | B, C, P | 0 | yes | NO = No F Flyash | NO = No F Flyash | | likely | maybe | maybe | no | | | Matt McCombs | 720-413-8750=cell | | | |
| **Martin Marietta** | CD4575 | B, C, P | 0 | yes | NO = No F Flyash | NO = No F Flyash | | likely | likely | likely | no | | | | 720-612-6205=office | | | |
| **Martin Marietta (rev 1-16-19)** | CD4995 | B, D, P (C flyash) | 0 | yes | NO = No F Flyash | NO = No F Flyash | Ames_Federal, 7th to Hov | likely | likely | likely | | | | | | | | |
| **Martin Marietta** | ZA4514 | D Machine | ? | yes | yes | no | | likely | likely | no | no | | | | | | | |
| **Martin Marietta** | HE4212H | E, 12 hr | ? | yes | yes | YES, 12 hour High Early | | likely | likely | likely | likely | | | | | | | |
| **Martin Marietta** | HE4224H | E, 24 hr | ? | yes | yes | YES, 24 hour High Early | | likely | likely | likely | likely | | | | | | | |
| **Brannan Ready Mix** | | N=North Plant (GCC Cement), S = South Plant (Mountain Cement) | | | | | | | | | | | | | | | | |
| **Brannan Ready Mix** | 403068_S | BZ | 2 | No | No | No | Ames_Federal, 7th to Howard | | | | | | Yes | | | | | |
| **Brannan Ready Mix** | 403164_N | E_24hrs | 2 | | | Class 2 = yes | Ames_Federal, 7th to Howard | | | | | | | | | | | |
| **Brannan Ready Mix** | 423161_N or S | P | 2 | Yes | Class 2 = yes | Class 2 = yes | Ames_Federal, 7th to Howard | | | | | | | | | | | |
| **Brannan Ready Mix** | 451161_N | D | 2 | Yes | Class 2 = yes | No | Ames_Federal, 7th to Howard | | Yes | | | | | | | | | |
| **Brannan Ready Mix** | 451161_S | D | 2 | Yes | Class 2 = yes | No | Ames_Federal, 7th to Howard | | Yes | | | | | | | | | |
| **Ready Mixed (owned by Brannan,** | 17670 | B & D, crushed rock | 2 | Yes | Yes, w/cm = 0.40 at 3 " slump | No | annual 2018-April | | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ready Mixed (owned by Brannan,** | 17671 | P, crushed rock | 2 | for paving | for paving | Yes, w/cm = 0.40 at 3 " slump | annual 2018-April | | | | |
| **(owned by Brannan, was Boral)** | 17975 | D, high slump, crushed rock | 2 | Yes | Yes, w/cm = 0.36 at 5" slump | No | annual 2018-April | | | | |
| **Ready Mixed (owned by Brannan,** | 1712E | E = 12 hour P, crushed rock | 2 | for paving | for paving | Yes, w/cm = 0.31 at 3 " slump | annual 2018-April | | | | M=305 per submittal |
| **Ready Mixed (owned by Brannan,** | 1724E | E = 24 hour P, crushed rock | 2 | for paving | for paving | Yes, w/cm = 0.32 at 3 " slump | annual 2018-April | | | | M=580 per submittal |
| **Ready Mixed (owned by Brannan,** | 87620 | B, median cover | 2 | Yes | Yes, w/cm = 0.40 at 3 " slump | No | annual 2018-April | | | | |
| | | | | | | | | | | | |
| **Bestway = Ready Mixed** | 45VN01B2C | D, P; low slump | 1 | yes | NO = No Flyash | NO = No Flyash | w/cm = 0.41 per design | not deicer resistant | not deicer resistant | not deicer resistant | not deicer resistant |
| | 45VN01C4C | D, P; hand work = higher slump | 1 | yes | NO = No Flyash | NO = No Flyash | w/cm = 0.41 per design | not deicer resistant | not deicer resistant | not deicer resistant | not deicer resistant |
| | 30VS11D6X | E = high early P; 10 % flyash | 1 | yes | NO = Not enough Flyash | NO = Not enough Flyash | w/cm = 0.30 per design | yes | yes | yes | 380 for traffic |
| | 45FN31E4C | ? | | ? | ? | ? | | | | | |
| | | | | | | | | | | | |
| **Aggregate Industries** | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Villalobos (portable)** | 547201 | D & P | | yes but its low slump | yes but its low slump | yes | Ames_Federal, 7th to Howard | | | | No |

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**Attachment B**

# Regulated Asbestos Contaminated Soil Standard Operating Procedure

For City and County of Denver

Prepared by the Denver Department of Public Health and Environment

Environmental Quality Division

May 2, 2019

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# Acronyms

| Acronym | Definition |
|---|---|
| ACM | Asbestos-containing Material |
| AHERA | Asbestos Hazard Emergency Response Act |
| AMS | Air Monitoring Specialist |
| AOC | Area of Contamination |
| AQCD | Air Quality Control Division |
| BDL | Below Detection Limits |
| BMP | Best Management Practice |
| CABI | Certified Asbestos Building Inspector |
| CCOD | City and County of Denver |
| CCR | Code of Colorado Regulation |
| CDPHE | Colorado Department of Public Health and Environment |
| CFR | Code of Federal Regulation |
| CMU | Concrete Masonry Unit |
| CSWR | Colorado Solid Waste Regulations |
| DDPHE | Denver Department of Public Health and Environment |
| GPS | Global Position System |
| HEPA | High-efficiency Particulate Air |
| HVAC | Heating, Venting and Air Conditioning |
| IDW | Investigation-derived Waste |
| MMP | Materials Management Plan |
| mph | Miles Per Hour |

| Acronym | Definition |
|---|---|
| NIOSH | National Institute for Occupational Safety and Health |
| NIST | National Institute of Standards and Technology |
| NVLAP | National Voluntary Laboratory Accreditation Program |
| OSHA | Occupational Safety and Health Administration |
| PCM | Phase Contrast Microscopy |
| PLM | Polarized Light Microscopy |
| Poly | Polyethylene |
| PPE | Personal Protection Equipment |
| PSRMP | Project-Specific Regulated Asbestos Contaminated Soil Management Plan |
| RACS | Regulated Asbestos Contaminated Soil |
| RWA | Regulated Work Area |
| TEM | Transmission Electron Microscopy |

# Definitions

"**Adequately wet**" means sufficiently wet to minimize visible emissions of dust and/or debris within the regulated work area (RWA) and to prevent the release of visible emissions from leaving the RWA. The observance of visible emissions, outside of the RWA, of dust and/or debris may be an indication that soils are not adequately wet.

"**Adjacent Receptor Zone**" means an area of uncontrolled access at a distance of 150 feet or less from the nearest RWA boundary during active Regulated Asbestos Contaminated Soil (RACS) disturbance. For the purpose of this definition, highways, streets, and roads without sidewalks, where only vehicles are permitted, are considered to be areas of controlled access and therefore not adjacent receptor zones. For the purpose of this definition "vehicle" means a device that is capable of moving itself, or of being moved, from place to place upon wheels, including bicycles and electrical assisted bicycles. For the purpose of this definition, an area for which access is not ordinarily controlled that is closed to the public during soil disturbing activities in the adjacent RWA is considered to be an area of controlled access and therefore not an adjacent receptor zone.

"**Amended water**" means water containing a wetting agent, such as a 50:50 mixture of polyoxyethylene ester and polyoxyethylene ether, or the equivalent, in a 0.16 percent solution (1 ounce to 5 gallons) of water, or as per manufacturer recommendations for the wetting of asbestos.

"**Air Monitoring Specialist**" (AMS) means a person trained and certified, in accordance with the requirements of Air Quality Control Commission Regulation No. 8 (5 Code of Colorado Regulation [CCR] 1001-10, Part B) (CDPHE, 2008), for the collection of air samples to determine airborne particulate and/or asbestos concentrations.

"**Asbestos**" means the asbestiform varieties of serpentine (chrysotile) and amphibole minerals, riebeckite (crocidolite), amosite (cummingtonite-grunerite), anthophyllite, actinolite, and tremolite.

"**Asbestos-containing material**" (ACM) means any material that contains more than one percent (1%) asbestos by weight, area or volume. It is during a CABI's RACS/Non-RACS Determination that ACM will be analyzed for.

"**Asbestos Worker**" means an individual trained and certified under the Colorado State Regulation No. 8, Part B to disturb, enclose, remove, and abate friable and non-friable asbestos containing material.

"**Certified Asbestos Building Inspector**" (CABI) means a person trained and certified in accordance with Air Quality Control Commission Regulation No. 8, (5 CCR 1001-10, Part B), for the identification of asbestos containing materials and the collection of samples to determine asbestos content inspection and sampling, and who has forty (40) verifiable hours of on the job asbestos in soils experience on a minimum of three (3) different asbestos in soils projects, conducted under either AQCC Regulation No. 8 or CSWR §5.5. The CABI shall be independent of the general contractor (GC) and/or abatement

contractor unless the CABI and the GC or abatement contractor are both direct employees of the property owner. However, the GC or abatement contractor may hire a subcontractor CABI, but the CABI shall not be a direct employee of the GC or abatement contractor.

"**Consultant**" refers to the entity contracted to perform all oversight actions in the form of training, inspections, field directions, air monitoring and documentation related to soil disturbing activities in accordance with this standard operating procedure.

"**CSWR**" refers to the Colorado Solid Waste Regulations (6 CCR 1007-2). The sections most applicable to this standard operating procedure are Section 5 "Asbestos Waste Management", and specifically Section 5.5 "Management of Regulated Asbestos Contaminated Soil (RACS)".

"**Debris**" means any discarded material that contains or consists of any of the following: construction, renovation and demolition debris (regardless of how it was generated), building or facility components, components of building systems (heating, venting, air condition [HVAC], plumbing, electrical, control, fire protection, roofing), components of pavement or drainage systems, industrial or machinery components, and/or mechanical components from motorized vehicles.

**"Debris Determination"** for the purpose of this standard operating procedure, means a determination, conducted in the field by the contractor and/or their sub-contractors for the possibility of visible debris to be either Non-Suspect for ACM or Suspect for ACM. Determinations of Non-Suspect/Suspect shall be based on the requirements set forth in Section 4.1 & 4.2 of this standard operating procedure.

"**Facility Component**" - for purposes of this standard operating procedure, means any part of a facility including equipment. For the purpose of this definition, "facility" means (as defined in Air Quality Control Commission Regulation No. 8 (5 CCR 1001-10, Part B): "any institutional, commercial, public, industrial, or residential structure, installation, or building (including any structure, installation, or building containing condominiums or individual dwelling units operated as a residential cooperative, but excluding: residential buildings having four or fewer dwelling units); any ship; and any active or inactive waste disposal site. For purposes of the definition, any building, structure, or installation that contains a loft used as a dwelling is not considered a residential structure, installation, or building. Any structure, installation or building that was previously subject to this subpart is not excluded, regardless of its current use or function."

"**Friable ACM**" means any material that contains more than one percent asbestos by weight, area, or volume, and when dry can be crumbled, pulverized, or reduced to powder by hand pressure. The term includes non-friable forms of asbestos after such previously non-friable material becomes damaged to the extent that when dry it can be crumbled, pulverized, or reduced to powder by hand pressure as determined in the field by a CABI.

"**General Abatement Contractor**" refers to State-certified entity contracted to perform asbestos contaminated soil disturbing activities in accordance with the standard operating procedure.

"**Geofabric**" means a permeable fabric or synthetic material used for both visual and physical separation.

"**Green Waste**" biodegradable waste that can be composed of garden or park waste, such as grass or flower cuttings and hedge trimmings, as well as domestic and commercial food waste.

"**Mechanical**" means operated or produced by mechanism, tool or machine. This may include but shall not be limited to, an excavator, backhoe, grader, tiller, auger, or hand shovel.

"**Non-regulated Asbestos Contaminated Soil**" **(Non-RACS)** means soil or debris that has been inspected by a CABI to contain only:

- Intact non-damaged, non-friable ACM(s).
- Damaged non-friable ACM(s) that do not have a high probability to release fibers based on the forces expected to act upon the material during disturbance as determined in the field by a CABI(s) through a "RACS Determination". The following ACM(s) are predetermined to be Non-RACS:
    - Resin-based materials including but not limited to phenolic-plastic (Bakelite), used in electrical and mechanical parts
    - Resilient flooring (vinyl, asphalt, rubber) excluding non-tar impregnated friable felt backing on sheet vinyl flooring (linoleum)
    - Tar-impregnated or asphaltic materials in good condition that have not become brittle
    - Elastic, pliable, or rubberized materials, including but not limited to:
        - Pliable duct sealant
        - Pliable fiberglass insulation sealant
        - Pliable fire-stop caulking /sealants
        - Pliable window and door caulking
    - Extremely hard materials, coatings and sealants including but not limited to:
        - Laboratory countertops and sinks
        - Epoxy-type Concrete Masonry Unit (CMU) coatings
        - Epoxy-type panel adhesive
        - Duct sealant
        - Ceiling tile adhesive
    - Other ACM(s) as approved by the Department at the request of the owner or person disturbing debris, to not have a high probability to release fibers.

**"Suspect Debris"** means non-soil debris that is Suspect, including ash, to contain ACM. This material requires a RACS determination by a CABI, and until the CABI determination is complete, will be assumed to be RACS and managed in accordance with this standard operating procedure. Although this material may not require special management as ACM, it may still require management as a solid waste. Co-mingled Suspect and Non-Suspect debris should be managed as Suspect Debris.

**"Non-soil Debris"** means materials entrained within the soil matrix that are not composed of soil. These may include Non-RACS, RACS, or Non-Suspect. Often associated with uncontrolled fill, or historical urban fill areas.

"**Project-specific Regulated Asbestos Contaminated Soil Management Plan**" (PSRMP) means a RACS management plan for a single project submitted in accordance with CSWR §5.5

"**Regulated Asbestos Contaminated Soil**" (RACS) means soil, ash or debris (plus six inches in all directions of surrounding soil or other matrix material) containing:

- Friable ACM as determined in the field by a CABI through a RACS determination; Previously non-friable ACM(s) that have been rendered friable as determined in the field by a CABI(s) through a RACS determination.
- Non-friable ACM(s) that have a high probability of releasing fibers based on the forces expected to act upon the material during soil disturbance as determined in the field by a CABI(s) through a RACS determination; deteriorated non-friable ACM(s) that are in poor condition resulting in a high probability to release fibers due to weathering, historical mechanical impact, fire damage (by evidence of ACM within an ash layer) or other factors as determined in the field by a CABI(s) through a RACS determination.
- The following broken, resized, or damaged ACM(s) are predetermined to be RACS:
    - Asbestos cement materials
    - Plaster
    - Brittle caulking, glazing and sealants
    - Powdery Concrete Masonry Unit (CMU) sealant
    - Powdery floor leveling compound
    - Drywall/wallboard and associated joint compound material
    - Firebrick
    - Other material as determined by the Department, at the request of the owner or person disturbing debris, to have a high probability to release fibers.
- Soil or ash known to contain non-visible asbestos based on documented evidence.

"**RACS Determination**" for the purpose of this standard operating procedure means a determination, conducted in the field by a Certified Asbestos Building Inspector (CABI), of the friability of Asbestos Containing Material (ACM) and the probability of non-friable ACM to release fibers based on the condition of the material and the forces that are expected to act on it during disturbance. Determinations of friability shall be based on the requirements for such determinations set forth in Air Quality Control Commission Regulation No. 8 (5 CCR 1001-10, Part B). Determinations of the probability for non-friable ACM to release fibers during disturbance shall be based on the following:

1) The condition of the material prior to disturbance, based on observations of weathering, the integrity of the material, historical mechanical impact, or fire damage;

2) The potential for the material to be broken, resized or damaged during planned disturbance;

3) The material shall be considered RACS if the planned disturbance includes any of the following:

a. Augers

b. Rotary style trenchers

c. Driving on ACM lying on the surface (vehicles or equipment)

d. Blasting or other detonation

e. Intentional burning

f. Other types of direct mechanical impact which are:

i. In direct contact with ACM or result in observation of ACM after disturbance, and

ii. Causing damage to the ACM

"**Regulated Work Area**" (RWA) means the portion(s) of a site at which soil disturbing activities involving RACS occur

**"RACS Disturbance**" means activities such as removal, management, or other physical disturbance of RACS

"**Soil-disturbing Activities**" means digging, excavating, staging, loading, stockpiling, backfilling, compacting, grading, tilling, drilling, intrusive sampling, and equipment or vehicle movement or any other mechanical activity, that when used, disturbs the surface and/or subsurface soil. Disturbance or removal of soil, or soil with debris and/or RACS is considered a soil-disturbing activity. Hand disturbance or removal of RACS is subject to the State Regulation and this standard operating procedure but is not considered to be a mechanical disturbance.

**"Staging"** means the accumulation of RACS in the RWA for twelve (12) hours or less.

**"Stockpiling"** means the accumulation of RACS that will exist for more than twelve hours, up to and including ten calendar days

**"Storage"** means the accumulation of RACS greater than ten days but not exceeding six months unless a longer timeframe is approved by the Department and DDPHE.

"**Visible Emissions**" means any airborne or liquid emissions, coming from, or having come into contact with RACS, which are visually detectable without the aid of instruments. Proper disposal of appropriately filtered decontamination water does not constitute a visible emission.

"**Visual Inspection**" means observation with sufficient proximity to identify discrete visible materials, while maintaining the safety of the inspector.

# 1. Introduction

The City and County of Denver (CCOD) recognizes the need for construction activities to have a well-established agreement in place regarding the risks from management of construction projects where soil may be impacted by asbestos-containing materials (ACMs). While these agreements modify traditional construction work practices and required personnel, they do remain consistent with the established Colorado Department of Public Health and Environmental (CDPHE) rules and regulations and current industry standards for the management of regulated asbestos-contaminated soil (RACS). Today's public safety realities are highlighted by the numerous construction projects that encounter RACS, and the need for CCOD and its construction partners to have established field standards that protect public health from exposure to asbestos, and help the projects stay on schedule and on budget. This document has been prepared to be used on CCOD's projects. Implementation of this standard operating procedure on other projects not owned or controlled by the CCOD are in no way the responsibility of the CCOD.

The Denver Department of Public Health and Environmental (DDPHE) and CDPHE have worked cooperatively to develop a solution designed to be followed by any contractor or its sub-contractor when performing soil-disturbing activities (as defined within this standard operating procedure) during excavation at CCOD's construction projects. Initially, the solution establishes standard operating procedures that are intended to be followed during construction projects where activities have disturbed and/or identified non-soil debris within the soil matrix. Additional standard operating procedures are predicated on the type and amount of non-soil debris and coordination with and the approval by the CCOD project manager.

Soil that is not to be disturbed by planned construction on a project will remain in-place. Characterization and remediation of soil not directly disturbed by project activities are beyond the scope of this standard operating procedure, unless specifically directed by DDPHE. If remedial actions are required, additional planning would be conducted under the direction of DDPHE.

## 1.1 Purpose

This standard operating procedure has been prepared to ensure compliance with the Colorado Solid Waste Regulations CCR 1007-2 Part 1, Section 5.5 (Colorado Solid Waste Regulation [CSWR] §5.5; CDPHE, 2014), and provides the procedures for identification, safe handling, transport, and disposal of Non-RACS or RACS that may be encountered during soil-disturbing activities. Provisions of CSWR §5.5, not specifically referenced within this standard operating procedure, must be followed; therefore, any contractor working on CCOD projects must be familiar with both this document, and CSWR §5.5. In the event of any disparity between the two, CSWR §5.5 will supersede provisions included within this document.

This standard operating procedure has been prepared to minimize potential delays, and to develop approved standard procedures that the contractor will implement as needed for future soil-disturbing where Non-RACS and RACS may be encountered. The quick disseminating of critical information to participating parties is key to the proper identification of debris, management of Non-RACS and RACS, and protection of public health and environment.

This standard operating procedure has been approved by the CDPHE (Appendix A) and incorporates by reference CDPHE Regulations Pertaining to Solid Waste Sites and Facilities (6 CCR 1007-2, Part 1), CSWR §5.5 - Management of Regulated Asbestos Contaminated Soils (CSWR §5.5). The Regulation can be found at: https://www.colorado.gov/pacific/cdphe/solid-waste-regulations.

## 1.2 Applicability

The requirements of CSWR §5.5 apply to the owner or operator of any property with RACS at which soil-disturbing activities are occurring or planned. The owner/operator may choose to follow the procedures set forth in CSWR §5.5.1(A) and (B) when debris is exposed or disturbed to determine if the debris is RACS. Soil-disturbing activities involving Non-RACS, where no RACS is present or generated, are not subject to the requirements of CSWR §5.5, but Non-RACS must be disposed as non-friable asbestos waste in accordance with the disposal requirements set forth in Section 5.2 of the CSWR, where applicable.

It is the responsibility of the general contractor (contractor), including the contractor's subcontractors, to incorporate this standard operating procedure into a project's scope for identifying debris or other environmental hazards and the subsequent management of that material according to this standard operating procedure and the Materials Management Plan (MMP) (if applicable). Unless otherwise written, separate from this standard operating procedure, it is the responsibility of the contractor to employ appropriate personnel capable of meeting the requirements of this standard operating procedure and CSWR §5.5 during identification and management of all debris and RACS.

Prior to commencing soil-disturbing activities, if there is no visible or documented evidence, such as construction drawings or analytical reports or environmental investigations, of RACS during a soil-disturbing action, the contractor does not have a duty under this standard operating procedure or CSWR §5.5 to sample or otherwise investigate for RACS. However, if RACS or suspect RACS is discovered, the contractor is obligated to follow this standard operating procedure.

This standard operating procedure may be incorporated within a MMP and/or Health and Safety Plan for site-specific safe work practices. Should either of those plans or other site-specific environmental work plans require changes to this standard operating procedure, the contractor shall present a written draft amendment to be reviewed by the CCOD Project Manager (who will coordinate with DDPHE) prior to submittal for review and approval by CDPHE.

## 1.3 Non-RACS vs. RACS

As described in CSWR §5.5 (and the definitions presented in this standard operating procedure):

- Non-RACS is soil or debris that contains intact, non-damaged ACM, or damaged non-friable ACM that does not have a high probability to release fibers as determined by a Certified Asbestos Building Inspector (CABI) (note, additional description provided in the definitions).
- RACS is soil, ash, or debris (plus 6 inches in all directions) containing friable ACM, non-friable ACM that has been rendered friable, or deteriorated ACM that has a high potential to release fibers due to weathering or other processes (note, additional description provided in the definitions).

Essentially, Non-RACS material contains ACM that is unlikely to release asbestos fibers, and RACS is material that contains ACM that is likely to release asbestos fibers. Although Non-RACS is technically not subject to the provisions of CSWR §5.5, disposal requirements still apply per CSWR §5.2. Further, the presence of Non-RACS still requires special attention during management activities, as there is a high potential that RACS and Non-RACS may be co-located at a project, or that management activities may result in Non-RACS releasing asbestos fibers, and thus transforming into RACS.

## 1.4 Project-specific Regulated Asbestos Contaminated Soil Management Plan

As determined by DDPHE, a Project-specific Regulated Asbestos Contaminated Soil Management Plan (PSRMP) may be prepared for individual projects; the PSRMP would detail project-specific RACS management protocols, amended best management practices (BMPs), or other applicable changes to this standard operating procedure. If DDPHE determines that a PSRMP is necessary, the PSRMP would be reviewed and approved by DDPHE then CDPHE, and management techniques may supplant those presented in this standard operating procedure. At a minimum, this standard operating procedure should be utilized a foundation for the PSRMP.

## 1.5 Key Parties and Responsibilities

The following table provides contact and general responsibility information for key parties. A full contacts list may not be established at the beginning of every project. In cases where RACS management will be needed, contact information shall be amended as required.

*Table 1 Key Parties and Responsibilities*

| Party | Contact | Responsibility |
|---|---|---|
| CDPHE | Brian Long<br>Phone: 303-691-4033<br>Email: briant.long@state.co.us | Regulatory Agency – State of Colorado |
| CCOD – DDPHE | Steve Gonzales<br>Phone: 720-865-5447<br>Email: steve.gonzales@denvergov.org<br><br>If no immediate response, call 720-460-1706 | Environmental Quality Technical Oversight – City and County of Denver |
| CCOD Project Manager | TBD | Overall project management of CCOD Project |
| Contractor | TBD | General Construction; RACS Management |
| Specialized Abatement Contractor (if applicable) | TBD | RACS Management |
| Environmental Consultant (CABI, AMS) | TBD | CABI, RACS Oversight and if necessary Air Monitoring Specialist (AMS); discovery notification to CCOD Project Manager and DDPHE, and to CDPHE if approved by DDPHE |

Responsibilities for key personnel are summarized in Table 2, and discussed in detail in the standard operating procedures. Key personnel will be contacted as required, as described in the text of the standard operating procedure.

*Table 2 Responsibilities*

| Duties per Standard Operation Procedure | Project Personnel | | | | |
|---|---|---|---|---|---|
| | Contractor | Sub-contractors | CABI | Air Monitoring Specialist (AMS) | GAC |
| Provide Awareness Training | | | ☒ | | |
| Receive annual RACS Awareness Training (All Site Personnel) | ☒ | ☒ | | | ☒ |
| Receive Project-Specific Annual Asbestos Awareness Training (to enter any Regulated Work Area [RWA] during RACS disturbance) | ☒ | ☒ | ☒ | ☒ | ☒ |
| Environmental Consultant Responsibilities | | | ☒ | ☒ | |
| Handling, Disturbing, Removing RACS | ☒ | ☒ | ☒ | ☒ | ☒ |
| Decontamination of Equipment, Personal Protective Equipment (PPE) and RWA | | | ☒ | ☒ | ☒ |
| Wind Speed Monitoring | | | ☒ | ☒ | |
| Air Monitoring | | | | ☒ | |
| Documentation | ☒ | ☒ | ☒ | ☒ | ☒ |

# 2. Process Flow and Decision Scenarios

The following process flow and corresponding figures present the more likely scenarios related to the discovery of debris and management of RACS for CCOD's projects, and the decisions to be made for conducting continued soil-disturbing activities under these discovered conditions. Note that these scenarios are general. Each RACS discovery and project is unique, so the actual steps necessary to reasonably respond to a RACS discovery and management may change. Coordination with DDPHE on the most practical management strategy is required when there is reason to believe that RACS is present or is identified.

## 2.1 Scenarios

This standard operating procedure has been prepared to provide guidance for five soil-disturbing scenarios, which are described in detail below.

### 2.1.1 Excavation in Areas with No Debris

This scenario applies when soil disturbance is planned and there are no RACS concerns (e.g., soil that is "clean" with no visible debris) (**Figure 1**). This scenario applies where the contractor has been provided information from the CCOD Project Manager, or has determined for himself, that the project area is not likely to have RACS or Non-RACS present because, through visible inspection or other research, no debris is present. The contractor will then proceed with work as planned, but must be familiar with this standard operating procedure, and must be observant regarding unexpected debris discovery.

### 2.1.2 Excavation in Areas with Non-Suspect Debris

This scenario applies when soil disturbance would occur in areas where Non-Suspect Debris is present [e.g., soil containing pieces of clean concrete (with no associated or attached materials)], but when no Suspect Debris has been identified (**Figure 2**). In this standard operating procedure, the contractor is empowered to make this determination himself. However, if the contractor is unsure of the nature of debris, a CABI should be consulted to provided certainty of the debris identified. Additional information about the classification of debris is presented in detail in Section 4.

### 2.1.3 Discovery of Suspect Debris or Suspect RACS During Excavation

This scenario applies when soil disturbance occurs where Suspect Debris, including RACS, is suspected or encountered unexpectedly (e.g., work within a known historical urban fill area [https://www.denvergov.org/opendata/dataset/city-and-county-of-denver-historical-fill-areas] (**Figure 3**). There are many areas in the CCOD where uncontrolled fill is present in the subsurface, including historical urban fills, areas where buildings once stood but have since been demolished, areas where

channelization along streams and rivers occurred or where floodplains or gravel pits were filled, or where heavy industries were once present. A key component of discovery is to: conduct interim actions that are described in this standard operating procedure in detail; contact a CABI to make a RACS determination; and, coordinate stabilization, removal actions and required documentation.

### 2.1.4 Excavation in Areas with Known RACS

This scenario applies where soil disturbance is planned in an area where known RACS is present (as confirmed through prior investigation or via a RACS determination by a CABI) (**Figure 4**). In this scenario, careful planning would be conducted to perform management actions in accordance with this standard operating procedure and CSWR §5.5.

### 2.1.5 Subsurface Investigations

This scenario applies when soil disturbance is conducted related to subsurface investigations, including environmental, geotechnical or utilities (**Figure 5**). These investigations are generally small in scale, where a drill rig may be used to drill a small-diameter hole to evaluate geologic conditions; a small test pit/trench is excavated to visually assess subsurface conditions (primarily in the investigation of Suspect Debris conditions); or a vacuum truck/water knife is used to locate a utility line. Detailed analysis of the RACS management strategies are presented in Section 5.1.5 of this standard operating procedure. **Note, if a utility investigation utilizing a vacuum truck/water knife is proposed in a <u>known historical urban fill site and/or area with known RACS or Suspect Debris</u>, additional project-specific planning will be necessary BEFORE work is initiated as there is a high potential that equipment may become contaminated. Coordination with DDPHE will be required.**

*Figure 1 Excavation in Areas with No Debris*

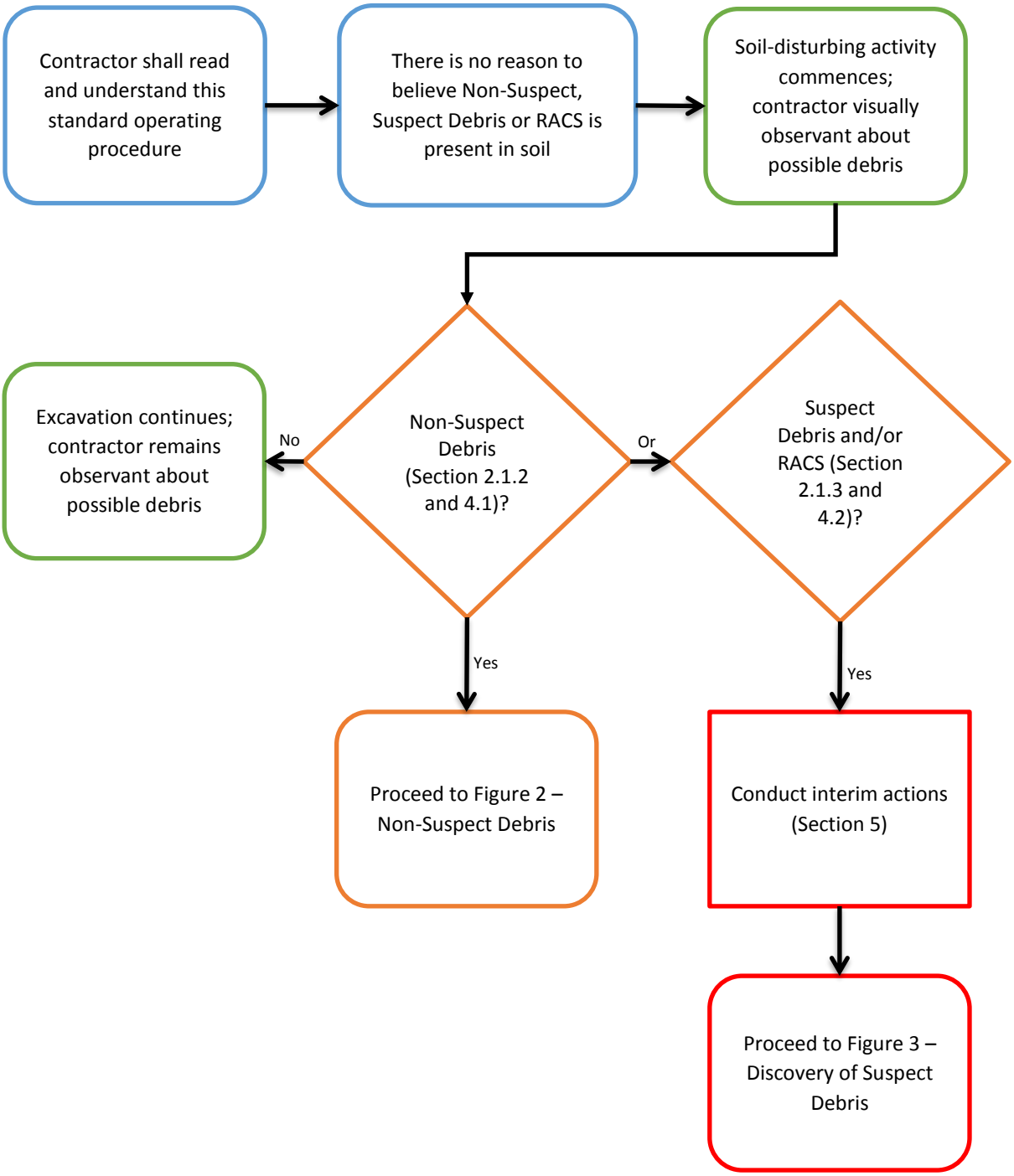


*Figure 2 Excavation in Areas with Non-Suspect Debris*

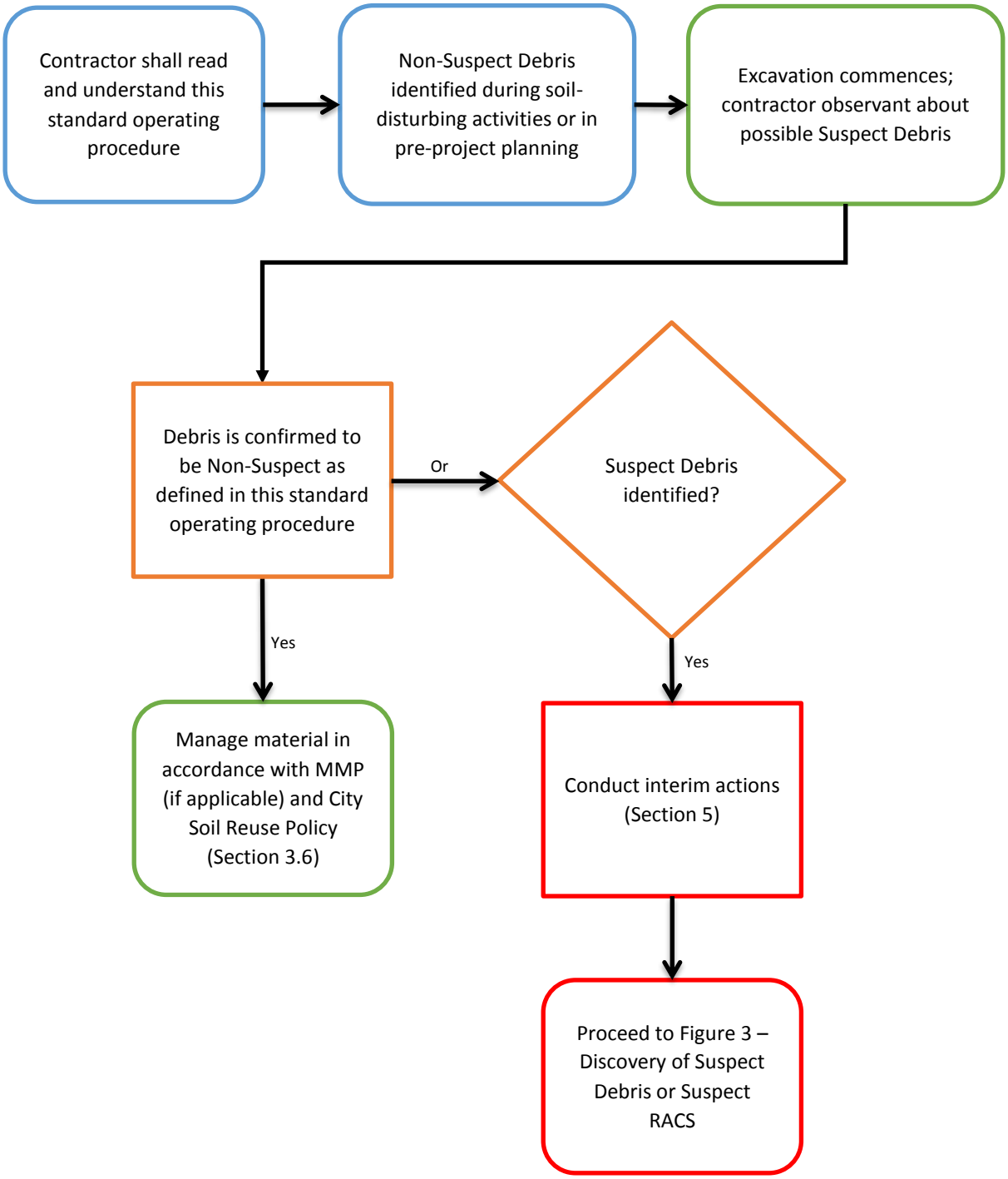


*Figure 3 Discovery of Suspect Debris or Suspect RACS During Excavation*

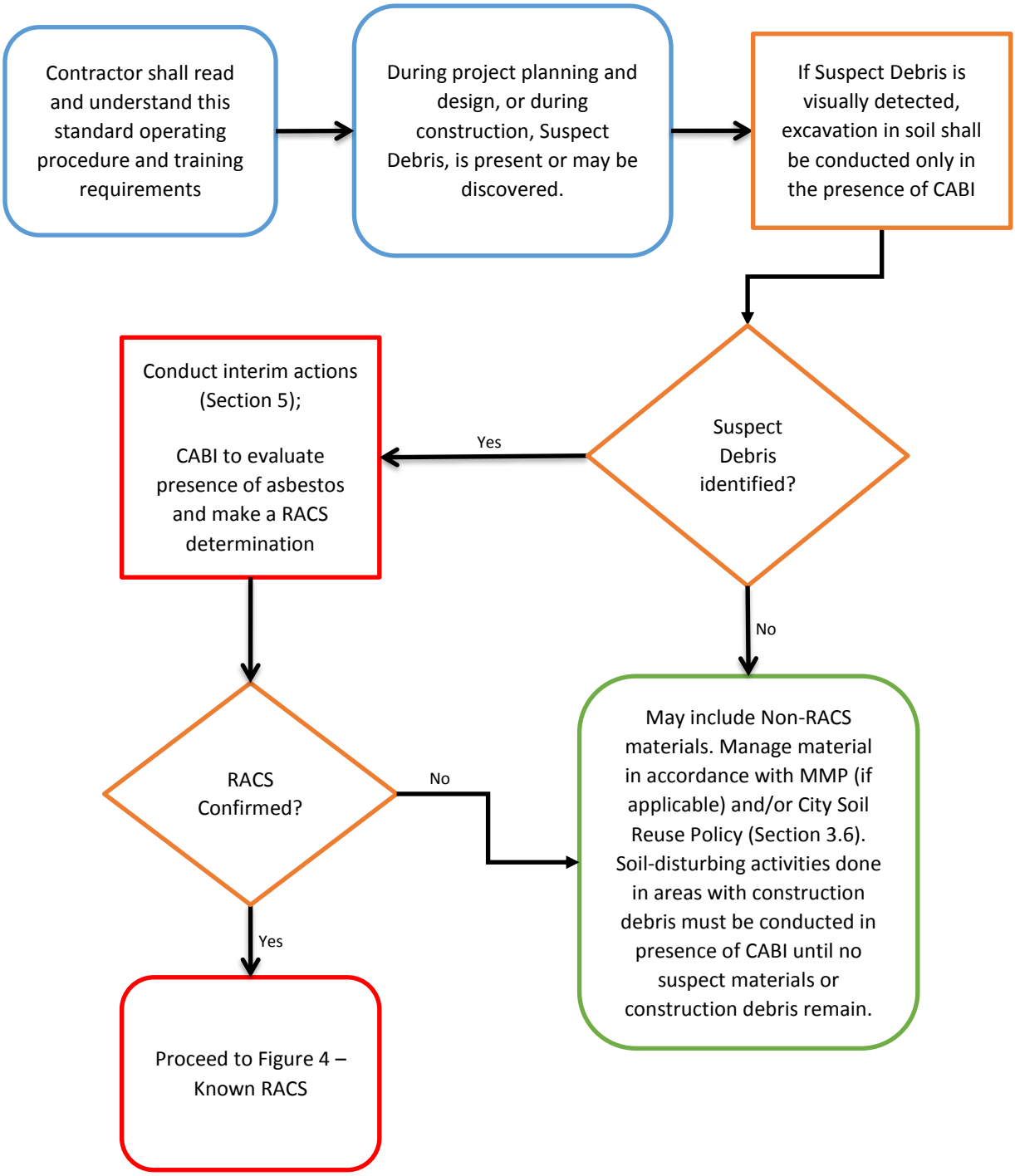


*Figure 4 Excavation in Areas with Known RACS*

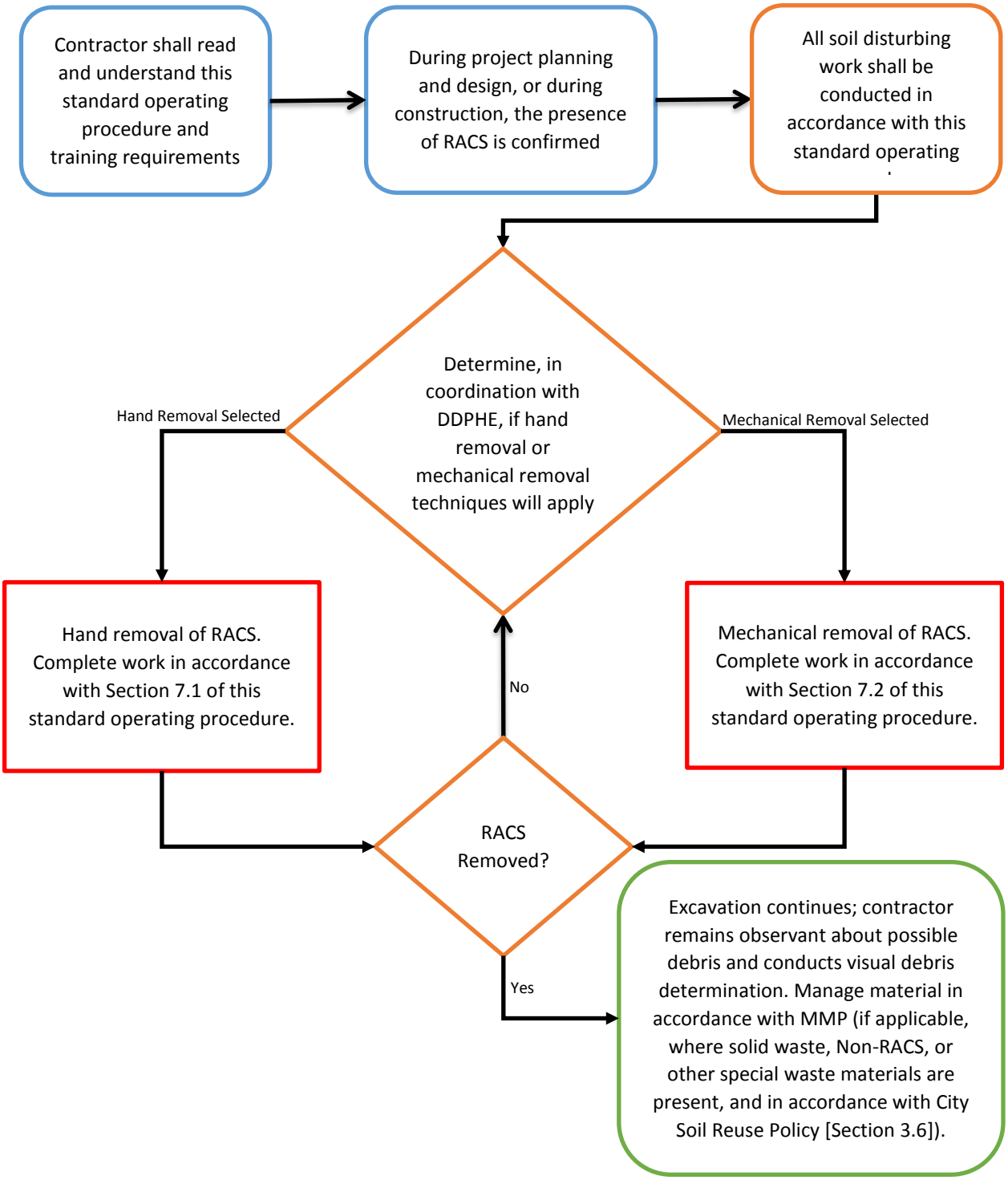
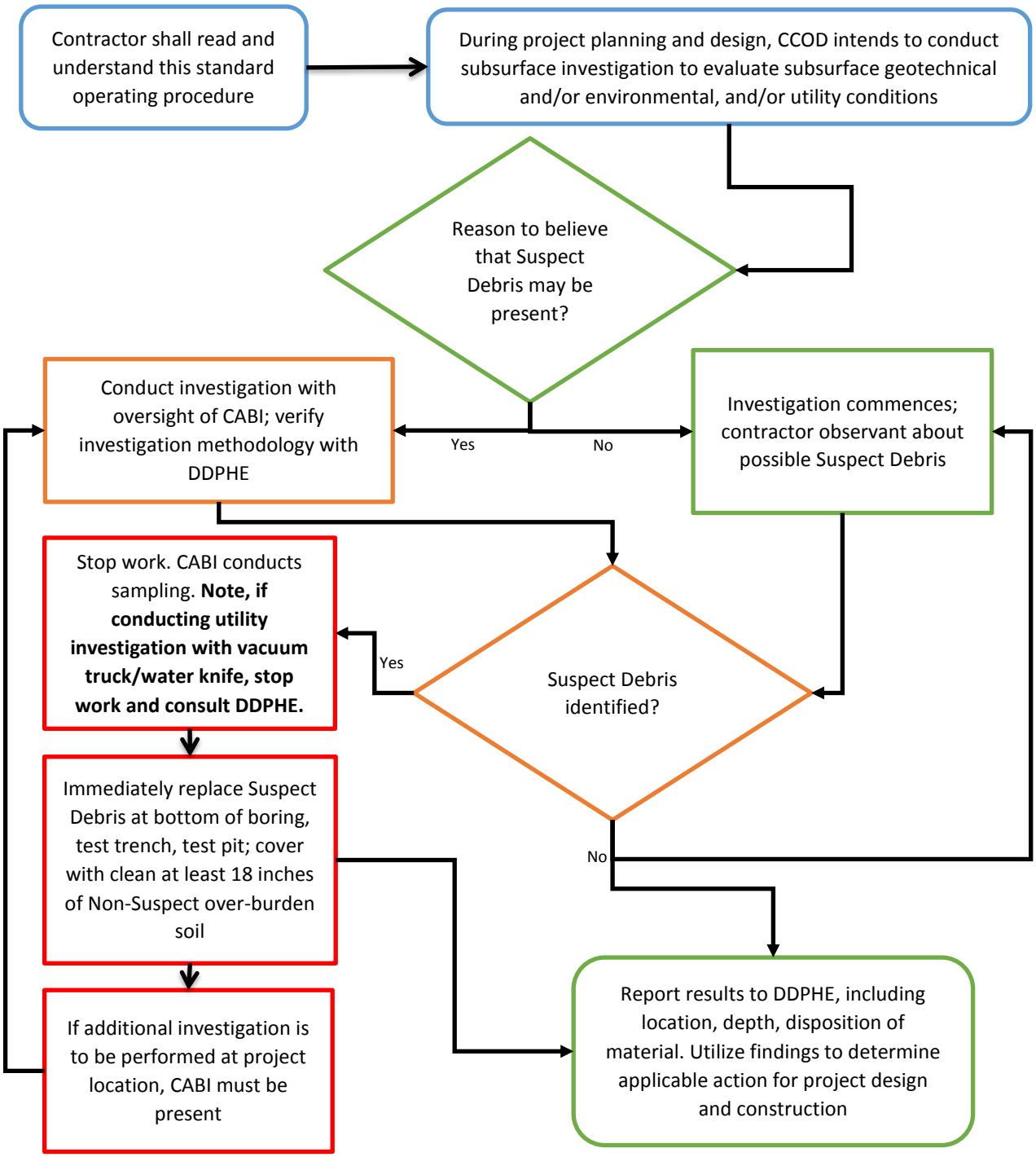


*Figure 5 Subsurface Investigations*



# 3. General Requirements

The following sections describe general requirements for the management of RACS.

## 3.1 Training for Site Personnel

As described in CSWR §5.5.3, personnel overseeing, directing, inspecting, and/or handling RACS (including suspect asbestos) and all personnel inside the Regulated Work Area (RWA) during the disturbance of RACS, shall have annual asbestos awareness training, and provide documentation to the CABI.

Personnel who enter the RWA during disturbance of RACS will receive project-specific training by a CABI familiar with this standard operating procedure and CSWR §5.5, as well as the project. This includes drivers of trucks carrying contaminated material for off-site disposal. The training will cover the provisions of this standard operating procedure, as well as the following:

- Background of asbestos, including health effects
- Overview of the requirements of CSWR §5.5 and this standard operating procedure and its implementation
- Recognition of Suspect Debris that may contain asbestos and which requires further evaluation by a CABI
- Overview of Non-Suspect Debris, Suspect Debris, RACS, and Non-RACS, and standard operating procedure protocols for each
- Controls and notifications to be followed when debris that may contain asbestos is encountered
- The nature of operations that could result in exposure to asbestos fibers
- Spill prevention and contamination reduction techniques
- Proper use, handling, and disposal of PPE
- Respiratory protection levels required for various activities and conditions
- Engineering controls and other measures to prevent contact with contaminants
- Engineering controls to prevent visible emissions from leaving the RWA
- Personnel and equipment decontamination and the establishment of decontamination stations
- Emergency procedures

- Project chain-of command and identification of authorized personnel with stop-work authority
- Hands-on training specific to the soil-disturbing activities the individual will be performing subject to CSWR §5.5.

Records of this training will be retained by the CABI, and will be available for inspection for the duration of the project for which the training is conducted.

## 3.2 Health and Safety

There is a potential for increased risk to the health of workers during disturbance/removal of RACS. Awareness by site personnel of these hazards is of the highest priority. Therefore, a site-specific Health and Safety Plan will be developed by the contractor prior to any RACS management. Site personnel will be provided with a copy of the Health and Safety Plan for review, and will be required to sign a form stating that they are aware of, agree to, and understand the requirements of the plan. The contractor will be required to employ the proper personnel, and PPE, to provide a safe working environment for its employees, consultants and subcontractors.

## 3.3 CABI and AMS Requirements

When a *Discovery of Unknown Suspect Debris or Suspect RACS,* or *Known RACS* is present, a CABI who meets the training, certification, and experience requirements of CSWR § 5.5.3(D) (and an Air Monitoring Specialist [AMS] if a RWA is required) shall be on-site on a full-time basis during all soil-disturbing activities, to physically observe and monitor the air and site conditions and provide information to the contractor to help limit and avoid asbestos fiber release. The CABI and AMS can be the same person if she/he meets the CABI and AMS requirements listed below. Ideally, the CABI and AMS will be the same person. Depending on site conditions and scope, more than one CABI, AMS, or both may be required.

When a *Discovery of Suspect Debris or Suspect RACS,* or *Known RACS,* is present, the CABI(s) will be responsible for the following:

- Have all current applicable training certificates and State of Colorado Certification(s) in accordance with the CDPHE-Air Quality Control Commission (AQCD Reg. 8) and Hazardous Materials and Waste Management (HMWMD) regulations to be a CABI (CSWR § 5.5.3 (D)).
- Be on-site on a full-time basis and continuously observe all soil disturbing, excavation, and loading activities.
- Identify if suspect RACS is present.
- Complete necessary sampling of suspect asbestos, and make RACS determination(s).

- Complete CABI Work Day Documentation Form (Appendix B), thoroughly detailing site activities as presented in Section 8 – Close Out Report.
- Maintain all pertinent documentation related to adherence of the standard operating procedure, including sampling results, air monitoring data, waste manifests, photographs, etc.
- Inspect the RWA and equipment after removal of RACS to evaluate whether remaining ACM is present on the surface or on equipment.
- The CABI will have "Stop Work" authority if it is believed that work is being performed outside the guidelines of this standard operating procedure or of CSWR §5.5, or if actions harmful to life and health, or the environment, are observed; the CABI will not be responsible for consequential damages for any work stoppage, including real or perceived harm, including lost productivity, that may result.
- Notification of RACS disturbance to CDPHE on behalf of the contractor.
- Updates to CCOD Project Manager and CDPHE on contractor decisions regarding RACS management.
- Notification of deviations from this standard operating procedure to the CDPHE (note: deviations from this standard operating procedure and/or CSWR §5.5 will require approval by DDPHE and CDPHE; deviations may be addressed through preparation of an amendment to this standard operating procedure, PSRMP, or other means as approved).
- Monitor and log wind speed and direction during soil disturbing activities.

If RACS management is required by Section 7.2.5 of this standard operating procedure or CSWR §5.5, the AMS(s) will be responsible for the following:

- Have all current applicable training certificates and State of Colorado Certifications in accordance with the CDPHE-AQCD regulations to be an AMS (Air Quality Control Commission Regulation No. 8 (5 CCR 1001-10, Part B).
- Be on site on a full-time basis during disturbance, excavation, and loading of RACS.
- Monitor RWA during removal and disposal of RACS for compliance of this plan.
- Place and monitor air samples on site and around RWA during soil-disturbing activities.
- Monitor and log wind speed and direction during soil disturbing activities.
- The AMS will have "Stop Work" authority if it is believed that work is being performed outside the guidelines of this plan or of CSWR §5.5, or if actions harmful to life and health, or the environment, are observed; the AMS will not be responsible for consequential

damages for any work stoppage, including real or perceived harm, including lost productivity, that may result.

- Submitting an Emission Control Plan for each detection of asbestos by TEM analysis as required by CDPHE in accordance with CSWR § 5.5.7 (E)(2)(f)(i)(ii) & (iii).

## 3.4 Contractor Requirements

The following contains requirements for the contractor performing RACS disturbance/removal:

- The contractor shall provide documentation to the CABI and CCOD that all individuals performing RACS-disturbing activities have completed a project-specific awareness training that provides information necessary to perform their duties in a way that ensures compliance with the requirements of the CSWR §5.5. If the contractor cannot provide this documentation, then the applicable training will be conducted by the CABI.
- The contractor shall ensure that individuals performing RACS-disturbing activities have completed asbestos awareness training in accordance with Occupation, Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1926.1101(k) Communication of Hazards - (9)(10) .
- Records that document the training, experience, or certification requirements in CSWR §5.5. Documents shall be available on-site for review throughout the duration of soil-disturbing activities.
- The contractor will be required to prepare and implement a Health and Safety Plan in accordance with the applicable regulations, including OSHA. The contractor will be responsible for the health and safety of its employees, subcontractors, consultants, etc., as well as provide all necessary training and PPE for completion of work.
- The contractor will be responsible for maintaining all necessary site controls to prevent unauthorized entry into the RWA in accordance with Section 5.2 of this standard operating procedure, and with CSWR § 5.5.7(A) “Establishment and Control of a Regulated Work Area (RWA)”.
- The contractor will be responsible for adherence to this plan at the direction of the CABI/AMS. The CABI/AMS will be completing air monitoring in accordance with Section 7.2.5. Based on the air monitoring results, the CABI/AMS will direct the contractor to institute additional BMPs, if necessary, to eliminate fugitive dust emissions or visible emissions.

The following contains requirements for the contractor performing any soil disturbing activity:

## 3.5 Notifications

The Notification of RACS Disturbance form (Appendix C) must be submitted to CDPHE prior to commencing work in planned RACS management or within twenty-four (24) hours of unexpected discovery of RACS areas. The notification shall indicate which management approach will be utilized per the project's soil-disturbing scenario as presented in Section 2 of this standard operating procedure:

- Use this standard operating procedure (and note what, if any, deviations are proposed [with DDPHE approval]); or
- A project-specific PSRMP (with DDPHE approval); or
- Standard Requirements of CSWR §5.5 (with DDPHE approval).

Planned RACS disturbance shall not commence until approval has been granted by CDPHE. Notification must have the approval of the CCOD Project Manager and DDPHE must be notified before any notification is submitted to CDPHE. Notification is not required when only sampling debris for ACM content by a CABI.

For all soil-disturbing activities where the contractor or subcontractor will perform RACS management:

- Within twenty-four (24) hours of **unplanned** RACS discovery, the contractor or CABI shall submit a Notification of RACS Disturbance form (Appendix C) to CDPHE indicting that the project will be using the RACS management steps as detailed in this standard operating procedure.
- Ten (10) days prior to start of RACS disturbance for **planned** RACS management, the contractor or CABI, shall submit a Notification of RACS Disturbance form (Appendix C) to CDPHE indicting that the project will be using the RACS management steps as detailed in this standard operating procedure.
- Notification of RACS Disturbance form shall be emailed to CDPHE address on the form, and copied to the CCOD Project Manager and DDPHE contact.
- Maps, figures, drawings, or other applicable information shall be included with the Notification of RACS Disturbance form.
- In the event of an emergency (a condition which is immediately dangerous to life or property; e.g., broken water main, broken gas line) in which a soil-disturbing activity must continue or commence at once, notification shall be made as soon as possible, but within 24 hours of identifying or assuming the presence of RACS within the soil-disturbing area. During the initial response to the immediate emergency, the standard requirements of RACS management in accordance this standard operating procedure shall be implemented to the extent possible. Within 48 hours, any disturbed and/or exposed RACS shall be managed in accordance with this standard operating procedure.

- RACS management must be approved by the CCOD Project Manager prior to commencing ongoing soil-disturbing activities involving RACS. Exceptions would be RACS inspection, stabilization, and necessary decontamination activities. Any planned changes to this standard operating procedure must be approved by the CCOD Project Manager, DDPHE, and CDPHE prior to commencing RACS disturbance activity.

## 3.6 Soil Reuse

In some circumstances, an MMP will be prepared for a project. Soil reuse, and management of soil not impacted by RACS, should be followed in accordance with the MMP. If an MMP is not available, coordination with DDPHE, and potentially CDPHE, may be necessary. Regardless, all CCOD projects must follow the DDPHE *Guidance for Reuse of Soil on City Projects*. Some general requirements (but not all requirements) are described as follows:

- If the soil generated at a project would be reused at a third-party property, coordination with DDPHE will be required, as well as other requirements noted in the *Guidance for Reuse of Soil on City Project,* which define soil quality and analytical requirements.
- Soil that is proposed for reuse at a CCOD-owned park must meet the requirements defined for Unrestricted Reuse, and cannot contain any debris (Suspect or Non-Suspect).
- Soil that is not to be disturbed by planned construction on the project will remain in-place, regardless of its reuse classification. Characterization and remediation of soil not directly disturbed by project activities are beyond the scope of this standard operating procedure, unless specifically directed by DDPHE. If remedial actions are required, additional planning would be conducted under the direction of DDPHE.
- No debris (including Non-Suspect), RACS, or impacted soil may be left exposed at final grade surfaces. Depending on the conditions discovered, it may be necessary to over-excavate these materials 12 inches or more (18 inches minimum if RACS is present), and backfill with clean soil to the final grade (see Section 5.1 of this standard operating procedure).
- **No soil containing debris, whether Suspect or Non-Suspect, may be reused onsite or off-site.** There may be certain circumstance where approval may be obtained, but only through coordination with DDPHE, and possibly with CDPHE, in accordance with applicable regulations.
- All soil destined for landfill disposal, including RACS managed according to this standard operating procedure, must be disposed under proper waste characterization and waste profiling procedures at the Denver-Arapahoe Disposal Site.

# 4. Debris Identification

The contractor and/or sub-contractor(s) to the contractor, while performing soil-disturbing activities under this standard operating procedure, shall have the responsibility of inspecting all soil-disturbing activities through continuous visual inspection for the presence of Suspect Debris or Non-Suspect Debris. All visible debris will have a debris determination as **non-suspect for ACM** (Non-Suspect), or **suspect for ACM** (Suspect). The contractor/sub-contractor shall follow the directions given in this standard operating procedure related to findings and debris classifications. If the contractor/sub-contractor is unsure of a classification or unable to make this classification, the contractor/sub-contractor shall contact a CABI to assist in the final classification of soil and/or debris, or contact DDPHE.

The contractor and/or sub-contractor shall evaluate any debris encountered to see if it meets the parameters of Section 4.1 of this SOP and CSWR § 5.5.2 (H) & (I) during all soil-disturbing activities. To ensure an accurate evaluation is made, any contractor and/or sub-contractor performing any soil-disturbing activities while operating under the provisions of this SOP and not identified as a General Abatement Contractor, shall be required to have all project field personnel complete a general RACS awareness training as detailed in CSWR § 5.5.3 (A) annually. This training is required to be presented by a CABI that meets the training and experience requirements of section CSWR § 5.5.3 (D) and will specifically address all necessary protocols and actions for debris identification regarding sections 4.1 and 4.2 of this SOP. Furthermore, the contractor and/or sub-contractor shall document their debris evaluation(s) and debris encounters(s). Debris documentation and training records shall be made available at upon request by CCOD and/or CDPHE.

## 4.1 Debris Classified as Non-Suspect for ACM

Materials will be defined as **non-suspect for ACM** when it meets the following criteria:

- The material is soil only, where there are no visible signs of construction debris at the point of soil disturbance; or
- Soil that contains the following non-suspect debris:
    - Metal - with NO associated materials on it (e.g. sealants, insulation, adhesives, etc.)
    - Glass - with NO associated materials on it (e.g. caulking, glazing, sealants, etc.)
    - Plastic - with NO associated materials on it (e.g. sealants, adhesives, etc.)
    - Wood - with NO associated materials on it (eg. drywall, plaster, adhesives, caulking, etc.)
    - Concrete - bare, with NO associated materials on it (e.g sealants, adhesives, waterproofing, tars, floor tiles, etc.)
    - Plant material, including plant wastes from the food processing industry and vegetative food waste
    - Yard trimmings

- Untreated wood wastes
- Non-industrial and non-insulative paper products (e.g., newspaper, magazines, food wrappers)
- Debris that has been evaluated during a project-specific subsurface investigation, and has been determined by a CABI as Non-Suspect (documentation must be maintained on the project at all times); special caution is recommended, as subsurface conditions in areas where filling has been conducted can be highly variable, and unexpected discoveries may be identified
- Or other material as approved by CDPHE

## 4.2 Debris Classified as Suspect for ACM

The contractor shall classify all other debris types not specifically listed as non-suspect for ACM above, as **suspect for ACM**, and therefore must have a RACS determination completed by a CABI following the definitions sections of this standard operating procedure and CSWR §5.5, or be assumed to be RACS and managed in accordance with this standard operating procedure (with approval from DDPHE).

Soil or ash known to contain non-visible asbestos fibers, based on documented evidence such as construction drawings or analytical reports, is RACS, and if exposed during a soil-disturbing action, shall be managed in accordance with this standard operating procedure.

Because ash can contain burnt building debris that contains asbestos materials, it is automatically assumed to be RACS. However, it can be evaluated by a CABI (including through laboratory analysis), to be non-ACM during the RACS determination.

# 5. Initial Actions and Stabilization for RACS Discovery

This section describes the immediate and interim actions that will be implemented by the contractor if he identifies debris that is classified as **suspect for ACM**. When Suspect Debris is discovered during soil-disturbing activities, the critical requirements are: 1) **avoid generating dust and avoid being in direct contact with airborne soil emissions**, thereby limiting potential exposure to asbestos fibers; and 2) **stabilize the discovery**. Each Suspect Debris encounter scenario will vary; however, the following general processes must be followed:

- Stop all soil-disturbing activities around the discovery until a CABI's RACS determination can be made that has been reviewed by DDPHE.
- Remove all contractor personnel out of the Suspected Debris area.
- Contact DDPHE, and CCOD Project Manager, of the discovery to coordinate next steps.
- A layer of 6-millimeter (mil) polyethylene (poly) sheeting may be used to prevent cross-contamination onto clean soils during initial characterization activities by placing the poly on the ground and then placing the potentially contaminated soil, which has been adequately wetted, directly on the poly.
- Poly will be used to cover the suspect materials to prevent cross-contamination and spreading; care should be taken to make sure the poly will remain attached to the ground, even in high-wind conditions.
- Wet the area immediately surrounding the suspect RACS with water, prior to performing sampling activities that disturb the material (note: visual inspection does not require wetting). Maintain wet conditions throughout sampling activities.
- Isolate the area where the discovery has been made to prevent worker or public exposure and cross-contamination. It may be necessary install fencing or other measures to preclude such access.
- Coordinate with CABI to perform a RACS determination within 24 hours.
- The CABI will evaluate if personnel decontamination is required and advise accordingly.
- The CABI should evaluate equipment for the need for decontamination, and advise accordingly.
- The CABI will collect samples of the suspect RACS according to procedures provided in this standard operating procedure (Section 6).
- If leaving the site unattended, cover the disturbed soil with a layer of 6-mil poly sheeting, or spray with magnesium chloride solution (or equivalent) in sufficient amounts to adequately

wet the soil to prevent dust generation. The contractor shall implement control mechanisms to prevent unauthorized or unintended contact with the material (e.g., install fencing).

- After confirmation of RACS by the CABI, the CABI, in coordination with DDPHE, will direct the contractor on proper implementation of this standard operating procedure.

## 5.1 Temporary Stabilization Procedures

Any contractor who exposes RACS during a soil-disturbing activity, but does not disturb or come into contact with the RACS debris, such as a side-wall or bottom of excavation, and determines to have the RACS remain in place, shall have it covered or stabilized using one of the following methods:

### 5.1.1 Horizontal Excavation Faces (Excavation Floors)

- Cover RACS with geofabric, followed by eighteen (18) inches of fill suitable for unrestricted use, and vegetation; or
- Cover RACS with geofabric, followed by six (6) inches of fill suitable for unrestricted use, and concrete or asphalt.

### 5.1.2 Vertical Excavation Faces (Excavation Side Walls or Trenches)

- Cover RACS with geofabric, followed by fill suitable for unrestricted use to grade or six (6) inches, whichever is greater; or
- Alternate cover designs as approved by the CCOD Project Manager and CDPHE.

### 5.1.3 Standard Requirements for Temporary Sub-Surface Stabilization of RACS.

Any contractor who excavates RACS during a soil-disturbing activity, where it is decided that RACS will be put back into place for a future planned RACS removal not to exceed six (6) months, shall comply with the following

- RACS may only be placed within the Area of Contamination (AOC) that it was originally removed from; and
- Placement and stabilization of RACS shall utilize standard RACS management requirements in accordance with Section 5.1.1 of this standard operating procedure; and
- Provide DDPHE with a plan to coordinate with the CDPHE on how DDPHE/CCOD will track the 6-month time storage of RACS.

### 5.1.4 Standard Requirements for Permanent Stabilization of RACS

Except as provided in Section 5.5.1(D)(5) of CSWR §5.5, a contractor who disturbs or exposes RACS shall make the decision upon the initial discovery of RACS to either manage the RACS in accordance with Section 7 of this standard operating procedure, or cease soil-disturbing activities and permanently stabilize the disturbed or exposed RACS to control the release of asbestos fibers in accordance with one of the following:

- Cover RACS with geofabric, or equivalent visible and physical barrier, and restore the site to pre-disturbance conditions using fill suitable for unrestricted use; or
- Cover RACS with geofabric, or other equivalent visible and physical barrier, followed by eighteen (18) inches of fill suitable for unrestricted use, and vegetation; or
- Cover RACS with geofabric, or other equivalent visible and physical barrier, followed by six (6) inches of fill suitable for unrestricted use, and concrete or asphalt; or
- Cover RACS with geofabric, or other equivalent visible and physical barrier, followed by fill suitable for unrestricted use to grade for vertical excavation faces or trenches; or
- Alternate cover designs as approved by CDPHE.
- Determinations as to what materials would constitute an equivalent visible and physical barrier replacing geofabric shall be made through consultation with DDPHE and CDPHE.

All procedures shall follow standard requirements for RACS management as per Section 7 of this standard operating procedure.

### 5.1.5 Standard Requirements to Stabilize Investigation-Derived Waste

During the process of investigating or examining subsurface conditions during project design, Suspect Debris (debris classified as suspect for ACM) may be found. Investigations may include: geotechnical or environmental investigations (generally using continuous-flight augers advanced by a truck-mounted drill rig); environmental investigations utilizing excavated test pits or test trenches, utilizing an excavator or backhoe; or utility investigations using a water knife and vacuum truck to locate buried utilities. After investigation or examination, the soil generated during the investigation may be placed back into the subsurface area of origination (e.g., soil boring or test pit from which the material came). The following provisions shall apply:

- Subsurface Suspect Debris locations will be documented and can be made available to CDPHE upon request.
- Only soil generated during the subsurface investigation, at the location of origination, may be placed back into the subsurface.

- Upon discovery of Suspect Debris, drilling or excavation activities will cease. If a CABI is present, the material will be sampled, and the remaining Suspect Debris will then be placed directly back into the point of origination, at the deepest depth as practicable.
- Suspect Debris shall be placed at the bottom of the excavation (boring or test pit), and then covered with clean over-burden soil. At least 12 inches of clean soil must cover Suspect Debris. If a CABI is not present when suspect material is first identified, investigation and replacement of soil may not continue until a CABI is present for the remainder of investigation.
- In lieu of stabilization, Suspect Debris and the surrounding 12 inches of soil can be removed, and then managed and disposed as RACS in accordance with this standard operating procedure.
- **If a utility investigation utilizing a vacuum truck/water knife is proposed in a <u>known historical urban fill site and/or area with known RACS or Suspect Debris</u>, additional project-specific planning will be necessary BEFORE work is initiated as there is a high potential that equipment may become contaminated. Coordination with DDPHE will be required.**
- The contractor completing the investigation work must report to DDPHE Suspect Debris discoveries, including the location, depth, and disposition of the material. These findings will be used to determine applicable actions during the implementation/construction of the project.
- No additional stabilization or management of Suspect Debris, including RACS if confirmed, is required after these steps have been completed.
- The CABI will evaluate the need to decontaminate personnel and/or equipment, and advise accordingly.
- Information collected during the investigation shall be made available to the CCOD Project Manager and DDPHE, who will consider design strategies during the project design to avoid, minimize, or mitigate (via this standard operating procedure) RACS during project construction.
- Notification to the CDPHE of an unexpected discovery is required if stabilization procedures and documentation to DDPHE are performed in accordance with this standard operating procedure.

## 5.2 Site Access Control

The contractor will be responsible for maintaining effective project access control by establishing and taking measures to prevent access to the RWA (or areas where discoveries have been made and are being evaluated) by unauthorized persons. A fence should be erected around the perimeter of the project area to limit access to the site. Instances of unauthorized access not under the control of the contractor shall be evaluated to determine if additional access controls are warranted. The unauthorized access, and the response actions taken, shall be documented and provided to the CDPHE within 48 hours of the incident. Access will be limited to individuals that are approved to be on site.

If RACS is encountered/confirmed, the contactor will install proper signage stating the area is a RWA because of the presence of asbestos, and that the area is off-limits to unauthorized personnel. Personnel working on the site shall be advised and directed not to disturb areas where suspected or known asbestos is encountered. Personnel driving onto the site shall be notified of suspect or known asbestos locations and directed to not drive on or disturb those areas. At no time will vehicle traffic be allowed on surfaces where samples have shown positive test results, or where visible asbestos is present, or where untested suspect materials are located. This excludes equipment that is to remain off the road and on the project area for removal operations. Project equipment/vehicles moving across contaminated soils must do so in a way as to not generate visible emissions, and the soil shall be wetted to control visible emissions. Equipment/vehicles that come into contact with RACS will require decontamination as per section 7.2.7 of this standard operating procedure.

# 6. Suspect Asbestos Bulk Sampling

If Suspect Debris (which is suspect for ACM) is visually identified, the following steps will be applied to sample and analyze potential ACM by the CABI (only a CABI who meets the requirements discussed in Section 3.3 of this standard operating procedure may collect samples to determine asbestos content). Additional information is presented in Appendix D (CSWR §5.5 – Appendix 5A). All sampling and analysis shall be conducted in accordance with CSWR §5.5 – Appendix 5A.

- Samples of suspect asbestos material will be placed in appropriate sample containers such as sample bags or jars.
- Care should be taken to ensure that suspect asbestos material is adequately wetted to prevent visible emissions during the sampling process.
- Bulk samples shall be collected by homogenous type based on color, pattern, texture, thickness, associated materials, or by other identifying characteristics.
- The quantity and location of a suspect material shall be used to determine the number of bulk samples required to characterize the asbestos content of each homogeneous suspect material. For the purpose of determining that a homogeneous suspect material does not contain asbestos:
    - A minimum of three bulk samples shall be collected from the homogeneous material, unless there is insufficient material to constitute three samples.
    - If one of the collected samples of a homogeneous bulk material is determined to be ACM, then the homogeneous material shall be considered ACM.
- A field sampling form or log book entry will be maintained for each sample obtained. The form or log book entry will include the location using a hand-held global positioning system (GPS) instrument, date and time of each sample, depth below the ground surface the sample was identified, description of the type of material, assessment of friability of the material, and other observations made.
- Proper chain-of-custody procedures will be followed for all samples collected.
- Samples of newly discovered suspect asbestos materials will be analyzed by a National Voluntary Laboratory Accreditation Program (NVLAP)-accredited laboratory by Polarized Light Microscopy (PLM) methodology to determine if any asbestos fibers are present.
- Suspect materials not sampled according to these procedures must be assumed to be ACM and managed as such.

# 7. RACS Management

Through coordination with the CCOD Project Manager and DDPHE, the contractor may be retained to conduct RACS management. CCOD will require that the contractor, in coordination with the CABI/AMS, utilize management strategies that are protective of human health and the environment, meet the CSWR §5.5 requirements, and provide the best value to the CCOD. A detailed scope of work detailing how this standard operating procedure will be implemented, including costs, will be required prior to initiating RACS management.

A specialized asbestos abatement contractor may also be retained to conduct these services. Any entity who wishes to engage in RACS management must understand the intricacies of the CSWR §5.5 regulation, the materials, the risks, and management of the material. Due to the complexity of the work, it is highly encouraged that only experienced contractors conduct RACS management activities. The CCOD Project Manager and DDPHE will evaluate the experience and qualifications of the contractor conducting RACS management prior to implementing RACS management on a project through review of the detailed scope of work and other qualifications, as requested.

Two standard RACS management strategies are provided in this standard operating procedure, which are described in this following text. The Hand Removal strategy may be effective where small amounts of RACS (or Non-RACS) is likely to be found. The mechanical removal strategy may be effective where large amounts of RACS (or Non-RACS) is likely to be found. Again, the CCOD Project Manager, DDPHE, and the key parties should thoroughly evaluate site conditions before determining the appropriate RACS management strategy. Some projects may use both strategies at different times as the most effective way to manage RACS.

## 7.1 Hand Removal

During this action, the CABI will direct the contractor (or perform themselves) in the removal of these pieces of suspect or confirmed ACM (including RACS and Non-RACS) using the procedures listed below:

- The CABI will conduct a visual inspection of area and surrounding surface for the presence of suspect or confirmed RACS.
- Establish the RWA according to Section 7.2.1 (an RWA is not required if the material is determined to be a Non-RACS).
- Adequately wet the suspect or confirmed RACS and surrounding soil (12 inches) with amended water containing a wetting agent, such as a 50:50 mixture of polyoxyethylene ester and polyoxyethylene ether.
- Gather the RACS and remaining 12 inches of surrounding soil and place into double-bagged, 6-mil poly bags.

- The CABI will then complete a second visual inspection of the area and surrounding surface where minimal material was discovered to safeguard that no further RACS is in the scope area.
- If the CABI encounters further material after removal of the original discovery in which hand removal is not practical or effective, mechanical removal methods inside a RWA should be implemented.
- If RACS remains as part of the scope, it shall be managed according with Section 5.1.4 of this standard operating procedure.
- Dispose of waste in marked, 6-mil poly bags with attached generator labels in accordance with the CSWR §5.
- Hand-removed, bagged RACS waste may be stored in a leak-tight and secure container labeled for asbestos, and disposed in accordance with CSWR §5. Bagged RACS may not be stored for more than 10 days without a CDPHE-approved RACS storage plan.
- Asbestos worker and equipment decontamination shall be performed in accordance with Section 7.2.7.

Where there are minimal amounts of RACS/Non-RACS discovered as described above, the CABI may conduct the removal actions as stated in this standard operating procedure, and the utilization of an abatement contractor is not required (although an abatement contractor may provide trained asbestos workers to complete removal actions under the supervision of the CABI).

This method may also be applicable where other contaminants are present in soil (such as heavy metals or petroleum hydrocarbons), which are being managed in accordance with a MMP. During mechanical removal actions of special solid waste, the CABI must carefully (and safely) observe soil during the excavation process, prior to the material being loaded into trucks, to ensure that RACS is not overlooked. It may be necessary for the contractor to remove soil, carefully spread on the ground where it may be adequately visually inspected by the CABI (wetting as needed so there is no visible dust), and then re-excavate the material and place in dump trucks for landfill disposal. In no event may excavated soil that contains non-soil debris of any kind (Suspect or Non-Suspect) (e.g., non-ACM bricks, concrete, ceramic) be reused at an off-site location, whether if the property is owned by CCOD or not. These soils must be disposed at the Denver-Arapahoe Disposal Site (3500 South Gun Club Road, Aurora, Colorado 80018) as a special solid waste according with the MMP and CCOD's soil reuse policy (Section 3.6).

## 7.2 Mechanical Removal

Mechanical removal of RACS is often the safest and most cost-effective method of RACS management, particularly where large quantities of RACS/ACM is present, or is expected to be present.

### 7.2.1 Establishing a RWA after Confirmed Discovery of RACS

The contractor, under the direction of the CABI, will be responsible for establishing any RWA(s) for discovered RACS the CABI identifies, which will be removed, as follows:

- Establish a visible perimeter around the discovered material, which is identifiable to all persons on site, to prevent cross contamination. Demarcate area suspected of containing RACS with barrier tape, or other means, and provide access control.
- Post-labeling and signage to demarcate RWA(s). The RWA shall be demarcated with a visual means that defines the full extent of the RWA. Labeling and signage shall indicate the potential presence of asbestos, and that the area is off limits to unauthorized personnel.

### 7.2.2 Engineering Controls

#### *7.2.2.1 Initial Minimum Controls*

Minimum engineering controls will be implemented when excavations occur within the footprint of the RWA. The minimum engineering control include, but are not limited to, the following:

- A CABI must observe each area where soil disturbing or loading activities are taking place; therefore, if multiple excavations are occurring simultaneously, a CABI must be available to visually inspect each excavation location (i.e., utilize multiple CABIs).
- The CABI(s) will be on site at all times that RACS is being removed to ensure that no visible emissions are generated at any time during soil-disturbing activities. Additionally, the CABI will verify that the soil moisture is sufficient during removal to suppress dust, and to ensure that the material is adequately wet. If visible emissions are observed, then work practices will be modified.
- Stockpiled soils will be stabilized using the application of water or magnesium chloride, and/or by covering with overlapped poly sheeting or appropriate cover/stabilization.

#### *7.2.2.2 Wind Break Barriers*

As needed, wind break barriers should be constructed prior to commencement of removal activities, and constructed of materials appropriate to site conditions. Ultimately, wind break barriers will be the responsibility of the contractor. It is recommended that the wind break barriers be relatively portable and adequate to minimize soil dispersal from the work area. The wind break barriers will be placed to completely encompass the work area and loading area, as this will assist to prevent uncontrolled access to the work area by unauthorized personnel during and after work shifts.

### 7.2.3 RACS Disposal Procedures

#### *7.2.3.1 Mechanical Removal/Disturbance of RACS from a Regulated Work Area*

- Removal and disturbance of RACS will be conducted utilizing a direct-load system. RACS and its associated required removal quantities will be removed adequately wet and transported directly to DADS. Trucks will be prepared prior to loading by installing at least one leak tight 6-mil layer of poly as a liner (for non-friable RACS), or at least two layers of leak tight 6-mil poly (for friable RACS). The liner(s) will be installed such that under normal conditions, it (they) will not rupture during loading, transportation, and disposal. The poly liners will be sealed at the opened ends for transport with mechanical fasteners (i.e., tie wire, zip-ties, etc.).
- The project will have the option for all loads, based on continuous visual inspection and documentation by a CABI, to be determined to contain less than one percent (by volume of the load or container) of friable RACS, non-friable RACS or assumed ACM debris. In these cases, the loads shall be packaged and disposed of with one leak tight 6-mil layer of poly as a liner. If debris is assumed to be ACM, continuous CABI visual inspection is still required to determine if the amount of RACS remains below 1% of the disposal load.
- An area to load the trucks with RACS will be prepared as close to the RWA as possible, allowing safe access in and out of the site. A layer of 10-mil poly will be placed on the ground as a loading pad to capture potentially spilled RACS and immediately cleaned or replaced if any spillage or damage to the liner occurs.
- Standard erosion control BMPs must be established by the contractor to prevent stormwater run-on/off for the duration of the loading and transportation activities.
- Spill prevention measures, as outlined in CSWR §5.5.7(G), will be incorporated during loading of the RACS to prevent cross-contamination of adjacent areas. Specific measures include;
    - Protect surfaces of loading, transport or container equipment not meant to be in direct contact with RACS materials. Should these surfaces come into contact with RACS, they shall be decontaminated per section 7.2 of this standard operating procedure;
    - Do not overfill the excavator or loader bucket and return the bucket to a closed position prior to moving from the loading point;
    - Replace protective coverings when worn or damaged in order to prevent breaches;
    - Control runoff in order to prevent cross contamination outside of the RWA from water containing asbestos.
- Spilled RACS shall be treated as an RWA and cleaned up immediately in accordance with CSWR § 5.5.7 (J). It will not be allowed to dry out or accumulate on any surface. The

Department's Hazardous Materials and Waste Management Division shall be notified, through the spill reporting hotline, in the event that spills of RACS cannot be cleaned up within 24 hours of spill identification.

- Where there are breaches in ground coverings that have the potential to allow water contaminated with asbestos to impact the material below the covering or surfaces that are contacted by asbestos-contaminated water, a minimum of three (3) inches of soil, or other matrix material, shall be removed.
- If ground coverings are placed on top of a durable surface such as concrete or asphalt, the surface shall be decontaminated using wet methods, followed by CABI inspection that all soil and debris has been removed from the surface.
- Rinsate, runoff, or any other water that has come into contact with RACS shall be considered to be asbestos contaminated water and shall be collected. However it cannot be  for discharge to a sanitary sewer or other Department-approved disposal facility. It may be re-applied to RACS that will be stabilized and managed under this SOP.
- Surfaces that are contacted by asbestos contaminated water can be permanently stabilized as per Section 5.1.4 of this standard operating procedure.

- Trucks carrying friable RACS (friable material over 1% by volume of the disposal load) must be labeled in accordance with the requirements of CSWR §5.5 using one of the following legends in type at least five inches tall:

**CAUTION**
**CONTAINS ASBESTOS**
**AVOID OPENING OR BREAKING CONTAINER**
**BREATHING ASBESTOS IS HAZARDOUS TO YOUR HEALTH**

**DANGER**
**CONTAINS ASBESTOS**
**AVOID CREATING DUST**
**CANCER AND LUNG DISEASE HAZARD**

- Non-friable RACS will be labeled "Asbestos, Danger" along with the name of the generator during transport.
- The contractor will be responsible for Department of Transportation protocols and labeling for transportation of RACS.

- It is likely that an excavator or front-end loader will be utilized for RACS removal, disturbance, management, and loading. During all soil-disturbing activities involving RACS, adequate wetting of soils will be performed. At least one water hose operator is required at each excavation, and other means may be employed to ensure that RACS is adequately wet (e.g., misting bars, additional hose operators).
- The equipment operator(s) will load the RACS directly into the pre-lined truck; the truck drivers will not be allowed to exit the trucks during loading operations and will be required to keep their windows closed and air handling systems off while their trucks are being loaded.
- The excavation bucket will not be filled greater than 2/3 its capacity to avoid overfilling and spilling.
- The CABI will continuously observe excavation and loading operations to verify that adequate wetting has taken place and that no visible emissions occur, and that compliance to this standard operating procedure is adhered to.
- During mechanical removal, if the CABI observes solid waste material (e.g., Non-Suspect material as described in Section 4.1), with no visible evidence of suspect ACM, and there is sufficient quantity, the CABI and contractor may elect to segregate this material for disposal as non-ACM.

#### *7.2.3.2 RACS Removal Quantities*

The extent of removal quantities differs depending on where the RACS disturbance is taking place as follows:

- When RACS is being removed from the **surface** – Wet and remove all RACS and its associated six-inches in all directions, plus a minimum of six inches of soil or other matrix material, in all directions from the last occurrence of visible ACM with CABI confirmation that the visible extent of RACS has been removed (i.e., removal of visible ACM plus a minimum 12-inches of soil in all directions).
- When RACS is being removed from the **subsurface** – Wet and remove all RACS and its associated six-inches plus a minimum of three linear feet of soil or other matrix material, in the direction of planned excavation with CABI confirmation that the visible extent of RACS has been removed.

#### *7.2.3.3 Off-Site Disposal of RACS*

It will be the responsibility of the contractor to direct the schedule of transportation of RACS to DADS. When loaded, each truck will be assigned a waste manifest to serve as the shipping document for that load. Documentation stating that the soil originating from the project shall not be used as a daily cover

or sold as clean fill will accompany each load of RACS removed from the project. DDPHE will coordinate the waste profile and obtain waste manifests if requested.

RACS will be transported to DADS. Disposal of RACS will be conducted while adhering to CSWR §5. The landfill processes will be followed, specifically regarding notification, profiling, and on-site disposal.

Disposal of Non-RACS will require notification to the landfill that the material to be disposed contains Non-RACS, and based on the DADS requirements, the material will be handled accordingly (e.g., unlined trucks, single-lined trucks). Special precautions shall be undertaken during the management of non-RACS to prevent the material from being turned into RACS (i.e. being rendered friable).

### 7.2.4 Wind Speed Monitoring

Periodic wind speed measurements will be taken during RACS disturbance within each RWA by an AMS or CABI at least once per every half hour. This frequency will be increased at the AMS's or CABI's discretion when it has been determined that wind conditions may be approaching threshold limits, and during wind gusts. It will be the responsibility of the AMS or CABI's to take and record all wind speed measurements onto the daily logs. All wind speed measurements will be taken within the work area in a location deemed representative of the area. The following are conditions where work will be shut down and started:

**Shut down Conditions** – RACS disturbance operations should immediately and temporarily cease when one or more of the following conditions have been met:

- Any wind gust reaches or exceeds 20 miles per hour (mph) as determined by hand-held instruments
- Sustained wind speeds reach or exceed 12 mph averaged over a 10-minute period
- Winds produce visible emissions or create movement of dust or debris in or near the work area or loading area
- Winds impact any engineering controls and prevents them from functioning as designed
- During wind-related project shutdowns, other work not related to RACS disturbance may continue

**Startup Conditions** – RACS disturbance operations may resume after all the following conditions have been met:

- All wind gust readings drop below 20 mph for a period of 20 minutes as determined by hand-held instruments
- Sustained wind speeds are below 12 mph averaged over a 20-minute period

- Winds no longer produce visible emissions or create movement of dust or debris in or near the RACS disturbance area
- Winds are not impacting the ability of engineering controls to work as designed

### 7.2.5 Air Monitoring

CDPHE will require minimum air monitoring when suspect or confirmed ACM/RACS is being disturbed within a RWA, after the second consecutive day of RACS management. An appropriately trained and certified AMS must perform the air monitoring activities at the project. The CABI will characterize debris and air monitoring requirements will be made by the AMS based on the CABIs identification of the debris and applicable regulations. The CABI and AMS can be the same person if she/he meets the CABI and AMS requirements in Section 3.3. Ideally, the CABI and AMS will be the same person.

Air monitoring samples will be collected by the AMS using the procedures outlined below. All air samples will be collected and analyzed in accordance with CSWR §5.5 – Appendix 5A.

#### *7.2.5.1 Air Monitoring Matrix Tables*

Personnel Monitoring and RWA Perimeter Sampling shall be performed in accordance with the following air-monitoring matrix tables:

*Table 3 Removal/Disturbance (by hand or hand-held tools) of Non-Friable RACS*

| Monitoring Type | Sample Frequency | Duration | Analysis |
|---|---|---|---|
| RWA Perimeter Monitoring | None | Not Applicable | Not Applicable |

*Table 4 Removal/Disturbance (by hand or hand-held tools) of Friable RACS*

| Monitoring Type | Sample Frequency | Duration | Analysis |
|---|---|---|---|
| RWA Perimeter Monitoring | Four samples at the perimeter of the RWA, at the points of the compass. | Ongoing after the 2nd day of RACS disturbance | PCM and Transmission Electron Microscopy (TEM) sampling around RWA. Any sample with PCM results exceeding 0.01 fibers per cubic centimeter (f/cc) must be analyzed by TEM. |

*Table 5 Removal/Disturbance by Mechanical Means (Heavy Equipment) of Non-Friable RACS*

| Monitoring Type | Sample Frequency | Duration | Analysis |
|---|---|---|---|
| RWA Perimeter Monitoring | Four samples at the perimeter of the RWA, at the points of the compass. | Ongoing after the 2nd day of RACS disturbance | PCM and TEM sampling around RWA. Any sample with PCM results exceeding 0.01 fibers/cc must be analyzed by TEM. |

*Table 6 Removal/Disturbance by Mechanical Means (Heavy Equipment) of Friable RACS*

| Monitoring Type | Sample Frequency | Duration | Analysis |
|---|---|---|---|
| Area of Disturbance Perimeter Monitoring | Four samples at the perimeter of the RWA at the points of the compass, and two downwind floater samples. | Ongoing after the 2nd day of RACS disturbance | PCM and TEM sampling around RWA. Any sample with PCM results exceeding 0.01 fibers/cc must be analyzed by TEM. |

#### *7.2.5.2 Personnel Air Monitoring*

Personnel monitoring will be the responsibility of the contractor, per OSHA requirements, and is not directed by this standard operating procedure.

#### *7.2.5.3 Required Preliminary and Area Air Sampling Protocol*

- **During the first five days of RACS disturbance/removal** – All air samples collected are required to be analyzed by PCM methodology. Additionally, a minimum of 25% of the samples collected from each RWA shall be submitted for TEM analysis. The sample(s) selected for TEM analysis shall have the highest PCM result(s) based on fiber concentration. If all PCM results are Below Detectable Limit (BDL) for fiber concentration, then the sample(s) selected for TEM analysis shall be determined by highest fiber count. If all samples have no fiber counts, then no TEM analysis is required.
- **After five days of RACS removal/disturbance with no asbestos detections by TEM analysis** – the frequency of analysis by TEM, on the highest 25% of PCM results(s), may be reduced to once every five days of RACS removal/disturbance, or portions thereof, using the same selection criteria as above. During the period of reduced frequency of TEM analysis, the first occurrence of high winds, exceeding wind shutdown criteria (Section 7.2.4), or visible

emissions, shall result in that day's samples (25%) being submitted for TEM analysis. In the absence of high-wind events or visible emissions the selected day for TEM analysis may be random, as determined by the AMS.

- If at any time, a sample analyzed by PCM returns results greater than 0.01f/cc, that sample shall then be analyzed by TEM as required by CDPHE.
- If there are any asbestos detections during the random once-every-five-days-analysis by TEM, then TEM analysis shall be conducted for three consecutive days of RACS removal/disturbance, or portions thereof. If there are no additional asbestos detections during the three consecutive days of RACS removal/disturbance with samples submitted for TEM analysis, then the frequency of TEM analysis may return to random, once-every-five-days of RACS removal/disturbance.

#### *7.2.5.4 Area Air Sampling*

- Air samples will be collected continuously during all mechanical removal of RACS.
- Area monitoring shall consist of a minimum of four samples collected on the perimeter of the RWA, at the four-compass points, and at appropriate intervals to provide representative information regarding potential releases of asbestos fibers to the Adjacent Receptor Zone(s).
- Two additional downwind floating samples will be required for mechanical removal/disturbance of friable RACS. The samples shall be moved based on prevailing wind direction and adjacent receptors.
- Additional samples shall be collected for large perimeter RWAs (greater than one (1) acre). RWAs greater than one (1) acre shall require additional perimeter monitoring points be added at a rate of one (1) sample for every 200 linear feet (or approximately each additional ¼ acre).
- Air monitoring is not required where RACS management activities will occur in areas where there is no Adjacent Receptor Zone present according to the definition of an adjacent receptor zone where access to the public can be controlled (i.e., an area of at least 150 feet surrounding the RWA can be controlled allowing no public access).

#### *7.2.5.5 Sampling Media*

Air samples will be collected by drawing air through a 25-millimeter mixed cellulose ester filter, 0.8-micron pore size, with an open-faced, long cowl using low-flow personnel sampling pumps. The flow rate and the volume of the air passed through the filter will be determined based on the National Institute of Occupational Safety and Health (NIOSH) 7400 (NIOSH, 1987) analytical method. Each pump will be calibrated before and after the collection of each sample using a primary standard.

#### *7.2.5.6 Sample Analysis*

Air samples submitted for Phase Contrast Microscopy (PCM) shall be analyzed according to NIOSH Method 7400 by a laboratory showing successful participation in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program or individual(s) certified through the AIHA Asbestos Analysts Registry (AAR) Program. Analysis of TEM air samples will be submitted to a National Institute of Standards and Technology (NIST) accredited laboratory using TEM in accordance with CSWR §5.5 Appendix 5A (Appendix D).

#### *7.2.5.7 Response to Laboratory Results*

If an air sample analyzed by PCM indicates fiber concentrations over 0.01f/cc, that sample is then required to be analyzed by TEM. If an air sample has concentrations of airborne asbestos fibers after TEM analysis of personnel and/or work RWA samples, then the CDPHE will be notified immediately. The work practices and engineering controls, through consultation with CDPHE, will then be modified to reduce emissions. In the event that this should occur, the following actions shall take place:

- Excavation will immediately halt
- The source(s) of fiber release will be identified
- RACS management operations and engineering controls will be reassessed to safeguard that additional fiber releases do not occur
- If asbestos fibers are detected in air samples:
    - All soil-disturbing activities will immediately cease
    - The source of fiber release will be identified
    - An Emission Control Plan in accordance with Section 5.5.7 of the CSWR §5.5 will be derived and submitted to CCOD and the CDPHE for review
    - Soil disturbance shall not continue until the CDPHE provides verbal and/or written authorization to proceed.

### 7.2.6 RACS Stockpiling

#### *7.2.6.1 Stockpiling of RACS*

If RACS, which must be removed from the project, is in a location with limited or no access for direct loading into trucks, the material may be stockpiled on site if the conditions below are met in accordance with CSWR §5.5:

- The accumulation of RACS cannot exist for more than 10 calendar days without the approval of a RACS Storage Plan by CDPHE.

- Stockpiled RACS shall be placed on a minimum of 6-mil poly or a minimum of three-inches of soil, or other matrix material located under the stockpile which must be removed following removal of all stockpiled material.
- Rinsate/runoff shall be collected, filtered to five-microns, and discharged to a sanitary sewer (contractor must have appropriate authorizations) or re-applied to RACS that will be stabilized and managed under this standard operating procedure.
- The RACS must be adequately wet during stockpiling.
- The stockpile shall be stabilized by polyethylene sheeting, geofabric, or a chemical stabilizer demonstrated to be effective in the stabilization of RACS (e.g., magnesium chloride).
- The condition of the stockpile and cover sheeting/geofabric/stabilizer must be inspected daily and no later than 12 hours following storm events.
- All damage to the cover sheeting/geofabric/stabilizer must be repaired or replaced immediately upon discovery.

#### *7.2.6.2 Transporting RACS to Stockpile*

The following directives and RACS handling must take place during on-site transport of RACS to a stockpile location:

- Driving speeds shall not exceed 12 mph while machine is moving RACS.
- Transportation equipment tires shall not contact RACS. If tires do contact RACS, the RACS must be adequately wetted to prevent dust/emissions and all equipment surfaces that have come into contact with RACS shall be decontaminated (Section 7.2.7).
- If the transport equipment tires come in contact with RACS:
    - The haul road shall be managed as RACS and maintained to prevent dust or emissions generation and if any RACS is visibly observed it is to be removed immediately, along with the required six inches of surrounding soil and handled appropriately.
    - Following completion of excavation and grading activities, the material used in construction of the haul road as well as three inches of underlying soil will be removed and managed in the same manner as the RACS.
    - Water and runoff from the haul road shall be collected and filtered to less than five microns (or applicable local requirements) and discharged to a sanitary sewer (contractor must have appropriate authorizations) or re-applied to RACS that will be stabilized and managed under this standard operating procedure.

### 7.2.7 Decontamination Procedures

#### *7.2.7.1 Heavy Equipment or Machinery Decontamination*

Heavy equipment will be decontaminated prior to leaving a RWA in such a manner as to ensure that residual soil and contaminants are removed and other hazards are not present. Heavy equipment decontamination will include the following steps:

- Decontamination will occur within a waste container when possible, and if not will be staged on 6- or 10-mil poly to prevent cross contamination or spills. This will include mechanical removal by asbestos workers using shovels or other hand-held tools while wearing appropriate PPE.
- Next, the equipment will be thoroughly cleaned with amended water and rags.
- All used rags and disposable PPE will be disposed of as asbestos waste and transported to the landfill.
- It will be the responsibility of the CABI to make final visual inspections and a final determination regarding the decontamination of equipment for release to other portions of the project, or off-site.

#### *7.2.7.2 Asbestos Worker Decontamination During RACS Disturbance in a RWA*

A fully functioning decontamination unit or trailer will be utilized at the project whenever RACS disturbance within a RWA takes place. The decontamination unit will be located within 100 feet of the project, and as near the removal area as practical. The decontamination unit will consist of three chambers, should have fully operational hot and cold running water adjustable at the tap, and a functioning water filtration unit that will filter the waste water to five microns or less. Reuse of waste water from personnel decontamination is prohibited. For disposal, waste water may not be discharged to the sanitary sewer within the City and County of Denver. However, it may be added to RACS, generated by the project, as part of RACS disposal procedures if it does not interfere with the requirements of section 7.2.3 (RACS Disposal Procedures) of this SOP, and does not cause the load to fail a paint filter test. Disposal of decontamination water from equipment must also follow the same disposal protocols. In no event may decontamination water be discharged to any sanitary sewer, storm sewer, ditch, gutter, or stream.

To prevent cross-contamination, asbestos workers will wear clean outer protective suits as they exit from the work area(s) to the decontamination area. The asbestos workers will either double suit and remove the exterior suit, or don a second clean suit over the single suit, within the work area prior to moving out of the RWA to get to the decontamination unit. The decontamination unit should be utilized by the asbestos workers each time they exit the work area(s).

#### *7.2.7.3 Decontamination and Personnel Protection During Removal of RACS/ACM*

Asbestos workers and equipment will be decontaminated on site; dirt and debris should not leave the immediate work area. The following procedures can be modified by the CABI based on the potential level of exposure:

- Decontamination of workers can consist of removal of disposable Tyvek® suites, gloves, and boot covers. These PPE will be bagged, labeled, and disposed as asbestos waste.
- Decontaminate non-disposable personal items by removing visible soil and dust with damp wipes or rags, or by use of a high efficiency particulate air (HEPA) filter equipped vacuum. Place wipes and rags in a plastic bag and dispose along with RACS materials. If additional clothing is available, clothes should be changed and potentially contaminated clothing should be bagged separately from wipes and rags.
- Decontaminate hand equipment and tools by removing gross soils and dust, then washing the equipment. Materials used for decontamination should be bagged and disposed along with RACS materials. Equipment decontamination rinsate water should be collected and filtered to five microns prior to disposal, or reused for wetting of asbestos contaminated areas that will be removed.

Based on analytical results of suspect materials, if asbestos is present, decontamination materials should be bagged and disposed of as asbestos waste at the Denver-Arapahoe Disposal Site or with RACS in accordance with this plan. If analytical results indicate that no asbestos is present, bags (non-asbestos waste bags) can be disposed as non-asbestos solid waste.

### 7.2.8 Work Area Clearance

It will be the responsibility of the CABI to provide final visual clearance of the work area following completion of RACS disturbance/removal. The CABI will document locations, and other pertinent information, onto the daily logs for work area clearance.

# 8. Close-Out Report

The CABI will be responsible for maintaining complete documentation of the project in accordance to C.S.W.R 5.5.7 (L). After RACS disturbance/removal actions are completed, a project close-out report will be prepared for CCOD's files. The project close-out report will include at a minimum:

- Property description and description of area(s) with RACS
- Description of soil-disturbing activities
- Description of field operations or submittal of daily logs (Appendix B)
- Air monitoring logs
- Description/results of asbestos sampling events, including sample locations
- Analytical results
- Disposal summaries and manifests
- Details of excavation profiles
- Description of capped material left in place and site plan showing the capped area(s)
- Photographic logs
- Personnel certifications

Copies of the project close-out report will be submitted to the CCOD Project Manager. Project close-out reports for RACS management projects are not required to be submitted to CDPHE.

# 9. References

CDPHE, 2008. "Regulation No. 8, Part B – Asbestos", Colorado Department of Public Health and Environment, Air Quality Control Commission, Denver, Colorado, January 2008.

CDPHE, 2014. "Deletion and Replacement of Existing Section 5.5 Regulations (Management of Asbestos-Contaminated Soil) with New Section 5.5 Regulations (Management of Regulated Asbestos Contaminated Soil (RACS)); the Addition of Appendix 5A (Sample Collection Protocols and Analytical Methodologies) and the Associated Additions and Revision to Section 1.2 Definitions." Colorado Department of Public Health and Environment, dated August 19, 2014.

NIOSH, 1987. National Institute for Occupational Safety and Health (NIOSH) Method 7400 Entitled "Fibers" published in the NIOSH Manual of Analytical Methods, 3rd Edition, second supplement, August 1987.

OSHA, 1987. Occupational Safety and Health Administration (OSHA) Regulation "Asbestos", 29 C.F.R. Part 1910.1001, Appendix B (OSHA 1987)

# Appendices

# Appendix A
# CDPHE Approval Letter

COLORADO
Hazardous Materials
& Waste Management Division
Department of Public Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

May 2, 2019

Mr. Steve Gonzales
City and County of Denver
Department of Public Health and Environment
101 W. Colfax, #800
Denver, CO 80202

RE: **Approval:** *Regulated Asbestos Contaminated Soil Standard Operating Procedure for City and County of Denver* - dated May 2, 2019
SW/DNV/GEN 3.10

Dear Mr. Gonzales:

The Colorado Department of Public Health and Environment ("CDPHE"), Hazardous Materials and Waste Management Division ("Division") has reviewed the following standard operating procedure (SOP) regarding Regulated Asbestos Contaminated Soil (RACS) management activities in Denver, CO:

- *Regulated Asbestos Contaminated Soil Standard Operating Procedure for City and County of Denver* (the SOP)

The SOP was initially received in our office electronically on May 9, 2018. The Division provided comments on the initial version of the plan that were dated June 13, 2018. A revised version of the plan was received electronically on September 5, 2018. The Division provided additional comments in a letter dated November 2, 2018. Another revision to the SOP was dated January 23, 2019. Additional discussion between the Division and the Denver Department of Public Health and Environment resulted in a final version of the SOP that was provided to the Division on May 2, 2019. The SOP was prepared and submitted by The Denver Department of Public Health and Environment.

**The Division has completed its review and is pleased to hereby approve this SOP for RACS Management. Please keep in mind that all soil disturbing activities involving RACS must be performed in accordance with this approved SOP and the Colorado Solid Waste Regulations (6 CCR 1007-2, Part1).**

In closing, the Division is authorized to bill for is review of technical submittals at $125 per hour, pursuant to Section 1.7 of the Solid Waste Regulations, 6 CCR 1007-2. An invoice for the Division's review of the above referenced document will be sent out under separate cover.

The Division contact person for this project is Brian Long, and may be contacted at (303) 691-4033 or briant.long@state.co.us.

Sincerely,

Digitally signed by Brian Long
Date: 2019.05.02 16:37:42 -06'00'

Brian T. Long
Environmental Protection Specialist
Solid Waste Compliance Assurance Unit
Solid Waste and Materials Management Program

ec: Ed Smith, CDPHE HMWMD

# Appendix B
# CABI Work Day Documentation Form

# City and County of Denver
## Certified Asbestos Building Inspector Work Day Documentation
## Project Name_____

DDPHE V1.0

| | | | |
|---|---|---|---|
| Inspector Name: | | Date: | |
| Inspector Certification Number:<br>Inspector's Company/Affiliation: | | Weather: | |
| Location Description: | | | |
| Description of Site Activities : | | | |
| Equipment Used (Model Number): | | | |

### CABI Documentation

**Identify environmental hazards discussed at the safety meeting:**

- ☐ Delineation of Work Area
- ☐ Work Zones
- ☐ Utility Identification
- ☐ Haul Routes / Access
- ☐ Equipment Mobilization
- ☐ Emissions Controls
- ☐ Fencing and Wind Barriers
- ☐ Other:_____

### Description of Encountered Debris Materials and Practices

| | |
|---|---|
| 1A | **Types of Debris Identified (List all materials, clarify depths of piles):** |
| 1B | **Description of Suspect Debris Material (RACS/ Non-RACS):** |
| 1C | **Description of Hand Removals (Assumed RACS or Analyzed To Be RACS):** |
| 1D | **Friability of Suspect Debris Materials:** |
| 1E | **Observation of Non-Earthen Material or the Appearance of Fill:** |
| 1F | **Observation of Any Other Impacted Soils (Non-Asbestos Impacts):** |

### Bulk Sample Log

| Sample ID# | Time Sampled | Depth | Sample Location/Description | Asbestos Content From Analytical |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

# RACS Management Detail

## Decontamination

| No. | Items | YES | NO |
|---|---|---|---|
| 2A | Have all equipment surfaces in contact with RACS been decontaminated? | ○ | ○ |
| | Details: | | |
| 2B | Have workers conducted personal and equipment decontamination in accordance with applicable procedures? | ○ | ○ |
| | Details: | | |

## Engineering and Administrative Controls

| No. | Items | YES | NO |
|---|---|---|---|
| 3 | Onsite Staging, Stockpiling, & Storage of RACS | ○ | ○ |
| | Annual Awareness Training for Regulated Work Area Personnel | ○ | ○ |
| | Annual Awareness Training for Non-Regulated Work Area Personnel | ○ | ○ |
| | Details: (provide detailed description of any deficiencies) | | |

## Spill Response

| No. | Items | YES | NO |
|---|---|---|---|
| 4 | | ○ | ○ |
| | Details (provide information on corrective actions): | | |

## Air Monitoring Information As Applicable

### General Conditions

| No. | Items | YES | NO |
|---|---|---|---|
| 5A | Were work conditions maintained below stoppage requirements? | ○ | ○ |

Daily Wind Speed — Sustained High: ____ Gust Max: ____

Details (Provide Prevailing Wind Direction and 30-Minute Readings):

| Time | Wind Speed | Direction | Time | Wind Speed | Direction |
|---|---|---|---|---|---|
| 7:00 | | | 12:00 | | |
| 7:30 | | | 12:30 | | |
| 8:00 | | | 13:00 | | |
| 8:30 | | | 13:30 | | |
| 9:00 | | | 14:00 | | |
| 9:30 | | | 14:30 | | |
| 10:00 | | | 15:00 | | |
| 10:30 | | | 15:30 | | |
| 11:00 | | | 16:00 | | |
| 11:30 | | | 16:30 | | |

Comments:

Details of Wind Shut Down Event (If Applicable):

| No. | Items | YES | NO |
|---|---|---|---|
| 5B | Visible emissions observed? | ○ | ○ |
| | If visible emissions were observed, was worked stopped? | ○ | ○ |
| | Details (provide information on corrective actions): | | |

## Perimeter Monitoring

| | | | | |
|---|---|---|---|---|
| 6A | Adequate perimeter sampling points based on test area? | ○ | ○ | |
| | No disturbance to sampling equipment or power source? | ○ | ○ | |
| | Were samples compromised in any way? | ○ | ○ | |
| | Details: | | | |
| 6B | Has the pump been calibrated? | ○ | ○ | |
| | Details (Pump Calibration Method): | | | |
| 6C | Is there an adjacent public receptor zone within 150 ft. of a Regulated Work Area? | ○ | ○ | |
| | Details (Location): | | | |

## Air Sample Log

| Sample ID# | Start Time | Stop Time | Total Minutes: | Flow Rate Start: | Flow Rate Stop: | Sample Location | Volume | f/cc |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
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## Contractor Monitoring

| No. | Items | YES | NO | |
|---|---|---|---|---|
| 7 | Is contractor working in the regulated work area conducting personal monitoring? | ○ | ○ | |
| | Details: | | | |

## Work Practices and Completion

| No. | Items | YES | NO | |
|---|---|---|---|---|
| 8A | Are work practices conducted in accordance with the project MMP and State regulations? | ○ | ○ | |
| | Have excavation and loading activities been conducted in accordance with applicable procedures? | ○ | ○ | |
| | Details: | | | |
| 8B | Have loading and transportation requirements been met? | ○ | ○ | |
| | Details: | | | |
| 8C | Has visible material and associated soils been removed? | ○ | ○ | |
| | Details: | | | |
| 8D | Have appropriate samples been collected to confirm ACS has been removed? | ○ | ○ | |
| | Details: | | | |

| Soils Disposition | |
|---|---|
| 9A | Where did the soil originate (depth, specific area)? |
| 9B | Temporary or final disposition of soil (where on-site or disposed)? |
| 9C | Method of material movement (What type of truck and loading)? |
| How many cubic yards of soil excavated during shift? (0 - 10000 yds.) | |

**Comments:**

Provide at least 4 Photos From Daily Operations Where RACS Management Is Being Done

**During RACS Management Operations, Include a Map of RACS Management Location(s) with this Documentation**

**ASSOCIATED PHOTOS**

Picture 1

Picture 2

Picture 3

Picture 4

CABI Field Inspector Name

Date

# Appendix C
# Notification of Planned Soil Disturbing Activity

COLORADO
Department of Public Health & Environment
Dedicated to protecting and improving the health and environment of the people of Colorado

# NOTIFICATION OF REGULATED ASBESTOS CONTAMINATED SOIL (RACS) DISTURBANCE

**A map, figure, or drawing, to a recognizable engineering scale, depicting the project area(s) must be submitted with this form.**
The form, plan (if applicable), and depiction of the project area, can be emailed to: briant.long@state.co.us; or, mailed to: Colorado Department of Public Health and Environment, HMWMD-B2 Attn: Brian Long, Solid Waste Compliance Assurance Unit, see address below.

| | |
|---|---|
| **Date and time reported:** | |
| ☐ **Planned management**<br>**Start date:**<br>**Estimated duration:** | ☐ **Unexpected discovery (submit within 24 hours of discovery)**<br>**Discovery date and time:**<br>**Estimated duration:** |
| **Description of planned soil-disturbing activities:** | **Description of activities resulting in RACS discovery/disturbance:** |
| **Description of any access and/or emission control measures already implemented at the site:** | **Description of type and quantity of RACS discovered/disturbance:** |
| ☐ **This is an EMERGENCY management event (submit this form within 24 hours of RACS discovery, and comply with the Minimum Standards to the extent possible during initial management, and fully comply within 48 hours)**<br>**Detail the nature of the emergency (e.g., repair to an active utility line):** | |

**Check the box to indicate which management approach will be utilized on this project:**

| | | |
|---|---|---|
| ☐ **Project Specific RACS Mgmt. Plan**<br>**Submit PSRMP for Division review and approval with this form at least 10 working days prior to commencing RACS disturbing activities.**<br>**RACS disturbance shall not commence until the PSRMP is approved. However, the standard requirements from Section 5.5.7 of the Solid Waste Regulation may be used in the interim after the required notice.** | ☐ **Standard Operating Procedures**<br>**Has the Division approved SOPs for this project?**<br>☐ **Yes, include the name of the SOP here:**<br>**Notification shall be submitted to the Division prior to commencing RACS disturbing activities.**<br>☐ **No, submit SOPs for Division review and approval with this form at least 30 calendar days prior to commencing RACS disturbing activities.** | ☐ **Remediation Plan**<br>**Submit remediation plan for Division review and approval at least 45 calendar days prior to commencing RACS disturbing activities. Remediation shall not commence prior to plan approval.** |
| ☐ **Standard Requirements**<br>**The standard requirements of RACS management are found in Section 5.5.7 of the Solid Waste Regulations. Notification shall be submitted to the Division prior to commencing RACS disturbing activities.** | | ☐ **Risk Based Approach**<br>**Submit a site-specific risk assessment work plan for Division review and approval with this form prior to commencing RACS disturbing activities. RACS disturbance shall not commence until the plan is approved.** |

**Please indicate which program this project will take place under:** ☐ **Solid Waste (general)** / ☐ **Voluntary Cleanup Program (VCUP)** / ☐ **Hazardous Waste Corrective Action (RCRA)** / ☐ **Federal Facilities or CERCLA** / ☐ **Don't Know**

| | | |
|---|---|---|
| **Contact person for entity performing soil-disturbing activity:** | | |
| **Organization, company or agency:** | | |
| **Email:** | **Phone:** | |
| **Name of property owner/operator:** | | |
| **Owner/operator contact (if different):** | | |
| **Email:** | **Phone:** | **Ext:** |
| **Location of property:**<br>(Street address or other location description) | **Street Address:** | |
| | **County:** / **City:** | **Zip:** |
| **General site description:** | | |

Received by:_____ Date:_____

# Appendix D
# Sample Collection Protocols and Analytical Methodologies

# CSWR §5.5 – APPENDIX 5A
# SAMPLE COLLECTION PROTOCOLS AND ANALYTICAL METHODOLOGIES

## 1.0 Purpose

(A) The purpose of this appendix is to establish standard sample collection requirements and analytical methods and procedures for use in identifying and quantifying asbestos fibers in air, bulk material, and environmental media such as soil or ash.

## 2.0 Sample Collection Requirements

(A) The following sample collection requirements shall be followed when collecting samples for the purpose of determining the applicability of Section 5.5, and when collecting samples necessary to comply with the requirements of Section 5.5. Remediation plans submitted in accordance with Section 5.5.6 shall include a site specific sampling and analysis plan that incorporates the sample collection methodologies and analytical procedures in this Appendix, or proposes alternatives, and include site specific clearance criteria.

### 2.1 Bulk Samples

(A) Bulk samples shall be collected, in a manner sufficient to determine whether the material is asbestos-containing material (ACM) or not ACM, from each type of suspect ACM. Bulk samples shall be collected by a State of Colorado certified Asbestos Building Inspector (CABI). In the absence of bulk sample collection, any suspect ACMs must be assumed to be ACMs.

(B) Bulk samples shall be collected by homogenous type based on color, pattern, texture, thickness, associated materials, or by other identifying characteristics. Additionally, the quantity and location of a suspect material shall be used to determine the number of bulk samples required to characterize the asbestos content of each homogeneous suspect material. For the purpose of determining that a homogeneous suspect material does not contain asbestos, a minimum of three (3) bulk samples shall be collected from the homogeneous material unless there is insufficient material to constitute three (3) samples. If one of the collected samples of a homogeneous bulk material is determined to be ACM, then the homogeneous material shall be considered ACM.

## 2.2 Soil Samples

(A) Samples collected to determine asbestos content in soil shall be ten (10) point aliquot composite samples collected from a maximum area of 1,250 square feet (representing 0-6 inches beyond the exposed surface) or a maximum volume of forty (40) cubic yards. Individual aliquots shall be approximately 1/10 of the entire sample volume. At each aliquot location approximately one (1) tablespoon of soil shall be collected. The total volume of the ten (10) aliquots should equal roughly a half cup. The total collected sample volume should be greater than one quarter (¼) cup, but should not exceed one cup. Aliquot locations shall be randomly selected but shall be representative of the entire sample area or volume (to be inclusive of the interior of soil piles in addition to the surface). However, aliquots shall be co-located with any areas where friable ACM was formerly present. All samples collected to determine asbestos content shall be collected by a CABI.

(B) Sampling for clearance purposes of any exposed horizontal or vertical surface shall have the following additional requirements:

1) The aliquots of a clearance sample shall not be collected until after the RACS, and the required amount of associated material, has been removed.

2) A visual inspection shall be performed and passed (i.e., no visible ACM present) by a CABI prior to the collection of soil samples. Visual inspections shall include the following:

   a) The area to be cleared shall be designated before the visual inspection; and
   b) Former locations of friable materials shall be designated; and
   c) The surface being inspected shall be dry enough to allow identification of suspect ACM; and
   d) The visual inspection shall be conducted in adequate lighting; and
   e) The area to be cleared shall be free of visual impediments (e.g. snow cover, plastic sheeting, standing water, etc.); and
   f) At a minimum, the area to be cleared shall be inspected in at least two (2) perpendicular directions; and
   g) Single or multiple inspectors may be used to perform a visual inspection and clearance. However, a single inspector shall not

visually inspect more than a five (5) foot width with each pass [i.e. for a clearance area that is 25' x 50' a single inspector would be required to make at least five (5) passes in one direction (25' length) and at least ten (10) passes in the other direction (50' length)]; and

h) Detailed close examination of the area being cleared is required. The inspector(s) should use limited invasive inspection techniques, such as periodically sifting the surface being cleared and closely inspecting the disturbed area.

3) If sidewalls with six (6) inches or greater of vertical height are present, independent ten (10) point aliquot composite samples shall be collected from each of the sidewalls and the floor of the excavation.

## 2.3 Ash Samples

(A) Ash that contains, or is comingled with, suspect ACM and/or construction and demolition debris shall be considered to be RACS unless the ash is sampled, and analysis demonstrates that the ash is not RACS. Representative samples of each type of ash materials shall be sampled and analyzed in the same manner as soil (including area/volumetric limitations of sampling). Ash samples shall be collected by homogenous strata, location, content of other surrounding material, or other observations indicating heterogeneity of the ash present. All samples collected to determine asbestos content shall be collected by a CABI. In the absence of suspect ACM or construction and demolition debris, and in the absence of documented evidence of non-visible asbestos, ash material may be treated as non-RACS.

## 2.4 Cross Contamination Prevention

(A) All sample collection equipment shall be decontaminated in a manner sufficient to prevent cross contamination between individual samples or individual composite samples. Decontamination is not required between the collection of aliquots comprising a single composite sample.

## 2.5 Air Samples for Standard RACS Management

(A) Air samples shall be collected by drawing air through 0.8-micron (µm), 25-millimeter (mm), mixed cellulose ester (MCE) filters, using an open-faced cowl extension oriented face down at an angle of 45°. Sample flow rate shall be between 0.5-10 liters per minute depending on the anticipated duration of sampling and the specified detection sensitivity. The air sampling equipment

shall be run until the minimum volume required is collected for each sample. However, if the minimum air volume required by the method, and/or to reach the required analytical sensitivity, being utilized cannot be met, the State of Colorado trained and certified Air Monitoring Specialist (AMS) shall request that the laboratory prepare the sample using an indirect preparation method, for TEM presence/absence analysis. Air samples shall be collected at a height that is representative of the disturbance activity taking place. However, air samples shall be located at a height between three (3) feet above the ground surface but not to exceed twenty (20) feet above the ground surface. Air samples shall be collected by an AMS.

2.6 Air Samples for Risk-Based Air Threshold Monitoring

(A) Air samples shall be collected by an AMS. Air monitoring shall be conducted during each partial or full day of soil management activities using fixed and mobile monitors as follows:

1) A minimum of four (4) samples shall be collected for each regulated work area (RWA).
2) For the purpose of determining the number of samples necessary, each RWA shall be divided into four (4) equal quadrants. A minimum of one (1) sample shall be collected for each quadrant with an adjacent receptor zone.
3) If an RWA is greater than one (1) acre, one (1) additional sample for each quadrant with an adjacent receptor zone shall be collected and analyzed for each additional one quarter (¼) acre in RWA surface area.
4) Samples shall be located along the RWA perimeter, between the RWA and each adjacent receptor zone. Samples shall be placed between the RWA and any fixed adjacent receptor(s). In the absence of fixed adjacent receptors, sample placement shall be at the AMS's discretion.
5) The sample volume shall be the minimum necessary to meet analytical sensitivity.
6) Samples shall be collected by drawing air through 0.8-micron (µm), 0.25-millimeter (mm), mixed cellulose ester (MCE) filters, using an open-faced cowl extension oriented face down at an angle of 45°.

## 3.0 Analytical Requirements

(A) The following analytical methods shall be used to evaluate the presence of asbestos and/or to determine asbestos content when analyzing samples for the purpose of determining the applicability of Section 5.5, and when analyzing samples collected in accordance with Section 5.5:

## 3.1 Bulk Samples

(A) Samples of suspect ACM shall be analyzed by polarized light microscopy (PLM), according to United States Environmental Protection Agency (USEPA) Method EPA/600/R-93/116 or equivalent method, to determine if any asbestos fibers are present. If the asbestos content of a sample is estimated to be 1% asbestos or less, but greater than 0%, by a method other than point counting (such as visual estimation), the determination shall be repeated using the point counting technique with PLM. Alternatively, the material may be assumed to be ACM. Analysis shall be conducted by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory.

## 3.2 Soil Samples and Ash Samples

(A) Prior to preparation of a soil or ash sample, bulk materials shall be separated from the soil or ash sample for independent analysis. Any bulk materials identified in a soil or ash sample that contain any amount of asbestos shall be reported as independent layers of the whole sample. The samples shall be adequately prepared (crushed and dried) to facilitate stereomicroscopic analysis by the laboratory. The goal of the preparation process should be to produce dried conglomerates of approximately one eighth inch (1/8”) to one quarter inch (¼”) size. Rock and/or stone material does not need to be crushed (this process is not intended to be homogenization). Soil and ash samples shall be analyzed by PLM according to USEPA Method EPA/600/R-93/116 to determine if any asbestos fibers are present. Analysis shall be conducted by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory. During the stereomicroscopic analysis (10X – 50X) of the soil/ash sample the analyst shall sift through the sample at a rate of approximately one (1) tablespoon per minute. At the end of the stereomicroscopic analysis the sample shall be agitated or shaken as a final check for asbestos prior to the preparation of PLM grab mounts. At no time during the stereomicroscopic analysis shall a sub sample be collected. The entire sample shall be analyzed and the results reported. If no asbestos was identified by PLM after the initial stereomicroscopic examination, then three (3) random grab mount preparations shall be analyzed by PLM to determine if the sample is none detected for asbestos content. If any asbestos is found by the laboratory it shall be reported even in the absence of a second detection (i.e. there does not need to be a second detection to qualify a trace level of asbestos in the sample). Quantification of asbestos content shall be based on the entire sample volume, and be reported as such.

## 3.3 Air Samples for Standard RACS Management

(A) Air samples submitted for Phase Contrast Microscopy (PCM) shall be analyzed according to NIOSH Method 7400 by a laboratory showing successful participation in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program or individual(s) certified through the AIHA Asbestos Analysts Registry (AAR) Program.

(B) Air samples submitted for Transmission Electron Microscopy (TEM), for which quantification of asbestos is desired, shall be prepared and analyzed according to the standard Asbestos Hazard Emergency Response Act (AHERA) method (AHERA; 40 CFR Part 763, Subpart E, Appendix A). All TEM analysis shall be performed by a NVLAP accredited laboratory. If a presence/absence analysis is desired, the analysis shall be performed using the AHERA method modified in the following manner:

1) A minimum of two (2) preparations shall be prepared and utilized for each sample.
2) Analysis shall be conducted on a minimum of four (4) grid openings or until three (3) or more structures are identified, whichever comes first.
3) Any structure (adhering to the AHERA counting rules) identified during analysis shall be reported.
   a) Identification of less than three (3) structures shall be reported as present.
   b) Identification of three (3) or greater structures shall be reported as detected.

(C) Any air sample analysis that results in a “cannot be read (CBR)” determination from the analyst, or a “not analyzed (NA) or rejected” due to loose debris or uneven loading, shall be evaluated by the AMS to determine if a cause of the CBR or NA can be ascertained. If it is determined that the CBR is a result of overloading from airborne emissions, then the AMS shall request that the laboratory prepare the sample, using an indirect preparation method, for TEM presence/absence analysis.

## 3.4 Risk-Based Air Threshold Samples

(A) Air samples collected for TEM analysis shall be submitted to a NVLAP accredited laboratory. Samples shall be analyzed by TEM according to ISO Method 10312 with the following modifications for PCM equivalent (PCMe) structures:

1) An aspect ratio of 3:1 shall be used when counting structures greater than 5 µm in length, rather than the 5:1 ratio specified in the method.
2) A width range of 0.25 to 3 µm will be used when counting PCMe structures, rather than the 0.2 to 3 µm specified in the method.
3) A minimum of ten grid openings will be counted, rather than the minimum of four (4) grid openings specified in the method.
4) Calculations shall be made based on total fibers rather than primary fibers.

(B) The maximum number of grid openings (GOs) to be counted to achieve the specified analytical sensitivity shall be estimated as follows:

$$\text{Number of GOs} = \text{EFA} \div (A_{GO} \times V \times S \times CF)$$

where:

EFA = effective filter area (385 for a 25-mm filter)
$A_{GO}$ = area of a grid opening (approximately 0.01 $mm^2$; actual value to be provided by the analytical laboratory)
V = volume of air sampled (in liters [L])
S = analytical sensitivity (structures per cubic centimeter [s/cc])
CF = conversion factor (1000 cc/L)

(C) Any air sample analysis that results in a “cannot be read (CBR)” determination from the analyst, or a “not analyzed (NA) or rejected” due to loose debris or uneven loading, shall be prepared by the laboratory, using an indirect preparation method, for TEM presence/absence analysis.

## 3.5 Data Evaluation for Risk-Based Air Threshold Samples

(A) General requirements:

1) Samples collected for comparison to risk-based air thresholds shall be evaluated based on the average (mean) concentration over the exposure duration.

2) All valid data shall be used to calculate daily and ten (10) day rolling averages.
3) For all projects a minimum of three (3) samples per day must have quantifiable data (not CBR or rejected). If less than three (3) quantifiable analytical results are available then the daily average is invalid.

(B) Project days 1-9:

1) The results of the daily samples must be averaged to calculate a daily average for use in comparing to the risk based air threshold for days 1-9 of monitoring.
2) A ten (10) day average shall be calculated for days 1-9. The ten (10) day average shall be comprised of at least eight (8) valid daily average results. However, all valid data shall be used to calculate the ten (10) day average.
3) If the ten (10) day average exceeds the risk-based air threshold, engineering controls shall be adjusted to reduce the daily average.
4) The Department shall be notified within 24 hours if the calculations in paragraphs 1 and 2 above cannot be completed due to invalid data.

(C) Project days 10 and greater:

1) Starting on day 10, a ten (10) day rolling average shall be calculated and compared to the risk-based threshold.
2) If average concentration trends indicate the risk-based air threshold will be exceeded before project completion, engineering controls shall be adjusted to reduce the daily asbestos emissions.
3) If subsequent evaluation of average concentration trends indicates that the risk-based air threshold will still be exceeded before project completion, additional adjustments to engineering controls shall be made.
4) If changes in engineering controls are not effective in reducing airborne concentration trends such that the risk-based air thresholds can be met, consultation with the Department is required.
5) The Department shall be notified within five (5) working days if the averaged airborne asbestos concentration for the entire project exceeds the risk-based air threshold.

## 4.0 Documentation

(A) All of the following sampling and analytical documentation shall be maintained during a project and available for Department review upon request. This documentation need not be submitted to CDPHE unless requested or as required in a project specific plan.

1) Documentation of bulk, soil, and ash samples shall include:

    a. A description of the material being sampled including friability.
        i. For samples collected for characterization purposes also include an estimate of the quantity of visible suspected RACS present.
        ii. For samples of ash, also include a brief description of the ash layer, and any associated identifiable debris.
    b. Name of person collecting the sample(s).
    c. Date and time of sample collection.
    d. Location of sample collection (a map, drawing, or diagram showing sample locations in relation to the work area and surrounding area).
    e. The boundary/limits that are represented by the collected sample.
    f. Chain of custody documentation.
    g. Laboratory analysis reports.
    h. Log of characterized homogeneous bulk materials including material descriptions, photographic documentation, and asbestos content.

2) Documentation of air samples shall include:

    a. Name of person collecting the sample(s).
    b. Date and time(s) of sample collection.
    c. Locations of air sample collection.
    d. Any relocation of air samples.
    e. A map, drawing, or diagram showing air sample locations (initial and relocations) in relation to the work area and the surrounding area.
    f. Chain of custody documentation.
    g. Laboratory analysis reports.
    h. Explanation of any air sample malfunctions and any voided air samples.
    i. Risk based air threshold concentration calculations.

j. Air sample data (flow rates, time of sampling, volumes, calibration method, etc.).
k. Wind speed measurements.
l. Prevailing wind directions.
m. Wind shut down events.
n. Observations of visible emissions and responses.

## 5.0 Deviations from Sampling and Analysis Procedures

(A) Deviation from this sampling and analysis appendix shall only be allowed upon consultation with, review by, and approval from, the Department.

**Attachment C**

# 27TH STREET STORM INTERCEPTOR PHASE 2

## SUBSURFACE UTILITY ENGINEERING REPORT

**Prepared For:**

**Kelly Crum, PE**
**City and County of Denver**
**2000 W 3rd Ave.**
**Denver, CO 80223**

**Prepared By:**

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**5970 Greenwood Plaza Blvd.**
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**(303) 751-0741**
**Contact: Christina Ann Wisleder, PE**

**Submitted: June 18, 2019**

MERRICK PROJECT NO. 65419412

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## DISCLAIMER REGARDING UNDERGROUND UTILITIES

Existing utilities are depicted in this report and in accordance with the achieved "Quality Levels" for each utility as defined in the American Society of Civil Engineers' document ASCE 38 "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data" and as Required by C.R.S. 9-1.5-101 et. seq.

As it applies to the depiction of existing underground utility information, the stamp and seal on this report reflect only that depiction of the existing underground utility meets the noted ASCE 38 quality level, and does not serve as a guaranty, representation, or warranty that the depicted utilities exist in the noted locations.

Reliance upon this data for risk management purposes during bidding does not relieve the excavator or utility owner from following all applicable utility damage prevention statutes, policies, and/or procedures during excavation. It is important that the contractor investigates and understand the scope of work and consults with that project owner and the engineer regarding the scope and limits of the investigations leading to these utility depictions.

## CERTIFICATION STATEMENT

This subsurface utility engineering report of 27th Street Storm Interceptor Phase 2 was prepared by me or under my direct supervision in accordance with the achieved "Quality Levels" for each utility as defined in the American Society of Civil Engineers' document ASCE 38 "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data" and as required by C.R.S. 9-1.5-101 et. seq.

By: _____

Christina Ann Wisleder
Licensed Professional Engineer
State of Colorado No. 43395

## PROJECT INTRODUCTION

The following summarizes the results of subsurface utility engineering (SUE) utility designating and investigation for the storm sewer interceptor and improvements project along 27th Street from Arapahoe Street to Welton Street in Denver, Colorado.

## PROJECT LOCATION

Project boundaries were set based on limits of the project scope for the construction of upgraded storm sewer along 27th Street from Arapahoe Street to Welton Street. Full limits of utility investigation are shown in Figure 1.

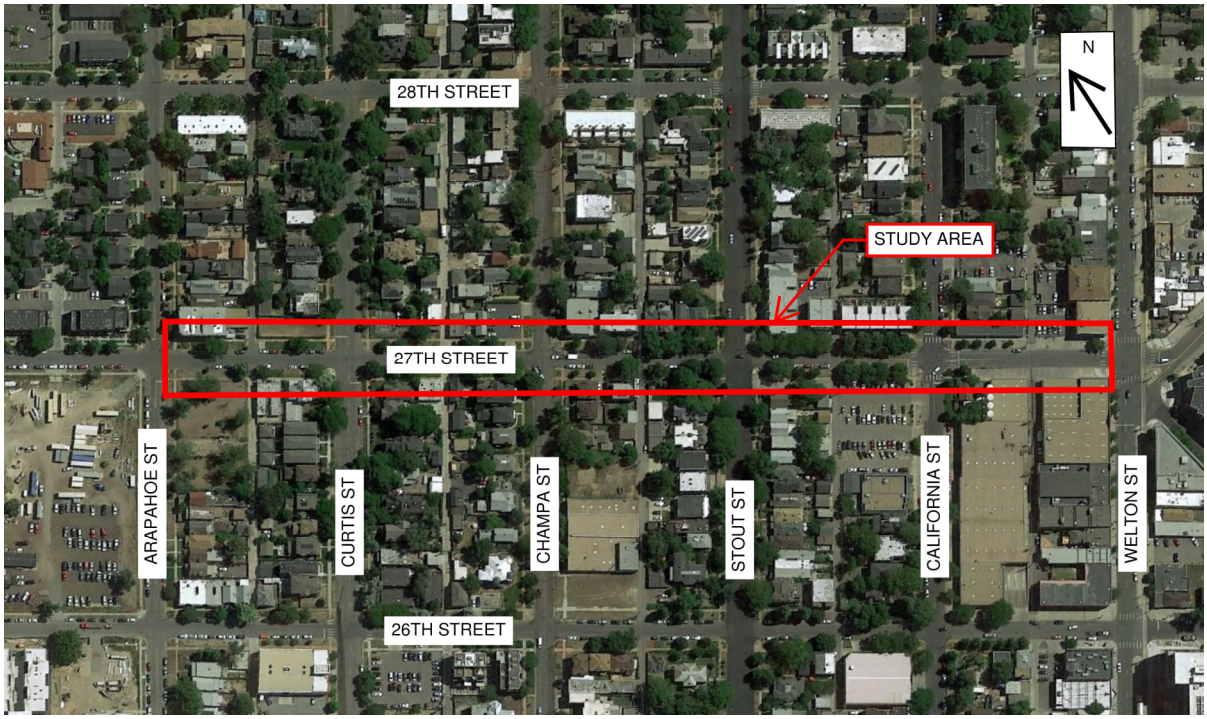



*Figure 1 – Vicinity Map*

## SUE SERVICES PERFORMED

### *Utility Designating*

For the purposes of this work, "designate" means to establish by engineering and drafting practices the presence and horizontal location of subsurface utilities using, to the fullest extend practical, available records and geophysical detection methods, including, magnetic, electromagnetic, and if authorized, ground penetrating radar techniques. Utilities detected and mapped using geophysical methods are designated as quality level B utilities. Subsurface utility locating service obtained mapping of utilities in the project limits and referenced the mapping to designate underground utilities. Underground Consulting Solutions provided the subsurface utilities locating for this project on February 4-5, 2019. Engineering oversight for utility designating was provided for this project.

An 811 Colorado Subsurface Utility Engineering call was placed on November 15, 2018 to determine all underground utility owners in the general proximity of the 27th Street corridor between Arapahoe Street and Welton Street. Results of the call are shown in Table 1.

| 811 Colorado Tier 1 Results | | |
|---|---|---|
| **Company** | **Utility Facilities** | **Notes** |
| CenturyLink | Fiber Optic and Telecommunication | |
| Comcast | Cable TV and Fiber Optic | |
| Crown Castle | Electric and Fiber Optic | No 811 Response |
| Deep Rock Water Company | Fiber Optic and Water | No 811 Response; No known utilities in project limits |
| Denver Public Works | Fiber Optic and Electric | No 811 Response |
| Integra | Fiber Optic | No 811 Response |
| Level 3 (CenturyLink) | Fiber Optic | No 811 Response |
| MCI | Fiber Optic | No 811 Response |
| Viaero Wireless | Fiber Optic and Telecommunication | No 811 Response; No known utilities in project limits |
| Windstream | Fiber Optic and Telecommunication | |
| Xcel Energy Electric | Electric | |
| Xcel Energy Gas | Gas | |
| Xcel Energy Steam | Steam | |
| Xcel Energy Transmission | Electric Transmission | No 811 Response |
| Zayo | Fiber Optic | No 811 Response |
| **811 Colorado Tier 2 Results** | | |
| **Company** | **Utility Facilities** | |
| Denver Parks and Recreation | Water and Irrigation | No known utilities in project limits |
| Denver Water Department | Water | |
| Wastewater Management Division | Sanitary and Storm Sewers | |

*Table 1 –811 Colorado Call Results*

Tier 1 facilities are required to respond to the 811 investigation call with mapping of requested area. Tier 1 facilities that did not respond to the 811 investigation call were contacted to obtain mapping. Tier 2 facility owners within the project area were contacted to obtain mapping.

Merrick and Company provided survey on February 12, 2019 of all surface utility features and utility locates. These surveyed features and utility locates were used to verify locations of mapping provided by utility companies.

### *Utility Ownership and Mapping*

Utility companies listed in the 811 call were contacted and requested to provide maps of all underground facilities or confirm there are no known utilities within the project limits. Table 2 specifies utility ownership and representative contact information for utilities identified within the SUE investigation project limits. Information is current as of the date of submittal and is subject to change.

| Utility Company | Contact Name | Phone / Email |
|---|---|---|
| AT&T | Duane Ward | 720-289-5471<br>Duanew@csc64.com |
| CenturyLink | Maureen Klick<br><br>Robert McLeod | 720-578-3720<br>Maureen.Klick@CenturyLink.com<br><br>Robert.McLeod@CenturyLink.com |
| Comcast | Kip West | Kip_west@cable.comcast.com |
| Denver Traffic | Chad Tavelli | 720-865-4008<br>Chad.tavelli@denvergov.org |
| Denver Wastewater Management | Kelly Crum | 303-446-3668<br>Kelly.Crum@denvergov.org |
| Denver Water | Ray Batts | 720-345-1069<br>Rapheal.batts@denverwater.org |
| Integra (Comcast) | Kip West | 720-347-9992<br>Kip_west@cable.comcast.com |
| Level 3 Communications (CenturyLink) | Travis Hudson | 303-542-6797<br>Travis.Hudson@centurylink.com |
| MCI – Verizon | Lane Grady | 801-301-0937<br>Lany.grady@verizon.com |
| Xcel Energy Electric | Jeramiah Johnson | 303-994-9848<br>Jeramiah.Johnson@xcelenergy.com |
| Xcel Energy Gas | Jeramiah Johnson | 303-994-9848<br>Jeramiah.Johnson@xcelenergy.com |
| Xcel Energy Steam | Jeramiah Johnson | 303-994-9848<br>Jeramiah.Johnson@xcelenergy.com |
| Xcel Energy Transmission | Aaron Geppert | Aaron.g.geppert@xcelenergy.com |
| XO Communications | Josh Hicks | 303-539-3237<br>Josh.D.Hicks@xo.com |
| Zayo | James Black | 719-216-8508<br>jamesr.black@zayo.com |
| Windstream Enterprise | Victor Koth | 720-529-7654<br>Victor.koth@windstream.com |

*Table 2 –Utility Contact Information*

The utility owner mapping was cross-referenced with the utility locating completed by Underground Consulting Solutions to designate underground utilities. Utility owner mapping is included in Appendix A.

### *Test Holes and Expose Utilities*

Utility test holes were performed where an existing utility crosses the proposed storm sewer for location and depth confirmation. Underground Consulting Solutions completed initial test holes July 2017, and the logs are shown in Appendix B. A secondary underground investigation was completed by Brannon in February 2019. Brannon was contracted by the City and County of Denver Wastewater to perform test holes and excavate to expose utilities that were previously unable to be found. Underground Consulting Solutions performed additional test holes on April 8 and 9, 2019. to excavate several additional utility lines that were not originally found.

## SUE INVESTIGATION

### *Quality Level Descriptions*

Quality Levels are defined by American Society of Civil Engineers (ASCE) in the ASCE 38 "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data". The definitions are described below:

Quality Level A: Precise horizontal and vertical location of utilities obtained by the actual exposure (or verification of previously exposed and surveyed utilities) and subsequent measurement of subsurface utilities, usually at a specific point. Minimally intrusive excavation equipment is typically used to minimize the potential for utility damage. A precise horizontal and vertical location, as well as other utility attributes, is shown in plan documents.

Quality Level B: Information obtained through the application of appropriate surface geophysical methods to determine the existence and approximate horizontal position of subsurface utilities. Quality level B data should be reproducible by surface geophysics at any point of their depiction. This information is surveyed to applicable tolerances defined by the project and reduced onto plan documents.

Quality Level C: Information obtained by surveying and plotting visible above-ground utility features and by using professional judgement in correlating this information to quality level D information.

Quality Level D: Information derived from existing records or oral recollections.

### *Utility Quality Levels*

Quality level A investigation is required for all existing utilities that cross a proposed gravity line per C.R.S. 7-1.5-101 et. seq. The test hole logs from both Underground Consulting Solutions and

Brannon are shown in Appendix B. Several utilities could not be found during the test hole process and can not be classified as QL A utilities. These unfound utilities are shown below in Table 3.

| Test Hole Number | Utility | Station | Comments |
|---|---|---|---|
| 1 | Unknown | 1021+46.75 | Location obtained. Owner Unknown. |
| PH 2 | Water | 1026+58.80 | Performed by Aztec prior to Merrick's design involvement. Does not meet QL A requirements per ASCE 38.02 |
| 3 | Unknown | 1022+90.84 | Location not found. |
| 5 | Unknown | 1023+04.11 | Location obtained. Owner unknown. |
| 81 | Denver Water | 1019+81.10 | Concrete encountered. Utility not found. |
| 93 | CenturyLink Fiber | 1023+03.10 | Not required to be QL A. Concrete encountered. Utility not found. |
| 94 | CenturyLink Fiber | 1023+05.52 | Not required to be QL A. Concrete encountered. Utility not found. |
| 97 | CenturyLink Fiber | 1023+30.23 | Not required to be QL A. Concrete encountered. Utility not found. |
| 100 | Denver Water | 1023+69.72 | Concrete encountered. Utility not found. |
| 203 | CenturyLink Fiber | 1023+12.85 | Concrete encountered. Utility not found. |
| 204 | CenturyLink Fiber | 1023+15.20 | Concrete encountered. Utility not found. |
| 206 | Sanitary Sewer | 1025+59.30 | Concrete encountered. Utility not found. |

*Table 3 – Unknown Test Hole Information*

Test holes 209 and 210 were performed to locate an existing sanitary sewer line that crosses the proposed storm sewer. These two test holes were incorrectly identified as sanitary sewer. The depth and location of the sanitary sewer line was then located by interpolating the invert elevations from survey shots of manhole depths.

Utilities located during the underground utility designating process meet quality level B. This includes existing Denver Water water lines; Xcel Energy gas lines; Xcel Energy electric lines; CenturyLink, Comcast, Integra, Level 3 Communications, MCI, Xcel, and Zayo fiber optic lines. The limits of QL B underground utilities designated is limited to the 27th Street right of way. All located utilities outside of the 27th Street right of way only meet QL D. These utilities are shown in the plans accordingly.

The existing sanitary and storm sewer lines do not meet quality level B and are identified as quality level C due to the absence of tracer wires on the pipes. The locations sketched in the plans are based on mapping and construction plans provided by the City of Denver and correlated to surveyed surface features. All manholes were dipped for pipe invert elevations to confirm elevations and pipe slopes shown on mapping.

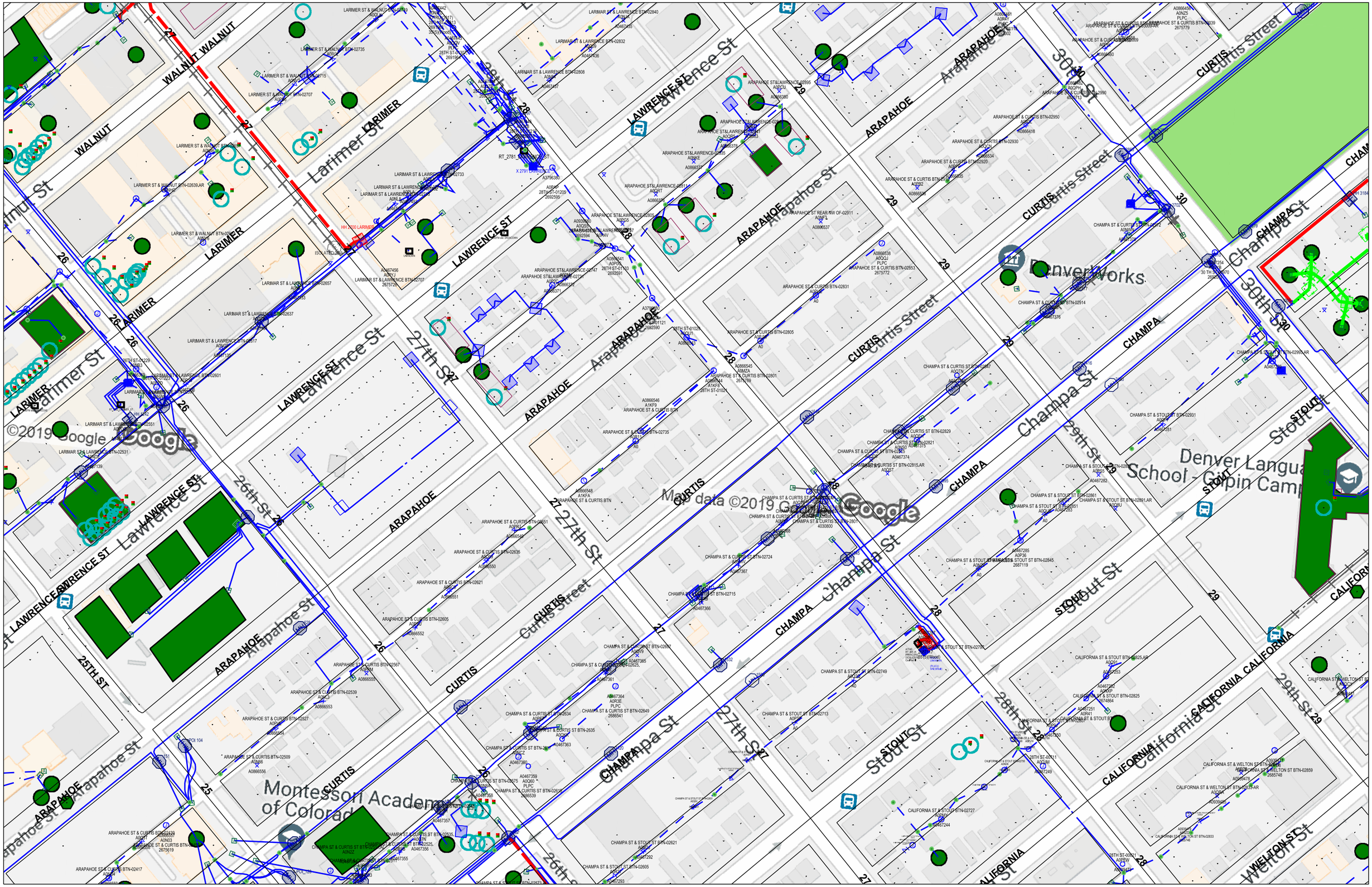
There are three fiber optic lines that are identified on the plans as Quality Level D for the entire length, due to unknown ownership of the lines. Two of these lines are shown running parallel to Curtis Street, and the third line is in the alley between Curtis Street and Champa Street.

Utilities are depicted on these plans in accordance with their achieved "quality levels" as defined in the ASCE document ASCE 38, "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data." Reliance upon these data for risk management purposes during bidding does not relieve the excavator or utility owner from following all applicable utility damage prevention statutes, policies, and/or procedures during excavation. It is important that the contractor investigates and understands the scope of work between the project owner and their engineer regarding the scope and limits of the utility investigations leading to these utility depictions.

# APPENDICES

# Appendix A

***Utility Mapping***



WALNUT WALNUT
LARIMER
LAWRENCE ST
ARAPAHOE
CURTIS
CHAMPA
STOUT
CALIFORNIA
WELTON ST
Larimer St
Lawrence St
Arapahoe St
Curtis Street
Champa St
Stout St
California St
27th St
26th St
25TH ST
28th St
29th St
30th St
Denver Works
Denver Langua
School - Gipin Camp
Montessori Academy
of Colorado
©2019 Google
Map data ©2019 Google

Map data ©2019 Google
Google
CURTIS
Curtis Street
CHAMPA
Champa St
27th St
STOUT
Stout St
CALIFORNIA
California St
28th St
29th St
WELTON ST
GLENARM PL
Glenarm Pl
DOWNING ST
E 27 AVE
26th St
27th & Welton Station
Five Points Jazz Festival
Denver Motor Vehicle
Anna Jo Garcia Hanes Child
TREMONT PL
E 26 AVE
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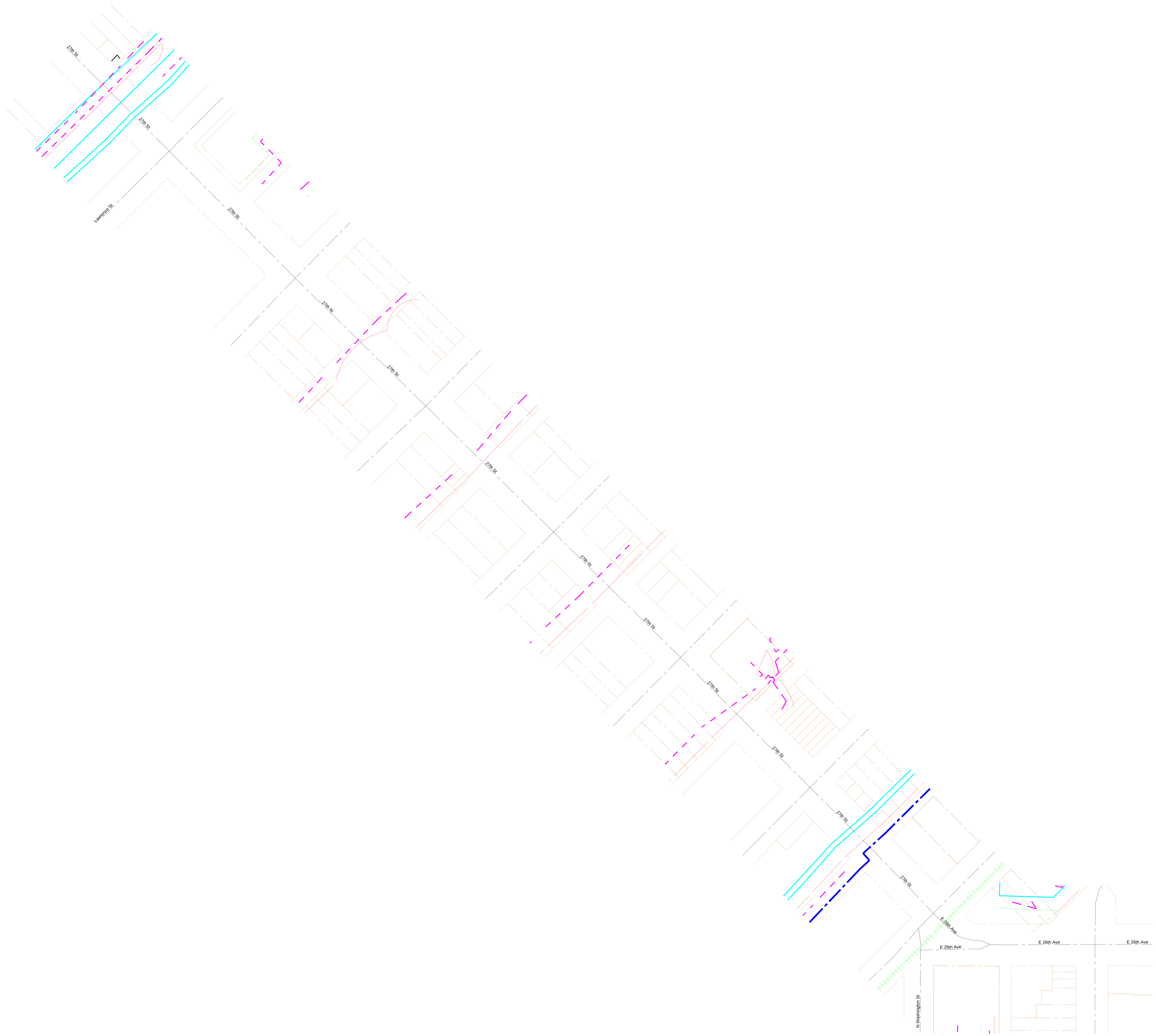
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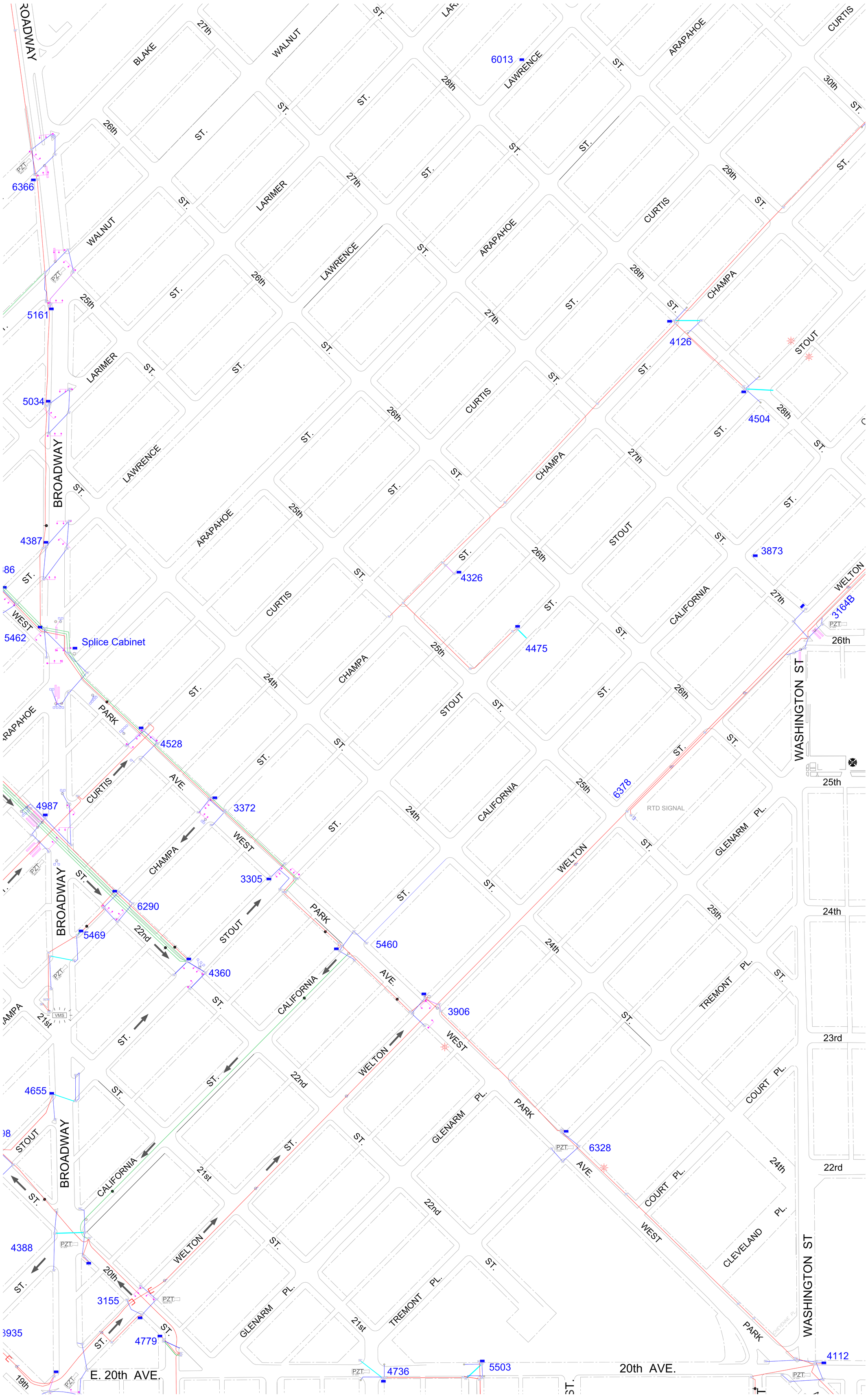
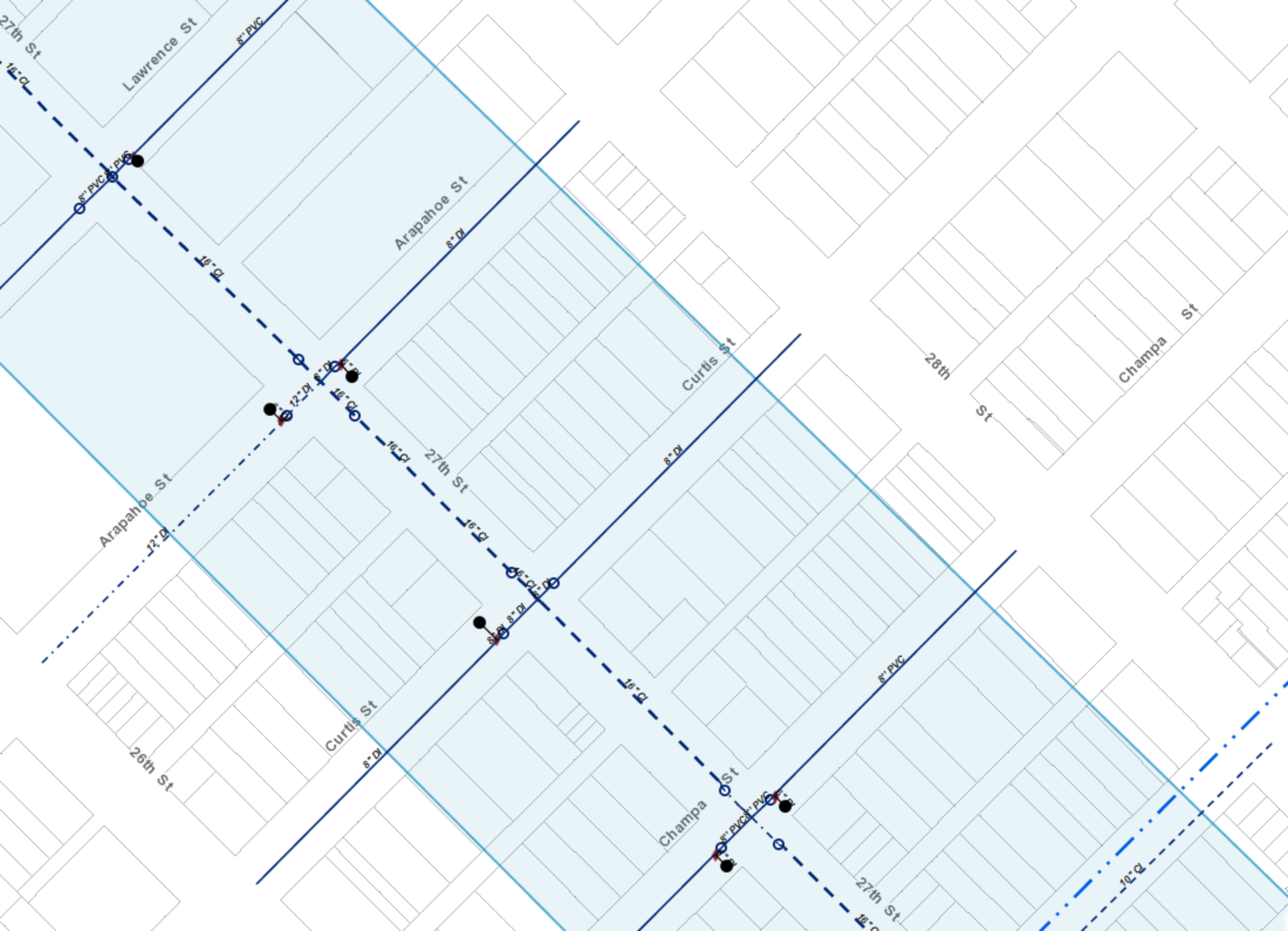
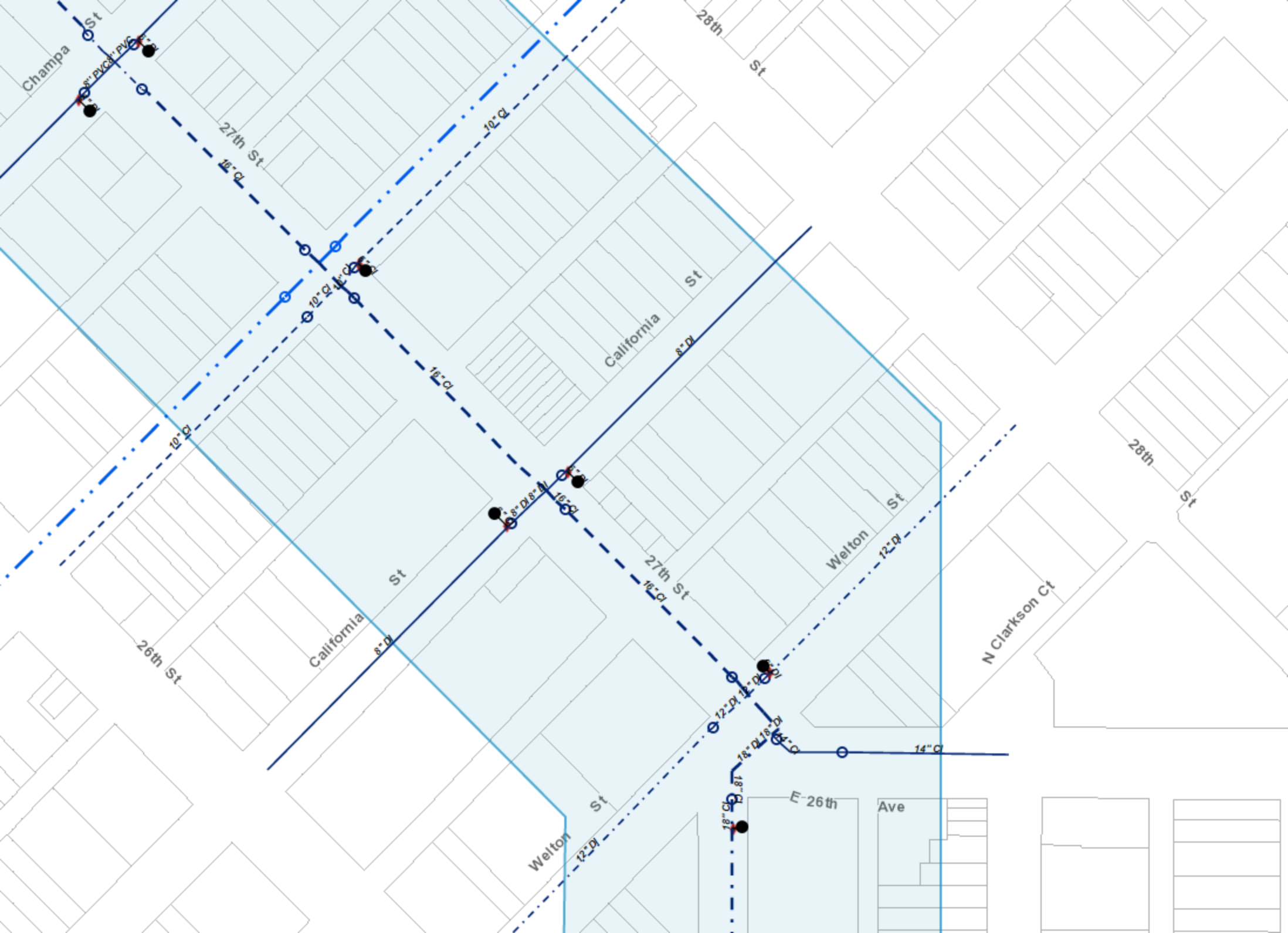


BROADWAY
WALNUT
BLAKE
LARIMER
LAWRENCE
ARAPAHOE
CURTIS
CHAMPA
STOUT
CALIFORNIA
WELTON
PARK
AVE.
WEST
GLENARM PL.
TREMONT PL.
COURT PL.
CLEVELAND PL.
WASHINGTON ST
E. 20th AVE.
20th AVE.
6013
6366
5161
5034
4387
5462
Splice Cabinet
4126
4504
4326
4475
3873
3164B
4528
3372
4987
6378
RTD SIGNAL
3305
6290
5469
4360
5460
3906
4655
6328
4388
3155
4779
4736
5503
4112



27th St
Lawrence St
8" PVC
16" CI
8" PVC
8" PVC
Arapahoe St
8" DI
16" CI
12" DI
8" DI
16" CI
27th St
Curtis St
8" DI
28th St
Champa St
Arapahoe St
12" DI
16" CI
16" CI
8" DI
8" DI
16" CI
8" PVC
Curtis St
8" DI
26th St
Champa St
8" PVC
8" PVC
27th St
10" CI


Champa St
28th St
27th St
California St
Welton St
26th St
N Clarkson Ct
E 26th Ave
8" PVC
10" CI
16" CI
8" DI
12" DI
14" CI
18" DI

**Legend**

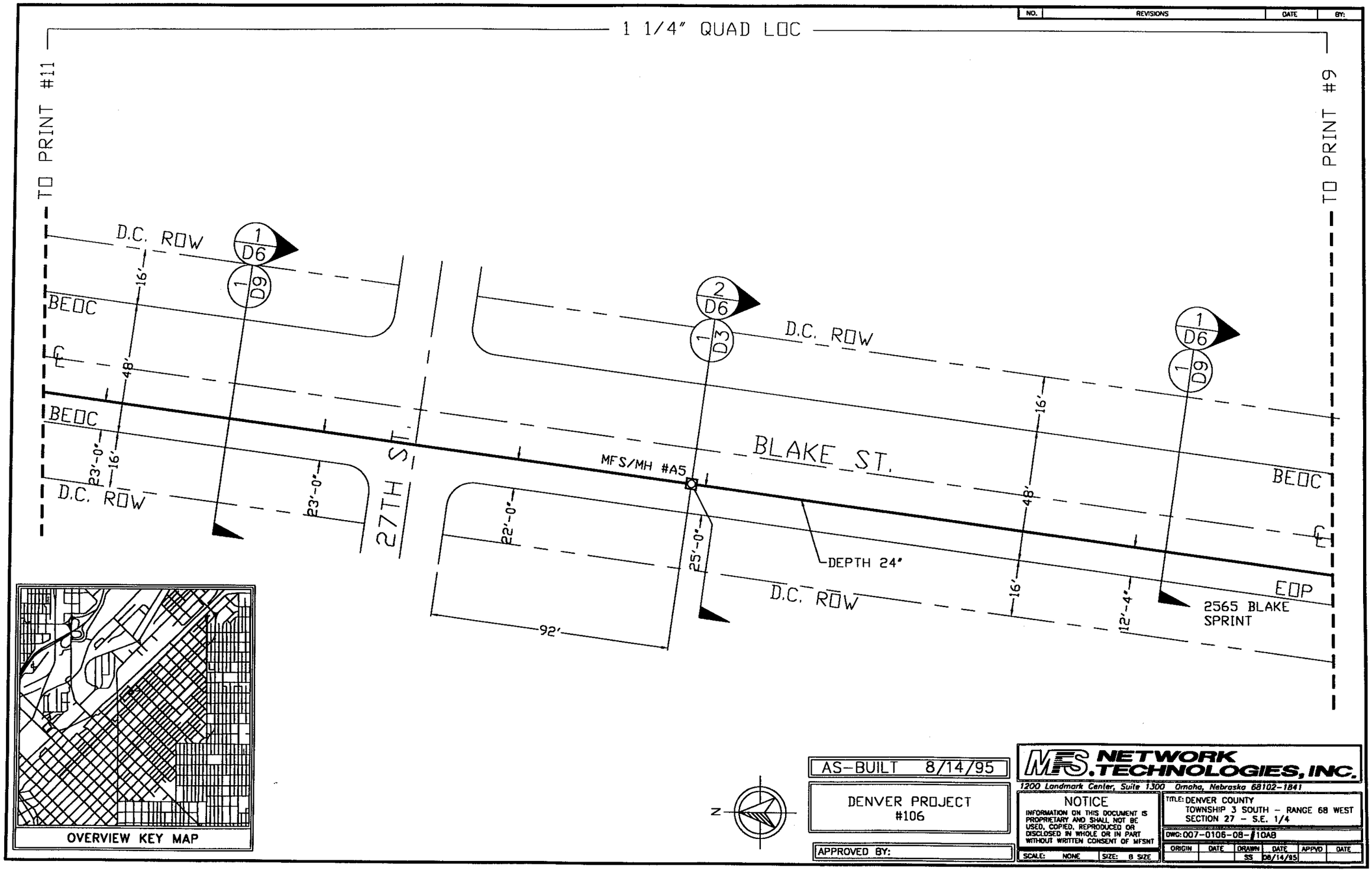
**Level 3 Facilities**

- Aerial
- Underground

**Non-Level 3 Fiber Optic Facilities**

- Aerial
- Underground

*Note that the locations of Facilities shown on these drawings are only approximate and Level 3 hereby disclaims any responsibility to third parties for the accuracy of this information. Persons working in the area covered by these drawings must contact the statewide Call-Before-You-Dig System to ascertain the location of underground facilities prior to performing any excavation.*



1 1/4" QUAD LOC
TO PRINT #11
TO PRINT #9
D.C. ROW
BEOC
BEOC
D.C. ROW
D.C. ROW
D.C. ROW
BLAKE ST.
27TH ST.
MFS/MH #A5
DEPTH 24"
EOP
2565 BLAKE SPRINT
1 D6
1 D9
2 D6
1 D3
1 D6
1 D9
16'
48'
23'-0"
16'
23'-0"
22'-0"
25'-0"
92'
16'
48'
16'
12'-4"
OVERVIEW KEY MAP
AS-BUILT 8/14/95
DENVER PROJECT #106
APPROVED BY:
NETWORK TECHNOLOGIES, INC.
1200 Landmark Center, Suite 1300 Omaha, Nebraska 68102-1841
NOTICE
INFORMATION ON THIS DOCUMENT IS PROPRIETARY AND SHALL NOT BE USED, COPIED, REPRODUCED OR DISCLOSED IN WHOLE OR IN PART WITHOUT WRITTEN CONSENT OF MFSNT
SCALE: NONE
SIZE: B SIZE
TITLE: DENVER COUNTY
TOWNSHIP 3 SOUTH - RANGE 68 WEST
SECTION 27 - S.E. 1/4
DWG: 007-0106-08-10AB
ORIGIN
DATE
DRAWN
DATE
APPVD
DATE
SS
08/14/95

| NO. | REVISIONS | DATE | BY: |
|---|---|---|---|

1 1/4" QUAD LOC

TO PRINT #27

TO PRINT #29

2 D6

1 D3

D.C. ROW

CONCRETE SIDEWALK

BEOC

10'

12'

MFS/MH #A16

16'

9'

48'

9'

DEPTH 24'

CONCRETE SIDEWALK

1 D6

1 D9

D.C. ROW

16'

BEOC

28TH ST.

12'

16'

D.C. ROW

CURTIS ST.

9'

48'

9'

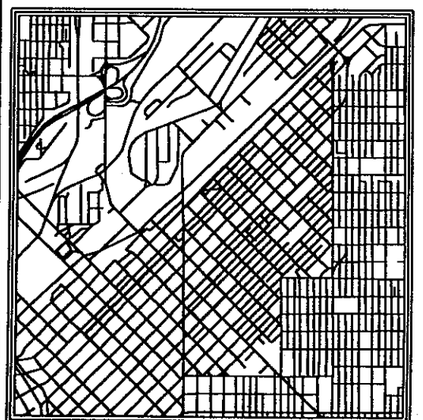
BEOC

16'

D.C. ROW

BEOC

27TH ST.



OVERVIEW KEY MAP

N

AS-BUILT 8/14/95

DENVER PROJECT
#106

APPROVED BY:

MFS NETWORK TECHNOLOGIES, INC.

1200 Landmark Center, Suite 1300 Omaha, Nebraska 68102-1841

NOTICE

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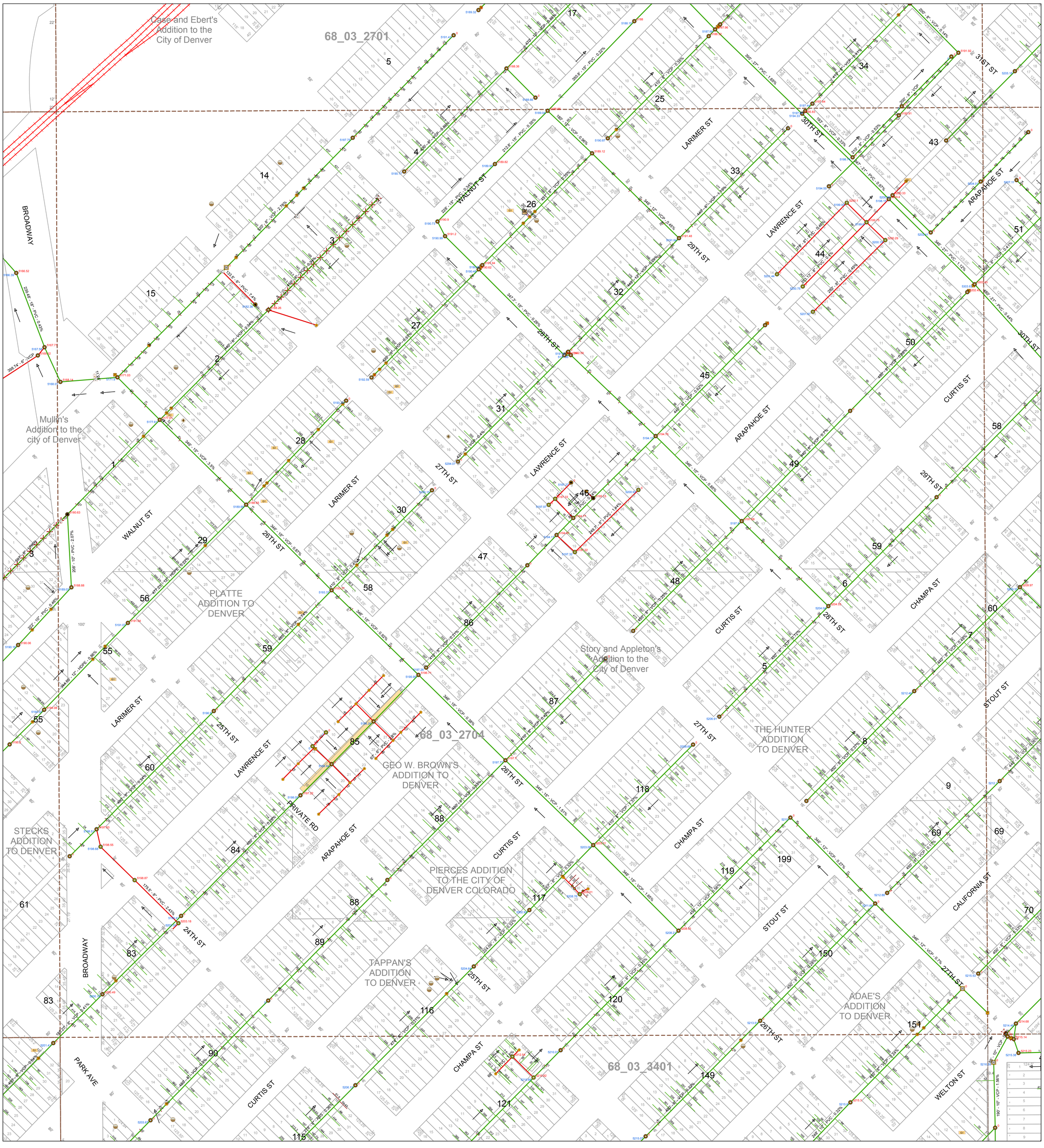
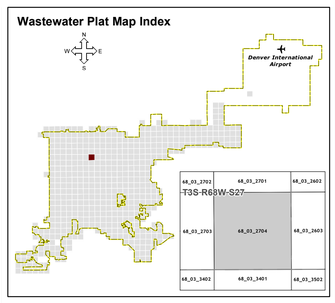
TITLE: DENVER COUNTY
TOWNSHIP 3 SOUTH – RANGE 68 WEST
SECTION 27 – S.E. 1/4

DWG: 007-0106-08-128AB

| SCALE: | NONE | SIZE: | B SIZE |
|---|---|---|---|

| ORIGIN | DATE | DRAWN | DATE | APPVD | DATE |
|---|---|---|---|---|---|
| | | SS | 08/15/95 | | |




## Legend

- Lot Lines
- Row
- Railroad

**Sanitary Manholes**
- Public Sanitary Manhole
- Private Sanitary Manhole
- Metro Sanitary Manhole
- Public High Point Manhole
- Private High Point Manhole
- Public Split Flow Manhole
- Private Split Flow Manhole
- Public Tap Manhole
- Private Tap Manhole
- Public Meter
- Private Meter

**Sanitary Fittings**
- Tap Fitting
- High Point Fitting
- Presumed Fitting
- Split Flow Fitting
- Gradebreak
- Cap
- Connector
- Coupling
- Junction
- Plug
- Tee
- Rubber Gasket
- Unknown

**Sanitary Structures**
- High Point Structure
- Tap Structure
- Split Flow Structure
- Diversion Chamber
- Junction Chamber
- Headwall
- Diversion Point
- Pump
- Lift Station
- Unknown

**Sanitary Pretreatment Facilities**
- Tap Pretreatment
- Industrial Waste Sample Site
- GI - Grease Interceptor
- AN - Acid Neutralization
- LT - Lint Trap
- HT - Hair Trap
- SO - Sand_Oil
- VR - Variance
- OT - Other

**Sanitary Cleanouts**
- Cleanout
- Tap Cleanout
- Split Flow Cleanout
- FlushingStructure
- LampHole

**Sanitary Mains**
- Public Collector
- Private Collector
- Metro Collector
- Public Interceptor
- Private Interceptor
- Metro Interceptor
- Public Force
- Private Force
- Metro Force
- Public Inverted Siphon
- Private Inverted Siphon
- Detention Pipe
- Box Culvert
- Encased
- Pretreatment
- Industrial Waste
- Stubout
- Unknown
- Abandoned

**Sanitary Service Lines**
- Tap
- Tap Cutoff
- Tap Manhole
- Wye
- Riser
- Sanitary Pipe Direction Arrow

**Sanitary Casing**
- Casement
- Access Tunnel
- Protective Tunnel
- Conduit Bridge

**Sanitary Easement**
- Sanitary Easement
- Saniatary Crossing Permit
- Sanitary Fee Title
- Sanitary License Agreement

**Reference**
- Canal
- Creek
- River
- Plat Index Boundary
- Lakes
- County Boundary

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CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
WASTEWATER MANAGEMENT DIVISION

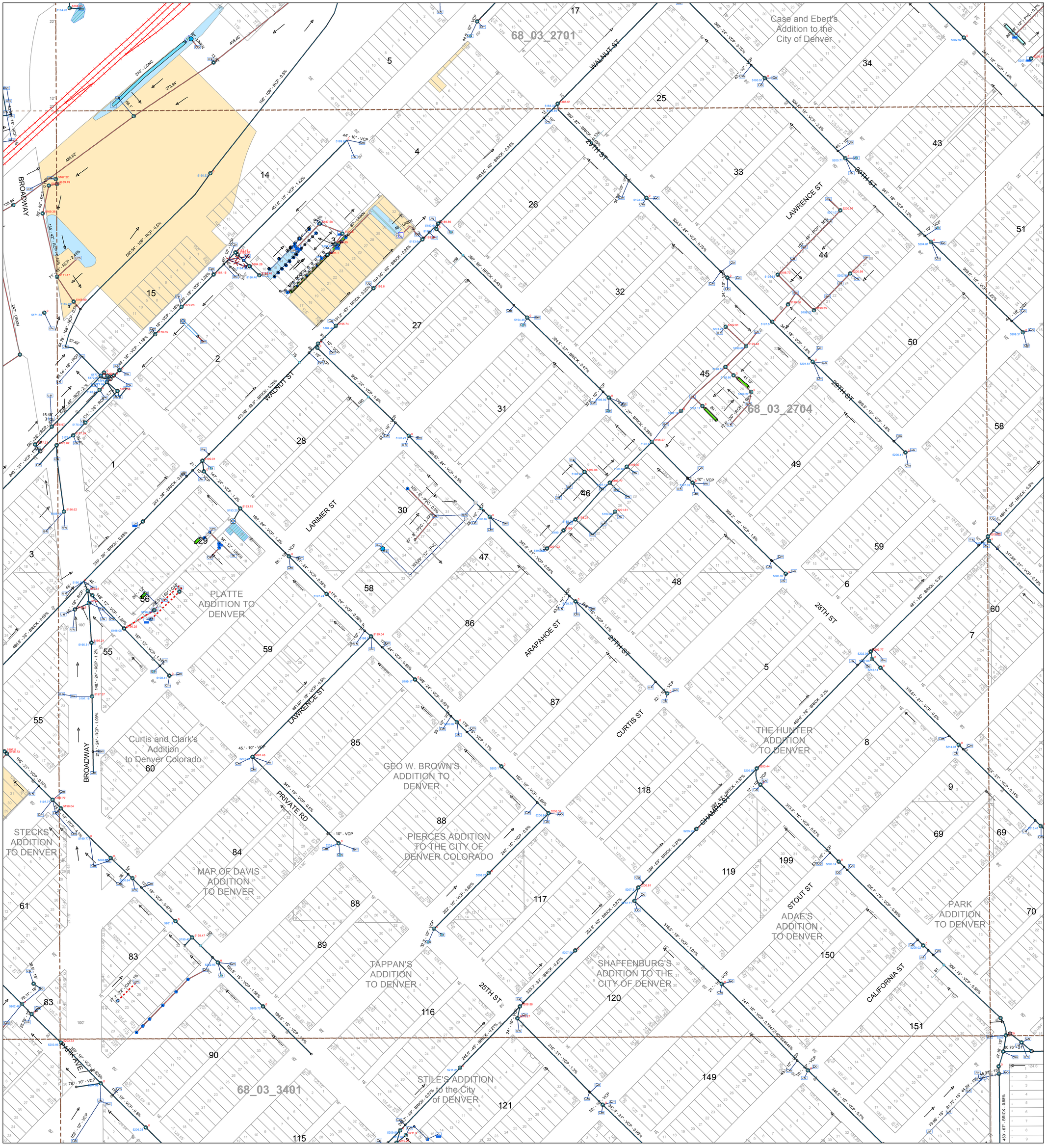
# SANITARY

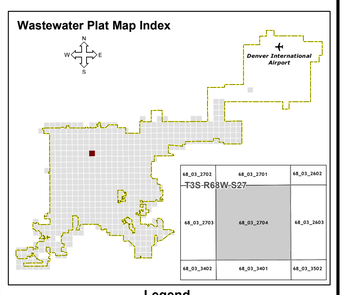
Revision Date: 3/26/2016

68_03_2704

100 50 0 100
Feet

Projection Stateplane
Units U.S. Survey Feet
Colorado Central Zone 502
Horizontal Datum NAD 83/92 HARN
Vertical Datum NAVD 88




## Legend

- Lot Lines
- Row
- Railroad

**Storm Manhole**
- Storm Manhole
- Split Flow Manhole
- Tap Manhole
- High Point Manhole
- Meter

**Storm Taps**
- Tap
- Tap Cutoff
- Riser

**Storm Inlet**
- Grated
- Combination
- Curb Opening
- Other Inlet
- Tap Inlet
- Unknown

**Storm Fitting**
- Cap
- Connector
- Gradebreak
- High Point Fitting
- Junction
- Plug
- Presumed Fitting
- Rubber Gasket
- Split Flow Fitting
- Tap Fitting
- Tee
- Unknown

**Storm Cleanout**
- Cleanout
- Tap Cleanout
- Flushing Structure
- Lamphole

**Storm Outfall**
- Outfall
- Tap Outfall
- Siphon Outfall
- Flared End Section
- Headwall

**Storm Structure**
- Drop Structure
- Outlet Structure
- Split Flow Structure
- Tap Structure
- Check Dam
- Pump Station
- Vault
- Sump
- Forebay
- Unknown

**Storm Main**
- Public Storm Pipe
- Private Storm Pipe
- Public Force Main
- Private Force Main
- Public Detention Pipe
- Private Detention Pipe
- Open Channel
- Trickle Channel
- Under Drain
- Trench Drain
- French Drain
- Box Culvert
- Encased
- Inverted Siphon
- Stubout
- Lateral
- Unknown
- Abandoned

**Storm Tap Service Lines**
- Tap
- Tap Cutoff
- Tap Manhole
- Riser

**Storm Casing**
- Casement
- Conduit Bridge
- Access Tunnel
- Protective Tunnel
- Plat Index Boundary

**Storm Stream Network**
- Ditch
- Gulch
- Irrigation Ditch
- Swale
- Potential Missing Pipes
- Presumed Surface Flow
- Thalweg
- Lake Flow Through
- Stream

**Storm Detention Pond**
- Detention Pond
- Retention Pond
- Water Quality Pond
- RipRap
- Swale
- Unknown
- Lakes

**Reference**
- PNEE or EIA Easement
- Storm Easement
- Storm Pipe Direction Arrow

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CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
WASTEWATER MANAGEMENT DIVISION

**STORM**

Revision Date: 3/28/2016

68_03_2704

100 50 0 100
Feet

Projection Stateplane
Units U.S. Survey Feet
Colorado Central Zone 502
Horizontal Datum NAD 83/92 HARN
Vertical Datum NAVD 88

2145154
05/30/2019

26TH ST

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Xcel Energy®

Scale: 1" equals 67'

2145154
05/30/2019

26TH ST

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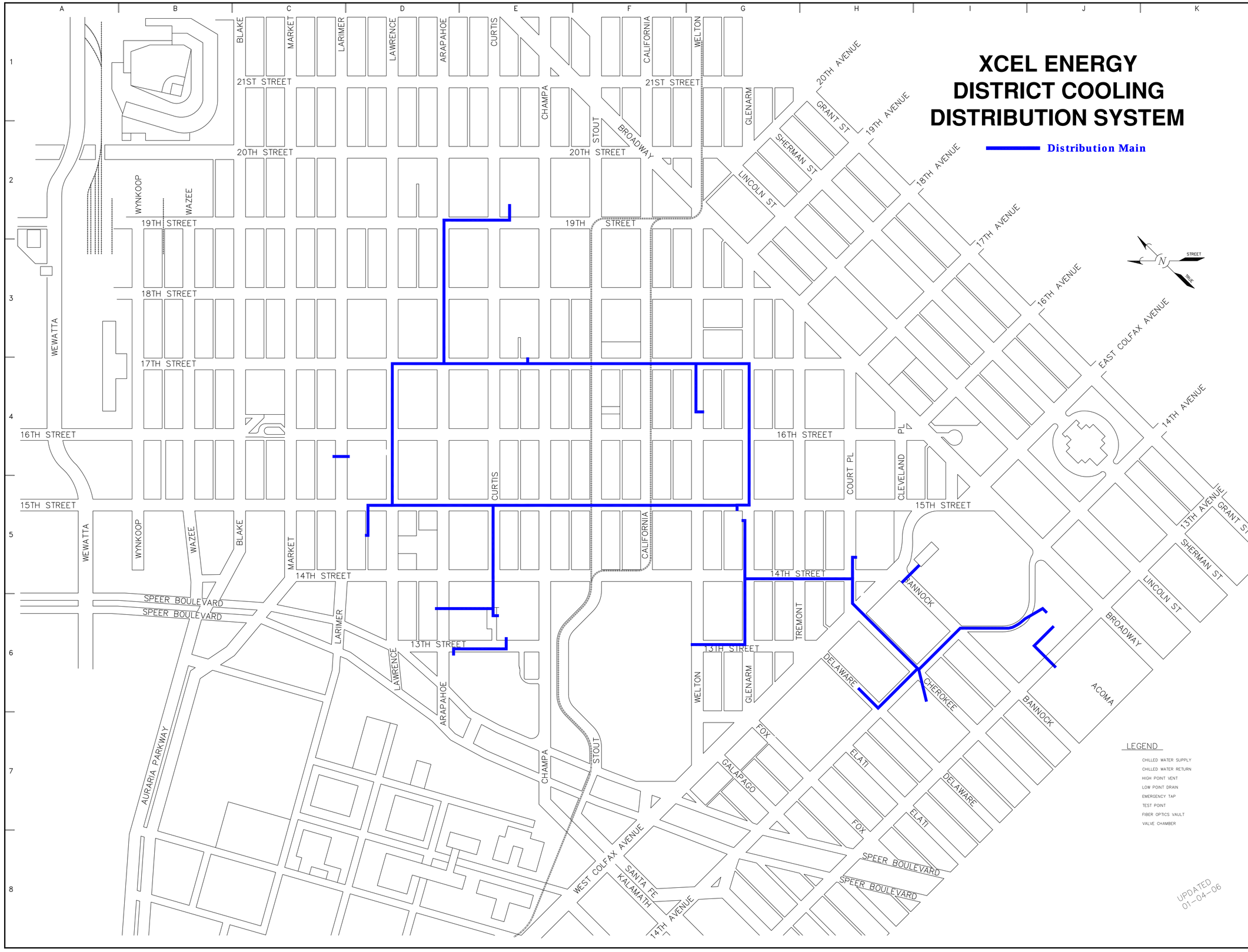
Xcel Energy®

Scale: 1" equals 67'

# XCEL ENERGY DISTRICT COOLING DISTRIBUTION SYSTEM

Distribution Main




DRAWING TITLE
REFERENCE DRAWINGS
MANUFACTURER
DWG NO
PLOTTED BY AUTOCAD REL. 14.0 ON 06-01-99 AT 12:32

| REVISION | | | | | |
|---|---|---|---|---|---|
| 3 | 01-04-06 | GAH | UPDATED | | |
| 2 | 08-24-05 | GAH | UPDATED | | |
| 1 | 05-15-03 | GAH | UPDATED | | |
| 0 | 06-01-99 | GEJ | INITIAL ISSUE | | |
| NO | ZONE | DATE | BY | CHK | |

DENVER DISTRICT COOLING
DISTRIBUTION SYSTEM MAP

PUBLIC SERVICE COMPANY OF COLORADO®
A xcel energy company

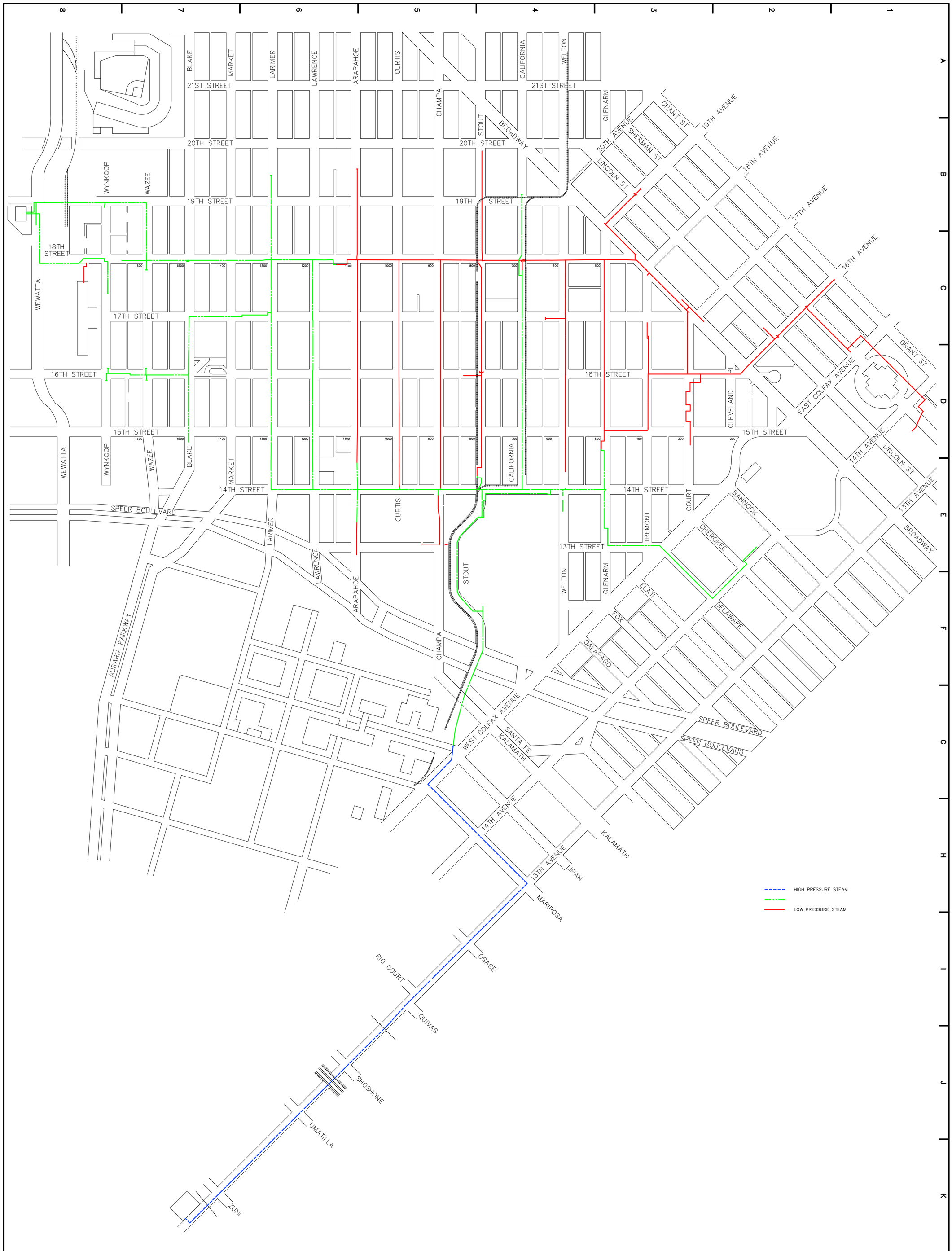
FILENAME: 5211020-01
R-CODE: 9703391
SCALE: NONE

DWN: GEJ DATE: 03-16-98
CHK: T.F. DATE: 03-24-99

52-11.020

SHEET 1 REV 3

MF NO




| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 12-8-97 | | GAH | UPDATE | | | | | | | | | | | | | |
| 8 | 01-26-95 | | GEJ | UPDATE | X | | | | | | | | | | | | |
| 7 | 11-21-93 | | GEJ | UPDATE | X | | | | | | | | | | | | |
| 6 | 11-22-93 | | GEJ | UPDATE | | | | | | | | | | | | | |
| 5 | 01-15-93 | | GEJ | UPDATE | | 14 | 01-31-07 | | GAH | UPDATE | | | | | | | |
| 4 | 01-20-92 | | GAH | UPDATE | | 13 | 02-06-04 | | GAH | UPDATE | | | | | | | |
| 3 | 12-05-90 | | GAH | UPDATE | | 12 | 02-08-02 | | GAH | UPDATE | | | | | | | |
| 2 | 07-16-90 | | GAH | UPDATE | | 11 | 01-06-00 | | GAH | UPDATE | | | | | | | |
| 1 | 01-16-90 | | GAH | UPDATE | | 10 | 01-05-99 | | GAH | UPDATE | | | | | | | |
| NO | DATE | BY | CHK | REVISION | MF | NO | DATE | BY | CHK | REVISION | MF | | | | | | |

| DWG NO | MANUFACTURER | DRAWING TITLE |
|---|---|---|
| | | REFERENCE DRAWINGS |

SHEET 1 OF 1 | REV 13

53-11.261

DWN: GEJ DATE: 05-16-83
CHK: DATE:

PUBLIC SERVICE COMPANY OF COLORADO℠
A NEW CENTURY ENERGIES COMPANY

THERMAL ENERGY
P.O. BOX 840
DENVER COLORADO 80201-0840

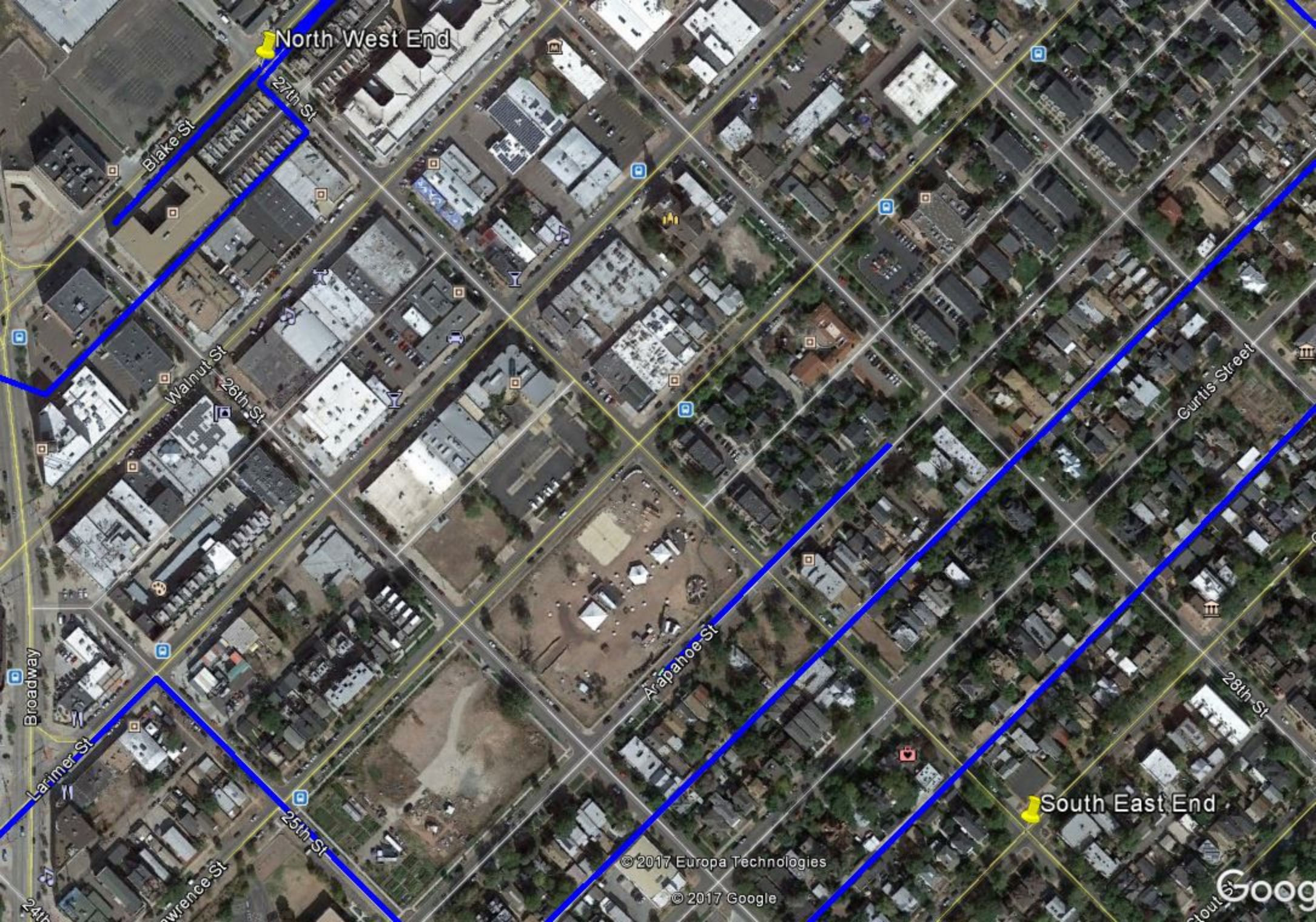
# DENVER STEAM HEAT

DISTRIBUTION SYSTEM
SYSTEM MAP AND
TIE LINE

FILENAME: H0530009
R-CODE:
SCALE: NONE

MF NO

PLOTTED BY AUTOCAD REL 13_C4 ON 12-11-97 AT 11:09


North West End
27th St
Blake St
Walnut St
26th St
Curtis Street
Arapahoe St
28th St
Broadway
Larimer St
25th St
South East End
© 2017 Europa Technologies
© 2017 Google

# Appendix B

***Subsurface Utility Locating Service Documentation***

Pg 1 of 3

# Underground Consulting Solutions

**Private/Engineering Facility Location Sketch**

E

Work Address 27th & ARAPAHOE

Contractor Name MERRICK

Billing Address ON FILE

City/State/Zip DENVER

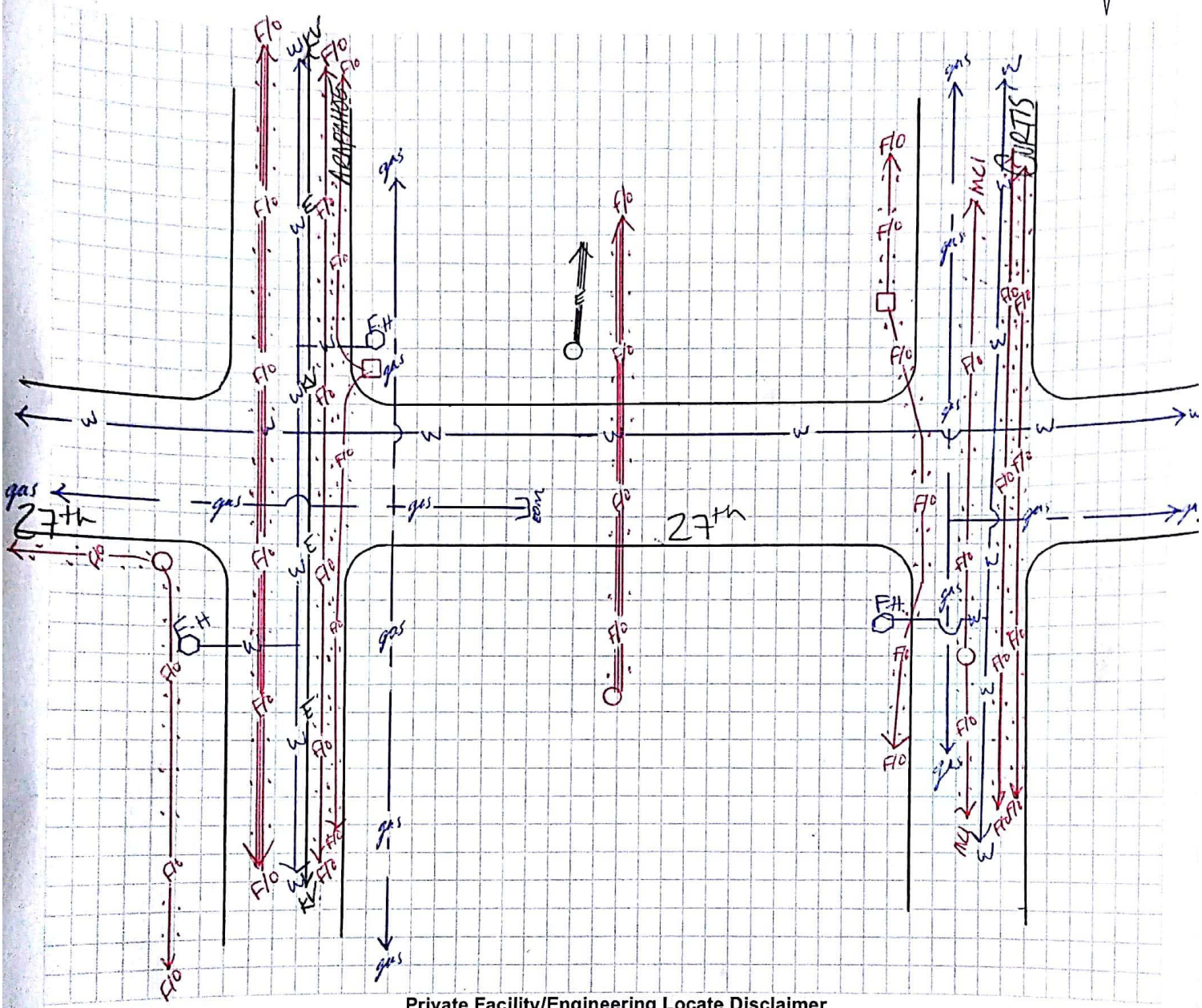
Contact Name MARK MILLER

Contact Phone # 303-353-3731

Date 1-2-19

Charge $ 15 HRS

N




**Private Facility/Engineering Locate Disclaimer**

I, _____, as representative for _____(Name of Company) understand that this locate is being performed by electronic devices and that there are no guarantees, written or implied. The aforementioned company shall indemnify and hold UCS, its clients, its agents, employees, all persons claiming hereunder harmless from and against any and all claims, damages, losses, and expenses, including attorney's fees, relating to, arising out of, or resulting from the performance of the work, or the accuracy of the locate itself. •Acceptance and usage of this sketch without signature will constitute agreement of such terms.

x NICK T.
UCS

x _____

Company: _____

Scanned by CamScanner

PG 2 OF 3

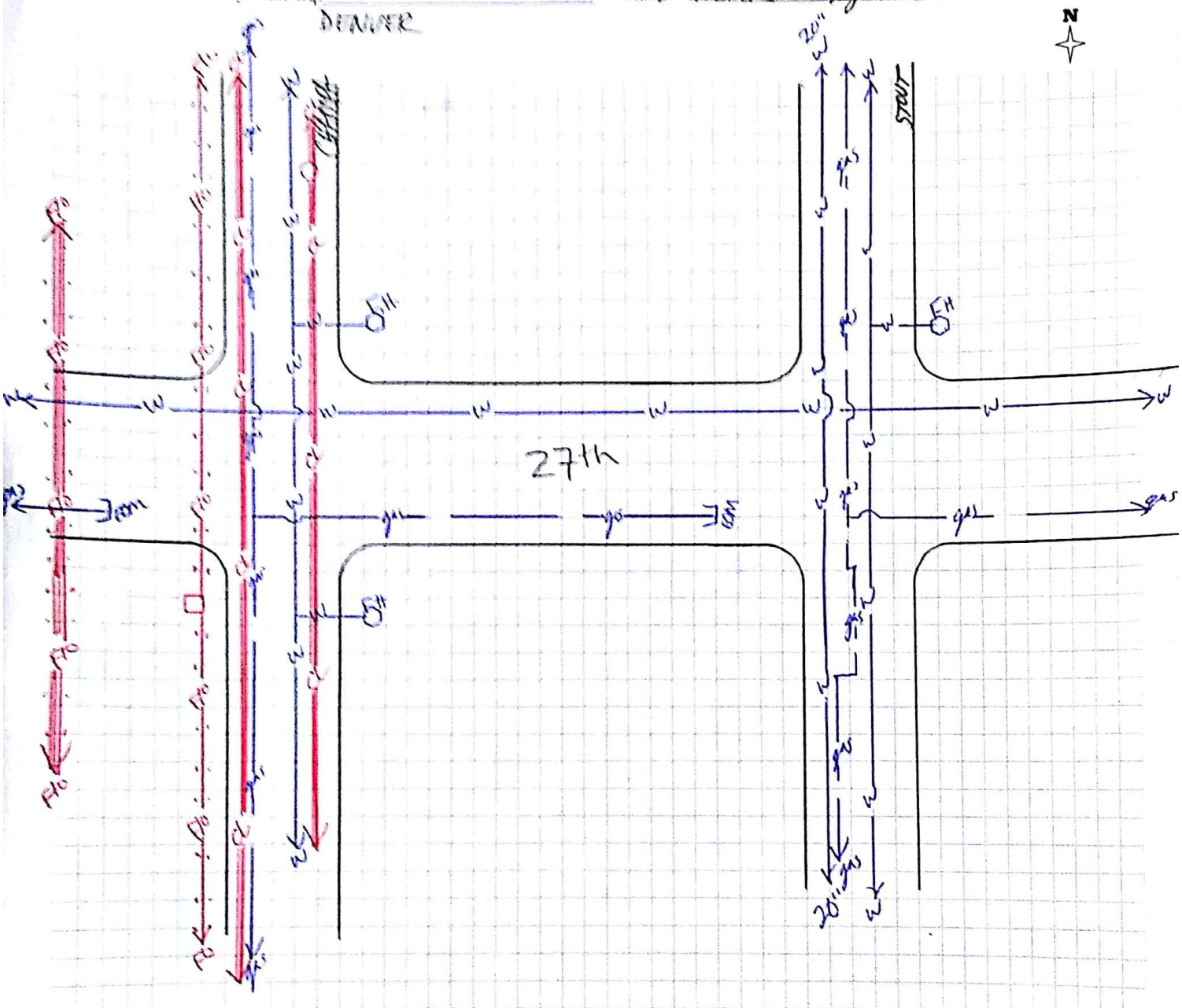
# Underground Consulting Solutions

**Private/Engineering Facility Location Sketch**

Work Address: 27th & ARAPAHOE
Contractor Name: MERRICK
Billing Address: ON FILE
City State Zip: DENVER

Contact Name: MARK MILLER
Contact Phone #: 303-353-3731
Date: 1-2-19
Charge $: REFER TO PG 1 OF 3

E




## Private Facility/Engineering Locate Disclaimer

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X Nick T.
UCS

X _____

Company: _____

Scanned by CamScanner

# Underground Consulting Solutions

**Private/Engineering Facility Location Sketch**

Pg 3 OF 3

E

Work Address 27th & ARAPAHOE

Contractor Name MERRICK

Billing Address ON FILE

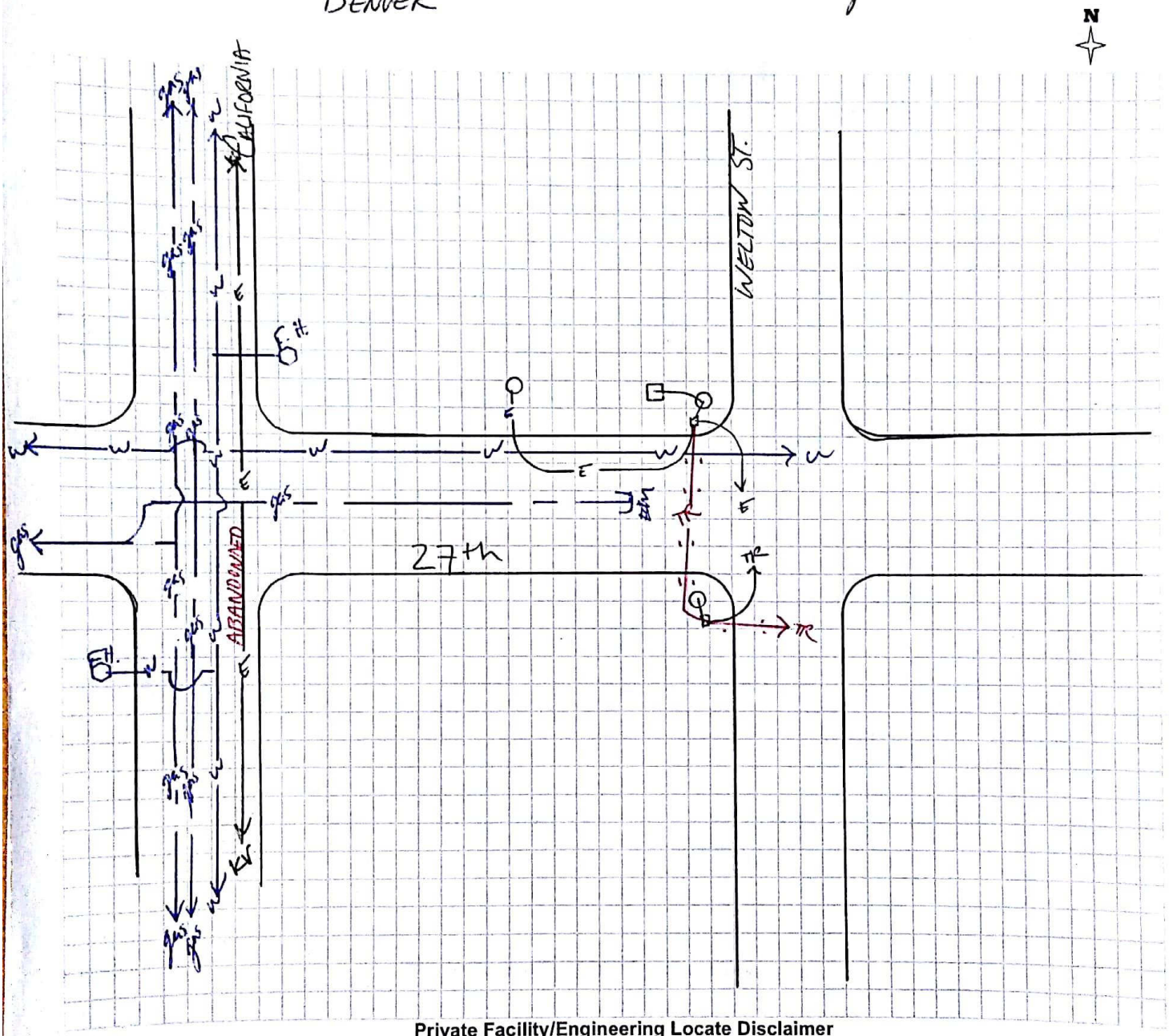
City/State/Zip DENVER

Contact Name MARK MILLER

Contact Phone # 303-353-3731

Date 1·2·19

Charge $ REFER TO pg 1 OF 3




**Private Facility/Engineering Locate Disclaimer**

I, _____, as representative for _____(Name of Company) understand that this locate is being performed by electronic devices and that there are no guarantees, written or implied. The aforementioned company shall indemnify and hold UCS, its clients, its agents, employees, all persons claiming hereunder harmless from and against any and all claims, damages, losses, and expenses, including attorney's fees, relating to, arising out of, or resulting from the performance of the work, or the accuracy of the locate itself. Acceptance and usage of this sketch without signature will constitute agreement of such terms.

x NICK T.
UCS

x _____

Company: _____

Scanned by CamScanner

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 71**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | Polyethylene |
| **DIAMETER** | 2” |
| **DEPTH TO TOP OF UTILITY** | 2.90’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | Ph71hb, 1650 |
| **NOTES** | 2” PVC Gas Line |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 72**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | PVC |
| **DIAMETER** | ¾” |
| **DEPTH TO TOP OF UTILITY** | 2.93’ |
| **SURFACE TYPE** | Asphalt / Concrete |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | PH72H, 72S |
| **NOTES** | Gas service direct buried |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 73a**

| | |
|---|---|
| **UTILITY OWNER** | Zayo |
| **COMPOSITION** | PVC |
| **DIAMETER** | 4 X 2” |
| **DEPTH TO TOP OF UTILITY** | 2.90’ |
| **SURFACE TYPE** | Asphalt / Concrete |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | PH73AH, 73AS |
| **NOTES** | Multi Conduit Duct direct buried |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 73b**

| | |
|---|---|
| **UTILITY OWNER** | Denver Water |
| **COMPOSITION** | Steel |
| **DIAMETER** | 2” |
| **DEPTH TO TOP OF UTILITY** | 4.20’ |
| **SURFACE TYPE** | Asphalt / Concrete |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | PH73BH, 73BS |
| **NOTES** | Water service direct buried |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 75**

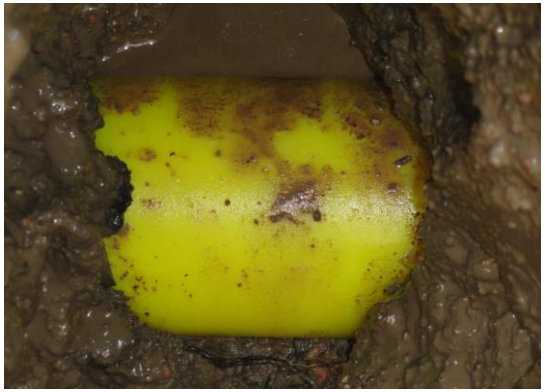
| | |
|---|---|
| **UTILITY OWNER** | Zayo Fiber Optic |
| **COMPOSITION** | PVC |
| **DIAMETER** | 2” |
| **DEPTH TO TOP OF UTILITY** | 2.55’ |
| **SURFACE TYPE** | Asphalt / Concrete |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | PH75H, 75S |
| **NOTES** | Fiber Optic Conduit direct buried |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 76**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | Plastic |
| **DIAMETER** | 6” |
| **DEPTH TO TOP OF UTILITY** | 2.60’ |
| **SURFACE TYPE** | Asphalt / Concrete |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | PH76H, PH76S |
| **NOTES** | Gas main direct buried |



Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 77**

| | |
|---|---|
| **UTILITY OWNER** | Level 3 Fiber |
| **COMPOSITION** | Plastic |
| **DIAMETER** | 3 x 2” |
| **DEPTH TO TOP OF UTILITY** | 9.85’ |
| **SURFACE TYPE** | Asphalt / Concrete |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | PH77H, PH77S |
| **NOTES** | Multi conduit fiber optic duct direct buried |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 78**

| | |
|---|---|
| **UTILITY OWNER** | Denver Water |
| **COMPOSITION** | Ductile Iron |
| **DIAMETER** | 8” |
| **DEPTH TO TOP OF UTILITY** | 4.35’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 78a, 1657 |
| **NOTES** | Water main wrapped in plastic |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 79**

| | |
|---|---|
| **UTILITY OWNER** | MCI Fiber Optic |
| **COMPOSITION** | Concrete Cap |
| **DIAMETER** | Unknown |
| **DEPTH TO TOP OF UTILITY** | 1.03’ |
| **SURFACE TYPE** | Asphalt / Concrete |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | PH79H, 79S |
| **NOTES** | Fiber Optic Conduit under concrete cap |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 80**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | Mill wrapped Steel |
| **DIAMETER** | 4” |
| **DEPTH TO TOP OF UTILITY** | 2.00’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 1639, 1337 |
| **NOTES** | Water main direct buried |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 81**

| | |
|---|---|
| **UTILITY OWNER** | Century Link Fiber Optic |
| **COMPOSITION** | Concrete Cap |
| **DIAMETER** | Unknown |
| **DEPTH TO TOP OF UTILITY** | 5.70’ |
| **SURFACE TYPE** | Asphalt / Concrete |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | PH81H, PH81S |
| **NOTES** | Fiber Optic Conduit under concrete cap |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 82**

| | |
|---|---|
| **UTILITY OWNER** | Denver Water |
| **COMPOSITION** | Ductile Iron |
| **DIAMETER** | 16” |
| **DEPTH TO TOP OF UTILITY** | 2.90’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 82h, |
| **NOTES** | Water main direct buried |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 83**

| | |
|---|---|
| **UTILITY OWNER** | Denver Water |
| **COMPOSITION** | Galvanized steel |
| **DIAMETER** | 1” |
| **DEPTH TO TOP OF UTILITY** | 3.80’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 83h, |
| **NOTES** | Gas is direct buried |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 84**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | Mill wrapped steel |
| **DIAMETER** | 2” |
| **DEPTH TO TOP OF UTILITY** | 3.25’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 1654, 1384 |
| **NOTES** | Gas is direct buried |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 85**

| | |
|---|---|
| **UTILITY OWNER** | Zayo Fiber |
| **COMPOSITION** | Concrete Cap |
| **DIAMETER** | N/A |
| **DEPTH TO TOP OF UTILITY** | 2.50’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 1654, 1384 |
| **NOTES** | Concrete encased |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 86**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | Polyethylene |
| **DIAMETER** | 2” |
| **DEPTH TO TOP OF UTILITY** | 3.00’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 1654, 1384 |
| **NOTES** | Gas line direct buried |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 87**

| | |
|---|---|
| **UTILITY OWNER** | Denver Water Main |
| **COMPOSITION** | Polyethylene |
| **DIAMETER** | 8” |
| **DEPTH TO TOP OF UTILITY** | 4.37’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | Ph87hb, 1665 |
| **NOTES** | 8” PVC Water Main |

Underground Consulting Solutions

**DATE 7/13/17**

**POTHOLE # 90**

| | |
|---|---|
| **UTILITY OWNER** | Denver Traffic |
| **COMPOSITION** | Polyethylene |
| **DIAMETER** | 3” |
| **DEPTH TO TOP OF UTILITY** | 6.65’ |
| **SURFACE TYPE** | Grass |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 1726, 1727 |
| **NOTES** | |

Underground Consulting Solutions

**DATE 7/13/17**

**POTHOLE # 91**

| | |
|---|---|
| **UTILITY OWNER** | Century Link Fiber Optic |
| **COMPOSITION** | Concrete Cap |
| **DIAMETER** | Unknown |
| **DEPTH TO TOP OF UTILITY** | 3.15’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | 0.52’ |
| **PHOTO #** | 1718, 1719 |
| **NOTES** | |

Underground Consulting Solutions

**DATE 7/13/17**

**POTHOLE # 92**

| | |
|---|---|
| **UTILITY OWNER** | Century Link Fiber Optic |
| **COMPOSITION** | Concrete Cap |
| **DIAMETER** | Unknown |
| **DEPTH TO TOP OF UTILITY** | 3.01’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | 0.49’ |
| **PHOTO #** | 1720, 1721 |
| **NOTES** | |

Underground Consulting Solutions

**DATE 7/13/17**

**POTHOLE # 93**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | Polyethylene |
| **DIAMETER** | 4” |
| **DEPTH TO TOP OF UTILITY** | 2.95’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | 0.53’ |
| **PHOTO #** | 1722, 1723 |
| **NOTES** | |

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**DATE 7/13/17**

**POTHOLE # 94**

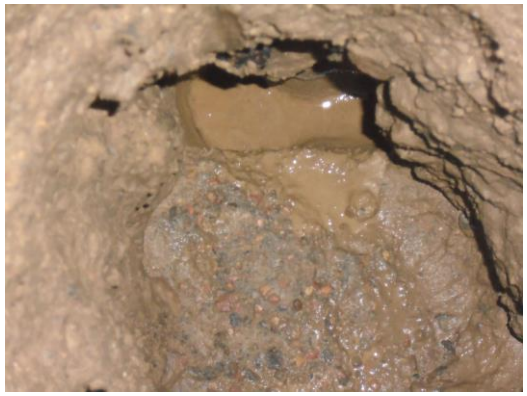
| | |
|---|---|
| **UTILITY OWNER** | Denver Water |
| **COMPOSITION** | Ductile Iron |
| **DIAMETER** | 12” |
| **DEPTH TO TOP OF UTILITY** | 4.40’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | 0.82’ |
| **PHOTO #** | 1724, 1725 |
| **NOTES** | |

Underground Consulting Solutions

**DATE 7/13/17**

**POTHOLE # 95**

| | |
|---|---|
| **UTILITY OWNER** | Century Link Fiber Optic |
| **COMPOSITION** | Concrete Cap |
| **DIAMETER** | Unknown |
| **DEPTH TO TOP OF UTILITY** | 2.55’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | 0.65’ |
| **PHOTO #** | 1716, 1717 |
| **NOTES** | |



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**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 96**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | Polyethylene |
| **DIAMETER** | 2” |
| **DEPTH TO TOP OF UTILITY** | 2.60’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 96h, 1666 |
| **NOTES** | Gas line direct buried |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 97**

| | |
|---|---|
| **UTILITY OWNER** | CenturyLink Fiber Optic |
| **COMPOSITION** | Concrete cap |
| **DIAMETER** | N/A |
| **DEPTH TO TOP OF UTILITY** | 1.70’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 97h, 97s |
| **NOTES** | Concrete cap encountered |

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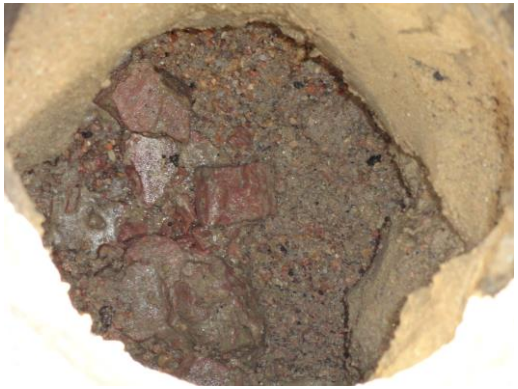
**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 98**

| | |
|---|---|
| **UTILITY OWNER** | Denver Water |
| **COMPOSITION** | Concrete cap |
| **DIAMETER** | N/A |
| **DEPTH TO TOP OF UTILITY** | 3.08’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 98h, 98s |
| **NOTES** | Concrete cap encountered |



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**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 99**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | Polyethylene |
| **DIAMETER** | 1” |
| **DEPTH TO TOP OF UTILITY** | 2.05’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 99h, 99s |
| **NOTES** | Gas is direct buried |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 100**

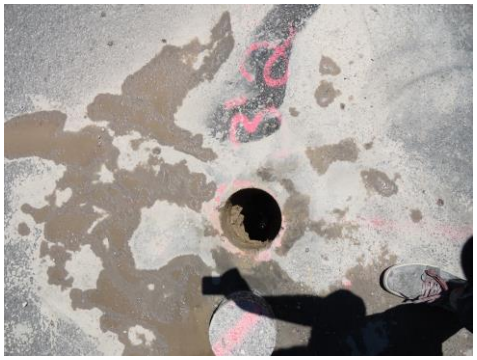
| | |
|---|---|
| **UTILITY OWNER** | CenturyLink Fiber |
| **COMPOSITION** | Concrete Encased |
| **DIAMETER** | N/A |
| **DEPTH TO TOP OF UTILITY** | 0.53’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 100s, 1379 |
| **NOTES** | Gas is direct buried |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 102**

| | |
|---|---|
| **UTILITY OWNER** | Denver Traffic |
| **COMPOSITION** | Polyethylene |
| **DIAMETER** | 2” |
| **DEPTH TO TOP OF UTILITY** | 4.50’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 100s, 1379 |
| **NOTES** | Poly conduit direct buried |



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**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 104**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | Mill wrapped steel |
| **DIAMETER** | 2” |
| **DEPTH TO TOP OF UTILITY** | 2.93’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 104s, 104b |
| **NOTES** | Water service direct buried |

Underground Consulting Solutions

**DATE 4/24/2017 – 6/5/2017**

**POTHOLE # 104a**

| | |
|---|---|
| **UTILITY OWNER** | Denver Water |
| **COMPOSITION** | Galvanized Steel |
| **DIAMETER** | 1” |
| **DEPTH TO TOP OF UTILITY** | 4.45’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 104a, 1669 |
| **NOTES** | Water service direct buried |

Underground Consulting Solutions

**DATE 7/10/17**

**POTHOLE #107**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | Polyethylene |
| **DIAMETER** | 4” |
| **DEPTH TO TOP OF UTILITY** | 3.40’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 1537, 1538, 1539 |
| **NOTES** | Gas line Direct Buried |

Underground Consulting Solutions

**DATE 7/17/17**

**POTHOLE # 108**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | Polyethylene |
| **DIAMETER** | 4” |
| **DEPTH TO TOP OF UTILITY** | 2.05” |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | PH108S, PH108HA |
| **NOTES** | |

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**DATE 7/10/17**

**POTHOLE #110**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | Polyethylene |
| **DIAMETER** | 4” |
| **DEPTH TO TOP OF UTILITY** | 3.10’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 1540, 1541, 1542 |
| **NOTES** | Gas line Direct Buried |

Underground Consulting Solutions

**DATE 7/10/17**

**POTHOLE #111**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | Fusion Bond Steel |
| **DIAMETER** | 10” |
| **DEPTH TO TOP OF UTILITY** | 3.37’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 1543, 1544, 1545 |
| **NOTES** | Gas line Direct Buried |

Underground Consulting Solutions

**DATE 7/10/17**

**POTHOLE #111a**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | Polyethylene |
| **DIAMETER** | 4” |
| **DEPTH TO TOP OF UTILITY** | 3.37’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 1546, 1547, 1548 |
| **NOTES** | Gas line Direct Buried |

Underground Consulting Solutions

**DATE 7/10/17**

**POTHOLE #112**

| | |
|---|---|
| **UTILITY OWNER** | Denver Water |
| **COMPOSITION** | Ductile Iron |
| **DIAMETER** | 8” |
| **DEPTH TO TOP OF UTILITY** | 4.95’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 1553, 1554 |
| **NOTES** | Water line direct buried |

Underground Consulting Solutions

**DATE 7/10/17**

**POTHOLE #113**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy kV Electric |
| **COMPOSITION** | Steel Conduit |
| **DIAMETER** | 6” |
| **DEPTH TO TOP OF UTILITY** | 7.81’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 1549, 1550, 1551, 1552 |
| **NOTES** | Xcel kV electric in 6” Conduit |

Underground Consulting Solutions

**DATE 7/10/17**

**POTHOLE #114**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | Polyethylene |
| **DIAMETER** | 6” |
| **DEPTH TO TOP OF UTILITY** | 2.60’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 1555, 1556 |
| **NOTES** | Xcel Gas direct buried |

Underground Consulting Solutions

**DATE 7/10/17**

**POTHOLE #115**

| | |
|---|---|
| **UTILITY OWNER** | Denver Water |
| **COMPOSITION** | Cast Iron |
| **DIAMETER** | 16” |
| **DEPTH TO TOP OF UTILITY** | 3.00’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 1557, 1558, 1559 |
| **NOTES** | Denver Water Plastic Wrapped |

Underground Consulting Solutions

**DATE 7/10/17**

**POTHOLE #116**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | Polyethylene |
| **DIAMETER** | 2” |
| **DEPTH TO TOP OF UTILITY** | 3.40’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 1581, 1582 |
| **NOTES** | Xcel Energy Gas Direct Buried |

Underground Consulting Solutions

**DATE 7/10/17**

**POTHOLE #117**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Gas |
| **COMPOSITION** | Polyethylene |
| **DIAMETER** | 2” |
| **DEPTH TO TOP OF UTILITY** | 2.90’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 1585, 1586 |
| **NOTES** | Xcel Energy Gas Direct Buried |

Underground Consulting Solutions

**DATE 7/10/17**

**POTHOLE #117b**

| | |
|---|---|
| **UTILITY OWNER** | Denver Water |
| **COMPOSITION** | Galvanized Steel |
| **DIAMETER** | 1” |
| **DEPTH TO TOP OF UTILITY** | 4.05’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 1583, 1584 |
| **NOTES** | Denver Water Direct Buried |

Underground Consulting Solutions

**DATE 7/10/17**

**POTHOLE #118**

| | |
|---|---|
| **UTILITY OWNER** | Xcel Energy Electric |
| **COMPOSITION** | Polyethylene |
| **DIAMETER** | 2” |
| **DEPTH TO TOP OF UTILITY** | 2.55’ |
| **SURFACE TYPE** | Asphalt |
| **PAVEMENT THICKNESS** | N/A |
| **PHOTO #** | 1565, 1566 |
| **NOTES** | Xcel Energy Electric Polyethylene Conduit |

UNDERGROUND CONSULTING SOLUTIONS

Pothole #: 200
Date: 4/8/2019

| | |
|---|---|
| Utility Type | Fiber |
| Utility Owner | Century Link |
| Composition | Duct |
| Diameter | NA |
| Depth to Top of Utility | 2.90 |
| Surface Type | Asphalt |
| Pavement Thickness | 1.40 |
| Notes | |

Photo:

Pothole #: 201
Date: 4/8/2019

| | |
|---|---|
| Utility Type | Gas |
| Utility Owner | Xcel |
| Composition | Plastic |
| Diameter | 1in |
| Depth to Top of Utility | 2.80 |
| Surface Type | Asphalt |
| Pavement Thickness | .75 |
| Notes | |

Photo:

Pothole #: 202
Date: 4/8/2019

| | |
|---|---|
| Utility Type | Water |
| Utility Owner | City |
| Composition | Steel |
| Diameter | 6in |
| Depth to Top of Utility | 4.30 |
| Surface Type | Asphalt |
| Pavement Thickness | 0.60 |
| Notes | |

Photo:

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UNDERGROUND CONSULTING SOLUTIONS

Pothole #: 203
Date: 4/8/2019

| | |
|---|---|
| Utility Type | Fiber |
| Utility Owner | Century Link |
| Composition | Duct |
| Diameter | NA |
| Depth to Top of Utility | .80 |
| Surface Type | Asphalt |
| Pavement Thickness | .80 |
| Notes | |

Photo:

Pothole #: 204
Date: 4/8/2019

| | |
|---|---|
| Utility Type | Fiber |
| Utility Owner | Century Link |
| Composition | Duct |
| Diameter | NA |
| Depth to Top of Utility | 0.90 |
| Surface Type | Asphalt |
| Pavement Thickness | 0.90 |
| Notes | |

Photo:

Pothole #: 205
Date: 4/8/2019

| | |
|---|---|
| Utility Type | Gas |
| Utility Owner | Xcel |
| Composition | Poly |
| Diameter | 2in |
| Depth to Top of Utility | 2.80 |
| Surface Type | Asphalt |
| Pavement Thickness | 0.75 |
| Notes | |

Photo:

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UNDERGROUND CONSULTING SOLUTIONS

Pothole #: 206
Date: 4/8/2018

| | |
|---|---|
| Utility Type | Sanitary |
| Utility Owner | City |
| Composition | Duct |
| Diameter | NA |
| Depth to Top of Utility | 2.00 |
| Surface Type | Asphalt |
| Pavement Thickness | 2.00 |
| Notes | |

Photo:

Pothole #: 207
Date: 4/9/2019

| | |
|---|---|
| Utility Type | Sanitary |
| Utility Owner | City |
| Composition | Steel |
| Diameter | 6in |
| Depth to Top of Utility | 5.65 |
| Surface Type | Asphalt |
| Pavement Thickness | .70 |
| Notes | |

Photo: Corrupted images

Pothole #: 208
Date: 4/9/2019

| | |
|---|---|
| Utility Type | Water |
| Utility Owner | City |
| Composition | Steel |
| Diameter | 8in |
| Depth to Top of Utility | 5.65 |
| Surface Type | Asphalt |
| Pavement Thickness | .62 |
| Notes | |

Photo: Corrupted images

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UNDERGROUND CONSULTING SOLUTIONS

Pothole #: 209
Date: 4/9/2019

| | |
|---|---|
| Utility Type | Sanitary |
| Utility Owner | City |
| Composition | Concrete |
| Diameter | NA |
| Depth to Top of Utility | 8.80 |
| Surface Type | Asphalt |
| Pavement Thickness | .40 |
| Notes | Got inverts at 18ft on the north manhole and 8ft on the south. Hit concrete at 8.80 but sanitary is lining up to be deeper according to inverts |

Photo: Corrupted images

Pothole #: 210
Date: 4/9/2019

| | |
|---|---|
| Utility Type | Sanitary |
| Utility Owner | City |
| Composition | NA |
| Diameter | NA |
| Depth to Top of Utility | Clear 12ft |
| Surface Type | Asphalt |
| Pavement Thickness | .42 |
| Notes | Got inverts at 18ft on the north manhole and 8ft on the south. |

Photo: Corrupted images

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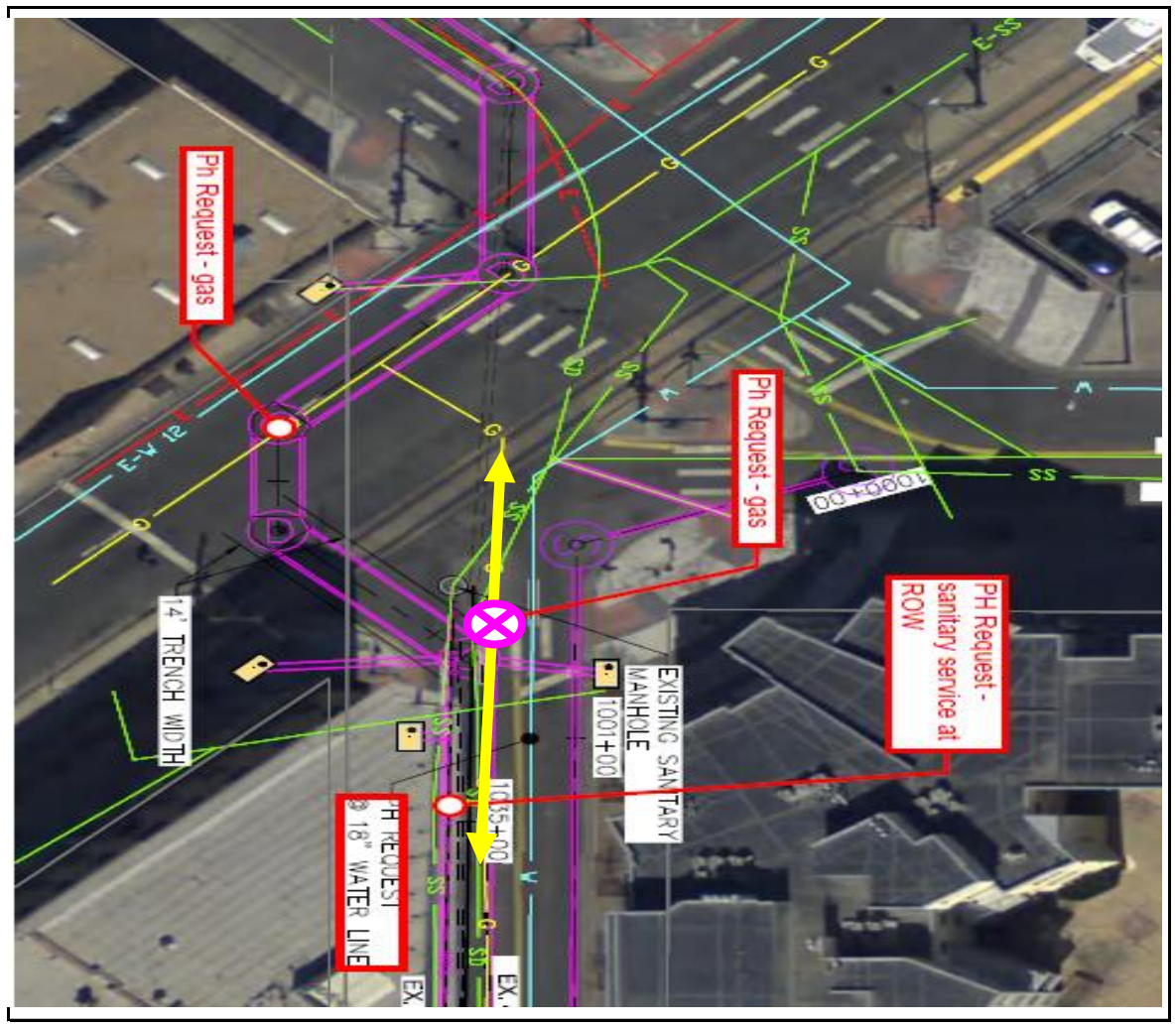
# TEST HOLE DATA REPORT

| | | | | |
|---|---|---|---|---|
| Test Hole # | 2 | AZTEC www.aztec.us TYPSA group | SUE Crew | Sean/Allied |
| Date Dug | 10/7/2016 | | Truck # | 849 |
| Project # | AZU1407 | 6000 E. Evans Ave., Suite 1-428, Denver, CO 80222 | City | Denver |
| Phase # | 024 | Tel. (720)708-4176 Alt. (602) 454-0402 | County | Denver |
| Location | S. Washington & E. Welton St. | | | |

LOCATION PLAN - NOT TO SCALE



| SITE BENCHMARK | CROSS SECTION - NOT TO SCALE |
|---|---|
| BM = CCD #371 - Brass Monument S/E Corner of Downing & 24th<br>ELEV = 5252.14 (NAVD88) | FACING North<br>SURFACE ELEVATION 5226.00<br>4.5 WIDTH/O.D.<br>TOP ELEVATION 5222.45<br>3.55 TOP DEPTH (FEET)<br>BOTTOM ELEVATION 5222.07<br>3.93 BOTTOM (FEET) |
| RIBBON COLOR Yellow | |

COORDINATES: NORTHING 399731.37 EASTING 577471.31

STATIONING: STATION None OFFSET None

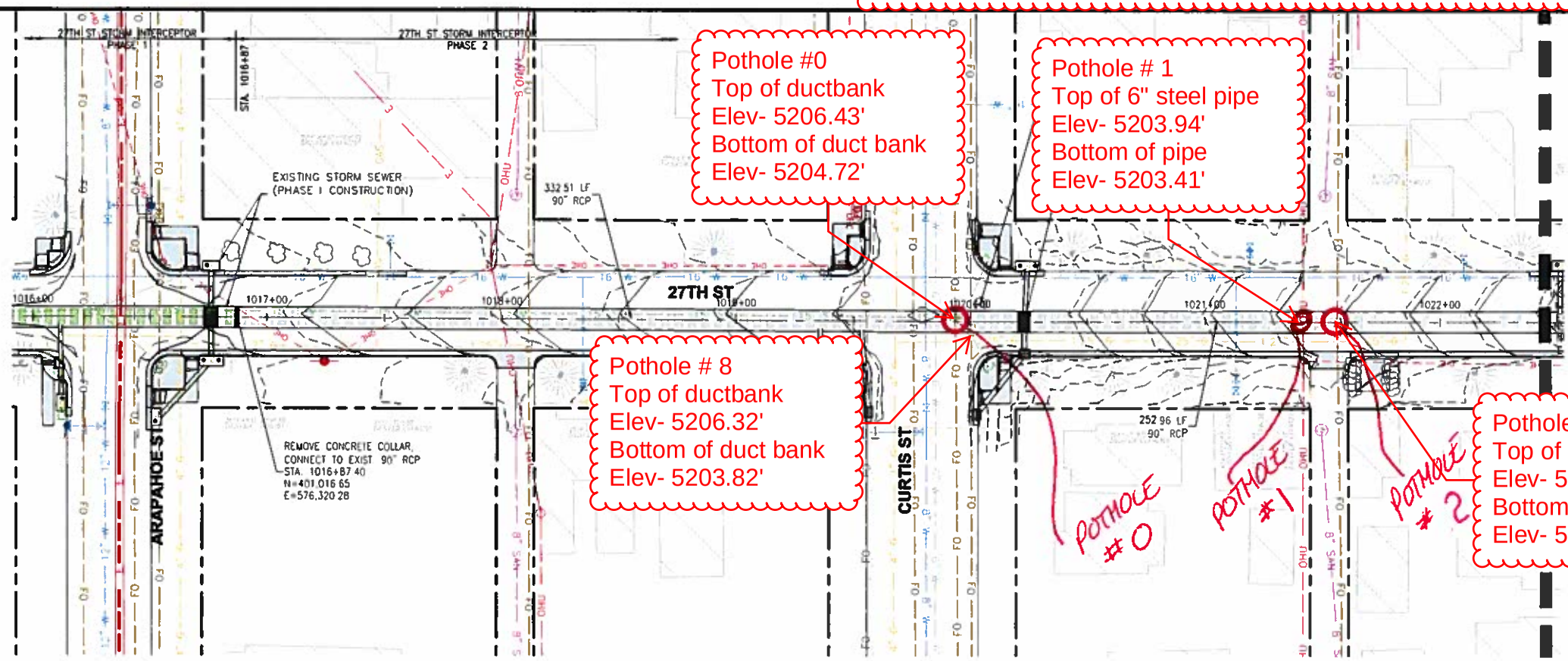
PAVING THICKNESS 8" PAVING TYPE Asphalt SOIL CONDITION Base/Sand

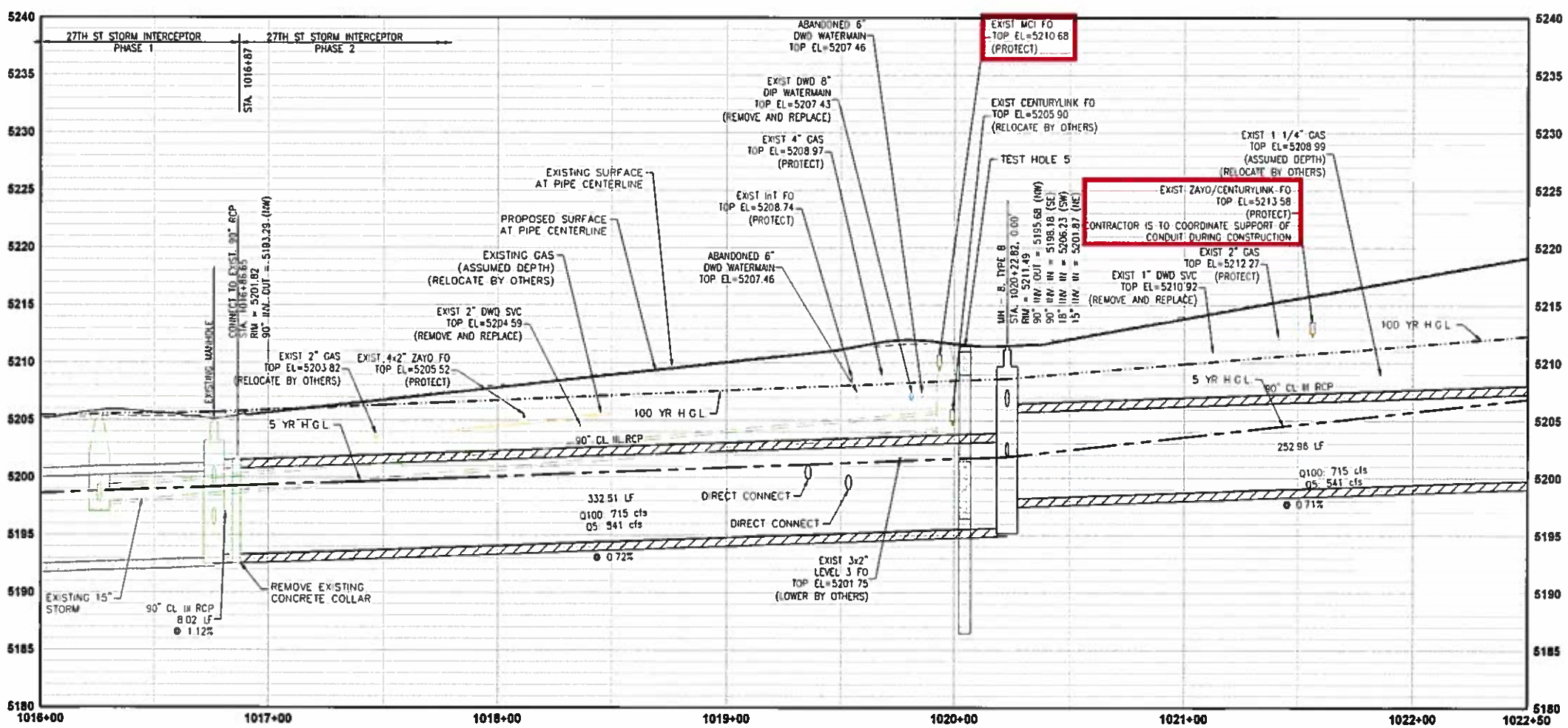
SIZE 4" TYPE PE Gas FACILITY OWNER Energy

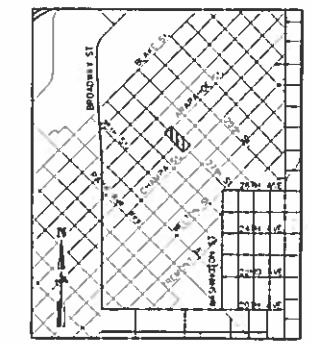
COMMENTS:

PREPARED BY: S Estle CHECKED BY: J Cherry

Pot holes for information only




KEY MAP
SCALE: 1"=2000'

GENERAL NOTES

1. SEE STORM LATERAL PLAN AND PROFILE SHEETS 16-19 FOR ALL INLET AND STORM LATERALS.

2. REFER TO SHEETS 10-11 FOR UTILITY INFORMATION.

SOIL BORING NOTES

1. SOIL BORINGS INFORMATION TAKEN FROM REPORT TITLED "GEOTECHNICAL ENGINEERING STUDY, 27TH STREET STORM DRAIN INTERCEPTOR PROJECT, 27TH STREET/WELTON STREET/WASHINGTON STREET, DENVER, COLORADO" BY KUMAR & ASSOCIATES, INC.

2. NO GROUNDWATER WAS ENCOUNTERED DURING THIS SUBSURFACE INVESTIGATION.

FORESTRY NOTES

1. EXISTING TREES TO BE PRESERVED IN PUBLIC RIGHT OF WAY SHALL BE PROTECTED PER FORESTRY STANDARDS AND PRACTICES. TREE PROTECTION SHALL INSTALLED PRIOR TO ISSUE OF DEMOLITION PERMIT, APPROVED BY FORESTRY, AND SHALL REMAIN IN PLACE THROUGHOUT CONSTRUCTION. NO CONSTRUCTION ACTIVITIES OR STORAGE OF MATERIALS SHALL TAKE PLACE WITHIN TREE PROTECTION ZONES WITHOUT PRIOR WRITTEN AUTHORIZATION FROM THE OFFICE OF THE CITY FORESTER.

| NO. | DESCRIPTION OF REVISIONS | DATE | BY |
|---|---|---|---|
| | | | |

CALL UNCC TWO WORKING DAYS BEFORE YOU DIG 1-800-922-1987


CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
CAPITAL PROJECTS MANAGEMENT
2000 W. 3RD AVE. DENVER, CO 80223
TEL.: (303) 446-3617 FAX: (303) 446-3647


# 27TH STREET STORM INTERCEPTOR PHASE 2

PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

STORM PLAN AND PROFILE, STA. 1016+00 - STA. 1022+50

HOR. SCALE: 1" = 30'
VERT SCALE: 1" = 5'

PRELIMINARY NOT FOR CONSTRUCTION


MERRICK®
5970 GREENWOOD PLAZA BLVD
GREENWOOD VILLAGE, CO 80111


DRAWN BY: MMIKS/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY:
DRAWING NAME: 9412-DR-PP02.dwg
DATE: November 21, 2018
SHEET NO: 13

PLOT DATE: November 21, 2018

\\MERRICKCOM\CCI\DATA\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDR\9412-DR-PP02.DWG

Pot holes for information only

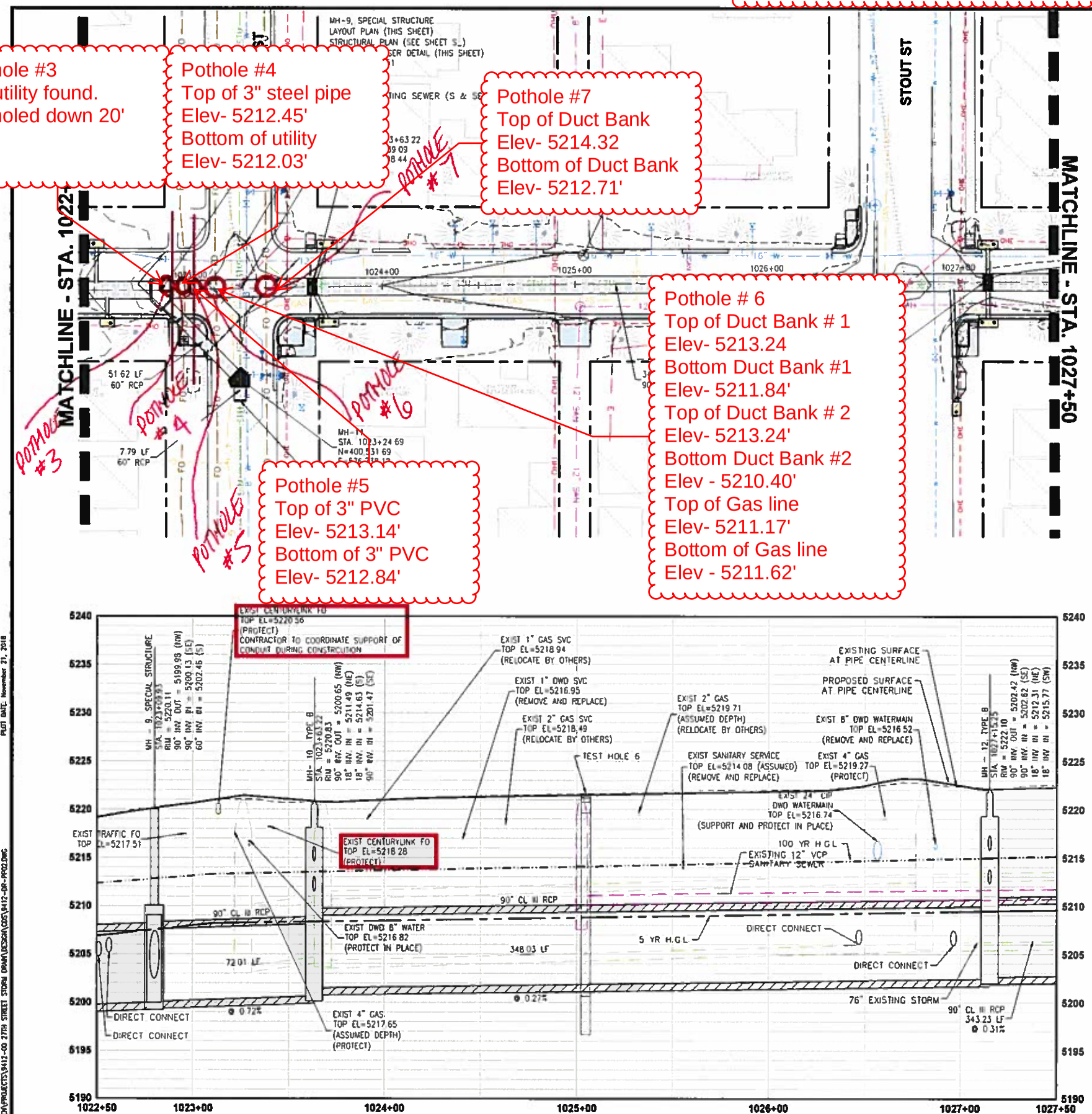
Pothole #3
No utility found.
Potholed down 20'

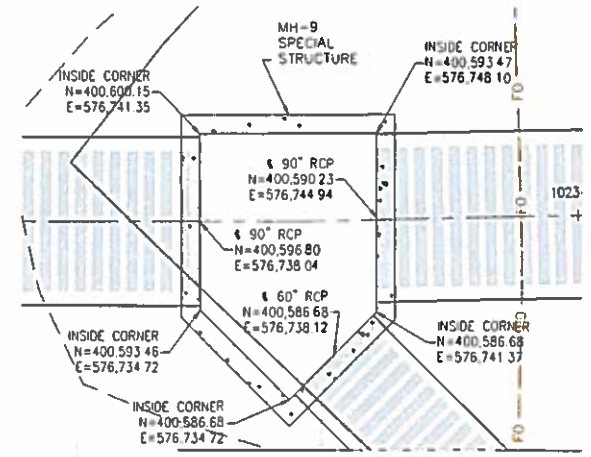
Pothole #4
Top of 3" steel pipe
Elev- 5212.45'
Bottom of utility
Elev- 5212.03'

Pothole #7
Top of Duct Bank
Elev- 5214.32
Bottom of Duct Bank
Elev- 5212.71'

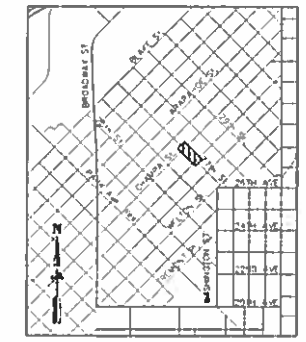
Pothole # 6
Top of Duct Bank # 1
Elev- 5213.24
Bottom Duct Bank #1
Elev- 5211.84'
Top of Duct Bank # 2
Elev- 5213.24'
Bottom Duct Bank #2
Elev - 5210.40'
Top of Gas line
Elev- 5211.17'
Bottom of Gas line
Elev - 5211.62'

Pothole #5
Top of 3" PVC
Elev- 5213.14'
Bottom of 3" PVC
Elev- 5212.84'




MH-9 PLAN
SCALE: 1"=5'



KEY MAP
SCALE: 1"=2000'

GENERAL NOTES

1. SEE STORM LATERAL PLAN AND PROFILE SHEETS 16-19 FOR ALL INLET AND STORM LATERALS.

2. REFER TO SHEETS 10-11 FOR UTILITY INFORMATION.

SOIL BORING NOTES

1. SOIL BORINGS INFORMATION TAKEN FROM REPORT TITLED "GEOTECHNICAL ENGINEERING STUDY, 27TH STREET STORM DRAIN INTERCEPTOR PROJECT, 27TH STREET/WELTON STREET/WASHINGTON STREET, DENVER, COLORADO" BY KUMAR & ASSOCIATES, INC.

2. NO GROUNDWATER WAS ENCOUNTERED DURING THIS SUBSURFACE INVESTIGATION.

FORESTRY NOTES

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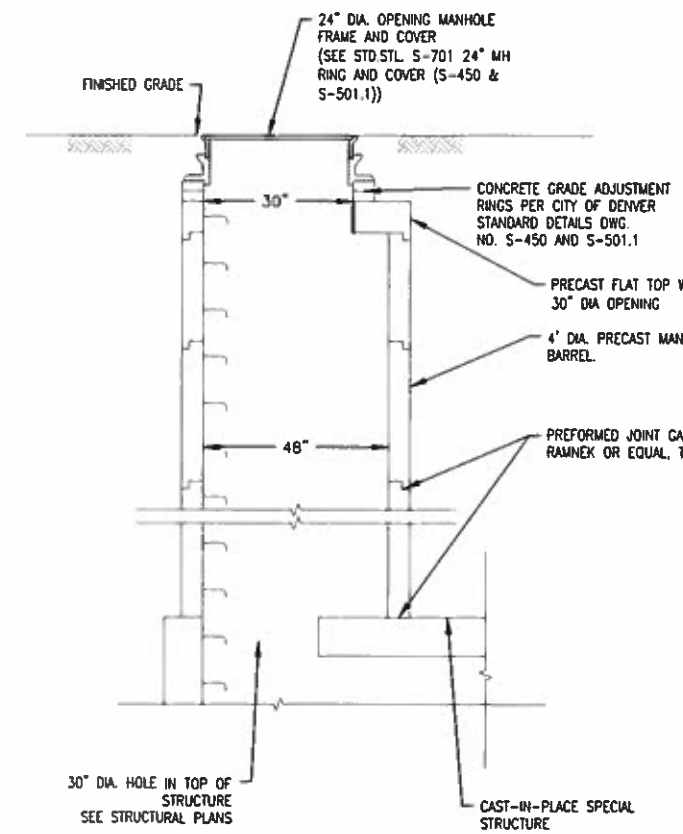


TYPICAL ACCESS RISER FOR SPECIAL STRUCTURES
NOT TO SCALE

HOR. SCALE: 1" = 30'
VERT. SCALE: 1" = 5'

PRELIMINARY NOT FOR CONSTRUCTION

MERRICK®
5970 GREENWOOD PLAZA BLVD
GREENWOOD VILLAGE, CO 80111

| NO. | DESCRIPTION OF REVISIONS | DATE | BY |
|---|---|---|---|
| | | | |

CALL UNCC TWO WORKING DAYS BEFORE YOU DIG 1-800-922-1987

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
CAPITAL PROJECTS MANAGEMENT
2000 W. 3RD AVE. DENVER, CO 80223
TEL.: (303) 446-3617 FAX: (303) 446-3647

27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343
STORM PLAN AND PROFILE, STA. 1022+50 - STA. 1027+50

DRAWN BY: MMIKS/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY:
DRAWING NAME: 9412-DR-PP02.dwg
DATE: November 21, 2018
SHEET NO: 14

PLOT DATE: November 21, 2018
\\MERRICK.COM\CES\DDA\PROJECTS\9412-DD 27TH STREET STORM DRAIN\DESIGN\CDS\9412-DR-PP02.DWG

POTHOLE 2

POTHOLE 5

POTHOLE 6

POTHOLE 6

Duct bank Pothole # 8

# Appendix C

***811 Colorado Call Confirmation and Formal Responses***

**Mark Miller**

**From:** Ticket Express <ticketexpress@co811.org>
**Sent:** Thursday, November 15, 2018 10:47 AM
**To:** Christi Wisleder
**Subject:** TICKET EXPRESS

Engineering Request **TICKET #A831900808-00A** **Ticket Express Locate Request**

Hello **CHRISTI**,

You recently submitted a locate request through our Ticket Express program at the address of **27TH ST and ARAPAHOE ST,** in which the work type selected was engineering. Your ticket has been processed as an Engineering Request and requires the following disclaimer:

Engineering Request Disclaimer

An Engineering or Architectural Locate Request is never to be used for any excavation activities, either now or in the future. It is a request to obtain general information as to the description, nature and location of underground facilities for planning, design or engineering purposes only. Some facility owners may charge for this service, and will respond without a specified time frame.

For more information on Engineering Requests please view our Procedures Guide..

For additional questions or support please contact us between 7 A.M. and 5 P.M. Monday through Friday by calling the Ticket Express hotline at 877-318-8188 (option 2) or replying to this email.

Thank you,

Colorado 811 Online Services Department

**TMS**


**WEB SERVICES DEPARTMENT**

DAMAGE PREVENTION SPECIALIST

16361 Table Mountain Pkwy Golden, CO 80403

(877) 318-8188 option 2 ticketexpress@co811.org


Follow us!

**Have you heard about the new 811 legislation?**
**Click here to learn more**


**DISCLAIMERS:** This email and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. This message contains confidential information and is intended only for the individual named. If you are not the named addressee you should not disseminate, distribute or copy this e-mail. Please notify the sender immediately by e-mail if you have received this e-mail by mistake and delete this e-mail from your system.

## Mark Miller

**From:** Colorado 811 <OCARS_Pro@uncc.org>
**Sent:** Thursday, November 15, 2018 10:47 AM
**To:** Christi Wisleder
**Subject:** Colorado 811 Confirmation Request 2018-11-15 Ticket A831900808-00A

Email Confirmation 11/15/18 10:47 AM A831900808-00A ENGINEERING NEW LOCATE REQUEST

Please stay at least 18" outside of the exterior sides of any markings.
Marks are only valid for 30 days from the date of the locate or until no
longer visible, whichever comes first. There may be private facilities
within your dig area. Private facilities are owned by the owner of the
property and therefore will not be marked with this request. It is the
responsibility of the excavator to have private facilities located. To
learn more and for a list of private locate companies in your area please
visit our web site at http://www.colorado811.org

Ticket: A831900808-00A
Original Call Date: 11/15/18 Time: 10:46 AM
Locate By Date : 11/19/18 Time: 11:59 PM Meet: No
State: CO County: DENVER Place: DENVER
Street: 27TH ST
Cross Street: ARAPAHOE ST
Lat/Long: 39.757942/-104.984180 39.759896/-104.982692
: 39.752898/-104.977556 39.754852/-104.976068
Type of Work: ENGINEERING
Explosives : No Directional Boring: No
Location: FROM INTERSECT LOC S/E APX 1800FT TO WELTON ST R/O/W TO R/O/W *ACCESS
OPEN*

Company : MERRICK & COMPANY
Address : 5970 GREENWOOD PLAZA BLVD
City : GREENWOOD VILLAGE St: CO Zip: 80111
Caller : CHRISTI WISLEDER Phone: (303)353-3677
Alternate Contact: MARK MILLER Phone: (303)353-3731
Email: christi.wisleder@merrick.com
Done for: CITY AND COUNTY OF DENVER

Colorado 811 notified the following Tier 1 Member Facilities:
QLNCNC00=CENTURY LINK = FIBER AND TELCO
CMSNOCO=COMCAST = CATV & FIBER
PCHIPND=COPY TERM - - COPY TERM = GAS
CRCSTL1=CROWN CASTLE = ELECTRIC AND FIBER
DPRK01 =DEEP ROCK WATER CO = FIBER AND WATER
DPWTM1 =DENVER PUBLIC WORKS = FIBER, STREET LIGHTS ELECTRIC
INTRG1 =INTEGRA TELECOM = FIBER OPTIC
LVL311 =LEVEL 3 NOW CENTURYLINK = FIBER OPTIC
MCI01 =MCI = FIBER OPTIC
VIAEROW=VIAERO WIRELESS = FIBER AND TELCO
PAETEC =WINDSTREAM/PAETEC = FIBER AND TELCO
PCDM02 =XCEL ENERGY = ELECTRIC AND GAS
PCDM03 =XCEL ENERGY = ELECTRIC AND GAS
PCDS01 =XCEL ENERGY--DENVER STEAM = STEAM
PCKVEL =XCEL ENERGY-ELEC TRANSM = ELECTRIC
ZAYO1 =ZAYO BANDWIDTH = FIBER OPTIC

You are responsible for contacting any other facility owners not listed above,

including the following Tier 2 Members:

| | | |
|---|---|---|
| DNVPR1 DENVER PARKS & REC. | (720)865-6976 | After Hours (303)514-3380 |
| DNVH20 DENVER WATER DEPT | (303)628-6666 | After Hours (303)628-6801 |
| WWMG01 WASTEWATER MGMT DIVISION | (303)446-3744 | After Hours (303)446-3400 |

Check the status of your request at
http://newtin.uncc.org/newtinweb/responsedisplay.nas

For Colorado 811 Procedure Guide go to
http://colorado811.org/education_consolidated/

## Mark Miller

**From:** cl_irth_comm@irth.com
**Sent:** Thursday, November 15, 2018 11:54 AM
**To:** Christi Wisleder
**Subject:** Ticket A831900808 - Qwest local network notification

==========
To: MERRICK & COMPANY Attn: CHRISTI WISLEDER
Voice: 3033533677 Fax:
Re: Qwest local network notification

This is an important message from CenturyLink replying to your request to locate our underground facilities in an area described on the one call center ticket. If you have any questions please call Qwest at 1-800-283-4237

==========

Ticket: A831900808
County: DENVER Place: DENVER
Address: 27TH ST

QLNCNC00:
The described dig area of your locate request has been checked and is clear for CenturyLink Local Network. If you have any questions please call CenturyLink at 1-800-283-4237.

==========

Qwest

==========

This message was generated by an automated system. Please do not reply to this email.

## Mark Miller

**From:** agt_comm@irth.com
**Sent:** Thursday, November 15, 2018 10:50 AM
**To:** Christi Wisleder
**Subject:** Ticket A831900808 - Comcast Response to Locate Request

==========
To: MERRICK & COMPANY Attn: CHRISTI WISLEDER
Voice: 3033533677 Fax:
Re: Comcast Response to Locate Request

This is an important courtesy message, in response to your locate request for underground facility markings. [Este es un mensaje importante de turismo (de cortesia), en respuesta a su solicitud de contado de las marcas de instalacion subterranea.]

==========

Ticket: A831900808
County: DENVER Place: DENVER
Address: 27TH ST

CMSNOCO:
Please know, Comcast has received your Engineering Locate Request. So as to obtain the current guidelines, by which Comcast may support your design or flow line needs, please contact Comcast at 303-603-2682. {Sepa que Comcast ya ha recibido su pedido de informacion ingenieria. Para continuar con esta pedido, llame a Comcast at 303-603-2682 para obtener la guia. Con esto, Comcast puede Soportar su solicito.}

==========

If you have any questions, please contact Comcast's locate contractor, "USIC Locating Services", at 800-778-9140. Thank you for contributing toward a safe excavation. Have a great day. [Si usted tiene alguna pregunta, pongase en contacto con el contratista; "USIC Locating Servicios", en 800-778-9140.
Gracias por contribuir a una excavacion segura. Que tenga un gran dia.]

==========

This message was generated by an automated system. Please do not reply to this email.

# Locate Sketch

Ticket # **A831900808-00A**

Locate Due Date 11/19/2018 23:59

Address 0, 27TH ST

City/State/Zip DENVER, DENVER

Type of Work ENGINEERING

Excavator's Name MERRICK &

Sitewise
SMART SOLUTIONS. FULL-SERVICE COMMITMENT.

Denver Office P 303.459.6537 F 303.648.6348

**LOCATOR NAME** JOEY BAKES **DATE** 11/19/2018 07:58:07

**MEMBER CODE** PCKVEL - **UTILITY TYPE**

**LOG #** **START TIME** **END TIME** **TOTAL TICKET TIME HOURS**

**NOTE**

N

no charge ticket, engr.

**CAUTION**
(Hand dig 18" either side of marks)

☐ I agree that this ticket will be an extended time ticket and that no digging will take place unless the Excavator has a signed copy of this ticket in their hands.

Date/Time: 11/19/2018 08:46:06

CLIENT SIGNATURE: SITE TECH SIGNATURE: Joey Baker

NOTE:

PRINT NAME:

## Mark Miller

**From:** windstreamprs@korweb.com
**Sent:** Friday, November 16, 2018 8:40 AM
**To:** Christi Wisleder
**Subject:** Ticket A831900808 for PAETEC - Status Change

**Importance:** High

Ticket A831900808 for PAETEC - Status Change

==========
Company: MERRICK & COMPANY Email: CHRISTI.WISLEDER@MERRICK.COM
==========
Ticket Number: A831900808
Work to Begin Date/Time: 11/19/2018 11:59:00 pm
County: DENVER
City: DENVER
Address: 0 27TH ST
Contact: CHRISTI WISLEDER
Phone: (303)353-3677
---
Member Code Facility Last Completion Date/Time
---
PAETEC CUSTOM2 11/16/2018 03:35:04 pm
** PHONE: Excavation Site Clear,
Response: CLEARED IN FIELD **

---

If you have problems with this report please contact:
Locate Desk (800)289-1901
Notes:
Windstream has addressed your ticket as noted above. If you have any further questions please contact our Damage Prevention Groups at 1-800-289-1901.

## Mark Miller

**From:** cl_irth_comm@irth.com
**Sent:** Thursday, November 15, 2018 10:50 AM
**To:** Christi Wisleder
**Subject:** Ticket A831900808 - Response to Dig Request

==========
To: MERRICK & COMPANY Attn: CHRISTI WISLEDER
Voice: 3033533677 Fax:
Re: Response to Dig Request

This is an important message from XCEL Energy replying to your request to locate our underground facilities in an area described on the one call center ticket.

==========

Ticket: A831900808
County: DENVER Place: DENVER
Address: 27TH ST

PCDM02 (Xcel Colorado Distribution):
XCEL ENERGY distribution has determined this ticket meets the definition of an engineering, planning or information request. This request will not be dispatched for field markings. Maps of XCEL ENERGY distribution facilities may be requested by contacting the Mapping Department at 303-571-6636. Upon completion of the design or engineering of this project, contact 811 to obtain an excavation request. Please contact an Xcel Energy representative at 303-716-2040 with any questions.

==========

If you have any questions please contact XCEL Energy.

==========

This message was generated by an automated system. Please do not reply to this email.

## Mark Miller

**From:** cl_irth_comm@irth.com
**Sent:** Thursday, November 15, 2018 10:51 AM
**To:** Christi Wisleder
**Subject:** Ticket A831900808 - Response to Dig Request

==========
To: MERRICK & COMPANY Attn: CHRISTI WISLEDER
Voice: 3033533677 Fax:
Re: Response to Dig Request

This is an important message from XCEL Energy replying to your request to locate our underground facilities in an area described on the one call center ticket.

==========

Ticket: A831900808
County: DENVER Place: DENVER
Address: 27TH ST

PCDM03 (Xcel Colorado Distribution):
XCEL ENERGY distribution has determined this ticket meets the definition of an engineering, planning or information request. This request will not be dispatched for field markings. Maps of XCEL ENERGY distribution facilities may be requested by contacting the Mapping Department at 303-571-6636. Upon completion of the design or engineering of this project, contact 811 to obtain an excavation request. Please contact an Xcel Energy representative at 303-716-2040 with any questions.

==========

If you have any questions please contact XCEL Energy.

==========

This message was generated by an automated system. Please do not reply to this email.

## Mark Miller

**From:** cl_irth_comm@irth.com
**Sent:** Thursday, November 15, 2018 2:30 PM
**To:** Christi Wisleder
**Subject:** Ticket A831900808 - Response to Dig Request

==========
To: MERRICK & COMPANY Attn: CHRISTI WISLEDER
Voice: 3033533677 Fax:
Re: Response to Dig Request

This is an important message from XCEL Energy replying to your request to locate our underground facilities in an area described on the one call center ticket.

==========

Ticket: A831900808
County: DENVER Place: DENVER
Address: 27TH ST

PCDS01:
In reference to request for locate, XCEL ENERGY Steam has determined due to the type of excavation or where the excavation is to occur, XCEL ENERGY Steam has no conflict within the dig area requested. Please ensure all other affected facility owners have responded. If you have any questions please contact Gary Hubel at Xcel Energy 303-598-9150

==========

If you have any questions please contact XCEL Energy.

==========

This message was generated by an automated system. Please do not reply to this email.

PROTECTING INFRASTRUCTURE

# Ticket Status Notification

To: MERRICK & COMPANY
Email: christi.wisleder@merrick.com

Below lists utilities that were statused by USIC. Please note there may be other Utilities which include private facilities that may be present in the work area and are NOT the responsibility of USIC to locate or mark.

You are receiving this notification because your contact information is listed on the above ticket from the One Call System. If you have any questions regarding this notification, please contact USIC at 1-800-762-0592.

| Ticket | Address |
|---|---|
| A831900808-00A | 27TH ST,DENVER,CO |

| Utility | Locate Date / Time | Status | Detail |
|---|---|---|---|
| CenturyLink Telephone CO | 11/15/18 12:49 PM | Not Marked | No Locate Required |

---

Stay Up-to-Date with Real-Time Access to USIC's assigned Tickets through our DigCheck Pro App.
You will have the flexibility to see Open and Closed Tickets, Post Locate Photos, and Street Views!
There is no cost to access our DigCheck Pro App.

Sign up by emaling DigCheck@usicllc.com and provide your
First Name:
Last Name:
Company Name:
Email Address:
State or States:
Phone Number:

You can download DigCheck Pro from Apple App Store or Google Play Store Now!

It's Free!

DigCheck
Powered by USIC

Questions or Comments:

DigCheck@usicllc.

**CITY AND COUNTY OF DENVER**
**DEPARTMENT OF PUBLIC WORKS**

**CONTRACT NO. 201950389**
**PROJECT NAME: 27th STREET STORM INTERCEPTOR, PHASE 2**

**ADDENDUM NO. 4 TO CONTRACT DOCUMENTS**

Bidders are hereby instructed that the drawings, specifications, and other contract documents are modified, corrected, supplemented, and/or superseded for the above-mentioned project as hereinafter described in the following:

**Postponement of Bid Opening**

**City and County of Denver**
**Department of Public Works**
**Bid Postponement Notice**

**Contract No. 201950389**
**27th Street Storm Interceptor Phase 2**

Notice is hereby given that the Sealed Bid Opening for Contract No. 201950389 - 27th Street Storm Interceptor Phase 2, is hereby postponed. Sealed bids will be received in Room 6.G.7., 201 W. Colfax Ave., Denver, CO 80202, no later than:

**11:00am, local time**
**July 18, 2019**

Published in the Daily Journal on July 1, 2 and 3, 2019.

This **ADDENDUM** shall be attached to, become a part of, and be returned with the Bid Proposal.

Lesley B. Thomas
City Engineer

6/28/19
Date

The undersigned bidder acknowledges receipt of this Addendum. The Proposal submitted herewith is in accordance with the stipulations set forth herein.

Concrete Works of Colorado, Inc.
Contractor

**ADDENDUM NO.** 4

DATE: 6/28/19

**CITY AND COUNTY OF DENVER**
**DEPARTMENT OF PUBLIC WORKS**

**CONTRACT NO. 201950389**
**PROJECT NAME: 27th STREET STORM INTERCEPTOR, PHASE 2**

**ADDENDUM NO. 5 TO CONTRACT DOCUMENTS**

Bidders are hereby instructed that the drawings, specifications, and other contract documents are modified, corrected, supplemented, and/or superseded for the above-mentioned project as hereinafter described in the following:

**QUESTIONS & ANSWERS**

Q1- Bid Item 44-1 Dewatering, the documents provide no information regarding the location or volume of ground water to be encountered. Does CCD have a Geotechnical Data Report for this project so that the Contractors can make a reasonable assessment for the need and locations for dewatering?
**A1- The geotechnical report prepared by Kumar & Associates for the 27th Street Storm Drain Interceptor Project dated April 9, 2018 was included in the technical specifications section of the project documents. Based on the report findings, it is not anticipated that ground water will be encountered on Phase 2 of the project.**

Q2- Has the alignment for Phase 2 been revised per further utility investigation and alternate Phase 3 storm alignment?
**A2- Yes, the Phase 2 storm alignment has been revised to accommodate the alternate Phase 3 alignment. Phase 2 will now stop at California on 27th Street and begin to head south down California Street. The revised Storm Plan and Profile sheet and revised Bid Form and Statement of Quantities are attached to this addendum.**

**ADDED DOCUMENTS**

**Attachment A: Approved 27th Street Storm Interceptor Phase 2 Denver Water Only Plans & Approval Letter**

**Attachment B: Revised Storm Plan and Profile, Sheet 15**

**Attachment C: Revised Bid Form**

**Attachment D: Revised Statement of Quantities**

This **ADDENDUM** shall be attached to, become a part of, and be returned with the Bid Proposal.

Lesley B. Thomas
Lesley B. Thomas
City Engineer
7.10.19
Date

The undersigned bidder acknowledges receipt of this Addendum. The Proposal submitted herewith is in accordance with the stipulations set forth herein.

_____
Contractor

**ADDENDUM NO. 5** DATE: _____

Attachment A

# CITY AND COUNTY OF DENVER

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
WASTEWATER CAPITAL PROJECTS MANAGEMENT

# 27TH STREET STORM INTERCEPTOR PHASE 2

**PROJECT MASTER NO : 2017-PROJMSTR-0000343**
**CONTRACT CONTROL NO : _____**

**DENVER WATER DISTRIBUTION SYSTEM IMPROVEMENTS**
**WATER SERVICE, FIRE LINE, AND FIRE HYDRANT RELOCATION**
**27TH STREET - CHAMPA STREET TO WELTON STREET**
**WASHINGTON STREET - 26TH AVE TO 20TH AVE**

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## Materials List

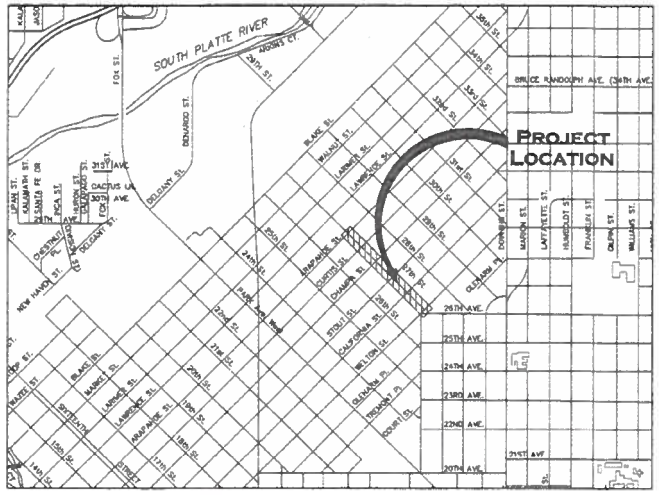
| Description | Qty | Unit |
|---|---|---|
| Fire Hydrant Assemblies (Adjust) | 1 | EA |
| Fire Hydrant Assemblies (Adjust) | 1 | EA |
| 10" Class 52 DIP | 30 | LF |
| 8" Class 52 DIP | 95 | LF |
| 6" Class 52 DIP | 28 | LF |
| 3/4" Copper Service | 179 | LF |
| 8" Gate Valve | 3 | EA |
| 6" Gate Valve | 2 | EA |
| 8" x 6" Swivel Tee | 2 | EA |
| 3/4" Curb Stop | 3 | EA |
| 8" x 3/4" Tapping Saddle w/ Corp Stop | 1 | EA |
| 16" x 3/4" Tapping Saddle w/ Corp Stop | 3 | EA |

## LEGEND

| EXISTING | PROPOSED |
|---|---|
| CONDUIT | 12" WATER |
| 20" WATER | 10" WATER |
| 16" WATER | 8" WATER |
| 14" WATER | DOMESTIC WATER |
| 12" WATER | FIRE HYDRANT LINE |
| 10" WATER | ABANDON WATER |
| 8" WATER | FIRE HYDRANT |
| DOMESTIC WATER | VALVE |
| FIRE HYDRANT LINE | WATER METER IN MANHOLE |
| FIRE HYDRANT | FDC |
| CURB STOP | PLUG |
| VALVE | CROSS |
| WATER METER IN MANHOLE | TEE |
| PROPERTY LINE | WATER METER IN VAULT |
| FDC | REDUCER |
| BEND 90° | TAPPING SLEEVE AND VALVE |
| CROSS | BUTTERFLY VALVE |
| TEE | |
| WATER MANHOLE | |
| CLOSED GATE VALVE | |
| AIR VALVE WITH ACCESS MANHOLE | |
| BUTTERFLY VALVE IN MANHOLE | |

## STANDARD ABBREVIATIONS

| | | | |
|---|---|---|---|
| BFV | BUTTERFLY VALVE | FH | FIRE HYDRANT |
| CAV | COMBINATION AIR VALVE | FO | FIBER OPTICS |
| CBG | CURB AND GUTTER | G | GAS |
| CIP | CAST IRON PIPE | GUY | GUY WIRE |
| CL | CENTERLINE | GV | GATE VALVE |
| CO | CLEAN OUT | IRRIG | IRRIGATION |
| COMM | COMMUNICATION | KB | KICK BLOCK |
| CONC | CONCRETE | LF | LINEAL FEET |
| Cu | COPPER | MH | MANHOLE |
| DIP | DUCTILE IRON PIPE | OE | OVERHEAD ELECTRIC |
| DWD/DW | DENVER WATER DEPARTMENT | PP | POWER POLE |
| E | ELECTRIC | PVC | POLYVINYL CHLORIDE |
| EXIST | EXISTING | ROW | RIGHT-OF-WAY |
| FBG | FARMERS AND GARDENERS | S | SANITARY |
| FDC | FIRE DEPARTMENT CONNECTION | SAN | SANITARY |
| | | SVC | SERVICE |
| | | T.BLK | THRUST BLOCK |
| | | TYP | TYPICAL |
| | | UT | UNDERGROUND TELEPHONE |
| | | W/ | WITH |




## Sheet List Table

| Sheet Number | Sheet Title |
|---|---|
| 1 | COVER SHEET |
| 2 | DENVER WATER DEPARTMENT NOTES |
| 3 | DENVER WATER - WATER ONLY PLAN |
| 4 | DENVER WATER - WATER ONLY PLAN |
| 5 | DENVER WATER - UTILITY PLAN |
| 6 | DENVER WATER - UTILITY PLAN |

NOTE:

1. ALL PIPE 3" AND LARGER INSTALLED WITH THIS PROJECT SHALL BE DIP w/ NITRILE GASKETS.
2. ALL CHANGE OVER TAPS SHALL BE MADE WITH THIS PROJECT. #10968.

Approved for Construction
Approved Valid for 1-year
Date 6/26/2019 Plan# 19968
Drawing# 1000 District Denver
DENVER WATER
Katie L. Ross
Katie L. Ross, P.E.
Distribution Engineering Manager

Fire hydrants shall be installed according to Denver Water Standards. The number and location(s) of fire hydrants(s) and fire flow as shown on this water main installation is correct as specified by the Denver Fire Department.
Signature of Fire Chief or Designated Representative
Date Signed _____ gpm fire flow

PROJECT MAPPING PROJECTION:

TRANSVERSE MERCATOR ZONE, CCD_LOCAL
DATUM: NAD83-1992
CENTRAL POINT FALSE NORTHING = 400000.0000
CENTRAL POINT FALSE EASTING = 600000.0000
LATITUDE OF ORIGIN = N39°45'19.00000"
CENTRAL MERIDIAN = W104°53'53.00000"
ZONE WIDTH = 6°0'00.0"
SCALE FACTOR AT ORIGIN = 1.00025403000
UNITS ARE US SURVEY FEET

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TEL.: (303) 446-3617 FAX: (303) 446-3647


27TH STREET STORM INTERCEPTOR PHASE 2
PRO TRACKING NO: PWWW2017-012
PROJECT MASTER NO: 2017-PROJMSTR-0000343
COVER SHEET

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412 DEN WAT CS.dwg
DATE: JUNE 5, 2019
SHEET NO.: 1

Revision Date: October 17, 2018

**General Construction and Water Notes:**

1. Projects located in Distributor Contract Areas shall require the District to contact Denver Water prior to the pre-construction meeting.
2. All materials and workmanship shall be in accordance with Denver Water's Engineering Standards, Materials Specifications, and Drawings. All main installations/system modifications will be approved and inspected by Denver Water. Field change directives made by Distribution Inspection shall be made within 24 hours by the contractor.
3. Contractors shall maintain a copy of the current Engineering Standards on-site at all times during construction. See the chart below for a quick reference to the frequently used material specifications.

**Material Specification Quick References:**

| Material Specification | Description |
|---|---|
| MS 01 | Ductile Iron Pipe |
| MS 02 | Polyvinyl Chloride Pressure Pipe |
| MS 03 | Ductile Iron Waterworks Fittings |
| MS 5 | Resilient Seated Gate Valves |
| MS 6 | Rubber Seated Butterfly Valves |
| MS 8 | Tapping Valves - Mechanical Joint Type |
| MS 9 | Fabricated Carbon Steel and Stainless Steel Tapping Sleeves |
| MS 12 | Cast Iron Valve Boxes |
| MS 13 | Dry-Barrel Fire Hydrants |
| MS 14 | Polyethylene Encasement Material |
| MS 23 | Brass and Bronze Goods |
| MS 28 | Concrete Vaults |
| MS 29 | Mechanical Joint Restraint |
| MS 30 | Bolted Sleeve-Type Couplings |
| MS 36 | Flanged Joint Accessories |

4. AWG 12 solid copper wire shall be installed on all non-metallic water mains.
5. The depth of cover over the pipe, measured from official street grade to the top of the pipe, shall be a minimum of 4-1/2 feet and shall be known as the *cover over the pipe*. If difficulties arise when crossing interference, and where specifically approved by Denver Water, deviations from 4-1/2 feet of cover will be permitted. The cover over the pipe shall be a minimum of 4-1/2 feet and a maximum of 10 feet with Denver Water approval.
6. Any changes in alignment and grade shall be authorized by Denver Water and shall be accomplished by the installation of additional fittings. The deflection of joints is permitted only when installing pipe on horizontal or vertical curves.
7. Prior to the installation of water mains, road construction must have progressed to at least the sub-grade state. Sub-grade is defined as an elevation of no more than 7 inches below the finished street grade.
8. The Contractor shall adjust all valve boxes and fire hydrants to the final finished grade.
9. Bends, tees, fire hydrants, blow-offs, and plugs at dead-end mains shall be protected from thrust with mechanical restraint and concrete kick blocks in accordance with Denver Water's Engineering Standards.
10. Valves shall be located on property line extensions, except for tapping tees where an additional valve shall be placed on the tapping tee. Other valve locations may be required as shown on the plans.
11. Utility crossings shall maintain a minimum clearance of 18-inches from the outside of the pipes.
12. Only one point of connection is allowed until the testing of the new main installations is complete.
13. Newly installed water mains and fire service lines shall be hydrostatically tested in accordance with Denver Water Engineering Standards, Section 8.25.
14. The trench shall be excavated and the pipe exposed for inspection at any location on the project, when requested by Denver Water.
15. The sterilization and flushing of mains shall be inspected and certified by the Health Department having jurisdiction; one copy of the certification shall be provided to Denver Water. The certification shall note the location of the main and state the main has been inspected by a representative of the Health Department having jurisdiction and complies with the procedures set forth by that department.
16. The Contractor is responsible for:
    a. Notifying customers verbally or in writing who may be affected by a water outage during construction.
    b. Obtaining, at the Contractor's expense, applicable licenses, permits, bonds, etc., that are required for the main installation/system modification.
    c. Contacting Denver Water's Construction Engineering personnel for the Pre-construction Meeting and Inspection, at 303-628-6671, at least 48 hours prior to beginning construction.
    d. In the event of an emergency in Denver or in a Total Service Area after working hours, call Denver Water's Westside Dispatcher: 303-628-6801. In a Master Meter or Read & Bill District, please contact the representative of the district in which the Project is taking place.
    e. Paying all additional charges for inspection outside normal work hours.

*Note: Be advised that on occasion valves in our system may be inoperable. On such occasions, it may become necessary to back up an additional block for the shut out. If that occurs, make additional notifications verbally or in writing to customers with the mandatory 24 hours advance notice. When valve maintenance is required, a delay of several days should be expected.*

**Tap and Meter Notes (for Denver, Total Service, and Read and Bill Areas only. In Master Meter Districts please refer to the Specification for that District).**

1. Before any taps are made on mains, tap applications and payment must be received and approved by the Distributor and Denver Water, and the water main has passed water quality testing.
2. Denver Water will make all taps that are 2 inches and smaller.
3. Individual service line PRVs shall be installed by the licensee when area pressure exceeds 80 psi.
4. Services and Meters:
    a. The Contractor may request an on-site pre-construction conference with the Meter Inspector for all taps, service lines, and meters larger than one-inch, and for projects involving more than one tap and service. To schedule a pre-construction conference, call Meter Inspection at 303-628-6145.
    b. A copy of the approved plans with Denver Water's approval sticker must be present on-site at the time the tap is made and the meter is inspected or installed.
    c. Prior to the tap being made, the service address shall be posted, and the curb valve shall be installed. Upon tap installation, the contractor may request the meter inspection after the first pour of concrete foundation has occurred. The service address shall remain posted until the meter setting passes inspection.
    d. Meters cannot be set, inspected, or services activated, until the requirements for backflow prevention have been completed. Contact the Backflow Prevention Program personnel at 303-628-5969 for further information.
    e. Meter pits and vaults must be set flush with the final grade of the landscape, including the proper depth for soil amendment. If final grading has not been completed at the time of meter inspection, the Owner will be required to raise or lower the meter pit/vault when final grade is established. Adjustment of the pit may require adjustment of the meter setting within the pit.
    f. Meter setting, valves, and service lines from the main to the Backflow Preventer Assembly, if present, or to 5 feet after the meter vault, must meet all applicable Engineering Standards in effect at the time of activation. Modifications may be required from the details on these plans to comply with the current engineering standards.
    g. No present or future fences or walls are permitted between the Right-Of-Way (ROW) or easement and the meter setting. There shall be no permanent obstructions within 5 feet of the outside wall of the meter pit or vault.
    h. Inside the City of Denver, all multi-family dwellings with a single tap, service line, and meter are required to sub-meter each individual unit (Sec 401.3.2 of Denver modifications to the International Plumbing Code, Ordinance Number 576, Series of 2004). Call the City and County of Denver Plumbing Inspector for information at 720-865-2625.
    i. Inside the City of Denver, all service lines must be installed to avoid existing or proposed street trees. Contact the City and County of Denver's Forester at 720-913-0647 for information.

**Cross-Connection Control Requirements:**

The licensees listed below shall be in conformance with Denver Water's Engineering Standards, Chapter 5.05, *Cross-Connection Control and Backflow Prevention*. Backflow prevention assemblies are required to be installed on the following water service lines:

1. Commercial domestic service lines
2. Multi-Family domestic service lines (depending on potential hazard)
3. Fire service lines
4. Irrigation service lines
5. Single family residential domestic service lines with an auxiliary water source (Dual Water Service Agreement required)
6. Recycled Water service lines, if system design includes chemical injection or pumps.
    a. Backflow prevention assemblies installed on recycled water service lines shall be identified as "Recycled Water".
7. It is at the sole discretion of Denver Water's Cross-Connection Control section to approve or deny a variance request related to a proposed backflow prevention assembly installation.
    a. Backflow prevention assemblies shall be a model manufactured in accordance with AWWA C510 and C511 and shall have met the specifications by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research.
    b. The licensee is required to have a certified American Backflow Prevention Association (ABPA) or American Society of Sanitary Engineering (ASSE) tester inspect and test the existing and/or newly installed containment backflow prevention assemblies on dedicated domestic, irrigation, fire and recycle water service lines upon installation and annually thereafter.
    c. Within 48 hours of Denver Water setting the meter and turning on the water service, the ABPA or ASSE tester is required to submit the containment backflow assembly test report(s) to the Cross-Connection Control Office:

       Fax: 303-794-8325
       E-Mail: CrossConnectionControl@denverwater.org

    d. There shall be no unprotected takeoffs from the service line ahead of any meter or backflow prevention assembly located at the point of delivery to the customer's water system.
    e. No branch line or taps are allowed on dedicated irrigation water service lines or recycled water service line for domestic (potable) use (e.g., drinking fountains, water play features, swimming pool, restroom facilities, etc.)

**DEN Requirements:**

1. Contractors shall maintain a copy of the current Engineering Standards and Capital Project Construction Standards, when applicable, on site at all times during construction.
2. Wax tape, metallic fittings, and appurtenances shall be in accordance with Denver Water Capital Projects Construction Standards, 3rd Edition SECTION 09 97 13.04.
3. An AMI endpoint is required to be purchased by the contractor at the time of meter installation.
4. Contact the following Denver Water personnel prior to construction for project coordination and inspection services at DEN:

DEN Airside Construction Inspection

a. **Minimum of 30 days prior to construction**
b. **Denver Water Construction Management - Jeff Slankard** 303-628-6165

DEN Landside Construction Inspection

c. **Minimum of 48 hours prior to construction**
d. **Denver Water Construction Engineering - 303-628-6671**

DEN Cathodic Protection Inspection

a. Minimum of 48 hours prior to construction
b. Denver Water Construction Management - Lee Burke 303-628-6293

Approved for Construction
Approval Valid for 1 year

| | | | |
|---|---|---|---|
| Date | 6/26/2019 | Plan# | 19968 |
| Denver# | 1000 | District | Denver |

DENVER WATER
Katie L. Ross
Katie L. Ross, P.E.
Distribution Engineering Manager

COLORADO LICENSED PROFESSIONAL ENGINEER 43391

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TEL.: (303) 446-3617 FAX: (303) 446-3647

27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO: PWWW2017-012
PROJECT MASTER NO: 2017-PROJMSTR-0000343
DENVER WATER DEPARTMENT NOTES

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412_DEN WAT CS.dwg
DATE: JUNE 5, 2019
SHEET NO.: 2

PLOT DATE: June 18, 2019
O:\DCX\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\WATER\9412_DEN_WAT_CS.DWG

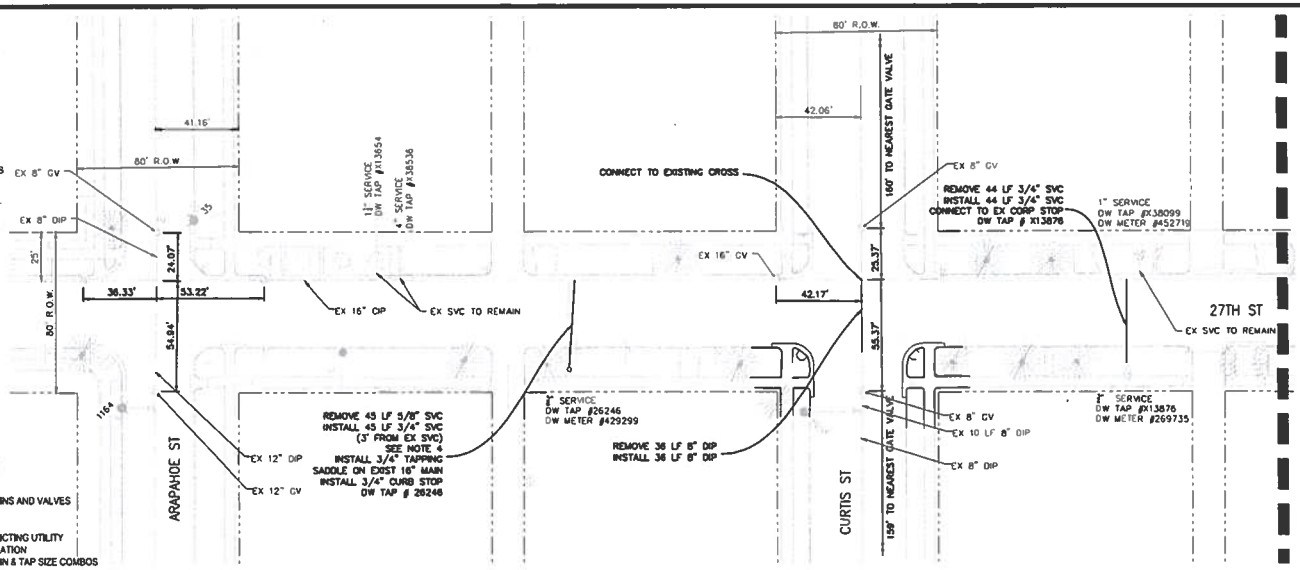
NOTE:

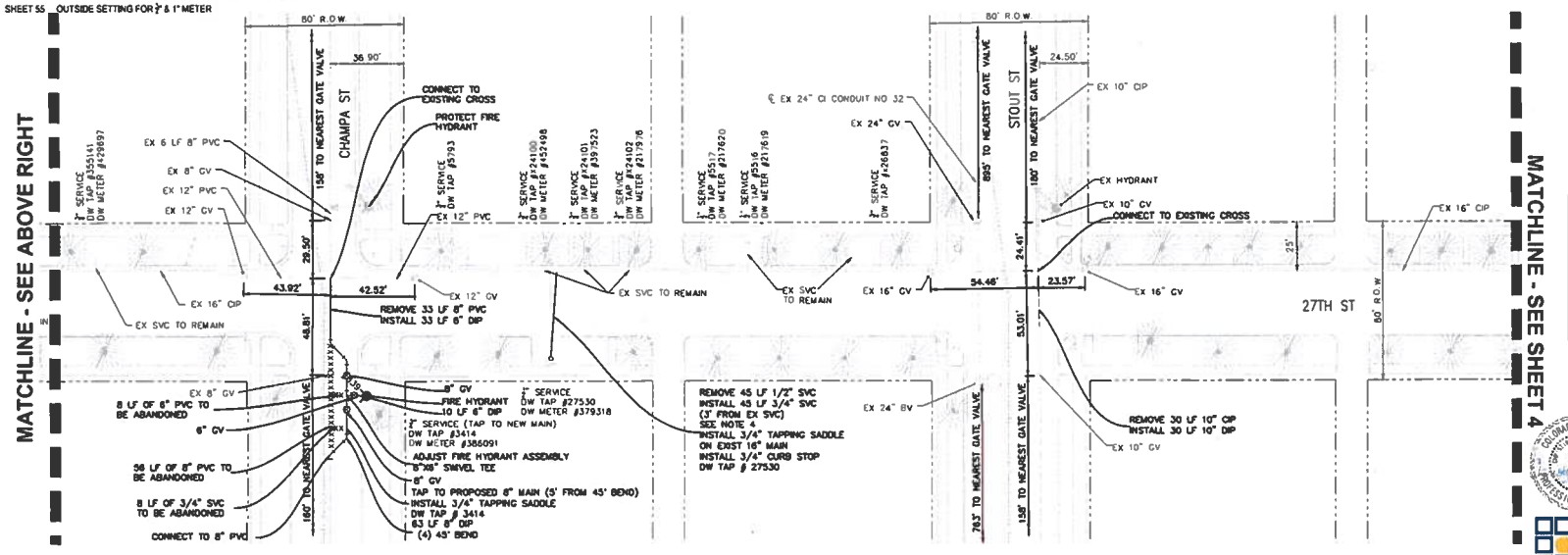
1. **ALL PIPE 3" AND LARGER INSTALLED WITH THIS PROJECT SHALL BE DIP w/ NITRILE GASKETS.**
2. ALL CHANGE OVER TAPS SHALL BE MADE WITH THIS PROJECT, #19968.
3. THE EXISTING MAIN IS LEAD JOINT IN SOME AREAS; ANY DISTURBANCES OF CUT PIPE WITHIN A FEW FEET OF A LEAD JOINT WILL CAUSE THE PACKING OF LEAD TO LOOSEN WHICH MAY CAUSE LEAKAGE. THE CONTRACTOR SHOULD EXERCISE CAUTION WHEN CUTTING OLD PIPE SO NOT TO LOOSEN ANY LEAD JOINTS NEARBY. IT IS ADVISABLE TO BLOCK THE PIPE FOR SUPPORT PRIOR TO CUTTING THE PIPE; THIS WILL REDUCE THE MOVEMENT OF THE PIPE PROTRUDING OUT OF THE LEAD JOINT BELL NEARBY. THE CONTRACTOR WILL BE HELD RESPONSIBLE FOR ANY LEAD AT OR NEAR THE EXCAVATION. SOME OF THE VALVES REQUIRED TO MANIPULATE FLOW ARE OVER 100 YEARS OLD AND MAY NOT FUNCTION PROPERLY. THE CONTRACTOR SHOULD EXPECT DELAYS AND RE-MOBILIZATION IF THE SHUTOUT EXPANDS TO ALTERNATE VALVES RESULTING IN ADDITIONAL 24-HOUR PRIOR NOTIFICATION TO CUSTOMERS. IN MOST CASES THE INSPECTOR WILL TEST THE SHUTOUT PRIOR TO THE SCHEDULED CONSTRUCTION.
4. ALL SERVICE LINES TO BE REPLACED SHALL BE REPLACED FROM MAIN TO METER, INCLUDING CURB STOP.
5. ALL TAPS TO BE ABANDONED, BACKFLOW PREVENTERS (IF EXISTING) MAY NOT BE REPLACED WITHOUT APPROVAL FROM DENVER WATER.

DWD STANDARD DRAWING INDEX

THE FOLLOWING DWD STANDARD DETAILS SHALL BE APPLIED ACCORDINGLY TO THE WORK DEPICTED WITHIN THIS DRAWING SET:

| | |
|---|---|
| SHEET 8 | TYPICAL TRENCH SECTION |
| SHEET 10 | PLAN, PROFILE AND LOCATION FOR FIRE HYDRANTS, MAINS AND VALVES |
| SHEET 11 | TRACER WIRE INSTALLATION FOR PVC WATERMAIN |
| SHEET 14 | STORM & SANITARY SEWER CROSSING |
| SHEET 15 | OPEN CUT CROSSING OVER OR UNDER CONDUIT CONFLICTING UTILITY |
| SHEET 18 | CONCRETE KICKBLOCKS BEARING SURFACES & INSTALLATION |
| SHEET 19 | CONCRETE KICKBLOCK REQUIREMENTS FOR WATER MAIN & TAP SIZE COMBOS |
| SHEET 40 | VALVE OPERATION |
| SHEET 46 | GENERAL METER & SERVICE NOTES |
| SHEET 47 | 3" & LARGER DOMESTIC & FIRELINE CONNECTIONS |
| SHEET 50 | ¾" & 1" SERVICE LINE, STOP BOX & OUTSIDE METER INSTALLATION |
| SHEET 51 | 2" & SMALLER NON-COPPER SERVICE LINE REPLACEMENT |
| SHEET 55 | OUTSIDE SETTING FOR ¾" & 1" METER |




Approved for Construction

| | | | |
|---|---|---|---|
| Date | 6/26/2019 | Plan# | 19968 |
| Dispatch | 8000 | District | Denver |

DENVER WATER

Katie L. Ross

Katie L. Ross, P.E.
Distribution Engineering Manager

COLORADO LICENSED PROFESSIONAL ENGINEER 43795

SCALE: 1" = 30'

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| NO | DESCRIPTION OF REVISIONS | DATE | BY |
|---|---|---|---|
| | | | |

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2000 W. 3RD AVE. DENVER, CO 80223
TEL.: (303) 446-3617 FAX: (303) 446-3647

27TH STREET STORM INTERCEPTOR
PHASE 2

PRO TRACKING NO: PWWW2017-012
PROJECT MASTER NO: 2017-PROJMSTR-0000343

DENVER WATER - WATER ONLY PLAN

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 8413_DEN_WAT_WATER_PLAN(3).dwg
DATE: JUNE 5, 2019
SHEET NO: 3

PLOT DATE: June 18, 2019

NOTE:

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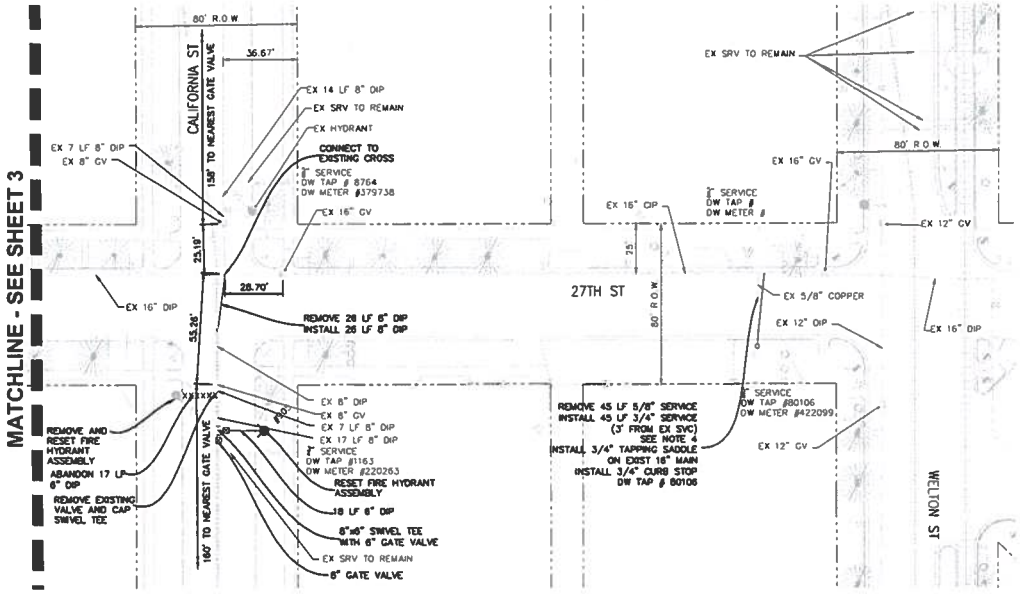


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Approved for Construction
Approved Valid for 1-year

| | | | |
|---|---|---|---|
| Date | 6/26/2019 | Project | 19968 |
| Contract | 1000 | District | Denver |

DENVER WATER

Katie L. Ross

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Distribution Engineering Manager

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SCALE: 1" = 30'

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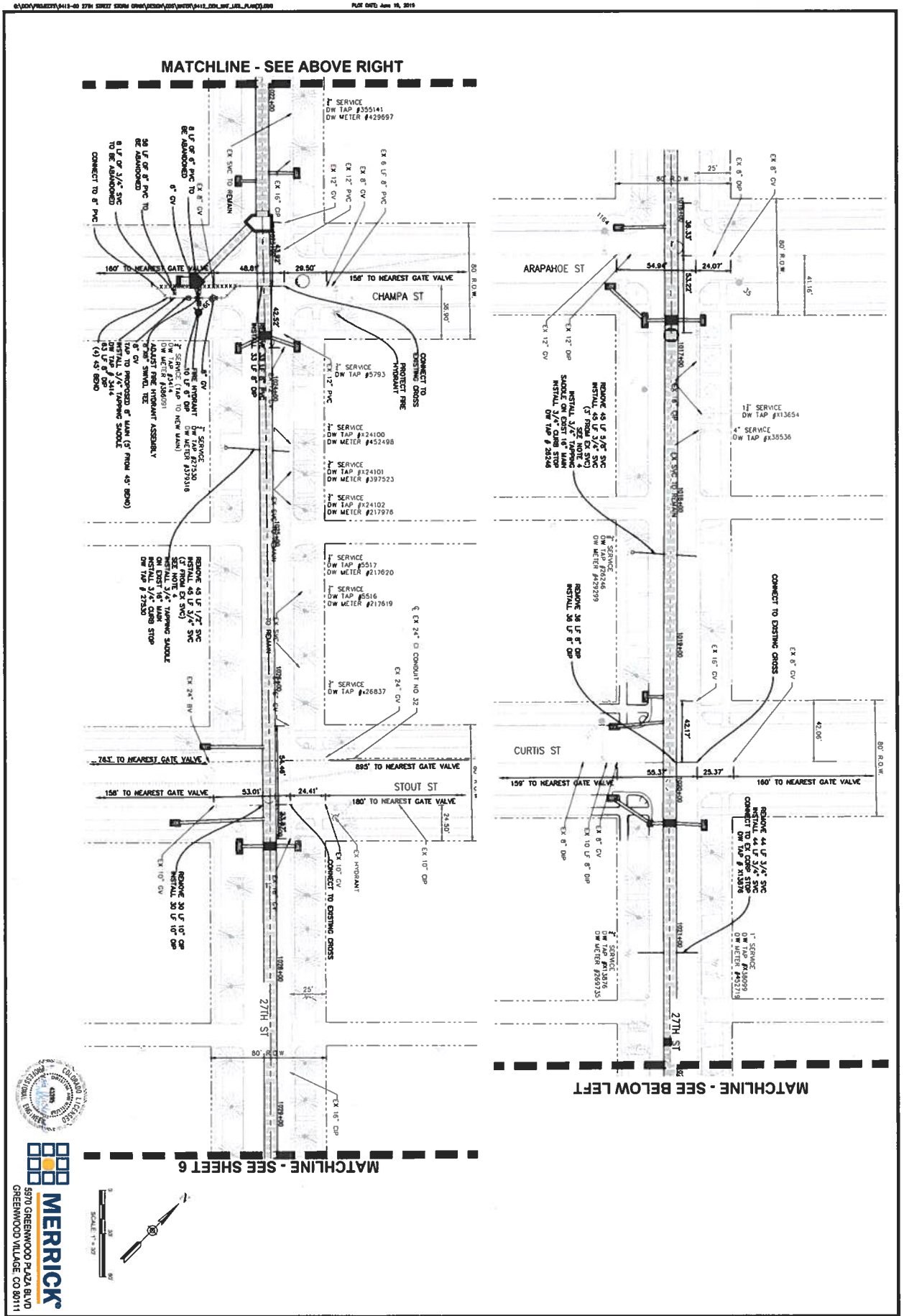
27TH STREET STORM INTERCEPTOR
PHASE 2

PRO TRACKING NO: PWWW2017-012
PROJECT MASTER NO: 2017-PROJMSTR-0000343

DENVER WATER - WATER ONLY PLAN

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 5412_DEN_MAT_WATER_PLAN(2)-4
DATE: JUNE 5, 2019
SHEET NO: 4

PLOT DATE: June 18, 2019
G:\JOB\PROJECTS\5412-B_27th_STREET_STORM_SEWER\DESIGN\CONTRACT\WATER\5412_DEN_MAT_WATER_PLAN(2).dwg

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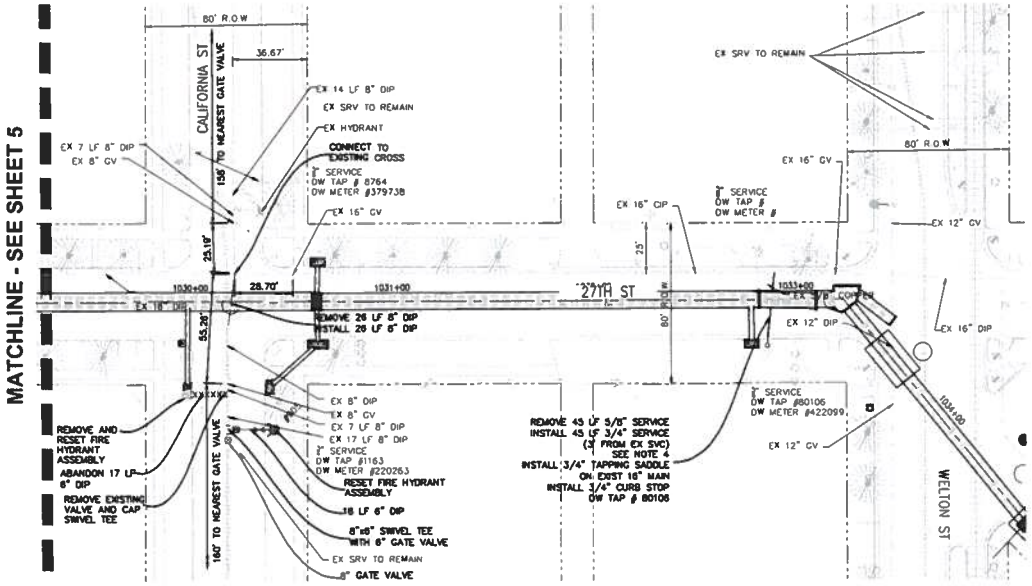
GREENWOOD VILLAGE, CO 80111

| | | | |
|---|---|---|---|
| DRAWN BY: MMILLER/AWOLFF | 27TH STREET STORM INTERCEPTOR PHASE 2 | CITY AND COUNTY OF DENVER<br>DEPARTMENT OF PUBLIC WORKS<br>ENGINEERING DIVISION<br>CAPITAL PROJECTS MANAGEMENT<br>2000 W. 3RD AVE. DENVER, CO 80223<br>TEL.: (303) 446-3617 FAX: (303) 446-3647 | CALL UNCC<br>TWO WORKING DAYS BEFORE YOU DIG<br>1-800-523-1987 |
| DESIGNED BY: CWISLEDER | PRO TRACKING NO: PWWW2017-012 | | |
| APPROVED BY: CWISLEDER | PROJECT MASTER NO: 2017-PROJMSTR-0000343 | | |
| DRAWING NAME: 8412_DEN_WAT_UTIL_PLAN(2).dwg | DENVER WATER - UTILITY PLAN | | |
| DATE: JUNE 5, 2019 | | | |
| SHEET NO: 5 | | | |

| NO | DESCRIPTION OF REVISIONS | DATE | BY |
|---|---|---|---|
| | | | |




SCALE: 1" = 30'

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| NO | DESCRIPTION OF REVISIONS | DATE | BY |
|---|---|---|---|
| | | | |

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1-800-423-1987

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
CAPITAL PROJECTS MANAGEMENT
2000 W. 3RD AVE. DENVER, CO 80223
TEL.: (303) 446-3617 FAX: (303) 446-3647

# 27TH STREET STORM INTERCEPTOR PHASE 2

PRO TRACKING NO: PWWW2017-012
PROJECT MASTER NO: 2017-PROJMSTR-0000343
DENVER WATER - UTILITY PLAN

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 0012_DEN_WAT_UTIL_PLANES.dwg
DATE: JUNE 5, 2019
SHEET NO 6

DENVER WATER

1600 West 12th Ave
Denver, CO 80204-3412
303.628.6000
denverwater.org

June 26, 2019

Mr. Mark Miller
Merrick and Company
5970 Greenwood Plaza Blvd
Greenwood Village, CO 80111

Dear Mr. Miller:

These are the approved plans for the water main(s) to serve **27th Street Storm Drain Phase 2** (PT# 19968)

It is your responsibility to notify the following individuals:

1. All customers possibly affected by any outage of water during construction.
2. Please contact our Engineering Division at 303-628-6671, for the pre-construction meeting and or inspection.
3. The Water Line Contractor will be billed for time Denver Water Inspectors spend on this job site beyond their normal working hours. To arrange for after-hours inspection, please contact our on-site Inspector.

Other requirements that you should be aware of are:

1. Any deviations from the approved plans must be approved by in advance Denver Water.
2. The new water mains must be chlorinated and flushed prior to the appropriate healthagency taking sample(s) for bacteriological tests. Prior to the purchase of any water taps, Sales Administration must receive a copy of thehealth release.
3. The Developer, or the Developers representative, is to contact a Tap Sales Representative at 303-628-6100 #3 or email watersales@denverwater.org to purchase a Stub-in Permit or Water Supply License for taps to be installed under this project. Failure to pay for the Permit or License may result in a sizable delay in the purchase and scheduling of taps.
4. One (1) copy of the approved plans must be available on the site at all times.

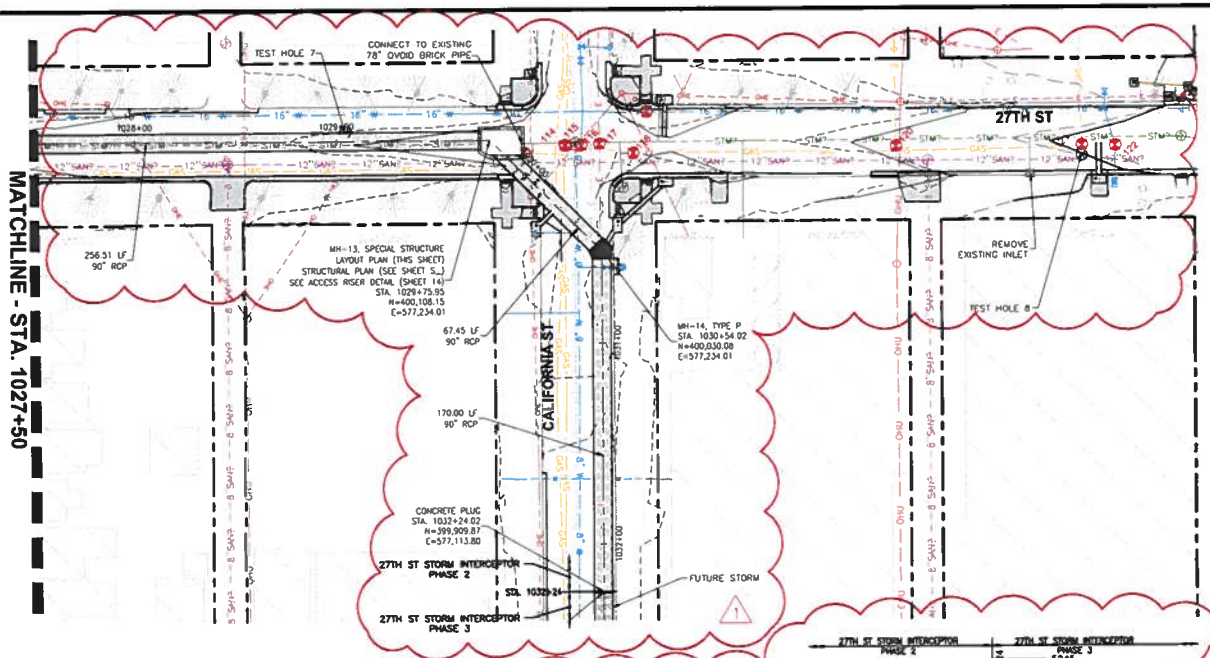
If you have any questions, please contact me at 303-628-6104.

Sincerely,

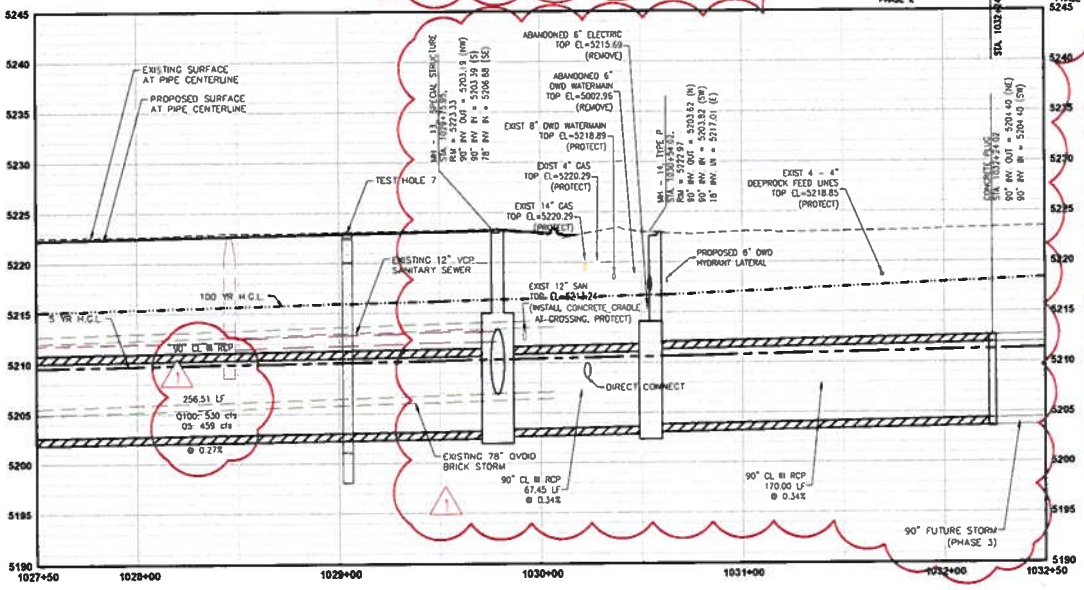
Raquel Chandler

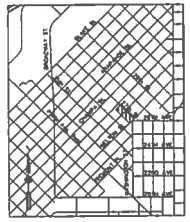
Raquel Chandler
Senior Plan Review Coordinator

Attachment B




Shop drawings for MH-13 will be provided to the selected contractor prior to the start of construction



KEY MAP
SCALE: 1"=2000'

GENERAL NOTES

1. SEE STORM LATERAL PLAN AND PROFILE SHEETS 16-19 FOR ALL INLET AND STORM LATERALS.

2. REFER TO SHEETS 9-11 FOR UTILITY INFORMATION.

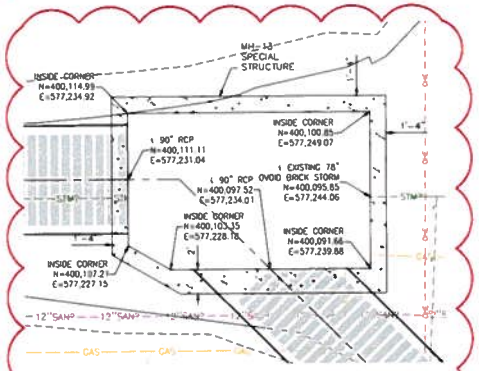
SOIL BORING NOTES

1. SOIL BORINGS INFORMATION TAKEN FROM REPORT TITLED "GEOTECHNICAL ENGINEERING STUDY, 27TH STREET STORM DRAIN INTERCEPTOR PROJECT, 27TH STREET/WELTON STREET/WASHINGTON STREET, DENVER, COLORADO" BY KUMAR & ASSOCIATES, INC.

2. NO GROUNDWATER WAS ENCOUNTERED DURING THIS SUBSURFACE INVESTIGATION.

FORESTRY NOTES

1. EXISTING TREES TO BE PRESERVED IN PUBLIC RIGHT OF WAY SHALL BE PROTECTED PER FORESTRY STANDARDS AND PRACTICES. TREE PROTECTION SHALL INSTALLED PRIOR TO ISSUE OF DEMOLITION PERMIT, APPROVED BY FORESTRY, AND SHALL REMAIN IN PLACE THROUGHOUT CONSTRUCTION. NO CONSTRUCTION ACTIVITIES OR STORAGE OF MATERIALS SHALL TAKE PLACE WITHIN TREE PROTECTION ZONES WITHOUT PRIOR WRITTEN AUTHORIZATION FROM THE OFFICE OF THE CITY FORESTER.




MH-13 PLAN
SCALE: 1"=5'

HOR. SCALE: 1" = 30'
VERT. SCALE: 1" = 6'

MERRICK
5970 GREENWOOD PLAZA BLVD
GREENWOOD VILLAGE, CO 80111

| NO | DESCRIPTION OF REVISIONS | DATE | BY |
|---|---|---|---|
| 1 | 30% ADDENDUM RE-ALIGNMENT TO CALIFORNIA ST | 03/19/19 | GRS |

CALL UNCC TWO WORKING DAYS BEFORE YOU DIG 1-800-922-1987

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
CAPITAL PROJECTS MANAGEMENT
2000 W. 3RD AVE. DENVER, CO 80223
TEL. (303) 446-3617 FAX: (303) 446-3647

27TH STREET STORM INTERCEPTOR PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343
STORM PLAN AND PROFILE, STA. 1027+50 - STA. 1033+50

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-DR-PP02.dwg
DATE: APRIL 16, 2019
SHEET NO: 15

PLOT DATE: July 9, 2019

Attachment C

## *Bid Form*

### *27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | | Estimated Cost |
|---|---|---|---|---|---|
| 01-21.16.01 | **ALLOWANCE FOR TREE REMOVAL, TRIMMING/ REPLACEMENT AND DISPOSAL - SEE PROJECT SPECIAL PROVISIONS** | | | | |
| | at the unit price of $ Twenty Thousand Dollars and No Cents | 1 | A/A | $ | 20,000.00 |
| | true and verifiable costs + mark up | | | | |
| 01-21.19.01 | **ALLOWANCE FOR CERTIFIED ASBESTOS BUILDING INSPECTOR (CABI)/AIR MONITOR(HOURLY) - SEE PROJECT SPECIAL PROVISIONS** | | | | |
| | at the unit price of $ Twenty Thousand Dollars and No Cents | 1 | A/A | $ | 20,000.00 |
| | true and verifiable costs + mark up | | | | |
| 01-52.13 | **TEMPORARY OFFICE FACILITIES** | | | | |
| | at the unit price of _____ | 1 | LS | $ | _____ |
| | lump sum | | | | |
| 2-1.2a | **REMOVE 6" CONCRETE CURB AND/OR GUTTER** | | | | |
| | at the unit price of _____ | 2,279 | LF | $ | _____ |
| | per linear foot | | | | |
| 2-1.4 | **REMOVE SIDEWALK ACCESSIBILITY CONCRETE CURB RAMP** | | | | |
| | at the unit price of | 5,060 | SF | $ | |
| | per square foot | | | | |
| 2-2.1 | **REMOVE CONCRETE SIDEWALK** | | | | |
| | at the unit price of _____ | 2,220 | SF | $ | _____ |
| | per square foot | | | | |
| 2-2.2 | **REMOVE CONCRETE DRIVEWAY PAVING** | | | | |
| | at the unit price of _____ | 800 | SF | $ | _____ |
| | per square foot | | | | |
| 2-3.3 | **REMOVE CONCRETE ALLEY PAVING** | | | | |
| | at the unit price of | 2,937 | SF | $ | |
| | per square foot | | | | |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 2-5 | **REMOVE CONCRETE RETAINING WALL**<br>*Add'l Info: FOR RAMP AT 27TH & CURTIS*<br>at the unit price of _____ per linear foot | 100 | LF | $ |
| 2-11.2b | **REMOVE EXISTING 10" STORM SEWER PIPE**<br>*Add'l Info: VCP*<br>at the unit price of _____ per linear foot | 248 | LF | $ |
| 2-11.2d | **REMOVE EXISTING 15" STORM SEWER PIPE**<br>*Add'l Info: VCP*<br>at the unit price of _____ per linear foot | 409 | LF | $ |
| 2-11.2q | **REMOVE EXISTING 66" STORM SEWER PIPE**<br>*Add'l Info: 63x42 OVOID BRICK*<br>at the unit price of _____ per linear foot | 77 | LF | $ |
| 2-11.2s | **REMOVE EXISTING 78" STORM SEWER PIPE**<br>*Add'l Info: 75" VCP*<br>at the unit price of _____ per linear foot | 983 | LF | $ |
| 2-11.5a | **ABANDON EXISTING 8" SEWER PIPE**<br>*Add'l Info: 6" DIP WATER LINE*<br>at the unit price of _____ per linear foot | 20 | LF | $ |
| 2-11.5a | **ABANDON EXISTING 8" SEWER PIPE**<br>*Add'l Info: 8" PVC WATER LINE*<br>at the unit price of _____ per linear foot | 60 | LF | $ |
| 2-12.2 | **REMOVE EXISTING STORM MANHOLE**<br>at the unit price of _____ each | 6 | EA | $ |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 2-13.1 | **REMOVE EXISTING STORM INLET**<br>at the unit price of _____ each | 14 | EA | $ _____ |
| 2-17.1 | **REMOVE AND REPLACE/RELOCATE UTILITY POLES**<br>*Add'l Info: INCLUDES SUPPORT OF POLES*<br>at the unit price of _____ each | 4 | EA | $ _____ |
| 2-17.3 | **REMOVE AND REPLACE/RELOCATE SIGN**<br>at the unit price of _____ each | 25 | EA | $ |
| 2-17.3 | **REMOVE AND REPLACE/RELOCATE SIGN**<br>*Add'l Info: REMOVE AND RESET BOLLARD*<br>at the unit price of _____ each | 2 | EA | $ _____ |
| 2-17.7 | **RELOCATE EXISTING UTILITY**<br>*Add'l Info: COORDINATION WITH UTILITY COMPANIES*<br>at the unit price of _____ lump sum | 1 | LS | $ _____ |
| 2-17.7 | **RELOCATE EXISTING UTILITY**<br>*Add'l Info: RELOCATE TRAFFIC OVERHEAD. CONTRACTOR TO PROVIDE SUPPORT POLES.*<br>at the unit price of _____ lump sum | 1 | LS | $ |
| 2-20a | **REMOVE TROLLEY TRACKS**<br>at the unit price of _____ per linear foot | 180 | LF | $ _____ |
| 02-22.13 | **VIBRATION ASSESSMENT**<br>at the unit price of _____ lump sum | 1 | LS | $ _____ |
| 2-23 | **REMOVE DECORATIVE LANDSCAPING**<br>at the unit price of _____ lump sum | 1 | LS | $ |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 3-2 | **HAULING OF CONTAMINATED MATERIALS TO DENVER/ARAPAHOE DISPOSAL SITE (DADS)*LICENSED PER D.R.M.C. 48-62** | | | |
| | at the unit price of _____ per ton | 2,000 | TON | $ |
| 3-7a | **HEALTH & SAFETY PLAN** | | | |
| | at the unit price of _____ lump sum | 1 | LS | $ _____ |
| 3-7b | **MATERIAL MANAGEMENT PLAN** | | | |
| | at the unit price of _____ lump sum | 1 | LS | $ |
| 5-2a | **SUBGRADE MATERIAL (SELECT BACKFILL)** | | | |
| | at the unit price of _____ per ton | 2,000 | TON | $ _____ |
| 5-7 | **CONTROLLED LOW STRENGTH MATERIALS (CLSM)** | | | |
| | at the unit price of _____ per cubic yard | 100 | CY | $ |
| 5-8 | **CRUSHED GRAVEL BASE COURSE (CDOT CLASS 6 ROAD BASE)** | | | |
| | at the unit price of _____ per ton | 300 | TON | $ |
| 8-1.1b | **6" DIP AWWA C151, CLASS 50 WATER LINE** | | | |
| | at the unit price of _____ per linear foot | 60 | LF | $ |
| 8-1.1c | **8" DIP AWWA C151, CLASS 50 WATER LINE** | | | |
| | at the unit price of _____ per linear foot | 170 | LF | $ _____ |
| 8-1.1d | **10" DIP AWWA C151, CLASS 50 WATER LINE** | | | |
| | at the unit price of _____ per linear foot | 40 | LF | $ |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 8-1.1e | **12" DIP AWWA C151, CLASS 50 WATER LINE**<br>at the unit price of _____<br>per linear foot | 20 | LF | $ _____ |
| 8-1.1h | **16" DIP AWWA C151, CLASS 50 WATER LINE**<br>at the unit price of<br>per linear foot | 20 | LF | $ |
| 8-1.2b | **INSTALL 6" WATER VALVE**<br>at the unit price of<br>each | 3 | EA | $ |
| 8-1.2c | **INSTALL 8" WATER VALVE**<br>at the unit price of _____<br>each | 3 | EA | $ _____ |
| 8-1.3a | **4" PVC AWWA C900, CLASS 200**<br>*Add'l Info: REMOVE AND REPLACE SANITARY SERVICE LINE*<br>at the unit price of _____<br>per linear foot | 50 | LF | $ _____ |
| 8-1.3b | **6" PVC AWWA C900, CLASS 150**<br>*Add'l Info: SANITARY REPLACEMENT*<br>at the unit price of<br>per linear foot | 50 | LF | $ |
| 8-1.5a | **LEAD SERVICE LINE REPLACEMENT, <2" ID**<br>at the unit price of _____<br>per linear foot | 90 | LF | $ _____ |
| 8-2 | **REMOVE FIRE HYDRANT ASSEMBLY**<br>at the unit price of<br>each | 3 | EA | $ |
| 8-3 | **RESET OR INSTALL FIRE HYDRANT ASSEMBLY**<br>at the unit price of _____<br>each | 3 | EA | $ _____ |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | | Estimated Cost |
|---|---|---|---|---|---|
| 8-4 | **REMOVE EXISTING WATER LINE**<br>*Add'l Info: REMOVE 6" CML WATER LINE*<br>at the unit price of<br>per linear foot | 30 | LF | $ | |
| 8-4 | **REMOVE EXISTING WATER LINE**<br>*Add'l Info: REMOVE 8" DIP & PVC WATER LINE*<br>at the unit price of<br>per linear foot | 100 | LF | $ | |
| 8-4 | **REMOVE EXISTING WATER LINE**<br>*Add'l Info: REMOVE 10" CIP WATER LINE*<br>at the unit price of _____<br>per linear foot | 40 | LF | $ | _____ |
| 12-1.1 | **6" CURB AND GUTTER 2' PAN (CD0T T2, IIB)**<br>at the unit price of<br>per linear foot | 2,279 | LF | $ | |
| 12-1.7 | **6" CONCRETE CURB HEAD**<br>*Add'l Info: FOR RAMP AT 27TH & CURTIS*<br>at the unit price of _____<br>per linear foot | 60 | LF | $ | _____ |
| 12-1.8 | **SIDEWALK ACCESSIBILITY CONCRETE CURB RAMP**<br>at the unit price of<br>per square foot | 5,060 | SF | $ | |
| 12-1.9 | **GUTTER OVERLAY**<br>*Add'l Info: CDOT CLASS D CONCRETE GUTTER OVERLAY WITH FIBER MESH REINFORCEMENT*<br>at the unit price of _____<br>per linear foot | 1,500 | LF | $ | _____ |
| 12-2.1 | **CONCRETE SIDEWALK**<br>at the unit price of _____<br>per square foot | 1,000 | SF | $ | _____ |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | | Estimated Cost |
|---|---|---|---|---|---|
| 12-2.1 | **CONCRETE SIDEWALK**<br>*Add'l Info: PIGMENTED*<br>at the unit price of<br>per square foot | 2,000 | SF | $ | |
| 12-2.1 | **CONCRETE SIDEWALK**<br>*Add'l Info: 8" PIGMENTED FOR RAMP AT 27TH & CURTIS*<br>at the unit price of<br>per square foot | 220 | SF | $ | |
| 12-5.1 | **CONCRETE DRIVEWAY PAVING**<br>at the unit price of _____<br>per square foot | 800 | SF | $ | _____ |
| 12-5.5 | **CONCRETE ALLEY PAVING**<br>at the unit price of _____<br>per square foot | 2,937 | SF | $ | _____ |
| 12-16a | **CONCRETE RETAINING WALL**<br>*Add'l Info: FOR RAMP AT 27TH & CURTIS*<br>at the unit price of _____<br>lump sum | 1 | LS | $ | _____ |
| 16-3 | **CHAIN LINK FENCE**<br>*Add'l Info: TREE PROTECTION, INCLUDES TREE WRAP. ALSO INCLUDES FENCE FOR MAINTAINING PEDESTRIAN ACCESS.*<br>at the unit price of<br>per linear foot | 2,500 | LF | $ | |
| 20-2ce | **ASPHALT SURFACE COURSE, SX, RAP 20%, N=100, 64-22.**<br>at the unit price of<br>per square yard inch | 17,258 | SY-IN | $ | |
| 20-3ce | **ASPHALT BASE COURSE, S, RAP 20%, N=100, 64-22.**<br>at the unit price of _____<br>per square yard inch | 47,459 | SY-IN | $ | _____ |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 20-4 | **ASPHALT ROTOMILL**<br>at the unit price of _____<br>per square yard inch | 2,000 | SY-IN | $ _____ |
| 20-5 | **ASPHALT PATCH**<br>at the unit price of _____<br>per square yard inch | 6,903 | SY-IN | $ |
| 34-2.3d | **15" DIAMETER C-76 RCP, CLASS III**<br>at the unit price of _____<br>per linear foot | 115 | LF | $ |
| 34-2.3e | **18" DIAMETER C-76 RCP, CLASS III**<br>at the unit price of _____<br>per linear foot | 292 | LF | $ _____ |
| 34-2.3g | **24" DIAMETER C-76 RCP, CLASS III**<br>at the unit price of _____<br>per linear foot | 17 | LF | $ |
| 34-2.3p | **60" DIAMETER C-76 RCP, CLASS III**<br>at the unit price of _____<br>per linear foot | 60 | LF | $ _____ |
| 34-2.3u | **90" DIAMETER C-76 RCP, CLASS III**<br>at the unit price of _____<br>per linear foot | 1,500 | LF | $ |
| 34-7.1c | **12" DIAMETER PVC PIPE**<br>*Add'l Info: FOR ROOF DRAIN 1031+05*<br>at the unit price of _____<br>per linear foot | 30 | LF | $ _____ |
| 34-12.4a | **CAST-IN-PLACE TYPE B MANHOLE WITH TYPE A TOP SLAB**<br>at the unit price of _____<br>each | 4 | EA | $ _____ |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | | Estimated Cost |
|---|---|---|---|---|---|
| 34-12.5b | **CAST-IN-PLACE TYPE P MANHOLE WITH TOP SLAB FOR H>2' DEPTH**<br>at the unit price of _____ each | 2 | EA | $ | |
| 34-12.7 | **CAST-IN-PLACE SPECIAL STRUCTURE**<br>*Add'l Info: MH-9*<br>at the unit price of _____ each | 1 | EA | $ | |
| 34-12.7 | **CAST-IN-PLACE SPECIAL STRUCTURE**<br>*Add'l Info: PRECAST CONCRETE PLUG*<br>at the unit price of _____ each | 1 | EA | $ | |
| 34-12.7 | **CAST-IN-PLACE SPECIAL STRUCTURE**<br>*Add'l Info: MH-13*<br>at the unit price of _____ each | 1 | EA | $ | |
| 34-12.8 | **UNCOVER AND RAISE (ADJUST) MANHOLE**<br>*Add'l Info: MEASUREMENT IS EACH*<br>at the unit price of _____ vertical feet | 4 | VF | $ | |
| 34-12.9 | **ADJUST UTILITY LIDS**<br>at the unit price of _____ each | 5 | EA | $ | |
| 34-15.3 | **UTILITY EXPLORATORY INVESTIGATION**<br>at the unit price of _____ each | 20 | EA | $ | |
| 34-16.1a | **#14 INLET (L=6')**<br>at the unit price of _____ each | 4 | EA | $ | |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 34-16.1a | **#14 INLET (L=6')**<br>*Add'l Info: SPECIAL(DEEPER THAN 6')*<br>at the unit price of _____ each | 5 | EA | $ |
| 34-16.1b | **#14 INLET (L=9')**<br>at the unit price of _____ each | 3 | EA | $ _____ |
| 34-16.1b | **#14 INLET (L=9')**<br>*Add'l Info: SPECIAL(DEEPER THAN 6')*<br>at the unit price of _____ each | 4 | EA | $ _____ |
| 34-16.2a | **SINGLE #16 INLET WITH OPEN THROAT**<br>at the unit price of _____ each | 2 | EA | $ _____ |
| 40-3 | **SODDING**<br>at the unit price of _____ per square foot | 10,000 | SF | $ |
| 40-4b | **RELOCATE EXISITING SPRINKLER LINE**<br>at the unit price of _____ per linear foot | 3,000 | LF | $ |
| 40-6 | **DECORATIVE LANDSCAPING**<br>*Add'l Info: INCLUDES REMOVAL AND REPLACEMENT OF PLANTERS, DECORATIVE BRICK PAVING AND FLAGSTONE, AND GRADING AROUND RAMPS AND SIDEWALK*<br>at the unit price of _____ lump sum | 1 | LS | $ |
| 41-1 | **TRAFFIC CONTROL**<br>*Add'l Info: TO INCLUDE POTENTIAL TEMPORARY 2-WAY CONVERSION OF CHAMPA, STOUT, 27TH STREET*<br>at the unit price of _____ lump sum | 1 | LS | $ |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Bid Item Description and Unit Price | Estimated Quantity | | Estimated Cost |
|---|---|---|---|---|
| 43-1d | **STORM WATER MANAGEMENT (SCENARIO 4) See SCS 23.0** | | | |
| | at the unit price of _____ lump sum | 1 | LS | $ |
| 44-1 | **DEWATERING** | | | |
| | at the unit price of _____ lump sum | 1 | LS | $ |
| 45-2 | **QUALITY CONTROL TESTING** | | | |
| | at the unit price of _____ lump sum | 1 | LS | $ |
| 46-1 | **PAVEMENT MARKING (PAINT)** | | | |
| | at the unit price of _____ per square foot | 470 | SF | $ |
| 46-4 | **PREFORMED PLASTIC PAVEMENT MARKING** | | | |
| | at the unit price of _____ per square foot | 500 | SF | $ |
| 47-1 | **CONSTRUCTION SURVEYING** | | | |
| | at the unit price of _____ lump sum | 1 | LS | $ |
| 47-2 | **SURVEY MONUMENTATION** | | | |
| | *Add'l Info: RESET RANGE POINT* | | | |
| | at the unit price of _____ each | 3 | EA | $ |
| 47-2 | **SURVEY MONUMENTATION** | | | |
| | *Add'l Info: FOR SURVEY MARKING (OTHER THAN RANGE POINT) TO BE TIED OUT* | | | |
| | at the unit price of _____ each | 25 | EA | $ |
| 50-1 | **MOBILIZATION** | | | |
| | at the unit price of _____ lump sum | 1 | LS | $ |

Attachment D

## *Statement of Quantities*

### *27th Street Storm Interceptor, Phase 2*

| Pay Item # | Description | Estimated Quantity | Units |
|---|---|---|---|
| 01-21.16.01 | ALLOWANCE FOR TREE REMOVAL, TRIMMING/ REPLACEMENT AND DISPOSAL - SEE PROJECT SPECIAL PROVISIONS | 1 | A/A |
| 01-21.19.01 | ALLOWANCE FOR CERTIFIED ASBESTOS BUILDING INSPECTOR (CABI)/AIR MONITOR(HOURLY) - SEE PROJECT SPECIAL PROVISIONS | 1 | A/A |
| 01-52.13 | TEMPORARY OFFICE FACILITIES | 1 | LS |
| 2-1.2a | REMOVE 6" CONCRETE CURB AND/OR GUTTER | 2,279 | LF |
| 2-1.4 | REMOVE SIDEWALK ACCESSIBILITY CONCRETE CURB RAMP | 5,060 | SF |
| 2-2.1 | REMOVE CONCRETE SIDEWALK | 2,220 | SF |
| 2-2.2 | REMOVE CONCRETE DRIVEWAY PAVING | 800 | SF |
| 2-3.3 | REMOVE CONCRETE ALLEY PAVING | 2,937 | SF |
| 2-5 | REMOVE CONCRETE RETAINING WALL<br>*Add'l Info: FOR RAMP AT 27TH & CURTIS* | 100 | LF |
| 2-11.2b | REMOVE EXISTING 10" STORM SEWER PIPE<br>*Add'l Info: VCP* | 248 | LF |
| 2-11.2d | REMOVE EXISTING 15" STORM SEWER PIPE<br>*Add'l Info: VCP* | 409 | LF |
| 2-11.2q | REMOVE EXISTING 66" STORM SEWER PIPE<br>*Add'l Info: 63x42 OVOID BRICK* | 77 | LF |
| 2-11.2s | REMOVE EXISTING 78" STORM SEWER PIPE<br>*Add'l Info: 75" VCP* | 983 | LF |
| 2-11.5a | ABANDON EXISTING 8" SEWER PIPE<br>*Add'l Info: 6" DIP WATER LINE* | 20 | LF |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Description | Estimated Quantity | Units |
|---|---|---|---|
| 2-11.5a | ABANDON EXISTING 8" SEWER PIPE<br>*Add'l Info: 8" PVC WATER LINE* | 60 | LF |
| 2-12.2 | REMOVE EXISTING STORM MANHOLE | 6 | EA |
| 2-13.1 | REMOVE EXISTING STORM INLET | 14 | EA |
| 2-17.1 | REMOVE AND REPLACE/RELOCATE UTILITY POLES<br>*Add'l Info: INCLUDES SUPPORT OF POLES* | 4 | EA |
| 2-17.3 | REMOVE AND REPLACE/RELOCATE SIGN | 25 | EA |
| 2-17.3 | REMOVE AND REPLACE/RELOCATE SIGN<br>*Add'l Info: REMOVE AND RESET BOLLARD* | 2 | EA |
| 2-17.7 | RELOCATE EXISTING UTILITY<br>*Add'l Info: COORDINATION WITH UTILITY COMPANIES* | 1 | LS |
| 2-17.7 | RELOCATE EXISTING UTILITY<br>*Add'l Info: RELOCATE TRAFFIC OVERHEAD. CONTRACTOR TO PROVIDE SUPPORT POLES.* | 1 | LS |
| 2-20a | REMOVE TROLLEY TRACKS | 180 | LF |
| 02-22.13 | VIBRATION ASSESSMENT | 1 | LS |
| 2-23 | REMOVE DECORATIVE LANDSCAPING | 1 | LS |
| 3-2 | HAULING OF CONTAMINATED MATERIALS TO DENVER/ARAPAHOE DISPOSAL SITE (DADS)*LICENSED PER D.R.M.C. 48-62 | 2,000 | TON |
| 3-7a | HEALTH & SAFETY PLAN | 1 | LS |
| 3-7b | MATERIAL MANAGEMENT PLAN | 1 | LS |
| 5-2a | SUBGRADE MATERIAL (SELECT BACKFILL) | 2,000 | TON |
| 5-7 | CONTROLLED LOW STRENGTH MATERIALS (CLSM) | 100 | CY |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Description | Estimated Quantity | Units |
|---|---|---|---|
| 5-8 | CRUSHED GRAVEL BASE COURSE (CDOT CLASS 6 ROAD BASE) | 300 | TON |
| 8-1.1b | 6" DIP AWWA C151, CLASS 50 WATER LINE | 60 | LF |
| 8-1.1c | 8" DIP AWWA C151, CLASS 50 WATER LINE | 170 | LF |
| 8-1.1d | 10" DIP AWWA C151, CLASS 50 WATER LINE | 40 | LF |
| 8-1.1e | 12" DIP AWWA C151, CLASS 50 WATER LINE | 20 | LF |
| 8-1.1h | 16" DIP AWWA C151, CLASS 50 WATER LINE | 20 | LF |
| 8-1.2b | INSTALL 6" WATER VALVE | 3 | EA |
| 8-1.2c | INSTALL 8" WATER VALVE | 3 | EA |
| 8-1.3a | 4" PVC AWWA C900, CLASS 200<br>*Add'l Info: REMOVE AND REPLACE SANITARY SERVICE LINE* | 50 | LF |
| 8-1.3b | 6" PVC AWWA C900, CLASS 150<br>*Add'l Info: SANITARY REPLACEMENT* | 50 | LF |
| 8-1.5a | LEAD SERVICE LINE REPLACEMENT, <2" ID | 90 | LF |
| 8-2 | REMOVE FIRE HYDRANT ASSEMBLY | 3 | EA |
| 8-3 | RESET OR INSTALL FIRE HYDRANT ASSEMBLY | 3 | EA |
| 8-4 | REMOVE EXISTING WATER LINE<br>*Add'l Info: REMOVE 6" CML WATER LINE* | 30 | LF |
| 8-4 | REMOVE EXISTING WATER LINE<br>*Add'l Info: REMOVE 8" DIP & PVC WATER LINE* | 100 | LF |
| 8-4 | REMOVE EXISTING WATER LINE<br>*Add'l Info: REMOVE 10" CIP WATER LINE* | 40 | LF |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Description | Estimated Quantity | Units |
|---|---|---|---|
| 12-1.1 | 6" CURB AND GUTTER 2' PAN (CD0T T2, IIB) | 2,279 | LF |
| 12-1.7 | 6" CONCRETE CURB HEAD<br>*Add'l Info: FOR RAMP AT 27TH & CURTIS* | 60 | LF |
| 12-1.8 | SIDEWALK ACCESSIBILITY CONCRETE CURB RAMP | 5,060 | SF |
| 12-1.9 | GUTTER OVERLAY<br>*Add'l Info: CDOT CLASS D CONCRETE GUTTER OVERLAY WITH FIBER MESH REINFORCEMENT* | 1,500 | LF |
| 12-2.1 | CONCRETE SIDEWALK | 1,000 | SF |
| 12-2.1 | CONCRETE SIDEWALK<br>*Add'l Info: PIGMENTED* | 2,000 | SF |
| 12-2.1 | CONCRETE SIDEWALK<br>*Add'l Info: 8" PIGMENTED FOR RAMP AT 27TH & CURTIS* | 220 | SF |
| 12-5.1 | CONCRETE DRIVEWAY PAVING | 800 | SF |
| 12-5.5 | CONCRETE ALLEY PAVING | 2,937 | SF |
| 12-16a | CONCRETE RETAINING WALL<br>*Add'l Info: FOR RAMP AT 27TH & CURTIS* | 1 | LS |
| 16-3 | CHAIN LINK FENCE<br>*Add'l Info: TREE PROTECTION, INCLUDES TREE WRAP. ALSO INCLUDES FENCE FOR MAINTAINING PEDESTRIAN ACCESS.* | 2,500 | LF |
| 20-2ce | ASPHALT SURFACE COURSE, SX, RAP 20%, N=100, 64-22. | 17,258 | SY-IN |
| 20-3ce | ASPHALT BASE COURSE, S, RAP 20%, N=100, 64-22. | 47,459 | SY-IN |
| 20-4 | ASPHALT ROTOMILL | 2,000 | SY-IN |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Description | Estimated Quantity | Units |
|---|---|---|---|
| 20-5 | ASPHALT PATCH | 6,903 | SY-IN |
| 34-2.3d | 15" DIAMETER C-76 RCP, CLASS III | 115 | LF |
| 34-2.3e | 18" DIAMETER C-76 RCP, CLASS III | 292 | LF |
| 34-2.3g | 24" DIAMETER C-76 RCP, CLASS III | 17 | LF |
| 34-2.3p | 60" DIAMETER C-76 RCP, CLASS III | 60 | LF |
| 34-2.3u | 90" DIAMETER C-76 RCP, CLASS III | 1,500 | LF |
| 34-7.1c | 12" DIAMETER PVC PIPE<br>*Add'l Info: FOR ROOF DRAIN 1031+05* | 30 | LF |
| 34-12.4a | CAST-IN-PLACE TYPE B MANHOLE WITH TYPE A TOP SLAB | 4 | EA |
| 34-12.5b | CAST-IN-PLACE TYPE P MANHOLE WITH TOP SLAB FOR H>2' DEPTH | 2 | EA |
| 34-12.7 | CAST-IN-PLACE SPECIAL STRUCTURE<br>*Add'l Info: MH-9* | 1 | EA |
| 34-12.7 | CAST-IN-PLACE SPECIAL STRUCTURE<br>*Add'l Info: PRECAST CONCRETE PLUG* | 1 | EA |
| 34-12.7 | CAST-IN-PLACE SPECIAL STRUCTURE<br>*Add'l Info: MH-13* | 1 | EA |
| 34-12.8 | UNCOVER AND RAISE (ADJUST) MANHOLE<br>*Add'l Info: MEASUREMENT IS EACH* | 4 | VF |
| 34-12.9 | ADJUST UTILITY LIDS | 5 | EA |
| 34-15.3 | UTILITY EXPLORATORY INVESTIGATION | 20 | EA |
| 34-16.1a | #14 INLET (L=6') | 4 | EA |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Description | Estimated Quantity | Units |
|---|---|---|---|
| 34-16.1a | #14 INLET (L=6')<br>*Add'l Info: SPECIAL(DEEPER THAN 6')* | 5 | EA |
| 34-16.1b | #14 INLET (L=9') | 3 | EA |
| 34-16.1b | #14 INLET (L=9')<br>*Add'l Info: SPECIAL(DEEPER THAN 6')* | 4 | EA |
| 34-16.2a | SINGLE #16 INLET WITH OPEN THROAT | 2 | EA |
| 40-3 | SODDING | 10,000 | SF |
| 40-4b | RELOCATE EXISITING SPRINKLER LINE | 3,000 | LF |
| 40-6 | DECORATIVE LANDSCAPING<br>*Add'l Info: INCLUDES REMOVAL AND REPLACEMENT OF PLANTERS, DECORATIVE BRICK PAVING AND FLAGSTONE, AND GRADING AROUND RAMPS AND SIDEWALK* | 1 | LS |
| 41-1 | TRAFFIC CONTROL<br>*Add'l Info: TO INCLUDE POTENTIAL TEMPORARY 2-WAY CONVERSION OF CHAMPA, STOUT, 27TH STREET* | 1 | LS |
| 43-1d | STORM WATER MANAGEMENT (SCENARIO 4) See SCS 23.0 | 1 | LS |
| 44-1 | DEWATERING | 1 | LS |
| 45-2 | QUALITY CONTROL TESTING | 1 | LS |
| 46-1 | PAVEMENT MARKING (PAINT) | 470 | SF |
| 46-4 | PREFORMED PLASTIC PAVEMENT MARKING | 500 | SF |
| 47-1 | CONSTRUCTION SURVEYING | 1 | LS |
| 47-2 | SURVEY MONUMENTATION<br>*Add'l Info: RESET RANGE POINT* | 3 | EA |

*27th Street Storm Interceptor, Phase 2*

| Pay Item # | Description | Estimated Quantity | Units |
|---|---|---|---|
| 47-2 | SURVEY MONUMENTATION<br>*Add'l Info: FOR SURVEY MARKING (OTHER THAN RANGE POINT) TO BE TIED OUT* | 25 | EA |
| 50-1 | MOBILIZATION | 1 | LS |

# CITY AND COUNTY OF DENVER

## STATE OF COLORADO

## DEPARTMENT OF PUBLIC WORKS

Technical Specifications

Contract Number: 201950389

27th Street Storm Interceptor, Phase 2

May 29, 2019

# 27th STREET STORM DRAIN INTERCEPTOR – PHASE 2

## Arapahoe St. – Welton St.

# PROJECT SPECIFICATIONS
# May 2019

Denver Contract Control No:

*Prepared for:*
**City and County of Denver**
**Public Works Engineering Division**
**Wastewater Infrastructure Project Management**
2000 West 3rd Avenue
Denver, CO 80223

*Prepared by:*
**Merrick & Company**
5970 Greenwood Plaza Blvd.
Greenwood Village, CO 80111
Merrick Job No: 65419412

# Sections

- Supplementation to Specifications
- Appendix A – Geotechnical Engineering Study by Kumar & Associates, April 9, 2018
- Appendix B – Materials Management Plan by Pinyon Environmental, Inc., October 27, 2017

# Supplementation to Specifications

# TABLE OF CONTENTS

Supplementation of Section 1.0 – Scope .....2
Supplementation of Section 3.0 – Existing Facilities…….....3

## SUPPLEMENTATION OF SECTION 1.0
## SCOPE

**Section 1.0 of the Wastewater Capital Projects Management Standard Construction Specifications is hereby supplemented for this project as follows:**

**Section 1.0 shall include the following:**

In addition, the Colorado Department of Transportation Standard Specifications for Roadway and Bridge Construction, (Sections 105.10 and 105.11) adopted in 2017 shall be used as indicated herein. All relevant revisions to these sections of the CDOT standard special provisions shall be used for this project and can be found at:
https://www.codot.gov/business/designsupport/cdot-construction-specifications/2017-construction-standard-specs/rev-ssp
References to CCD, City, Department, or Engineer in the Standard Construction Specifications and/or Project Special Provisions refer to the City and County of Denver Project Manager.

It is the intent of the City to use applicable details from the City of Denver's Wastewater Management Division Standard Details, and the Denver Water Department's Standard Drawings, most recent editions. Drainage related appurtenances shall be constructed as shown in the City and County of Denver (CCD), Department of Public Works documents for storm and sanitary sewer construction. These documents can be found at the following web address:
https://www.denvergov.org/content/denvergov/en/wastewater-management/capital-projects-management/engineeringand-permits.html

## SUPPLEMENTATION OF SECTION 3.0
## EXISTING FACILITIES

**Section 3.0 of the Wastewater Capital Projects Management Standard Construction Specifications is hereby supplemented for this project as follows:**

**Section 3.0 shall include the following:**

### UTILITIES

The known utilities and contacts within the limits of this project are:

| **Utility Company**<br>**Address** | **Contact Name**<br>**Email** | **Telephone** |
|---|---|---|
| AT&T | Duane Ward<br>Duanew@csc64.com | 720-289-5471 |
| CenturyLink<br>5325 Zuni St, Room 728<br>Denver, CO 80221 | Maureen Klick<br>Maureen.Klick@CenturyLink.com<br><br>Robert McLeod<br>Robert.McLeod@CenturyLink.com | 720-578-3720 |
| Comcast<br>8000 E Iliff Ave<br>Denver, CO 80231 | Artjahmel Davis<br>Artjahmel_Davis@comcast.com<br><br>Kip West<br>Kip_west@cable.comcast.com | 303-603-2682<br><br>720-347-9992 |
| Denver Traffic<br>201 W Colfax Ave<br>Denver, CO 80202 | Chad Tavelli<br>Chad.tavelli@denvergov.org | 720-865-4008<br>720-448-6700 (cell) |
| Denver Wastewater Management<br>2000 W. 3rd Avenue<br>Denver, CO 80223 | Kelly Crum<br>Kelly.Crum@denvergov.org | 303-446-3668 |
| Denver Water<br>1600 W 12th Ave<br>Denver, CO 80204 | Ray Batts<br>Rapheal.batts@denverwater.org | 720-345-1069 |
| InTegera (Comcast)<br>8000 E Iliff Ave<br>Denver, CO 80231 | Kip West<br>Kip_west@cable.comcast.com | 720-347-9992 |
| Level 3 Communications (CenturyLink)<br>14200 E Jewell<br>Aurora, CO 80012 | Ben Braden<br>Benjamin.Braden@centurylink.com | 303-718-0773 (cell) |
| MCI-Verizon<br>24055 E 6th Ave<br>Aurora, CO 80018 | Lane Grady<br>Lane.grady@verizon.com | 801-301-0937 |
| Xcel<br>1123 W 3rd Ave<br>Denver, CO 80223 | Nick Martin<br>Nicholas.Martin@xcelenergy.com | 720-340-6036 (cell) |
| XO Communications<br>1660 Lincoln St #2600<br>Denver, CO 80264 | Josh Hicks<br>Josh.D.Hicks@xo.com | 303-539-3237<br>720-448-4886 (cell) |

| | | |
|---|---|---|
| Zayo<br>4772 Walnut St., Suite 100<br>Boulder, CO 80301 | James Black<br>jamesr.black@zayo.com<br><br>Wayne Stain<br>Wayne.stain@zayo.com | 719-216-8508<br><br><br>719-290-5861 |
| Windstream Enterprise | Victor Koth<br>Victor.koth@windstream.com | 720-529-7654<br>720-347-7845 (cell) |

The work described in these plans and specifications requires coordination between the Contractor and the utility companies in conducting their respective operations as necessary to complete the utility work with minimum delay to the project.

**PART 1 - <u>CONTRACTOR</u> SHALL PERFORM THE WORK LISTED BELOW:**

Coordinate project construction with the performance by the utility owner of each utility work element listed in Part 2 below. Perform preparatory work specified in Part 2 for each utility work element. Provide an accurate construction schedule that includes all utility work elements to the owner of each impacted utility. Provide each utility owner with periodic updates to the schedule. Conduct necessary utility coordination meetings, and provide other necessary accommodations as directed by the Engineer.

Notify each utility owner in writing; with a copy to the Engineer, prior to the time each utility work element is to be performed by the utility owner. Written notice shall be provided in the time specified in Part 2 immediately prior to the time the utility work must begin to meet the project schedule. The Contractor shall allow the number of work days required for each utility work element in the construction schedule. The number of days expected for construction and number of days of prior notice is specified below for each utility owner.

Prior to excavating, the Contractor shall positively locate all potential conflicts with existing underground utilities and proposed construction, as determined by the Contractor according to proposed methods and schedule of construction. Please note that UNCC marks only its members' facilities – Other facilities, such as ditches and drainage pipes may exist, and it is the Contractor's responsibility to investigate, locate and avoid such facilities.

Work involving changes in, or interference with, utility service shall be done at such times and in such manner that it will cause the least interference with the proper handling and delivery of the utility service to the receiving customers. The Contractor shall notify all parties that will be affected 24 hours prior to the time sewer or water service is disconnected or interrupted. All services so disconnected, interrupted, or damaged shall be immediately repaired and restored to service. Repair work shall be continuous until the service is restored. No service shall be left inoperative overnight.

When work is being performed in the vicinity of utilities, the Contractor shall take appropriate measures to provide for the protection of the utility.

Should the Contractor desire to have any rearrangement made in any utility facility for his convenience in order to facilitate his construction operations, he shall make whatever arrangements necessary with the owners of such utility for such rearrangement and bear all expenses in connection therewith.

Provide traffic control, as directed by the Engineer, for any utility work by the utility owner expected to be coordinated with construction. However, traffic control for utility work outside of typical project work hours shall be the responsibility of the utility owner.

Perform each utility work element for every utility owner listed here in Part 1. Notify each utility owner in advance of any work being done by the Contractor to its facility, so that the utility owner can coordinate its inspections for final acceptance of the work with the Engineer.

All costs incidental to the foregoing requirements shall not be paid for separately but shall be included in the work. Full compensation for compliance and cooperation, as required by this section, shall be included in the unit prices paid for Contract items of work and no additional compensation will be allowed.

**All Utility Companies**

The Contractor will contact each utility company a minimum of two (2) business days, unless otherwise noted, prior to working in the utility company's area so that the utility company can provide an inspector and/or complete any necessary adjustments or relocations.

If a need for utility work by either the Contractor or a Utility Company arises, the following shall apply:

> The Contractor shall be responsible for coordinating the adjustment of utilities on this project. The Contractor shall keep each utility company advised of any work being performed in the vicinity of their facilities, so that each utility company can coordinate any needed locates, adjustments or inspections. Contractor shall provide the appropriate utility company ample notice, but not less than two (2) working days, prior to commencing activities in the vicinity of their facilities. Any additional work performed by the Contractor on behalf of the impacted utility company shall not be paid for by the City but shall be paid by the utility company requiring the work, unless otherwise agreed to in writing by the Engineer.
>
> Prior to excavating, the Contractor shall positively locate all potential conflicts with existing underground utilities and proposed construction, as determined by the Contractor according to proposed methods and schedule of construction. Please note that UNCC marks only its members' facilities; other facilities such as ditches and drainage pipes may exist, and it is the Contractor's responsibility to investigate, locate and avoid such facilities.

**Denver Water Department Work Elements:**

- All work shall be done by a contractor who has been pre-qualified by Denver Water. A list of pre-qualified contractors for the installation of 12-in and smaller mains is available from Denver Water. All materials and workmanship shall be in in conformance with Denver Water's current Engineering Standards, Material Specifications and Drawings. All main installations/system modifications shall be approved and inspected by Denver Water.
- The Contractor shall remove the abandoned 6-in waterlines in the following locations:
    - Sta. 1019+56 – in the 27th St and Curtis St intersection
    - Sta. 1019+85 – in the 27th St and Curtis St intersection
    - Sta. 1023+29 – 6" service South of the 27th St and Champa St intersection

    - Sta. 1030+26 – in the 27th St and California St intersection.
- The Contractor shall remove and replace the following Denver Water Department pipes along 27th Street as shown on the plans. Replacing shall include all necessary work and materials necessary to provide a complete functional installation at the new location.
    - Sta. 1018+35 – water service West of 27th St and Curtis St intersection
    - Sta. 1019+81 – 8-in watermain in the 27th Stand Curtis St intersection
    - Sta. 1021+13 – water service East of 27th St and Curtis St intersection
    - Sta. 1024+42 – water service East of 27th St and Champa St intersection
    - Sta. 1026+87 – 10-in watermain in the 27th St and Stout St intersection
    - Sta. 1030+21 – 8-in watermain in the 27th St and California St intersection
    - Sta. 1032+84 – water service West of 27th St and Welton St intersection
- The Contractor shall remove and relocate the following Denver Water Department pipes along 27th Street as shown on the plans. Relocating shall include all necessary work and materials necessary to provide a complete functional installation at the new location.
    - Sta. 1023+32 – 8-in watermain South of 27th St and Champa St intersection
- The Contractor shall remove and reset the following Denver Water Department fire hydrants along 27th Street as shown on the plans. Resetting shall include all necessary work and materials necessary to provide and complete functional installation at the new location.
    - Sta. 1029+98 – (West Side) South of 27th St and California St
- The Contractor shall adjust the following Denver Water Department fire hydrants along 27th Street as shown on the plans. Adjusting shall include all necessary work and materials necessary to provide and complete functional installation at the new location.
    - Sta. 1023+49 – (East Side) South of 27th St and Champa St
- The Contractor shall adjust water manholes to 1/4” to 1/2” below adjacent final finished street grade elevation. All work shall include all items necessary to complete the work, and materials necessary to provide a complete functional installation of the water manhole.
- The Contractor shall adjust water valve boxes to 1/4” to 1/2” below adjacent final finished street grade elevation. All work shall include all items necessary to complete the work, and materials necessary to provide a complete functional installation of the water valve.
- After final adjustment is completed, the Contractor shall clean water valve boxes of all foreign debris such that the operating nut of the valve is fully accessible to operation.
- The Contractor shall coordinate inspections with Denver Water. The Contractor shall provide the utility owner written notice 5 days immediately prior to required inspections.
- The Contractor shall protect the waterlines in 27th Street as shown in the plans. The existing 14-in and 16-in watermains in 27th Street are cast iron with lead joints, and the lines are sensitive to excessive vibration. The Contractor shall include considerations for protecting the existing waterlines with the vibration assessment.
- The Contractor shall support all waterlines crossing the storm main and storm laterals when they are exposed for work to be conducted beneath them.

**Denver Wastewater – Sanitary Work Elements:**

- The Contractor shall remove and replace the following Denver Wastewater Department pipes along 27th Street as shown on the plans. Resetting shall include all necessary work and materials necessary to provide a complete functional installation at the new location.
    - Sta. 1025+55 – 4-in pipe West of 27th St and Stout St intersection
- The Contractor shall adjust sanitary manholes to 1/4" to 1/2" below adjacent final finished street grade elevation.
- The Contractor shall coordinate inspections with Denver Wastewater. The Contractor shall provide the utility owner written notice 5 days immediately prior to required inspections.

**PART 2 - <u>UTILITY OWNERS</u> SHALL PERFORM THE WORK LISTED BELOW:**

The City of and County of Denver Contractor shall provide traffic control for any utility work expected to be coordinated with construction, as directed by the City Engineer. However, traffic control for utility work outside of typical project work hours shall be the responsibility of the utility owner. The utility owner shall prepare and submit to the City Engineer a Method of Handling Traffic for utility work to be performed outside typical project work hours. The utility owner shall obtain acceptance of the Method of Handling traffic from the City Engineer prior to beginning the utility work to be performed outside typical project work hours or outside of project limits.

This work will be performed by the utility owners as necessary to avoid conflicts with construction activities. New locations shall be as indicated in the plans. Utility owners shall comply with schedule requirements of the Contractor and make every effort not to impact the overall construction schedule. Unless otherwise approved by the Engineer, abandoned aboveground appurtenances such as pedestals shall be removed and abandoned underground utilities and manholes/handholds shall be abandoned in place.

Utility owners are responsible for obtaining all necessary permits from the City and County of Denver, as required. The following items of work are expected to be completed prior to, or coordinated with, construction and costs incurred by the project.

**Comcast Work Elements:**

- Comcast shall temporarily raise overhead cable lines at the following locations:
    - Sta. 1018+00 – at the alley between Arapahoe St and Curtis St
    - Sta. 1021+42 – at the alley between Curtis St and Champa St
    - Sta. 1024+90 – at the alley between Champa St and Stout St
    - Sta. 1028+54 – at the alley between Stout St and California St
    - Sta. 1030+51 – East of 27th St and California St intersection
    - Sta. 1031+79 – at the alley between California St and Welton St
- Comcast shall be responsible for traffic control related to each utility work element.
- Comcast shall complete each utility work element prior to the start of the 27th Street Interceptor construction project.
- The Contractor shall provide the utility owner written notice 30 days immediately prior to each utility work element expected to be coordinated with construction.

**Denver Water Work Elements:**

- Denver Water shall drain the 24" watermain in Champa during construction of the storm crossing. This work is expected to be coordinated with construction.
- Inspect the utility work performed by the Contractor listed in Part 1 above.
- The Contractor shall provide the utility owner written notice 5 days immediately prior to each required inspection.

**Denver Wastewater – Sanitary Work Elements:**

- Inspect the utility work performed by the Contractor listed in Part 1 above.
- The Contractor shall provide the utility owner written notice 5 days immediately prior to each required inspection.

**InTegra (Comcast) Work Elements:**

- InTegra (Comcast) shall relocate the fiber optic lines at the following locations:
    - Sta. 1019+52 – at the intersection of 27th St and Curtis St
- Comcast shall be responsible for traffic control related to each utility work element. The Contractor shall provide the utility owner written notice 30 days immediately prior to each utility work element expected to be coordinated with construction.

**Level 3 (CenturyLink) Work Elements:**

- Level 3 shall raise or lower the fiber optic line in the 27th St and Curtis St Intersection, at Sta. 1019+76.
- Level 3 shall be responsible for traffic control related to each utility work element.
- Level 3 shall complete each utility work element prior to the start of the 27th Street Interceptor construction project.
- Level 3 shall be responsible for traffic control related to each utility work element. The Contractor shall provide the utility owner written notice 30 days immediately prior to each utility work element expected to be coordinated with construction.

**Xcel Energy – Electric Distribution Work Elements:**

- Xcel Energy shall remove and reset the utility poles at the following locations in coordination with construction:
    - Sta. 1017+24 on the South side of 27th St, East of Arapahoe St.
    - Sta. 1026+46 on the Southwest corner of the 27th St and Stout St intersection
    - Sta. 1029+96 on the Southwest corner of the 27th St and California St intersection
- Xcel Energy shall remove and reset the light poles at the following locations in coordination with construction:
    - Sta. 1021+42 on the South side of 27th St at the alley between Curtis St and Champa St.
    - Sta. 1023+01 on the South side of 27th St at the intersection of 27th St and Champa St.
    - Sta. 1029+00 on the South side of 27th St at the alley between Stout St. and California St.
- Xcel Energy shall be responsible for traffic control related to each utility work element.

- The Contractor shall provide the utility owner written notice 30 days immediately prior to each utility work element expected to be coordinated with construction.

**Xcel Energy – Gas Work Elements:**

- Xcel Energy shall relocate the following gas pipes along 27th Street as shown on the plans. Xcel Energy shall complete each relocation work element prior to the start of the 27th Street Interceptor construction project.
    - Sta. 1017+46 – 2-in gas line East of 27th St and Arapahoe St intersection
    - Sta. 1021+85 – 1.25-in gas line West of 27th St and Champa St. intersection
    - Sta. 1023+30 – 4-in gas line South of 27th St and Champa St. intersection
    - Sta. 1023+90 – 1-in gas line East of 27th St and Champa St. intersection
    - Sta. 1024+63 – 2-in gas line East of 27th St and Champa St. intersection
    - Sta. 1024+95 – 2-in gas line East of 27th St and Champa St. intersection
    - Sta. 1025+32 – 2-in gas line West of 27th St and Stout St. intersection
    - Sta. 1031+77 – 2-in gas line East of the 27th St and California St intersection
    - Sta. 1032+35 – 4-in gas line West of the 27th St and Welton St intersection
    - Sta. 1032+69 – 2-in gas line West of the 27th St and Welton St intersection
- Xcel Energy shall remove and replace the following gas pipes along 27th Street as shown on the plans. Xcel Energy shall complete each relocation work element prior to the start of the 27th Street Interceptor construction project.
    - Sta. 1021+47 – in the alley between Curtis St. and Champa St.
- Xcel Energy shall coordinate with the Contractor when Xcel's gas lines need to be supported in place by the Contractor for work to be conducted beneath them.
- Xcel Energy shall be responsible for traffic control related to each utility work element. The Contractor shall provide the utility owner written notice 30 days immediately prior to each utility work element expected to be coordinated with construction.

**GENERAL**:

The Contractor shall comply with Article 1.5 of Title 9, CRS ("Excavation Requirements") when excavation or grading is planned in the area of underground utility facilities. The Contractor shall notify all affected utilities at least two (2) business days, not including the day of notification, prior to commencing such operations. The Contractor shall contact the Utility Notification Center of Colorado (UNCC) at (**8-1-1**) or **1-800-922-1987** to have locations of UNCC registered lines marked by member companies. All other underground facilities shall be located by contacting the respective company. Utility service laterals shall also be located prior to beginning excavating or grading.

The location of utility facilities as shown on the plan and profile sheets, and herein described, were obtained from the best available information.

All costs incidental to the foregoing requirements will not be paid for separately but shall be included in the work.

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# Wastewater Capital Projects Management
# Project Specific Construction Specification

## Bid Item 01-21.16.01: TREE TRIMMING, REMOVAL AND REPLACEMENT/TRANSPLANTING AND DISPOSAL (*CITY RIGHT OF WAY ONLY) ALLOWANCE ACCOUNT

**27th Street Storm Drain Interceptor, Phase 2**

**ALLOWANCE ACCOUNT ITEMS**

**DESCRIPTION**

This Special Provision contains the City and County of Denver's estimate for Allowance Account Items for ***all allowances*** necessary for **Tree Trimming, Removal, Replacement/Transplanting and Disposal** of trees which are identified in the tree protection plan; or at the direction of the City Construction Project Manager. Duties of the arborist shall be to provide tree trimming, removal, and when required, replacement of trees in the City and County of Denver Right of Way, in accordance with the Denver Parks and Recreation/Forestry Division guidelines and specifications. The work must be performed by a City and County of Denver Forestry approved, licensed and bonded arborist. Replacement trees must be obtained from a Denver Parks and Recreation/Forestry approved vendor or from Denver Parks and Recreation Forestry Division directly. The selected vendor must comply with all federal, state, and local requirements, and shall only be paid after submittal of receipts and an itemized statement endorsed by the Contractor, and approved by the City Construction Project Manager. The estimated allowance account amounts will be added to the total bid to determine the amount of the performance and payment bonds. Allowance account work shall be performed and reimbursed to the contractor as approved by the City Construction Project Manager. In no event shall the contractor be reimbursed for items outside of the basis of payment.

**BASIS OF PAYMENT**

Payment will be made at true and verifiable cost plus 3% within the associated allowance account item category indicated below (A-D). The costs of **Tree Trimming, Removal, Replacement/Transplanting and Disposal** includes the rental costs of any required equipment, coordinating the work and disposal of the tree waste. The schedule of values shall be submitted by the contractor and accepted by the City Construction Project Manager within 60 days of Notice to Apparent Low Bidder. **Tree Trimming, Removal, Replacement/Transplanting and Disposal** shall be performed by a subcontractor meeting the above qualifications, and the unit prices will only be paid at true and verifiable cost plus a 3% mark up in

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accordance with the City and County of Denver General Contract Conditions. Mark up shall not be applied to sales tax or reclamation fees/charges. Payment will constitute full compensation for all true and verifiable costs associated with **Tree Trimming, Removal, Replacement/Transplanting and Disposal**; and allowances necessary to complete the scope of the project. The contractor will be required to submit itemized invoices for the tree trimming, removal and replacement in a spreadsheet tabulation indicating the 3% mark up for inclusion in the Field Measurement Report (FMR). The City Construction Project Manager will approve payments in the appropriate dollar amount on the monthly payment applications.

***Each Right of Way tree in the City and County of Denver has value which is assessed by Denver Parks and Recreation/Forestry. When the Contractor's means and methods impact a tree to such an extent that Denver Parks and Recreation/Forestry requires the removal of the tree, Denver Parks and Recreation/Forestry requires compensation of the assessed value of the tree. No payment will be made under this bid item for Denver Parks and Recreation/Forestry assessed values of trees removed. The Contractor is solely responsible for compensating Denver Parks and Recreation/Forestry for the assessed value of any tree removed.***

No payment will be made under this bid item for disposal of any construction debris as identified in the Wastewater Capital Projects Management Standard Construction Specifications, Measurement and Payment for Pipe (**page 32)** nor for any trees damaged through construction operations or contractor negligence.

Allowance Account work must be coordinated through a City and County of Denver Forestry approved*, licensed and bonded arborist and shall only be paid for after receipt of an itemized statement endorsed by the Contractor and approved by the City Construction Project Manager.

| Item No. | Allowance Account Item | Quantity | Estimated Amount |
|---|---|---|---|
| 01-21.16.01A | Tree Trimming | A/A | $6,000.00 |
| 01-21.16.01B | Tree Removal | A/A | $12,000.00 |
| 01-21.16.01C | Tree Replacement/Transplanting | A/A | $0.00 |
| 01-21.16.01D | Disposal of Tree Material | A/A | $2,000.00 |
| | | **Maximum Total:** | **$20,000.00** |

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**Allowance Account Item Definitions:**

01-21-16.01A **Tree Trimming** – must be completed in accordance with Denver Parks and Recreation/Forestry guidelines. The price shall include all of the Contractor's costs of whatsoever nature, incurred in contracting with certified arborist. The price shall include all labor costs associated with tree trimming.

01-21.16.01B **Tree Removal** – must be completed in accordance with Denver Parks and Recreation Specification **329643 Tree Transplanting** – **Extracting trees**, including but not limited to the proper marking of the tree; stump grinding and landscape restoration. The price shall include all labor costs associated with tree removal.

01-21.16.01C **Tree Replacement/Transplanting** – must be completed in accordance with Denver Parks and Recreation Specification **329643 Tree Transplanting** including preparation of a written plan, procurement of the correct caliper and type of tree required, staking and support systems, slow release watering devices, arborist certifications, application of requested products (i.e. mulch, grates), and warranty from the arborist. The price shall include all labor costs associated tree replacement/transplanting.

01-21.16.01D **Disposal of Tree Material** – Proper disposal tree waste shall be in accordance with City and County of Denver Parks and Recreation/Forestry guidelines and Executive Order 115. Infected/infested tree debris must go to DADS. Tree waste may be recycled if the recycling facility can provide a submittal which certifies that they can correctly process the debris. The price shall include all labor costs associated with disposal of tree material.

*Approval of the Arborist shall be in the form of a submittal after contract award.

Date Issued: 03/18/2019

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ENGINEERING DIVISION

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## Bid Item 01-21.19.01 CERTIFIED ASBESTOS BUILDING INSPECTOR (CABI)/AIR MONITOR (HOURLY) ALLOWANCE ACCOUNT

**27th Street Storm Drain Interceptor, Phase 2**
**ALLOWANCE ACCOUNT ITEMS**

### DESCRIPTION

This Special Provision contains the City and County of Denver's estimate for Allowance Account Items for ***all allowances*** necessary for the ***hourly Certified Asbestos Building Inspector/Air Monitor***. Duties of the CABI/Air monitor shall be to provide asbestos awareness training for all personnel associated with the project; monitor and cause to enforce that all project activities, excavations and site controls are in compliance with Denver Department of Public Health and Environment – Asbestos-Contaminated Soil Management Standard Operating Procedure (current version); ensure compliance with all state and federal laws, regulations and guidelines; and any other duties as defined within a site specific Material Management Plan. The estimated amounts will be added to the total bid to determine the amount of the performance and payment bonds. Allowance Account work shall be performed and reimbursed to the contractor as approved by the City Construction Project Manager. In no event shall reimbursement to the contractor exceed that maximum total indicated in the basis of payment below.

### BASIS OF PAYMENT

Payment will be made at unit prices for a schedule of values that are associated with each allowance account item category indicated below (A-D). The hourly employment costs of the CABI/Air Monitor for training; the unit prices for rental costs of any required equipment; coordinating testing and/or disposal of samples as indicated below (A-D). The schedule of values shall be submitted by the contractor and accepted by the City Construction Project Manager within 60 days of Notice to Apparent Low Bidder. CABI shall be a subcontractor and the unit prices will only be paid at true and verifiable cost plus a 3% mark up in accordance with the City and County of Denver General Contract Conditions. Mark up shall not be applied to sales tax or reclamation fees/charges. Payment will constitute full compensation for all true and verifiable costs associated with CABI/Air Monitor and allowances necessary to complete the scope of the project. The contractor will be required to submit itemized invoices for hourly employment of CABI/Air Monitor, rental of equipment for air sampling, testing and/or disposal of samples; along with

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# Project Specific Construction Specification

a spreadsheet tabulation indicating the 3% for inclusion in the Field Measurement Report (FMR). The City Construction Project Manager will approve payments in the appropriate dollar amount on the monthly payment applications.

No payment will be made under this bid item for any items associated with bid item 3-2 **Hauling of Contaminated Materials to Denver/Arapahoe Disposal Site (DADS).**
Allowance Account work must be coordinated through an approved* Environmental Consulting Firm with access to a Certified Asbestos Building Inspector (CABI) who can provide training, perform visual inspection and air monitoring, reporting, collect samples and submit for testing in compliance with all federal, state, and local requirements, and shall only be paid for after receipt of an itemized statement endorsed by the Contractor and approved by the City Construction Project Manager.

| Item No. | Allowance Account Item | Quantity | Estimated Amount |
|---|---|---|---|
| **01-21.19.01 A** | CABI/Air Monitor Hourly | A/A | $10,000.00 |
| **01-21.19.01 B** | Materials & Equipment | A/A | $5,000.00 |
| **01-21.19.01 C** | Lab Testing | A/A | $2,500.00 |
| **01-21.19.01 D** | Disposal of Waste & Associated Profiling | A/A | $2,500.00 |
| | | **Maximum Total: $20,000.00** | |

**Allowance Account Item Definitions:**

**01-21.19.01A** **CABI/Air Monitor Hourly** – The price shall include all the Contractor's costs of whatsoever nature, incurred in contracting with an approved* Environmental Consulting Firm for the services of a CABI/Air Monitor. The price shall include: all labor required for the inspector to provide Asbestos Awareness Training to all job site personnel, respond within 2 hours to evaluate potential asbestos containing material, and collect air fiber samples for evaluation of suspicious materials; monitoring of all construction activities once asbestos is confirmed.

**01-21.19.01B** **Materials and Equipment** – The price shall include: all materials and equipment required for the inspector to provide training, monitor the construction site, evaluate potential asbestos containing material, and collect air fiber samples.

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**01-21.19.01C** **Lab Testing & Associated Profiling** – The price shall include: Laboratory testing of any suspect materials, soil samples or air fibers to evaluate for the presence of asbestos; including laboratory analysis costs associated with creation of a disposal profile and any required modification of the site-specific Materials Management plan.

**01-21.19.01D** **Disposal of Sample Waste** – The price shall include*:* Proper disposal of sample waste or contaminated materials associated with the testing and profiling of the suspect materials to ensure compliance with all federal, state, and local transportation requirements.

*Approval of the Environmental Consulting firm shall be in the form of a submittal after contract award.

Date Issued 1/9/2019

# Appendix A – Geotechnical Engineering Study by Kumar & Associates, April 9, 2018

**Kumar & Associates, Inc.**
Geotechnical and Materials Engineers
and Environmental Scientists

ACEC
MEMBER

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# GEOTECHNICAL ENGINEERING STUDY
# 27th STREET STORM DRAIN INTERCEPTOR PROJECT
# 27TH STREET/WELTON STREET/WASHINGTON STREET
# DENVER, COLORADO

Prepared By:

Ryan Kumar, E.I. Project Engineer

Reviewed By:

James A. Noll, P.E.

COLORADO REGISTERED
JAMES A. NOLL
27051
4-9-2018
PROFESSIONAL ENGINEER

*Prepared For:*

Merrick & Company
5970 Greenwood Plaza Boulevard
Greenwood Village, Colorado 80111

Attention: Brian Poling, P.E.

Project No. 17-1-117

April 9, 2018

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## SUMMARY

1. The subsurface conditions were explored by drilling 17 exploratory borings at the locations indicated on Figs. 1A through 1H. The borings encountered slightly variable thicknesses of fill material overlying predominantly natural granular soils with occasional clay strata. The borings were terminated in the natural soils at depths ranging from approximately 20 to 30 feet beneath the ground surface. Bedrock was not encountered in any of the borings.

   The thickness of the fill encountered in the borings ranged from about 2 to 4 feet, with the exception of Boring 1 where approximately 12 feet of fill was encountered. The fill material generally consisted of silty clayey sand with occasional silty clay. The majority of the natural soils underlying the fill were granular and consisted primarily of silty sand with occasional concentrations of poorly- to well-graded sands with varying concentrations of gravel. The borings located along the western end of the alignment occasionally encountered poorly-graded gravel with silt and sand. Natural lean clays with varying sand content were encountered in several borings beneath the granular soils.

   Groundwater was encountered in Borings 1 and 1A during drilling at depths of approximately 15 and 19.5 feet beneath the existing ground surface, respectively. At the completion of drilling, Borings 1, 9, and 11 were completed as monitoring wells. The remaining borings were backfilled and patched at the completion of drilling. A follow-measurement made 42 days after drilling indicated groundwater in Boring 1 at a depth of approximately 15 feet.

2. The excavations should be constructed in accordance with all OSHA requirements, and other applicable local and state requirements. In the event that sloped excavation walls are used over trench boxes, the on-site granular soils encountered in the borings generally classify as an OSHA Type C soil.

3. Bedding material supporting the pipe bottom should consist of an un-compacted layer of imported granular material meeting the pipe manufacturer's recommendations for pipe bedding. Based on the assumed pipe diameter for the conduit and AWWA guidelines, we recommend a minimum uncompacted bedding thickness of 6 inches. The bedding layer should be of adequate thickness to fully support the pipe when seated on top of the bedding. The pipe-zone material placed above the bedding and surrounding the pipe should consist of granular material similar to that described above for pipe bedding. Backfill placed above the pipe-zone materials to the surface should consist of the on-site soil obtained from the pipeline excavation.

4. Recommendations for pavement design for the replacement pavement sections are presented herein and should include 7.5 inches of full-depth asphalt, or 5.5 inches of asphalt overlying 10 inches of CDOT Class 6 aggregate base course for non-bus routes. Bus routes should be paved using a minimum of 10.5 inches of full-depth asphalt, or a composite section consisting of 8.0 inches of asphalt overlying 14 inches of Class 6 aggregate base course. Bus pads, and any areas of the pavement that will be subjected to concentrated truck turning and stopping movements should be paved using a minimum of 10.0 inches of Portland cement concrete.

## PURPOSE AND SCOPE OF WORK

This report presents the results of a geotechnical engineering study performed for the proposed 27th Street storm drain interceptor to be installed beneath 27th Street, Washington Street, and a portion of Welton Street in Denver, Colorado. The project site is shown on Figs. 1A through 1H. The field exploration and laboratory testing programs used to obtain the data were performed in accordance with the scope of work presented in our revised Proposal No. P-16-684 to Merrick & Company dated November 15, 2016.

The results of the field exploration and laboratory testing were analyzed to develop recommendations and construction considerations for the pipeline including excavation, and pipe bedding and backfill.

This report has been prepared to summarize the data obtained during this study and to present our conclusions and recommendations based on the proposed construction and the subsurface conditions encountered.

## PROPOSED CONSTRUCTION

We understand that the storm sewer outfall will be approximately 6,000 feet in length and will be located beneath 27th Street from just west of Blake Street to the intersection with Welton/Washington. At the intersection, the alignment was proposed to turn and continue beneath Washington Street to the intersection with 20th Avenue/ Park Avenue West; however, we understand that the portion of the storm sewer beneath Washington will not be constructed under current funding.

The storm sewer will be a concrete reinforced pipe (RCP) with variable pipe diameters along the alignment of 72, 78, 90, ad 96 inches. Pipe inverts range from approximately 11.5 to 23 feet below the pavement surface.

The sewer will be installed using conventional cut and cover methods, except at the 27th Street/Welton Street/Washington Street intersection where a trenchless crossing may be required. The trench section will be constructed using trench boxes, the sizes of which will be based on the associated infrastructure and adjacent development constraints. At the time of this

report, we understand the project is considering leaving the existing storm sewer in place at the RTD crossing to avoid costs associated with trenchless crossing.

If the proposed construction varies significantly from that described above or depicted in this report, we should be notified to reevaluate the recommendations provided in this report.

## SITE CONDITIONS

The proposed sewer alignment will be generally be located beneath areas of asphalt pavement, with the exception of 27th Street and Blake Street where concrete pavement was encountered within the intersection. The roadway templates for the majority of the alignment include a single travel lane in each direction with wide shoulders on both sides for parking. The streets are bounded by concrete curb and gutter. The RTD D-Line is located within the alignment of Welton Street at the intersections with 27th Street and Washington Street.

The ground surface along the alignment has a steady elevation gain of approximately 75 feet from the lowest elevation point at 27th Street and Blake Street to the highest elevation point at Washington Street and 20th Avenue/Park Avenue West. Areas surrounding the project alignment consist of single- and multi-family housing, small office, and commercial spaces.

## SUBSURFACE CONDITIONS

Field Exploration Program: The subsurface conditions at the site were explored by drilling 17 exploratory borings along the alignment at the approximate locations shown on Figs. 1A through 1H. The majority of the borings were drilled at approximate evenly spaced intervals. Borings 8, 9, 10, and 11 were drilled near the intersection of 27th Street/Welton Street/Washington Street in the areas of the proposed trenchless crossing.

The exploratory borings were advanced through the overburden soils using 4-inch diameter continuous flight augers, and 7.75-inch hollow stem augers. Samples of the soils encountered in the borings were obtained with 1 3/8-inch diameter split-spoon, and 2-inch diameter California-type drive samplers. The samplers were driven with blows from a 140-pound hammer falling 30 inches. This sampling procedure is similar to the standard penetration test described by ASTM D 1586. Penetration resistance values indicate the relative density or consistency of the subsurface soils.

Graphic logs of the exploratory borings are plotted below their plan view locations on Figs. 1A through 1H, and on Figs. 2 through 5. A legend and notes describing the subsurface soils encountered is presented on Fig. 6.

Existing Pavement Sections: The exploratory borings encountered variable pavement section types that included full-depth asphalt, asphalt overlying base course, asphalt overlying concrete, and a Portland cement concrete section. The 6-inch thick concrete pavement section was encountered in Boring 1 at the northwestern end of the alignment. The asphalt over concrete sections were encountered in Borings 2 and 10 and consisted of approximately 4.5 and 4.25 inches of asphalt overlying about 4.5 and 8.25 inches of concrete, respectively. The remaining borings encountered either a full-depth asphalt section ranging in thickness from about 6.0 to 9.25 inches, or a flexible composite section consisting of about 4.75 inches 8.25 inches of asphalt overlying about 2.5 to 6.75 inches of aggregate base course. The pavement section types and thicknesses are indicated next to the boring logs, and in the Legend and Notes on Figs. 2 through 6.

Subsurface Soil Conditions: Subsurface conditions encountered in the borings generally consisted of slightly variable thicknesses of fill material overlying natural granular soils overlying occasional clay strata. The borings were terminated in the natural soils at depths ranging from approximately 20 to 30 feet beneath the ground surface. Bedrock was not encountered in any of the borings.

The thickness of the fill encountered in the borings ranged from about 2 to 4 feet, with the exception of Boring 1 where approximately 12 feet of fill was encountered. The fill material generally consisted of silty clayey sand with occasional silty clay. The fill was fine- to coarse-grained, and moist. The exact lateral and vertical extents, and degree of compaction of the fill across the site were not determined as part of this study.

The majority of the natural soils underlying the fill were granular and consisted primarily of silty sand with occasional concentrations of poorly- to well-graded sands with varying concentrations of gravel. The borings located along the western end of the alignment occasionally encountered poorly-graded gravel with silt and sand. Natural lean clays with varying sand content were encountered in several borings beneath the granular soils. The granular soils were fine- to coarse-

grained, slightly moist, and loose to very dense based on sampler penetration resistance values (blow counts). The natural clay soils were moist, and stiff to very stiff.

Groundwater was encountered in two borings (Borings 1 and 1A) during drilling at depths of approximately 15 and 19.5 feet beneath the existing ground surface, respectively. At the direction of Pinyon Environmental, Borings 1, 9, and 11 were completed as monitoring wells. We understand that Pinyon will be filing or has filled the appropriate permitting paperwork with the Colorado Division of Water Resources. The borings not completed as monitoring wells were backfilled and patched after drilling due to safety considerations. A follow-up groundwater measurement was made in the monitoring wells 42 days later and indicated groundwater in Boring 1 at a depth of approximately 15 feet. The monitoring wells installed in Borings 9 and 11 were dry.

## LABORATORY TESTING

Laboratory testing was performed on selected samples to determine soil moisture content and dry unit weight, liquid and plastic limits, gradation, electrical resistivity, swell-consolidation, and concentration of water soluble sulfates. The results of the laboratory testing program are shown adjacent to the boring logs on Figs. 2 through 5, plotted graphically on Figs. 7 through 15, and summarized in the attached Table I. The testing was conducted in general accordance with recognized ASTM and CDOT test procedures.

Gradation Analysis: Gradation testing was performed on selected samples of the granular soils obtained from the borings. The granular soils classified as silty sand, poorly-graded gravel with silt and sand, and poorly- to well-graded sands with gravel. The gradation test results are plotted graphically on Figs. 9 through 17. The maximum particle size obtained from the borings was limited to the sampling technique used, and caution should be exercised when evaluating construction techniques in the areas of the trenchless crossing.

Swell-Consolidation Testing: Swell-consolidation testing was conducted on two samples of the natural clayey overburden to determine their swell or compressibility characteristics under loading and when wetted. Each sample was prepared and placed in a confining ring between porous discs. A selected surcharge pressure of 500 psf was applied to the samples, and each sample

was allowed to compress to a stabilized height before being submerged in water. The sample height was monitored until deformation practically ceased under each load increment.
The results of the swell-consolidation testing indicate low swell potential for the tested samples of the clayey overburden. The results of the swell-consolidation tests are plotted as a curve of the final strain at each increment of pressure against the log of the pressure on Figs. 7 and 8.

Water Soluble Sulfates: The concentration of water soluble sulfates measured in samples obtained from the exploratory borings was determined to be 0.00%. This concentration of water soluble sulfates represents a Class 0 severity of exposure to sulfate attack on concrete exposed to these materials. These degrees of attack are based on a range of Class 0, Class 1, Class 2, and Class 3 severity exposure as presented in ACI 201.2R.

Based on the laboratory test results, we believe special sulfate resistant cement will generally not be required for concrete exposed to the on-site soils.

Electrical Resistivity: The results of electrical resistivity testing on samples of the natural are presented on Fig. 18. The results of the electrical resistivity testing indicate minimum laboratory electrical resistivity values for the natural soils ranging from about 1,084 to 1,770 ohm-cm at moisture contents around 25.0%, and resistivity values ranging from 1,930 to greater than 6,000 ohm-cm at in-situ moisture contents ranging from about 3.8 to 10.5%.

Based on the laboratory electrical resistivity test results, the on-site soils generally classify as mildly to moderately corrosive in accordance with the U.S. Bureau of Reclamation.

## EXCAVATION CONSIDERATIONS

We believe that overburden soils may be excavated with conventional heavy-duty excavation equipment. Although not found in the borings, bedrock materials, if encountered during excavation, may be more difficult when being performed in confined areas.

Based on the proposed elevation of the pipeline and the absence of groundwater in all but one of the borings during drilling, we anticipate that much of the alignment will likely not encounter groundwater during excavation. In the event that localized perched groundwater is encountered

during excavation, we believe that dewatering the excavations may be accomplished using a sump pump system.

Surface water runoff into the excavations can act to erode and potentially destabilize the trench slopes and result in soft ground conditions along the trench bottom and should not be allowed. Diversion berms and other measures should be used to prevent surface water runoff into the trenches.

Temporary Excavation Slopes: We assume that the temporary excavations will be constructed using appropriate shoring or by excavating the slopes to a stable configuration where enough space is available. All excavations should be constructed in accordance with OSHA requirements, as well as state, local and other applicable requirements. OSHA requires that excavations requiring trenching over 20 feet deep be designed by a registered professional engineer. Based on the nature of the subsurface soils at the site and OSHA excavation guidelines, the on-site soils should be classified as OSHA Type C soils.

Excavation Shoring: Where insufficient lateral space is available due to the proximity to property boundaries and existing structures and facilities, temporary shoring will be required. Temporary shoring provided in close proximity to existing structures or traffic areas should be sufficiently stiff to prevent movement. It is our experience that temporary shoring systems are typically designed and built by specialty contractors and that the designers will typically develop their own design criteria based on soil data presented in the Owner's geotechnical study report. We are available upon request for further consultation on temporary shoring design criteria.

Excavated slopes may soften or loosen due to construction traffic and erode from surface runoff. Measures to keep surface runoff from excavation slopes, including diversion berms, should be considered.

Temporary shoring provided in close proximity to existing structures, utility lines, or traffic areas should be sufficiently stiff to prevent movement. We recommend that a pre-condition reconnaissance of adjacent existing structures be performed prior to beginning excavations, and temporary shoring, to document the condition of those structures (e.g., with photographs), and locate areas where instrumentation (e.g., crack monitors across existing cracks) should be

considered for monitoring potential impacts to the structures caused by that work. Ideally, representatives of the owner of the adjacent structure, client, geotechnical engineer and contractor should perform the reconnaissance, and personnel responsible for monitoring the structures and any instrumentation should be identified. We recommend a qualified vibration monitoring consultant be retained during construction.

PIPELINE RECOMMENDATIONS

Pipe Bedding and Backfill: Bedding material supporting the pipe bottom should consist of an un-compacted layer of imported granular material meeting the pipe manufacturer's recommendations for pipe bedding. Bedding placed within 6 inches beneath the pipe invert should not be compacted to allow the pipe to seat in the bedding material during installation. Prior to placing the bedding, the subgrade should be excavated and loose material removed to provide firm subgrade support. If soft soil conditions persist in the trench bottoms, it may be necessary to sub-excavate to a greater depth and replace such soils with a deeper bedding section to provide proper pipe support. Bedding material placed below the 6-inch depth for additional support, if required should be compacted using a vibratory plate or other approved densification methods.

The pipe-zone material placed above the bedding and surrounding the pipe should consist of granular material similar to that described above for pipe bedding and should be compacted to at least 75% relative density (ASTM D 4253 and ASTM D 4254). The pipe-zone material should also be placed and compacted in accordance with the requirements of the pipe manufacturer. Special care should be taken to provide adequate compaction below the haunches of the pipe using a concrete vibrator, vibratory plates or other light compaction equipment as needed. Pipe-zone material should be placed and compacted in equal lifts on both sides of the sewer line during construction before the addition of the next lift to avoid laterally loading one side of the pipe.

Backfill placed above the pipe-zone materials to the surface should consist of suitable on-site soil obtained from the pipeline excavation. Suitable soils should have a maximum size of 3 inches and should be generally free of organics, wood, or other deleterious material that could decay over time. Most of the soils encountered in the exploratory borings satisfy the material requirements based on laboratory testing of selected samples. The backfill should be compacted to at least 95% of the standard Proctor (ASTM D 698) maximum dry density and placed at a moisture content between -1 and +3 percent of optimum for cohesive soils and compacted to

100% of the standard Proctor (ASTM D 698) maximum dry density and placed within 2 percentage points of optimum for granular soils. Granular soils with minimal fines content of 10 percent or less should be compacted to at least 80% relative density (ASTM D 4253 and ASTM D 4254).

Construction Monitoring and Instrumentation: The proposed pipeline sections will be located within existing city streets adjacent to existing sidewalks, structures and private landscape areas. To mitigate against potential damage to adjacent structures, and provide information for evaluating potential claims of damage, consideration should be given to performing a pre-construction survey of existing sidewalks, buildings and other structures located adjacent to the proposed excavations. The condition of existing structures, including existing cracks or other distress features should be documented in writing and photographs should be taken as appropriate. Ideally, representatives of the owner of the adjacent structure, client, geotechnical engineer, and contractor should perform the reconnaissance.

Tunneling/Trenchless Construction Considerations: Subsurface conditions at the site are expected to consist primarily of relatively highly permeable, relatively fine to coarse-grained granular soils and are not expected to containing significant quantities of gravel. Water levels should be assumed to be below the proposed pipeline. The subsurface materials should be assumed to be slightly moist to moist, but generally not saturated. Based on conditions encountered in the borings, these overburden soils are likely to cave readily. Temporary shoring may be necessary at the jacking and receiving pits. Selection of trenchless methods should consider the possibility of encountering conditions varying from medium dense to dense fine to coarse-grained granular soils with pockets of fine-grained silty and clayey soils.

## PAVEMENT THICKNESS DESIGN

The proposed construction will likely necessitate the removal and replacement of the majority of the pavement section on 27th Street, and approximately half- to most of the pavement on Washington Street. Recommendations for pavement design for the replacement pavement sections are presented below.

Pavement design procedures are based on strength properties of the subgrade and pavement materials assuming stable, uniform conditions. Performance of the pavement structure is directly related to the physical properties of the subgrade soils and traffic loadings. Soils are represented

for pavement design purposes by means of a resilient modulus for flexible pavements and by a modulus of subgrade reaction for rigid pavements. Both values are empirically related to strength. Subgrade Materials: Based on the results of the field exploration and laboratory testing programs, the near surface subgrade materials encountered across the site generally classify as A-2-4, and A-4 soils with group indices between 0 and 4, in accordance with the AASHTO soil classification system.

*Resilient Modulus Value*: MGPEC has specific guidelines for establishing the design of the resilient modulus value ($M_R$). Until recently, the guidelines required that unconfined compressive strength testing be performed on samples remolded to the proposed compaction specifications, and then correlated to a $M_R$ value using the appropriate MGPEC correlation equation. A revision to MGPEC standards presented in a memo dated March 13, 2017 discouraged this practice in favor of alternative methods of $M_R$ correlation such as laboratory $M_R$ testing, CBR and/or R-Value correlation. Based on our experience, an R-Value of 20 was selected to represent the subgrade soils; this correlates to a $M_R$ of 4,940 psi, which was used in the design.

Design Traffic: Based on discussions with the design team, we understand that traffic on 27th Street and Washington are designated as "Local/Collector" and will service residential and occasional commercial traffic. Certain segments of Washington Street will also include bus traffic. Traffic volumes for this study were determined from the City and County of Denver Transportation Standards & Details Std. Dwg. 12.7 (4/17). An 18-kip equivalent single axle loading (ESAL) value of 500,000 was used for 27th Street (Local) and the portions of Washington Street (Collector) not subjected to bus traffic. An ESAL value of 3,000,000 was used for the designated bus route segment of Washington Street. If traffic or roadway classification is anticipated to be different than above, we should be notified to reevaluate the pavement thickness sections provided below.

Pavement Thickness Recommendations: The pavement sections were developed from the DARWin™ computer program that solves the AASHTO pavement design equations. Based on the design inputs and assumptions indicated herein, a minimum full-depth asphalt pavement section of 7.5 inches is recommended for roadway segments not designated as bus routes. Alternatively, a composite section consisting of 5.5 inches of asphalt placed above 10 inches of CDOT Class 6 aggregate base course may be used for these roadway segments. For roadway segments designated as bus routes, we recommend a minimum full-depth asphalt section of 10.5

inches. As an alternative to the full-depth recommendation, bus routes may be paved using a composite section consisting of 8.0 inches of asphalt over 14 inches of CDOT Class 6 aggregate base course.

Bus pads, and any areas of the pavement that will be subjected to concentrated truck turning and stopping movements should be paved using a minimum of 10.0 inches of Portland cement concrete. Concrete pavement should contain sawed or formed joints to ¼ of the depth of the slab at a maximum distance of 12 to 14 feet on center for the transverse joints, and 12 feet on center for the longitudinal joints. Pavement design inputs and calculations are presented in Appendix A.

Subgrade Preparation: The subgrade underlying the pavement should be placed and compacted according to the recommendations presented in the "Bedding and Backfill" subsection of this report. The pavement subgrade should be proofrolled prior to placing pavement. Proofrolling should be performed with heavy rubber-tired equipment with a tire pressure of at least 100 psi capable of applying a minimum load of 18-kips per axle. Pavement design procedures assume a stable subgrade prior to paving. Areas that deform under wheel loads are not stable and should be removed and replaced to achieve a stable subgrade prior to paving.

Asphalt Mix Type: The asphalt mix should meet the latest requirements of the CDOT Standard Specifications for Road and Bridge Construction. The asphalt placed for the project should be designed in accordance with the SuperPave gyratory mix design method. The mix should meet Grading S or SX requirements and a SuperPave gyratory design revolution (NDES) of 100 should be used in the design process. Based on the design ESALs and traffic patterns, we recommend that a PG 64-22 asphalt binder be used for the mix.

Drainage: The collection and diversion of surface drainage away from paved areas is extremely important to the satisfactory performance of the pavement. Drainage design should provide for the removal of water from paved areas and prevent the wetting of the subgrade soils.

## LIMITATIONS

This study has been conducted in accordance with generally accepted geotechnical engineering practice in this area for exclusive use of the client for design purposes. The conclusions and recommendations submitted in this report are based upon the data obtained from the exploratory

borings at the locations indicated on Fig. 1A through 1H, and the proposed type of construction. This report does not reflect subsurface variations that may occur between the exploratory borings, and the nature and extent of variations across the site may not become evident until site grading and excavations are performed. If during construction, existing pavement section type and thickness, fill, soil, bedrock or ground water conditions appear to be different from those described herein, Kumar & Associates, Inc. should be advised at once so that a re-evaluation of the recommendations presented in this report can be made. Kumar & Associates, Inc. is not responsible for liability associated with interpretation of subsurface data by others.

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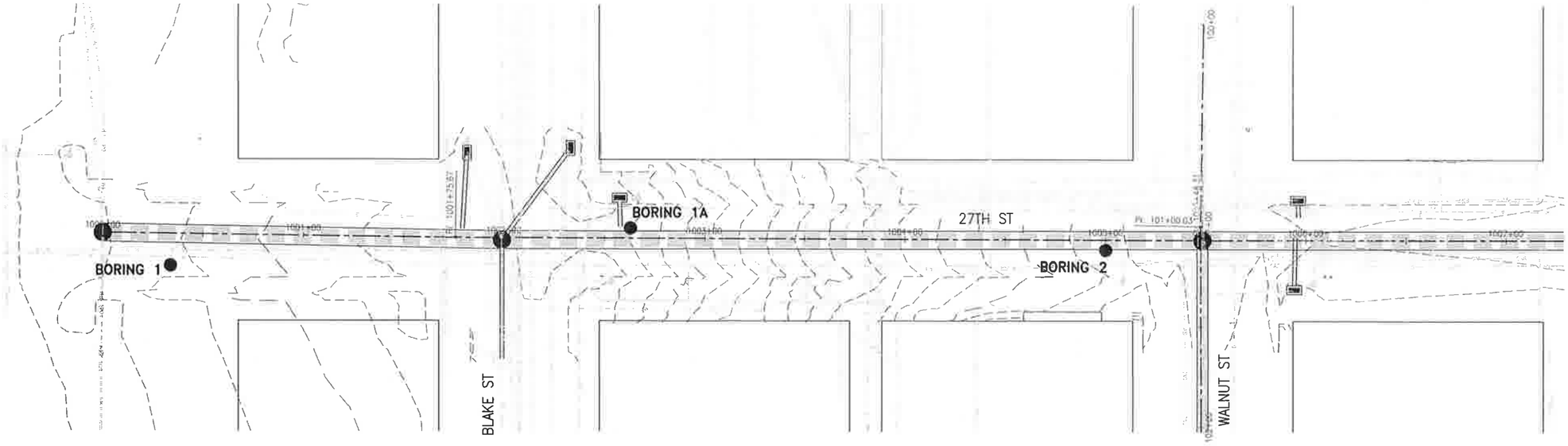


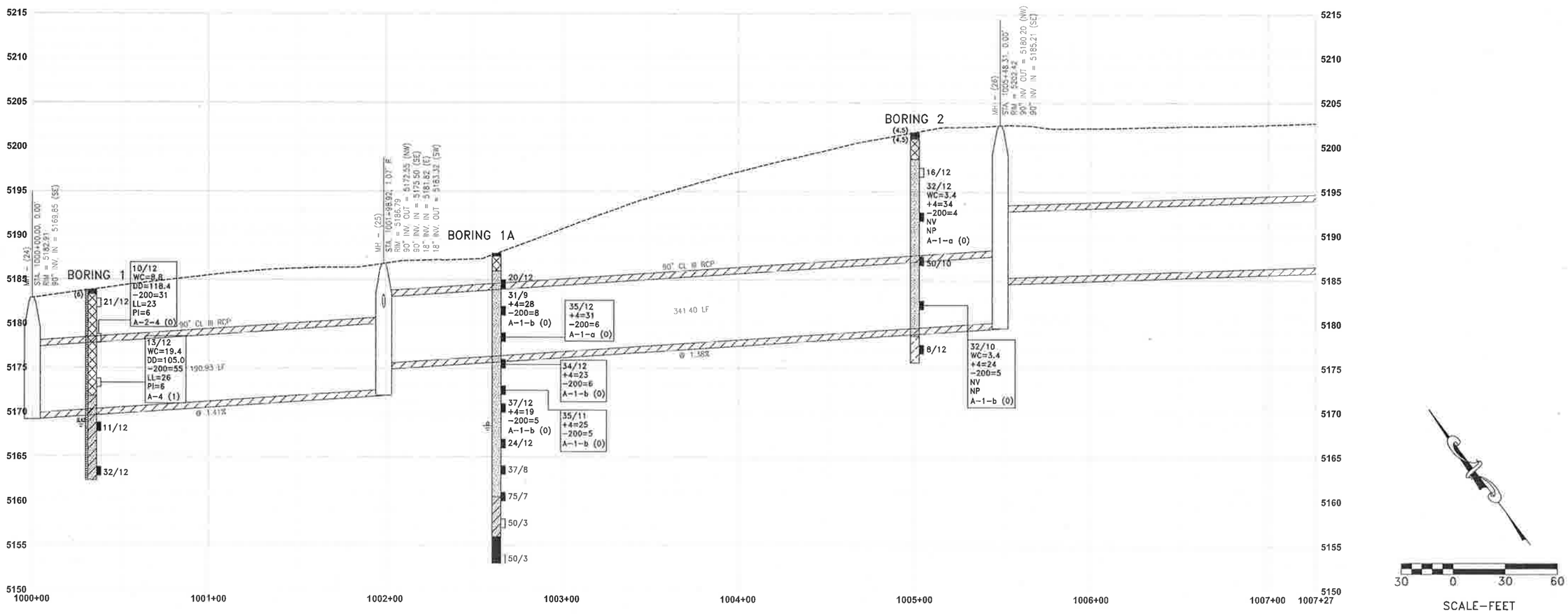


| 17-1-117 | Kumar & Associates | 27th STREET STORM SEWER, DENVER, COLORADO | LOCATION OF EXPLORATORY BORINGS | Fig. 1A |
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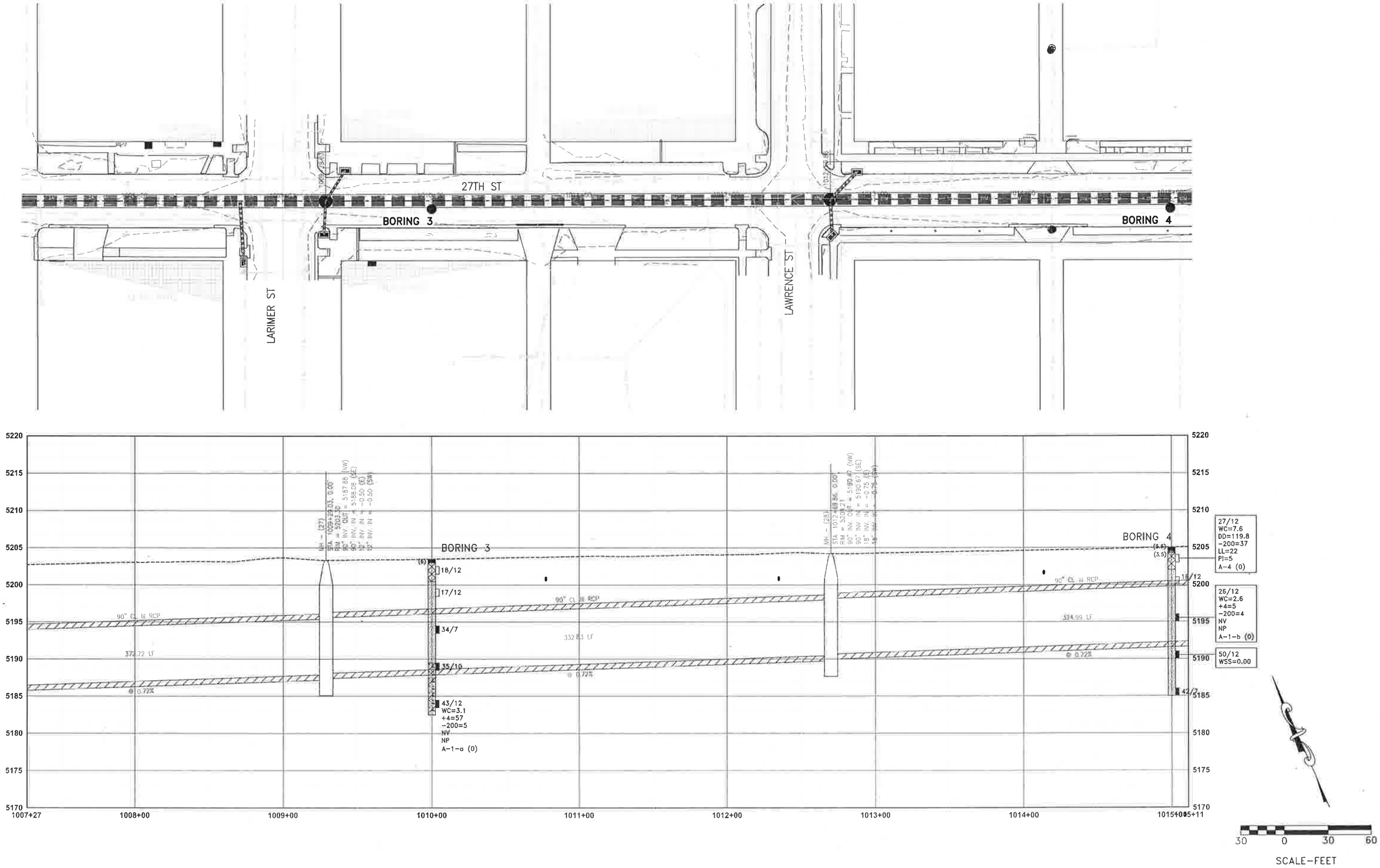
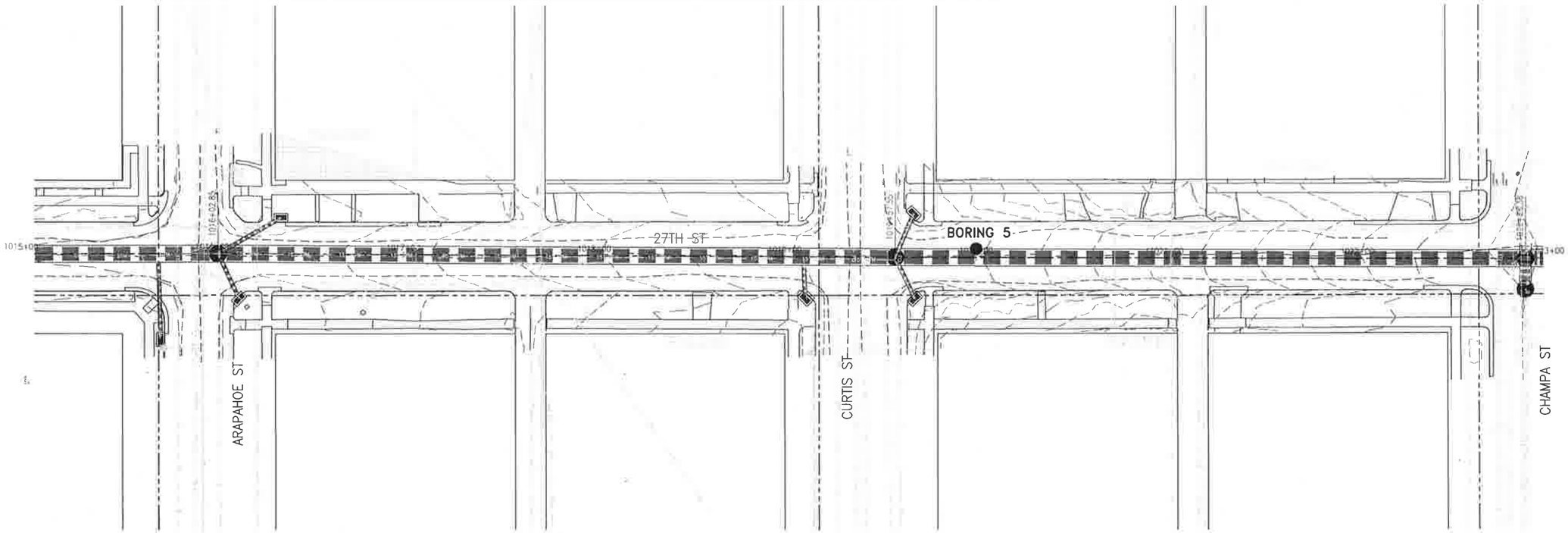
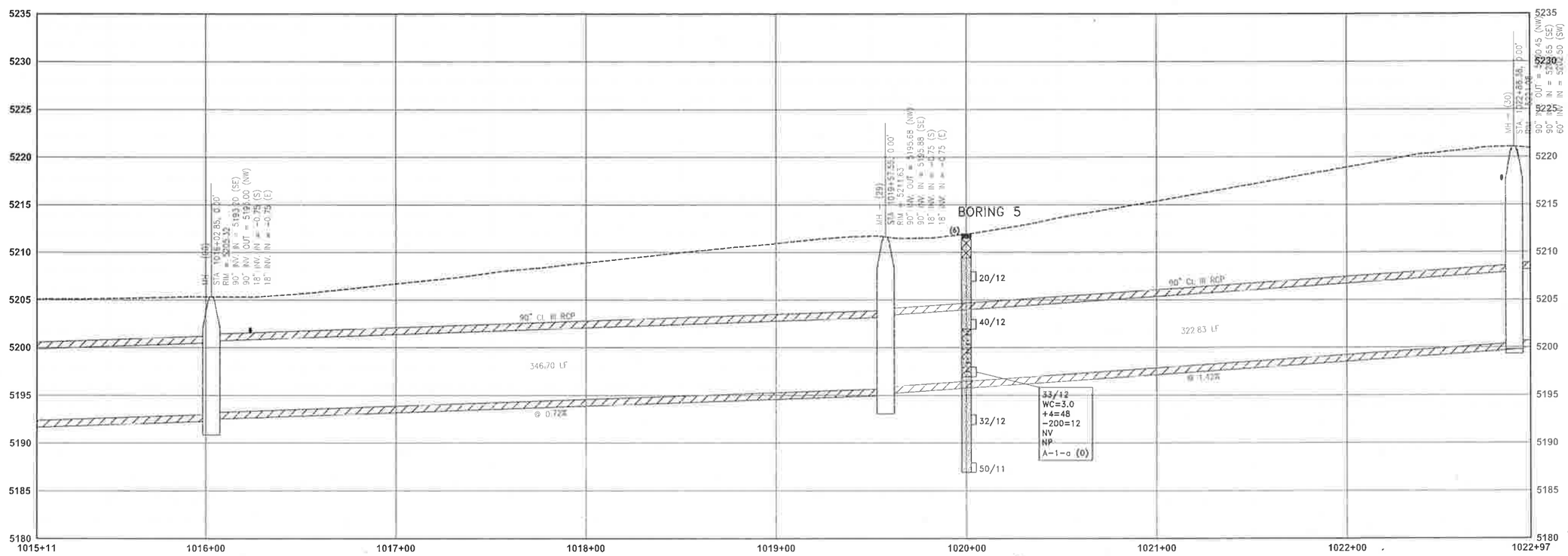
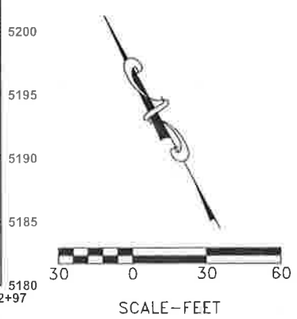



| 17-1-117 | Kumar & Associates | 27th STREET STORM SEWER, DENVER, COLORADO | LOCATION OF EXPLORATORY BORINGS | Fig. 1B |
|---|---|---|---|---|




| 17-1-117 | Kumar & Associates | 27th STREET STORM SEWER, DENVER, COLORADO | LOCATION OF EXPLORATORY BORING | Fig. 1C |
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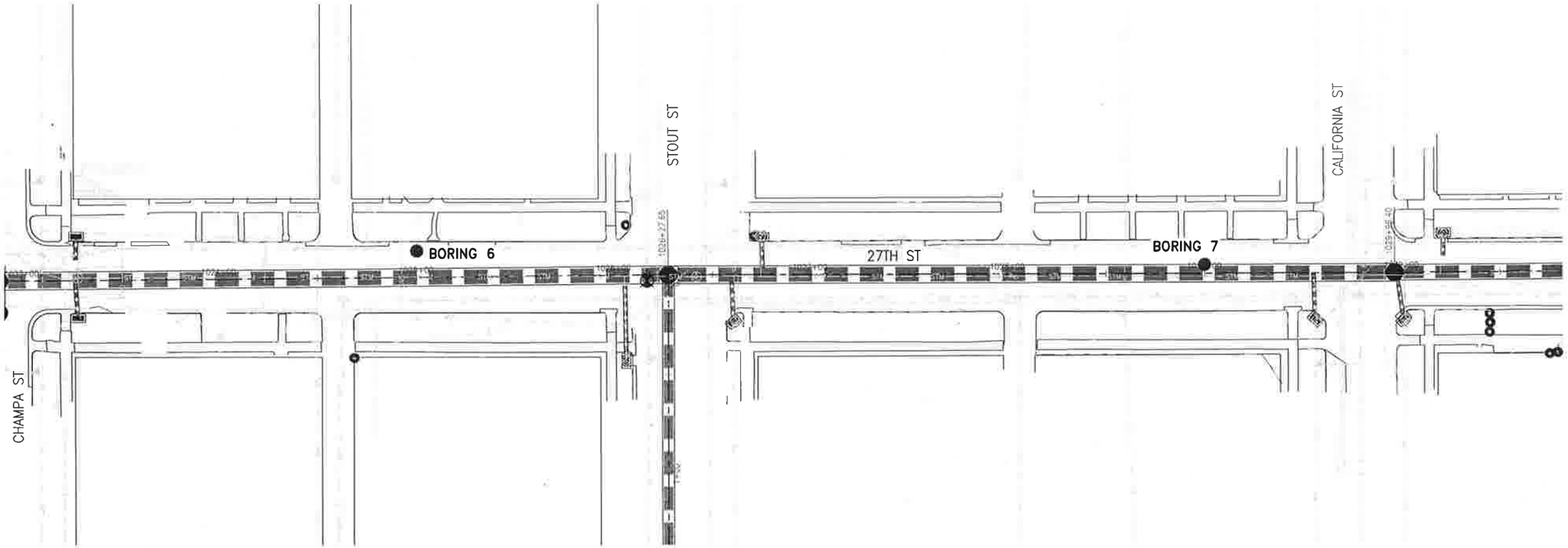


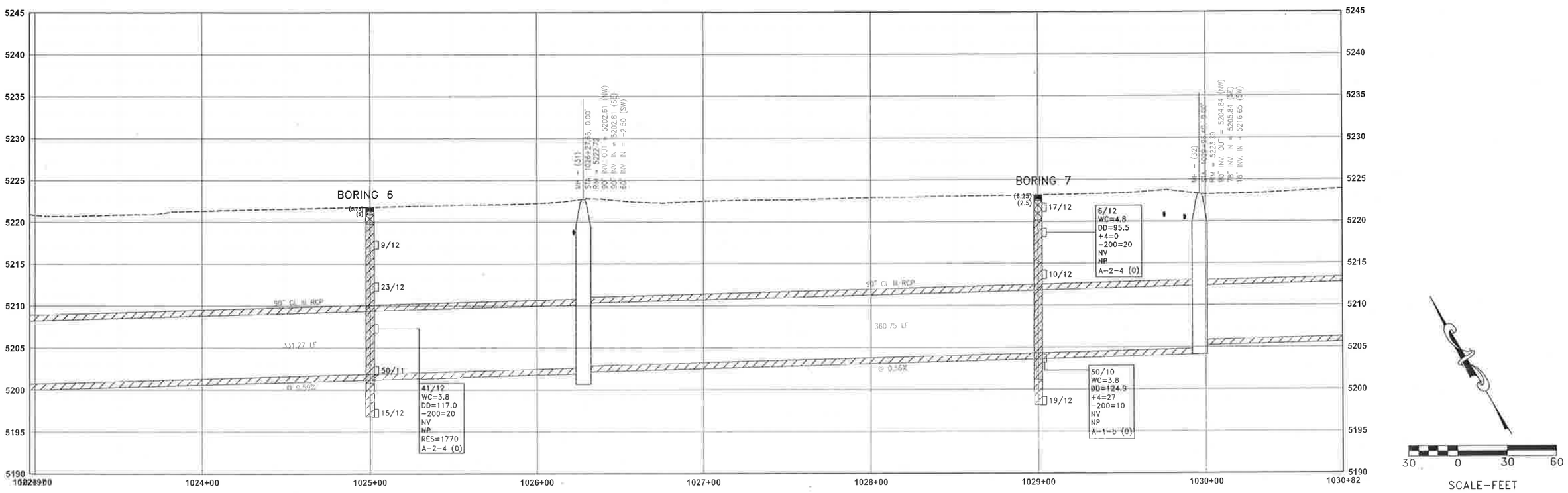


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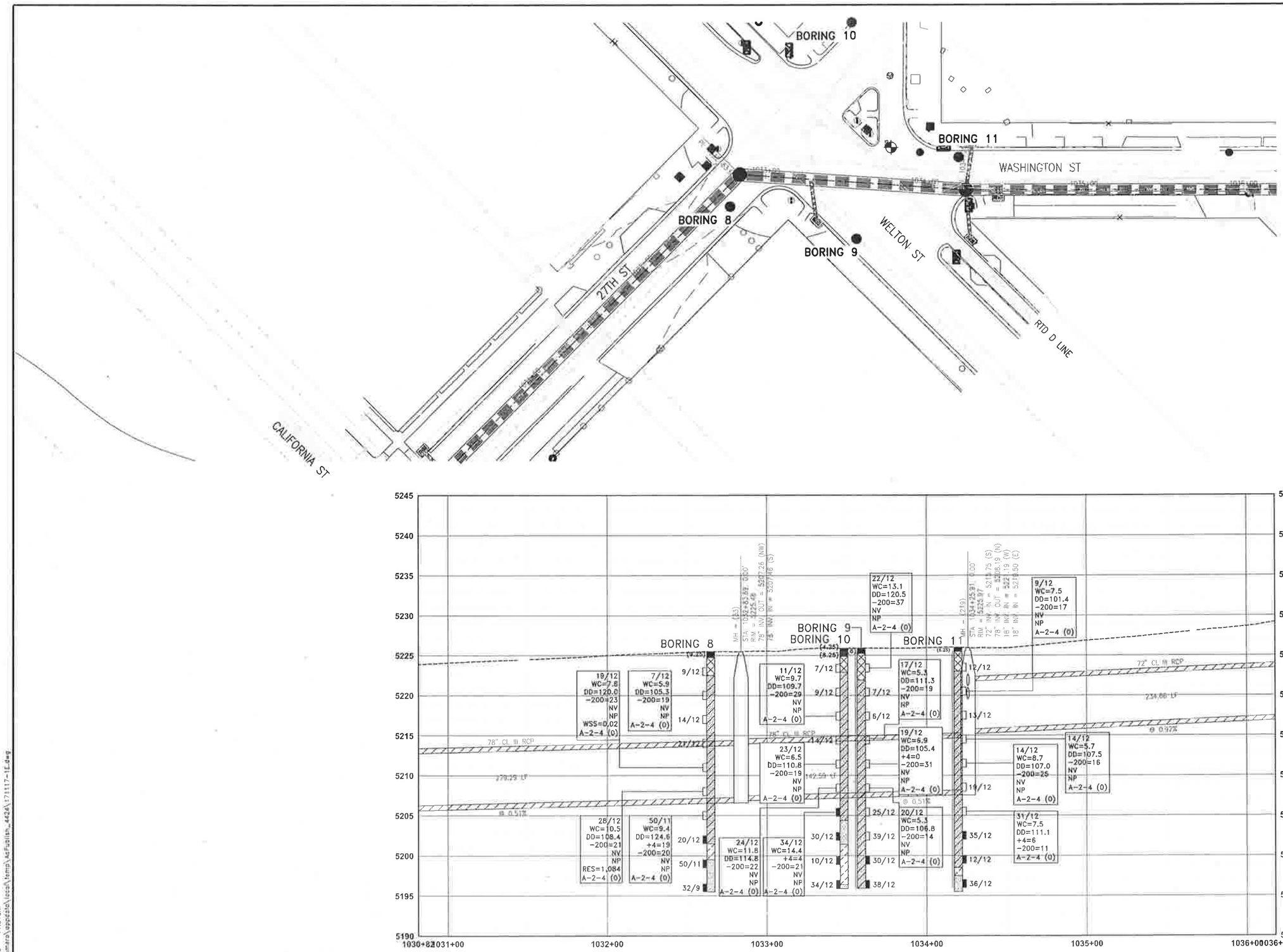
| 17-1-117 | Kumar & Associates | 27th STREET STORM SEWER, DENVER, COLORADO | LOCATION OF EXPLORATORY BORINGS | Fig. 1D |




| 17-1-117 | Kumar & Associates | 27th STREET STORM SEWER, DENVER, COLORADO | LOCATION OF EXPLORATORY BORINGS | Fig. 1E |
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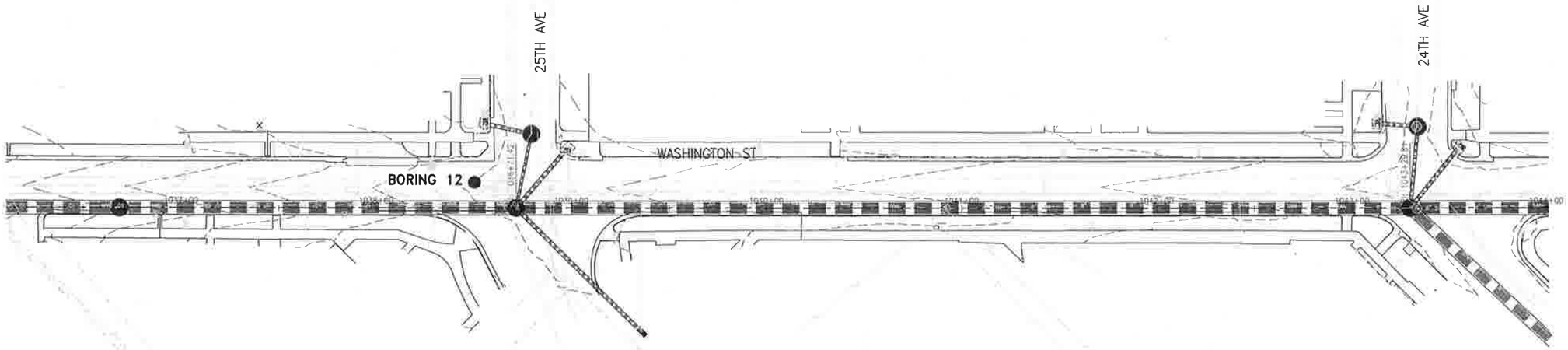


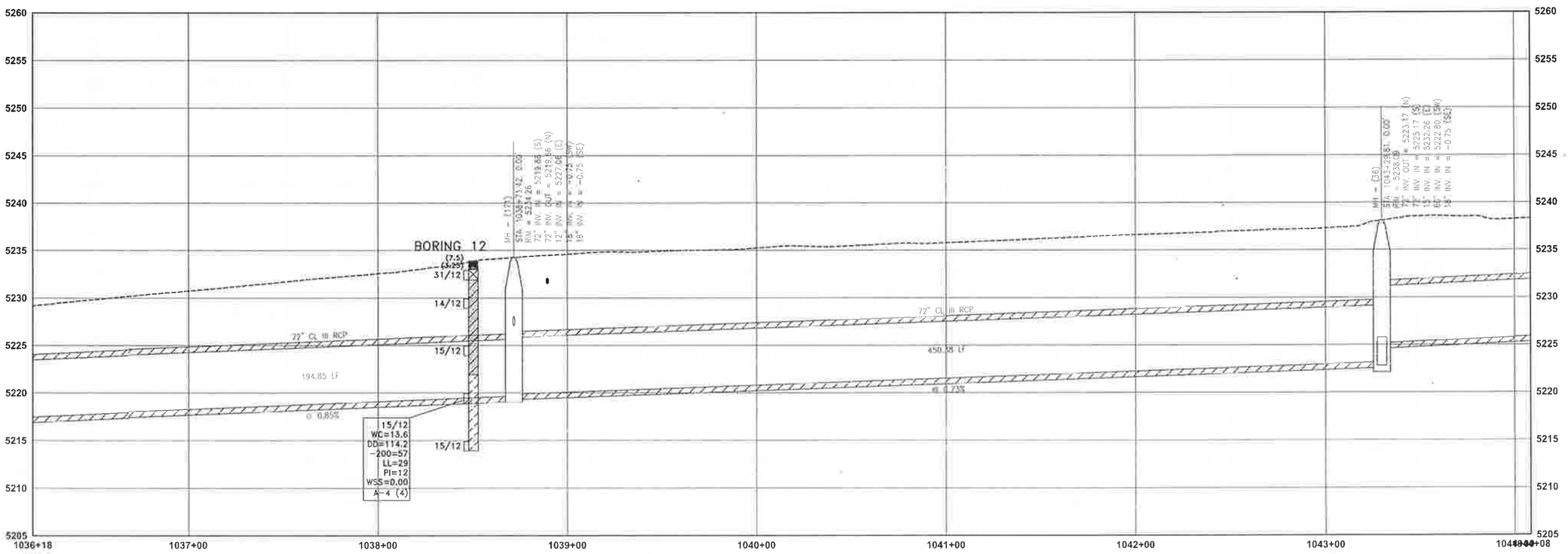


| 17-1-117 | Kumar & Associates | 27th STREET STORM SEWER, DENVER, COLORADO | LOCATION OF EXPLORATORY BORINGS | Fig. 1F |
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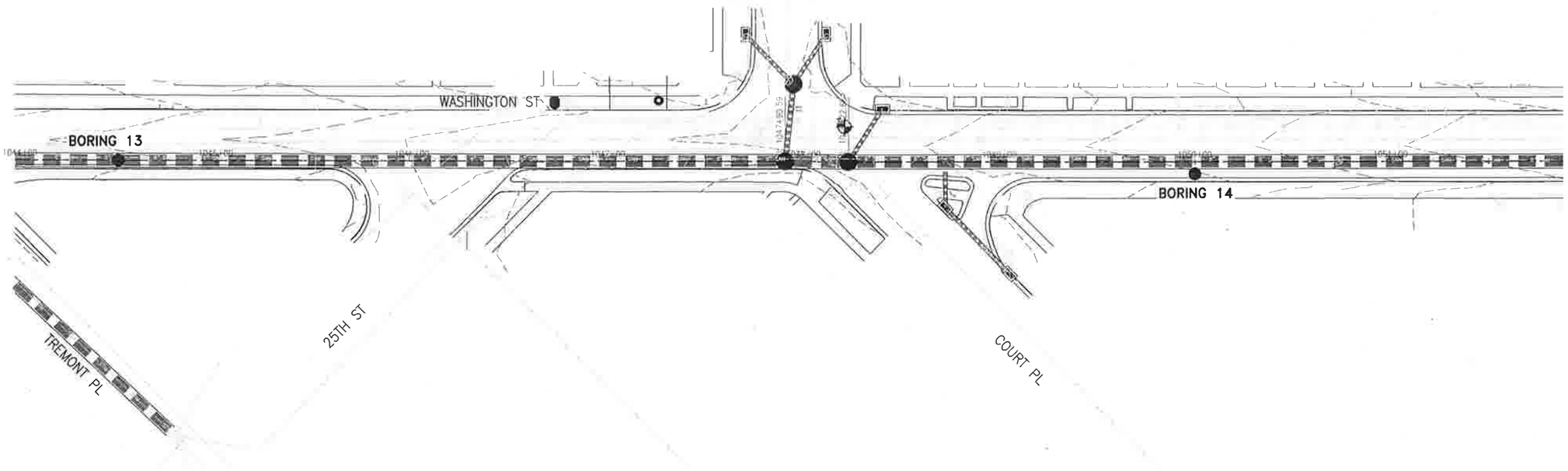


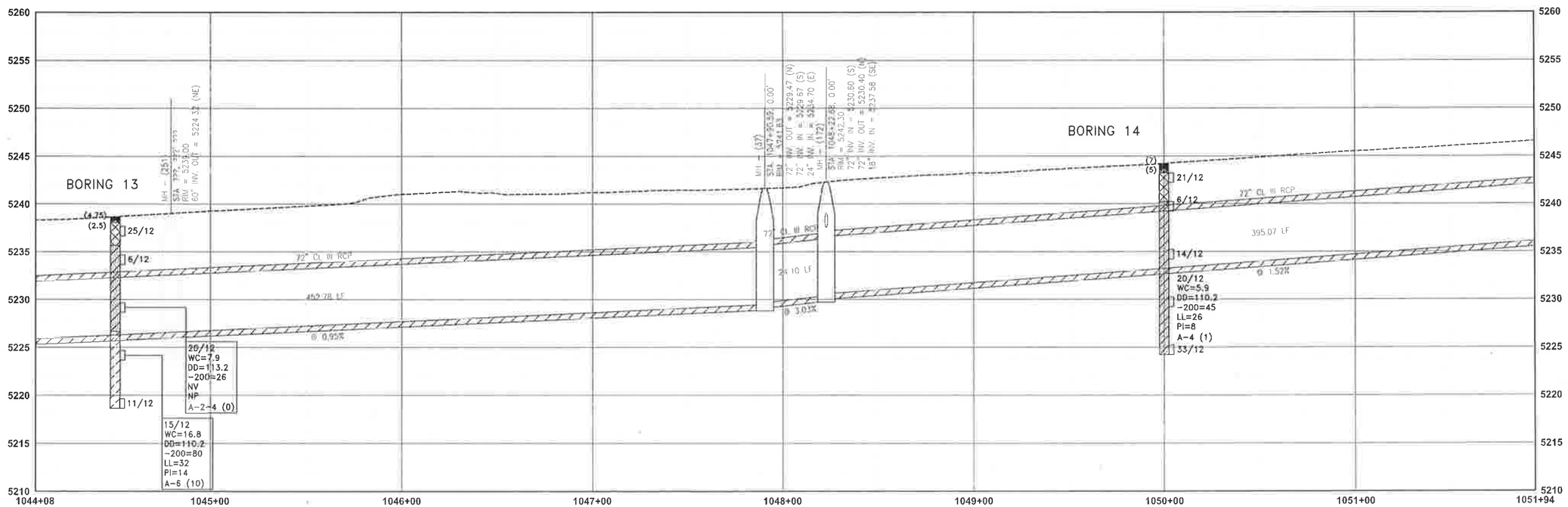


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SCALE-FEET

| 17-1-117 | Kumar & Associates | 27th STREET STORM SEWER, DENVER, COLORADO | LOCATION OF EXPLORATORY BORINGS | Fig. 1G |
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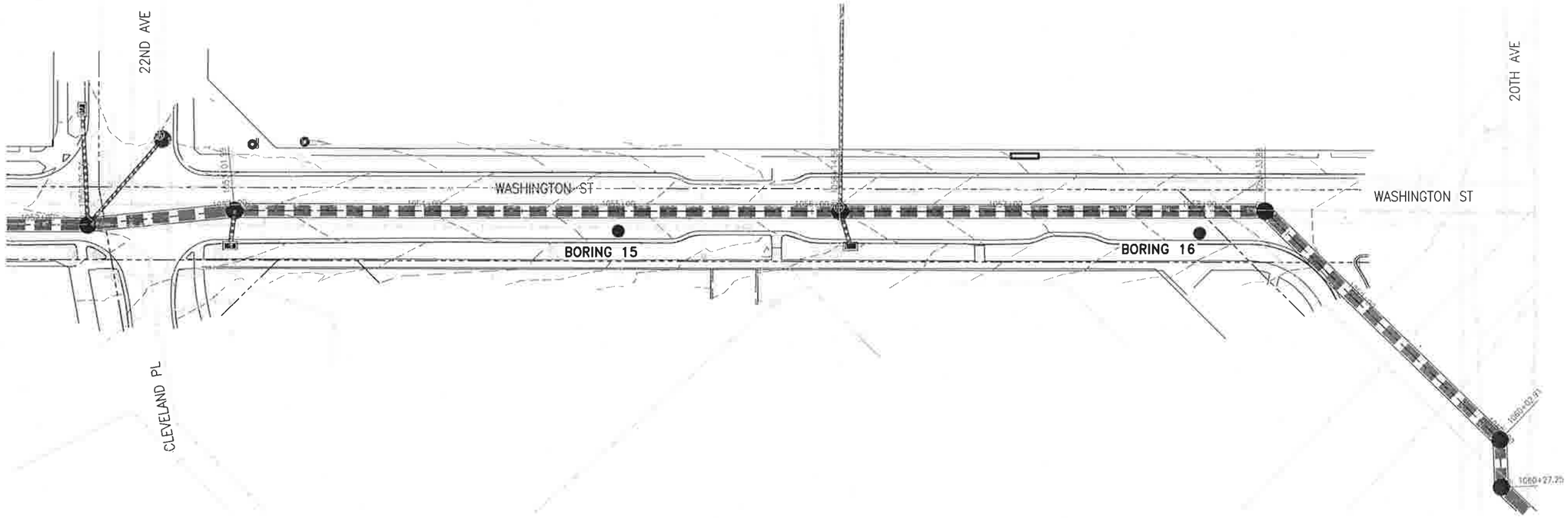


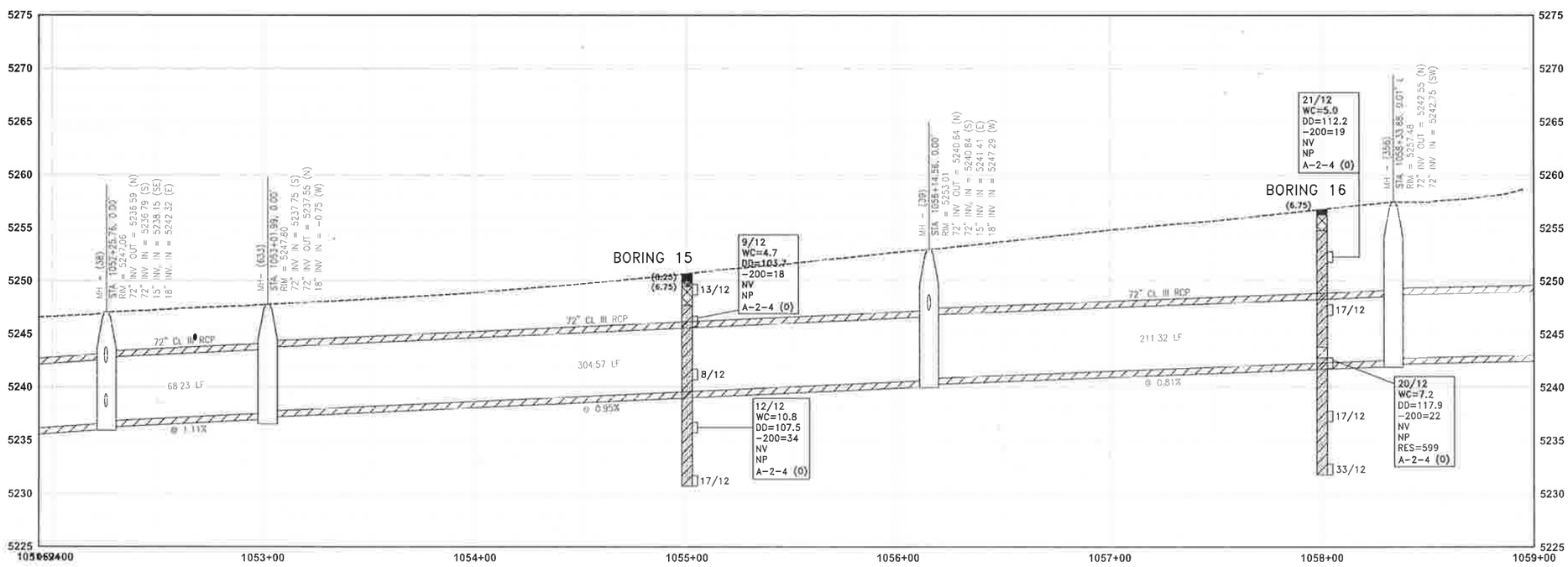


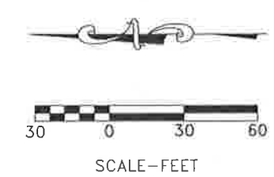


| 17-1-117 | Kumar & Associates | 27th STREET STORM SEWER, DENVER, COLORADO | LOCATION OF EXPLORATORY BORINGS | Fig. 1H |
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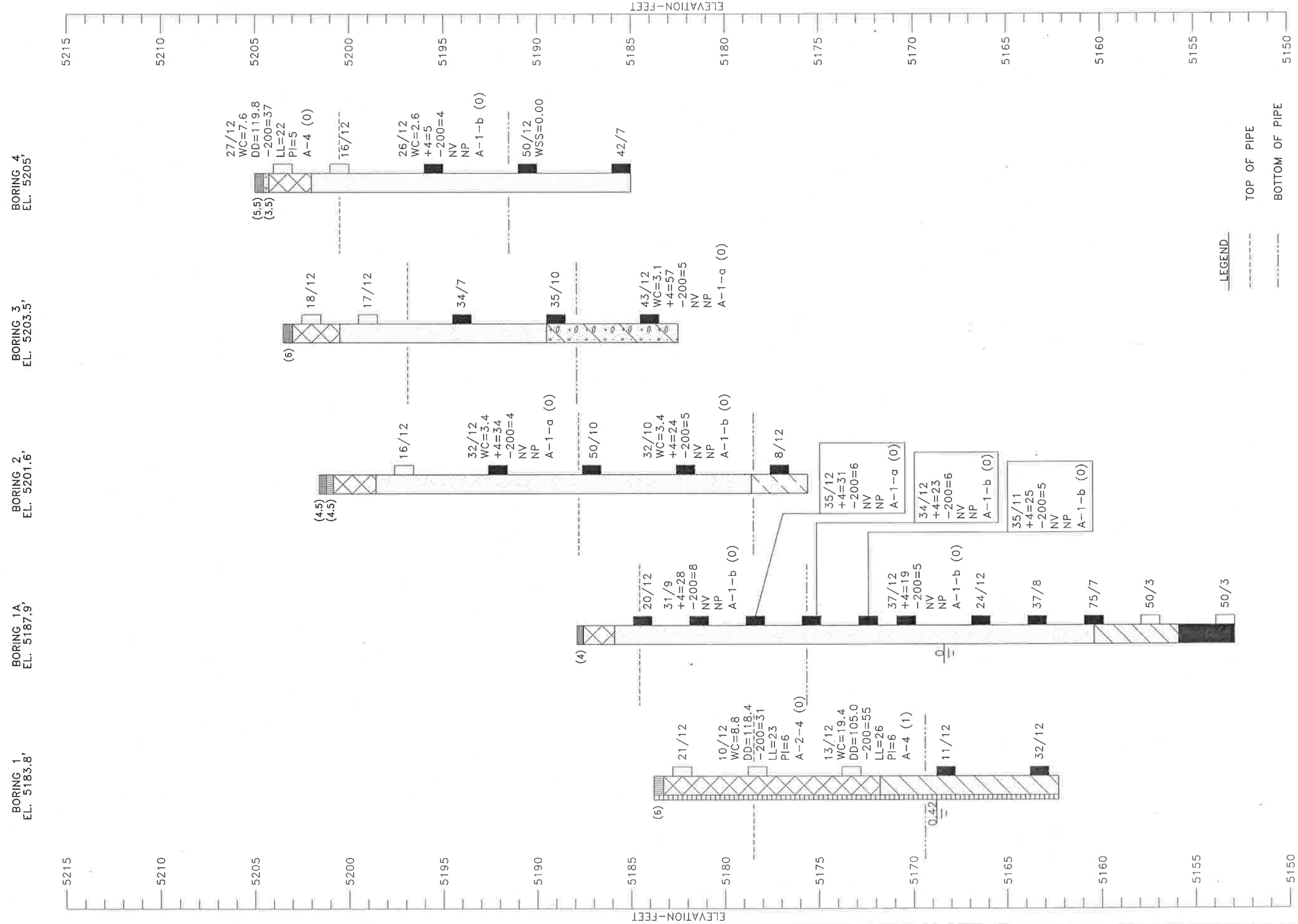


| 17-1-117 | Kumar & Associates | 27th STREET STORM SEWER, DENVER, COLORADO | LOGS OF EXPLORATORY BORINGS | Fig. 2 |
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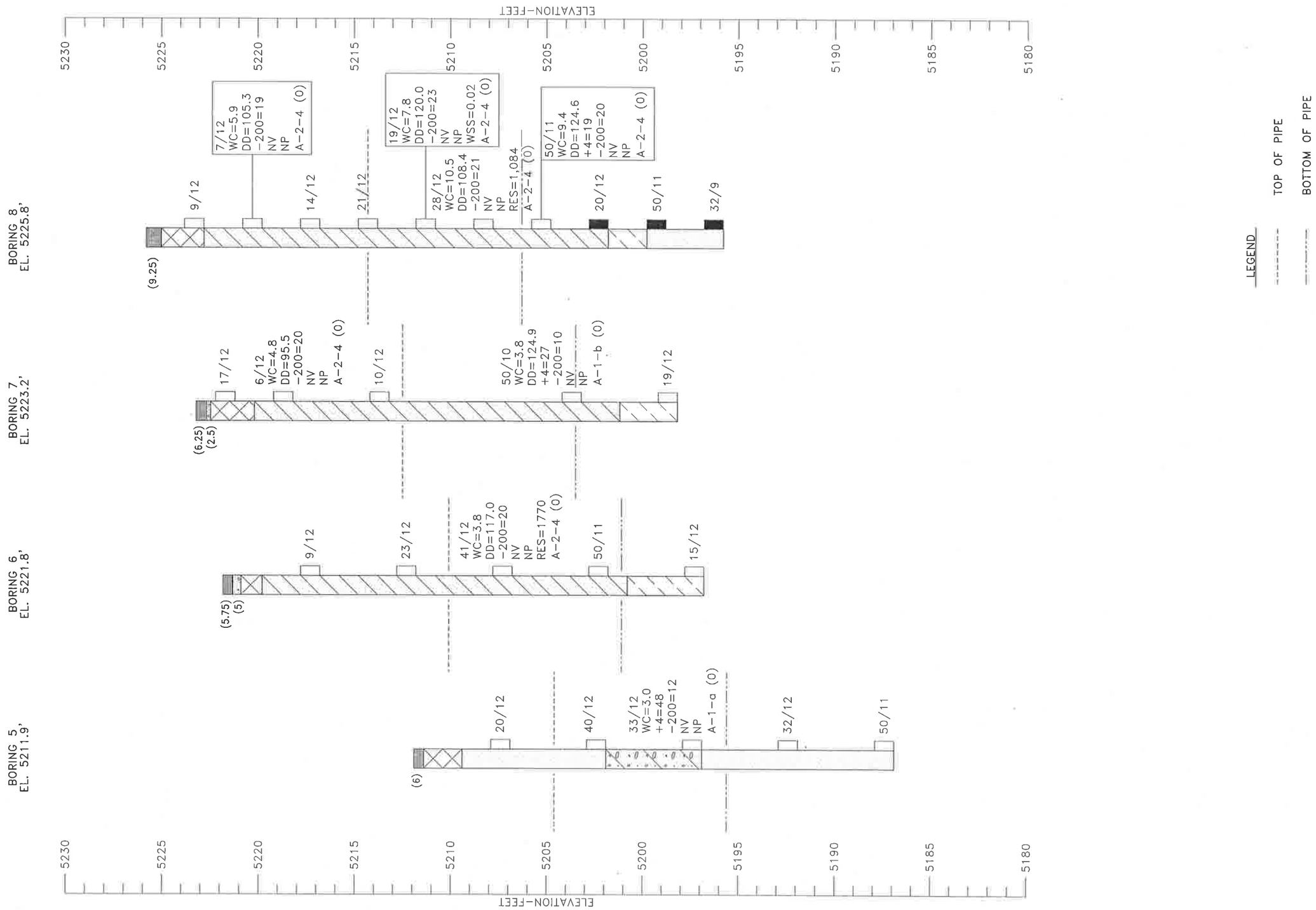


| 17-1-117 | Kumar & Associates | 27th STREET STORM SEWER, DENVER, COLORADO | LOGS OF EXPLORATORY BORINGS | Fig. 3 |
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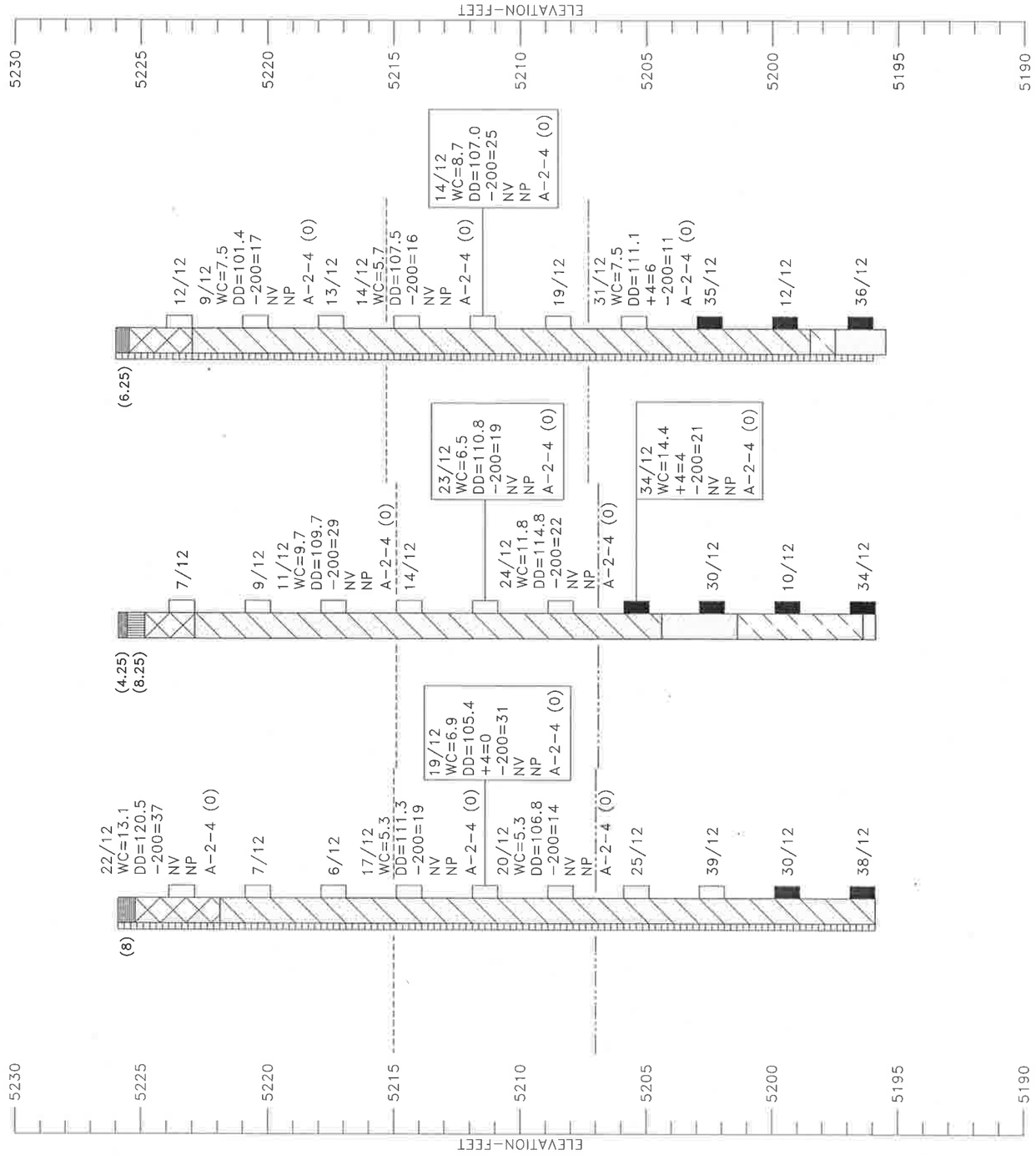


| 17-1-117 | Kumar & Associates | 27th STREET STORM SEWER, DENVER, COLORADO | LOGS OF EXPLORATORY BORINGS | Fig. 4 |
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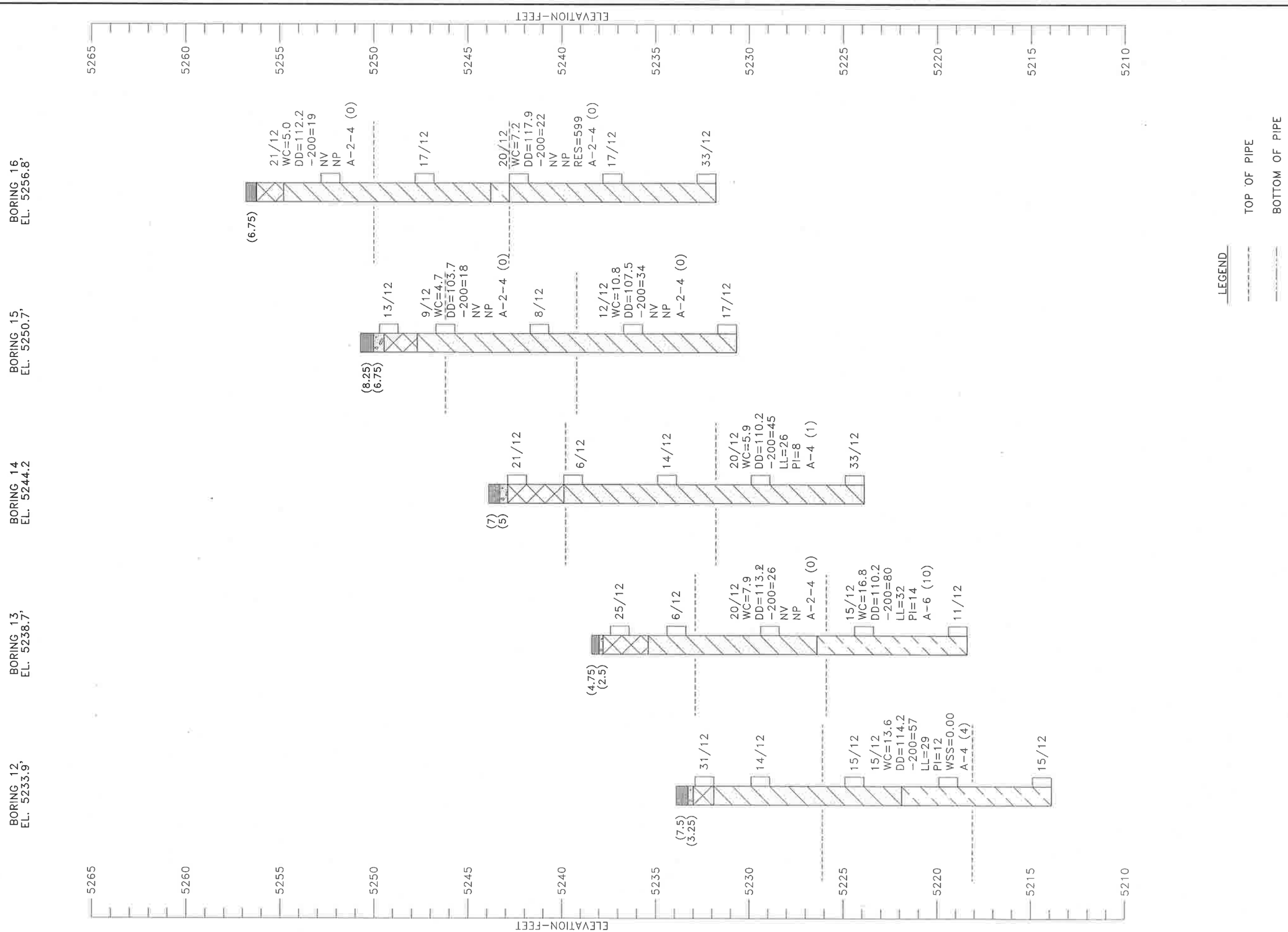


| 17-1-117 | Kumar & Associates | 27th STREET STORM SEWER, DENVER, COLORADO | LOGS OF EXPLORATORY BORINGS | Fig. 5 |
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## LEGEND

(6) CONCRETE, THICKNESS IN INCHES SHOWN IN PARENTHESES TO LEFT OF THE LOG.

(4.5) ASPHALT, THICKNESS IN INCHES SHOWN IN PARENTHESES TO LEFT OF THE LOG.

(3.5) AGGREGATE BASECOURSE, THICKNESS IN INCHES SHOWN IN PARENTHESES TO LEFT OF THE LOG.

FILL: SILTY CLAYEY SAND (SC-SM) AND SILTY CLAY WITH SAND (CL-ML), FINE TO COARSE-GRAINED WITH OCCASIONAL GRAVELS, MOIST, BROWN.

SANDY LEAN CLAY TO LEAN CLAY WITH SAND (CL), STIFF TO VERY STIFF, MOIST, BROWN.

SILTY SAND (SM), WITH OCCASIONAL POORLY-GRADED SAND WITH SILT (SP-SM), OCCASIONAL GRAVELS, LOOSE TO VERY DENSE, SLIGHTLY MOIST TO MOIST, LIGHT BROWN.

POORLY-TO WELL-GRADED SAND (SP TO SW), SILTY, OCCASIONAL GRAVELS, MEDIUM DENSE TO VERY DENSE, SLIGHTLY MOIST, LIGHT BROWN.

POORLY-GRADED GRAVEL WITH SILT AND SAND (GP-GM), DENSE, DRY TO SLIGHTLY MOIST, LIGHT BROWN.

DRIVE SAMPLE, 2-INCH I.D. CALIFORNIA LINER SAMPLE.

DRIVE SAMPLE, 1 3/8-INCH I.D. SPLIT SPOON SAMPLE.

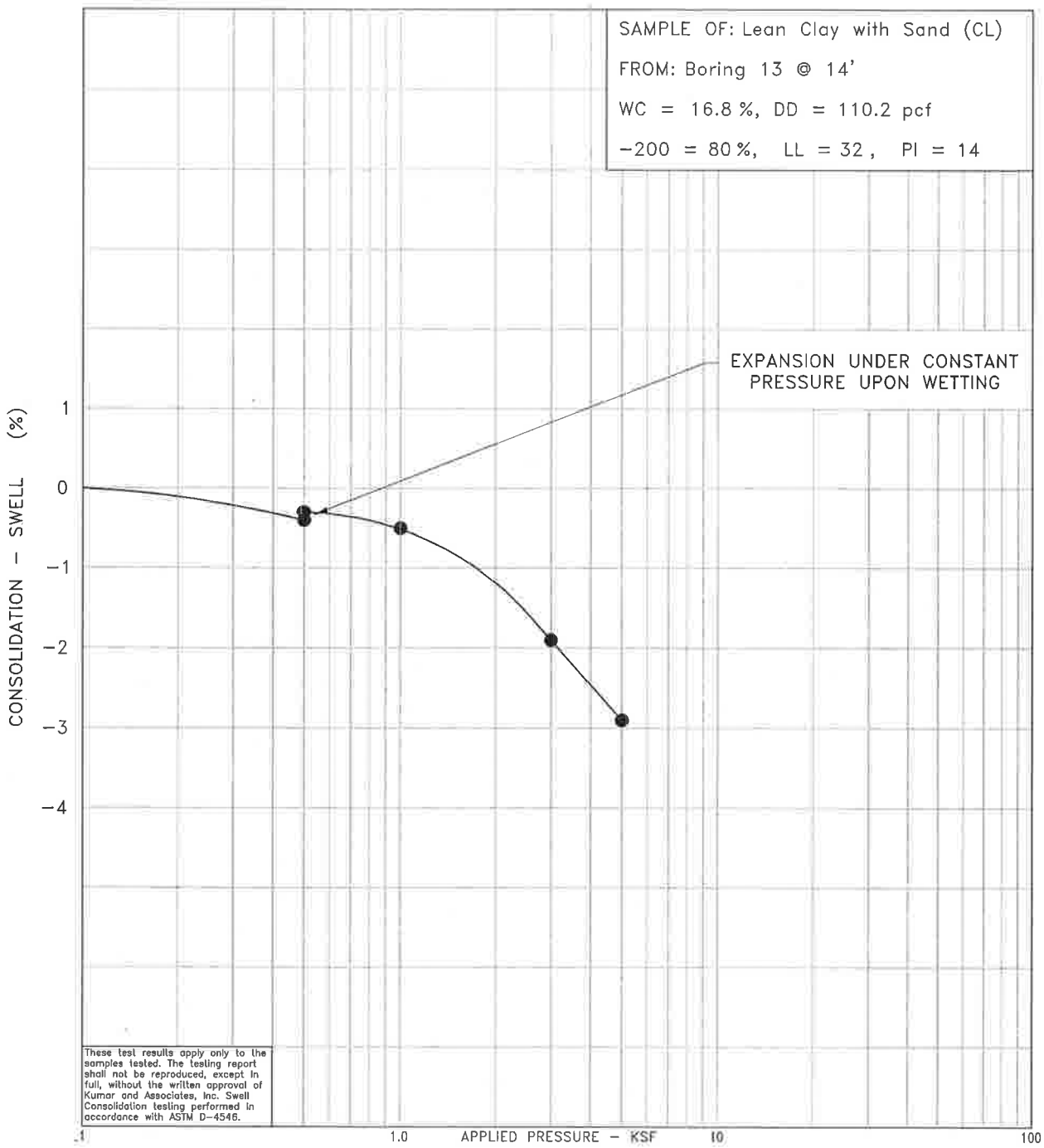
21/12 DRIVE SAMPLE BLOW COUNT. INDICATES THAT 21 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

BORING COMPLETED AS MONITORING WELL.

42 DEPTH TO WATER LEVEL AND NUMBER OF DAYS AFTER DRILLING MEASUREMENT WAS MADE.

## NOTES

1. THE EXPLORATORY BORINGS WERE DRILLED ON FEBRUARY 20, 21, 22, 23, 27, AND 28, 2017 WITH 4-INCH DIAMETER CONTINUOUS FLIGHT, AND 7.75-INCH HOLLOW STEM POWER AUGERS.
2. THE LOCATIONS OF THE EXPLORATORY BORINGS WERE MEASURED APPROXIMATELY BY PACING FROM FEATURES SHOWN ON THE SITE PLAN PROVIDED.
3. THE ELEVATIONS OF THE EXPLORATORY BORINGS WERE OBTAINED BY INTERPOLATION USING PLAN AND PROFILE INFORMATION ON THE DRAWINGS PROVIDED.
4. THE EXPLORATORY BORING LOCATIONS AND ELEVATIONS SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.
5. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
6. GROUNDWATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE TIME AND UNDER CONDITIONS INDICATED. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.
7. LABORATORY TEST RESULTS:
   WC = WATER CONTENT (%) (ASTM D 2216);
   DD = DRY DENSITY (pcf) (ASTM D 2216);
   +4 = PERCENTAGE RETAINED ON NO. 4 SIEVE (ASTM D 422);
   -200= PERCENTAGE PASSING NO. 200 SIEVE (ASTM D 1140);
   LL = LIQUID LIMIT (ASTM D 4318);
   PI = PLASTICITY INDEX (ASTM D 4318);
   NV = NO LIQUID LIMIT VALUE (ASTM D 4318);
   NP = NON-PLASTIC (ASTM D 4318);
   WSS = WATER SOLUBLE SULFATES (%) (CP-L 2103);
   RES = MINIMUM LABORATORY RESISTIVITY (ohm-cm.) (ASTM G 57).




| 17-1-117 | Kumar & Associates | SWELL-CONSOLIDATION TEST RESULT | Fig. 7 |
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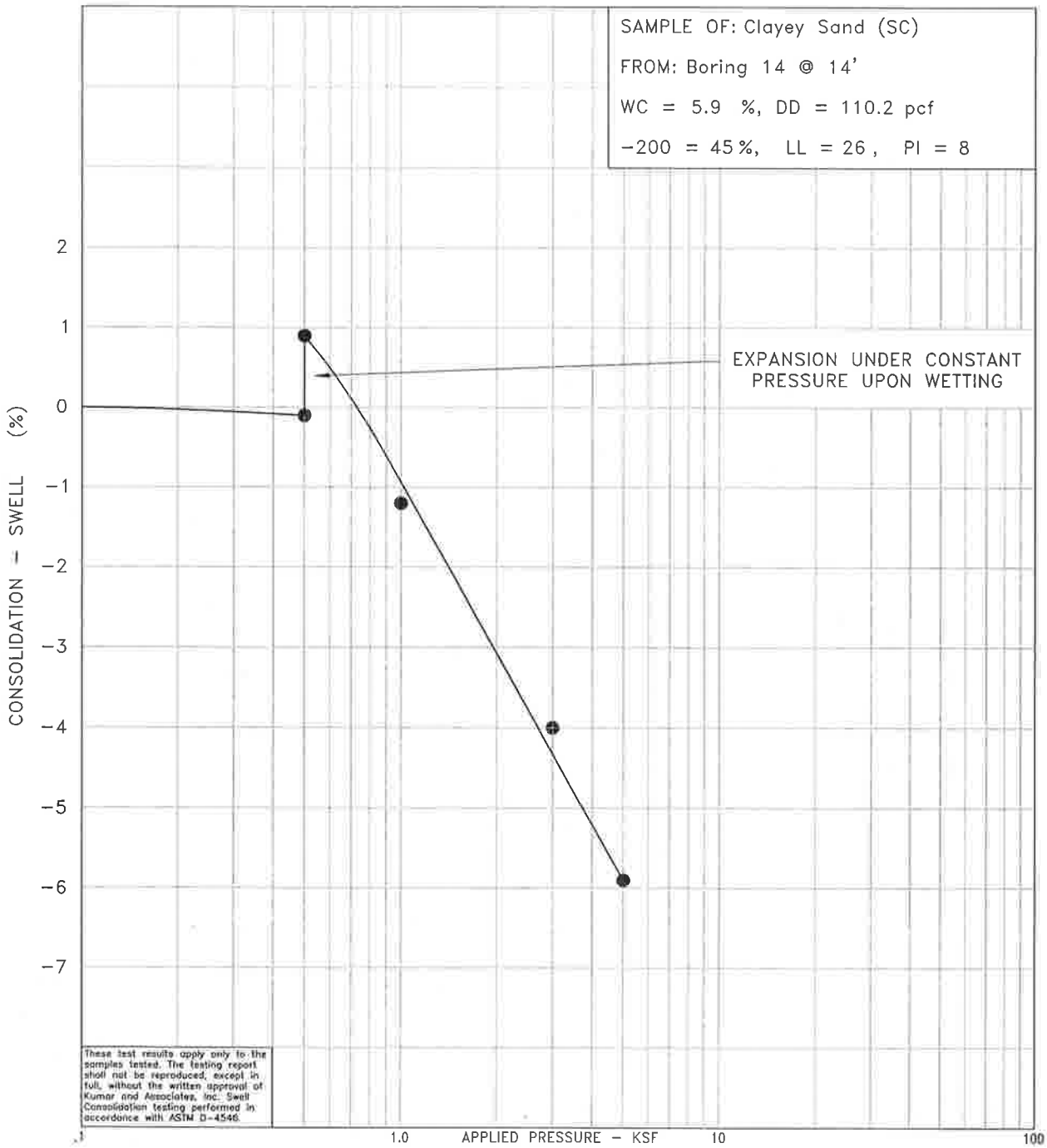


| 17-1-117 | Kumar & Associates | SWELL-CONSOLIDATION TEST RESULT | Fig. 8 |
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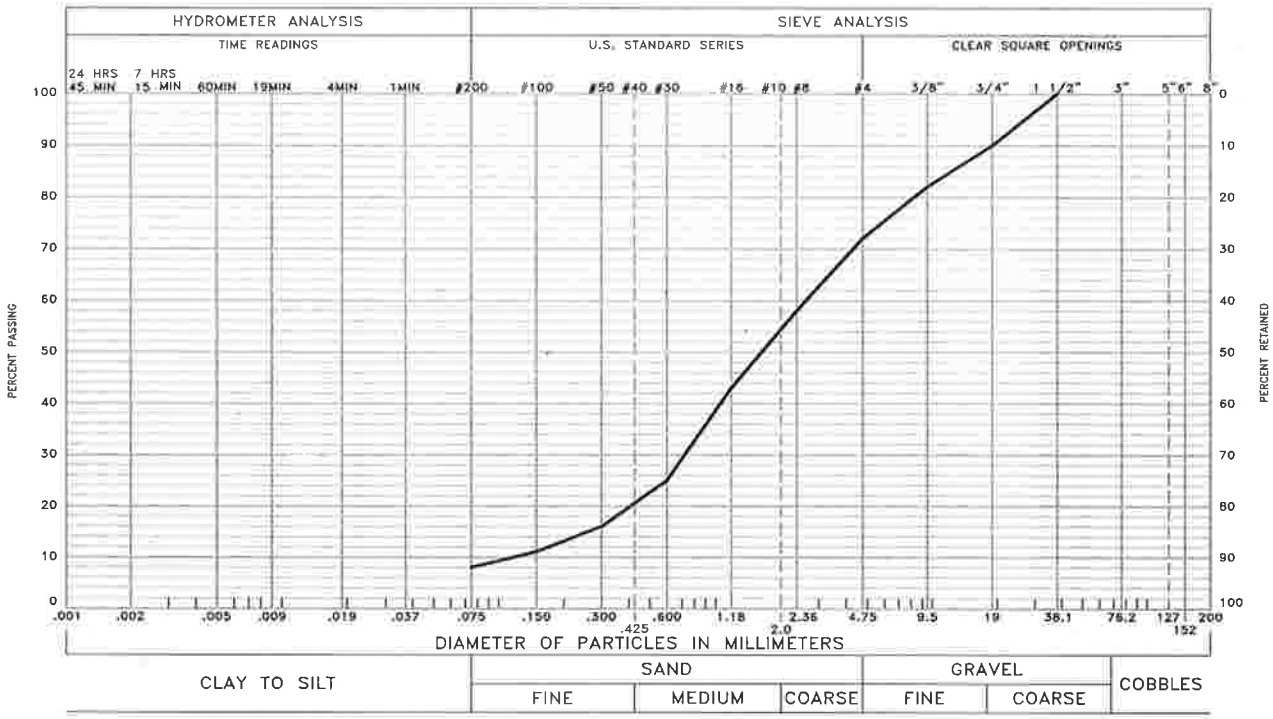
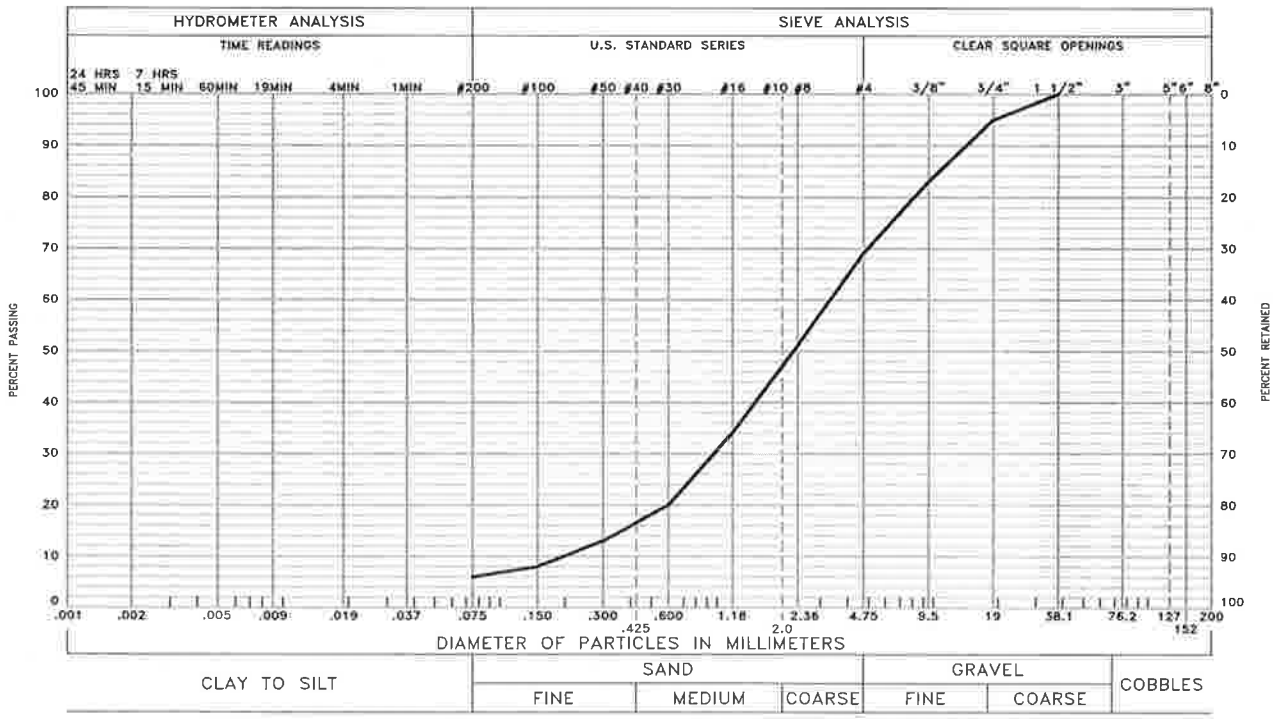



GRAVEL 28 % SAND 64 % SILT AND CLAY 8 %

LIQUID LIMIT PLASTICITY INDEX

SAMPLE OF: Well-Graded Sand with Silt & Gravel (SW-SM) FROM: Boring 1A @ 6'



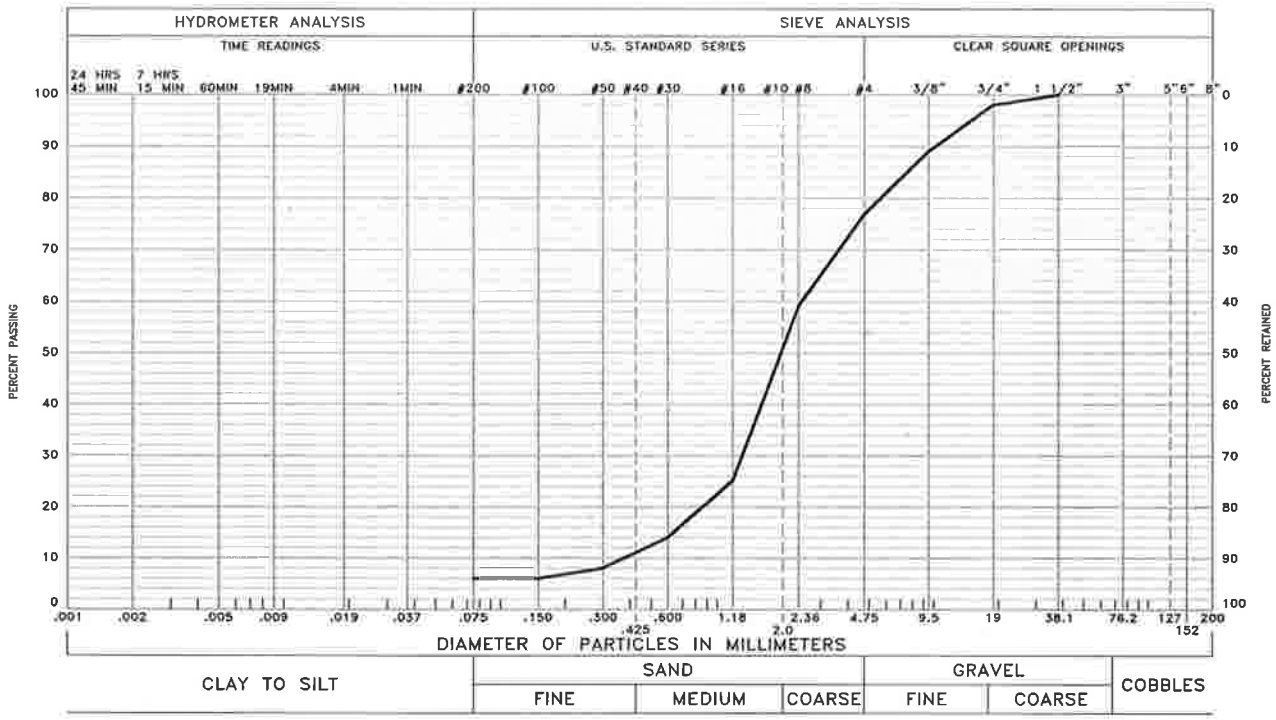

GRAVEL 31 % SAND 63 % SILT AND CLAY 6 %

LIQUID LIMIT PLASTICITY INDEX

SAMPLE OF: Well-Graded Sand with Silt & Gravel (SW-SM) FROM: Boring 1A @ 9'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D422, ASTM C136 and/or ASTM D1140.

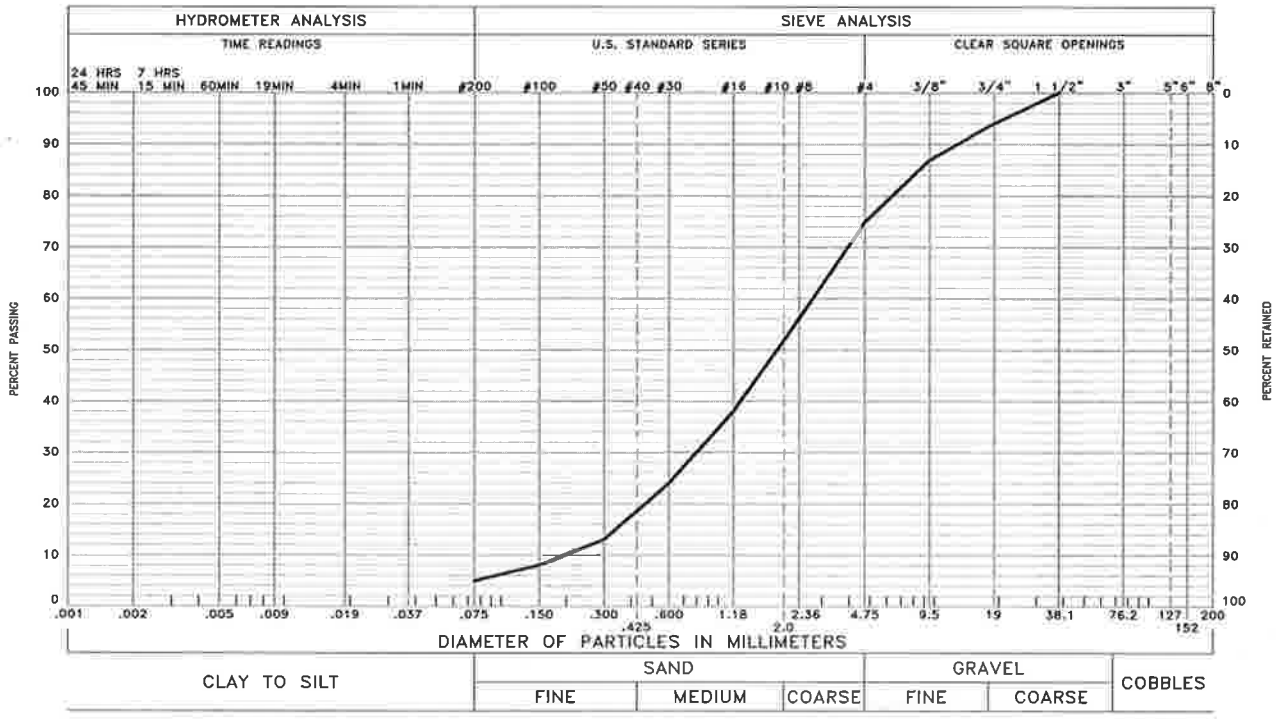
| 17-1-117 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 9 |
|---|---|---|---|




GRAVEL 23 % SAND 71 % SILT AND CLAY 6 %

LIQUID LIMIT PLASTICITY INDEX

SAMPLE OF: Well-Graded Sand with Silt & Gravel (SW-SM) FROM: Boring 1A @ 12'



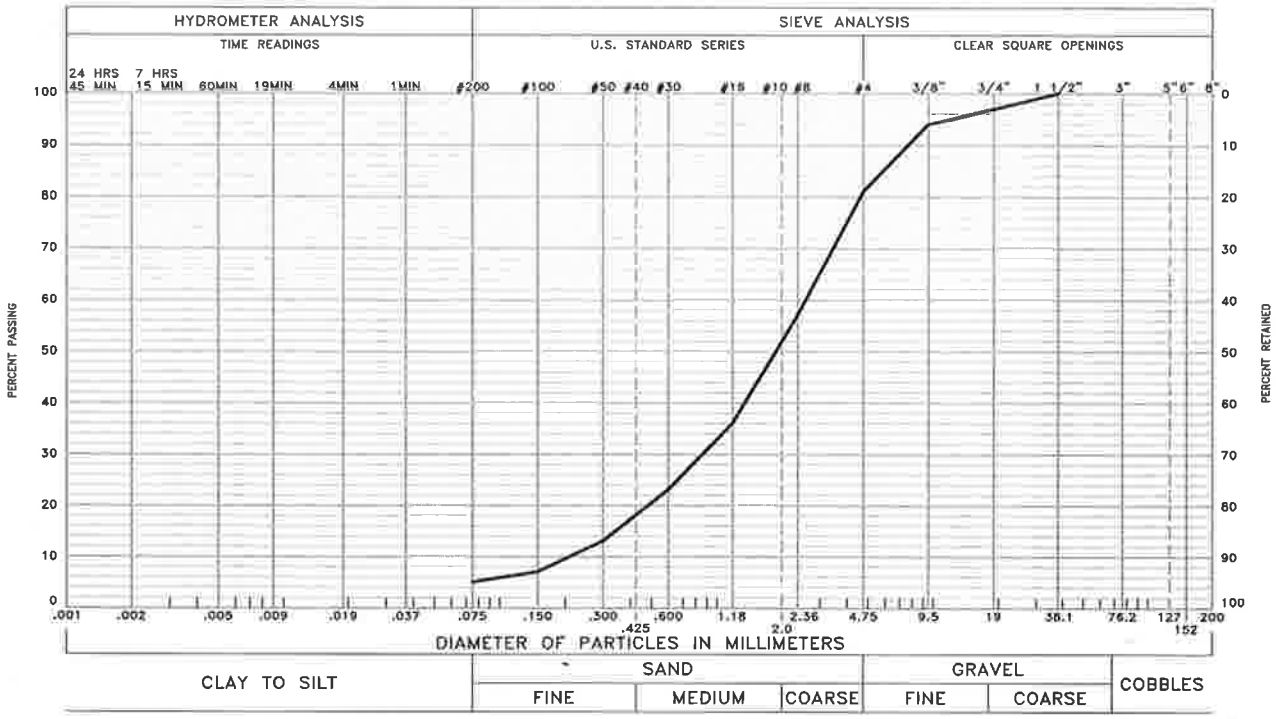

GRAVEL 25 % SAND 70 % SILT AND CLAY 5 %

LIQUID LIMIT PLASTICITY INDEX

SAMPLE OF: Well-Graded Sand with Silt & Gravel (SW-SM) FROM: Boring 1A @ 15'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D422, ASTM C136 and/or ASTM D1140.

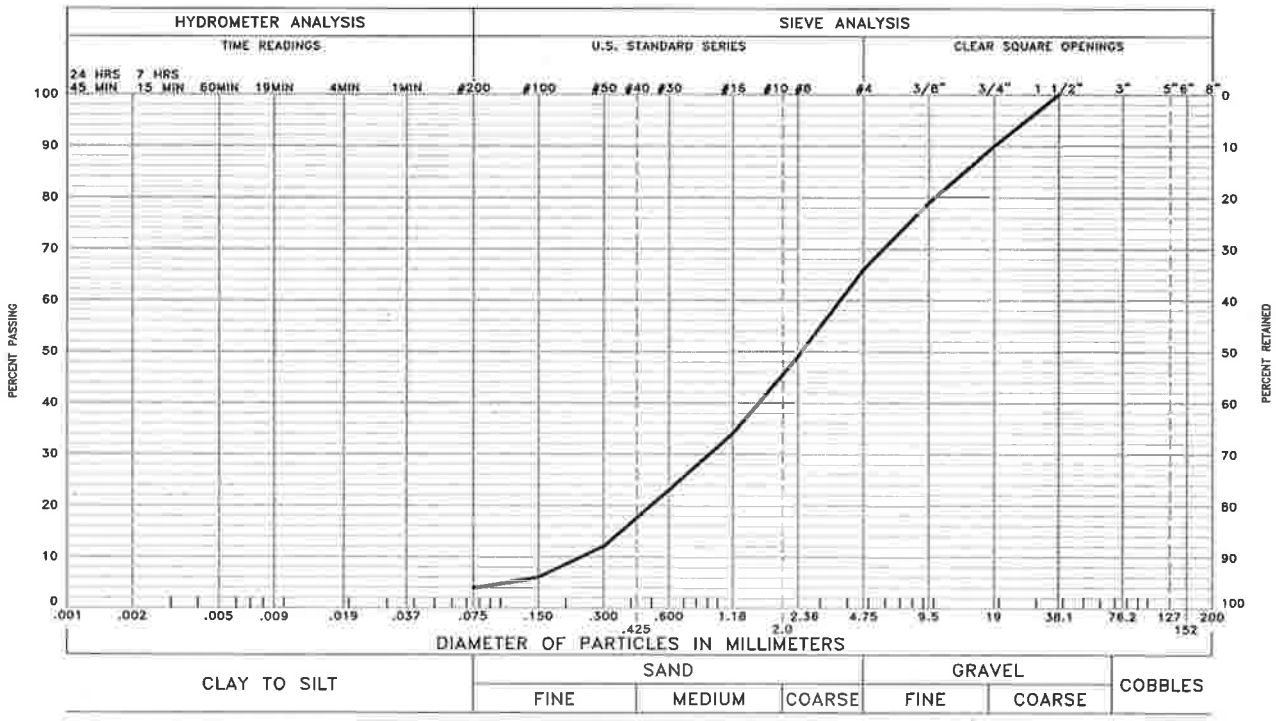
| 17-1-117 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 10 |
|---|---|---|---|




GRAVEL 19 % SAND 76 % SILT AND CLAY 5 %

LIQUID LIMIT PLASTICITY INDEX

SAMPLE OF: Well-Graded Sand with Silt & Gravel (SW-SM) FROM: Boring 1A @ 17'



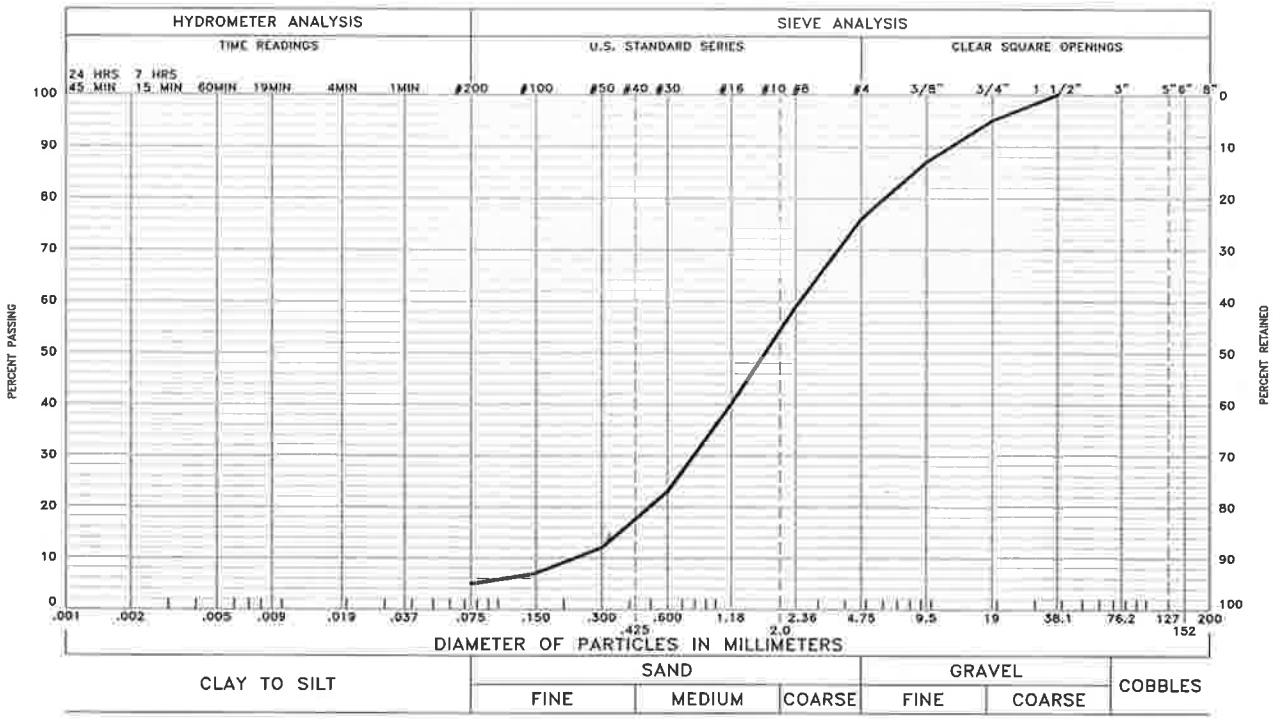

GRAVEL 34 % SAND 62 % SILT AND CLAY 4 %

LIQUID LIMIT NV PLASTICITY INDEX NP

SAMPLE OF: Poorly-Graded Sand with Gravel (SP) FROM: Boring 2 @ 9'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D422, ASTM C136 and/or ASTM D1140.

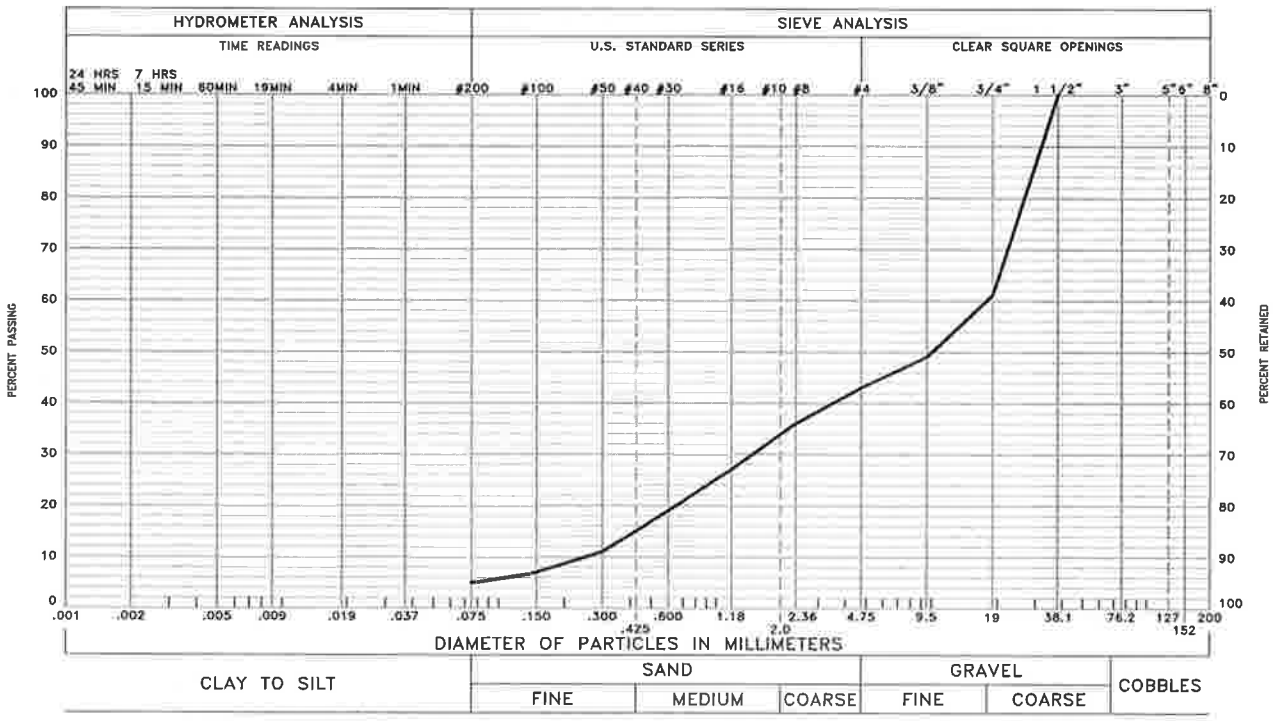
| 17-1-117 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 11 |
|---|---|---|---|




GRAVEL 24 % SAND 71 % SILT AND CLAY 5 %

LIQUID LIMIT NV PLASTICITY INDEX NP

SAMPLE OF: Well-Graded Sand with Gravel (SW) FROM: Boring 2 @ 19'



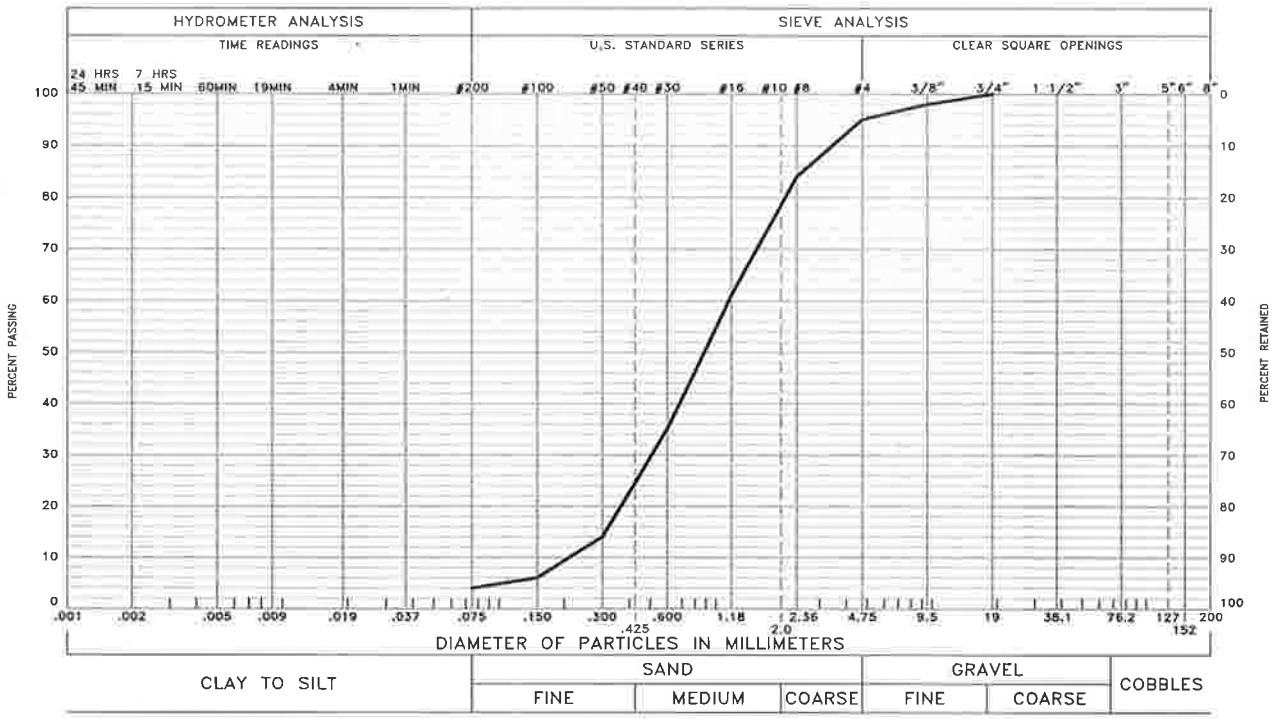

GRAVEL 57 % SAND 38 % SILT AND CLAY 5 %

LIQUID LIMIT NV PLASTICITY INDEX NP

SAMPLE OF: Poorly-Graded Gravel with Silt and Sand (GP-GM) FROM: Boring 3 @ 19'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D422, ASTM C136 and/or ASTM D1140.

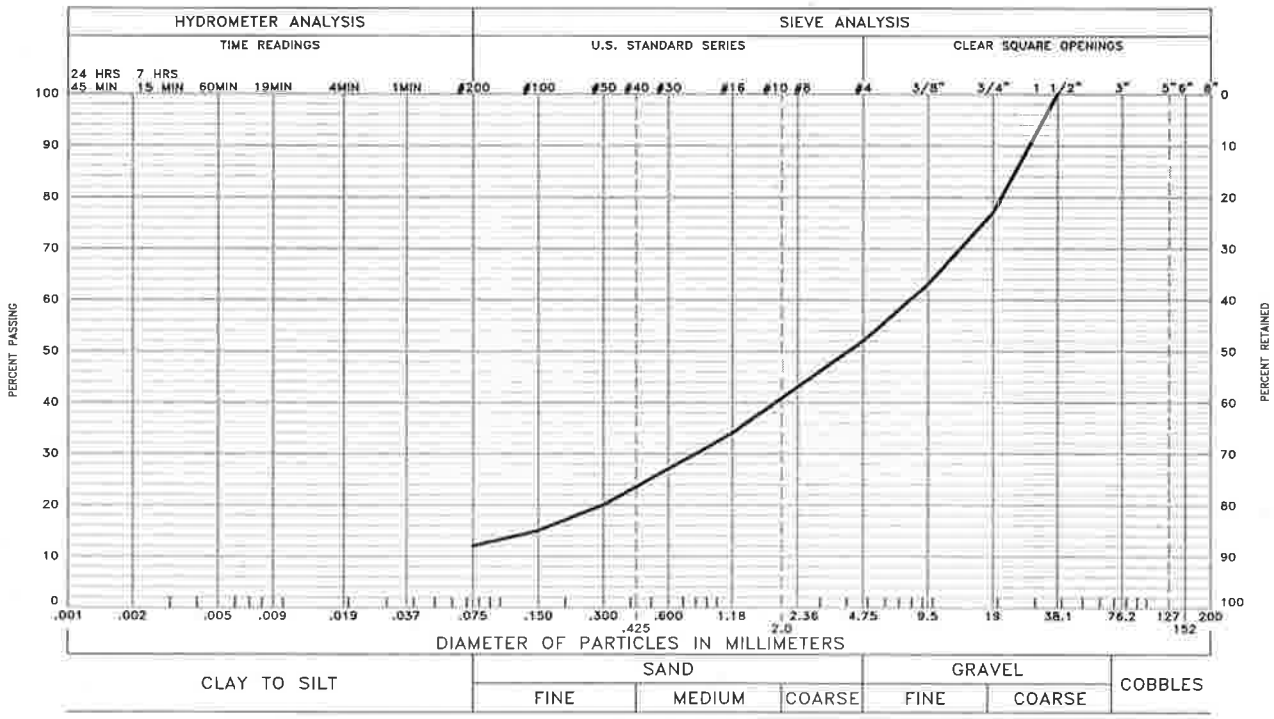
| 17-1-117 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 12 |
|---|---|---|---|




GRAVEL 5 % SAND 91 % SILT AND CLAY 4 %

LIQUID LIMIT NV PLASTICITY INDEX NP

SAMPLE OF: Poorly-Graded Sand (SP) FROM: Boring 4 @ 9'



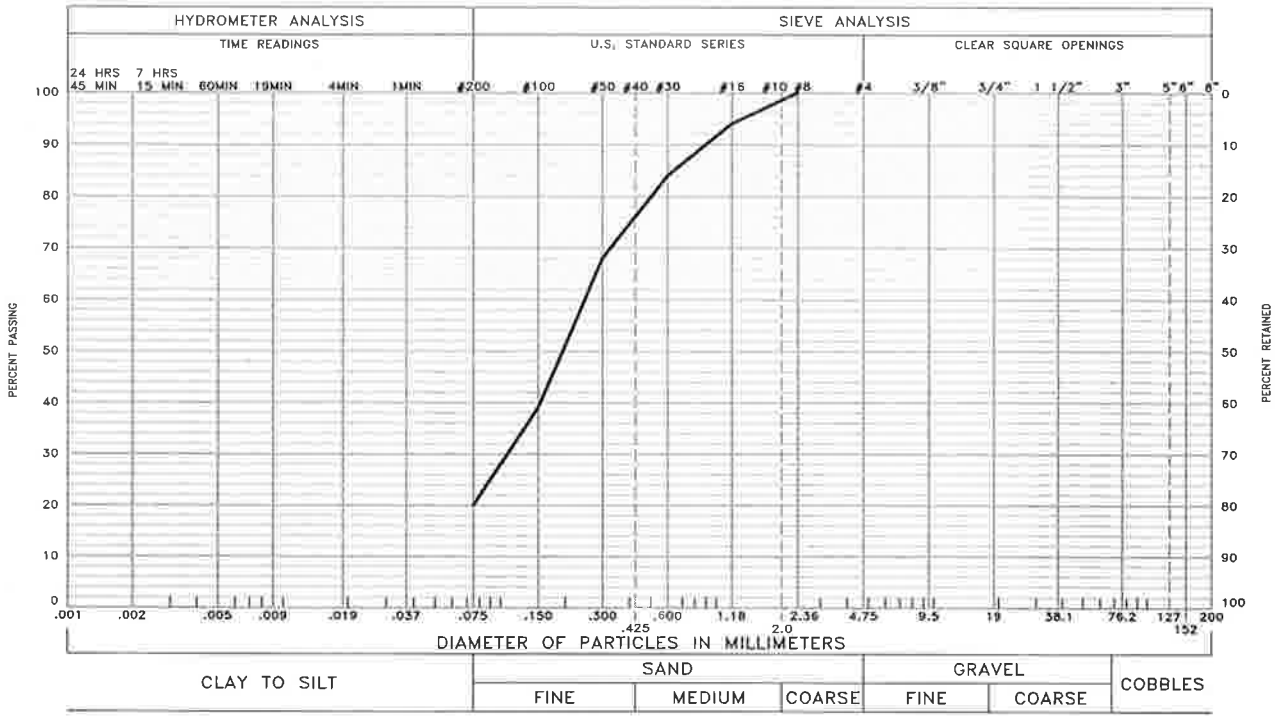

GRAVEL 48 % SAND 40 % SILT AND CLAY 12 %

LIQUID LIMIT NV PLASTICITY INDEX NP

SAMPLE OF: Poorly-Graded Gravel with Silt and Sand (GP-GM) FROM: Boring 5 @ 14'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D422, ASTM C136 and/or ASTM D1140.

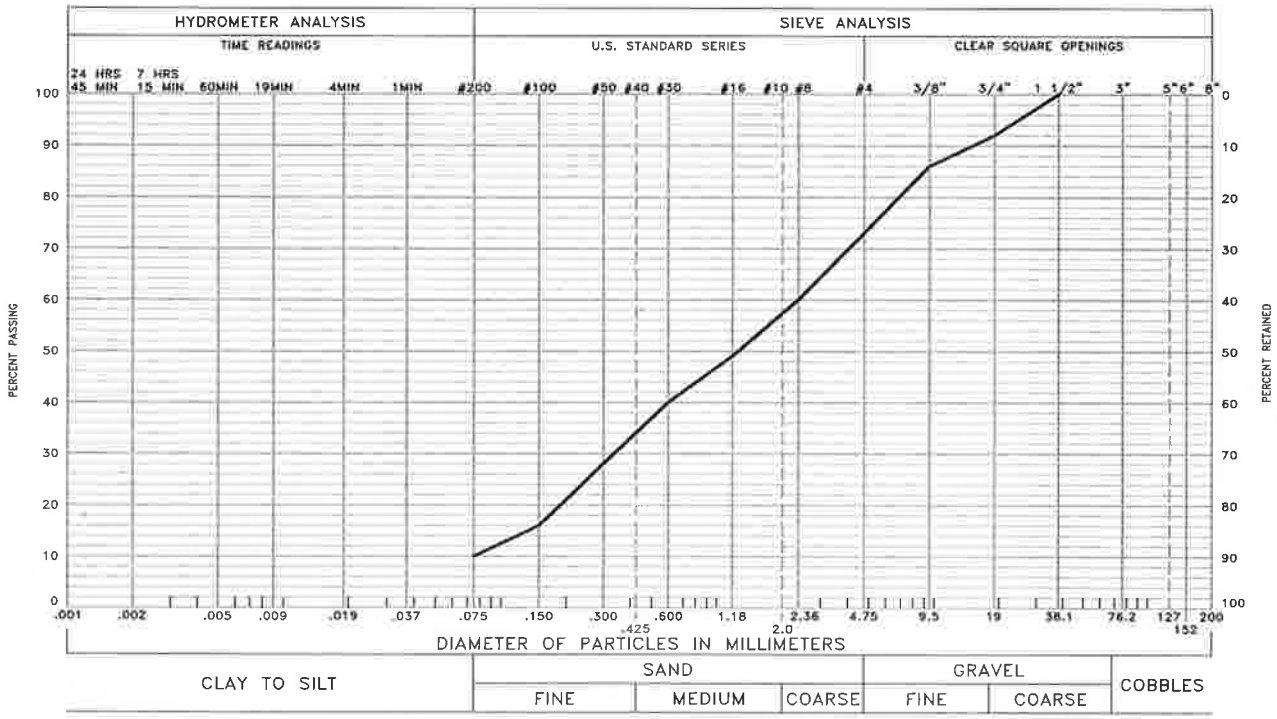
| 17-1-117 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 13 |
|---|---|---|---|




GRAVEL % SAND 80 % SILT AND CLAY 20 %

LIQUID LIMIT NV PLASTICITY INDEX NP

SAMPLE OF: Silty Sand (SM) FROM: Boring 7 @ 4'



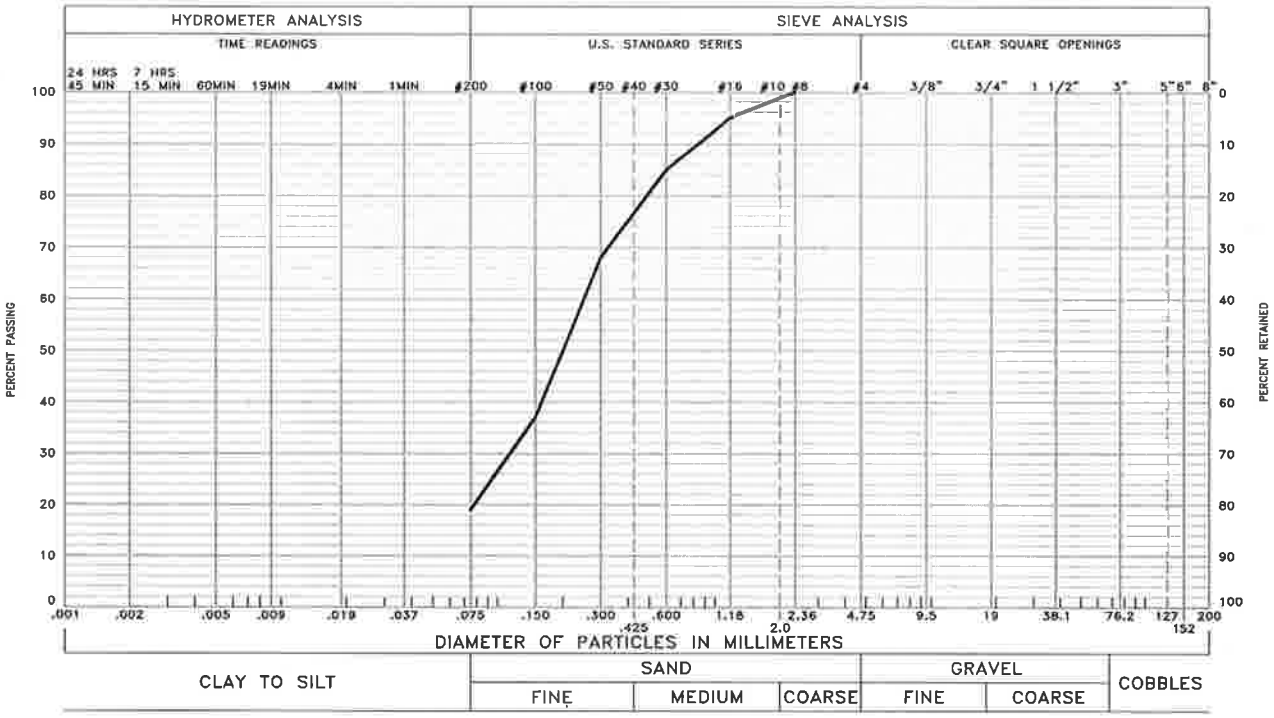

GRAVEL 27 % SAND 63 % SILT AND CLAY 10 %

LIQUID LIMIT NV PLASTICITY INDEX NP

SAMPLE OF: Poorly-Graded Sand with Silt and Gravel (SP-SM) FROM: Boring 7 @ 19'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D422, ASTM C136 and/or ASTM D1140.

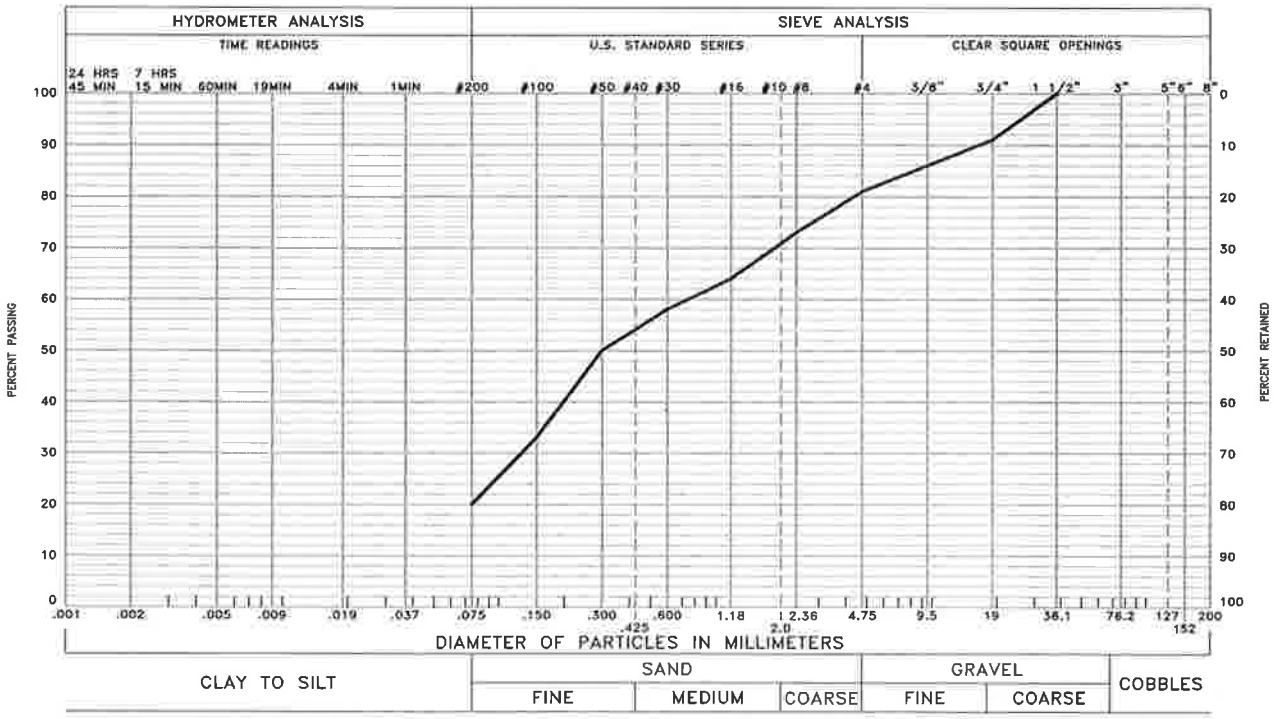
| 17-1-117 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 14 |
|---|---|---|---|




GRAVEL % SAND 81 % SILT AND CLAY 19 %

LIQUID LIMIT NV PLASTICITY INDEX NP

SAMPLE OF: Silty Sand (SM) FROM: Boring 8 @ 5'



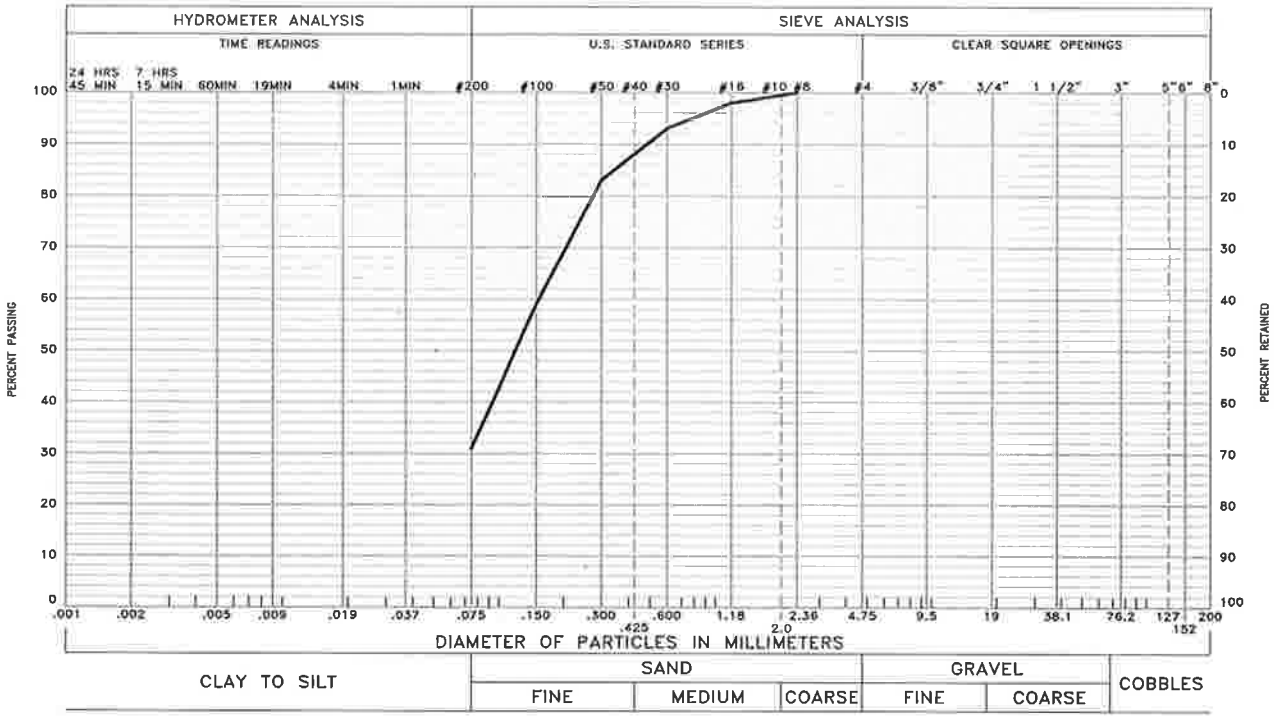

GRAVEL 19 % SAND 61 % SILT AND CLAY 20 %

LIQUID LIMIT NV PLASTICITY INDEX NP

SAMPLE OF: Silty Sand with Gravel (SM) FROM: Boring 8 @ 20'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D422, ASTM C136 and/or ASTM D1140.

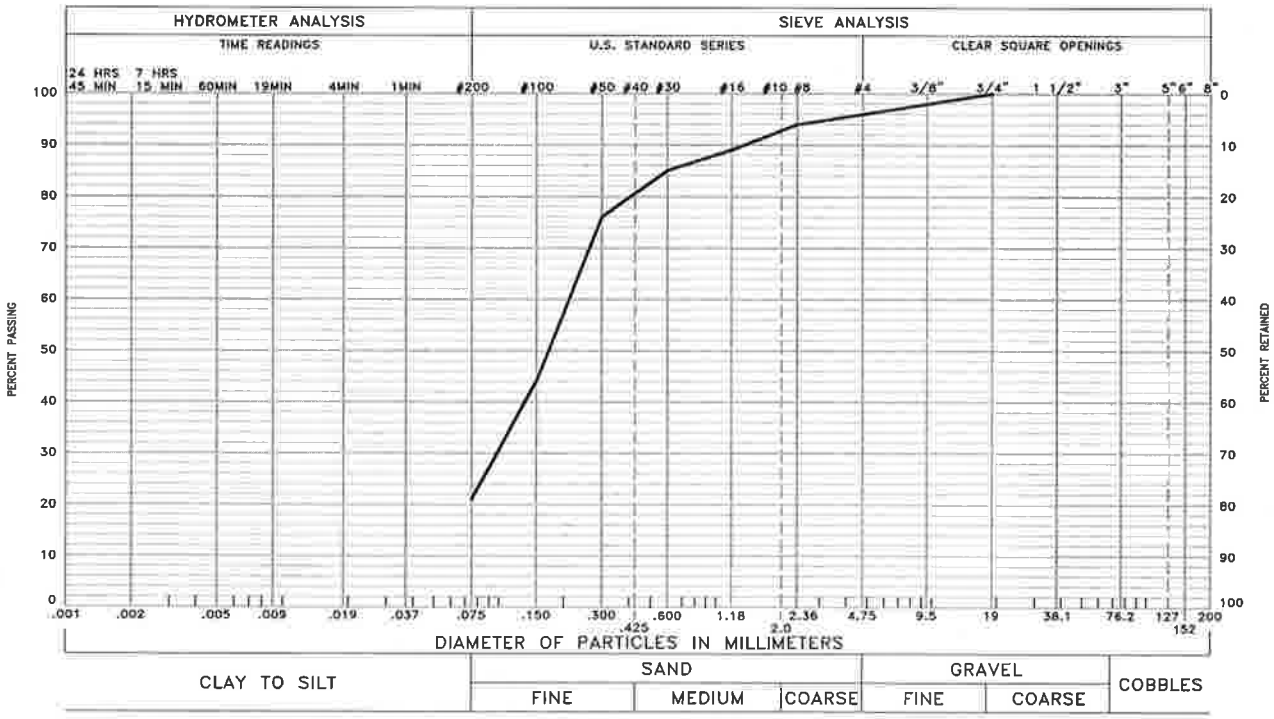
| 17-1-117 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 15 |
|---|---|---|---|




GRAVEL % SAND 69 % SILT AND CLAY 31 %

LIQUID LIMIT NV PLASTICITY INDEX NP

SAMPLE OF: Silty Sand (SM) FROM: Boring 9 @ 14'



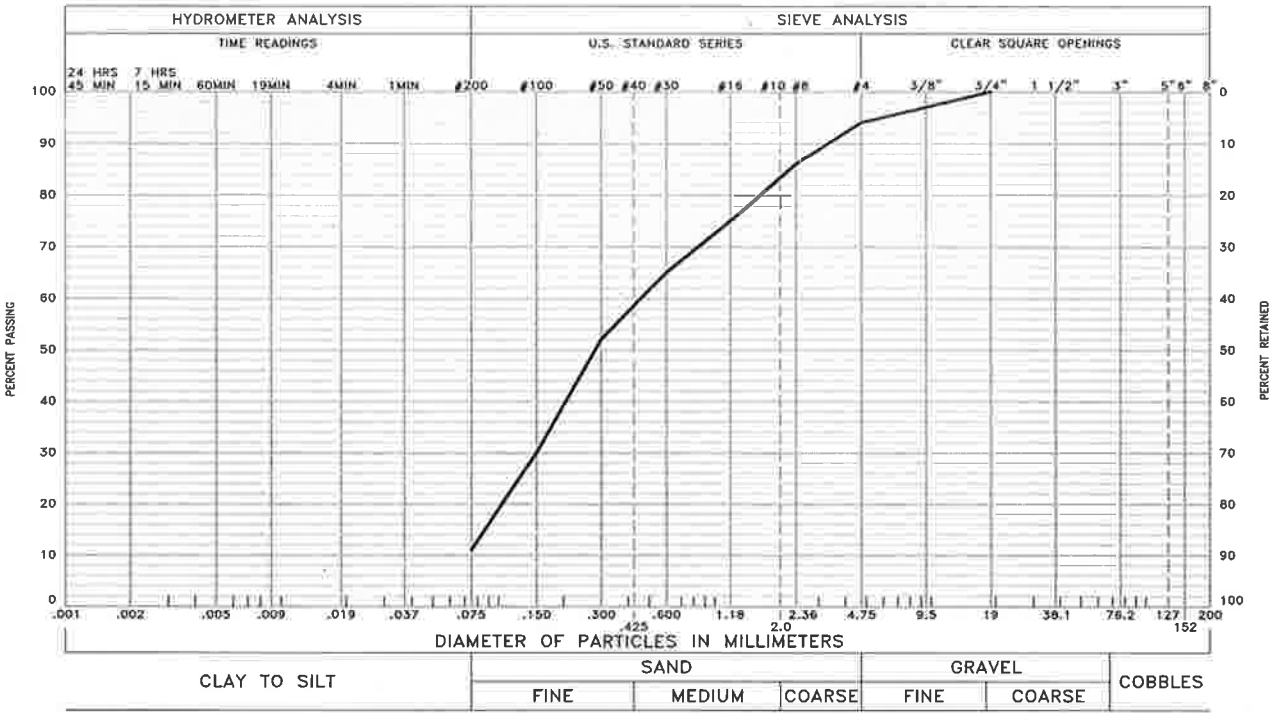

GRAVEL 4 % SAND 75 % SILT AND CLAY 21 %

LIQUID LIMIT NV PLASTICITY INDEX NP

SAMPLE OF: Silty Sand (SM) FROM: Boring 10 @ 20'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D422, ASTM C136 and/or ASTM D1140.

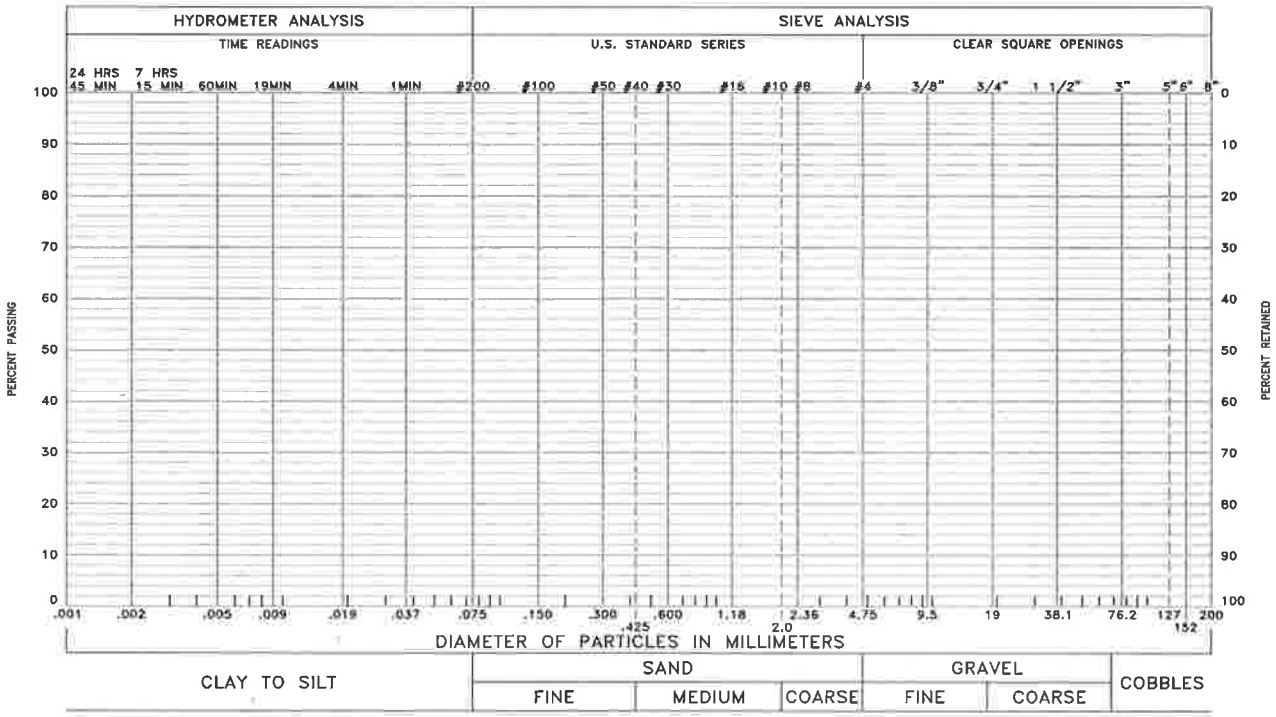
| 17-1-117 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 16 |
|---|---|---|---|




GRAVEL 6 % SAND 83 % SILT AND CLAY 11 %

LIQUID LIMIT NV PLASTICITY INDEX NP

SAMPLE OF: Poorly Graded Sand with Silt (SP-SM) FROM: Boring 11 @ 20'



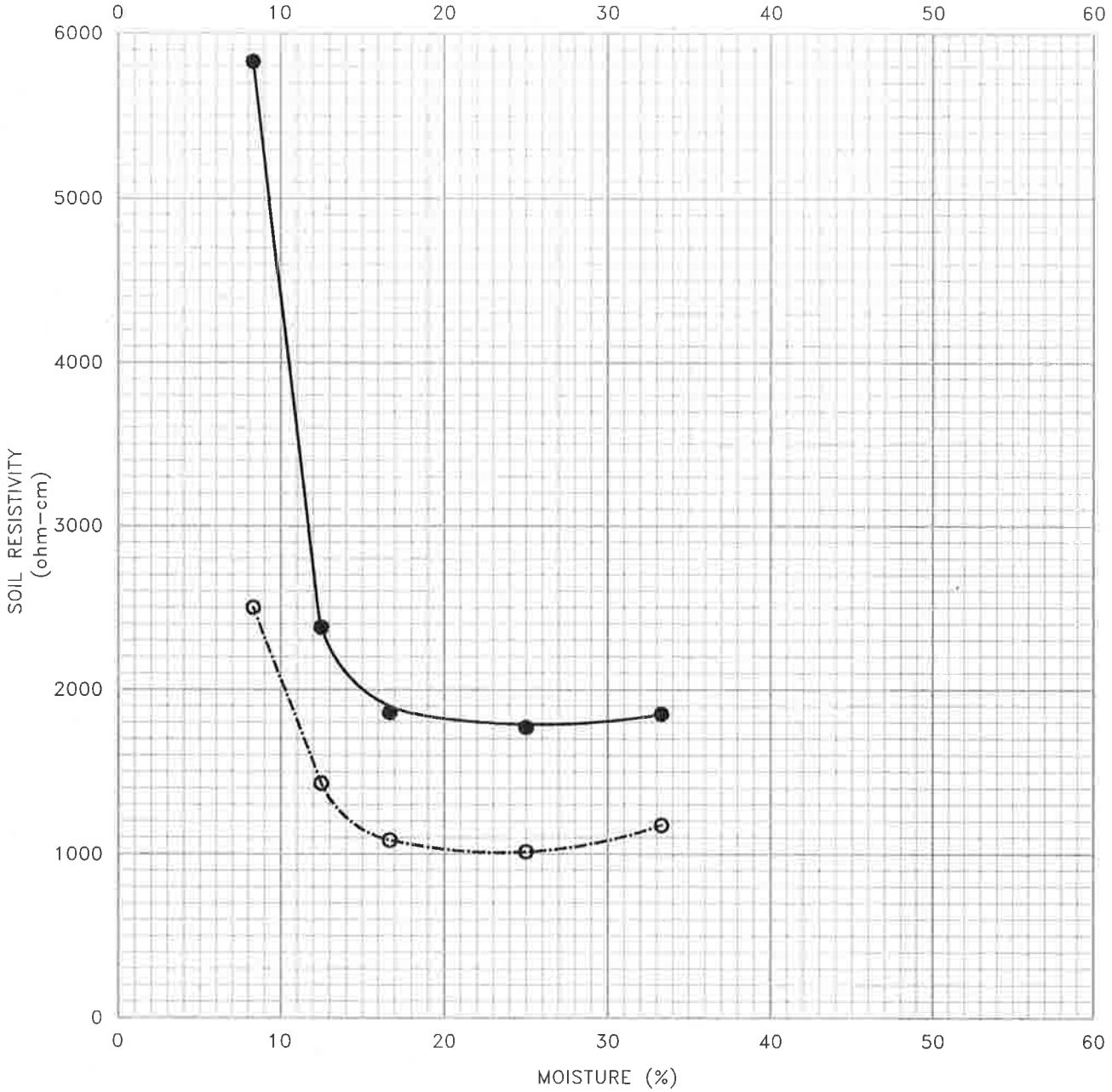

GRAVEL % SAND % SILT AND CLAY %

LIQUID LIMIT PLASTICITY INDEX

SAMPLE OF: FROM:

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D422, ASTM C136 and/or ASTM D1140.

| 17-1-117 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 17 |
|---|---|---|---|




| CURVE SYMBOL | SAMPLE IDENTIFICATION | SOIL OR BEDROCK TYPE | MINIMUM RESISTIVITY (ohm-cm) | RESISTIVITY AT IN SITU MOISTURE CONTENT (ohm-cm) |
|---|---|---|---|---|
| ● | BORING 6 @ 14 FT. | Silty Sand (SM) | 1,770 | >6,000 |
| ○ | BORING 8 @ 17 FT. | Silty Sand (SM) | 1,084 | 1,930 |

| | | | |
|---|---|---|---|
| 17-1-117 | Kumar & Associates | LABORATORY RESISTIVITY RESULTS | Fig. 18 |

TABLE I
SUMMARY OF LABORATORY TEST RESULTS

PROJECT NO.: 17-1-117
PROJECT NAME: 27th Street Storm Sewer
DATE SAMPLED: February 20,21,22,23,27 and 7-3-17
DATE RECEIVED: 3-7-17 and 7-7-17

| SAMPLE LOCATION | | DATE TESTED | NATURAL MOISTURE CONTENT (%) | NATURAL DRY DENSITY (pcf) | GRADATION | | PERCENT PASSING NO. 200 SIEVE | ATTERBERG LIMITS | | WATER SOLUBLE SULFATES (%) | MINIMUM ELECTRICAL RESISTIVITY (ohm-cm) | AASHTO CLASSIFICATION (group index) | SOIL OR BEDROCK TYPE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BORING | DEPTH (feet) | | | | GRAVEL (%) | SAND (%) | | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | | | | |
| 1 | 5 | 3-9-17 | 8.8 | 118.4 | | | 31 | 23 | 6 | | | A-2-4 (0) | Fill: Silty Clayey Sand (SC-SM) |
| 1 | 10 | 3-9-17 | 19.4 | 105.0 | | | 55 | 26 | 6 | | | A-4 (1) | Fill: Silty Clay with Sand (CL-ML) |
| 2 | 9 | 3-9-17 | 3.4 | | 34 | 62 | 4 | NV | NP | | | A-1-a (0) | Poorly-Graded Sand with Gravel (SP) |
| 1A | 6 | 7-7-17 | 3.4 | | 28 | 64 | 8 | NV | NP | | | A-1-b (0) | Well-Graded Sand with Silt and Gravel (SW-SM) |
| 1A | 9 | 7-7-17 | 2.1 | | 31 | 63 | 6 | NV | NP | | | A-1-a (0) | Well-Graded Sand with Silt and Gravel (SW-SM) |
| 1A | 12 | 7-7-17 | 5.1 | | 23 | 71 | 6 | NV | NP | | | A-1-b (0) | Well-Graded Sand with Silt and Gravel (SW-SM) |
| 1A | 15 | 7-7-17 | 4.3 | | 25 | 70 | 5 | NV | NP | | | A-1-b (0) | Well-Graded Sand with Silt and Gravel (SW-SM) |
| 1A | 17 | 7-7-17 | 4.0 | | 19 | 7.6 | 5 | NV | NP | | | A-1-b (0) | Well-Graded Sand with Silt and Gravel (SW-SM) |
| 2 | 19 | 3-9-17 | 3.4 | | 24 | 71 | 5 | NV | NP | | | A-1-b (0) | Well-Graded Sand with Gravel (SW) |
| 3 | 19 | 3-9-17 | 3.1 | | 57 | 38 | 5 | NV | NP | | | A-1-a (0) | Poorly-Graded Gravel with Silt and Sand (GP-GM) |
| 4 | 1 | 3-9-17 | 7.6 | 119.8 | | | 37 | 22 | 5 | | | A-4 (0) | Fill: Silty Clayey Sand (SC-SM) |
| 4 | 9 | 3-9-17 | 2.6 | | 5 | 91 | 4 | NV | NP | | | A-1-b (0) | Poorly-Graded Sand (SP) |
| 4 | 14 | 3-9-17 | | | | | | | | 0.00 | | | Poorly-Graded Sand (SP) |
| 5 | 14 | 3-9-17 | 3.0 | | 48 | 40 | 12 | NV | NP | | | A-1-a (0) | Poorly-Graded Gravel with Silt and Sand (GP-GM) |
| 6 | 14 | 3-9-17 | 3.8 | 117.0 | | | 20 | NV | NP | | 1,770 | A-2-4 (0) | Silty Sand (SM) |
| 7 | 4 | 3-9-17 | 4.8 | 95.5 | 0 | 80 | 20 | NV | NP | | | A-2-4 (0) | Silty Sand (SM) |
| 7 | 19 | 3-9-17 | 3.8 | 124.9 | 27 | 63 | 10 | NV | NP | | | A-1-b (0) | Poorly-Graded Sand with Silt and Gravel (SP-SM) |
| 8 | 5 | 3-9-17 | 5.9 | 105.3 | 0 | 81 | 19 | NV | NP | | | A-2-4 (0) | Silty Sand (SM) |
| 8 | 14 | 3-9-17 | 7.8 | 120.0 | | | 23 | NV | NP | 0.02 | | A-2-4 (0) | Silty Sand (SM) |
| 8 | 17 | 3-9-17 | 10.5 | 108.4 | | | 21 | NV | NP | | 1,084 | A-2-4 (0) | Silty Sand (SM) |
| 8 | 20 | 3-9-17 | 9.4 | 124.6 | 19 | 61 | 20 | NV | NP | | | A-2-4 (0) | Silty Sand with Gravel (SM) |
| 9 | 2 | 3-9-17 | 13.1 | 120.5 | | | 37 | NV | NP | | | A-2-4 (0) | Silty Sand (SM) |
| 9 | 11 | 3-9-17 | 5.3 | 111.3 | | | 19 | NV | NP | | | A-2-4 (0) | Silty Sand (SM) |
| 9 | 14 | 3-9-17 | 6.9 | 105.4 | 0 | 69 | 31 | NV | NP | | | A-2-4 (0) | Silty Sand (SM) |
| 9 | 17 | 3-9-17 | 5.3 | 106.8 | | | 14 | NV | NP | | | A-2-4 (0) | Silty Sand (SM) |
| 10 | 8 | 3-9-17 | 9.7 | 109.7 | | | 29 | NV | NP | | | A-2-4 (0) | Silty Sand (SM) |
| 10 | 14 | 3-9-17 | 6.5 | 110.8 | | | 19 | NV | NP | | | A-2-4 (0) | Silty Sand (SM) |
| 10 | 17 | 3-9-17 | 11.8 | 114.8 | | | 22 | NV | NP | | | A-2-4 (0) | Silty Sand (SM) |
| 10 | 20 | 3-9-17 | 14.4 | | 4 | 75 | 21 | NV | NP | | | A-2-4 (0) | Silty Sand (SM) |
| 11 | 5 | 3-9-17 | 7.5 | 101.4 | | | 17 | NV | NP | | | A-2-4 (0) | Silty Sand (SM) |
| 11 | 11 | 3-9-17 | 5.7 | 107.5 | | | 16 | NV | NP | | | A-2-4 (0) | Silty Sand (SM) |
| 11 | 14 | 3-9-17 | 8.7 | 107.0 | | | 25 | NV | NP | | | A-2-4 (0) | Silty Sand (SM) |
| 11 | 20 | 3-9-17 | 7.5 | 111.1 | 6 | 83 | 11 | NV | NP | | | A-2-4 (0) | Poorly-Graded Sand with Silt (SP-SM) |
| 12 | 14 | 3-9-17 | 13.6 | 114.2 | | | 57 | 29 | 12 | 0.00 | | A-4 (4) | Sandy Lean Clay (CL) |
| 13 | 9 | 3-9-17 | 7.9 | 113.2 | | | 26 | NV | NP | | | A-2-4 (0) | Silty Sand (SM) |
| 13 | 14 | 3-9-17 | 16.8 | 110.2 | | | 80 | 32 | 14 | | | A-6 (10) | Lean Clay with Sand (CL) |
| 14 | 14 | 3-9-17 | 5.9 | 110.2 | | | 45 | 26 | 8 | | | A-4 (1) | Clayey Sand (SC) |

# APPENDIX A

# DARWin™ PAVEMENT DESIGN CALCULATIONS

1993 AASHTO Pavement Design

# DARWin Pavement Design and Analysis System

## A Proprietary AASHTOWare Computer Software Product

Kumar & Associates, Inc.
2390 South Lipan Street
Denver, Colorado

## Flexible Structural Design Module

27th Street Storm Sewer
27th Street (Local) No Bus Traffic
Full-Depth Asphalt

## Flexible Structural Design

| | |
|---|---|
| 18-kip ESALs Over Initial Performance Period | 500,000 |
| Initial Serviceability | 4.5 |
| Terminal Serviceability | 2 |
| Reliability Level | 80 % |
| Overall Standard Deviation | 0.44 |
| Roadbed Soil Resilient Modulus | 4,940 psi |
| Stage Construction | 1 |
| Calculated Design Structural Number | 3.17 in |

## Specified Layer Design

| Layer | Material Description | Struct Coef. (Ai) | Drain Coef. (Mi) | Thickness (Di)(in) | Width (ft) | Calculated SN (in) |
|---|---|---|---|---|---|---|
| 1 | Asphalt | 0.44 | 1 | 7.5 | - | 3.30 |
| Total | - | - | - | 7.50 | - | 3.30 |

1993 AASHTO Pavement Design

# DARWin Pavement Design and Analysis System

## A Proprietary AASHTOWare Computer Software Product

Kumar & Associates, Inc.
2390 South Lipan Street
Denver, Colorado

## Flexible Structural Design Module

27th Street Storm Sewer
27th Street (Local) No Bus Traffic
Composite Section

## Flexible Structural Design

| | |
|---|---|
| 18-kip ESALs Over Initial Performance Period | 500,000 |
| Initial Serviceability | 4.5 |
| Terminal Serviceability | 2 |
| Reliability Level | 80 % |
| Overall Standard Deviation | 0.44 |
| Roadbed Soil Resilient Modulus | 4,940 psi |
| Stage Construction | 1 |
| Calculated Design Structural Number | 3.17 in |

## Specified Layer Design

| Layer | Material Description | Struct Coef. (Ai) | Drain Coef. (Mi) | Thickness (Di)(in) | Width (ft) | Calculated SN (in) |
|---|---|---|---|---|---|---|
| 1 | Asphalt | 0.44 | 1 | 5.5 | - | 2.42 |
| 2 | Class 6 ABC | 0.08 | 1 | 10 | - | 0.80 |
| Total | - | - | - | 15.50 | - | 3.22 |

1993 AASHTO Pavement Design

# DARWin Pavement Design and Analysis System

## A Proprietary AASHTOWare Computer Software Product

Kumar & Associates, Inc.
2390 South Lipan Street
Denver, Colorado

## Flexible Structural Design Module

27th Street Storm Sewer
Washington Street (Collector) Bus Route
Full-Depth Asphalt

## Flexible Structural Design

| | |
|---|---|
| 18-kip ESALs Over Initial Performance Period | 3,000,000 |
| Initial Serviceability | 4.5 |
| Terminal Serviceability | 2.5 |
| Reliability Level | 90 % |
| Overall Standard Deviation | 0.44 |
| Roadbed Soil Resilient Modulus | 4,940 psi |
| Stage Construction | 1 |
| Calculated Design Structural Number | 4.57 in |

## Specified Layer Design

| Layer | Material Description | Struct Coef. (Ai) | Drain Coef. (Mi) | Thickness (Di)(in) | Width (ft) | Calculated SN (in) |
|---|---|---|---|---|---|---|
| 1 | Asphalt | 0.44 | 1 | 10.5 | - | 4.62 |
| Total | - | - | - | 10.50 | - | 4.62 |

1993 AASHTO Pavement Design

# DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product

Kumar & Associates, Inc.
2390 South Lipan Street
Denver, Colorado

## Flexible Structural Design Module

27th Street Storm Sewer
Washington Street (Collector) Bus Route
Composite Section

## Flexible Structural Design

| | |
|---|---|
| 18-kip ESALs Over Initial Performance Period | 3,000,000 |
| Initial Serviceability | 4.5 |
| Terminal Serviceability | 2.5 |
| Reliability Level | 90 % |
| Overall Standard Deviation | 0.44 |
| Roadbed Soil Resilient Modulus | 4,940 psi |
| Stage Construction | 1 |
| Calculated Design Structural Number | 4.57 in |

## Specified Layer Design

| Layer | Material Description | Struct Coef. (Ai) | Drain Coef. (Mi) | Thickness (Di)(in) | Width (ft) | Calculated SN (in) |
|---|---|---|---|---|---|---|
| 1 | Asphalt | 0.44 | 1 | 8 | - | 3.52 |
| 2 | Class 6 ABC | 0.08 | 1 | 14 | - | 1.12 |
| Total | - | - | - | 22.00 | - | 4.64 |

# Appendix B – Materials Management Plan by Pinyon Environmental, Inc., October 27, 2017

Pinyon Environmental, Inc.

Corporate Headquarters
9100 West Jewell Avenue, Suite 200 Lakewood, CO 80232
TEL 303 980 5200 FAX 303 980 0089
www.pinyon-env.com

November 27, 2018

# Materials Management Plan

## 27th Street Storm Drain Interceptor – Coors Field Parking Lot to Arapahoe Street
## Denver, Colorado

**Prepared For:**

Merrick and Company
2480 West 26th Avenue, Unit B225
Denver, Colorado 80211

**Pinyon Project No.:**

1/17-803-01.8000

Pinyon Environmental, Inc.

Corporate Headquarters
9100 West Jewell Avenue, Suite 200 Lakewood, CO 80232
TEL 303 980 5200 FAX 303 980 0089
www.pinyon-env.com

November 27, 2018

# Materials Management Plan

## 27th Street Storm Drain Interceptor – Coors Field Parking Lot to Arapahoe Street
## Denver, Colorado

**Prepared For:**

Merrick and Company
2480 West 26th Avenue, Unit B225
Denver, Colorado 80211

**Pinyon Project No.:**

1/17-803-01.8000

**Prepared by:**

Timothy Grenier, P.E.
Environmental Engineer

**Reviewed by:**

Brian Partington
Principal – Project Delivery

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Appendix B Site Characterization Technical Memorandum

Appendix C Environmental Protection Agency Regional Screening Levels – Composite Worker and Residential; EPA Toxicity Maximum Concentrations of Contaminants; CDPHE-Hazardous Materials, and Waste Management Division Groundwater Protection Values Soil Cleanup Table

Appendix D City and County of Denver – Guidance for Reuse of Soil on City Projects

Appendix E City and County of Denver – Asbestos-Contaminated Soil Management Standard Operating Procedure

~~Appendix F Remediation Activities Discharging to Surface Water Permit~~

# List of Acronyms

| Acronym | Definition |
|---|---|
| ACM | Asbestos Containing Material |
| APEN | Air Pollution Emissions Notice |
| AQCC | Air Quality Control Commission |
| CABI | Certified Asbestos Building Inspector |
| CCD | City and County of Denver |
| CDPHE | Colorado Department of Public Health and Environment |
| CDPS | Colorado Discharge Permit System |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| CGI | Combustible Gas Indicator |
| CHMM | Certified Hazardous Materials Manager |
| CIH | Certified Industrial Hygienist |
| CWRSL | Composite Worker Regional Screening Level |
| CSP | Certified Safety Professional |
| DADS | Denver-Arapahoe Disposal Site |
| DDPHE | Denver Department of Public Health and Environment |
| EPA | Environmental Protection Agency |
| FID | Flame Ionization Detector |
| HASP | Health and Safety Plan |
| HSO | Health and Safety Officer |
| HUF | Historical Urban Fill |
| LBP | Lead-Based Paint |
| mg/kg | milligrams/kilogram |
| MMP | Materials Management Plan |
| OPS | Colorado Department of Labor and Employment, Division of Oil and Public Safety |
| OSHA | Occupational Safety and Health Administration |
| PCB | Polychlorinated biphenyl |
| PID | Photoionization Detector |

## List of Acronyms (continued)

| Acronym | Definition |
|---|---|
| PPE | Personal Protection Equipment |
| QA | Quality Assurance |
| RACS | Regulated Asbestos Contaminated Soil |
| RAMP | Remediation Activities Management Plan |
| RCRA | Resource Conservation and Recovery Act |
| REM | Registered Environmental Manager |
| RRSL | Residential Regional Screening Level |
| RSL | Regional Screening Level |
| SOP | Standard Operating Procedure |
| SWMP | Stormwater Management Plan |
| TCLP | Toxicity Characteristic Leaching Procedure |
| UST | Underground Storage Tank |
| WQCD | Water Quality Control Division |

# 1. Introduction

Pinyon Environmental, Inc. (Pinyon), was retained by Merrick and Company (Merrick), to prepare this Materials Management Plan (MMP) for construction of the City and County of Denver (CCD) 27th Street Storm Drain Interceptor Project. This MMP specifically addresses handling and disposal of contaminated materials and other suspect materials encountered during construction activities. This MMP has been developed to assist field construction personnel in preparing for identification and management of soil and/or groundwater that may be impacted by suspect materials.

It is the intent that this MMP will be attached to the project Plans and Specifications and that bidding contractors will have an opportunity to review this document as they prepare bids for construction. This MMP has been prepared to ensure, when properly implemented by the Contractor, that work activities will be completed in such a way as to protect human health and the environment. Further, this MMP has been prepared to minimize potential delays, and to develop approved standard procedures that will be implemented as needed in the event that suspect materials are encountered during construction. It is the responsibility of the Contractor to customize, finalize, and implement the MMP; follow all appropriate regulations; obtain the proper permits; and utilize field personnel trained to identify potential contamination. In the event that any discrepancy is noted between this MMP and any applicable regulation, the regulation will take precedence, unless a variance has been previously approved by the regulatory agency.

## 1.1 Proposed Action and Location

The 27th Street Storm Drain Interceptor Project is proposed to be completed in 27th Street beginning west of Blake Street, at the Coors Field Parking Lot, to the intersection with Welton Street, then south along Washington Street to Park Avenue, for a total of approximately 6,000 linear feet. Construction is proposed to relieve drainage problems in the Five Points neighborhood.

Construction is proposed to be completed in phases. Phase 1 will extend from the Coors Field Parking Lot to Arapahoe Street. Phasing of the remainder of the project will be determined based on available funding. This MMP is specific to Phase 1 (Phase I project area). The entire 27th Street Storm Drain Interceptor Project area will be referred to as the overall project area.

## 1.2 Key Parties and Responsibilities

The Contractor is responsible for providing this MMP to its staff and subcontractors and for compliance with the MMP. Through implementation of this MMP, the CCD will be immediately notified of potential environmental-related findings pertaining to construction activities at the Phase I project area. The key parties, their contact information and project responsibilities, are outlined below:

| Organization | Role/Responsibility | Contact Information |
|---|---|---|
| City and County of Denver Department of Public Works | Public Works Project Manager | Kelly Crum<br>Phone: 303-446-3668<br>Email: Kelly.crum@denvergov.org |
| City and County of Denver, Department of Public Health and Environment (DDPHE) | Environmental Quality Technical Oversight | Lisa Farrell<br>Phone: 720-865-5439<br>Email: lisa.farrell@denvergov.org<br><br>If no immediate response, call 720-460-1706 |
| Construction Contractor | Health and Safety Officer/ Contracting MMP Supervisor/ Construction | TBD |
| TBD | MMP Supervisor/ Environmental oversight quality assurance to identify potentially contaminated soil and potential asbestos | TBD |

## 1.3 Environmental Conditions

The *Limited Environmental Screening, 27th Street Storm Drain Interceptor Memorandum,* completed by Pinyon, dated February 17, 2017 (Pinyon, 2017), identified multiple facilities with a high potential of impacting the Phase I project area. These facilities include the Coors Parking Garage, Angelica Healthcare Plant 88, and various historical dry-cleaning facilities (Appendix A).

### *1.3.1 Groundwater*

Several of the facilities identified in Pinyon's *Limited Environmental Screening Memorandum* were identified as facilities with a high potential to impact groundwater at the Phase I project area. Three groundwater monitoring wells were installed along the overall project area, with one well installed at the Phase I project area. The wells were installed during the geotechnical investigations to provide additional Site environmental condition information; the information is detailed in the *Site Characterization Technical Memorandum* (Appendix B). The one well installed at the Phase I project area, monitoring well B-1, had groundwater at a depth of 14.8 feet bgs. The well is located approximately 150 feet northwest of the 27th Street and Blake Street intersection. A groundwater sample was collected and analyzed for the parameters that are required by the Colorado Department of Public Health and Environment (CDPHE)-Water Quality Control Division (WQCD) when applying for a Remediation Discharge Permit. Groundwater results indicate that several metals exceed the potential CDPHE-WQCD surface water discharge limits.

### *1.3.2 Soil*

Sixteen soil samples were collected and analyzed to support a waste profile at the Denver-Arapahoe Disposal Site (DADS) per CCD and Waste Management requirements. Four of the 16 samples were collected from the Phase I project area (samples B-1 through B-4), the other 12 samples were collected from the Phase 2 and Phase 3 areas.

The following soil results discussion is specific to the Phase I project area. Benzo(a)pyrene was detected in soil sample B-1 at a concentration exceeding the Environmental Protection Agency (EPA) Regional Screening Level for residential soil (RRSL), but below the composite worker protection screening level (CWRSL). None of the other analytes exceeded the RRSL. Appendix B should be referenced for complete soil sampling results.

### *1.3.3 Historical Urban Fill*

Historical urban fill (HUF) areas have not been identified within the Phase I project area boundaries.

### *1.3.4 Underground Storage Tanks*

Several underground storage tanks (USTs) were also identified as environmental concerns. These may include regulated tanks and releases, as well as historical and unregulated orphan tanks and service stations, or tanks associated with building components (e.g., tanks used to store heating oil). It is also possible that unregulated or undocumented tanks may be present, and discovered during construction activities.

## 2. Health and Safety

Because of the potential to encounter suspect materials, there is a possibility for increased risk to the health of workers during excavation within the Phase I project area. Project personnel must be made aware of the potential hazards and worker safety and awareness is of the highest priority. Therefore, a Health and Safety Plan (HASP) must be developed by the Contractor.

The Contractor will be required to employ the proper personnel, monitoring equipment, and personal protective equipment (PPE) to provide a safe working environment for its employees, consultants and sub-Contractors. The Contractor's field personnel must conduct work in Level D PPE until conditions arise that require additional protection. The decision to require additional protection is the responsibility of the Contractor's Health and Safety Officer (HSO) and should be evaluated based on observation of worker conditions. An MMP Supervisor will be designated by the Contractor and it is the responsibility of the MMP Supervisor to provide the HSO with information regarding environmental conditions, as available, to assist in that decision. The provisions of this MMP are summarized below, and will be incorporated into the HASP. However, in no way shall the HASP be limited to these provisions.

- The Contractor must develop a HASP in accordance with 29 Code of Federal Regulations (CFR) 1910 and 29 CFR 1926.
- The HASP must be prepared to address the environmental conditions described in this MMP.
- Workers and managers associated with intrusive project activities will be required to undergo a one-time health and safety orientation meeting at the start of the project, to include a brief on-Site description of project conditions. This meeting must include two-hour asbestos awareness training conducted by a trained asbestos professional (i.e., Certified Asbestos Building Inspector [CABI]).
- The Contractor may share its Health and Safety Plan with its subcontractors or require each subcontractor to prepare its own plan.

# 3. Environmental Responsibilities

The following sections detail the responsibilities of the applicable parties that will be associated with the project.

## 3.1 CCD Responsibilities

The CCD is the project owner. As such, the CCD will be responsible for:

- Overall project management
- Contracting with the Contractor
- Providing technical advice

## 3.2 MMP Supervisor Requirements and Training

Prior to implementation of the MMP, the Contractor will retain an MMP Supervisor to independently verify that the requirements of this plan are followed. The MMP Supervisor must be a competent individual experienced with field identification of suspect material and potential environmental hazards (e.g., abandoned underground storage tanks, asbestos, lead-based paint [LBP] or lead-containing materials), as well as appropriate characterization, management, and disposal methods for impacted materials. It is the responsibility of the MMP Supervisor to:

- Complete daily field notes detailing environmental conditions and responses to suspect materials that are identified.
- Provide regular updates to CCD.
- Ensure adherence to the MMP by identifying suspect materials and applying proper procedures outlined herein.
- Verify or perform field screening of soil in adherence to this plan (see Section 4.0).
- Notify CCD immediately of any unexpected environmental conditions or potentially impacted material. If RACS is discovered, a notification to the state must be filed and a copy must be submitted to the City Project Manager and DDPHE within 24 hours.
- Be on-site to verify Project operations on an as-needed basis when potentially impacted media have been encountered.
- Track and/or sign tickets and manifests for material hauled offsite for either reuse or disposal.
- Complete logs that thoroughly detail Project Quality Assurance (QA) activities.

## 3.3 Contractor Responsibilities

The Contractor will be responsible for the following:

- Designating an HSO.

- Designating an MMP Supervisor and ensuring that the MMP Supervisor is qualified to verify implementation of this MMP.
- Providing necessary equipment and personnel to implement the MMP.
- Coordinating review of MMP requirements with the MMP Supervisor, DDPHE, City Project Manager and the Engineer prior to beginning work.
- Providing asbestos awareness training to Project personnel who will conduct soil work. Training must be presented and documented by a CABI.
- Ensuring that subcontractors adhere to the MMP during Project work.
- Ensuring that proper procedures for material reuse or disposal are followed. This includes ensuring that suspect material that has been disturbed is not reused on-site unless it meets the designated reuse criteria or is disposed in accordance with applicable regulations and not in storm drains, sanitary sewers, streams, irrigation facilities or waterways.
- Ensuring that non-salvageable, non-hazardous solid waste materials excavated are removed from the Phase I project area and disposed of at the DADS in accordance with local, state and federal laws.
- Contacting the Project Manager and Engineer for conditions resulting in schedule or budget impacts to the project.
- If debris, household waste, or asbestos-containing materials (ACM)/regulated asbestos contaminated soil (RACS) is encountered, workers will contract a CABI certified in accordance with Air Quality Control Commission Regulation No. 8, (5 CCR 1001-10, Part B) to inspect materials during excavation.
- It is the responsibly of the Contractor and CABI to ensure that the subcontractor preforming RACS disturbance is capable of meeting the State requirements if RACS is managed during project.

### *3.3.1 Health and Safety Officer Requirements*

Prior to the initiation of Project work, the Contractor will designate a HSO. The HSO must:

- Complete health and safety monitoring during subsurface work
- Evaluate the appropriate level of PPE based on health and safety monitoring to be completed during subsurface work
- Ensure that Project activities and personnel adhere to the HASP set in place by the Contractor

### *3.3.2 Certified Asbestos Building Inspector Responsibilities*

Oversight and documentation of RACS shall be conducted by a CABI who meets the training requirements of Section 5.5.3(D) of the Regulation Pertaining to Solid Waste Work Sites and Facilities. The CABI will also be trained and certified in accordance with Air Quality Control Commission Regulation No. 8 (5 CCR 1001-10, Part B), for the identification of asbestos-containing materials and the collection of samples to evaluate asbestos content. All CABIs must have worked on at least three different asbestos-in-soil projects and with a minimum of 40 hours of experience as a CABI. The CABI must have sufficient experience to identify HUF, and associated RACS in the field. Depending on the project schedule, a minimum of one CABI will be overseeing excavation work, and it may be necessary to engage multiple CABIs if areas of known historical fill or debris are identified at multiple excavation areas.

For this project, the CABI will complete the following:

- Conduct Two-Hour Asbestos Awareness Training to all Site personnel who perform any soil disturbing activities. For the purpose of this MMP, those that could encounter these materials are any workers that could engage in subsurface excavation work, such as equipment operators and laborers. Two-hour Asbestos Awareness Training should include such topics as:
    - Information regarding the project scope of work
    - Background information on asbestos, including general awareness and regulations
    - Description of non-suspect ACM (i.e., inert debris, landscaping materials)
    - Health effects of asbestos
    - Worker protection programs
    - Recognition of suspect materials, including HUF, debris, or other materials that would be reason to believe that RACS may be present
    - Site-specific concerns related to asbestos and HUF
    - Immediate actions should asbestos be suspected
- The CABI will be present on a full-time basis during excavation in areas where HUF is located, or where RACS is suspected or confirmed.
- Collect samples of suspect materials as needed.
- When there is no reason to believe that RACS would be present during excavation activities, the CABI does not need to be present; however, the CABI should be available to mobilize to the Site within 24 hours should workers identifying suspect materials.
- Waste that can clearly be identified as only landscaping-type waste does not require CABI oversight.
- It is the responsibility of the Contractor and CABI to ensure that the subcontractor performing RACS disturbance is capable of meeting the state requirements if RACS is managed during the project.

#### *3.3.3 Tier 1 – Front-Line Workers*

Tier 1 workers include personnel that would be responsible for mitigating suspect materials and include equipment operators and laborers handling materials in accordance with this MMP. These workers must:

- Complete training on identification of suspect materials by the MMP Supervisor, including asbestos awareness training, which must be conducted and documented by a CABI.
- Complete work as directed by the MMP Supervisor, and in accordance with this MMP and HASP requirements.
- Complete work in accordance with the requirements of the Occupational Health and Safety Administration (OSHA), 29 CFR 1910.120. The level of training in accordance with CFR 1910.120 shall be the decision of the HSO.

### *3.3.4 Tier 2 – Excavation Workers*

Tier 2 workers include personnel that could encounter potentially impacted materials during the course of work, but will not be responsible for management of these materials. These employees include, but are not limited to front-line equipment operators, foremen, and operators that will complete typical excavation activities during the project, but will not complete handling of these materials after discovery. These personnel must:

- Complete training on identification of suspect materials by the MMP Supervisor, including asbestos awareness training, which must be conducted and documented by a CABI.
- Complete work as directed by the MMP Supervisor, and in accordance with this MMP and HASP requirements
- Immediately stop work in the event that potentially suspect materials are identified, and contact the MMP Supervisor of the discovery.
- Complete work in accordance with the requirements of the OSHA, 29 CFR 1910.120. The level or training in accordance with CFR 1910.120 shall be the decision of the HSO.

### *3.3.5 Tier 3 – Other Workers*

Tier-3 workers include personnel that will not complete sub-surface work activities. As the potential for these workers to encounter impacted materials on this project is low, MMP training requirements do not apply.

# 4. Soil Evaluation Criteria

CDPHE Groundwater Protection Values, EPA Regional Screening Levels (Appendix C) and other state/federal guidance will be used for comparison to soil data. In addition to the CCD's guidance for third-party reuse (Appendix D), the following guidance is applicable for evaluating soil concentrations for varying exposure scenarios:

**CDPHE Groundwater Protection** – These are often the most protective values and were developed to protect groundwater; these values are the maximum chemical concentration in soil that will not leach into groundwater. The CDPHE-Hazardous Materials and Waste Management Division Groundwater Protection Values Soil Cleanup Table (Appendix C) values will be used for comparison to soil data.

**EPA RSL Residential Protection** – These are the second most protective values and are typically the soil concentrations that would be considered appropriate for reuse in residential areas without restriction (except where values do not meet groundwater protection values as described above). These are the Residential Regional Screening Levels (RRSLs, Appendix C). It is expected that the RRSLs would apply for recreational (e.g., parks and open space), or residential (single-family, multi-family, mixed-use with residential component) properties.

**EPA CWRSL Composite Worker Protection** – These are the third most protective values, and are the acceptable concentrations that would be protective for City workers on City-owned properties such as right of ways (e.g., roads, sidewalks, bike paths), utilities corridors (e.g., stormwater, wastewater, water), or City-owned facilities (e.g., maintenance garages, office buildings, safety buildings) (Appendix C). Material meeting the CWRSL may be reused on Site, as all properties addressed within this MMP will have an ultimate configuration for meeting the CWRSL acceptance criteria as described in Appendix D. Soil with concentrations that exceed the CWRSL will be removed from the Phase I project area, and disposed at DADS.

**Arsenic Standards (exception to RSLs) -** In Colorado, arsenic occurs naturally, and often at concentrations greater than the regional screening levels (RSLs). The CDPHE has state-specific guidance related to evaluating arsenic concentrations in soil, specifically regarding screening data collected from sites where historical use does not indicate the potential for arsenic impacts (CDPHE, 2011a). The guidance is based on the collection of over 2,700 samples from 44 counties in Colorado. The average concentration of arsenic in soils based on this sampling was 11 milligrams per kilogram (mg/kg). The CDPHE has adopted a policy that if arsenic concentrations are lower than 11 mg/kg, and releases of arsenic could not have occurred at the site, the CDPHE will require no further action to address arsenic in soil.

**Hazardous Waste** – A material can be defined as hazardous based on definition (i.e., EPA F-Listed wastes) or based on characteristics such as corrosivity, ignitable, reactivity, or toxicity characteristics. A material may be defined as hazardous if any of the following criteria are met; however, additional criteria may apply as described in 6 CCR 1007-3 Part 261 Subpart D:

- The material contains a listed hazardous waste (discussed in 6 CCR 1007-3 Part 261 Subpart D)
- The pH is less than or equal to 2.0 or greater than or equal to 12.5; this material would be considered corrosive
- The flashpoint is less than 140 degrees Fahrenheit; this material would be considered ignitable
- The material is reactive
- Toxicity Characteristic Leaching Procedure (TCLP) results exceed the hazardous waste threshold

**20 Times Rule** - Waste Management (the operator of DADS) accepts solid material where concentrations as determined by the TCLP method are less than 20 times the EPA Toxicity Maximum Concentrations of Contaminants (included as Appendix C); this is referred to as the "20 Times Rule". Polychlorinated biphenyls (PCBs) are an exception to this rule, as discussed in Section 6.3. As an example, the regulatory level for lead provided by the EPA Toxicity Maximum Concentrations of Contaminants is 5.0 milligrams per liter (mg/L) when analyzed by TCLP. The Waste Management acceptable limit, when analyzed by totals analysis, would then be less than 100 mg/kg, using the 20 Times Rule. If concentrations of any contaminant exceed the 20 Times Rule by totals analysis, then analysis for TCLP is required. If the TCLP results exceed the toxicity characteristic maximum concentration, then the material would require disposal at a hazardous waste disposal Site in accordance with CDPHE requirements.

**Note that all soil evaluation and disposition of soils must be confirmed and approved by DDPHE before disposal and/or reuse.**

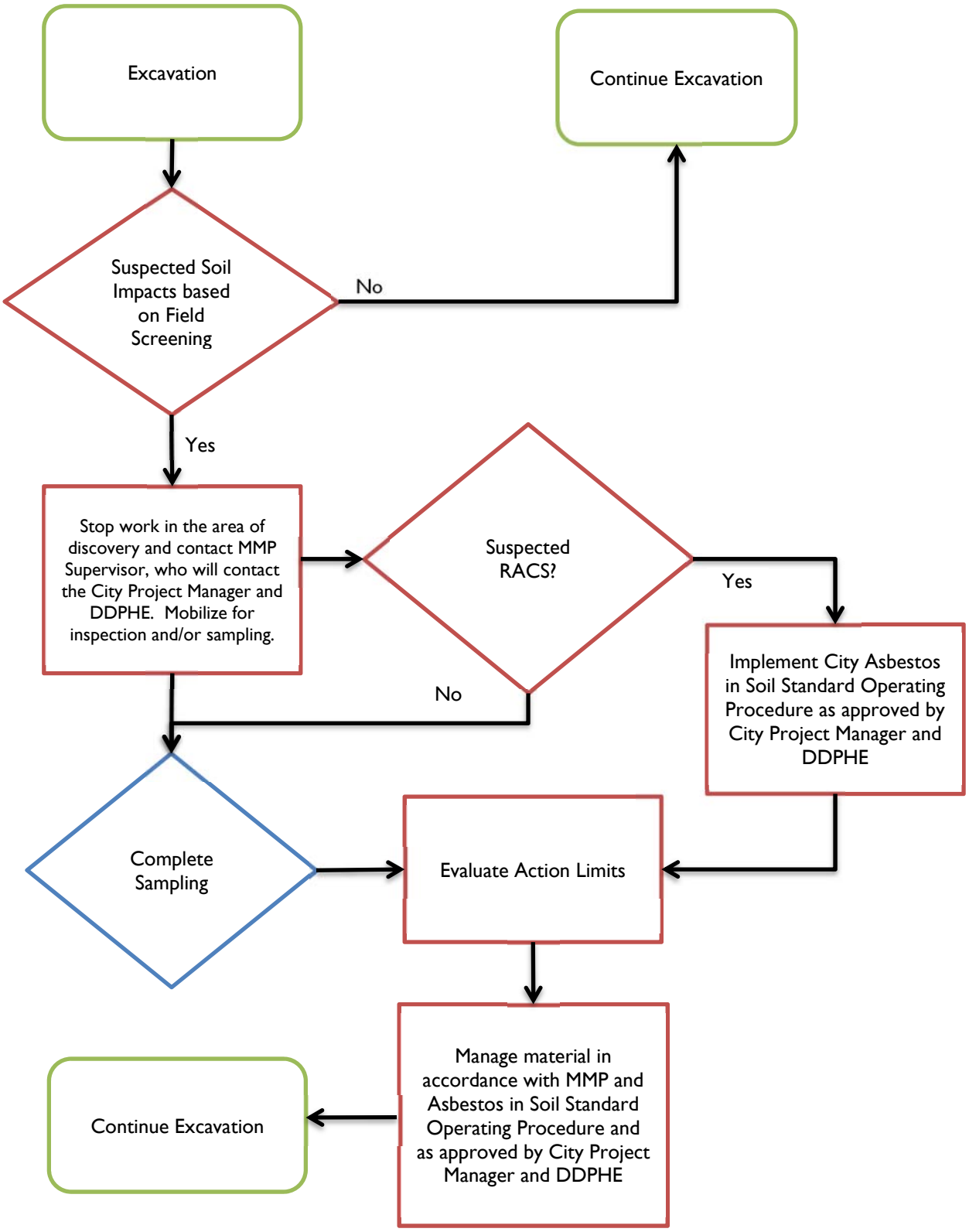
# 5. Soil Handling Procedures

Project activities include excavations up to depths of approximately 15 feet bgs. Because of the heterogeneous nature of the soil, it is important that the Contractor be aware of the possibility of encountering unknown or suspect materials and know how to manage materials. Detailing the proper procedures for handling these materials is a key purpose of this MMP.

If unknown/unanticipated conditions are encountered during the project, the Contractor must immediately stop work in the area of the discovery until the MMP Supervisor and DDPHE evaluate how to proceed per the requirements of this MMP. **If suspect materials, historical fill, or debris is encountered, a CABI must be contacted to provide field screening and/or visually assess the materials. RACS must be characterized and managed in accordance with the City's Asbestos-Contaminated Soil Management Standard Operating Procedure (Appendix E).** The Contractor must immediately notify the MMP Supervisor and DDPHE of the discovery. Following discussions with the MMP Supervisor and DDPHE, additional characterization, remediation, and/or analyses may be required. Work may continue in other areas of the Project while the discovery is resolved. The following sections provide detail on general procedures (for unexpected or unknown materials that may still be encountered). Known materials based on previous evaluation and identification of suspect materials within the Phase I project area have not been identified.

## 5.1 Process Flow

The following process-flow chart presents the general process that will be followed during excavation activities.


Excavation
Continue Excavation
Suspected Soil Impacts based on Field Screening
No
Yes
Stop work in the area of discovery and contact MMP Supervisor, who will contact the City Project Manager and DDPHE. Mobilize for inspection and/or sampling.
Suspected RACS?
Yes
No
Implement City Asbestos in Soil Standard Operating Procedure as approved by City Project Manager and DDPHE
Complete Sampling
Evaluate Action Limits
Manage material in accordance with MMP and Asbestos in Soil Standard Operating Procedure and as approved by City Project Manager and DDPHE
Continue Excavation

## 5.2 Field Screening

Debris/Historical Fill Materials - Visual monitoring of excavated soils should be completed during project construction. **Debris/historical fill material that is encountered will be assessed for the presence of suspect RACS by a CABI.**

Landfill Gas- Field monitoring for landfill gases will only be completed as required by the site-specific HASP for worker health and safety. If monitoring for landfill gases is required by the HSO, a Landtec GEM (or equivalent) handheld landfill gas monitor or combustible gas indicator (CGI) will be used to evaluate methane and/or the lower explosive limit, respectively.

Staining/Odors – Project personnel will assess excavated soils for visual and olfactory indications of potential impacts. Soils where visual or olfactory impacts are observed must be screened with field instrumentation to allow it to be designated for unrestricted use or stockpiled and managed. If potentially impacted soil is identified, excavation within proximity to the impacted area will then only continue under the observation of the MMP Supervisor. The utmost care should be taken to separate "clean" soils from potentially impacted soils. Once the MMP Supervisor confirms that excavation has transitioned into clean soils and potentially impacted material is no longer being excavated, the stockpiled material will be sampled for characterization and waste disposal purposes as described in Section 7.

Field Instruments – Field instruments will be utilized on an as-needed basis, particularly if petroleum- or solvent-impacted soil is suspected. A photoionization detector (PID) or flame ionization detector (FID) (related to heavy petroleum hydrocarbons such as oil or grease) may be used in the field to screen for non-specific volatile organic compounds (VOCs). If PID/FID concentrations exceed 50 parts per million (ppm), sampling will be required.

## 5.3 Soil Sampling

Of the sixteen soil samples collected from the overall project area, four were collected from the Phase I project area during the February 2017 subsurface investigation (Appendix B). The sample locations were selected to investigate the potential environmental impacts listed in Section 1.3, and were also spaced at approximately 500-foot intervals. Each of the samples were submitted, on ice and under chain of custody controls, to Origins Laboratory, Inc. (Origins), of Denver, Colorado. The samples were collected to support a waste profile at the DADS per CCD and Waste Management requirements. The samples were analyzed for the following:

- VOCs by EPA Method 8260C
- Polycyclic Aromatic Hydrocarbons (PAHs) by EPA Method 8270D SIM
- The eight Resource Conservation and Recovery Act (RCRA 8) Metals by EPA Method 9010C and 7471A
- Toxicity characteristic leaching procedure (TCLP) analysis for analytes that exceed the 20 times rule for TCLP
- PCBs by EPA Method 8082A

Benzo(a)pyrene was detected in sample B-1 at a concentration exceeding the RRSL. Elevated lead concentrations were also detected. Additional waste characterization sampling, for the analytes listed in this section will need to be completed in the area of the boring. There were no other exceedances of the soil evaluation criteria presented in Section 4.

In general, additional soil sampling is not expected unless visual/olfactory conditions indicate that an environmental condition may be present during the subsurface excavation. That is, unless soil has been

identified that "looks bad, smells bad," sampling and additional evaluation by the MMP Supervisor is not required. Therefore, during subsurface excavation, the MMP Supervisor and/or CABI will not be required to be present, except if suspect environmental conditions have been identified.

## 5.4 General Soil Stockpiling Requirements

Samples described below are four-point composite samples and will be collected from stockpiled soils, or at the discretion of the MMP Supervisor and/or the DDPHE. Sample collection will be performed in a manner that is representative of the majority of soil to be handled at each property.

Soil that may be impacted, based on evaluation completed by the MMP Supervisor, and that has been disturbed during excavation activities, must be temporarily stockpiled on 6 mil plastic sheeting and covered pending receipt of the results of laboratory analysis in accordance with the soil sampling protocols identified in this document. Stormwater best-management practices (BMPs) as identified must be applied to the stockpiles of potentially impacted material to prevent contact with stormwater runoff and erosion. Stockpiles of potentially impacted soil will be limited to a maximum of 500 cubic yards each. All other soils must be handled in accordance with the stormwater management plan (SWMP). This general stockpiling requirement does not apply if RACS is suspected or confirmed to be present (see Section 5.5)

## 5.5 Regulated Asbestos-Contaminated Soils (RACS)

**If suspect HUF, debris, household waste, or RACS is encountered, the Contractor shall immediately stop work, secure the work area, and contact the MMP Supervisor and the CABI to evaluate the situation.**

Oversight and documentation of RACS shall be conducted by a CABI who meets the training requirements as defined in Section 3.2 of this MMP. A minimum of one CABI will be present full time when general excavation activities are occurring at the properties where RACS is a concern, as noted herein. When HUF or debris is encountered, a CABI must be present during excavation at all times and at each work location where these materials have been identified. All RACS management will be performed by a Contractor capable of meeting the requirements in the Standard Operating Procedure (SOP) (Appendix E) as documented by a CABI. If suspect RACS is discovered, the critical requirement is to avoid cross contamination and generating or being in direct contact with airborne dust; work shall stop immediately upon discovery. Notification must be made to the MMP Supervisor and DDPHE immediately.

RACS must be characterized and managed accordance with the City's Asbestos-Contaminated Soil Management Standard Operating Procedure (Appendix E), and Section 5.5 of the Colorado Solid Waste Regulations. The current wording in the SOP has been approved by CDPHE and complies with the substantive requirements of the regulation prior to amendment. It shall remain in effect until amended and approved and may be used to comply with the amended Section 5.5 of the Solid Waste Regulations that address RACS. The Contractor will be ultimately responsible for adhering to the most current version of the SOP.

ACM associated with buried utilities may be addressed under provisions of the CDPHE Regulation No. 8 – Part B, Asbestos. Confirmation with DDPHE will be required to address how RACS or other ACMs will be mitigated, if encountered.

# 6. Special Wastes

Although not anticipated, other special wastes could include items such as drums, chemical or fuel containers, slag, coal, ash, biological waste, potential PCBs containing electrical equipment (transformers, light ballasts, voltage regulators, capacitors and circuit breakers), batteries, tar, and sludge. These materials may be present in small quantities and can be difficult to characterize. Upon identification of special wastes, excavation at that location will cease until additional assessment by the MMP Supervisor can be completed, and DDPHE is contacted. The MMP Supervisor will attempt to assess special wastes based on prudent and safe observation of the following:

- Handling of any special wastes will only be conducted under the direction of the MMP Supervisor and will be minimized whenever possible.
- If it is safe to move, special waste will be containerized or be placed on polyethylene plastic sheeting and covered, until additional assessment has been completed by the MMP Supervisor (the time frame will allow for laboratory testing and obtaining a profile and manifest for disposal).
- The special waste will remain covered or containerized until final removal.
- Stockpile requirements as described in Section 5.4 will apply and stockpile areas will be secured to prevent contact with unauthorized personnel and the public.
- The material will be characterized in accordance with the MMP, and manifests will be obtained before it is disposed of off-Site, and the material will be disposed of as soon as possible. If additional assessment of this material indicates that the material does not meet applicable regulatory requirements for disposal as a non-hazardous waste, the MMP Supervisor will arrange for off-Site disposal at a licensed hazardous waste facility, or other appropriate disposal Site.
- Special wastes that are generated will be managed in accordance with applicable local, state and federal regulations.
- Where potentially impacted material is determined to be non-hazardous by the MMP Supervisor, the material may be disposed of as non-hazardous solid waste at DADS.

## 6.1 Drums or Waste Containers

When drums or waste containers are identified, the Contractor must make note of the any of the following conditions and notify the MMP Supervisor and DDPHE.

- Indications of unsafe conditions, including swelling drums, leaking, fumes, odors, etc.
- Markings and or labels on containers/drums, condition of the containers/drums (e.g., rust, holes, damage, corrosion) and other indications of contents.
- Pressurized/swelling drums, suspected explosives, potentially shock-sensitive materials or other potentially dangerous items will not be handled until a person with appropriate experience with these situations has been consulted.

## 6.2 Slag, Coal, Ash

Slag, coal, or ash cannot be reused on the project and will be disposed at DADS unless the waste does not meet the DADS waste acceptance criteria (ie. fails TCLP analysis). These materials should be sampled in accordance with the requirements to dispose of the material at the DADS landfill. If the material cannot be accepted at the DADS landfill, additional sampling may be required by the alternate receiving facility. Ash is frequently associated with RACS and must be managed in accordance with the City's Asbestos-Contaminated Soil Management Standard Operating Procedure (Appendix E).

## 6.3 Electrical Equipment (PCBs)

If any potential electrical equipment (including transformers, light ballasts, voltage regulators, capacitors and circuit breakers) suspected of containing PCBs is identified, it will be segregated, analyzed, and depending on PCB concentrations, transported off-Site for disposal at a PCB-permitted disposal facility, if necessary, or, ideally, recycled properly. Until testing is completed, any electrical equipment visually identified during excavation will be assumed to contain PCBs. Equipment where the absence of PCBs has been verified may then be disposed as solid waste, or recycled. Waste Management will accept materials where PCB concentrations are less than 50 parts per million. If this material will be disposed at DADS, the MMP Supervisor will work with DDPHE to complete a WM PCB Certification, which must include copies of analytical reports confirming the PCB concentrations.

## 6.4 Biological Waste

Biological waste includes the following types of waste specified in Colorado Solid Waste Regulations 6 CCR 1007-2, Section 13:

- Biohazardous waste
- Blood and body fluids
- Infectious waste,
- Medical waste
- Pathological waste
- Pharmaceutical waste
- Potentially infectious waste

Biological wastes are regulated as solid waste under Colorado Solid Waste Regulations 6 CCR 1007-2 Section 13. Biological wastes should not be handled and work should be shut down upon discovery of biological waste. The Contractor must contact the MMP Supervisor and DDPHE and wait for the appropriate support personnel and evaluation prior to continuing work.

## 6.5 Underground Storage Tanks

It is possible that USTs may be discovered during demolition activities. USTs in the Phase I project area may have been utilized for retail sales (e.g., gas stations), commercial uses (e.g., new or used oil), or for storage of heating oil (e.g., for firing a boiler). This section details the activities that will be conducted, should a UST be discovered, and the activities needed to remove the UST in accordance with the Colorado Department of Labor and Employment, Division of Oil and Public Safety (OPS) requirements.

### *6.5.1 UST Discovery*

Upon the suspected discovery of a UST or UST component (e.g., product delivery line), the Contractor shall immediately stop work, secure the work area, and contact the MMP Supervisor and DDPHE. Reasons to believe that a UST may be present include: the visual identification of dispensers or dispenser islands; presence of vertical vent pipes; identification of filler ports; discovery of buried product delivery lines (constructed of either steel or fiberglass); and/or the presence of buried tank(s) uncovered during excavations. After the Contractor discovery and notification, the MMP Supervisor and DDPHE will initiate further evaluation of the presence of the UST, suspected releases, sampling, necessary notifications to the OPS, and evaluate removal alternatives and plans.

### *6.5.2 UST Closure/Removal*

UST closure/removal activities must conform to the OPS Storage Tank Regulations (7 CCR 1101-14), dated May 1, 2017. All closure/removal activities will be coordinated closely with the MMP Supervisor and DDPHE, and may require the development of a Site-specific work plan before removal actions may be initiated. If the Contractor is selected to remove the UST, the work plan preparation will be the responsibility of the Contractor. The work plan will detail notification requirements (to DDPHE, OPS and the Denver Fire Department), means and methods, sampling protocol, responsibilities, and information regarding applicability/cost recovery from the Petroleum Brownfields Program (where applicable). The following resources should be reviewed by the Contractor to help in the development of the work plan for UST removal activities:

- OPS Petroleum Program Guidance: http://www.coworkforce.gov/petroleumguidance/
- Petroleum Brownfields Program: https://www.colorado.gov/pacific/ops/Fund
- American Petroleum Institute Recommended Practice 1604, *Removal and Disposal of Used Underground Petroleum Storage Tanks*
- American Petroleum Institute Publication 2015, *Cleaning Petroleum Storage Tanks*

The MMP Supervisor will observe the UST closure activities, collect applicable samples, and prepare closure reports per OPS requirements. Depending on the work plan, the Contractor will prepare notifications to the OPS/Denver Fire Department, remove the contents of the tank, verify the tank is inert, provide all necessary equipment and qualified operators, remove the tank, and recycle/dispose of the tank. Again, details of the means and methods will be presented in the work plan, which will be approved by DDPHE before work commences.

Should a release be suspected or confirmed, the MMP Supervisor, in coordination with DDPHE, will provide the applicable OPS notifications. Remedial actions, if necessary, would be conducted under the direction of DDPHE, separately from this MMP, per OPS requirements.

### *6.5.3 Unregulated USTs*

It is possible that unregulated USTs would be discovered (i.e., tanks that were installed and operated prior to the OPS regulations), or USTs connected to a facility component (e.g., used to fire a building boiler). The MMP Supervisor, in close coordination with DDPHE, will evaluate the appropriate regulatory program to address the presence, removal, and remediation of unregulated USTs.

# 7. Reuse Criteria

It is expected that most soils encountered during construction of this project will fall into the unrestricted and/or restricted reuse categories; however, some soil may not be reusable on the Phase I project area. Details regarding various categories of soil use are presented in Sections below.

## 7.1 General Reuse Requirements

Additional requirements for specific types of soil use are described in the sections below in this document; however, some general requirements that apply to all reuse categories are described in this section including:

- Groundwater Protection Values must be met.
- If the soil would be reused at a third-party property, coordination with DDPHE will be required (Appendix D).
- If there is no place to reuse this soil on-Site and the material is characterized as non-hazardous and meets the waste acceptance criteria, it may be disposed at DADS with DDPHE approval, or at alternate off-Site locations with DDPHE approval (note that waste manifests or disposal tickets must be returned to DDPHE).
- Soil that is proposed for reuse at a City-owned park must meet the requirements defined for Unrestricted Reuse materials; therefore, only soils that meet the criteria defined in Section 7.3 will be approved for reuse within a City-owned park.
- Soil that is not to be disturbed by planned construction on the project will remain in-place, regardless of its reuse classification. Characterization and remediation of soils not directly disturbed by project activities are beyond the scope of the demolition project.

## 7.2 Use of Soil with Debris

Soil with debris cannot be reused on the project, or reused off-Site. Soil with debris that is characterized as non-hazardous and meets waste acceptance criteria will be taken to DADS landfill. If DADS cannot receive the waste, alternative facilities can be considered, but must be approved by DDPHE.

## 7.3 Unrestricted Reuse Soil

Soil with constituents of concern at concentrations within EPA RRSLs may be reused at residential, commercial, or industrial locations (either on- or off-site), assuming:

- The receiving facility has knowingly agreed to accept this material
- The receiving facility has been provided and understands the analytical data
- Soil is free of construction/demolition debris and RACS

## 7.4 Restricted Reuse Soil

Soil with constituents of concern at concentrations within EPA CWRSLs may be reused under roads, sidewalks, or bike paths, in accordance with the City's Soil Reuse Guidance Document (Appendix D), assuming:

- The receiving facility has knowingly agreed to accept this material
- The receiving facility has been provided and understands the analytical data
- Soil is free of construction/demolition debris and RACS

## 7.5 Non-Hazardous and Solid Waste Disposal

The Contractor, MMP Supervisor, and DDPHE must coordinate before the project begins to obtain DADS approval/waste profile, and waste manifests. It is possible, as limited sampling has been conducted, it will be required before a waste profile is approved and waste manifests are issued.

Solid waste including HUF and debris, and non-hazardous waste including geotechnically unsuitable soils or soils with constituents of concern at concentrations above EPA CWRSLs (not characterized as hazardous or liquids, see Section 7.5), must be transported off-Site to DADS. **These materials may not be reused on-Site.**

DADS will accept solid material where concentrations as determined by the TCLP are less than 20 times the toxicity characteristic maximum concentration, this is referred to as the "20 times rule". The EPA TCLP Maximum Concentrations of Contaminants are provided as Appendix C. Soils with constituents of concern exceeding the 20 times rule during the project will also require TCLP evaluation.

Note: Certain waste streams are specifically excluded in the Solid Waste Regulations (CDPHE, 2011b). The MMP Supervisor (and as approved by CCD) will be responsible for ultimate classification for disposal.

## 7.6 Hazardous Waste Disposal

If sample analysis indicates that the soil is designated as hazardous waste, the soil will be containerized immediately in a lined roll-off box, labeled, and transported to a designated storage area (either on-Site or off-Site) pending off-Site disposal at a hazardous waste disposal facility. Waste manifests must be completed for the material prior to transportation to the disposal facility in accordance with state and federal regulations. Once identified as hazardous waste, this material may not be stored on-Site longer than 90 days, and should be removed as soon as practicable.

The Deer Trail Landfill operated by Clean Harbors Environmental at 108555 East Highway 36 in Deer Trail, Colorado is the only facility within Colorado licensed to accept hazardous waste. The next closest licensed hazardous waste disposal facilities are located in Nebraska, Utah and Texas. Manifestation and transportation of these waste materials on public highways, streets, or roadways will be in accordance with 49 CFR and any applicable Department of Transportation regulations.

# 8. Construction Water Handling Procedures

Construction water may consist of stormwater, surface water, groundwater, and leachate and will be addressed using the following procedures.

## 8.1 Stormwater

The Contractor is required to obtain all applicable permits related to construction stormwater compliance with either or both the CDPHE, or the CCD, and implement best management practices and verify compliance in accordance with those permits. As applicable, Management Plans for demolition and construction activities must be developed and submitted to the CCD's permitting agency for review and approval prior to issuance of a Construction Activities Stormwater Discharge Permit (CASDP). Additional information may be found here:

https://www.denvergov.org/content/dam/denvergov/Portals/705/documents/guidelines/PWES-007.0-Construction_Activities_Stormwater_Manual.pdf.

## 8.2 Groundwater

Groundwater is expected to be encountered around to the west of Blake Street during the installation of the manhole structure. Excavation is anticipated to be to an elevation of 5162 feet above mean sea level (msl), and groundwater in the area is at approximately 5168 feet above msl.

The Contractor must be aware that if dewatering is necessary during subsurface construction activities, water from dewatering operations shall not be directly discharged into any waters of the State, including wetlands, irrigation ditches, canals, or storm sewers, unless allowed by a permit. Unless prohibited by law or otherwise specified in the Contract, the water from dewatering operations shall be contained in tanks in locations approved by the CCD Project Manager, treated for discharge in accordance with the CDPHE-WQCD permit(s), or shall be hauled away from the Phase I project area for proper disposal in accordance with applicable laws and regulations.

Evaluation of water disposition will be conducted in coordination with the MMP Supervisor and the CCD Project Manager. Previous sampling has confirmed the presence of metal-impacted groundwater within the Phase I project area; five metals exceeded the presumptive CDPHE-WQCD surface water discharge limits (Appendix B). The Contractor must understand that the CDPHE will not allow this water to be discharged without appropriate permitting and treatment.

The Contractor will implement the most cost effective method of groundwater handling and disposal that meets all state and federal regulations. If the Contractor intends to treat groundwater for discharge into a waters of the State, the Contractor must abide by the standards set forth in the Remediation Activities Discharge to Surface Water permit COG315000 (discharge permit) (Appendix F). The discharge permit is specific to the Phase I project area, which is the Coors Field Parking Lot to Arapahoe Street phase of the overall 27th Street project. Groundwater is not anticipated for the other phases of the project; therefore, discharge permits have not been obtained. If dewatering is necessary for the other project phases, a discharge permit must be obtained prior to initiating dewatering activities (the permit requires a 45-day review period).

A Remediation Activities Management Plan (RAMP) must be completed, by the Contractor, prior to discharge activities taking place. In accordance with permit procedures, the Contractor shall fill out and submit monthly Discharge Monitoring Reports (DMRs) to CDPHE-WQCD for the life of the permit, even if discharge activities are not conducted. Copies of monthly submittals shall be provided to the City.

The following are some general provisions; however, any requirements noted on the permit(s) take precedence over this MMP.

- Untested groundwater or groundwater that does not meet the discharge standards will not be discharged onto the ground or into sanitary or storm sewers.

- Groundwater that does meet discharge standards as evaluated by the MMP Supervisor may be discharged in accordance with applicable federal, state, and local regulations, or may be used on-site for moisture treatment of engineered fill material, or for dust suppression (assuming it meets Colorado Ground Water Standards). Use of groundwater for moisture treatment or dust suppression must be confirmed to be in compliance with water rights before implementation.

- Where chemical concentrations in groundwater are above permit limits, the water will be either be permitted and treated on-site or transported off-site and disposed at a licensed treatment facility.

The MMP Supervisor will discuss treatment and/or disposal options with the CCD Project Manager, and the CCD Project Manager will provide direction to the Contractor, who will be responsible for water treatment and/or disposal in accordance with the Contractor's approved permits.

## 8.3 Leachate

Materials excavated from below the groundwater table have the potential to generate liquids; however, it is unlikely that excavated material will generate significant liquids. If saturated materials are encountered, stockpile areas will be constructed to drain material before re-use as engineered fill, or transport for off-site disposal.

Generated liquids will drain to a central sump which must be of sufficient capacity to prevent overtopping. The sump will be excavated into the ground and sloped to a central location. It will also be lined with 10-mil polyethylene sheeting; a layer of gravel will be implemented to hold the sheeting in place and will extend beyond the edge of the sheeting. A berm will be placed around the sump to prevent surface water from commingling with the generated leachate water. Liquids accumulated within the sump will be submitted for analysis by the Contractor and coordinated with the MMP Supervisor. If constituents in the water exceed the surface water standards or CDPHE-WQCD permit limits (if applicable), the water must either be disposed at a licensed disposal facility with appropriate waste profiles and manifests or be treated to meet those standards before discharge (in accordance with the discharge permit). Solid wastes generated during this process must also be evaluated in accordance with sampling procedures prior to disposal; if this material will require disposal off-site, it must pass the paint filter test (EPA Method 9095A) prior to disposal at a licensed solid waste disposal facility.

# 9. Additional Requirements

## 9.1 Dust

In accordance with 5 CCR 1001 – Air Quality Control Commission (AQCC) Regulations, the Contractor will evaluate the need to obtain an Air Pollution Emissions Notice (APEN) and Application for Construction Permit, and obtain as applicable.

The Contractor is also responsible for following the CCD – DDPHE fugitive dust ordinance, as follows:

**Sec. 4-25. - Fugitive particulate emissions.**

(a) No person shall allow or cause: (1) any materials to be handled, transported, or stored; (2) a building, including its appurtenances, or a construction haul road to be used, constructed, altered, repaired or demolished; or (3) any unenclosed activity, including demolition, excavation, backfilling, grading, clearing of land, construction or sandblasting without taking all reasonable measures as the department requires to prevent particulate matter from becoming airborne. All persons shall take reasonable measures to prevent the visible discharge of fugitive particulate emissions beyond the lot line of the property on which the emissions originate. The measures taken must be effective in the control of fugitive particulate emissions at all times on the Phase I project area, including periods of inactivity such as evenings, weekends, and holidays as well as any other period of inactivity. Based upon the size of the construction site, proximity to sensitive receptors, or history of noncompliance with the provisions of this chapter, the department may require a fugitive particulate control plan for such activities.

(1) [Plan requirements.] The fugitive particulate control plan shall:

a. Be subject to department review, and if the department finds the plan to be inadequate, the department may require modifications;

b. Include the name and contact information of the person(s) responsible for the implementation of the plan and the person(s) responsible for the particulate generating activities;

c. Be effective in the control of fugitive particulates at all times, including evenings, weekends, and holidays, regardless of whether activities are being conducted at the site;

d. Identify each potentially fugitive particulate generating activity and operation to be carried out on the site and the actual and potential sources of fugitive emissions on-site;

e. Identify one (1) primary control measure and one (1) contingency control measure for each activity, operation or source of fugitive emissions identified above. A list of potential control measures may be obtained from the department;

f. Include at least daily vacuuming or wet sweeping of the right-of-way adjacent to individual projects to control any materials that are tracked out or that otherwise have come to be located in adjacent right-of-way; and

g. Be implemented for the duration of the project.

(2) Fees:

a. The board may require by rule and regulation payment of nonrefundable fees to be paid upon submittal of a fugitive dust control plan. The fees are to be of amount sufficient to offset all costs associated with the fugitive dust control plan review, including costs of administration and enforcement.

b. All fees must be paid at the time of filing the application for review with the department. No application will be valid or complete until all fees have been paid.

(Ord. No. 293-90, 5-29-90; Ord. No. 683-08, § 10, 12-8-08)

Regardless of the need to obtain an APEN or comply with the City ordinance, the Contractor will take reasonable measures to prevent particulate matter from becoming airborne and to prevent the visible discharge of fugitive particulate emissions beyond the property boundary on which the emissions originate. The Contractor shall provide sufficient quantities of equipment and personnel for dust control sufficient to prevent dust nuisance on and about the Phase I project area. Blowing dust and airborne particulates shall be controlled by wetting or other means, if approved by the MMP Supervisor and Project Manager. Dust control agents shall be applied in accordance with manufacturer's recommendations. The measures taken must be effective in the control of fugitive emissions at all times on the Phase I project area, including periods of inactivity such as evenings, weekends, and holidays as well as any other periods of inactivity.

## 9.2 Decontamination of Heavy Equipment

Equipment that has come into contact with potentially impacted waste as identified by the MMP Supervisor will be decontaminated prior to leaving the project Site to prevent impacted material and/or soil with nuisance weed seeds from being spread off-Site. Gross removal of material from equipment will be completed using hand tools such as shovels, brooms and brushes. If the MMP Supervisor finds it necessary, more thorough decontamination may be required such as pressure washing. Spent decontamination water will be collected in basins and pumped into water containers. The Contractor will be responsible for analyzing the waste-water and working with the MMP Supervisor and City to evaluate final disposal options in accordance with applicable federal, state and local regulations. A minimum of 10-mil polyethylene line shall be placed beneath equipment needing decontamination to collect residual materials and prevent unauthorized dispersal of liquids.

## 9.3 Site Security

The Contractor will be responsible for maintaining effective access control for the project.

## 9.4 Monitoring Wells

If active groundwater monitoring wells are encountered, special care will be taken so as not to disturb their structural integrity. If this is not possible, then the well will be properly abandoned and replaced after construction (if needed) as coordinated and conducted by the MMP Supervisor. The CCD Project Manager and DDPHE shall be notified and will coordinate abandonment of monitoring wells.

## 9.5 Complaints

Any complaints received by the Contractor will be immediately reported to the CCD Project Manager. Additionally, any environmental-related complaint, such as noise, odor, or dust, will be immediately reported to DDPHE. Complaints must be addressed within 24 hours.

# 10. Imported Materials and Site Stabilization

Any soils, including embankment and/or topsoil, brought to the Phase I project area must meet the Unrestricted Reuse Criteria.

For each source of imported embankment or topsoil:

- The Contractor shall assure and certify that unacceptable concentrations of constituents in the analyses described below in Section 10.1, including but not limited to those defined in the 40 CFR Part 261 Subparts C and D, and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Section 101(14) as amended, are not incorporated into the project as a result of importing embankment or topsoil materials.

- The Contractor shall submit such certification to DDPHE and the Project Manager, signed and stamped (or sealed) by one of the following:

    - A qualified environmental consultant

    - Certified Industrial Hygienist (CIH)

    - Certified Hazardous Materials Manager (CHMM)

    - Registered Professional Engineer (PE)

    - Certified Safety Professional (CSP)

    - Registered Environmental Manager (REM)

- Additionally, the material must be visually evaluated by a CABI, and be determined free of any confirmed or suspected RACS, solid waste, debris, and demolition materials.

- Recycled asphalt materials that will be utilized for interim stabilization do not require the above evaluations before being brought to the Phase I project area.

If Contractor source material for embankment or topsoil, originating outside of the Phase I project area limits, is placed at the Phase I project area and was not cleared through the sampling protocols described in Section 10.1, the Contractor shall remove the material from the project, dispose of it in accordance with applicable laws and regulations, and make necessary restoration. This work will be the sole burden of the Contractor.

The cost of complying with these requirements, including sampling, testing, and corrective action by the Contractor, will not be paid for separately, and shall be included in the work.

## 10.1 Sample Analysis and Frequency

Representative samples of proposed import fill shall be collected at a frequency of one sample for every 2,000 cubic yards. Samples shall be analyzed for the following constituents:

- VOCs by EPA Method 8260

- PAHs by EPA Method 8270

- RCRA eight metals using EPA Method 6010/6020/7471
- Pesticides/PCBs using EPA Method 8082

The City DDPHE may adjust the frequency of sample analysis, and analysis requirements, at its discretion.

## 10.2 Imported Fill Documentation

Certification documentation shall be provided to the City Project Manager and DDPHE for approval prior to being brought to the Phase I project area.

# 11. Reporting

Upon Project completion, the MMP Supervisor will prepare a summary report detailing the work performed at the Phase I project area specifically related to the implementation of this MMP. Detailed documentation of the on- or off-site disposition will be maintained by the MMP Supervisor. Documentation will include:

- Maps showing the locations of Project features related to this MMP, including sample locations, location of wastes discovered, and any other important features identified during the course implementation of this MMP
- Field Screening and analytical data
- Summary and copies of analytical results/reports
- Summary of quantities materials that were managed and the procedures used
- Location and manner (i.e., embankment fill, surface soil, etc.) of soil use including any cover materials (soil, asphalt, etc.)
- Representative Project photographs showing soil reuse areas
- A reference to the proximity to groundwater (must meet requirements described in Section 7.1)
- Waste profiles and waste manifests for all solid waste, soil, water, or other material transported off-site for disposal
- Any records required under permits; including verification of closure of those permits (e.g., for the CGP permit, copy of the Notice of Termination). Any other documentation detailing important features related to this project
- CABI documentation to RACS management as required by the City's Asbestos SOP and Section 5.5 of the Solid Waste Regulations

# 12. References

CDPHE, 2011a. "Risk Management Guidance for Evaluating Arsenic Concentrations in Soil." Colorado Department of Public Health and Environment, Hazardous Materials and Waste Management Division, June 2011.

CDPHE, 2011b. "Regulations Pertaining to Solid Waste Disposal Sites and Facilities, 6 CCR 1007-2, Part 1." Prepared by the Colorado Department of Public Health and Environment, Hazardous Waste Unit, August 22, 2011.

Pinyon, 2017. "Limited Environmental Screening, 27th Street Storm Drain Interceptor, Denver, Colorado, 11780301," Prepared by Pinyon Environmental, Inc., dated February 17, 2017.

# Appendix A Limited Environmental Screening, 27th Street Storm Drain Interceptor

Pinyon Environmental, Inc.

Corporate Headquarters
3222 South Vance Street, Suite 200, Lakewood, CO 80227
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# Memorandum

**To:** Project File

**Subject:** Geographic Applicability of Materials Management Plans Prepared for the 27th Street Storm Drain Interceptor – Coors Field Parking Lot to Arapahoe Street, and the 27th Street Storm Drain Interceptor – Arapahoe Street to Welton Street Projects, City and County of Denver, Colorado

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Suspected soil and/or groundwater impacts have not been identified by past environmental sampling and evaluations completed along the 27th Street Storm Drain Interceptor project corridor. However, impacted soil and/or groundwater, if encountered, will require special management.

The 27th Street Storm Drain Interceptor project extends along 27th Street from the Coors Field Parking lot south to Washington Street where it extends south to East 20th Avenue. A Materials Management Plan (MMP) has been completed for Phase 1 of the project (Coors Field Parking Lot to Arapahoe Street); Phase 2 will extend from Arapahoe Street to Welton Street. Both project areas have been evaluated for environmental conditions, and a MMP has been prepared for Phase 1 to address specific conditions for each independent project. Environmental conditions between the two phases are similar; therefore, the Contractor is required to implement the MMP produced for the Phase 1 for Phase 2 of the project.

The Contractor shall be responsible for compliance with the Materials Management Plan as referenced below:

Pinyon, 2017. "Materials Management Plan, 27th Street Storm Drain Interceptor – Coors Field Parking Lot to Arapahoe Street, Denver, Colorado." Prepared by Pinyon Environmental, Inc., October 27, 2017.

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# MEMORANDUM

| | |
|---|---|
| **Date:** | February 17, 2017 |
| **To:** | Brian Poling |
| **Company:** | Merrick & Company |
| **Address:** | 2480 West 26th Avenue, Unit B225, Denver, CO 80211 |
| **From:** | Arianne Godwin |
| **Delivery Method:** | Email |
| **Subject:** | Limited Environmental Screening, 27th Street Storm Drain Interceptor, Denver, Colorado, 11780301 |

## Introduction

The objective of this Limited Environmental Screening is to provide information about facilities that pose a potential risk of being impacted by Recognized Environmental Conditions (RECs). Assessment of facilities in and near the project area for past or present soil and/or groundwater impacts is an integral component of the planning process. In cases where potential impacts are suspected, avoidance and/or identification of potential mitigation measures can be implemented when reasonably possible.

This Limited Environmental Screening addresses (and in many cases incorporates) components of the Colorado Department of Transportation (CDOT) Form 881 and the ASTM Standard 1527-13 Phase I Environmental Site Assessment. However, this document is limited in relation to the ASTM Standard, as noted in the Limitations. This Limited Environmental Screening provides project planners a "snapshot" of the existing conditions within the study area; however, more detailed information may be needed through additional investigation.

This document is considered a preliminary evaluation with a focus on assessing existing conditions through a desktop review. Pinyon is also tasked to complete soil and groundwater sampling along the project area concurrently with the geotechnical evaluation. The conclusions presented herein will be utilized to identify areas to strategically evaluate environmental conditions through sampling, and additional recommendations and mitigation strategies will be presented under separate cover.

## Project Description

A new storm drain is proposed to be installed in 27th Street beginning west of Blake Street to the intersection with Welton Street, then south along Washington Street to Park Avenue, for a total of approximately 6,000 feet. Construction is proposed to "relieve drainage problems in the Five Points neighborhood."

| Project Feature | Present (yes/no) | Discussion |
|---|---|---|
| Structure Acquisition | ☐ Yes ☒ No ☐ Unknown | Not applicable |
| Structure Modification | ☐ Yes ☒ No ☐ Unknown | Not applicable |

| Project Feature | Present (yes/no) | Discussion |
|---|---|---|
| Structure Demolition | ☐ Yes ☒ No ☐ Unknown | Not applicable |
| New Right of Way | ☐ Yes ☒ No ☐ Unknown | Not applicable |
| Easements | ☒ Yes ☐ No ☐ Unknown | Work will be completed within City and County of Denver roadways. |
| Utility Relocation | ☒ Yes ☐ No ☐ Unknown | Construction of the new storm drain along 27th Street, Welton Street, and Washington Street may require the relocation of utilities. |
| Excavation or Drilling | ☒ Yes ☐ No ☐ Unknown | Construction of the project will require excavation. Drilling activities are also expected for geotechnical analysis. |
| Disturbance Depth (feet) | Excavation is expected to range between 15 feet and 20 feet below ground surface. The deepest point of excavation is expected to be near the intersection of 27th Street and Blake Street, where excavation is expected to be approximately 25 feet.<br><br>Drilling is proposed near the intersection of Welton Street and Washington Street to a depth 30 feet. | |
| Dewatering | ☒ Yes ☐ No ☐ Unknown | Dewatering is expected near the intersection of Welton Street and Washington Street and potentially near 27th Street and Blake Street. |
| Groundwater Anticipated | ☒ Yes ☐ No ☐ Unknown | Groundwater is expected to be encountered at the intersection of Welton Street and Washington Street and potentially near 27th Street and Blake Street. |
| Depth to Groundwater (feet) | Approximately more than 20 feet below ground surface | |
| Groundwater Flow Direction | North-northwest | |
| Other | None | |

## Impact Criteria

The magnitude of the project impact from a regulated material perspective is dependent on different factors, including: the distance between a potential source of a regulated material and the project; status of regulated facilities (e.g., active or inactive); known or suspected releases into soil, surface water, and/or groundwater; the hydrogeologic relationship of the source of a regulated material to the project; and the depth and/or duration of construction. These factors have been considered in this Limited Environmental Screening as part

of the evaluation of whether a regulated material has the potential to impact the project. Facilities were categorized as either having a low or high potential to impact the study area. The following describes the categories:

Low Potential: Facilities that fit this criterion include:

- Facilities with minimal indications of an existing release, past release, or material threat of a release of regulated materials into the ground (soil), groundwater, and/or surface water that could impact the study area.
- Facilities located hydraulically down-gradient of the study area.
- Those facilities where regulated materials are known or suspected in the study area; however, there is a low potential for those materials to be exposed during construction of the project.

High Potential: Facilities that fit this criterion include:

- Facilities with indications of an existing release, past release, or material threat of a release of any regulated materials into the ground (soil), groundwater, and/or surface water, and the possibility of migration from the contaminant source into the study area.
- Those same facilities that have caused a migration of the contaminants into the study area, and where construction of the project would likely result in exposure of media impacted by those contaminants (e.g., soil, soil vapor, groundwater).

Pinyon has utilized these criteria throughout this Limited Environmental Screening in evaluating impact potential from regulated materials to the project.

**Methods**

Several data sources were reviewed to evaluate the potential for regulated materials to impact the study area, including those related to the physical setting of the study area, regulatory files, and historical land uses. A detailed list of references utilized in preparation of this Limited Environmental Screening is included. The following discussion presents a summary of the methodology used to complete this assessment.

Physical Setting **-** The physical setting of the study area was reviewed to help evaluate potential regulated material transport mechanisms, including topographic and hydrogeologic conditions.

Regulatory Files **-** A review of the compliance history of facilities within and in proximity to the study area, as identified by a regulatory database search and other reports (if available) was completed. This search included a review of publically available local, state, and federal records, or other reports as identified in the text.

Historical Land Uses **-** A review of historical uses in and around the study area was completed, using multiple sources as described in the text. This review focused on uses that could potentially impact the study area, such as commercial and industrial uses, and the storage and use of regulated materials.

**Results**

The following table provides an overview summary of those facilities identified in the study area that may be of environmental concern.

| Facility Name and Address (Figure 2) | Distance (feet)/ Direction/ Hydrogeologic Relationship | Facility Type [1] | Facility Status | Resource Source | Potential to Impact Study Area Rationale/ Discussion |
|---|---|---|---|---|---|
| Coors Parking Garage<br>27th and Blake Street | 0 feet northwest/ Down-gradient | VCRA | Closed | Regulatory Database | **High.** This facility was accepted into the Voluntary Cleanup Program November 9, 2012. Naphthalene and benzo(a)pyrene were detected in soil borings at the facility above their respective CDPHE soil values. Trace amount of asbestos were detected in the soil borings. Constituents detected in the groundwater for the facility were at concentrations below the respective CDPHE groundwater standards for stream discharge. Remediation was stated as complete in November 2014 and a no action determination (NAD) letter was issued August 28, 2014. This use of the site is identified as commercial.<br><br>Pinyon has previously completed subsurface investigations within the Coors Parking lot on behalf of the City and County of Denver. During those investigations, man-made fill with elevated concentrations of polycyclic aromatic hydrocarbons (PAHs), heavy metals, and asbestos-containing materials (ACMs) were identified; those conditions appeared to be prevalent in that area, and it is possible that those conditions would be present generally west of Blake Street. Further, groundwater in the area was impacted with constituents at concentrations that exceeded either the Colorado Ground Water Standards, and/or the Colorado surface water discharge standards.<br><br>Construction in the area of the Coors Parking lot could require dewatering, and excavation would result in exposure to potentially impacted soil. For this reason, this facility has a **high** potential to impact the project. |

| Facility Name and Address (Figure 2) | Distance (feet)/ Direction/ Hydrogeologic Relationship | Facility Type [1] | Facility Status | Resource Source | Potential to Impact Study Area Rationale/ Discussion |
|---|---|---|---|---|---|
| Colorado Color Specialties Inc.<br>1450 27th Street | 20 feet southwest/ Cross-gradient | RCRAGR08 | Closed | Regulatory Database<br><br>City Directories | **Low.** This facility was listed on the city directories starting in 1999. The facility is classified as a paint and coating manufacturing and is a conditionally exempt small quantity generator for waste paint related material including, but not limited to, benzene, methyl ethyl ketone, nitrobenzene, pyridine, tetrachloroethylene, and trichloroethylene. No violations were reported.<br><br>Due to the lack of reported violations and the cross-gradient location of the facility, proposed excavation activities near the facility are considered to have a **low** potential that impacted soils will be encountered. |
| Simpson Building<br>2714 Walnut Street | 100 feet northeast/ Cross-gradient | LST | Closed | Regulatory Database | **Low.** One 1,000-gallon gasoline UST was identified at the address listed and was removed in June 1994. Samples collected after the tank was removed did not detect benzene, toluene, ethylbenzene, and xylenes (BTEX) or hydrocarbons. A no further action (NFA) was issued November 3, 1994.<br><br>Due to the cross-gradient location and lack of BTEX or hydrocarbons detected in the soil, excavation activities near this facility are considered to have a **low** potential that impacted soils will be encountered. |

| Facility Name and Address (Figure 2) | Distance (feet)/ Direction/ Hydrogeologic Relationship | Facility Type [1] | Facility Status | Resource Source | Potential to Impact Study Area Rationale/ Discussion |
|---|---|---|---|---|---|
| Zone Cab<br>2358 Washington Street | 20 feet east/ Up-gradient | LST | Closed | Regulatory Database | **Low.** One 4,000-gallon gasoline UST failed a tank tightness test in February 1992. Two USTs were closed in place as a result, in September 1992. Analysis of samples collected did not detect BTEX or total volatile hydrocarbons. An NFA letter was issued December 15, 1992. A new tank was installed in 1993.<br><br>One 300-gallon waste oil UST was removed in 1998. Confirmation sampling did not indicate a release.<br><br>A 6,000-gallon gasoline UST was removed in September 2002. Soil sampling did not indicate a release. An NFA was issued on October 29 2002.<br><br>The two USTs closed in place are not located within the roadway where excavation and drilling activities are proposed; therefore, activities near this facility are considered to have a **low** potential to encounter the USTs or impacted soils. |

| Facility Name and Address (Figure 2) | Distance (feet)/ Direction/ Hydrogeologic Relationship | Facility Type [1] | Facility Status | Resource Source | Potential to Impact Study Area Rationale/ Discussion |
|---|---|---|---|---|---|
| Angelica Healthcare Plant 88<br>2701 Lawrence Street | 50 feet northeast/ Cross-gradient | LST | Closed | Regulatory Database<br><br>Previous Reports<br><br>Reconnaissance Survey | **High.** City-Elite Laundry was listed at the address in 1946, 1956, 1966, 1976, and 1986. Puritan Laundry Co was also listed at the address in 1956. In addition, the building currently present indicates they have been in business since 1886.<br><br>Four USTs were registered at the address to City-Elite Laundry in 1986. Two 1,125-gallon Mintrex tanks and one 1,000-gallon gasoline tank were removed from the facility in October 1990. Soil beneath the tanks was observed to be impacted with hydrocarbons and was excavated. Additional sampling beneath the excavation indicated no risk to human health or the environment. An NFA was issued for the UST closure on June 10, 1991.<br><br>The in-place closure of a 7,500-gallon waste oil tank was schedule for October 1993. Drilling activities did not find evidence of a petroleum release and "no contaminants were detected in the soil samples." No additional information was available.<br><br>Construction activities near the intersection of Lawrence Street and 27th Street could result in exposure to potentially impacted soil and/or groundwater from the historical use as a dry cleaning facility. For this reason, this facility has a **high** potential to impact the project. |

| Facility Name and Address (Figure 2) | Distance (feet)/ Direction/ Hydrogeologic Relationship | Facility Type [1] | Facility Status | Resource Source | Potential to Impact Study Area Rationale/ Discussion |
|---|---|---|---|---|---|
| CCOD Fire Station #3<br>2500 Washington Street | 50 feet east/ Up-gradient | LST | Closed | Regulatory Database | **Low.** One 550-gallon diesel UST was registered to the facility. During removal of the tank in April 1992, no impacts were observed in the soil around the pipe or tank. An NFA for the tank removal was issued July 10, 1992.<br><br>Due to the lack of impacts observed when the tank was removed, this facility is considered to have a **low** potential to impact the project. |
| Seniors Nutrition Program/Volunteers of America<br>2636 Larimer Street | 100 feet southwest/ Cross-gradient | LST | Closed | Regulatory Database | **Low.** One 4,000-gallon gasoline UST was registered to the facility. The tank was removed January 1991. Impacted soils were excavated and disposed of off-site. An NFA for the tank removal was issued July 25, 1997.<br><br>Due to the remediation activities conducted in 1991 and the cross-gradient location of the facility, this facility is considered to have a **low** potential to impact the project. |
| F&B Auto Service<br>2660 Larimer Street | 50 feet southwest/ Up-gradient to Cross-gradient | UST | Closed | Regulatory Database<br><br>Previous Reports | **Low.** F&B Auto Service was listed as a gas station in 1966, 1976, and 1986. Two 1,000-gallon gasoline USTs and two 550-gallon USTs were registered to the facility. All four USTs were removed from the facility in September 1989. No additional information was available.<br><br>Due to the cross-gradient location, this facility is considered to have a **low** potential to impact the project. |

| Facility Name and Address (Figure 2) | Distance (feet)/ Direction/ Hydrogeologic Relationship | Facility Type [1] | Facility Status | Resource Source | Potential to Impact Study Area Rationale/ Discussion |
|---|---|---|---|---|---|
| Thomas Bean Towers<br>135 Park Avenue West | 50 feet west/ Up-gradient | LST | Closed | Regulatory Database | **Low.** One 200-gallon diesel UST was registered to the facility. The UST was removed December 1998. Analysis of soil samples collected beneath the UST did not indicate impacts above the corresponding limit. An NFA for the tank removal was issued January 28, 1999.<br><br>Due to the lack of impacts identified beneath the tank, this facility is considered to have a **low** potential to impact the project. |
| C&B Cleaners<br>2748 Welton Street | 300 feet northeast/ Cross-gradient | Cleaners | Closed | Regulatory Database<br><br>Previous Reports | **High.** C&B Cleaners was listed at the address in 1966, 1976, 1986, and 2006. The facility is classified as a dry cleaning and laundry services facility and is a no longer regulated RCRA generator facility. No violations were reported.<br><br>Due to multiple dry cleaning facilities being historically present in the area, there is a **high** potential that groundwater in the region is impacted with low-level concentrations of tetrachloroethene (PCE). |
| 2733 Larimer Street | 150 feet northeast/ Cross-gradient | Historical Dry Cleaner | Closed | Previous Reports | **High.** The facility was listed as a dry cleaner in 1926 and 1936 as Weber Marcel.<br><br>Due to multiple dry cleaning facilities being historically present in the area, there is a **high** potential that groundwater in the region is impacted with low-level concentrations of PCE. |

| Facility Name and Address (Figure 2) | Distance (feet)/ Direction/ Hydrogeologic Relationship | Facility Type [1] | Facility Status | Resource Source | Potential to Impact Study Area Rationale/ Discussion |
|---|---|---|---|---|---|
| 2721 Lawrence Street | 100 feet northeast/ Cross-gradient | Historical Dry Cleaner | Closed | Previous Reports | **High.** The facility was listed as Tip Top Cleaners in 1946.<br><br>Due to multiple dry cleaning facilities being historically present in the area, there is a **high** potential that groundwater in the region is impacted with low-level concentrations of PCE. |
| 2701 Champa Street | 50 feet northeast/ Cross-gradient | Historical Gas Station | Closed | Previous Reports | **Low.** The facility was listed as a gas station in 1936 (Trinder Service Station), 1946 (Champa Service Station), and1966 (Ullbarri's Standard Service and Garage).<br><br>Due to the cross-gradient location, this facility has a **low** potential to impact the project. |
| 2552/2554 Washington Street | 50 feet west/ Down-gradient | Historical Dry Cleaner | Closed | Previous Reports | **High.** The facility was listed as Best Cleaners and Dryers (2552 Washington Street) in 1926 and Gigantic Cleaners and Laundry (2554 Washington Street) in 1946.<br><br>Due to multiple dry cleaning facilities being historically present in the area, there is a **high** potential that groundwater in the region is impacted with low-level concentrations of PCE. |
| 730 East 22nd Avenue | 100 feet east/ Up-gradient | Historical Gas Station | Closed | Previous Reports | **Low.** The facility was listed as Acacia Standard Service in 1966.<br><br>Due to the estimated short duration of use as a gas station, this facility has a **low** potential to impact the project. |

| Facility Name and Address (Figure 2) | Distance (feet)/ Direction/ Hydrogeologic Relationship | Facility Type [1] | Facility Status | Resource Source | Potential to Impact Study Area Rationale/ Discussion |
|---|---|---|---|---|---|
| 1959 Park Avenue | 150 feet southeast/ Up-gradient | Historical Dry Cleaner and Gas Station | Closed | Previous Reports | **High.** The facility was listed as Navy Gas and Supply Co in 1936 and City-Elite Laundry and Dry Cleaning in 1956.<br><br>Due to multiple dry cleaning facilities being historically present in the area, there is a **high** potential that groundwater in the region is impacted with low-level concentrations of PCE. |
| 739 East 26th Avenue | 100 feet east/ Up-gradient | Historical Dry Cleaner | Closed | Previous Reports | **High.** The facility was listed as Arcada Cleaners and Dryers in 1946 and 1956 and as Bell Cleaners and Tailors in 1966.<br><br>Due to multiple dry cleaning facilities being historically present in the area, there is a **high** potential that groundwater in the region is impacted with low-level concentrations of PCE. |
| 728 East 26th Avenue | 50 feet east/ Up-gradient | Historical Gas Station | Closed | Previous Reports | **Low.** The facility was listed as Da-Nite Service Station in 1936.<br><br>Due to the estimated short duration of use as a gas station, this facility has a **low** potential to impact the project. |
| 704 East 26th Avenue | 50 feet southeast/ Up-gradient | Historical Dry Cleaner | Closed | Previous Reports | **High.** The facility was listed as Fabulous Cleaners in 1956 and Best Fine Cleaners in 1966.<br><br>Due to multiple dry cleaning facilities being historically present in the area, there is a **high** potential that groundwater in the region is impacted with low-level concentrations of PCE. |

| Facility Name and Address (Figure 2) | Distance (feet)/ Direction/ Hydrogeologic Relationship | Facility Type [1] | Facility Status | Resource Source | Potential to Impact Study Area Rationale/ Discussion |
|---|---|---|---|---|---|
| 27th and Welton | Up-gradient | Historical Gas Station | Closed | Previous Reports | **Low.** The facility was listed as Skeet's Service Station in 1936.<br><br>Due to the short duration of use as a gas station, this facility has a **low** potential to impact the project. |
| 2701 Welton Street | 50 feet north/ Up-gradient to Cross-gradient | Historical Dry Cleaner | Closed | Previous Reports | **High.** The facility was listed as Four Season Cleaners in 1976 and 1986.<br><br>Due to multiple dry cleaning facilities being historically present in the area, there is a **high** potential that groundwater in the region is impacted with low-level concentrations of PCE. |
| 617 27th Street | 50 feet north/ Up-gradient to Cross-gradient | Historical Dry Cleaner | Closed | Previous Reports | **High.** The facility was listed as Mid-Town Cleaners in 1956.<br><br>Due to multiple dry cleaning facilities being historically present in the area, there is a **high** potential that groundwater in the region is impacted with low-level concentrations of PCE. |
| 2712 Welton Street | 50 feet northeast/ Cross-gradient | Historical Dry Cleaner | Closed | Previous Reports | **High.** The facility was listed as Five Point Cleaners in 1926.<br><br>Due to multiple dry cleaning facilities being historically present in the area, there is a **high** potential that groundwater in the region is impacted with low-level concentrations of PCE. |

| Facility Name and Address (Figure 2) | Distance (feet)/ Direction/ Hydrogeologic Relationship | Facility Type [1] | Facility Status | Resource Source | Potential to Impact Study Area Rationale/ Discussion |
|---|---|---|---|---|---|
| 2717 Welton Street | 50 feet northeast/ Cross-gradient | Historical Dry Cleaner | Closed | Previous Reports | **High.** The facility was listed as Forty Minute Cleaners in 1966.<br><br>Due to multiple dry cleaning facilities being historically present in the area, there is a **high** potential that groundwater in the region is impacted with low-level concentrations of PCE. |
| 2600 Walnut Street | 350 feet southwest/ Cross-gradient | LST | Closed | Regulatory Database | **Low.** One 2,300-gallon gasoline UST was identified at the address listed and was removed in October 1991. Based on visual evidence, no impacts were observed in the soils after the tank was removed. An NFA was received March 26, 1992.<br><br>Due to the cross-gradient location of the facility and distance from 27th Street, excavation activities near this facility are considered to have a **low** potential to encounter impacted soils. |
| 2632 Blake Street | 200 feet southwest/ Cross-gradient | LST | Closed | Regulatory Database | **Low.** One 1,000-gallon gasoline UST was identified at the address listed and was removed in September 2005. An NFA was issued February 5, 2007. An additional NFA was issued March 10, 2005 in reference to the AST that was removed prior to 1961. No additional information was available.<br><br>Due to the cross-gradient location of the facility, the facility has a **low** potential to impact the project. |

| Facility Name and Address (Figure 2) | Distance (feet)/ Direction/ Hydrogeologic Relationship | Facility Type [1] | Facility Status | Resource Source | Potential to Impact Study Area Rationale/ Discussion |
|---|---|---|---|---|---|
| 2360 Cleveland Place | 200 feet west/ Down-gradient | Historical Dry Cleaner | Closed | Previous Reports | **Low.** The facility was listed as Cleveland Cleaners in 1956.<br><br>Due to the down-gradient location of the dry cleaning facility, there is a **low** potential that this facility will impact the project. |
| 2423 Tremont Place | 400 feet west/ Down-gradient | Historical Dry Cleaner | Closed | Previous Reports | **Low.** The facility was listed as National Cleaners and Dyers in 1926, and Neighborhood Cleaners and Dyers in 1926 and 1936.<br><br>Due to the down-gradient location of the dry cleaning facility, there is a **low** potential that this facility will impact the project. |
| 2624 Welton Street | 200 feet northwest/ Down-gradient | Historical Dry Cleaner | Closed | Previous Reports | **Low.** The facility was listed as Bell Cleaners and Tailors in 1946 and 1956.<br><br>Due to the down-gradient location of the dry cleaning facility, there is a **low** potential that this facility will impact the project. |
| 2619 Welton Street | 220 feet northwest/ Down-gradient | Historical Dry Cleaner | Closed | Previous Reports | **Low.** The facility was listed as Lucky Fred's Place (dry cleaner) in 1946.<br><br>Due to the down-gradient location of the dry cleaning facility, there is a **low** potential that this facility will impact the project. |

| Facility Name and Address (Figure 2) | Distance (feet)/ Direction/ Hydrogeologic Relationship | Facility Type [1] | Facility Status | Resource Source | Potential to Impact Study Area Rationale/ Discussion |
|---|---|---|---|---|---|
| 2566 Arapahoe Street | 650 feet southwest/ Cross-gradient | Historical Dry Cleaner | Closed | Previous Reports | **Low.** The facility was listed as Model Cleaners and Dyers in 1966.<br><br>Due to the cross-gradient location of the dry cleaning facility and distance from 27th Street, there is a **low** potential that this facility will impact the project. |

*Notes:*
*[1] – See GeoSearch report for information regarding acronyms and facility types.*

## Conclusions

The following facilities were identified with a high potential to impact the project area. Facilities with a low potential to impact the project area are not listed.

- *Coors Parking Garage (27th and Blake Street):* The Coors Parking Garage was a part of the Voluntary Cleanup Program between 2012 and 2014. Remediation was conducted at the facility. Institutional knowledge from previous Pinyon projects within that area indicates there may be ACMs and impacted soils encountered. It is likely that soil excavated from this area will require disposal at a permitted landfill. In addition, typical projects near the facility that require dewatering must obtain a remediation dewatering permit. Proposed excavation activities near this facility are considered to have a **high potential** that impacted soils or groundwater will be encountered.

- *Angelica Healthcare Plant 88 (2701 Lawrence Street):* This facility has been occupied by City-Elite Laundry since 1886. Due to the extended historical use of the facility as a dry cleaner, drilling and excavation activities near the facility have a **high potential** to encountered impacted soils and/or groundwater.

- *Various Historical Dry Cleaning Facilities:* Multiple dry cleaning facilities were historically present in the area, as early as 1926, during a period when current regulations did not exist. Due to this historical use, there is a **high potential** that groundwater in the region is impacted with low-level PCE; however, it may be challenging to identify a single source. If groundwater dewatering is required, treatment for solvents may be necessary.

## Recommendations

Pinyon is currently tasked to complete soil and groundwater sampling along the proposed project area; those results should be utilized to develop further recommendations regarding construction management of impacted soil and groundwater. Management of soil and groundwater must be completed to protect human health and the environment, and to meet regulatory requirements. Additional discussion of recommendations, which may include preparation of a Materials Management Plan (MMP) and obtaining a Remediation Discharge Permit, will be presented under future cover after sampling activities have been completed.

**References**

| Data Source | Reference |
|---|---|
| **Physical Setting** | |
| Topographic Conditions | USGS, 2013. "Commerce City, Colorado 7.5-Minute Quadrangle," United Stated Geological Survey, 2013.<br>USGS, 2013. "Englewood, Colorado 7.5-Minute Quadrangle," United Stated Geological Survey, 2013. |
| Hydrogeology Information | Hillier, Donald E., Schneider, Paul A., and Hutchinson, E. Carter, 1983. "Depth to the Water Table (1976-1977), In the Greater Denver Area, Front Range Urban Corridor, Colorado," United States Geological Survey, Map I-856-K, 1983. |
| Geotechnical Study | None available |
| **Regulatory Files** | |
| ASTM Standard Record Sources | GeoSearch, 2017. "Radius Report, Target Property: 27th Street Storm Drain Interceptor, Denver, Center County, Colorado 80205," GeoSearch, January 17, 2107. |
| Search Radii | ☒ ASTM ☐ Modified |
| Previous Environmental Reports | ☒ NA |
| Other Files (Assessor, Fire Department, Building Department, Planning, etc.) | Records provided by CDPHE and OPS for listed facilities |
| **Historical Land Uses** | |
| Topographic Map(s) | GeoSearch, 2017. "Historical Topographic Maps, Target Property: 27th Street Storm Drain Interceptor, Denver, Denver County, Colorado 80205," GeoSearch, January 19, 2017. |
| Aerial Photograph(s) | GeoSearch, 2017. "Historical Aerials Package, Target Property: 27th Street Storm Drain Interceptor, Denver, Denver County, Colorado 80205," GeoSearch, January 18, 2017. |

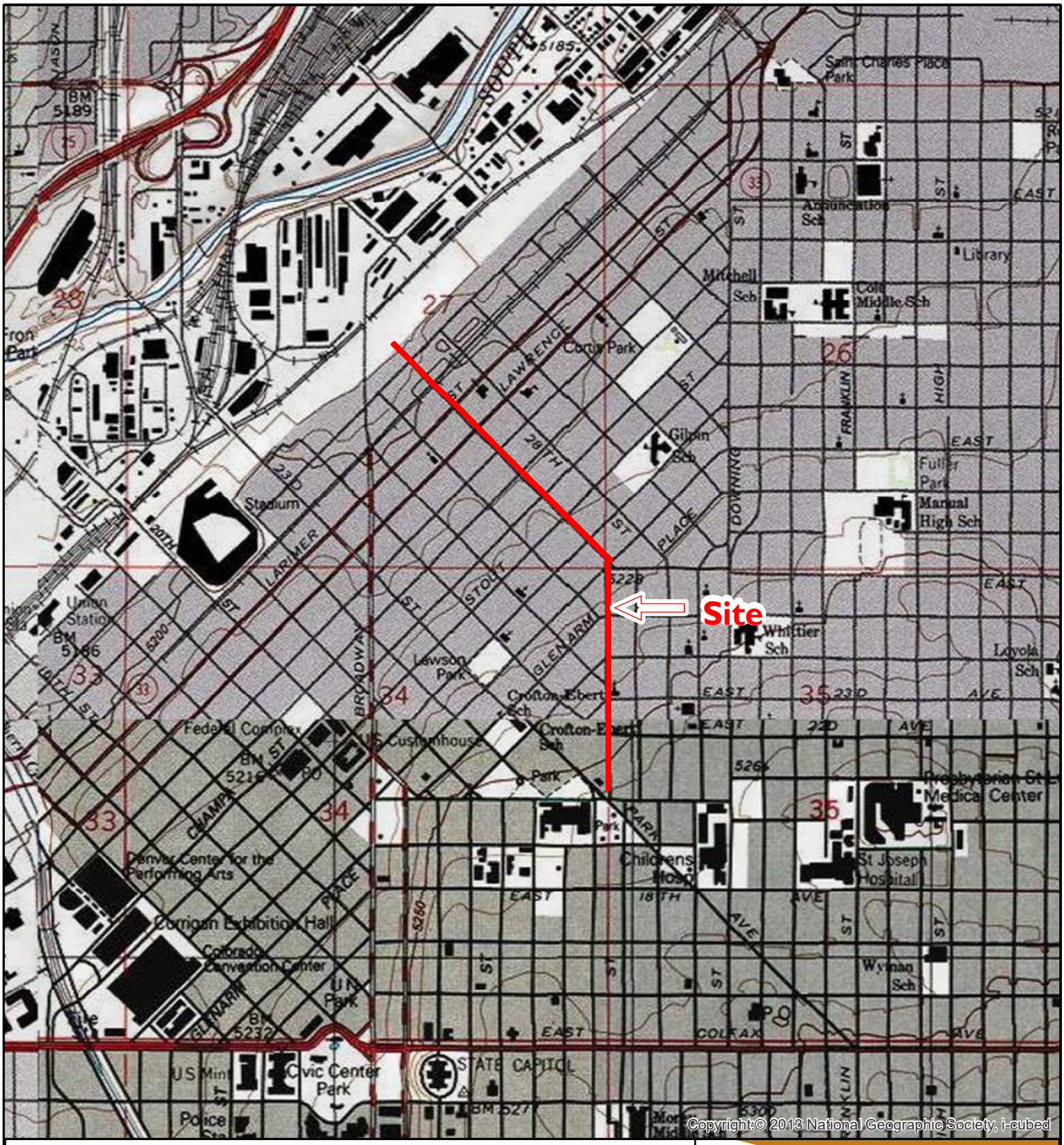
| Data Source | Reference |
|---|---|
| Sanborn Fire Insurance Maps | Sanborn, 1929. "Insurance Maps of Denver Colorado, Volume One," Sanborn Map Company, 1929.<br>Sanborn, 1945. "Insurance Maps of Denver Colorado, Volume One," Sanborn Map Company, 1945. |
| City Directories | GeoSearch, 2017. "City Directory Target Property Address, Target Property: 27th St, Denver, Colorado, 80205," GeoSearch, January 20, 2017.<br>GeoSearch, 2017. "City Directory Standard Report, Target Property: Washington St, Denver, CO 80205," GeoSearch, January 20, 2017. |
| **Interviews** | |
| No interviews were conducted for this Limited Environmental Screening | |
| **Other (e.g., analytical reports)** | |
| Previous Report | Pinyon, 2007. "City and County of Denver Historical Gas Stations and Dry Cleaners Database." Prepared by Pinyon, 2007. |
| *Notes:*<br>*NA – Not Available* | |

**Limitations**

A Limited Environmental Screening does not meet the ASTM 1527-13 standard, as several key components of the ASTM standard are not included in the Limited Environmental Screening methodology, including but not limited to: property observations/access, property owner interviews, or completion of user questionnaires. Additionally, sampling of soils, groundwater and/or surface water is beyond the scope of this Limited Environmental Screening, unless otherwise noted herein. The visual assessment was limited to areas accessible along the public right-of-way and did not include access to private properties where right of entry was unavailable, fenced-in areas, interiors of buildings, rear lots or areas not visible from public right-of-way in the project area. Also, interviewing property owners or tenants was beyond the scope of this assessment. Accordingly, it is possible that additional assessment and/or field investigations may be required in the future if right-of-way acquisition is required, including but not limited to, completion of an ASTM 1527-13 Phase I Environmental Site Assessment. Mitigation for potential contaminants, including, but not limited to, development of specific materials management or institutional controls may be required during construction, and have not been completed as part of this Limited Environmental Screening.

**Attachments**

**Figures**




N

## Legend

Site Boundary

USGS 7.5' Topographic Map
Commerce City, Colorado 1965 (Revised 1994)

0 1,000 2,000 Feet

Pinyon Environmental, Inc.

### SITE LOCATION

*27th Street Storm Drain Interceptor*
*Denver, Colorado*

| | | |
|---|---|---|
| Site Location: Section 27, 26, 35 T 3S, R 68W, 6th Principal Meridian | Drawn By: SJA | Figure: 1 |
| Pinyon Project Number: 1/17-803-01.3000 | Reviewed By: AMG | Date: 1/26/2017 |

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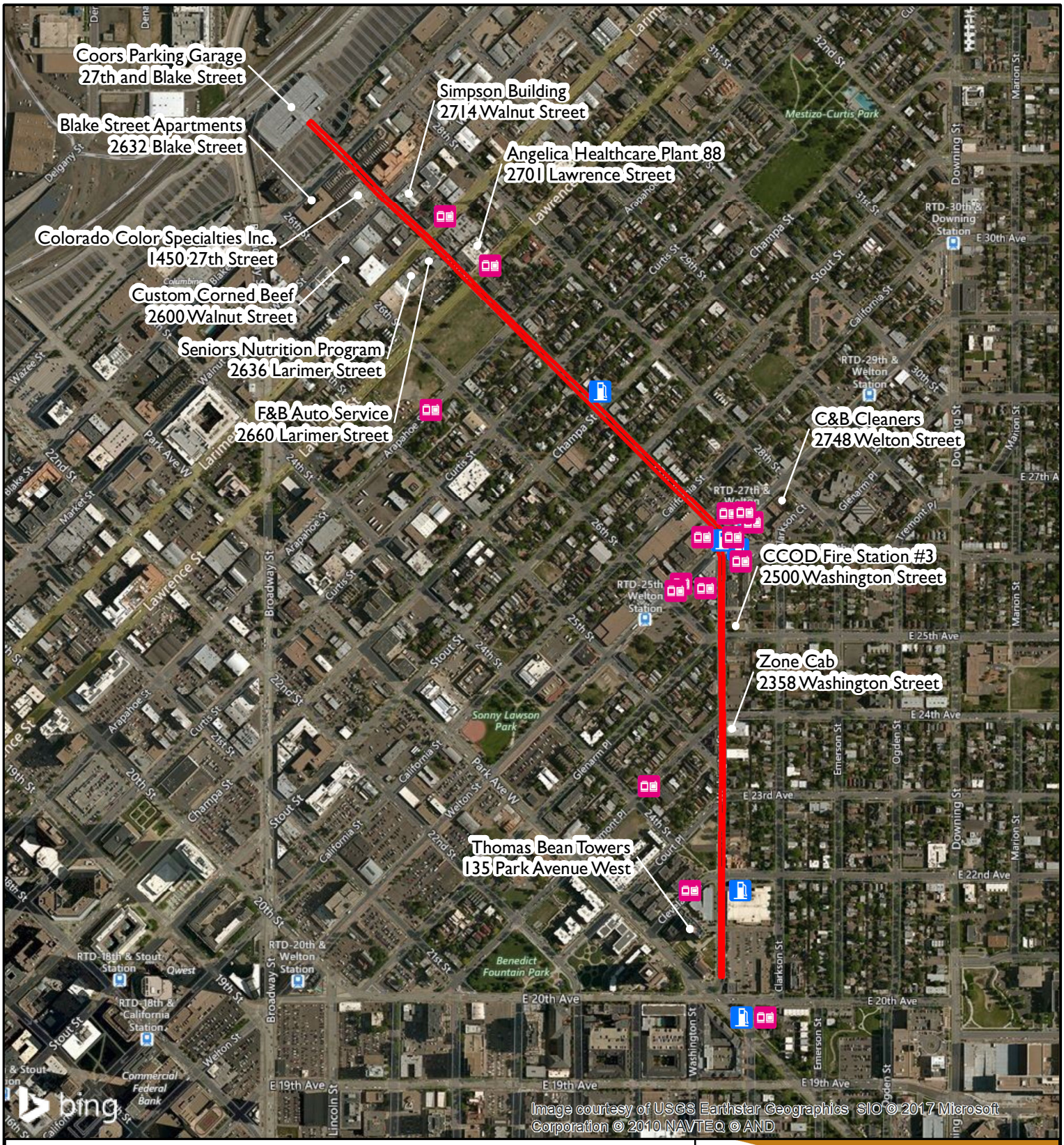


N

## Legend

- Site Boundary
- Historical Dry Cleaner
- Historical Gas Station

0 500 1,000 Feet

Pinyon Environmental, Inc.

**SITE PLAN**

*27th Street Storm Drain Interceptor*
*Denver, Colorado*

| | | |
|---|---|---|
| Site Location: Section 27, 26, 35 T 3S, R 68W, 6th Principal Meridian | Drawn By: SJA | Figure: 2 |
| Pinyon Project Number: 1/17-803-01.3000 | Reviewed By: AMG | Date: 2/16/2017 |

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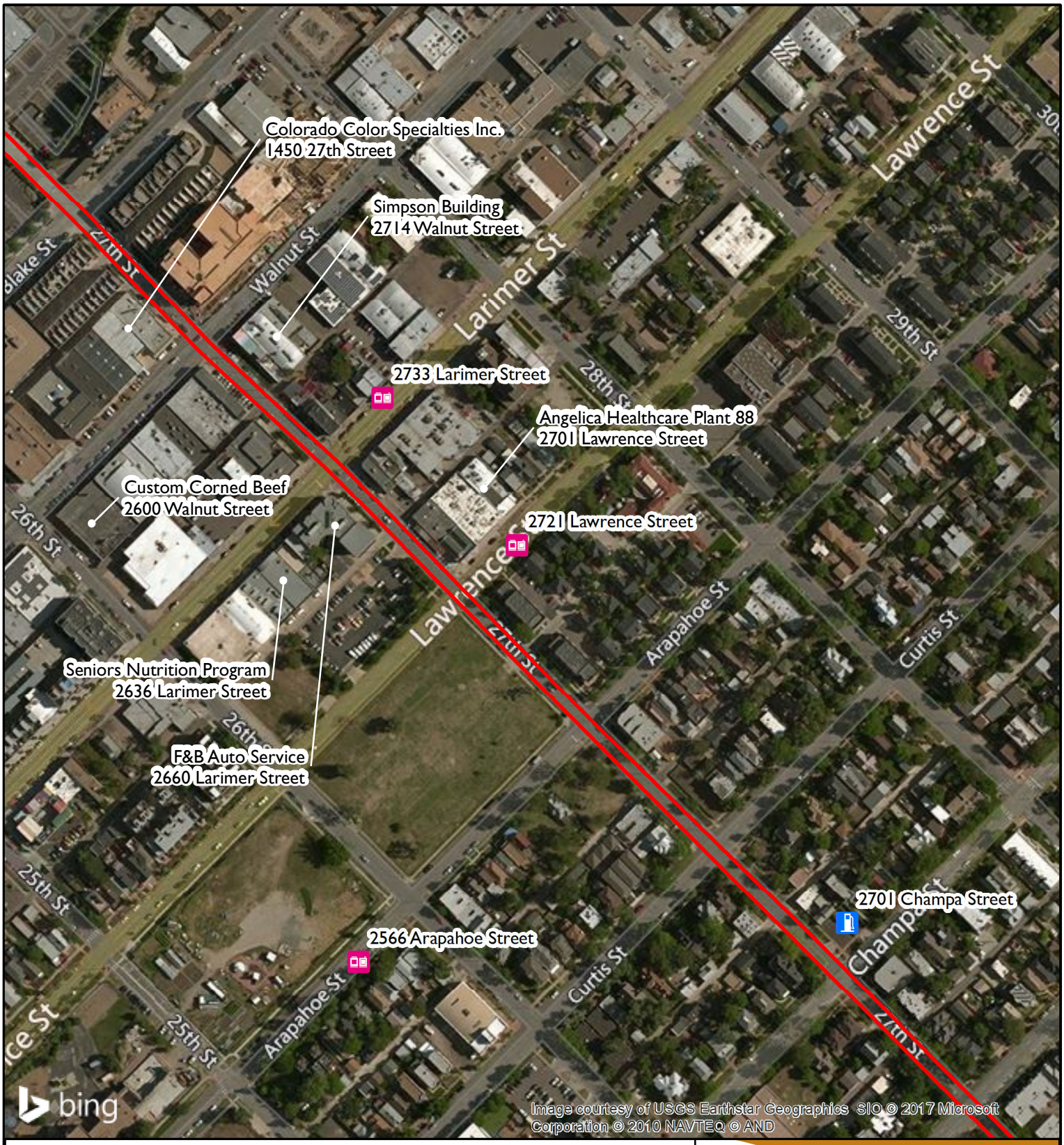


N

## Legend

- Site Boundary
- Historical Dry Cleaner
- Historical Gas Station

0 175 350 Feet

Pinyon Environmental, Inc.

**SITE DETAIL 27th STREET**

*27th Street Storm Drain Interceptor*
*Denver, Colorado*

| | | |
|---|---|---|
| Site Location: Section 27, 26, 35 T 3S, R 68W, 6th Principal Meridian | Drawn By: SJA | Figure: 3 |
| Pinyon Project Number: 1/17-803-01.3000 | Reviewed By: AMG | Date: 2/16/2017 |

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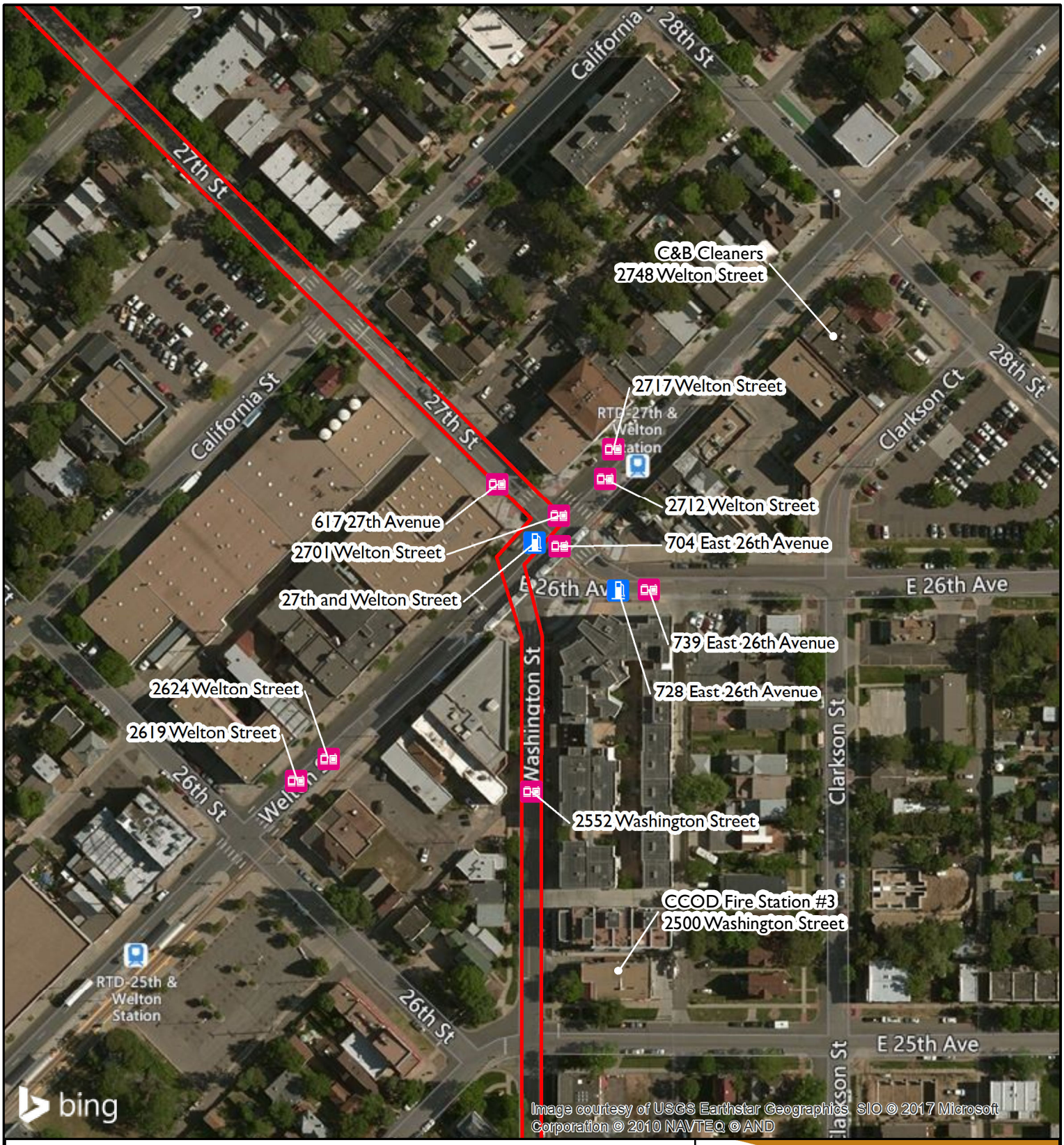


N

## Legend

- Site Boundary
- Historical Dry Cleaner
- Historical Gas Station

0 100 200 Feet

Pinyon Environmental, Inc.

**SITE DETAIL 27th STREET AND WASHINGTON STREET**

*27th Street Storm Drain Interceptor*
*Denver, Colorado*

| | | |
|---|---|---|
| Site Location: Section 27, 26, 35 T 3S, R 68W, 6th Principal Meridian | Drawn By: SJA | Figure: 4 |
| Pinyon Project Number: 1/17-803-01.3000 | Reviewed By: AMG | Date: 2/16/2017 |

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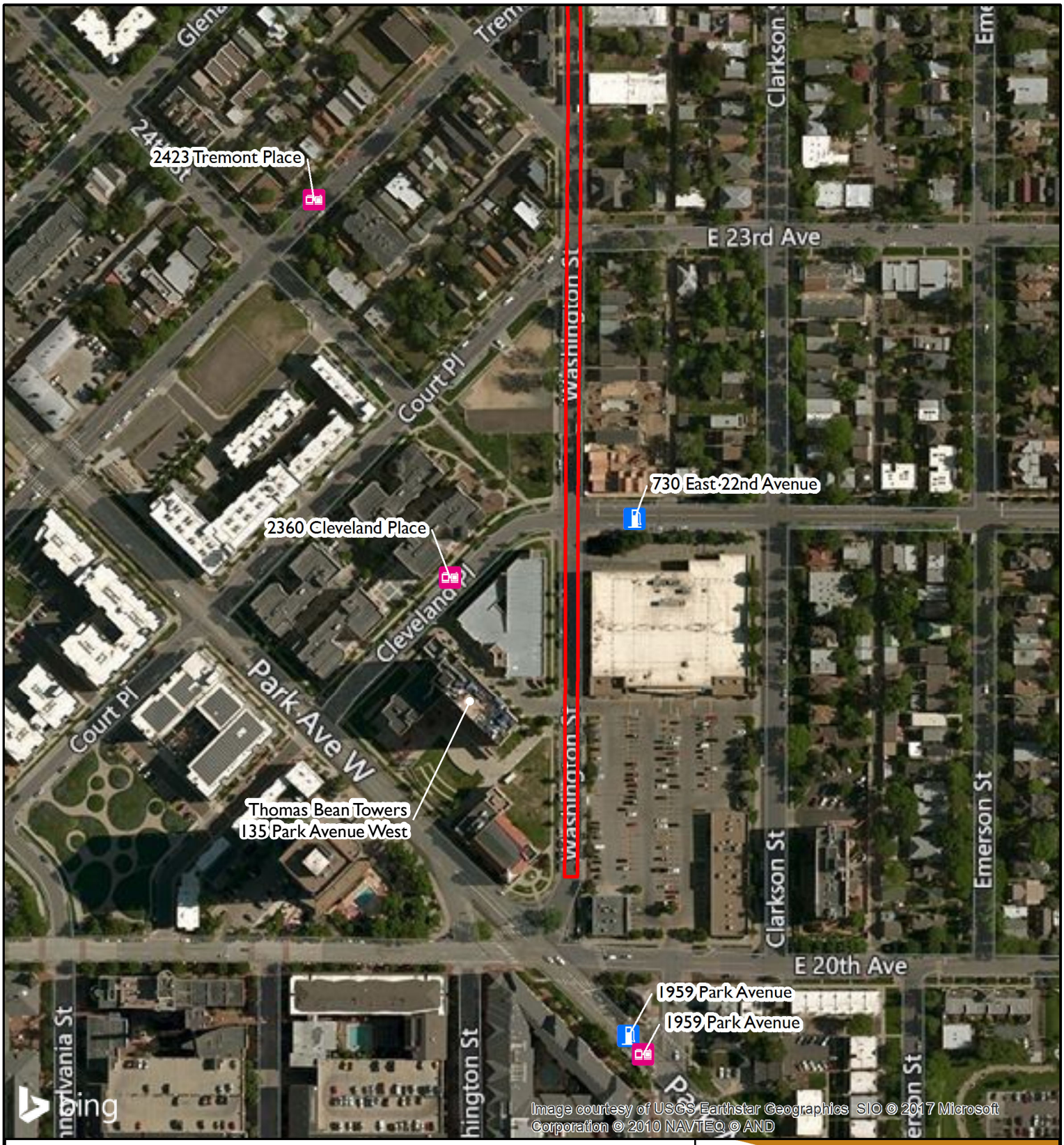


N

## Legend

- Site Boundary
- Historical Dry Cleaner
- Historical Gas Station

0 150 300 Feet

Pinyon Environmental, Inc.

**SITE DETAIL**
**WASHINGTON STREET**

*27th Street Storm Drain Interceptor*
*Denver, Colorado*

| | | |
|---|---|---|
| Site Location: Section 27, 26, 35 T 3S, R 68W, 6th Principal Meridian | Drawn By: SJA | Figure: 5 |
| Pinyon Project Number: 1/17-803-01.3000 | Reviewed By: AMG | Date: 2/16/2017 |

Document Path: \\PINYON10\company2\PROJECTS\2017\11780301 27th Street Storm Drain Interceptor\Limited ESA\Figures\ArcMap\MXDs\PH105_SD.mxd

**Agency Database Report**

GeoSearch

On time. On target. In touch.™

# Radius Report

Satellite view

*Target Property:*

***27th Street Storm Drain Interceptor***
***Denver, Denver County, Colorado 80205***

*Prepared For:*

***Pinyon Environmental Inc***

***Order #: 80161***
***Job #: 173377***
***Project #: 11780301***
***PO #: AMG***
***Date: 01/17/2017***

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## Disclaimer

*This report was designed by GeoSearch to meet or exceed the records search requirements of the All Appropriate Inquiries Rule (40 CFR §312.26) and the current version of the ASTM International E1527, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process or, if applicable, the custom requirements requested by the entity that ordered this report. The records and databases of records used to compile this report were collected from various federal,state and local governmental entities. It is the goal of GeoSearch to meet or exceed the 40 CFR §312.26 and E1527 requirements for updating records by using the best available technology. GeoSearch contacts the appropriate governmental entities on a recurring basis. Depending on the frequency with which a record source or database of records is updated by the governmental entity, the data used to prepare this report may be updated monthly, quarterly, semi-annually, or annually.*

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# Target Property Summary

## Target Property Information

*27th Street Storm Drain Interceptor*
*Denver, Colorado  80205*

***Coordinates***
*Corridor*

***USGS Quadrangle***
*Commerce City, CO*
*Englewood, CO*

## Geographic Coverage Information

***County/Parish:*** Denver (CO)
***ZipCode(s):***
Denver CO: 80202, 80203, 80204, 80205, 80206, 80211, 80216, 80218

***Radon***
* Target property is located in Radon Zone 1.
Zone 1 areas have a predicted average indoor radon screening level greater than 4 pCi/L (picocuries per liter).

# Database Summary

## FEDERAL LISTING

### Standard Environmental Records

| Database | Acronym | Locatable | Unlocatable | Search Radius (miles) |
|---|---|---|---|---|
| RESOURCE CONSERVATION & RECOVERY ACT - NON-GENERATOR | RCRANGR08 | 3 | 0 | TP/AP |
| EMERGENCY RESPONSE NOTIFICATION SYSTEM | ERNSCO | 3 | 0 | 0.1250 |
| NO LONGER REGULATED RCRA GENERATOR FACILITIES | NLRRCRAG | 5 | 0 | 0.1250 |
| RESOURCE CONSERVATION & RECOVERY ACT - GENERATOR | RCRAGR08 | 3 | 0 | 0.1250 |
| FEDERAL ENGINEERING INSTITUTIONAL CONTROL SITES | EC | 0 | 0 | 0.2500 |
| LAND USE CONTROL INFORMATION SYSTEM | LUCIS | 0 | 0 | 0.2500 |
| RCRA SITES WITH CONTROLS | RCRASC | 0 | 0 | 0.2500 |
| BROWNFIELDS MANAGEMENT SYSTEM | BF | 4 | 0 | 0.5000 |
| NO LONGER REGULATED RCRA NON-CORRACTS TSD FACILITIES | NLRRCRAT | 0 | 0 | 0.5000 |
| RESOURCE CONSERVATION & RECOVERY ACT - NON-CORRACTS TREATMENT, STORAGE & DISPOSAL FACILITIES | RCRAT | 0 | 0 | 0.5000 |
| SUPERFUND ENTERPRISE MANAGEMENT SYSTEM | SEMS | 2 | 0 | 0.5000 |
| SUPERFUND ENTERPRISE MANAGEMENT SYSTEM ARCHIVED SITE INVENTORY | SEMSARCH | 6 | 0 | 0.5000 |
| DELISTED NATIONAL PRIORITIES LIST | DNPL | 0 | 0 | 1.0000 |
| NATIONAL PRIORITIES LIST | NPL | 2 | 0 | 1.0000 |
| NO LONGER REGULATED RCRA CORRECTIVE ACTION FACILITIES | NLRRCRAC | 3 | 0 | 1.0000 |
| PROPOSED NATIONAL PRIORITIES LIST | PNPL | 0 | 0 | 1.0000 |
| RESOURCE CONSERVATION & RECOVERY ACT - CORRECTIVE ACTION FACILITIES | RCRAC | 2 | 0 | 1.0000 |
| RESOURCE CONSERVATION & RECOVERY ACT - SUBJECT TO CORRECTIVE ACTION FACILITIES | RCRASUBC | 0 | 0 | 1.0000 |
| SUB-TOTAL | | 33 | 0 | |

### Additional Environmental Records

| Database | Acronym | Locatable | Unlocatable | Search Radius (miles) |
|---|---|---|---|---|
| HAZARDOUS MATERIALS INCIDENT REPORTING SYSTEM | HMIRSR08 | 0 | 0 | 0.1250 |
| TOXICS RELEASE INVENTORY | TRI | 1 | 0 | 0.1250 |
| CLANDESTINE DRUG LABORATORY LOCATIONS | CDL | 0 | 0 | 0.2500 |
| HISTORICAL GAS STATIONS | HISTPST | 0 | 0 | 0.2500 |
| OPEN DUMP INVENTORY | ODI | 0 | 0 | 0.5000 |
| FORMER MILITARY NIKE MISSILE SITES | NMS | 0 | 0 | 1.0000 |
| RECORD OF DECISION SYSTEM | RODS | 2 | 0 | 1.0000 |

# Database Summary

| | | | | |
|---|---|---|---|---|
| SUB-TOTAL | | 3 | 0 | |

# Database Summary

## STATE (CO) LISTING

### Standard Environmental Records

| Database | Acronym | Locatable | Unlocatable | Search Radius (miles) |
|---|---|---|---|---|
| HAZARDOUS WASTE SITES- GENERATOR | HWSG | 2 | 0 | 0.1250 |
| ABOVEGROUND STORAGE TANK FACILITIES | AST | 25 | 0 | 0.2500 |
| ENVIRONMENTAL REAL COVENANTS LIST | COVENANTS | 0 | 0 | 0.2500 |
| UNDERGROUND STORAGE TANK FACILITIES | UST | 40 | 0 | 0.2500 |
| HISTORICAL SOLID WASTE LANDFILLS | HISTSWLF | 9 | 0 | 0.5000 |
| LEAKING STORAGE TANK FACILITIES | LST | 108 | 0 | 0.5000 |
| LEAKING UNDERGROUND STORAGE TANKS TRUST FUND SITES | LUSTTRUST | 2 | 0 | 0.5000 |
| SOLID WASTE FACILITIES | SWF | 5 | 0 | 0.5000 |
| VOLUNTARY CLEANUP AND REDEVELOPMENT PROGRAM SITES | VCRA | 43 | 0 | 0.5000 |
| HAZARDOUS WASTE SITES- CORRECTIVE ACTION | HWSCA | 7 | 0 | 1.0000 |
| SUPERFUND SITES | SF | 2 | 0 | 1.0000 |

| | | | | |
|---|---|---|---|---|
| SUB-TOTAL | | 243 | 0 | |

### Additional Environmental Records

| Database | Acronym | Locatable | Unlocatable | Search Radius (miles) |
|---|---|---|---|---|
| SPILLS LISTING | SPILLS | 7 | 0 | 0.1250 |
| CLANDESTINE DRUG LABORATORY LOCATIONS | CDL | 0 | 0 | 0.2500 |
| DRY CLEANING FACILITIES | CLEANERS | 4 | 0 | 0.5000 |
| HAZARDOUS WASTE SITES- TREATMENT, STORAGE & DISPOSAL | HWSTSD | 0 | 0 | 0.5000 |
| METHANE GAS STUDY SITES | METHANESITES | 0 | 0 | 0.5000 |

| | | | | |
|---|---|---|---|---|
| SUB-TOTAL | | 11 | 0 | |

# Database Summary

## LOCAL LISTING

### Additional Environmental Records

| Database | Acronym | Locatable | Unlocatable | Search Radius (miles) |
|---|---|---|---|---|
| DENVER COUNTY HISTORIC LANDFILLS | DCHISTLF | 7 | 0 | 0.5000 |

| | | | | |
|---|---|---|---|---|
| SUB-TOTAL | | 7 | 0 | |

# Database Summary

## TRIBAL LISTING

### Standard Environmental Records

| Database | Acronym | Locatable | Unlocatable | Search Radius (miles) |
|---|---|---|---|---|
| UNDERGROUND STORAGE TANKS ON TRIBAL LANDS | USTR08 | 0 | 0 | 0.2500 |
| LEAKING UNDERGROUND STORAGE TANKS ON TRIBAL LANDS | LUSTR08 | 0 | 0 | 0.5000 |
| OPEN DUMP INVENTORY ON TRIBAL LANDS | ODINDIAN | 0 | 0 | 0.5000 |

| | | | | |
|---|---|---|---|---|
| SUB-TOTAL | | 0 | 0 | |

| | | | | |
|---|---|---|---|---|
| TOTAL | | 297 | 0 | |

# Database Radius Summary

## FEDERAL LISTING

*Standard environmental records are displayed in **bold**.*

| Acronym | Search Radius (miles) | TP/AP (0 - 0.02) | 1/8 Mile (> TP/AP) | 1/4 Mile (> 1/8) | 1/2 Mile (> 1/4) | 1 Mile (> 1/2) | > 1 Mile | Total |
|---|---|---|---|---|---|---|---|---|
| **RCRANGR08** | **0.0200** | **3** | **NS** | **NS** | **NS** | **NS** | **NS** | **3** |
| **ERNSCO** | **0.1250** | **0** | **3** | **NS** | **NS** | **NS** | **NS** | **3** |
| HMIRSR08 | 0.1250 | 0 | 0 | NS | NS | NS | NS | 0 |
| **NLRRCRAG** | **0.1250** | **0** | **5** | **NS** | **NS** | **NS** | **NS** | **5** |
| **RCRAGR08** | **0.1250** | **1** | **2** | **NS** | **NS** | **NS** | **NS** | **3** |
| TRI | 0.1250 | 0 | 1 | NS | NS | NS | NS | 1 |
| CDL | 0.2500 | 0 | 0 | 0 | NS | NS | NS | 0 |
| **EC** | **0.2500** | **0** | **0** | **0** | **NS** | **NS** | **NS** | **0** |
| HISTPST | 0.2500 | 0 | 0 | 0 | NS | NS | NS | 0 |
| **LUCIS** | **0.2500** | **0** | **0** | **0** | **NS** | **NS** | **NS** | **0** |
| **RCRASC** | **0.2500** | **0** | **0** | **0** | **NS** | **NS** | **NS** | **0** |
| **BF** | **0.5000** | **0** | **1** | **1** | **2** | **NS** | **NS** | **4** |
| **NLRRCRAT** | **0.5000** | **0** | **0** | **0** | **0** | **NS** | **NS** | **0** |
| ODI | 0.5000 | 0 | 0 | 0 | 0 | NS | NS | 0 |
| **RCRAT** | **0.5000** | **0** | **0** | **0** | **0** | **NS** | **NS** | **0** |
| **SEMS** | **0.5000** | **0** | **0** | **0** | **2** | **NS** | **NS** | **2** |
| **SEMSARCH** | **0.5000** | **0** | **1** | **3** | **2** | **NS** | **NS** | **6** |
| **DNPL** | **1.0000** | **0** | **0** | **0** | **0** | **0** | **NS** | **0** |
| **NLRRCRAC** | **1.0000** | **0** | **0** | **0** | **2** | **1** | **NS** | **3** |
| NMS | 1.0000 | 0 | 0 | 0 | 0 | 0 | NS | 0 |
| **NPL** | **1.0000** | **0** | **0** | **0** | **1** | **1** | **NS** | **2** |
| **PNPL** | **1.0000** | **0** | **0** | **0** | **0** | **0** | **NS** | **0** |
| **RCRAC** | **1.0000** | **0** | **0** | **0** | **0** | **2** | **NS** | **2** |
| **RCRASUBC** | **1.0000** | **0** | **0** | **0** | **0** | **0** | **NS** | **0** |
| RODS | 1.0000 | 0 | 0 | 0 | 1 | 1 | NS | 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SUB-TOTAL | | 4 | 13 | 4 | 10 | 5 | 0 | 36 |

# Database Radius Summary

## STATE (CO) LISTING

*Standard environmental records are displayed in **bold**.*

| Acronym | Search Radius (miles) | TP/AP (0 - 0.02) | 1/8 Mile (> TP/AP) | 1/4 Mile (> 1/8) | 1/2 Mile (> 1/4) | 1 Mile (> 1/2) | > 1 Mile | Total |
|---|---|---|---|---|---|---|---|---|
| **HWSG** | **0.1250** | **0** | **2** | **NS** | **NS** | **NS** | **NS** | **2** |
| SPILLS | 0.1250 | 1 | 6 | NS | NS | NS | NS | 7 |
| **AST** | **0.2500** | **3** | **7** | **14** | **NS** | **NS** | **NS** | **24** |
| CDL | 0.2500 | 0 | 0 | 0 | NS | NS | NS | 0 |
| **COVENANTS** | **0.2500** | **0** | **0** | **0** | **NS** | **NS** | **NS** | **0** |
| **UST** | **0.2500** | **6** | **9** | **25** | **NS** | **NS** | **NS** | **40** |
| CLEANERS | 0.5000 | 0 | 2 | 0 | 2 | NS | NS | 4 |
| **HISTSWLF** | **0.5000** | **0** | **0** | **3** | **6** | **NS** | **NS** | **9** |
| HWSTSD | 0.5000 | 0 | 0 | 0 | 0 | NS | NS | 0 |
| **LST** | **0.5000** | **5** | **12** | **24** | **64** | **NS** | **NS** | **105** |
| **LUSTTRUST** | **0.5000** | **0** | **0** | **0** | **2** | **NS** | **NS** | **2** |
| METHANESITES | 0.5000 | 0 | 0 | 0 | 0 | NS | NS | 0 |
| **SWF** | **0.5000** | **0** | **0** | **1** | **4** | **NS** | **NS** | **5** |
| **VCRA** | **0.5000** | **2** | **8** | **12** | **16** | **NS** | **NS** | **38** |
| **HWSCA** | **1.0000** | **0** | **0** | **1** | **2** | **4** | **NS** | **7** |
| **SF** | **1.0000** | **0** | **0** | **0** | **1** | **1** | **NS** | **2** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SUB-TOTAL | | 17 | 46 | 80 | 97 | 5 | 0 | 245 |

# Database Radius Summary

## LOCAL LISTING

*Standard environmental records are displayed in **bold**.*

| Acronym | Search Radius (miles) | TP/AP (0 - 0.02) | 1/8 Mile (> TP/AP) | 1/4 Mile (> 1/8) | 1/2 Mile (> 1/4) | 1 Mile (> 1/2) | > 1 Mile | Total |
|---|---|---|---|---|---|---|---|---|
| DCHISTLF | 0.5000 | 0 | 0 | 2 | 5 | NS | NS | 7 |
| SUB-TOTAL | | 0 | 0 | 2 | 5 | 0 | 0 | 7 |

# Database Radius Summary

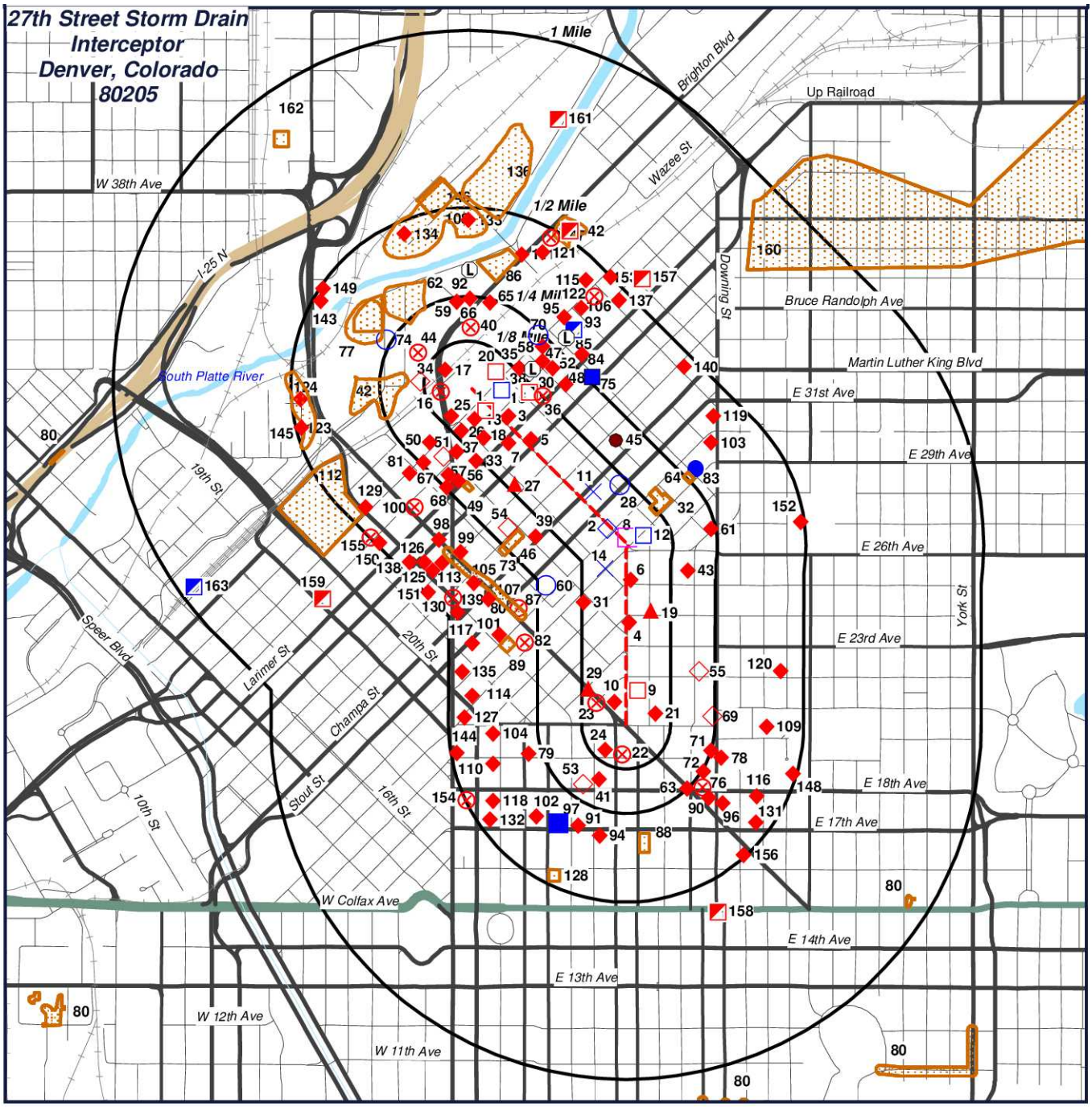
## TRIBAL LISTING

*Standard environmental records are displayed in **bold**.*

| Acronym | Search Radius (miles) | TP/AP (0 - 0.02) | 1/8 Mile (> TP/AP) | 1/4 Mile (> 1/8) | 1/2 Mile (> 1/4) | 1 Mile (> 1/2) | > 1 Mile | Total |
|---|---|---|---|---|---|---|---|---|
| **USTR08** | **0.2500** | **0** | **0** | **0** | **NS** | **NS** | **NS** | **0** |
| **LUSTR08** | **0.5000** | **0** | **0** | **0** | **0** | **NS** | **NS** | **0** |
| **ODINDIAN** | **0.5000** | **0** | **0** | **0** | **0** | **NS** | **NS** | **0** |
| SUB-TOTAL | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | | 21 | 59 | 86 | 112 | 10 | 0 | 288 |

***NOTES:***
***NS = NOT SEARCHED***
***TP/AP = TARGET PROPERTY/ADJACENT PROPERTY***

# Radius Map 1




Target Property (TP)

| | | | | |
|---|---|---|---|---|
| RCRAGR08 | HWSG | SWF | NPL | NLRRCRAC |
| AST | SEMSARCH | HISTSWLF | RODS | HWSCA |
| LST | LST | DCHISTLF | SEMS | SWF |
| RCRANGR08 | UST | BF | SF | RCRAC |
| ERNSCO | VCRA | HWSCA | SEMS | RCRAC |
| NLRRCRAG | NLRRCRAG | AST | HISTSWLF | |
| VCRA | CLEANERS | BF | SEMSARCH | |
| SPILLS | UST | CLEANERS | NLRRCRAC | |

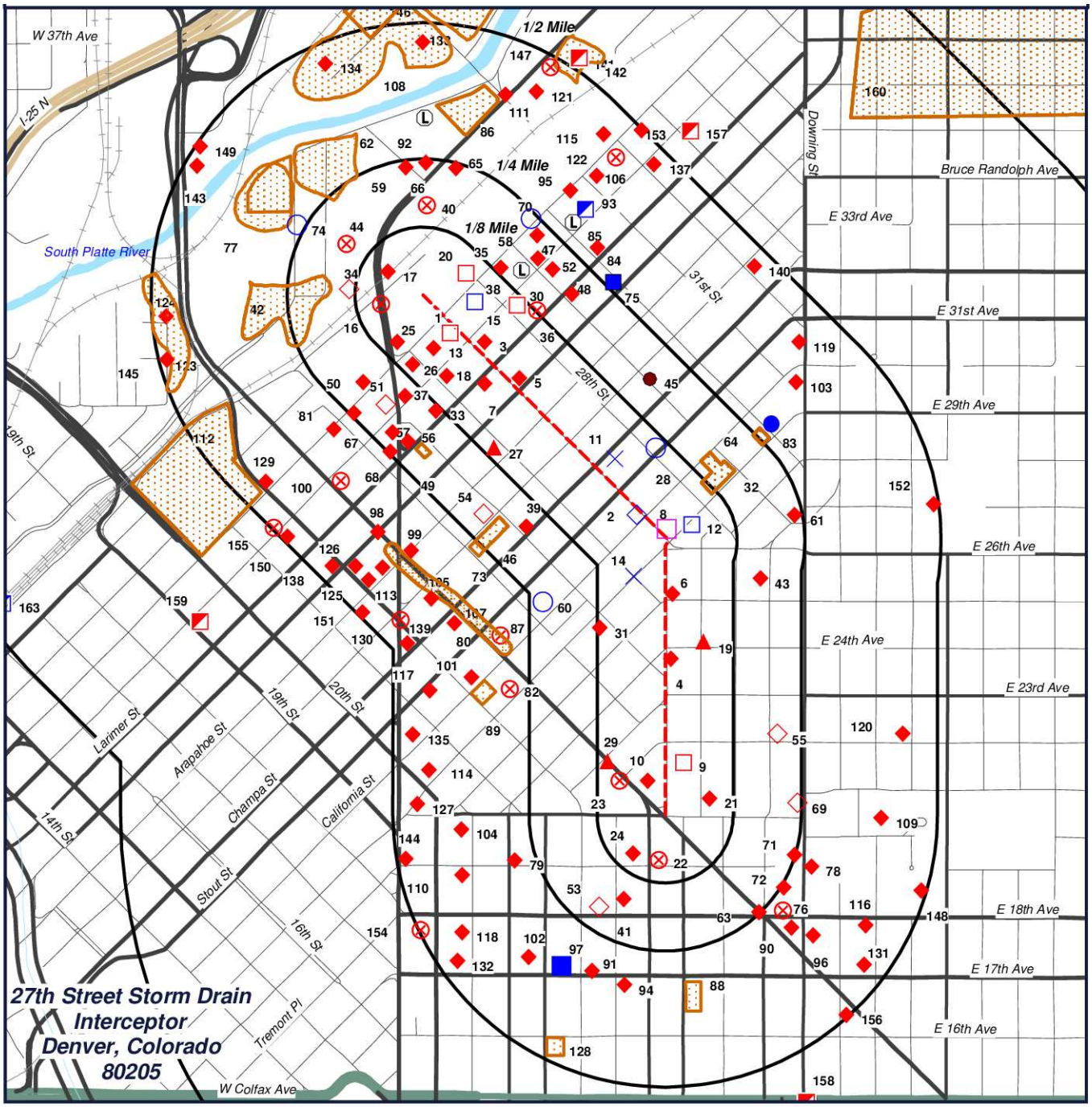
N W E S

0' 1150' 2300' 3450'

SCALE: 1" = 2300'

Click here to access Satellite view

# Radius Map 2




Target Property (TP)

| | | | | |
|---|---|---|---|---|
| RCRAGR08 | HWSG | SWF | NPL | NLRRCRAC |
| AST | SEMSARCH | HISTSWLF | RODS | HWSCA |
| LST | LST | DCHISTLF | SEMS | SWF |
| RCRANGR08 | UST | BF | SF | RCRAC |
| ERNSCO | VCRA | HWSCA | SEMS | RCRAC |
| NLRRCRAG | NLRRCRAG | AST | HISTSWLF | |
| VCRA | CLEANERS | BF | SEMSARCH | |
| SPILLS | UST | CLEANERS | NLRRCRAC | |

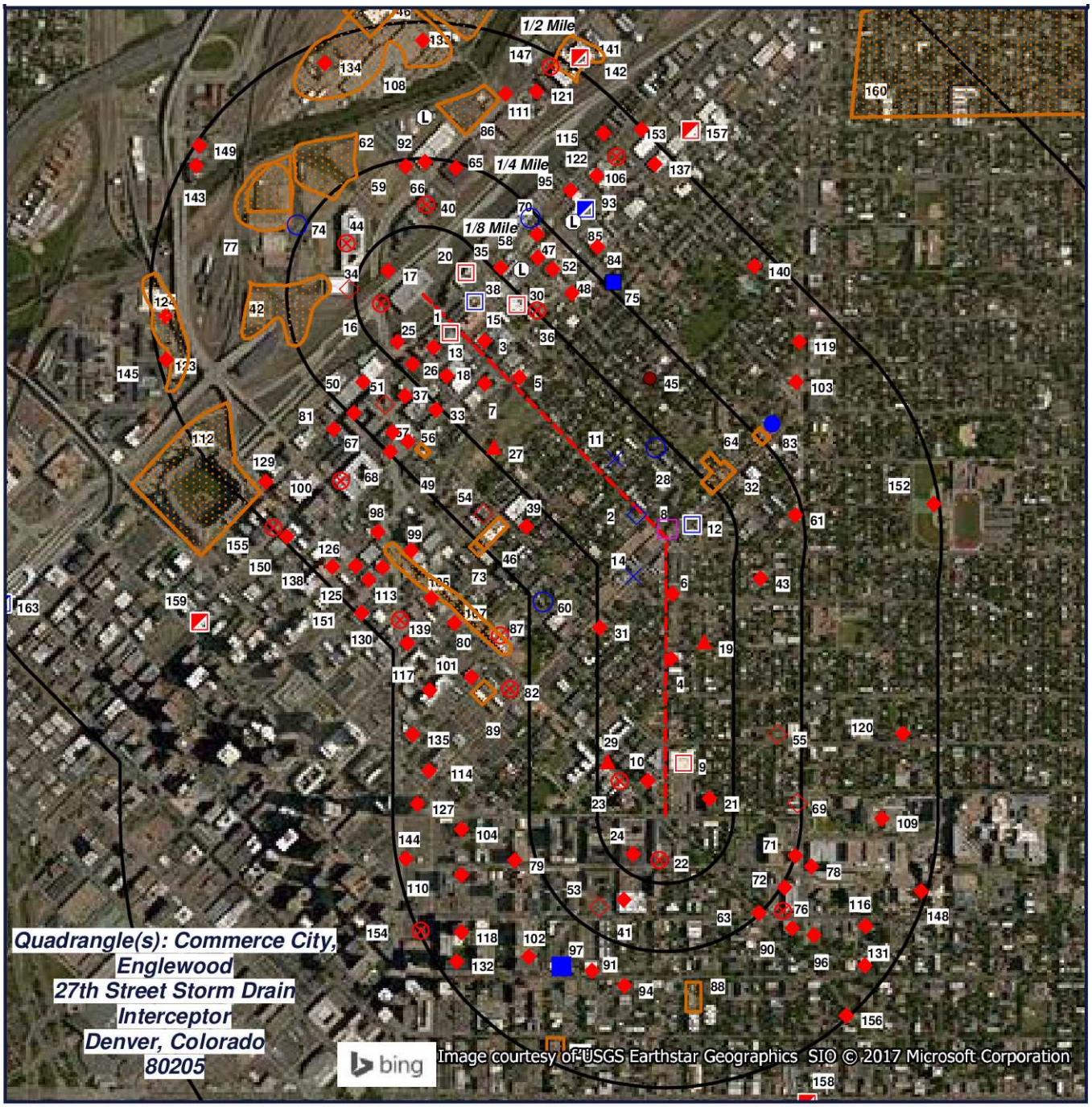
N W E S

0' 750' 1500' 2250'

SCALE: 1" = 1500'

Click here to access Satellite view

# Ortho Map




Target Property (TP)

| | | | | |
|---|---|---|---|---|
| RCRAGR08 | HWSG | SWF | NPL | NLRRCRAC |
| AST | SEMSARCH | HISTSWLF | RODS | HWSCA |
| LST | LST | DCHISTLF | SEMS | SWF |
| RCRANGR08 | UST | BF | SF | RCRAC |
| ERNSCO | VCRA | HWSCA | SEMS | RCRAC |
| NLRRCRAG | NLRRCRAG | AST | HISTSWLF | |
| VCRA | CLEANERS | BF | SEMSARCH | |
| SPILLS | UST | CLEANERS | NLRRCRAC | |

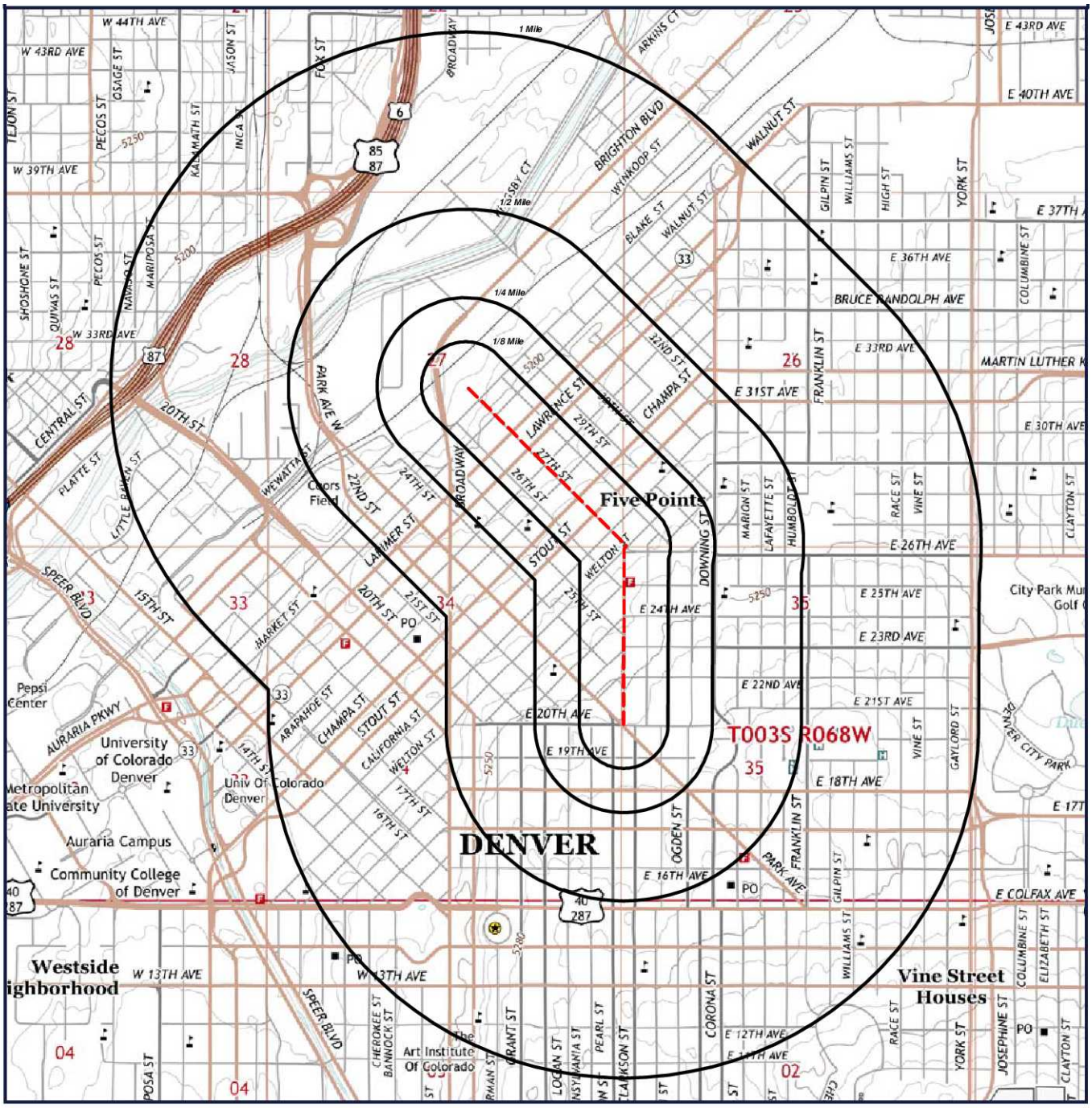
N W E S

0' 750' 1500' 2250'

SCALE: 1" = 1500'

Click here to access Satellite view

# Topographic Map




Target Property (TP)

***Quadrangle(s): Commerce City, Englewood***
***Source: USGS, 08/08/2013***
***27th Street Storm Drain Interceptor***
***Denver, Colorado***
***80205***

N
W E
S

0' 1150' 2300' 3450'
SCALE: 1" = 2300'

[Click here to access Satellite view]

# Located Sites Summary

*NOTE: Standard environmental records are displayed in **bold**.*

| Map ID# | Database Name | Site ID# | Distance From Site | Site Name | Address | PAGE # |
|---|---|---|---|---|---|---|
| 1 | VCRA | 140714-1 | 0.01 mi. NW (53 ft.) | COORS PARKING GARAGE II | 27TH AND BLAKE ST., DENVER, CO 80202 | 27 |
| 1 | VCRA | 121012-1 | 0.01 mi. NW (53 ft.) | COORS PARKING GARAGE | 27TH AND BLAKE STREET, DENVER, CO 80202 | 28 |
| 1 | RCRAGR08 | COR000216093 | 0.02 mi. W (106 ft.) | COLORADO COLOR SPECIALTIES INC | 1450 27TH ST, DENVER, CO 80205 | 29 |
| 1 | SPILLS | 2009-0189 | 0.01 mi. NW (53 ft.) | | ON 27TH NEAR THE INTERSECTION WITH BLAKE ST., DENVER, CO 80205 | 31 |
| 2 | AST | 16849AST | 0.01 mi. SW (53 ft.) | DEEP ROCK WATER | 2653 CALIFORNIA, DENVER, CO 80205 | 32 |
| 3 | LST | 13147LST | 0.02 mi. NE (106 ft.) | SIMPSON BUILDING | 2714 WALNUT ST, DENVER, CO 80205 | 33 |
| 3 | UST | 5437 | 0.02 mi. NE (106 ft.) | UNKNOWN | 2714 WALNUT, DENVER, CO 80205 | 34 |
| 3 | UST | 6118 | 0.02 mi. NE (106 ft.) | SIMPSON BUILDING | 2714-2718 WALNUT ST, DENVER, CO 80205 | 35 |
| 3 | AST | 13147AST | 0.02 mi. NE (106 ft.) | SIMPSON BUILDING | 2714 WALNUT ST, DENVER, CO 80205 | 36 |
| 4 | LST | 4226LST | 0.02 mi. SE (106 ft.) | ZONE CAB | 2358 WASHINGTON ST, DENVER, CO 80205 | 37 |
| 4 | UST | 4226 | 0.02 mi. SE (106 ft.) | ZONE CAB | 2358 WASHINGTON ST, DENVER, CO 80205 | 38 |
| 4 | RCRANGR08 | COR000011791 | 0.02 mi. SE (106 ft.) | ZONE CAB | 2358 WASHINGTON, DENVER, CO 80205 | 39 |
| 4 | LST | 7129EVENTID | 0.02 mi. SE (106 ft.) | | 2358 WASHINGTON, DENVER, CO 80205 | 41 |
| 5 | LST | 8461LST | 0.02 mi. N (106 ft.) | ANGELICA HEALTHCARE PLANT 88 | 2701 LAWRENCE ST, DENVER, CO 80205 | 42 |
| 5 | UST | 8461 | 0.02 mi. N (106 ft.) | ANGELICA HEALTHCARE PLANT 88 | 2701 LAWRENCE ST, DENVER, CO 80205 | 43 |
| 5 | RCRANGR08 | COD031963010 | 0.02 mi. N (106 ft.) | CITY-ELITE LAUNDRY CO | 2701 LAWRENCE ST, DENVER, CO 80205 | 44 |
| 5 | AST | 10174AST | 0.02 mi. N (106 ft.) | ANGELICA HEALTHCARE #8 PLANT | 2701 LAWRENCE ST, DENVER, CO 80205 | 46 |
| 6 | UST | 8812 | 0.02 mi. SE (106 ft.) | CCOD FIRE STATION #3 | 2500 WASHINGTON ST, DENVER, CO 80205 | 47 |
| 6 | LST | 8812LST | 0.02 mi. SE (106 ft.) | CCOD FIRE STATION #3 | 2500 WASHINGTON, DENVER, CO 80205 | 48 |
| 7 | UST | 10739 | 0.04 mi. W (211 ft.) | SENIORS NUTRITION PROGRAM | 2636 LARIMER ST, DENVER, CO 80205 | 49 |
| 7 | UST | 8307 | 0.02 mi. W (106 ft.) | F & B AUTO SERVICE | 2660 LARIMER ST, DENVER, CO 80205 | 50 |
| 7 | RCRAGR08 | COR000012799 | 0.04 mi. W (211 ft.) | VOLUNTEERS OF AMERICA NSD DIV | 2636 LARIMER ST, DENVER, CO 80205 | 51 |
| 7 | LST | 10739LST | 0.04 mi. W (211 ft.) | SENIORS NUTRITION PROGRAM | 2636 LARIMER ST, DENVER, CO 80205 | 53 |
| 8 | RCRANGR08 | COD037443389 | 0.02 mi. N (106 ft.) | COLORADO NATIONAL BANK | 2701 WELTON, DENVER, CO 80205 | 54 |

# Located Sites Summary

| | | | | | | |
|---|---|---|---|---|---|---|
| 9 | ERNSCO | 1123028 | 0.04 mi. SE (211 ft.) | | 757 EAST 20TH AVE, DENVER, CO | 56 |
| 9 | RCRAGR08 | COR000234898 | 0.04 mi. SE (211 ft.) | SAFEWAY STORE #2246 | 757 E 20TH AVE, DENVER, CO 80205 | 57 |
| 9 | SPILLS | 2015-0447 | 0.04 mi. SE (211 ft.) | | 757 E. 20TH AVE, DENVER, CO 80205 | 59 |
| 10 | UST | 704 | 0.04 mi. SW (211 ft.) | THOMAS BEAN TOWERS | 135 PARK AVE W, DENVER, CO 80205 | 60 |
| 10 | LST | 704LST | 0.04 mi. SW (211 ft.) | THOMAS BEAN TOWERS | 135 PARK AVE WEST, DENVER, CO 80205 | 61 |
| 11 | ERNSCO | 132531 | 0.04 mi. NE (211 ft.) | | 2724 CHAMPA ST, DENVER, CO | 62 |
| 12 | NLRRCRAG | CO0000083899 | 0.06 mi. NE (317 ft.) | C & B CLEANERS | 2748 WELTON ST, DENVER, CO 80205 | 63 |
| 12 | CLEANERS | 031-1163CL | 0.06 mi. NE (317 ft.) | C & B CLEANERS | 2748 WELTON ST, DENVER, CO 80205 | 65 |
| 13 | LST | 17753LST | 0.06 mi. SW (317 ft.) | BLAKE STREET APARTMENTS | 2632 BLAKE ST, DENVER, CO 80202 | 66 |
| 13 | UST | 17753 | 0.06 mi. SW (317 ft.) | BLAKE STREET APARTMENTS | 2632 BLAKE ST, DENVER, CO 80202 | 67 |
| 13 | AST | 17753AST | 0.06 mi. SW (317 ft.) | BLAKE STREET APARTMENTS | 2632 BLAKE ST, DENVER, CO 80202 | 68 |
| 14 | ERNSCO | 1148696 | 0.06 mi. W (317 ft.) | | 26TH STREET AND WELTON STREET, DENVER, CO | 69 |
| 15 | NLRRCRAG | COR000220590 | 0.07 mi. N (370 ft.) | A R WILFLEY AND SONS INC | 2750 BLAKE ST, DENVER, CO 80205 | 70 |
| 16 | VCRA | 001005-1 | 0.07 mi. W (370 ft.) | JEFFERSON @ GATEWAY I | SE CORNER, 29TH & BROADWAY, DENVER, CO 80221 | 72 |
| 16 | VCRA | 020211-1 | 0.08 mi. W (422 ft.) | JEFFERSON @ GATEWAY II | 2800 BROADWAY, DENVER, CO | 73 |
| 17 | LST | 14142LST | 0.08 mi. NW (422 ft.) | ABANDONED UST | 2868 S BROADWAY, DENVER, CO 80216 | 74 |
| 17 | AST | 14142AST | 0.08 mi. NW (422 ft.) | ABANDONED UST | 2868 S BROADWAY, DENVER, CO 80216 | 75 |
| 18 | LST | 12562LST | 0.08 mi. SW (422 ft.) | CUSTOM CORNED BEEF | 2600 WALNUT ST, DENVER, CO 80205 | 76 |
| 18 | SPILLS | 2007-0052 | 0.1 mi. SW (528 ft.) | | 26TH & WALNUT (IN THE ALLEY), DENVER, CO | 77 |
| 18 | UST | 2712 | 0.08 mi. SW (422 ft.) | CUSTOM CORNED BEEF | 2600 WALNUT, DENVER, CO 80205 | 78 |
| 18 | VCRA | 140224-1 | 0.08 mi. W (422 ft.) | DENVER CENTER THEATRE | 2601 LARIMER STREET, DENVER, CO 80205 | 79 |
| 18 | AST | 12562AST | 0.08 mi. SW (422 ft.) | CUSTOM CORNED BEEF | 2600 WALNUT ST, DENVER, CO 80205 | 80 |
| 19 | SPILLS | CO93-374 | 0.08 mi. SE (422 ft.) | | 350 W. 23RD, DENVER, CO | 81 |
| 20 | NLRRCRAG | COD007078363 | 0.09 mi. NE (475 ft.) | A R WILFLEY AND SONS INC | 2763 BLAKE ST, DENVER, CO 80205 | 82 |
| 20 | TRI | 80205RWLFL2763B | 0.09 mi. NE (475 ft.) | A R WILFLEY & SONS INC | 2763 BLAKE ST, DENVER, CO 80205 | 84 |
| 20 | HWSG | COD007078363 | 0.09 mi. NE (475 ft.) | WILFLEY A R & SONS INC | 2763 BLAKE ST, DENVER, CO 80205 | 86 |

# Located Sites Summary

| | | | | | | |
|---|---|---|---|---|---|---|
| 21 | LST | 13743LST | 0.09 mi. E (475 ft.) | CITY MAINTENANCE SHOP | 2024 CLARKSON ST, DENVER, CO 80205 | 87 |
| 21 | UST | 702 | 0.09 mi. E (475 ft.) | BARNEY FORD HEIGHTS | 2024 CLARKSON ST, DENVER, CO 80205 | 88 |
| 21 | AST | 13743AST | 0.09 mi. E (475 ft.) | CITY MAINTENANCE SHOP | 2024 CLARKSON ST, DENVER, CO 80205 | 89 |
| 22 | VCRA | 070424-1 | 0.09 mi. S (475 ft.) | MARTIN FEIN INTERESTS | 1900 WASHINGTON STREET, DENVER, CO | 90 |
| 23 | BF | 120399 | 0.09 mi. W (475 ft.) | PARK AVENUE REDEVELOPMENT | 240 PARK AVENUE WEST, DENVER, CO 80205 | 91 |
| 23 | VCRA | 100617-1 | 0.09 mi. W (475 ft.) | DENVER HOUSING GAS STATION | 240 PARK AVENUE WEST, DENVER, CO 80205 | 92 |
| 24 | LST | 13856LST | 0.1 mi. SW (528 ft.) | | 601 E 19TH AVE, DENVER, CO 80203 | 93 |
| 24 | UST | 6655 | 0.1 mi. SW (528 ft.) | ST LUKES HOSPITAL | 601 E 19TH AVE, DENVER, CO 80203 | 94 |
| 24 | VCRA | 970228-1 | 0.1 mi. SW (528 ft.) | ST LUKES HOSPITAL | 601 E 19 AVE, DENVER, CO 80203 | 95 |
| 24 | AST | 13856AST | 0.1 mi. SW (528 ft.) | ST LUKES HOSPITAL | 601 E 19TH AVE, DENVER, CO 80203 | 96 |
| 25 | LST | 13678LST | 0.1 mi. SW (528 ft.) | BURLINGTON NORTHERN RAILYARD | 2565 BLAKE ST, DENVER, CO 80205 | 97 |
| 25 | AST | 13678AST | 0.1 mi. SW (528 ft.) | BURLINGTON NORTHERN RAILYARD | 2565 BLAKE ST, DENVER, CO 80205 | 98 |
| 26 | LST | 13652LST | 0.11 mi. SW (581 ft.) | CCOD | 2564 BLAKE ST, DENVER, CO 80205 | 99 |
| 26 | AST | 13652AST | 0.11 mi. SW (581 ft.) | CCOD | 2564 BLAKE ST, DENVER, CO 80205 | 100 |
| 27 | SPILLS | CO90-187 | 0.11 mi. SW (581 ft.) | | 1116 26TH ST, DENVER, CO | 101 |
| 28 | SEMSARCH | COD983768359 | 0.11 mi. NE (581 ft.) | STOUT STREET DRUMS | 2801 STOUT STREET, DENVER, CO 80202 | 102 |
| 28 | SPILLS | CO90-162 | 0.11 mi. NE (581 ft.) | | 2801, 05, 11 STOUT ST, DENVER, CO | 103 |
| 29 | SPILLS | 2011-0441 | 0.11 mi. W (581 ft.) | | DHA BLOCK5, 290 PARK AVE WEST, DENVER, CO | 104 |
| 30 | LST | 5234LST | 0.12 mi. NE (634 ft.) | GOLD STAR SAUSAGE CO | 2800 WALNUT ST, DENVER, CO 80205 | 105 |
| 30 | UST | 5234 | 0.12 mi. NE (634 ft.) | GOLD STAR SAUSAGE CO | 2800 WALNUT ST, DENVER, CO 80205 | 106 |
| 30 | NLRRCRAG | COD983796194 | 0.12 mi. NE (634 ft.) | GOLD STAR SAUSAGE COMPANY | 2800 WALNUT ST, DENVER, CO 80205 | 107 |
| 30 | HWSG | COD983796194 | 0.12 mi. NE (634 ft.) | GOLD STAR SAUSAGE COMPANY | 2800 WALNUT STREET, DENVER, CO 80205 | 109 |
| 31 | UST | 9512 | 0.12 mi. W (634 ft.) | COASTAL MART #1222 | 2460 WELTON ST, DENVER, CO 80205 | 110 |
| 31 | VCRA | 150520-1 | 0.12 mi. W (634 ft.) | 2560 WELTON LLC | 2430-2560 WELTON ST., DENVER, CO 80246 | 111 |
| 31 | LST | 9512LST | 0.12 mi. W (634 ft.) | COASTAL MART #1222 | 2460 WELTON ST, DENVER, CO 80205 | 112 |
| 32 | LST | 5035LST | 0.12 mi. NE (634 ft.) | LAUNDRY SERVICES | 2863 WELTON ST, DENVER, CO 80205 | 113 |

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|---|---|---|---|---|---|---|
| 32 | UST | 5035 | 0.12 mi. NE (634 ft.) | LAUNDRY SERVICES | 2863 WELTON ST, DENVER, CO 80205 | 114 |
| 32 | VCRA | 140612-1 | 0.12 mi. NE (634 ft.) | MARKEL HOMES | 2821-2843 WELTON ST., DENVER, CO 80205 | 115 |
| 32 | NLRRCRAG | CO0001014984 | 0.12 mi. NE (634 ft.) | LEAVE IT TO US LAUNDRY & CLEANERS | 2863 WELTON ST, DENVER, CO 80205 | 116 |
| 32 | CLEANERS | 031-1642CL | 0.12 mi. NE (634 ft.) | LAUNDRY SVCS INC | 2863 WELTON ST, DENVER, CO 80205 | 118 |
| 33 | UST | 4573 | 0.14 mi. SW (739 ft.) | BENJAMIN MOORE & CO | 2555 LARIMER ST, DENVER, CO 80201 | 119 |
| 33 | LST | 4573LST | 0.14 mi. SW (739 ft.) | BENJAMIN MOORE & CO | 2555 LARIMER ST, DENVER, CO 80205 | 120 |
| 34 | UST | 1972 | 0.14 mi. W (739 ft.) | GREYHOUND LINES INC | 2901 BROADWAY, DENVER, CO 80216 | 121 |
| 35 | UST | 194 | 0.14 mi. NE (739 ft.) | A R WILFLEY AND SONS | 2850 BLAKE ST, DENVER, CO 80205 | 122 |
| 35 | VCRA | 160407-1 | 0.14 mi. NE (739 ft.) | 2840 BLAKE ST. | 2840 BLAKE ST., DENVER, CO 80205 | 123 |
| 35 | LST | 194LST | 0.14 mi. NE (739 ft.) | A R WILFLEY AND SONS | 2850 BLAKE ST, DENVER, CO 80205 | 124 |
| 36 | VCRA | 080228-1 | 0.14 mi. NE (739 ft.) | TOTAL LONGTERM CARE | 2819 LARIMER STREET, DENVER, CO 80205 | 125 |
| 37 | LST | 15108LST | 0.16 mi. SW (845 ft.) | INTERSECTION OF WALNUT ST & BROADWAY | 2519 WALNUT ST, DENVER, CO 80202 | 126 |
| 37 | VCRA | 030814-1 | 0.18 mi. SW (950 ft.) | BENJAMIN MOORE PAINT | 2500 WALNUT STREET, DENVER, CO 80205 | 127 |
| 37 | SEMSARCH | COD007068372 | 0.18 mi. SW (950 ft.) | BENJAMIN MOORE & CO | 2500 WALNUT, DENVER, CO 80205 | 128 |
| 37 | AST | 15108AST | 0.16 mi. SW (845 ft.) | INTERSECTION OF WALNUT ST & BROADWAY | 2519 WALNUT ST, DENVER, CO 80202 | 129 |
| 38 | SWF | 1208WTR | 0.17 mi. NE (898 ft.) | ERICO MOTORSPORTS | 2855 WALNUT ST, DENVER, CO 80205 | 130 |
| 39 | UST | 15052 | 0.17 mi. SW (898 ft.) | ERROL CEROVSKI | 2501 CHAMPA ST, DENVER, CO 80205 | 131 |
| 39 | LST | 15052LST | 0.17 mi. SW (898 ft.) | ERROL CEROVSKI | 2501 CHAMPA ST, DENVER, CO 80205 | 132 |
| 40 | VCRA | 060601-1 | 0.17 mi. N (898 ft.) | DENARGO MARKET | SW CORNER OF 29TH ST., AND BRIGHTON BLVD., DENVER, CO 80216 | 133 |
| 40 | VCRA | 130328-1 | 0.17 mi. N (898 ft.) | DENARGO MARKET ROADWAYS AND UTILITIES | SW CORNER OF 29TH ST., AND BRIGHTON BLVD., DENVER, CO 80216 | 134 |
| 41 | AST | 19378AST | 0.18 mi. SW (950 ft.) | LEVEL 3 COMMUNICATIONS - DNVTCO56 | 1850 PEARL ST, DENVER, CO 80203 | 135 |
| 41 | LST | 11934LST | 0.18 mi. SW (950 ft.) | MCI TELECOMMUNICATIONS | 601 E 18TH AVE, DENVER, CO 80203 | 136 |
| 41 | AST | 11934AST | 0.18 mi. SW (950 ft.) | MCI TELECOMMUNICATIONS | 601 E 18TH AVE, DENVER, CO 80203 | 137 |
| 42 | HISTSWLF | 00070-0001202 | 0.18 mi. W (950 ft.) | 2900 N. BROADWAY | 2900 N.BROADWAY, DENVER, CO 80205 | 138 |

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|---|---|---|---|---|---|---|
| 42 | HISTSWLF | 00070-0000638 | 0.18 mi. W (950 ft.) | ARTIFICIAL FILL | FROM RR TRACKS ON WEST TO DENARGO MARKET, SOUTH TO UPRR AND SLIG, DENVER, CO 80216 | 139 |
| 42 | DCHISTLF | 93 | 0.18 mi. W (950 ft.) | 3S-68W-27SW2 | SEE REFERENCED SITE # ON FIGURE | 140 |
| 43 | UST | 16047 | 0.18 mi. E (950 ft.) | PIPKIN MORTUARY | 2531 OGDEN ST, DENVER, CO 80205 | 141 |
| 43 | LST | 16047LST | 0.18 mi. E (950 ft.) | PIPKIN MORTUARY | 2531 OGDEN ST, DENVER, CO 80205 | 142 |
| 44 | VCRA | 130104-1 | 0.18 mi. NW (950 ft.) | YARDS AT DENARGO MARKET | 2797 WEWATTA WAY, LOT1, BLOCK 3, DENVER, CO 80216 | 143 |
| 45 | BF | 138663 | 0.19 mi. NE (1003 ft.) | CURTIS PARK COMMUNITY CENTER AND ADMIN BUILDING | 929 29TH ST, DENVER, CO 80205 | 144 |
| 46 | LST | 6841LST | 0.2 mi. SW (1056 ft.) | GREYHOUND LINES INC | 2450 CURTIS ST, DENVER, CO 80205 | 146 |
| 46 | UST | 6841 | 0.2 mi. SW (1056 ft.) | GREYHOUND LINES INC | 2450 CURTIS ST, DENVER, CO 80205 | 147 |
| 46 | HWSCA | COD980958904 | 0.2 mi. SW (1056 ft.) | GREYHOUND LINES INC | 2450 CURTIS, DENVER, CO 80205 | 148 |
| 47 | UST | 3077 | 0.2 mi. NE (1056 ft.) | REPUBLIC NATIONAL BANK | 2901 WALNUT ST, DENVER, CO 80205 | 149 |
| 47 | LST | 3077LST | 0.2 mi. NE (1056 ft.) | REPUBLIC NATIONAL BANK | 2901 WALNUT ST, DENVER, CO 80205 | 150 |
| 48 | LST | 2041LST | 0.2 mi. NE (1056 ft.) | MILE HIGH AUTO | 2903 LARIMER ST, DENVER, CO 80205 | 151 |
| 48 | LST | 17775LST | 0.2 mi. NE (1056 ft.) | ORIGINAL VENETIAN BLIND LAUNDRY COMPANY | 2900 LARIMER ST, DENVER, CO 80205 | 152 |
| 48 | UST | 17775 | 0.2 mi. NE (1056 ft.) | ORIGINAL VENETIAN BLIND LAUNDRY COMPANY | 2900 LARIMER ST, DENVER, CO 80205 | 153 |
| 48 | UST | 2041 | 0.2 mi. NE (1056 ft.) | MILE HIGH AUTO | 2903 LARIMER ST, DENVER, CO 80205 | 154 |
| 48 | VCRA | 160613-1 | 0.23 mi. NE (1214 ft.) | 2929 LARIMER ST. | 2929, 2937, 2945, & 2951 LARIMER ST, DENVER, CO 80205 | 155 |
| 48 | AST | 17775AST | 0.2 mi. NE (1056 ft.) | ORIGINAL VENETIAN BLIND LAUNDRY COMPANY | 2900 LARIMER ST, DENVER, CO 80205 | 156 |
| 49 | UST | 18833 | 0.2 mi. SW (1056 ft.) | COMMERCIAL WAREHOUSE BUILDING | 2450 LARIMER ST, DENVER, CO 80205 | 157 |
| 49 | LST | 18833LST | 0.2 mi. SW (1056 ft.) | COMMERCIAL WAREHOUSE BUILDING | 2450 LARIMER STREET, DENVER, CO 80205 | 158 |
| 50 | UST | 15388 | 0.2 mi. SW (1056 ft.) | BALL PARK LOFTS | 2465 BLAKE ST, DENVER, CO 80205 | 159 |
| 50 | LST | 15388LST | 0.2 mi. SW (1056 ft.) | BALL PARK LOFTS | 2465 BLAKE STREET, DENVER, CO 80205 | 160 |
| 51 | UST | 15426 | 0.2 mi. SW (1056 ft.) | UNKNOWN | 1451 24TH ST, DENVER, CO 80202 | 161 |
| 52 | LST | 734LST | 0.21 mi. NE (1109 ft.) | THREEWIT - COOPER CEMENT CO | 2900 WALNUT ST, DENVER, CO 80205 | 162 |

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|---|---|---|---|---|---|---|
| 52 | UST | 734 | 0.21 mi. NE (1109 ft.) | THREEWIT - COOPER CEMENT CO | 2900 WALNUT ST, DENVER, CO 80205 | 163 |
| 52 | AST | 734AST | 0.21 mi. NE (1109 ft.) | THREEWIT - COOPER CEMENT CO | 2900 WALNUT ST, DENVER, CO 80205 | 164 |
| 53 | UST | 5486 | 0.21 mi. SW (1109 ft.) | RESOLUTION TRUST CORP PROPERTY | PEARL & PENNSLYVANIA 18TH & 19TH, DENVER, CO 80203 | 165 |
| 54 | UST | 9824 | 0.21 mi. SW (1109 ft.) | DENVER CURTIS PARK CENTRAL OFFICE | 2485 CURTIS ST, DENVER, CO 80205 | 166 |
| 55 | UST | 8077 | 0.21 mi. E (1109 ft.) | REMAX SOUTHEAST INC | CORNER LOT 2202 OR 2216 OGDEN ST, DENVER, CO 80205 | 167 |
| 56 | LST | 15461LST | 0.22 mi. SW (1162 ft.) | NE CORNER OF LARIMER & BROADWA | 2445 LARIMER ST, DENVER, CO 80202 | 168 |
| 56 | UST | 18311 | 0.22 mi. SW (1162 ft.) | ABANDONED TANK | 2452 BROADWAY ST, DENVER, CO 80223 | 169 |
| 56 | AST | 15461AST | 0.22 mi. SW (1162 ft.) | NE CORNER OF LARIMER & BROADWA | 2445 LARIMER ST, DENVER, CO 80202 | 170 |
| 57 | LST | 1272LST | 0.23 mi. SW (1214 ft.) | RECYCLE AMERICA OF DENVER | 2441 BROADWAY, DENVER, CO 80205 | 171 |
| 57 | UST | 1272 | 0.23 mi. SW (1214 ft.) | RECYCLE AMERICA OF DENVER | 2441 BROADWAY, DENVER, CO 80205 | 172 |
| 57 | AST | 11752AST | 0.23 mi. SW (1214 ft.) | SILVER STATE LAUNDRY | 2441 BROADWAY, DENVER, CO 80205 | 173 |
| 58 | LST | 8052LST | 0.23 mi. NE (1214 ft.) | WHOLESALE SPECIALTIES | 2950 BLAKE ST, DENVER, CO 80205 | 174 |
| 58 | UST | 8052 | 0.23 mi. NE (1214 ft.) | WHOLESALE SPECIALTIES | 2950 BLAKE ST, DENVER, CO 80205 | 175 |
| 58 | AST | 13809AST | 0.23 mi. NE (1214 ft.) | WHOLESALE SPECIALTIES INC | 2950 BLAKE ST, DENVER, CO 80205 | 176 |
| 59 | AST | 11964AST | 0.24 mi. N (1267 ft.) | CALLAHAN WHOLESALE FLORISTS | 1850 29TH ST, DENVER, CO 80216 | 177 |
| 59 | LST | 11859LST | 0.23 mi. N (1214 ft.) | ROCKY MOUNTAIN FRUIT & PRODUCE | 1800 29TH ST, DENVER, CO 80216 | 178 |
| 59 | LST | 11964LST | 0.24 mi. N (1267 ft.) | CALLAHAN WHOLESALE FLORISTS | 1850 29TH ST, DENVER, CO 80216 | 179 |
| 59 | AST | 11859AST | 0.23 mi. N (1214 ft.) | ROCKY MOUNTAIN FRUIT & PRODUCE | 1800 29TH ST, DENVER, CO 80216 | 180 |
| 60 | SEMSARCH | CO0010164098 | 0.23 mi. W (1214 ft.) | 24TH & CALIFORNIA MERCURY SPILL | 2417 CALIFORNIA APT #5, DENVER, CO 80205 | 181 |
| 61 | LST | 12396LST | 0.24 mi. E (1267 ft.) | ARTISTIC PLUMBING | 2655 DOWNING ST, DENVER, CO 80205 | 182 |
| 61 | AST | 12396AST | 0.24 mi. E (1267 ft.) | ARTISTIC PLUMBING | 2655 DOWNING ST, DENVER, CO 80205 | 183 |
| 62 | HISTSWLF | 00070-0000627 | 0.24 mi. NW (1267 ft.) | KNOWN LANDFILL | BOUNDARIES APPROXIMATE: W: DENARGO ST. N: ARKINS CT.; E: J, DENVER, CO 80216 | 184 |
| 62 | DCHISTLF | 82 | 0.24 mi. NW (1267 ft.) | 3S-68W-27NW | SEE REFERENCED SITE # ON FIGURE | 185 |
| 63 | LST | 19151LST | 0.26 mi. SE (1373 ft.) | ORPHAN TANK | E 18TH AVE @ NW CORNER OF OGDEN ST, DENVER, CO 80218 | 186 |

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|---|---|---|---|---|---|---|
| 63 | VCRA | 080125-1 | 0.24 mi. SE (1267 ft.) | CHILDRENS HOSPITAL PARCEL A AND B | NW CORNER OF PARK AVE AND OGDEN ST;, DENVER, CO 80218 | 187 |
| 63 | AST | 19151AST | 0.26 mi. SE (1373 ft.) | ORPHAN TANK | E 18TH AVE @ NW CORNER OF OGDEN ST, DENVER, CO 80218 | 188 |
| 64 | AST | 13773AST | 0.25 mi. NE (1320 ft.) | PIPER PROPERTY | 2975 WELTON ST, DENVER, CO 80205 | 189 |
| 64 | LST | 13769LST | 0.25 mi. NE (1320 ft.) | PIPER PROPERTY | 2975 WELTON ST, DENVER, CO 80205 | 190 |
| 64 | UST | 7444 | 0.25 mi. NE (1320 ft.) | UNKNOWN | 2975 WELTON ST, DENVER, CO 80205 | 191 |
| 64 | AST | 13769AST | 0.25 mi. NE (1320 ft.) | PIPER PROPERTY | 2975 WELTON ST, DENVER, CO 80205 | 192 |
| 65 | UST | 11 | 0.25 mi. N (1320 ft.) | WEICKER MOVING & STORAGE | 2900 BRIGHTON BLVD, DENVER, CO 80216 | 193 |
| 65 | LST | 11LST | 0.25 mi. N (1320 ft.) | WEICKER MOVING & STORAGE | 2900 BRIGHTON BLVD, DENVER, CO 80216 | 194 |
| 66 | UST | 5225 | 0.25 mi. N (1320 ft.) | BRIGHTON BLVD INVESTMENT PARTNERSHIP | 3001 BRIGHTON BLVD, DENVER, CO 80206 | 195 |
| 66 | VCRA | 150317-1 | 0.25 mi. N (1320 ft.) | INDUSTRY DENVER II | 3001 BRIGHTON BLVD., DENVER, CO 80216 | 196 |
| 66 | VCRA | 130830-1 | 0.25 mi. N (1320 ft.) | INDUSTRY DENVER | 3001, 3063 BRIGHTON BLVD.,1855 29TH ST.,AND 2800-2900 ARKIS CT., DENVER, CO 80216 | 197 |
| 66 | LST | 5225LST | 0.25 mi. N (1320 ft.) | BRIGHTON BLVD INVESTMENT PARTNERSHIP | 3001 BRIGHTON BLVD, DENVER, CO 80216 | 198 |
| 67 | LST | 13386LST | 0.25 mi. SW (1320 ft.) | | 2450 BLAKE ST, DENVER, CO 80205 | 199 |
| 67 | UST | 7004 | 0.25 mi. SW (1320 ft.) | BACKER ROD CO | 2450 BLAKE ST, DENVER, CO 80205 | 200 |
| 67 | VCRA | 000824-1 | 0.25 mi. SW (1320 ft.) | BALLPARK LOFTS I | WALNUT-BLAKE, 24ST-BROADWAY, DENVER, CO | 201 |
| 67 | VCRA | 010507-1 | 0.25 mi. SW (1320 ft.) | BALLPARK LOFTS II | WALNUT-BLAKE, 24ST-BROADWAY, DENVER, CO | 202 |
| 67 | AST | 13386AST | 0.25 mi. SW (1320 ft.) | BACKER ROD CO | 2450 BLAKE ST, DENVER, CO 80205 | 203 |
| 68 | UST | 10076 | 0.25 mi. SW (1320 ft.) | INTERSTATE CONOCO | 2435 BROADWAY, DENVER, CO 80205 | 204 |
| 68 | LST | 10076LST | 0.25 mi. SW (1320 ft.) | INTERSTATE CONOCO | 2435 N BROADWAY, DENVER, CO 80205 | 205 |
| 69 | UST | 8648 | 0.25 mi. E (1320 ft.) | AMBULANCE SERVICE CO | 2045 DOWNING ST, DENVER, CO 80218 | 206 |
| 70 | SEMSARCH | COD980635072 | 0.25 mi. NE (1320 ft.) | MAGNUS CO INC | 2945 BLAKE ST, DENVER, CO 80205 | 207 |
| 71 | LST | 2694LST | 0.26 mi. E (1373 ft.) | SAINT JOSEPH HOSPITAL | 1925 DOWNING ST, DENVER, CO 80218 | 208 |
| 72 | LST | 6660LST | 0.26 mi. SE (1373 ft.) | CHILDRENS HOSPITAL | 1056 E 19TH AVE, DENVER, CO 80218 | 209 |
| 73 | BF | 136601 | 0.26 mi. SW (1373 ft.) | TEMPLE EMANUEL | 2400 CURTIS STREET, DENVER, CO 80205 | 210 |
| 74 | SEMSARCH | COD087372512 | 0.27 mi. NW (1426 ft.) | B-D CHEM CO | 699 DENARGO MARKET, DENVER, CO 80216 | 212 |

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|---|---|---|---|---|---|---|
| 75 | CLEANERS | 031-1981CL | 0.27 mi. NE (1426 ft.) | COLORADO CLEANERS | 1220 30TH ST, DENVER, CO 80205 | 213 |
| ***76*** | ***VCRA*** | ***950811-1*** | ***0.28 mi. SE (1478 ft.)*** | ***CHILDRENS HOSPITAL ASSOC*** | ***18TH & DOWNING,, DENVER, CO 80218*** | ***214*** |
| ***76*** | ***VCRA*** | ***090115-1*** | ***0.28 mi. SE (1478 ft.)*** | ***CHILDRENS HOSPITAL PARCEL MAIN*** | ***NE CORNER OF 18TH AVE AND OGDEN STREET, DENVER, CO 80218*** | ***215*** |
| ***77*** | ***HISTSWLF*** | ***00070-0000632*** | ***0.29 mi. NW (1531 ft.)*** | ***ARTIFICIAL FILL*** | ***W OF DENARGO ST; S OF PLATTE RIVER; E OF BNRR; AND NORTH OF WHER, DENVER, CO 80216*** | ***216*** |
| ***77*** | ***LST*** | ***84LST*** | ***0.29 mi. NW (1531 ft.)*** | ***FORMER KING SOOPERS GARAGE*** | ***3325 DENARGO ST, DENVER, CO 80216*** | ***217*** |
| 77 | DCHISTLF | 87 | 0.29 mi. NW (1531 ft.) | 3S-68W-27NW3 | SEE REFERENCED SITE # ON FIGURE | 218 |
| ***78*** | ***LST*** | ***7425LST*** | ***0.29 mi. E (1531 ft.)*** | ***BOETTCHER*** | ***1900 DOWNING ST, DENVER, CO 80218*** | ***219*** |
| ***79*** | ***LST*** | ***15776LST*** | ***0.29 mi. W (1531 ft.)*** | ***1900 GRANT LTD*** | ***1900 GRANT, DENVER, CO 80203*** | ***220*** |
| ***80*** | ***NPL*** | ***COD980716955*** | ***0.29 mi. S (1531 ft.)*** | ***DENVER RADIUM SITE*** | ***VARIOUS PLACES IN DENVER, DENVER, CO 80204*** | ***221*** |
| 80 | RODS | COD980716955 | 0.29 mi. S (1531 ft.) | DENVER RADIUM SITE | VARIOUS PLACES IN DENVER, DENVER, CO | 280 |
| ***80*** | ***SEMS*** | ***COD980716955*** | ***0.29 mi. S (1531 ft.)*** | ***DENVER RADIUM SITE*** | ***VARIOUS PLACES IN DENVER, DENVER, CO 80204*** | ***297*** |
| ***80*** | ***SF*** | ***COD980716955*** | ***0.29 mi. S (1531 ft.)*** | ***DENVER RADIUM*** | ***VARIOUS PLACES IN DENVER, DENVER, CO 80204*** | ***361*** |
| ***81*** | ***VCRA*** | ***030610-1*** | ***0.29 mi. SW (1531 ft.)*** | ***PROFESSIONAL OFFICE BLDG.*** | ***2399 BLAKE STREET, DENVER, CO 80205*** | ***363*** |
| ***81*** | ***LST*** | ***12987LST*** | ***0.3 mi. SW (1584 ft.)*** | ***24TH & BLAKE STREET CO*** | ***2340 BLAKE ST, DENVER, CO 80205*** | ***364*** |
| ***82*** | ***VCRA*** | ***150601-1*** | ***0.29 mi. W (1531 ft.)*** | ***2200 WELTON ST.*** | ***2200-2250 WELTON AND 600-602 PARK AVE. WEST, DENVER, CO 80205*** | ***365*** |
| ***83*** | ***SEMS*** | ***CO0001844422*** | ***0.29 mi. NE (1531 ft.)*** | ***WELTON STREET CHEMICAL*** | ***3001 WELTON STREET, DENVER, CO 80205*** | ***366*** |
| ***84*** | ***LST*** | ***15185LST*** | ***0.3 mi. NE (1584 ft.)*** | ***WAREHOUSE*** | ***3001 LARIMER ST, DENVER, CO 80227*** | ***367*** |
| ***85*** | ***HISTSWLF*** | ***00070-0000910*** | ***0.3 mi. NE (1584 ft.)*** | ***3001 WALNUT*** | ***UNKNOWN, CITY NOT REPORTED, CO 80205*** | ***368*** |
| ***86*** | ***LST*** | ***14024LST*** | ***0.31 mi. N (1637 ft.)*** | ***PEPPER TANK CO*** | ***3063 OR 3099 BRIGHTON BLVD, DENVER, CO 80216*** | ***369*** |
| ***86*** | ***SEMSARCH*** | ***CO0009625352*** | ***0.31 mi. N (1637 ft.)*** | ***BRIGHTON BLVD SOLVENTS*** | ***3099 BRIGHTON BOULEVARD, DENVER, CO 80216*** | ***370*** |
| ***86*** | ***LST*** | ***2938LST*** | ***0.31 mi. N (1637 ft.)*** | ***KATHY & JOHNNY'S INC*** | ***3083 BRIGHTON BLVD, DENVER, CO 80205*** | ***371*** |
| ***87*** | ***VCRA*** | ***130809-1*** | ***0.31 mi. W (1637 ft.)*** | ***MILE HIGH UNITE WAY HEADQUARTERS*** | ***711 PARK AVENUE AND 2350 STOUT STREET, DENVER, CO 80205*** | ***372*** |
| ***88*** | ***LST*** | ***14725LST*** | ***0.32 mi. S (1690 ft.)*** | ***MOORE HOWARD MORTUARY*** | ***800 E 17TH AVE, DENVER, CO 80202*** | ***373*** |
| ***89*** | ***LST*** | ***17958LST*** | ***0.32 mi. W (1690 ft.)*** | ***BILL JACKSON PROPERTY*** | ***2220 CALIFORNIA, DENVER, CO 80205*** | ***374*** |
| ***90*** | ***LST*** | ***7536LST*** | ***0.32 mi. SE (1690 ft.)*** | ***ROBERT L NAIMAN CO*** | ***1000 E 18TH AVE, DENVER, CO 80218*** | ***375*** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 91 | LST | 14681LST | 0.33 mi. SW (1742 ft.) | DENVER HOUSING AUTHORITY | 501 E 17TH AVE, DENVER, CO 80203 | 376 |
| 92 | SWF | 1788264177REC | 0.33 mi. N (1742 ft.) | REPSCO INC | 2950 ARKINS CT, DENVER, CO 80216 | 377 |
| 93 | NLRRCRAC | COD007088503 | 0.33 mi. NE (1742 ft.) | UNIVERSAL CHEMICAL AND SUPPLIES CO | 3043 WALNUT ST, DENVER, CO 80205 | 378 |
| 94 | LST | 9302LST | 0.33 mi. S (1742 ft.) | 7-ELEVEN #22537 | 1690 PEARL ST, DENVER, CO 80203 | 380 |
| 95 | LST | 4249LST | 0.34 mi. NE (1795 ft.) | DENVER BURGLAR ALARM CO | 3040 BLAKE ST, DENVER, CO 80205 | 381 |
| 96 | VCRA | 141104-1 | 0.34 mi. SE (1795 ft.) | METRO CARERING II | 1100 E. 18TH AVE., DENVER, CO 80218 | 382 |
| 96 | VCRA | 140623-1 | 0.34 mi. SE (1795 ft.) | METRO CARERING | 1100 E. 18TH AVE, DENVER, CO 80218 | 383 |
| 96 | LST | 6115LST | 0.36 mi. SE (1901 ft.) | AAMCO | 1780 DOWNING ST, DENVER, CO 80218 | 384 |
| 97 | CLEANERS | 031-0737CL | 0.34 mi. SW (1795 ft.) | ORLINS CLEANERY CLEANING & LAUNDRY | 411 E 17TH AVE, DENVER, CO 80203 | 385 |
| 98 | BF | 176190 | 0.35 mi. SW (1848 ft.) | EDDIE MAESTAS TRIANGLE PARK | 2317 LAWRENCE ST, DENVER, CO 80202 | 386 |
| 98 | LST | 17869LST | 0.38 mi. SW (2006 ft.) | BROADWAY TRIANGE PARK | 23RD & LAWRENCE, DENVER, CO 80202 | 387 |
| 99 | LST | 13589LST | 0.36 mi. SW (1901 ft.) | TIRE STORE BLDG | 2300 ARAPAHOE ST, DENVER, CO 80205 | 388 |
| 100 | VCRA | 121109-1 | 0.36 mi. SW (1901 ft.) | ARAPAHOE SQUARE DEVELOPMENT II | 2300 WALNUT STREET, DENVER, CO 80205 | 389 |
| 100 | VCRA | 111128-1 | 0.36 mi. SW (1901 ft.) | ARAPAHOE SQUARE DEVELOPMENT | 2300 WALNUT STREET, DENVER, CO 80205 | 390 |
| 100 | VCRA | 140415-1 | 0.36 mi. SW (1901 ft.) | ARAPAHOE SQUARE DEVELOPMENT III | 2300 WALNUT STREET, DENVER, CO 80205 | 391 |
| 101 | LST | 11748LST | 0.36 mi. W (1901 ft.) | RYDER TRUCK RENTAL INC | 2215 CALIFORNIA ST, DENVER, CO 80205 | 392 |
| 102 | LST | 9596LST | 0.37 mi. SW (1954 ft.) | STARR REALTY MANAGEMENT CORP | 303 E 17TH AVE, DENVER, CO 80203 | 393 |
| 103 | LST | 2668LST | 0.38 mi. NE (2006 ft.) | BIG STEVE AUTO SALON | 2955 DOWNING, DENVER, CO 80205 | 394 |
| 104 | LST | 2686LST | 0.38 mi. W (2006 ft.) | DENVER BURGLAR ALARM CO INC | 1955 SHERMAN ST, DENVER, CO 80203 | 395 |
| 105 | LST | 17952LST | 0.39 mi. SW (2059 ft.) | PARKING LOT/FORMER GAS STATION | 2256 CURTIS ST, DENVER, CO 80205 | 396 |
| 106 | LST | 15857LST | 0.39 mi. NE (2059 ft.) | FIRE CLAY LOFTS | 3100 BLAKE ST, DENVER, CO 80205 | 397 |
| 107 | LST | 2012LST | 0.39 mi. W (2059 ft.) | GEORGES SUPER CONOCO | 838 PARK AVE, DENVER, CO 80205 | 398 |
| 108 | HISTSWLF | 00070-0000620 | 0.4 mi. N (2112 ft.) | ARTIFICIAL FILL | NORTH AND WEST OF PLATTE RIVER; SOUTH OF 31ST STREET; EAST OF BN, DENVER, CO 80216 | 399 |
| 108 | DCHISTLF | 75 | 0.4 mi. N (2112 ft.) | 3S-68W-27NW2 | SEE REFERENCED SITE # ON FIGURE | 400 |
| 109 | LST | 11954LST | 0.4 mi. E (2112 ft.) | KAISER PERMANENTE | 2000 LAFAYETTE ST, DENVER, CO 80205 | 401 |

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|---|---|---|---|---|---|---|
| 110 | LST | 9639LST | 0.4 mi. W (2112 ft.) | EUROMONT GROUP (THE) | 140 E 19TH ST, DENVER, CO 80203 | 402 |
| 111 | LST | 9980LST | 0.41 mi. N (2165 ft.) | H & N CONOCO | 3101 BRIGHTON BLVD, DENVER, CO 80216 | 403 |
| 112 | LST | 13316LST | 0.42 mi. SW (2218 ft.) | RTD OFFICE | 1520 20TH ST<br>2001 BLAKE ST, DENVER, CO 80202 | 404 |
| 112 | NLRRCRAC | COD983796954 | 0.42 mi. SW (2218 ft.) | COORS FIELD BASEBALL STADIUM | 2139 BLAKE ST, DENVER, CO 80202 | 405 |
| 112 | HWSCA | COD983796954 | 0.42 mi. SW (2218 ft.) | COORS FIELD BASEBALL STADIUM | 2139 BLAKE STREET, DENVER, CO 80202 | 407 |
| 113 | LST | 10377LST | 0.42 mi. SW (2218 ft.) | CAPRA PLUMBING & HEATING INC | 2235 ARAPAHOE ST, DENVER, CO 80205 | 408 |
| 114 | LST | 2690LST | 0.43 mi. W (2270 ft.) | DENVER BURGLAR ALARM CO INC | 2025 WELTON ST, DENVER, CO 80205 | 409 |
| 114 | LST | 8531LST | 0.44 mi. W (2323 ft.) | HERTZ CORP | 2017 WELTON ST, DENVER, CO 80205 | 410 |
| 115 | VCRA | 010110-1 | 0.43 mi. NE (2270 ft.) | BRICK PLANT II | 3101-3225 BLAKE, DENVER, CO 80205 | 411 |
| 115 | VCRA | 991018-1 | 0.43 mi. NE (2270 ft.) | BRICK PLANT I | 3101-3225 BLAKE, DENVER, CO 80205 | 412 |
| 115 | LST | 15113LST | 0.45 mi. NE (2376 ft.) | SIEGEL INVESTMENTS CO LLC | 3225 BLAKE ST, DENVER, CO 80205 | 413 |
| 116 | LST | 13771LST | 0.43 mi. SE (2270 ft.) | BECHTOLD PROPERTY | 1775 LAFAYETTE ST, DENVER, CO 80218 | 414 |
| 117 | LST | 18713LST | 0.44 mi. W (2323 ft.) | 2130 STOUT ST | 2130 STOUT ST, DENVER, CO 80202 | 415 |
| 118 | LST | 11531LST | 0.44 mi. SW (2323 ft.) | EQUITABLE REAL ESTATE | 1775 SHERMAN ST, DENVER, CO 80203 | 416 |
| 119 | LST | 3545LST | 0.44 mi. NE (2323 ft.) | SWANK REALTY | 3021 N DOWNING, DENVER, CO 80205 | 417 |
| 120 | LST | 15960LST | 0.44 mi. E (2323 ft.) | BONNER PROPERTY | 2201 HUMBOLDT STREET, DENVER, CO 80205 | 418 |
| 121 | LUSTTRUST | 00177-0005174 | 0.44 mi. NE (2323 ft.) | CARROLL L CLARK | 3108 BRIGHTON BLVD, DENVER, CO 80216 | 419 |
| 121 | LST | 10023LST | 0.44 mi. NE (2323 ft.) | MOREWEST PROPERTIES | 3108 BRIGHTON BLVD, DENVER, CO 80216 | 420 |
| 122 | VCRA | 070917-1 | 0.44 mi. NE (2323 ft.) | VILLAGE FLATS | 3198 BLAKE STREET, DENVER, CO 80211 | 421 |
| 122 | SWF | 31WGR | 0.45 mi. NE (2376 ft.) | DENVER SANITARY CO | 3161 WALNUT ST, DENVER, CO 80205 | 422 |
| 123 | HISTSWLF | 00070-0000637 | 0.45 mi. W (2376 ft.) | ARTIFICIAL FILL | EAST OF FOX ST. TO RR; NORTH TO RR ON SOUTH SIDE OF PLATTE, AND, DENVER, CO 80216 | 423 |
| 123 | DCHISTLF | 92 | 0.45 mi. W (2376 ft.) | 3S-68W-27SW1 | SEE REFERENCED SITE # ON FIGURE | 424 |
| 124 | LST | 14780LST | 0.48 mi. W (2534 ft.) | ANT PROPERTIES LLC | 31ST & FOX ST, DENVER, CO 80216 | 425 |
| 125 | LST | 15276LST | 0.45 mi. SW (2376 ft.) | 2201 ARAPAHOE LLC | 2201 ARAPAHOE, DENVER, CO 80205 | 426 |
| 126 | LST | 15275LST | 0.45 mi. SW (2376 ft.) | PARK ALL DAY | 2202 LAWRENCE ST, DENVER, CO 80205 | 427 |
| 127 | LST | 14151LST | 0.46 mi. W (2429 ft.) | GARRISON PROP | 1950 WELTON ST, DENVER, CO 80202 | 428 |

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|---|---|---|---|---|---|---|
| 128 | LST | 17757LST | 0.46 mi. SW (2429 ft.) | LOGAN TOWER | 1580 LOGAN ST, DENVER, CO 80202 | 429 |
| 129 | LST | 5499LST | 0.46 mi. SW (2429 ft.) | M B GLASSMAN | 2201 BLAKE ST, DENVER, CO 80205 | 430 |
| 129 | HWSCA | COD032004137 | 0.46 mi. SW (2429 ft.) | VANASK WAREHOUSE CO | 2201 BLAKE ST, DENVER, CO 80205 | 431 |
| 130 | VCRA | 150219-1 | 0.46 mi. SW (2429 ft.) | BALTAR INC. | 2200 BROADWAY, DENVER, CO 80205 | 432 |
| 131 | LST | 3322LST | 0.47 mi. SE (2482 ft.) | MOORE-HOWARD MORTUARIES | 1711 LAFAYETTE ST, DENVER, CO 80218 | 433 |
| 132 | LST | 16001LST | 0.47 mi. SW (2482 ft.) | WELLS FARGO CENTER | 1700 LINCOLN STREET, DENVER, CO 80203 | 434 |
| 133 | LST | 9502LST | 0.47 mi. N (2482 ft.) | RTD DISTRICT SHOPS | 1900 31ST ST, DENVER, CO 80216 | 435 |
| 134 | LST | 6613LST | 0.47 mi. NW (2482 ft.) | COLORADO ALL STATE TRANSPORTATION | 1960 31ST ST, DENVER, CO 80216 | 436 |
| 135 | SWF | 297WTR | 0.47 mi. W (2482 ft.) | BRIDGESTONE RETAIL OPERATIONS, L | 2000 BROADWAY, DENVER, CO 80205 | 437 |
| 135 | LST | 7585LST | 0.47 mi. W (2482 ft.) | FIRESTONE STORE #2823 | 2000 BROADWAY, DENVER, CO 80205 | 438 |
| 136 | HISTSWLF | 00070-0000616 | 0.48 mi. N (2534 ft.) | ARTIFICIAL FILL | NORTH OF 31ST ST. TO APPROXIMATELY 34TH ST., EAST TO PLATTE RIV, DENVER, CO 80216 | 439 |
| 136 | DCHISTLF | 71 | 0.48 mi. N (2534 ft.) | 3S-68W-22SE2 | SEE REFERENCED SITE # ON FIGURE | 440 |
| 137 | LST | 9810LST | 0.48 mi. NE (2534 ft.) | DENVER HARDWARE CO | 3200 WALNUT ST, DENVER, CO 80205 | 441 |
| 138 | LUSTTRUST | 00023-0000076 | 0.48 mi. SW (2534 ft.) | 23RD ST. VIADUCT | 23RD ST. VIADUCT, DENVER, CO 80000 | 442 |
| 138 | LST | 13138LST | 0.48 mi. SW (2534 ft.) | CDOT 23RD STREET VIADUCT | 2155 LAWRENCE, DENVER, CO 80205 | 443 |
| 139 | LST | 6837LST | 0.48 mi. SW (2534 ft.) | BUDGET RENT A CAR SYSTEMS | 2150 BROADWAY, DENVER, CO 80205 | 444 |
| 140 | LST | 12903LST | 0.48 mi. NE (2534 ft.) | | 3200 CURTIS ST, DENVER, CO 80205 | 445 |
| 141 | HISTSWLF | 00070-0000624 | 0.49 mi. NE (2587 ft.) | ARTIFICIAL FILL | SOUTH OF BRIGHTON BLVD; BETWEEN 32ND & 33RD STREETS, ONE BLOCK T, DENVER, CO 80216 | 446 |
| 141 | DCHISTLF | 79 | 0.49 mi. NE (2587 ft.) | 3S-68W-27NE | SEE REFERENCED SITE # ON FIGURE | 447 |
| 142 | HWSCA | COD063350854 | 0.53 mi. NE (2798 ft.) | MCCANDLESS INT'L TRUCKS OF COLO | 3280 BRIGHTON BOULEVARD, DENVER, CO 80216 | 448 |
| 143 | LST | 18434LST | 0.49 mi. NW (2587 ft.) | RENAISSANCE RIVERFRONT | 3400 PARK AVE WEST, DENVER, CO 80216 | 449 |
| 144 | LST | 1735LST | 0.49 mi. W (2587 ft.) | AVIS RENT A CAR SYSTEM LLC | 1900 BROADWAY, DENVER, CO 80202 | 450 |
| 145 | LST | 8843EVENTID | 0.49 mi. W (2587 ft.) | | FOX ST AT E 30TH AVE, DENVER, CO 80201 | 451 |
| 146 | SWF | 1178WTR | 0.49 mi. N (2587 ft.) | FEDEX EXPRESS - BKFA | 2100 31ST STREET, DENVER, CO 80216 | 452 |
| 146 | LST | 426LST | 0.49 mi. N (2587 ft.) | COLORADO/DENVER DELIVERY | 2100 31ST ST, DENVER, CO 80216 | 453 |

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|---|---|---|---|---|---|---|
| 147 | VCRA | 110917-1 | 0.49 mi. NE (2587 ft.) | RINO CENTER DEVELOPMENT | 3200, 3280, AND 3310 BRIGHTON BLVD., DENVER, CO 80212 | 454 |
| 147 | VCRA | 120831-1 | 0.49 mi. NE (2587 ft.) | RINO CENTER II | 3200 BRIGHTON BLVD., DENVER, CO 80212 | 455 |
| 148 | LST | 18304LST | 0.5 mi. E (2640 ft.) | FRANKLIN PAVILION | 1835 FRANKLIN ST, DENVER, CO 80218 | 456 |
| 149 | LST | 12721LST | 0.5 mi. NW (2640 ft.) | TEXACO | 3460 FOX ST, DENVER, CO 80216 | 457 |
| 150 | LST | 11069LST | 0.5 mi. SW (2640 ft.) | W S MEGILL | 2140 MARKET ST, DENVER, CO 80205 | 458 |
| 151 | LST | 19906LST | 0.5 mi. SW (2640 ft.) | FORMER GAS STATION | 2140 ARAPAHOE ST, DENVER, CO 80205 | 459 |
| 152 | LST | 13011LST | 0.5 mi. E (2640 ft.) | MANUAL HIGH SCHOOL | 1700 E 28TH AVE, DENVER, CO 80205 | 460 |
| 153 | LST | 13284LST | 0.51 mi. NE (2693 ft.) | | 3200 BLAKE ST, DENVER, CO 80205 | 461 |
| 153 | VCRA | 060302-1 | 0.51 mi. NE (2693 ft.) | CENTEX HOMES | 3200 BLAKE STREET, DENVER, CO 80205 | 462 |
| 153 | LST | 3227LST | 0.51 mi. NE (2693 ft.) | SPORT AMERICA | 3200 BLAKE ST, DENVER, CO 80205 | 463 |
| 154 | VCRA | 140916-1 | 0.51 mi. SW (2693 ft.) | SKYHOUSE DENVER | 1756 BROADWAY, DENVER, CO 80202 | 464 |
| 154 | VCRA | 160113-1 | 0.51 mi. SW (2693 ft.) | SKYHOUSE DENVER II | 1756 BROADWAY, DENVER, CO 80202 | 465 |
| 155 | VCRA | 051214-1 | 0.51 mi. SW (2693 ft.) | FORMER PIGGLY WIGGLY PARCEL I | 2101-2163 MARKET STREET, DENVER, CO 80205 | 466 |
| 155 | VCRA | 060919-1 | 0.51 mi. SW (2693 ft.) | FORMER PIGGLY WIGGLY PARCEL II | 2101-2163 MARKET STREET, DENVER, CO 80205 | 467 |
| 156 | LST | 8822LST | 0.51 mi. SE (2693 ft.) | CCOD FIRE STATION #8 | 1616 PARK AVE, DENVER, CO 80216 | 468 |
| 157 | HWSCA | COD983774035 | 0.57 mi. NE (3010 ft.) | JEMM COMPANY | 3300 WALNUT ST, DENVER, CO 80205 | 469 |
| 158 | RCRAC | COD983772468 | 0.6 mi. SE (3168 ft.) | BRIDENT DENTAL | 1080 E COLFAX AVE, DENVER, CO 80218 | 470 |
| 159 | HWSCA | COD983777814 | 0.73 mi. SW (3854 ft.) | DENVER FIRE DEPT LINE SHOP | 1331 19TH ST, DENVER, CO 80202 | 473 |
| 160 | NPL | CO0002259588 | 0.8 mi. NE (4224 ft.) | VASQUEZ BOULEVARD AND I-70 | VASQUEZ BOULEVARD AND 1-70, DENVER, CO 80216 | 474 |
| 160 | RODS | CO0002259588 | 0.8 mi. NE (4224 ft.) | VASQUEZ BOULEVARD AND I-70 | VASQUEZ BOULEVARD AND 1-70, DENVER, CO | 484 |
| 160 | SF | COD002259588 | 0.8 mi. NE (4224 ft.) | VASQUEZ BOULEVARD/I70 | VASQUEZ BLVD AND I-70 BOUNDARY AREA, DENVER, CO 80216 | 485 |
| 161 | HWSCA | COD097663033 | 0.8 mi. N (4224 ft.) | YELLOW CAB CO-OP ASSOC | 3455 RINGSBY CT, DENVER, CO 80216 | 487 |
| 162 | RCRAC | COD000823492 | 0.85 mi. NW (4488 ft.) | TEXACO USA A DIVISION OF TEXACO INC | 805 W 38TH AVE, DENVER, CO 80216 | 488 |
| 163 | NLRRCRAC | COD983780180 | 0.96 mi. SW (5069 ft.) | RTD DENVER UNION TERMINAL | 1701 WYNKOOP ST, DENVER, CO 80202 | 491 |

# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 1** **Distance from Property: 0.01 mi. (53 ft.) NW**

**SITE INFORMATION**

FILE NUMBER: **140714-1**
SITE NO: **572**
NAME: **COORS PARKING GARAGE II**
ADDRESS: **27TH AND BLAKE ST.**
**DENVER, CO 80202**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **8/28/2014**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED**
REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **1425.00**
CLEANUP ACRES: **NOT REPORTED**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **COMMERCIAL**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **NOT REPORTED**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **NOT REPORTED**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 1** **Distance from Property: 0.01 mi. (53 ft.) NW**

**SITE INFORMATION**

FILE NUMBER: **121012-1**
SITE NO: **572**
NAME: **COORS PARKING GARAGE**
ADDRESS: **27TH AND BLAKE STREET**
**DENVER, CO 80202**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **VOLUNTARY CLEANUP PROGRAM**
REVIEW DATE DUE: **11/26/2012**
DECISION: **APPROVAL**

REMEDY START DATE: **11/9/2012** REMEDY END DATE: **11/9/2014**
ACTUAL COST: **1105.00** CLEANUP ACRES: **4.5**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **COMMERCIAL**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **NOT REPORTED**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **COAL FILL;#23;#ARSENIC;#8;#ASBESTOS CONTAMINATED MATERIALS;#25**

Back to Report Summary

# Resource Conservation & Recovery Act - Generator (RCRAGR08)

**MAP ID# 1** **Distance from Property: 0.02 mi. (106 ft.) W**

**FACILITY INFORMATION**

EPA ID#: **COR000216093**
NAME: **COLORADO COLOR SPECIALTIES INC**
ADDRESS: **1450 27TH ST**
**DENVER, CO 80205**
CONTACT NAME: **R. E STAFFELDT**
CONTACT ADDRESS: **1450 27TH ST**
**DENVER CO 80205**
CONTACT PHONE: **303-292-4544**
NON-NOTIFIER: **NOT A NON-NOTIFIER**
DATE RECEIVED BY AGENCY: **08/05/2008**

OWNER TYPE: **PRIVATE**
OWNER NAME: **DFC INVESTMENTS INC**
OPERATOR TYPE: **PRIVATE**
OPERATOR NAME: **COLORADO COLOR SPECIALTIES**

CERTIFICATION

| CERTIFICATION NAME: | CERTIFICATION TITLE: | CERTIFICATION SIGNED DATE: |
|---|---|---|
| **R. ERIC STAFFELDT** | **PRES** | **07/21/2008** |
| **ERIC STAFFELDT** | **PRES** | **07/21/2008** |
| **R. ERIC STAFFELDT** | **PRES** | **02/22/2007** |

INDUSTRY CLASSIFICATION (NAICS)

**32551 - PAINT AND COATING MANUFACTURING**

SITE HISTORY (INCLUDES GENERATORS AND NON-GENERATORS)

DATE RECEIVED BY AGENCY: **08/05/2008**
NAME: **COLORADO COLOR SPECIALTIES INC**

DATE RECEIVED BY AGENCY: **03/12/2007**
NAME: **COLORADO COLOR SPECIALTIES INC**

CURRENT ACTIVITY INFORMATION

GENERATOR STATUS: **CONDITIONALLY EXEMPT SMALL QUANTITY GENERATOR** LAST UPDATED DATE: **11/19/2008**
SUBJECT TO CORRECTIVE ACTION UNIVERSE: **NO**
TDSFs POTENTIALLY SUBJECT TO CORRECTIVE ACTION UNDER 3004 (u)/(v) UNIVERSE: **NO**
TDSFs ONLY SUBJECT TO CORRECTIVE ACTION UNDER DISCRETIONARY AUTHORITIES UNIVERSE: **NO**
NON TSDFs WHERE RCRA CORRECTIVE ACTION HAS BEEN IMPOSED UNIVERSE: **NO**
CORRECTIVE ACTION WORKLOAD UNIVERSE: **NO**

IMPORTER: **NO**
MIXED WASTE GENERATOR: **NO**
RECYCLER: **NO**
TRANSPORTER: **NO**
ONSITE BURNER EXEMPTION: **NO**
FURNACE EXEMPTION: **NO**
USED OIL REFINER: **NO**
USED OIL TRANSFER FACILITY: **NO**

UNDERGROUND INJECTION: **NO**
UNIVERSAL WASTE DESTINATION FACILITY: **NO**
TRANSFER FACILITY: **NO**
USED OIL FUEL BURNER: **NO**
USED OIL PROCESSOR: **NO**
USED OIL FUEL MARKETER TO BURNER: **NO**
SPECIFICATION USED OIL MARKETER: **NO**
USED OIL TRANSPORTER: **NO**

COMPLIANCE, MONITORING AND ENFORCEMENT INFORMATION

EVALUATIONS **- NO EVALUATIONS REPORTED -**

VIOLATIONS **- NO VIOLATIONS REPORTED -**

ENFORCEMENTS **- NO ENFORCEMENTS REPORTED -**

HAZARDOUS WASTE

| | |
|---|---|
| **D001** | **IGNITABLE WASTE** |
| **D018** | **BENZENE** |
| **D035** | **METHYL ETHYL KETONE** |
| **D036** | **NITROBENZENE** |
| **D038** | **PYRIDINE** |
| **D039** | **TETRACHLOROETHYLENE** |
| **D040** | **TRICHLORETHYLENE** |
| **F003** | **THE FOLLOWING SPENT NON-HALOGENATED SOLVENTS: XYLENE, ACETONE, ETHYL ACETATE, ETHYL BENZENE, ETHYL ETHER, METHYL ISOBUTYL KETONE, N-BUTYL ALCOHOL, CYCLOHEXANONE, AND METHANOL; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONLY THE ABOVE SPENT NONHALOGENATED SOLVENTS; AND ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS, AND A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THOSE SOLVENTS LISTED IN F001, F002, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.** |
| **F005** | **THE FOLLOWING SPENT NONHALOGENATED SOLVENTS: TOLUENE, METHYL ETHYL KETONE,CARBON DISULFIDE, ISOBUTANOL, PYRIDINE,BENZENE, 2-ETHOXYETHANOL, AND 2-NITROPROPANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001,F002, OR F004; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.** |

UNIVERSAL WASTE **- NO UNIVERSAL WASTE REPORTED -**

CORRECTIVE ACTION AREA **- NO CORRECTIVE ACTION AREA INFORMATION REPORTED -**

CORRECTIVE ACTION EVENT **- NO CORRECTIVE ACTION EVENT REPORTED -**

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# Spills Listing (SPILLS)

**MAP ID# 1** **Distance from Property: 0.01 mi. (53 ft.) NW**

## INCIDENT INFORMATION

CASE NUMBER: **2009-0189** NRC NUMBER: **NOT REPORTED**

SPILL DATE: **04/26/09**

SPILL LOCATION: **ON 27TH NEAR THE INTERSECTION WITH BLAKE ST.**

SPILL CITY/STATE/ZIP: **DENVER, CO 80205**

SPILL COUNTY: **DENVER**

## RESPONSIBLE PARTY

NAME: **UNKNOWN**

ADDRESS: **STREET NOT REPORTED**
**CITY NOT REPORTED, CO**

COUNTY: **NOT REPORTED**

CONTACT: **POSSIBLY EXCEL ENERGY**

PHONE: **NOT REPORTED**

## INCIDENT DETAILS

SOURCE: **OTHER**

SOURCE TYPE: **TIPPED OVER PORT-ALET**

MEDIUM: **WATER AND LAND**

WATERWAY: **STORM DRAIN**

CAUSE: **OTHER**

MATERIAL TYPE: **OTHER**

| MATERIAL DESCRIPTION: | MATERIAL QUANTITY: | WATER QUANTITY: |
|---|---|---|
| **TIPPED OVER PORTALET** | **1 UNKNOWN** | **1 U** |

CAUSE INFORMATION:

**PORT-A-LET APPARENTLY ACCIDENTALLY TIPPED OVER ON 4/26/09 BEFORE 21:00. NO ACTION TAKEN FOR CLEAN UP 2 DAYS LATER. SEWAGE IS GOING INTO THE STORM DRAIN. DIRT IS ALSO BLOCKING THE STORM DRAIN. EXCEL ENERGY APPEARS TO BE DOING CONSTRUCTION IN THE AREA.**

ACTION:

**NOT REPORTED**

RESPONSE COMMENTS:

**NOT REPORTED**

COMMENTS:

**NOT REPORTED**

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 2** **Distance from Property: 0.01 mi. (53 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **16849**
NAME: **DEEP ROCK WATER**
ADDRESS: **2653 CALIFORNIA**
**DENVER, CO 80205**
COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=16849

**OWNER INFORMATION**

OWNER ID: **19523**
NAME: **LPG UNKNOWN OWNER**
ADDRESS: **DIVISION OF OIL & PUBLIC SAFETY**
**DENVER, CO 80202**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **36838** | **LIQUEFIED PETROLEUM GAS** | **LPG** | **1000** | **CLOSED** | **NOT REPORTED** |
| **36839** | **LIQUEFIED PETROLEUM GAS** | **LPG** | **1000** | **CLOSED** | **NOT REPORTED** |
| **37520** | **LIQUEFIED PETROLEUM GAS** | **LPG** | **1000** | **CLOSED** | **NOT REPORTED** |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 3** **Distance from Property: 0.02 mi. (106 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **13147LST**
FACILITY ID: **13147**
NAME: **SIMPSON BUILDING**
ADDRESS: **2714 WALNUT ST**
**DENVER, CO 80205**
SITE NAME: **SIMPSON BUILDING**
LOCATION: **2714 WALNUT ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **3296** | **CLOSED** | **7/18/1994** | **SIMPSON BUILDING** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=3296

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# Underground Storage Tank Facilities (UST)

**MAP ID# 3** **Distance from Property: 0.02 mi. (106 ft.) NE**

**FACILITY INFORMATION**

FACILITY ID: **5437**

NAME: **UNKNOWN**

ADDRESS: **2714 WALNUT**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=5437

**OWNER INFORMATION**

OWNER ID: **9999**

NAME: **UNKNOWN**

ADDRESS: **UNKNOWN**
**ZIPCODE UNKNOWN, XX 99999**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **14910** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **999999999** | **CLOSED** | **NOT REPORTED** |

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# Underground Storage Tank Facilities (UST)

**MAP ID# 3** **Distance from Property: 0.02 mi. (106 ft.) NE**

**FACILITY INFORMATION**

FACILITY ID: **6118**

NAME: **SIMPSON BUILDING**

ADDRESS: **2714-2718 WALNUT ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=6118

**OWNER INFORMATION**

OWNER ID: **4437**

NAME: **ANDRE SIMPSON**

ADDRESS: **860 S CORONA ST**
**DENVER, CO 80209**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **16506** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **999999999** | **CLOSED** | **NOT REPORTED** |

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 3** **Distance from Property: 0.02 mi. (106 ft.) NE**

**FACILITY INFORMATION**

FACILITY ID: **13147**
NAME: **SIMPSON BUILDING**
ADDRESS: **2714 WALNUT ST**
**DENVER, CO 80205**
COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=13147

**OWNER INFORMATION**

OWNER ID: **16286**
NAME: **ANDRE SIMPSON**
ADDRESS: **860 S CORONA ST**
**DENVER, CO 80209**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 4** **Distance from Property: 0.02 mi. (106 ft.) SE**

**FACILITY INFORMATION**

UNIQUE ID: **4226LST**

FACILITY ID: **4226**

NAME: **ZONE CAB**

ADDRESS: **2358 WASHINGTON ST**
**DENVER, CO 80205**

SITE NAME: **ZONE CAB**

LOCATION: **2358 WASHINGTON ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **9045** | **CLOSED** | **9/25/2002 9:27** | **ZONE CAB** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=9045 | | | |
| **1683** | **CLOSED** | **11/4/1992** | **ZONE CAB** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=1683 | | | |

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# Underground Storage Tank Facilities (UST)

**MAP ID# 4** **Distance from Property: 0.02 mi. (106 ft.) SE**

**FACILITY INFORMATION**

FACILITY ID: **4226**

NAME: **ZONE CAB**

ADDRESS: **2358 WASHINGTON ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=4226

**OWNER INFORMATION**

OWNER ID: **1274**

NAME: **ZONE CAB**

ADDRESS: **2358 WASHINGTON ST**
**DENVER, CO 80205**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **11906** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **3200** | **CLOSED** | **NOT REPORTED** |
| **11907** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **3200** | **CLOSED** | **NOT REPORTED** |
| **11908** | **UNDERGROUND STORAGE TANK** | **6 - USED OIL (WASTE OIL)** | **300** | **CLOSED** | **NOT REPORTED** |
| **11909** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **6000** | **CLOSED** | **NOT REPORTED** |

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# Resource Conservation & Recovery Act - Non-Generator (RCRANGR08)

**MAP ID# 4** **Distance from Property: 0.02 mi. (106 ft.) SE**

**FACILITY INFORMATION**

EPA ID#: **COR000011791**
NAME: **ZONE CAB**
ADDRESS: **2358 WASHINGTON**
**DENVER, CO 80205**
CONTACT NAME: **NOT REPORTED**
CONTACT ADDRESS: **NOT REPORTED**

CONTACT PHONE: **NOT REPORTED**
NON-NOTIFIER: **NON-NOTIFIER**
DATE RECEIVED BY AGENCY: **10/05/1999**

OWNER TYPE: **NOT REPORTED**
OWNER NAME: **NOT REPORTED**
OPERATOR TYPE: **NOT REPORTED**
OPERATOR NAME: **NOT REPORTED**

CERTIFICATION **- NO CERTIFICATION REPORTED -**

INDUSTRY CLASSIFICATION (NAICS) **- NO NAICS INFORMATION REPORTED -**

SITE HISTORY (INCLUDES GENERATORS AND NON-GENERATORS)

DATE RECEIVED BY AGENCY: **10/05/1999**
NAME: **ZONE CAB**

CURRENT ACTIVITY INFORMATION

GENERATOR STATUS: **NOT A GENERATOR** LAST UPDATED DATE: **09/15/2000**
SUBJECT TO CORRECTIVE ACTION UNIVERSE: **NO**
TDSFs POTENTIALLY SUBJECT TO CORRECTIVE ACTION UNDER 3004 (u)/(v) UNIVERSE: **NO**
TDSFs ONLY SUBJECT TO CORRECTIVE ACTION UNDER DISCRETIONARY AUTHORITIES UNIVERSE: **NO**
NON TSDFs WHERE RCRA CORRECTIVE ACTION HAS BEEN IMPOSED UNIVERSE: **NO**
CORRECTIVE ACTION WORKLOAD UNIVERSE: **NO**

IMPORTER: **NO**
MIXED WASTE GENERATOR: **NO**
RECYCLER: **NO**
TRANSPORTER: **NO**
ONSITE BURNER EXEMPTION: **NO**
FURNACE EXEMPTION: **NO**
USED OIL REFINER: **NO**
USED OIL TRANSFER FACILITY: **NO**

UNDERGROUND INJECTION: **NO**
UNIVERSAL WASTE DESTINATION FACILITY: **NO**
TRANSFER FACILITY: **NO**
USED OIL FUEL BURNER: **NO**
USED OIL PROCESSOR: **NO**
USED OIL FUEL MARKETER TO BURNER: **NO**
SPECIFICATION USED OIL MARKETER: **NO**
USED OIL TRANSPORTER: **NO**

COMPLIANCE, MONITORING AND ENFORCEMENT INFORMATION

EVALUATIONS
**10/20/1998** **CEI COMPLIANCE EVALUATION INSPECTION ON-SITE**

VIOLATIONS **- NO VIOLATIONS REPORTED -**

ENFORCEMENTS **- NO ENFORCEMENTS REPORTED -**

HAZARDOUS WASTE

**- NO HAZARDOUS WASTE INFORMATION REPORTED -**

UNIVERSAL WASTE **- NO UNIVERSAL WASTE REPORTED -**

CORRECTIVE ACTION AREA **- NO CORRECTIVE ACTION AREA INFORMATION REPORTED -**

CORRECTIVE ACTION EVENT **- NO CORRECTIVE ACTION EVENT REPORTED -**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 4** **Distance from Property: 0.02 mi. (106 ft.) SE**

**FACILITY INFORMATION**

UNIQUE ID: **7129EVENTID**
FACILITY ID: **NOT ASSIGNED**
NAME: **NOT REPORTED**
ADDRESS: **2358 WASHINGTON**
**DENVER, CO 80205**
SITE NAME: **ZONE CAB**
LOCATION: **2358 WASHINGTON, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **7129** | **CLOSED** | **12/28/1998** | **ZONE CAB** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=7129

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 5** **Distance from Property: 0.02 mi. (106 ft.) N**

**FACILITY INFORMATION**

UNIQUE ID: **8461LST**
FACILITY ID: **8461**
NAME: **ANGELICA HEALTHCARE PLANT 88**
ADDRESS: **2701 LAWRENCE ST**
**DENVER, CO 80205**
SITE NAME: **CITY-ELITE LAUNDRY CO**
LOCATION: **2701 LAWRENCE ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **2435** | **CLOSED** | **11/27/1990** | **CITY-ELITE LAUNDRY CO** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=2435

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# Underground Storage Tank Facilities (UST)

**MAP ID# 5** **Distance from Property: 0.02 mi. (106 ft.) N**

## FACILITY INFORMATION

FACILITY ID: **8461**

NAME: **ANGELICA HEALTHCARE PLANT 88**

ADDRESS: **2701 LAWRENCE ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=8461

## OWNER INFORMATION

OWNER ID: **1198**

NAME: **ANGELICA HEALTHCARE SERVICES**

ADDRESS: **424 S WOODS MILL RD**
**CHESTERFIELD, MO 63017**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **22061** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **1000** | **CLOSED** | **NOT REPORTED** |
| **22062** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **1000** | **CLOSED** | **NOT REPORTED** |
| **22063** | **UNDERGROUND STORAGE TANK** | **6 - USED OIL (WASTE OIL)** | **2000** | **CLOSED** | **NOT REPORTED** |
| **22064** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **5000** | **CLOSED** | **NOT REPORTED** |

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# Resource Conservation & Recovery Act - Non-Generator (RCRANGR08)

**MAP ID# 5** **Distance from Property: 0.02 mi. (106 ft.) N**

**FACILITY INFORMATION**

EPA ID#: **COD031963010**
NAME: **CITY-ELITE LAUNDRY CO**
ADDRESS: **2701 LAWRENCE ST**
**DENVER, CO 80205**
CONTACT NAME: **DEAN WYCKOFF**
CONTACT ADDRESS: **P O BOX 1289**
**DENVER CO 80201**
CONTACT PHONE: **303-297-9979**
NON-NOTIFIER: **NOT A NON-NOTIFIER**
DATE RECEIVED BY AGENCY: **06/24/1993**

OWNER TYPE: **PRIVATE**
OWNER NAME: **GERALD P PETERS JR**
OPERATOR TYPE: **NOT REPORTED**
OPERATOR NAME: **NOT REPORTED**

CERTIFICATION **- NO CERTIFICATION REPORTED -**

INDUSTRY CLASSIFICATION (NAICS) **- NO NAICS INFORMATION REPORTED -**

SITE HISTORY (INCLUDES GENERATORS AND NON-GENERATORS)

DATE RECEIVED BY AGENCY: **06/24/1993**
NAME: **CITY-ELITE LAUNDRY CO**

CURRENT ACTIVITY INFORMATION

GENERATOR STATUS: **NOT A GENERATOR** LAST UPDATED DATE: **04/26/2004**
SUBJECT TO CORRECTIVE ACTION UNIVERSE: **NO**
TDSFs POTENTIALLY SUBJECT TO CORRECTIVE ACTION UNDER 3004 (u)/(v) UNIVERSE: **NO**
TDSFs ONLY SUBJECT TO CORRECTIVE ACTION UNDER DISCRETIONARY AUTHORITIES UNIVERSE: **NO**
NON TSDFs WHERE RCRA CORRECTIVE ACTION HAS BEEN IMPOSED UNIVERSE: **NO**
CORRECTIVE ACTION WORKLOAD UNIVERSE: **NO**

IMPORTER: **NO**
MIXED WASTE GENERATOR: **NO**
RECYCLER: **NO**
TRANSPORTER: **NO**
ONSITE BURNER EXEMPTION: **NO**
FURNACE EXEMPTION: **NO**
USED OIL REFINER: **NO**
USED OIL TRANSFER FACILITY: **NO**

UNDERGROUND INJECTION: **NO**
UNIVERSAL WASTE DESTINATION FACILITY: **NO**
TRANSFER FACILITY: **NO**
USED OIL FUEL BURNER: **NO**
USED OIL PROCESSOR: **NO**
USED OIL FUEL MARKETER TO BURNER: **NO**
SPECIFICATION USED OIL MARKETER: **NO**
USED OIL TRANSPORTER: **NO**

COMPLIANCE, MONITORING AND ENFORCEMENT INFORMATION

EVALUATIONS **- NO EVALUATIONS REPORTED -**

VIOLATIONS **- NO VIOLATIONS REPORTED -**

ENFORCEMENTS **- NO ENFORCEMENTS REPORTED -**

HAZARDOUS WASTE

**D001** **IGNITABLE WASTE**

**F002** **THE FOLLOWING SPENT HALOGENATED SOLVENTS: TETRACHLOROETHYLENE, METHYLENE CHLORIDE,TRICHLOROETHYLENE, 1,1,1-TRICHLOROETHANE,CHLOROBENZENE, 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE, ORTHO-DICHLOROBENZENE, TRICHLOROFLUOROMETHANE, AND 1,1,2, TRICHLOROETHANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001,F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.**

UNIVERSAL WASTE **- NO UNIVERSAL WASTE REPORTED -**

CORRECTIVE ACTION AREA **- NO CORRECTIVE ACTION AREA INFORMATION REPORTED -**

CORRECTIVE ACTION EVENT **- NO CORRECTIVE ACTION EVENT REPORTED -**

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 5** **Distance from Property: 0.02 mi. (106 ft.) N**

## FACILITY INFORMATION

FACILITY ID: **10174**

NAME: **ANGELICA HEALTHCARE #8 PLANT**

ADDRESS: **2701 LAWRENCE ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=10174

## OWNER INFORMATION

OWNER ID: **1198**

NAME: **ANGELICA HEALTHCARE SERVICES**

ADDRESS: **424 S WOODS MILL RD**
**CHESTERFIELD, MO 63017**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **27406** | **ABOVEGROUND STORAGE TANK** | **4 - DIESEL** | **5000** | **CLOSED** | **NOT REPORTED** |

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# Underground Storage Tank Facilities (UST)

**MAP ID# 6** **Distance from Property: 0.02 mi. (106 ft.) SE**

## FACILITY INFORMATION

FACILITY ID: **8812**

NAME: **CCOD FIRE STATION #3**

ADDRESS: **2500 WASHINGTON ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=8812

## OWNER INFORMATION

OWNER ID: **1000**

NAME: **DENVER DEPT OF ENVIRONMENTAL HEALTH**

ADDRESS: **200 W 14TH AVE STE 310**
**DENVER, CO 80204**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **23209** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **550** | **CLOSED** | **NOT REPORTED** |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 6** **Distance from Property: 0.02 mi. (106 ft.) SE**

**FACILITY INFORMATION**

UNIQUE ID: **8812LST**
FACILITY ID: **8812**
NAME: **CCOD FIRE STATION #3**
ADDRESS: **2500 WASHINGTON**
**DENVER, CO 80205**
SITE NAME: **CCOD FIRE STATION #3**
LOCATION: **2500 WASHINGTON, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **3245** | **CLOSED** | **6/23/1992** | **CCOD FIRE STATION #3** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=3245

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# Underground Storage Tank Facilities (UST)

**MAP ID# 7** **Distance from Property: 0.04 mi. (211 ft.) W**

**FACILITY INFORMATION**

FACILITY ID: **10739**

NAME: **SENIORS NUTRITION PROGRAM**

ADDRESS: **2636 LARIMER ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=10739

**OWNER INFORMATION**

OWNER ID: **5664**

NAME: **VOLUNTEERS OF AMERICA**

ADDRESS: **1865 LARIMER ST**
**DENVER, CO 80202**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **29294** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **4000** | **CLOSED** | **NOT REPORTED** |

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# Underground Storage Tank Facilities (UST)

**MAP ID# 7** **Distance from Property: 0.02 mi. (106 ft.) W**

**FACILITY INFORMATION**

FACILITY ID: **8307**

NAME: **F & B AUTO SERVICE**

ADDRESS: **2660 LARIMER ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=8307

**OWNER INFORMATION**

OWNER ID: **2166**

NAME: **F & B AUTO SERVICE**

ADDRESS: **2660 LARIMER ST**
**DENVER, CO 80205**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **21676** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **1000** | **CLOSED** | **NOT REPORTED** |
| **21677** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **1000** | **CLOSED** | **NOT REPORTED** |
| **21678** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **550** | **CLOSED** | **NOT REPORTED** |
| **21679** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **550** | **CLOSED** | **NOT REPORTED** |

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# Resource Conservation & Recovery Act - Generator (RCRAGR08)

**MAP ID# 7** **Distance from Property: 0.04 mi. (211 ft.) W**

**FACILITY INFORMATION**

EPA ID#: **COR000012799**
NAME: **VOLUNTEERS OF AMERICA NSD DIV**
ADDRESS: **2636 LARIMER ST**
**DENVER, CO 80205**
CONTACT NAME: **NOLAN KNOX**
CONTACT ADDRESS: **2636 LARIMER ST**
**DENVER CO 80205**
CONTACT PHONE: **303-294-0111**
NON-NOTIFIER: **NOT A NON-NOTIFIER**
DATE RECEIVED BY AGENCY: **02/25/1999**

OWNER TYPE: **PRIVATE**
OWNER NAME: **VOL OF AMER COLORADO BRANCH**
OPERATOR TYPE: **NOT REPORTED**
OPERATOR NAME: **NOT REPORTED**

CERTIFICATION **- NO CERTIFICATION REPORTED -**

INDUSTRY CLASSIFICATION (NAICS) **- NO NAICS INFORMATION REPORTED -**

SITE HISTORY (INCLUDES GENERATORS AND NON-GENERATORS)

DATE RECEIVED BY AGENCY: **02/25/1999**
NAME: **VOLUNTEERS OF AMERICA NSD DIV**

CURRENT ACTIVITY INFORMATION

GENERATOR STATUS: **CONDITIONALLY EXEMPT SMALL QUANTITY GENERATOR** LAST UPDATED DATE: **04/26/2004**
SUBJECT TO CORRECTIVE ACTION UNIVERSE: **NO**
TDSFs POTENTIALLY SUBJECT TO CORRECTIVE ACTION UNDER 3004 (u)/(v) UNIVERSE: **NO**
TDSFs ONLY SUBJECT TO CORRECTIVE ACTION UNDER DISCRETIONARY AUTHORITIES UNIVERSE: **NO**
NON TSDFs WHERE RCRA CORRECTIVE ACTION HAS BEEN IMPOSED UNIVERSE: **NO**
CORRECTIVE ACTION WORKLOAD UNIVERSE: **NO**

IMPORTER: **NO**
MIXED WASTE GENERATOR: **NO**
RECYCLER: **NO**
TRANSPORTER: **NO**
ONSITE BURNER EXEMPTION: **NO**
FURNACE EXEMPTION: **NO**
USED OIL REFINER: **NO**
USED OIL TRANSFER FACILITY: **NO**

UNDERGROUND INJECTION: **NO**
UNIVERSAL WASTE DESTINATION FACILITY: **NO**
TRANSFER FACILITY: **NO**
USED OIL FUEL BURNER: **NO**
USED OIL PROCESSOR: **NO**
USED OIL FUEL MARKETER TO BURNER: **NO**
SPECIFICATION USED OIL MARKETER: **NO**
USED OIL TRANSPORTER: **NO**

COMPLIANCE, MONITORING AND ENFORCEMENT INFORMATION

EVALUATIONS **- NO EVALUATIONS REPORTED -**

VIOLATIONS **- NO VIOLATIONS REPORTED -**

ENFORCEMENTS **- NO ENFORCEMENTS REPORTED -**

HAZARDOUS WASTE

**D001** **IGNITABLE WASTE**
**D008** **LEAD**

UNIVERSAL WASTE **- NO UNIVERSAL WASTE REPORTED -**

CORRECTIVE ACTION AREA **- NO CORRECTIVE ACTION AREA INFORMATION REPORTED -**

CORRECTIVE ACTION EVENT **- NO CORRECTIVE ACTION EVENT REPORTED -**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 7** **Distance from Property: 0.04 mi. (211 ft.) W**

**FACILITY INFORMATION**

UNIQUE ID: **10739LST**
FACILITY ID: **10739**
NAME: **SENIORS NUTRITION PROGRAM**
ADDRESS: **2636 LARIMER ST**
**DENVER, CO 80205**
SITE NAME: **VOLUNTEERS OF AMERICA NUTRITION**
LOCATION: **2636 LARIMER ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **938** | **CLOSED** | **1/30/1991** | **VOLUNTEERS OF AMERICA NUTRITION** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=938

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# Resource Conservation & Recovery Act - Non-Generator (RCRANGR08)

**MAP ID# 8** **Distance from Property: 0.02 mi. (106 ft.) N**

**FACILITY INFORMATION**

EPA ID#: **COD037443389**
NAME: **COLORADO NATIONAL BANK**
ADDRESS: **2701 WELTON**
**DENVER, CO 80205**
CONTACT NAME: **SAVOI RAGSDALE-HOCKER**
CONTACT ADDRESS: **2701 WELTON**
**DENVER CO 80205**
CONTACT PHONE: **303-298-7795**
NON-NOTIFIER: **NOT A NON-NOTIFIER**
DATE RECEIVED BY AGENCY: **11/06/1997**

OWNER TYPE: **PRIVATE**
OWNER NAME: **RICHARD D TILSCHNER**
OPERATOR TYPE: **NOT REPORTED**
OPERATOR NAME: **NOT REPORTED**

CERTIFICATION **- NO CERTIFICATION REPORTED -**

INDUSTRY CLASSIFICATION (NAICS) **- NO NAICS INFORMATION REPORTED -**

SITE HISTORY (INCLUDES GENERATORS AND NON-GENERATORS)

DATE RECEIVED BY AGENCY: **11/06/1997**
NAME: **COLORADO NATIONAL BANK**

CURRENT ACTIVITY INFORMATION

GENERATOR STATUS: **NOT A GENERATOR** LAST UPDATED DATE: **09/15/2000**
SUBJECT TO CORRECTIVE ACTION UNIVERSE: **NO**
TDSFs POTENTIALLY SUBJECT TO CORRECTIVE ACTION UNDER 3004 (u)/(v) UNIVERSE: **NO**
TDSFs ONLY SUBJECT TO CORRECTIVE ACTION UNDER DISCRETIONARY AUTHORITIES UNIVERSE: **NO**
NON TSDFs WHERE RCRA CORRECTIVE ACTION HAS BEEN IMPOSED UNIVERSE: **NO**
CORRECTIVE ACTION WORKLOAD UNIVERSE: **NO**

IMPORTER: **NO**
MIXED WASTE GENERATOR: **NO**
RECYCLER: **NO**
TRANSPORTER: **NO**
ONSITE BURNER EXEMPTION: **NO**
FURNACE EXEMPTION: **NO**
USED OIL REFINER: **NO**
USED OIL TRANSFER FACILITY: **NO**

UNDERGROUND INJECTION: **NO**
UNIVERSAL WASTE DESTINATION FACILITY: **NO**
TRANSFER FACILITY: **NO**
USED OIL FUEL BURNER: **NO**
USED OIL PROCESSOR: **NO**
USED OIL FUEL MARKETER TO BURNER: **NO**
SPECIFICATION USED OIL MARKETER: **NO**
USED OIL TRANSPORTER: **NO**

COMPLIANCE, MONITORING AND ENFORCEMENT INFORMATION

EVALUATIONS **- NO EVALUATIONS REPORTED -**

VIOLATIONS **- NO VIOLATIONS REPORTED -**

ENFORCEMENTS **- NO ENFORCEMENTS REPORTED -**

HAZARDOUS WASTE

**- NO HAZARDOUS WASTE INFORMATION REPORTED -**

UNIVERSAL WASTE **- NO UNIVERSAL WASTE REPORTED -**

CORRECTIVE ACTION AREA **- NO CORRECTIVE ACTION AREA INFORMATION REPORTED -**

CORRECTIVE ACTION EVENT **- NO CORRECTIVE ACTION EVENT REPORTED -**

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# Emergency Response Notification System (ERNSCO)

**MAP ID# 9** **Distance from Property: 0.04 mi. (211 ft.) SE**

## INCIDENT INFORMATION

GSID#: **1123028**
NRC ID#: **1123028**
INCIDENT LOCATION: **NOT REPORTED**
INCIDENT ADDRESS: **757 EAST 20TH AVE**
**DENVER, CO**
INCIDENT COUNTY: **DENVER**

## INCIDENT DETAILS

INCIDENT DATE: **7/17/2015 7:00**
INCIDENT CAUSE: **UNKNOWN**
INCIDENT TYPE: **FIXED**
INCIDENT OCCURED/DISCOVERED: **DISCOVERED**
INCIDENT DESCRIPTION: **CALLER IS STATING THAT THE DUMPSTER BEHIND THIS GROCERY STORE HAS BEEN LEAKING A NOXIOUS UNKNOWN MATERIAL FROM THE DUMPSTER. ALSO STATES THAT STORE EMPLOYEE HAS DUMPED USED COOKING OIL ON THE PAVEMENT BEHIND THE STORE WHICH ALL LEADS TO A GUTTER.**

## RESPONSIBLE PARTY

RESPONSIBLE COMPANY: **SAFEWAY**
ADDRESS: **ADDRESS NOT REPORTED**
**DENVER CO**
RESPONSIBLE COMPANY ORGANIZATION TYPE: **PRIVATE ENTERPRISE**

## MATERIALS INVOLVED

CHRIS CODE: **OUN**
MATERIAL REACHED WATER: **YES**
WATER AMOUNT: **0 UNKNOWN AMOUNT**
MATERIAL RELEASED/AMOUNT: **UNKNOWN OIL / UNKNOWN AMOUNT**

CHRIS CODE: **UNK**
MATERIAL REACHED WATER: **YES**
WATER AMOUNT: **0 UNKNOWN AMOUNT**
MATERIAL RELEASED/AMOUNT: **UNKNOWN MATERIAL / UNKNOWN AMOUNT**

## OTHER MATERIALS INVOLVED

**- NO OTHER MATERIALS INVOLVED -**

## REMEDIAL ACTION

REMEDIAL ACTION: **NONE**

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# Resource Conservation & Recovery Act - Generator (RCRAGR08)

**MAP ID# 9** **Distance from Property: 0.04 mi. (211 ft.) SE**

**FACILITY INFORMATION**

EPA ID#: **COR000234898**
NAME: **SAFEWAY STORE #2246**
ADDRESS: **757 E 20TH AVE**
**DENVER, CO 80205**
CONTACT NAME: **KEITH B POWERS**
CONTACT ADDRESS: **5918 STONERIDGE MALL RD**
**PLEASANTON CA 94588**
CONTACT PHONE: **925-226-5655**
NON-NOTIFIER: **NOT A NON-NOTIFIER**
DATE RECEIVED BY AGENCY: **09/03/2014**

OWNER TYPE: **PRIVATE**
OWNER NAME: **SILVER OAK ASSOCIATES LTD**
OPERATOR TYPE: **PRIVATE**
OPERATOR NAME: **SAFEWAY STORE #2246**

CERTIFICATION

| CERTIFICATION NAME: | CERTIFICATION TITLE: | CERTIFICATION SIGNED DATE: |
|---|---|---|
| **KEITH B POWERS** | **ENV COMPLIANCE MGR** | **08/29/2014** |

INDUSTRY CLASSIFICATION (NAICS)

**445110 - SUPERMARKETS AND OTHER GROCERY (EXCEPT CONVENIENCE) STORES**

SITE HISTORY (INCLUDES GENERATORS AND NON-GENERATORS)

DATE RECEIVED BY AGENCY: **09/03/2014**
NAME: **SAFEWAY STORE #2246**

CURRENT ACTIVITY INFORMATION

GENERATOR STATUS: **CONDITIONALLY EXEMPT SMALL QUANTITY GENERATOR** LAST UPDATED DATE: **09/19/2014**
SUBJECT TO CORRECTIVE ACTION UNIVERSE: **NO**
TDSFs POTENTIALLY SUBJECT TO CORRECTIVE ACTION UNDER 3004 (u)/(v) UNIVERSE: **NO**
TDSFs ONLY SUBJECT TO CORRECTIVE ACTION UNDER DISCRETIONARY AUTHORITIES UNIVERSE: **NO**
NON TSDFs WHERE RCRA CORRECTIVE ACTION HAS BEEN IMPOSED UNIVERSE: **NO**
CORRECTIVE ACTION WORKLOAD UNIVERSE: **NO**

IMPORTER: **NO**
MIXED WASTE GENERATOR: **NO**
RECYCLER: **NO**
TRANSPORTER: **NO**
ONSITE BURNER EXEMPTION: **NO**
FURNACE EXEMPTION: **NO**
USED OIL REFINER: **NO**
USED OIL TRANSFER FACILITY: **NO**

UNDERGROUND INJECTION: **NO**
UNIVERSAL WASTE DESTINATION FACILITY: **NO**
TRANSFER FACILITY: **NO**
USED OIL FUEL BURNER: **NO**
USED OIL PROCESSOR: **NO**
USED OIL FUEL MARKETER TO BURNER: **NO**
SPECIFICATION USED OIL MARKETER: **NO**
USED OIL TRANSPORTER: **NO**

COMPLIANCE, MONITORING AND ENFORCEMENT INFORMATION

EVALUATIONS **- NO EVALUATIONS REPORTED -**
VIOLATIONS **- NO VIOLATIONS REPORTED -**
ENFORCEMENTS **- NO ENFORCEMENTS REPORTED -**

HAZARDOUS WASTE

**D001** **IGNITABLE WASTE**
**D002** **CORROSIVE WASTE**

**P075** **NICOTINE, & SALTS**

**P075** **PYRIDINE, 3-(1-METHYL-2-PYRROLIDINYL)-,(S)-, & SALTS**

UNIVERSAL WASTE **- NO UNIVERSAL WASTE REPORTED -**

CORRECTIVE ACTION AREA **- NO CORRECTIVE ACTION AREA INFORMATION REPORTED -**

CORRECTIVE ACTION EVENT **- NO CORRECTIVE ACTION EVENT REPORTED -**

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# Spills Listing (SPILLS)

**MAP ID# 9** **Distance from Property: 0.04 mi. (211 ft.) SE**

## INCIDENT INFORMATION

CASE NUMBER: **2015-0447** NRC NUMBER: **1173028**

SPILL DATE: **7/15/2015**

SPILL LOCATION: **757 E. 20TH AVE**

SPILL CITY/STATE/ZIP: **DENVER, CO 80205**

SPILL COUNTY: **DENVER**

## RESPONSIBLE PARTY

NAME: **SAFEWAY**

ADDRESS: **757 EAST 20TH AVE**
**DENVER, CO 80205**

COUNTY: **NOT REPORTED**

CONTACT: **UNKNOWN**

PHONE: **303-861-8169**

## INCIDENT DETAILS

SOURCE: **OTHER**

SOURCE TYPE: **DUMPSTER BEHIND SAFEWAY**

MEDIUM: **WATER AND LAND**

WATERWAY: **STORM DRAINS --> CHERRY CREEK**

CAUSE: **OTHER**

MATERIAL TYPE: **OIL**

| MATERIAL DESCRIPTION: | MATERIAL QUANTITY: | WATER QUANTITY: |
|---|---|---|
| **USED COOKING OIL** | **NOT REPORTED** | **NOT REPORTED** |
| SMELLY LIQUID DRAINAGE | | |

CAUSE INFORMATION:

**CALLER REPORTS THAT THE DUMPSTER BEHIND THIS SAFEWAY HAS BEEN LEAKING A "NOXIOUS UNKNOWN MATERIAL" FROM THE DUMPSTER FOR YEARS. YESTERDAY A STORE EMPLOYEE REPORTEDLY DUMPED PERHAPS 100 GALLONS OF USED COOKING OIL INTO THE DUMPSTER, WHICH DRAINED OUT AND HEADED FOR A GUTTER LEADING TO A STORM DRAIN LEADING TO CHERRY CREEK.**

ACTION:

**NOT REPORTED**

RESPONSE COMMENTS:

**NOT REPORTED**

COMMENTS:

**DENVER COUNTY EH: GARY LASSWELL, BEN SILLER, BILL BENERMAN**

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# Underground Storage Tank Facilities (UST)

**MAP ID# 10** **Distance from Property: 0.04 mi. (211 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **704**

NAME: **THOMAS BEAN TOWERS**

ADDRESS: **135 PARK AVE W**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=704

**OWNER INFORMATION**

OWNER ID: **1028**

NAME: **DENVER HOUSING AUTHORITY**

ADDRESS: **1100 W COLFAX AVE**
**DENVER, CO 80204**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **2165** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **999999999** | **CLOSED** | **NOT REPORTED** |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 10** **Distance from Property: 0.04 mi. (211 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **704LST**

FACILITY ID: **704**

NAME: **THOMAS BEAN TOWERS**

ADDRESS: **135 PARK AVE WEST**
**DENVER, CO 80205**

SITE NAME: **BEAN TOWERS**

LOCATION: **135 PARK AVE WEST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **7197** | **CLOSED** | **1/19/1999** | **BEAN TOWERS** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=7197

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# Emergency Response Notification System (ERNSCO)

**MAP ID# 11** **Distance from Property: 0.04 mi. (211 ft.) NE**

## INCIDENT INFORMATION

GSID#: **132531**
NRC ID#: **132531**
INCIDENT LOCATION: **NOT REPORTED**
INCIDENT ADDRESS: **2724 CHAMPA ST**
**DENVER, CO**
INCIDENT COUNTY: **DENVER**

## INCIDENT DETAILS

INCIDENT DATE: **8/18/1992 8:35:00 PM**
INCIDENT CAUSE: **OPERATOR ERROR**
INCIDENT TYPE: **PIPELINE**
INCIDENT OCCURED/DISCOVERED: **OCCURRED**
INCIDENT DESCRIPTION: **DISTRIBUTION LINE / GAS WAS IGNITED WHEN WORKERS WHERE PLACING CLAMPON LINE**

## RESPONSIBLE PARTY

RESPONSIBLE COMPANY: **PUBLIC SERVICE CO**
ADDRESS: **ADDRESS NOT REPORTED**
**DENVER CO 80202**
RESPONSIBLE COMPANY ORGANIZATION TYPE: **PUBLIC UTILITY**

## MATERIALS INVOLVED

CHRIS CODE: **ONG**
MATERIAL REACHED WATER: **YES**
WATER AMOUNT: **UNKNOWN AMOUNT / NOT REPORTED**
MATERIAL RELEASED/AMOUNT: **NATURAL GAS / UNKNOWN AMOUNT**

## OTHER MATERIALS INVOLVED

**- NO OTHER MATERIALS INVOLVED -**

## REMEDIAL ACTION

REMEDIAL ACTION: **RELEASE HAS BEEN STOPPED**

---

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# No Longer Regulated RCRA Generator Facilities (NLRRCRAG)

**MAP ID# 12** **Distance from Property: 0.06 mi. (317 ft.) NE**

**FACILITY INFORMATION**

EPA ID#: **CO0000083899**
NAME: **C & B CLEANERS**
ADDRESS: **2748 WELTON ST**
**DENVER, CO 80205**
CONTACT NAME: **CRAYTON JONES JR**
CONTACT ADDRESS: **2748 WELTON ST**
**DENVER CO 80205**
CONTACT PHONE: **3032979544**
NON-NOTIFIER: **NOT A NON-NOTIFIER**
DATE RECEIVED BY AGENCY: **05/02/2016**

OWNER TYPE: **PRIVATE**
OWNER NAME: **CRAYTON JONES JR**
OPERATOR TYPE: **PRIVATE**
OPERATOR NAME: **CRAYTON JONES JR**

CERTIFICATION

| CERTIFICATION NAME: | CERTIFICATION TITLE: | CERTIFICATION SIGNED DATE: |
|---|---|---|
| **CRAYTON JONES JR** | **OWNER** | **05/02/2016** |
| **CRAYTON JONES JR** | **OWNER** | **05/15/2009** |

INDUSTRY CLASSIFICATION (NAICS)

**81232 - DRYCLEANING AND LAUNDRY SERVICES (EXCEPT COIN-OPERATED)**

SITE HISTORY (INCLUDES GENERATORS AND NON-GENERATORS)

DATE RECEIVED BY AGENCY: **05/02/2016**
NAME: **C & B CLEANERS**

DATE RECEIVED BY AGENCY: **06/01/2009**
NAME: **C & B CLEANERS**

DATE RECEIVED BY AGENCY: **12/23/1993**
NAME: **C & B CLEANERS**

CURRENT ACTIVITY INFORMATION

GENERATOR STATUS: **NOT A GENERATOR** LAST UPDATED DATE: **05/02/2016**
SUBJECT TO CORRECTIVE ACTION UNIVERSE: **NO**
TDSFs POTENTIALLY SUBJECT TO CORRECTIVE ACTION UNDER 3004 (u)/(v) UNIVERSE: **NO**
TDSFs ONLY SUBJECT TO CORRECTIVE ACTION UNDER DISCRETIONARY AUTHORITIES UNIVERSE: **NO**
NON TSDFs WHERE RCRA CORRECTIVE ACTION HAS BEEN IMPOSED UNIVERSE: **NO**
CORRECTIVE ACTION WORKLOAD UNIVERSE: **NO**

IMPORTER: **NO**
MIXED WASTE GENERATOR: **NO**
RECYCLER: **NO**
TRANSPORTER: **NO**
ONSITE BURNER EXEMPTION: **NO**
FURNACE EXEMPTION: **NO**
USED OIL REFINER: **NO**
USED OIL TRANSFER FACILITY: **NO**

UNDERGROUND INJECTION: **NO**
UNIVERSAL WASTE DESTINATION FACILITY: **NO**
TRANSFER FACILITY: **NO**
USED OIL FUEL BURNER: **NO**
USED OIL PROCESSOR: **NO**
USED OIL FUEL MARKETER TO BURNER: **NO**
SPECIFICATION USED OIL MARKETER: **NO**
USED OIL TRANSPORTER: **NO**

COMPLIANCE, MONITORING AND ENFORCEMENT INFORMATION

EVALUATIONS

**02/23/2015** **FSD FACILITY SELF DISCLOSURE**

| | | |
|---|---|---|
| 09/25/2014 | CEI | COMPLIANCE EVALUATION INSPECTION ON-SITE |
| 09/25/2014 | FCI | FOCUSED COMPLIANCE INSPECTION |
| 02/28/2014 | FSD | FACILITY SELF DISCLOSURE |
| 02/24/2013 | FSD | FACILITY SELF DISCLOSURE |
| 04/10/2012 | FSD | FACILITY SELF DISCLOSURE |
| 11/08/2011 | CEI | COMPLIANCE EVALUATION INSPECTION ON-SITE |
| 01/24/2011 | FSD | FACILITY SELF DISCLOSURE |
| 04/19/2006 | FSD | FACILITY SELF DISCLOSURE |

VIOLATIONS **- NO VIOLATIONS REPORTED -**

ENFORCEMENTS **- NO ENFORCEMENTS REPORTED -**

HAZARDOUS WASTE

| | |
|---|---|
| D001 | IGNITABLE WASTE |
| D002 | CORROSIVE WASTE |
| D003 | REACTIVE WASTE |
| F001 | THE FOLLOWING SPENT HALOGENATED SOLVENTS USED IN DEGREASING: TETRACHLOROETHYLENE,TRICHLORETHYLENE, METHYLENE CHLORIDE, 1,1,1-TRICHLOROETHANE, CARBON TETRACHLORIDE ANDCHLORINATED FLUOROCARBONS; ALL SPENT SOLVENT MIXTURES/BLENDS USED IN DEGREASING CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F002, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES. |

UNIVERSAL WASTE

| WASTE TYPE: | ACCUMULATED WASTE ON-SITE: | GENERATED WASTE ON-SITE: | SOURCE TYPE: |
|---|---|---|---|
| NOT REPORTED | NO | NO | NOTIFICATION |
| BATTERIES | NO | NOT REPORTED | NOTIFICATION |
| OTHER | NO | NO | NOTIFICATION |
| LAMPS | NO | NOT REPORTED | NOTIFICATION |
| MERCURY-CONTAINING DEVICES | NO | NO | NOTIFICATION |
| PESTICIDES | NO | NOT REPORTED | NOTIFICATION |
| MERCURY CONTAINING EQUIPMENT | NO | NOT REPORTED | NOTIFICATION |

CORRECTIVE ACTION AREA **- NO CORRECTIVE ACTION AREA INFORMATION REPORTED -**

CORRECTIVE ACTION EVENT **- NO CORRECTIVE ACTION EVENT REPORTED -**

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# *Dry Cleaning Facilities (CLEANERS)*

**MAP ID# 12** **Distance from Property: 0.06 mi. (317 ft.) NE**

## SITE INFORMATION

UNIQUEID: **031-1163CL**

FACILITY ID: **031-1163**

NAME: **C & B CLEANERS**

ADDRESS: **2748 WELTON ST**
**DENVER, CO 80205-2914**

CONTACT: **RESOURCE/ENV MGR**

## OWNER INFORMATION

ADDRESS: **2748 WELTON ST**
**DENVER, CO 80000**

## SITE DETAILS

MAKE/MODEL/SERIAL: **MANITOWAC/WAIE/1008**

CONSTRUCTION PERMIT #: **91DE001.CN**

EMISSION UNIT ID: **001**

EMISSION UNIT DESCRIPTION: **MANITOWAC W41E SN:.CN**

EMISSION PROCESS DESCRIPTION: **MANITOWAC W41E SN:1008**

ANNUAL THROUGHPUT: **0 GALLONS SOLVENT CONSUMED**

---

MAKE/MODEL/SERIAL: **MULTIMATIC DRY-TO-DRY UNT/VALORE V300 C1S/30-1091-4640**

CONSTRUCTION PERMIT #: **09DE0526**

EMISSION UNIT ID: **002**

EMISSION UNIT DESCRIPTION: **DRY CLEANER**

EMISSION PROCESS DESCRIPTION: **DRY CLEANER**

ANNUAL THROUGHPUT: **15 GALLONS SOLVENT CONSUMED**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 13** **Distance from Property: 0.06 mi. (317 ft.) SW**

## FACILITY INFORMATION

UNIQUE ID: **17753LST**
FACILITY ID: **17753**
NAME: **BLAKE STREET APARTMENTS**
ADDRESS: **2632 BLAKE ST**
**DENVER, CO 80202**
SITE NAME: **BLAKE STREET APARTMENTS**
LOCATION: **2632 BLAKE ST, DENVER 80202**

## LEAKING INFORMATION

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **10294** | **CLOSED** | **2/5/2007 8:24** | **BLAKE STREET APARTMENTS** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=10294 | | | |
| **9718** | **CLOSED** | **1/24/2005 7:23** | **2632 BLAKE ST** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=9718 | | | |

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# Underground Storage Tank Facilities (UST)

**MAP ID# 13** **Distance from Property: 0.06 mi. (317 ft.) SW**

## FACILITY INFORMATION

FACILITY ID: **17753**

NAME: **BLAKE STREET APARTMENTS**

ADDRESS: **2632 BLAKE ST**
**DENVER, CO 80202**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=17753

## OWNER INFORMATION

OWNER ID: **NOT REPORTED**

NAME: **BROADWAY PLAZA LOFTS LLP**

ADDRESS: **2330 BROADWAY STE 103**
**DENVER, CO 80205**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **39278** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **1000** | **PERMANENTLY CLOSED** | **NOT REPORTED** |

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 13** **Distance from Property: 0.06 mi. (317 ft.) SW**

## FACILITY INFORMATION

FACILITY ID: **17753**

NAME: **BLAKE STREET APARTMENTS**

ADDRESS: **2632 BLAKE ST**
**DENVER, CO 80202**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=17753

## OWNER INFORMATION

OWNER ID: **20325**

NAME: **BROADWAY PLAZA LOFTS LLP**

ADDRESS: **2330 BROADWAY STE 103**
**DENVER, CO 80205**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **39278** | **ABOVEGROUND STORAGE TANK** | **NOT REPORTED** | **0** | **CLOSED** | **NOT REPORTED** |

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# Emergency Response Notification System (ERNSCO)

**MAP ID# 14** **Distance from Property: 0.06 mi. (317 ft.) W**

## INCIDENT INFORMATION

GSID#: **1148696**
NRC ID#: **1148696**
INCIDENT LOCATION: **NOT REPORTED**
INCIDENT ADDRESS: **26TH STREET AND WELTON STREET**
**DENVER, CO**
INCIDENT COUNTY: **DENVER**

## INCIDENT DETAILS

INCIDENT DATE: **5/24/2016 17:01**
INCIDENT CAUSE: **OTHER**
INCIDENT TYPE: **PIPELINE**
INCIDENT OCCURED/DISCOVERED: **OCCURRED**
INCIDENT DESCRIPTION: **CALLER STATED A CONSTRUCTION COMPANY STRUCK TWO GAS SERVICE LINES AND THERE IS A RELEASE OF NATURAL GAS. CALLER STATED THE CONSTRUCTION COMPANY THAT STRUCK THE LINES HAS LEFT THE SCENE AND HAS NOT BEEN IDENTIFIED.**

## RESPONSIBLE PARTY

RESPONSIBLE COMPANY: **NOT REPORTED**
ADDRESS: **ADDRESS NOT REPORTED**
**CITY NOT REPORTED**
RESPONSIBLE COMPANY ORGANIZATION TYPE: **UNKNOWN**

## MATERIALS INVOLVED

CHRIS CODE: **ONG**
MATERIAL REACHED WATER: **NO**
WATER AMOUNT: **UNKNOWN AMOUNT / NOT REPORTED**
MATERIAL RELEASED/AMOUNT: **NATURAL GAS / UNKNOWN AMOUNT**

## OTHER MATERIALS INVOLVED

**- NO OTHER MATERIALS INVOLVED -**

## REMEDIAL ACTION

REMEDIAL ACTION: **CALLER STATED THEY ARE WORKING ON SECURING THE LINE, THE LINE IS NOT BLOWING BUT IT IS LEAKING.**

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# No Longer Regulated RCRA Generator Facilities (NLRRCRAG)

**MAP ID# 15** **Distance from Property: 0.07 mi. (370 ft.) N**

**FACILITY INFORMATION**

EPA ID#: **COR000220590**
NAME: **A R WILFLEY AND SONS INC**
ADDRESS: **2750 BLAKE ST**
**DENVER, CO 80205**
CONTACT NAME: **CHARLES P HOPLEY**
CONTACT ADDRESS: **PO BOX 2330**
**DENVER CO 80201**
CONTACT PHONE: **303-889-7107**
NON-NOTIFIER: **NOT A NON-NOTIFIER**
DATE RECEIVED BY AGENCY: **12/01/2015**

OWNER TYPE: **PRIVATE**
OWNER NAME: **FOUNDRIES INS**
OPERATOR TYPE: **PRIVATE**
OPERATOR NAME: **A R WILFLEY AND SONS INC**

CERTIFICATION

| CERTIFICATION NAME: | CERTIFICATION TITLE: | CERTIFICATION SIGNED DATE: |
|---|---|---|
| **CHARLES HOPLEY** | **SFTY COORD** | **11/17/2015** |
| **CHARLES HOPLEY** | **SFTY COORD** | **01/16/2009** |

INDUSTRY CLASSIFICATION (NAICS)

**333911 - PUMP AND PUMPING EQUIPMENT MANUFACTURING**

SITE HISTORY (INCLUDES GENERATORS AND NON-GENERATORS)

DATE RECEIVED BY AGENCY: **12/01/2015**
NAME: **A R WILFLEY AND SONS INC**

DATE RECEIVED BY AGENCY: **01/23/2009**
NAME: **A R WILFLEY AND SONS INC**

CURRENT ACTIVITY INFORMATION

GENERATOR STATUS: **NOT A GENERATOR** LAST UPDATED DATE: **12/03/2015**
SUBJECT TO CORRECTIVE ACTION UNIVERSE: **NO**
TDSFs POTENTIALLY SUBJECT TO CORRECTIVE ACTION UNDER 3004 (u)/(v) UNIVERSE: **NO**
TDSFs ONLY SUBJECT TO CORRECTIVE ACTION UNDER DISCRETIONARY AUTHORITIES UNIVERSE: **NO**
NON TSDFs WHERE RCRA CORRECTIVE ACTION HAS BEEN IMPOSED UNIVERSE: **NO**
CORRECTIVE ACTION WORKLOAD UNIVERSE: **NO**

IMPORTER: **NO**
MIXED WASTE GENERATOR: **NO**
RECYCLER: **NO**
TRANSPORTER: **NO**
ONSITE BURNER EXEMPTION: **NO**
FURNACE EXEMPTION: **NO**
USED OIL REFINER: **NO**
USED OIL TRANSFER FACILITY: **NO**

UNDERGROUND INJECTION: **NO**
UNIVERSAL WASTE DESTINATION FACILITY: **NO**
TRANSFER FACILITY: **NO**
USED OIL FUEL BURNER: **NO**
USED OIL PROCESSOR: **NO**
USED OIL FUEL MARKETER TO BURNER: **NO**
SPECIFICATION USED OIL MARKETER: **NO**
USED OIL TRANSPORTER: **NO**

COMPLIANCE, MONITORING AND ENFORCEMENT INFORMATION

EVALUATIONS **- NO EVALUATIONS REPORTED -**
VIOLATIONS **- NO VIOLATIONS REPORTED -**
ENFORCEMENTS **- NO ENFORCEMENTS REPORTED -**

HAZARDOUS WASTE

| | |
|---|---|
| **D001** | **IGNITABLE WASTE** |
| **D035** | **METHYL ETHYL KETONE** |
| **F003** | **THE FOLLOWING SPENT NON-HALOGENATED SOLVENTS: XYLENE, ACETONE, ETHYL ACETATE, ETHYL BENZENE, ETHYL ETHER, METHYL ISOBUTYL KETONE, N-BUTYL ALCOHOL, CYCLOHEXANONE, AND METHANOL; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONLY THE ABOVE SPENT NONHALOGENATED SOLVENTS; AND ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS, AND A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THOSE SOLVENTS LISTED IN F001, F002, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.** |
| **F005** | **THE FOLLOWING SPENT NONHALOGENATED SOLVENTS: TOLUENE, METHYL ETHYL KETONE,CARBON DISULFIDE, ISOBUTANOL, PYRIDINE,BENZENE, 2-ETHOXYETHANOL, AND 2-NITROPROPANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001,F002, OR F004; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.** |

UNIVERSAL WASTE

| WASTE TYPE: | ACCUMULATED WASTE ON-SITE: | GENERATED WASTE ON-SITE: | SOURCE TYPE: |
|---|---|---|---|
| **NOT REPORTED** | **NO** | **NO** | **NOTIFICATION** |
| **BATTERIES** | **NO** | **NOT REPORTED** | **NOTIFICATION** |
| **OTHER** | **NO** | **NO** | **NOTIFICATION** |
| **LAMPS** | **NO** | **NOT REPORTED** | **NOTIFICATION** |
| **MERCURY-CONTAINING DEVICES** | **NO** | **NO** | **NOTIFICATION** |
| **PESTICIDES** | **NO** | **NOT REPORTED** | **NOTIFICATION** |
| **MERCURY CONTAINING EQUIPMENT** | **NO** | **NOT REPORTED** | **NOTIFICATION** |

CORRECTIVE ACTION AREA **- NO CORRECTIVE ACTION AREA INFORMATION REPORTED -**

CORRECTIVE ACTION EVENT **- NO CORRECTIVE ACTION EVENT REPORTED -**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 16** **Distance from Property: 0.07 mi. (370 ft.) W**

**SITE INFORMATION**

FILE NUMBER: **001005-1**
SITE NO: **189**
NAME: **JEFFERSON @ GATEWAY I**
ADDRESS: **SE CORNER, 29TH & BROADWAY**
**DENVER, CO 80221**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **11/19/2000**
DECISION: **WITHDRAWN**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **1045.52** CLEANUP ACRES: **NOT REPORTED**

OTHER ISSUES: **UP GRADIENT SOURCE;#10**
LAND USE RESTRICTIONS: **NOT REPORTED**
PROJECT MANAGER: **WALKER**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **NOT REPORTED**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **NOT REPORTED**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 16** **Distance from Property: 0.08 mi. (422 ft.) W**

**SITE INFORMATION**

FILE NUMBER: **020211-1**
SITE NO: **189**
NAME: **JEFFERSON @ GATEWAY II**
ADDRESS: **2800 BROADWAY**
**DENVER, CO**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **3/28/2002**
DECISION: **APPROVAL**

REMEDY START DATE: **4/22/2003** REMEDY END DATE: **4/22/2004**
ACTUAL COST: **1082.86** CLEANUP ACRES: **4.0**

OTHER ISSUES: **UP GRADIENT SOURCE;#10**
LAND USE RESTRICTIONS: **NOT REPORTED**
PROJECT MANAGER: **WALKER**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **NOT REPORTED**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **NOT REPORTED**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 17** **Distance from Property: 0.08 mi. (422 ft.) NW**

**FACILITY INFORMATION**

UNIQUE ID: **14142LST**
FACILITY ID: **14142**
NAME: **ABANDONED UST**
ADDRESS: **2868 S BROADWAY**
**DENVER, CO 80216**
SITE NAME: **ABANDONED UST**
LOCATION: **2868 S BROADWAY, DENVER 80216**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **585** | **CLOSED** | **8/23/1990** | **ABANDONED UST** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=585

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 17** **Distance from Property: 0.08 mi. (422 ft.) NW**

**FACILITY INFORMATION**

FACILITY ID: **14142**
NAME: **ABANDONED UST**
ADDRESS: **2868 S BROADWAY**
**DENVER, CO 80216**
COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=14142

**OWNER INFORMATION**

OWNER ID: **17043**
NAME: **SIGNET PARTNERS**
ADDRESS: **3600 S YOSEMITE**
**DENVER, CO 80237**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 18** **Distance from Property: 0.08 mi. (422 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **12562LST**
FACILITY ID: **12562**
NAME: **CUSTOM CORNED BEEF**
ADDRESS: **2600 WALNUT ST**
**DENVER, CO 80205**
SITE NAME: **CUSTOM CORNED BEEF**
LOCATION: **2600 WALNUT ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **5502** | **CLOSED** | **11/25/1991** | **CUSTOM CORNED BEEF** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=5502

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# Spills Listing (SPILLS)

**MAP ID# 18** **Distance from Property: 0.1 mi. (528 ft.) SW**

## INCIDENT INFORMATION

CASE NUMBER: **2007-0052** NRC NUMBER: **NOT REPORTED**

SPILL DATE: **01/15/07**

SPILL LOCATION: **26TH & WALNUT (IN THE ALLEY)**

SPILL CITY/STATE/ZIP: **DENVER, CO NOT REPORTED**

SPILL COUNTY: **DENVER**

## RESPONSIBLE PARTY

NAME: **UNKNOWN CARPET CLEANING COMPANY**

ADDRESS: **STREET NOT REPORTED**
**CITY NOT REPORTED, CO**

COUNTY: **DENVER**

CONTACT: **NOT REPORTED**

PHONE: **NOT REPORTED**

## INCIDENT DETAILS

SOURCE: **PIPELINE**

SOURCE TYPE: **OTHER-BUILDING PIPE**

MEDIUM: **UNKNOWN**

WATERWAY: **STORM DRAIN**

CAUSE: **DUMPING**

MATERIAL TYPE: **COMPLAINT**

MATERIAL DESCRIPTION: **UNKNOWN**

MATERIAL QUANTITY: **NOT REPORTED**

WATER QUANTITY: **NOT REPORTED**

CAUSE INFORMATION:

**DISCHARGE PIPE COMING OUT OF THE BUILDING (6-INCH DIAMETER) SPEWING WATER FULL FORCE INTO A STORM DRAIN. WATER WAS CLEAR, WITH NO NOTED ODOR.**

ACTION:

**NOT REPORTED**

RESPONSE COMMENTS:

**THIS HAS HAPPENED BEFORE - AT LEAST TWICE OVER THE LAST 2 MONTHS. THEY BELIEVE THE WATER IS FROM A CARPET CLEANING COMPANY. YOU MAY CALL GWEN CHRISTENSON @ 303-895-5011 FOR ADDITIONAL INFORMATION.**

COMMENTS:

**NOT REPORTED**

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# Underground Storage Tank Facilities (UST)

**MAP ID# 18** **Distance from Property: 0.08 mi. (422 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **2712**

NAME: **CUSTOM CORNED BEEF**

ADDRESS: **2600 WALNUT**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=2712

**OWNER INFORMATION**

OWNER ID: **1243**

NAME: **CUSTOM CORNED BEEF**

ADDRESS: **2600 WALNUT**
**DENVER, CO 80205**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **7527** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **1000** | **CLOSED** | **NOT REPORTED** |

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 18** **Distance from Property: 0.08 mi. (422 ft.) W**

**SITE INFORMATION**

FILE NUMBER: **140224-1**

SITE NO: **643**

NAME: **DENVER CENTER THEATRE**

ADDRESS: **2601 LARIMER STREET**
**DENVER, CO 80205**

COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**

REVIEW DATE DUE: **4/10/2014**

DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**

ACTUAL COST: **760.00** CLEANUP ACRES: **1.0**

OTHER ISSUES: **NOT REPORTED**

LAND USE RESTRICTIONS: **COMMERCIAL**

PROJECT MANAGER: **APOSTOLOPOULOS**

INDOOR AIR: **NOT REPORTED**

MEDIA SEDIMENT: **NOT REPORTED**

MEDIA GROUND WATER: **ASBESTOS CONTAMINATED MATERIALS;#25**

MEDIA SURFACE WATER: **NOT REPORTED**

MEDIA SOIL: **BTEX;#6**

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 18** **Distance from Property: 0.08 mi. (422 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **12562**
NAME: **CUSTOM CORNED BEEF**
ADDRESS: **2600 WALNUT ST**
**DENVER, CO 80205**
COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=12562

**OWNER INFORMATION**

OWNER ID: **16903**
NAME: **CUSTOM CORNED BEEF**
ADDRESS: **2600 WALNUT ST**
**DENVER, CO 80205**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# Spills Listing (SPILLS)

**MAP ID# 19** **Distance from Property: 0.08 mi. (422 ft.) SE**

## INCIDENT INFORMATION

CASE NUMBER: **CO93-374** NRC NUMBER: **NONE**

SPILL DATE: **10/14/93**

SPILL LOCATION: **350 W. 23RD**

SPILL CITY/STATE/ZIP: **DENVER, CO NOT REPORTED**

SPILL COUNTY: **DENVER**

## RESPONSIBLE PARTY

NAME: **KODISH AUTO & GLASS**

ADDRESS: **350 W. 23RD**
**DENVER, CO**

COUNTY: **DENVER**

CONTACT: **NOT REPORTED**

PHONE: **NOT REPORTED**

## INCIDENT DETAILS

SOURCE: **FIXED FACILITY**

SOURCE TYPE: **AUTO AND GLASS SHOP**

MEDIUM: **LAND AND FIXED FACILITY**

WATERWAY: **NONE**

CAUSE: **D**

MATERIAL TYPE: **OIL**

MATERIAL DESCRIPTION:
**HYDRAULIC OIL**

MATERIAL QUANTITY:
**NOT REPORTED**

WATER QUANTITY:
**NOT REPORTED**

CAUSE INFORMATION:

**ALLEGED DUMPING**

ACTION:

**NOT REPORTED**

RESPONSE COMMENTS:

**NOT REPORTED**

COMMENTS:

**CALLER STATED THAT HYDRAULIC LIFT OIL WAS REMOVED WITHIN BUILDING AND LIFT FLU ID WAS DUMPED INTO TH**

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# No Longer Regulated RCRA Generator Facilities (NLRRCRAG)

**MAP ID# 20** **Distance from Property: 0.09 mi. (475 ft.) NE**

**FACILITY INFORMATION**

EPA ID#: **COD007078363**
NAME: **A R WILFLEY AND SONS INC**
ADDRESS: **2763 BLAKE ST**
**DENVER, CO 80205**
CONTACT NAME: **CHARLES P HOPLEY**
CONTACT ADDRESS: **P O BOX 2330**
**DENVER CO 80201**
CONTACT PHONE: **303-889-7107**
NON-NOTIFIER: **NOT A NON-NOTIFIER**
DATE RECEIVED BY AGENCY: **12/01/2015**

OWNER TYPE: **PRIVATE**
OWNER NAME: **A R WILFLEY AND SONS INC**
OPERATOR TYPE: **PRIVATE**
OPERATOR NAME: **A R WILFLEY AND SONS INC**

CERTIFICATION

| CERTIFICATION NAME: | CERTIFICATION TITLE: | CERTIFICATION SIGNED DATE: |
|---|---|---|
| **CHARLES HOPLEY** | **SAFETY COORD** | **11/17/2015** |
| **CHARLES HOPLEY** | **SAFETY COORD** | **08/02/2010** |
| **CHUCK HOPLEY** | **ENV MGR** | **11/26/2003** |

INDUSTRY CLASSIFICATION (NAICS)

**333911 - PUMP AND PUMPING EQUIPMENT MANUFACTURING**

SITE HISTORY (INCLUDES GENERATORS AND NON-GENERATORS)

DATE RECEIVED BY AGENCY: **12/01/2015**
NAME: **A R WILFLEY AND SONS INC**

DATE RECEIVED BY AGENCY: **08/11/2010**
NAME: **A R WILFLEY AND SONS INC**

DATE RECEIVED BY AGENCY: **11/26/2003**
NAME: **WILFLEY A R & SONS INC**

DATE RECEIVED BY AGENCY: **02/10/1994**
NAME: **WILFLEY A R & SONS INC**

CURRENT ACTIVITY INFORMATION

GENERATOR STATUS: **NOT A GENERATOR** LAST UPDATED DATE: **12/03/2015**
SUBJECT TO CORRECTIVE ACTION UNIVERSE: **NO**
TDSFs POTENTIALLY SUBJECT TO CORRECTIVE ACTION UNDER 3004 (u)/(v) UNIVERSE: **NO**
TDSFs ONLY SUBJECT TO CORRECTIVE ACTION UNDER DISCRETIONARY AUTHORITIES UNIVERSE: **NO**
NON TSDFs WHERE RCRA CORRECTIVE ACTION HAS BEEN IMPOSED UNIVERSE: **NO**
CORRECTIVE ACTION WORKLOAD UNIVERSE: **NO**

IMPORTER: **NO**
MIXED WASTE GENERATOR: **NO**
RECYCLER: **NO**
TRANSPORTER: **NO**
ONSITE BURNER EXEMPTION: **NO**
FURNACE EXEMPTION: **NO**
USED OIL REFINER: **NO**
USED OIL TRANSFER FACILITY: **NO**

UNDERGROUND INJECTION: **NO**
UNIVERSAL WASTE DESTINATION FACILITY: **NO**
TRANSFER FACILITY: **NO**
USED OIL FUEL BURNER: **NO**
USED OIL PROCESSOR: **NO**
USED OIL FUEL MARKETER TO BURNER: **NO**
SPECIFICATION USED OIL MARKETER: **NO**
USED OIL TRANSPORTER: **NO**

COMPLIANCE, MONITORING AND ENFORCEMENT INFORMATION

EVALUATIONS

| | |
|---|---|
| **08/31/2009** | **FSD FACILITY SELF DISCLOSURE** |
| **12/10/2008** | **FCI FOCUSED COMPLIANCE INSPECTION** |
| **08/14/2008** | **FSD FACILITY SELF DISCLOSURE** |
| **02/01/2005** | **NRR NON-FINANCIAL RECORD REVIEW** |
| **12/02/2004** | **CEI COMPLIANCE EVALUATION INSPECTION ON-SITE** |

VIOLATIONS

| | |
|---|---|
| **12/02/2004** | **262.A GENERATORS - GENERAL** |
| **12/02/2004** | **279.C USED OIL - GENERATORS** |

ENFORCEMENTS

| | |
|---|---|
| **12/02/2004** | **127 V3 CONVERSION COMPLIANCE ADVISORY** |

HAZARDOUS WASTE

| | |
|---|---|
| **D000** | |
| **D001** | **IGNITABLE WASTE** |
| **D002** | **CORROSIVE WASTE** |
| **D010** | **SELENIUM** |
| **D018** | **BENZENE** |
| **D039** | **TETRACHLOROETHYLENE** |
| **F003** | **THE FOLLOWING SPENT NON-HALOGENATED SOLVENTS: XYLENE, ACETONE, ETHYL ACETATE, ETHYL BENZENE, ETHYL ETHER, METHYL ISOBUTYL KETONE, N-BUTYL ALCOHOL, CYCLOHEXANONE, AND METHANOL; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONLY THE ABOVE SPENT NONHALOGENATED SOLVENTS; AND ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS, AND A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THOSE SOLVENTS LISTED IN F001, F002, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.** |
| **F005** | **THE FOLLOWING SPENT NONHALOGENATED SOLVENTS: TOLUENE, METHYL ETHYL KETONE,CARBON DISULFIDE, ISOBUTANOL, PYRIDINE,BENZENE, 2-ETHOXYETHANOL, AND 2-NITROPROPANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001,F002, OR F004; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.** |
| **F037** | **PETROLEUM REFINERY PRIMARY OIL/WATER/SOLIDS SEPARATION SLUDGE - ANY SLUDGE GENERATED FROM THE GRAVITATIONAL SEPARATION OF OIL/WATER/SOLIDS DURING THE STORAGE OR TREATMENT OF PROCESS WASTEWATERS AND OILY COOLING WASTEWATERS FROM PETROLEUM REFINERIES. SUCH SLUDGES INCLUDE, BUT ARE NOT LIMITED TO, THOSE GENERATED IN OIL/WATER/SOLIDS SEPARATORS; TANKS AND IMPOUNDMENTS; DITCHES AND OTHER CONVEYANCES; SUMPS; AND STORM WATER UNITS RECEIVING DRY WEATHER FLOW. SLUDGES GENERATED IN STORM WATER UNITS THAT DO NOT RECEIVE DRY WEATHER FLOW, SLUDGES GENERATED IN AGGRESSIVE BIOLOGICAL TREATMENT UNITS AS DEFINED IN SECTION 261.31(B)(2)(INCLUDING SLUDGES GENERATED IN ONE OR MORE ADDITIONAL UNITS AFTER WASTEWATERS HAVE BEEN TREATED IN AGGRESSIVE BIOLOGICAL TREATMENT UNITS), AND K051 WASTES ARE EXEMPTED FROM THIS LISTING.** |
| **K050** | **HEAT EXCHANGER BUNDLE CLEANING SLUDGE FROM THE PETROLEUM REFINING INDUSTRY.** |
| **K051** | **API SEPARATOR SLUDGE FROM THE PETROLEUM REFINING INDUSTRY.** |

UNIVERSAL WASTE **- NO UNIVERSAL WASTE REPORTED -**

CORRECTIVE ACTION AREA **- NO CORRECTIVE ACTION AREA INFORMATION REPORTED -**

CORRECTIVE ACTION EVENT **- NO CORRECTIVE ACTION EVENT REPORTED -**

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# Toxics Release Inventory (TRI)

**MAP ID# 20** **Distance from Property: 0.09 mi. (475 ft.) NE**

## FACILITY INFORMATION

ID #: **80205RWLFL2763B**

OWNER NAME: **NA**

FACILITY NAME: **A R WILFLEY & SONS INC**

ADDRESS: **2763 BLAKE ST**
**DENVER, CO 80205**

COUNTY: **DENVER**

(NAICS) INDUSTRIAL CLASSIFICATION

**333911 - THIS U.S. INDUSTRY COMPRISES ESTABLISHMENTS PRIMARILY ENGAGED IN MANUFACTURING GENERAL PURPOSE PUMPS AND PUMPING EQUIPMENT (EXCEPT FLUID POWER PUMPS AND MOTORS), SUCH AS RECIPROCATING PUMPS, TURBINE PUMPS, CENTRIFUGAL PUMPS, ROTARY PUMPS, DIAPHRAGM PUMPS, DOMESTIC WATER SYSTEM PUMPS, OIL WELL AND OIL FIELD PUMPS AND SUMP PUMPS.**

CHEMICAL/S RELEASED

**CHROMIUM, NICKEL,**

## RELEASE INFORMATION

*(Release amounts are reported in pounds)*

| REPORT YEAR | FUGITIVE AIR | STACK AIR | WATER RELEASE | CLASS I INJECTION WELLS | CLASS II - V INJECTION WELLS | RCRA C / OTHER LANDFILLS | LAND TREATMENT |
|---|---|---|---|---|---|---|---|
| 2014 | 1.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2013 | 1.57 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2012 | 5.48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2011 | 5.61 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2010 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2009 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2008 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2007 | 10.00 | 0.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2006 | 10.24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2005 | 10.29 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2004 | 10.32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2003 | 10.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2002 | 10.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2001 | 10.23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2000 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1999 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1998 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1997 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1996 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1995 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1994 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1993 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1992 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1991 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1990 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **1989** | **2.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |

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**MAP ID# 20** **Distance from Property: 0.09 mi. (475 ft.) NE**

**SITE INFORMATION**

EPA ID: **COD007078363**

SITE NAME: **WILFLEY A R & SONS INC**

SITE ADDRESS: **2763 BLAKE ST**
**DENVER, CO 80205**

SITE COUNTY: **DENVER**

FACILITY TYPE: **SQG**

STATUS: **ACTIVE**

LINKS: **http://www.epa.gov/cgi-bin/get1cReport.cgi?tool=echo&IDNumber=COD007078363**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 21** **Distance from Property: 0.09 mi. (475 ft.) E**

**FACILITY INFORMATION**

UNIQUE ID: **13743LST**
FACILITY ID: **13743**
NAME: **CITY MAINTENANCE SHOP**
ADDRESS: **2024 CLARKSON ST**
**DENVER, CO 80205**
SITE NAME: **CITY MAINTENANCE SHOP**
LOCATION: **2024 CLARKSON ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **333** | **CLOSED** | **8/8/1996** | **CITY MAINTENANCE SHOP** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=333

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# Underground Storage Tank Facilities (UST)

**MAP ID# 21** **Distance from Property: 0.09 mi. (475 ft.) E**

## FACILITY INFORMATION

FACILITY ID: **702**

NAME: **BARNEY FORD HEIGHTS**

ADDRESS: **2024 CLARKSON ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=702

## OWNER INFORMATION

OWNER ID: **1028**

NAME: **DENVER HOUSING AUTHORITY**

ADDRESS: **1100 W COLFAX AVE**
**DENVER, CO 80204**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **2162** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **999999999** | **CLOSED** | **NOT REPORTED** |

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 21** **Distance from Property: 0.09 mi. (475 ft.) E**

**FACILITY INFORMATION**

FACILITY ID: **13743**

NAME: **CITY MAINTENANCE SHOP**

ADDRESS: **2024 CLARKSON ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=13743

**OWNER INFORMATION**

OWNER ID: **1000**

NAME: **DENVER DEPT OF ENVIRONMENTAL HEALTH**

ADDRESS: **200 W 14TH AVE STE 310**
**DENVER, CO 80204**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 22** **Distance from Property: 0.09 mi. (475 ft.) S**

**SITE INFORMATION**

FILE NUMBER: **070424-1**

SITE NO: **386**

NAME: **MARTIN FEIN INTERESTS**

ADDRESS: **1900 WASHINGTON STREET**
**DENVER, CO**

COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**

REVIEW DATE DUE: **6/8/2007**

DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**

ACTUAL COST: **850.00** CLEANUP ACRES: **2.4**

OTHER ISSUES: **NOT REPORTED**

LAND USE RESTRICTIONS: **NOT REPORTED**

PROJECT MANAGER: **APOSTOLOPOULOS**

INDOOR AIR: **VOC'S;#6**

MEDIA SEDIMENT: **VOC'S;#4**

MEDIA GROUND WATER: **VOC'S;#4**

MEDIA SURFACE WATER: **VOC'S;#4**

MEDIA SOIL: **VOC'S;#4**

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# Brownfields Management System (BF)

**MAP ID# 23** **Distance from Property: 0.09 mi. (475 ft.) W**

**SITE INFORMATION**

ID#: **120399**

NAME: **PARK AVENUE REDEVELOPMENT**

ADDRESS: **240 PARK AVENUE WEST**
**DENVER, CO 80205**

TYPE FUNDING: **HAZARDOUS**

PREDOMINANT PAST USE (ACREAGE):

| GREENSPACE: | RESIDENTIAL: | COMMERCIAL: | INDUSTRIAL: |
|---|---|---|---|
| **NOT REPORTED** | **3.7** | **NOT REPORTED** | **NOT REPORTED** |

FUTURE USE (ACREAGE):

| GREENSPACE: | RESIDENTIAL: | COMMERCIAL: | INDUSTRIAL: |
|---|---|---|---|
| **NOT REPORTED** | **3.7** | **NOT REPORTED** | **NOT REPORTED** |

PROPERTY HIGHLIGHT:
**NOT REPORTED**

PROPERTY SIZE (Acres): **3.7**

CURRENT OWNER: **DENVER HOUSING AUTHORITY**

PROPERTY DESCRIPTION/ FORMER USE:
**NOT REPORTED**

CONTAMINATE(S): **VOCS**

CONTAMINATE(S) CLEANED UP: **NOT REPORTED**

MEDIA(S) AFFECTED: **GROUND WATER**

MEDIA(S) CLEANED UP: **NOT REPORTED**

TYPE OF BROWNFIELD GRANT: **ASSESSMENT**

ENVIRONMENTAL ASSESSMENT ACTIVITY: **PHASE II ENVIRONMENTAL ASSESSMENT**

ASSESSMENT START DATE: **12/8/2009 0:00**

ASSESSMENT COMPLETION DATE: **4/23/2010 0:00**

CLEANUP REQUIRED: **UNKNOWN**

STATE & TRIBAL ENROLLMENT ID: **NOT REPORTED**

STATE & TRIBAL ENROLLMENT DATE: **NOT REPORTED**

PROPERTY ENROLLED IN A STATE & TRIBAL PROGRAM?: **NOT REPORTED**

ARE INSTITUTIONAL CONTROLS REQUIRED?: **NO**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 23** **Distance from Property: 0.09 mi. (475 ft.) W**

## SITE INFORMATION

FILE NUMBER: **100617-1**
SITE NO: **488**
NAME: **DENVER HOUSING GAS STATION**
ADDRESS: **240 PARK AVENUE WEST**
**DENVER, CO 80205**
COUNTY: **DENVER**

## SITE DETAILS

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **8/1/2010**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED**
REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **722.50**
CLEANUP ACRES: **3.3**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **RESIDENTIAL**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **VOC'S;#4**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **NOT REPORTED**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 24** **Distance from Property: 0.1 mi. (528 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **13856LST**
FACILITY ID: **13856**
NAME: **NOT REPORTED**
ADDRESS: **601 E 19TH AVE**
**DENVER, CO 80203**
SITE NAME: **ST LUKES HOSPITAL**
LOCATION: **601 E 19TH AVE, DENVER 80203**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **4649** | **CLOSED** | **2/10/1997** | **ST LUKES HOSPITAL** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=4649

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# Underground Storage Tank Facilities (UST)

**MAP ID# 24** **Distance from Property: 0.1 mi. (528 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **6655**

NAME: **ST LUKES HOSPITAL**

ADDRESS: **601 E 19TH AVE**
**DENVER, CO 80203**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=6655

**OWNER INFORMATION**

OWNER ID: **5999**

NAME: **THE MEDICAL CENTER AURORA**

ADDRESS: **1501 S POTOMAC WAY**
**AURORA, CO 80012**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **17704** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **2000** | **CLOSED** | **NOT REPORTED** |
| **17705** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **2000** | **CLOSED** | **NOT REPORTED** |
| **17706** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **10000** | **CLOSED** | **NOT REPORTED** |
| **17707** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **20000** | **CLOSED** | **NOT REPORTED** |
| **17708** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **5000** | **CLOSED** | **NOT REPORTED** |
| **17709** | **UNDERGROUND STORAGE TANK** | **NOT LISTED** | **20000** | **CLOSED** | **NOT REPORTED** |

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 24** **Distance from Property: 0.1 mi. (528 ft.) SW**

**SITE INFORMATION**

FILE NUMBER: **970228-1**
SITE NO: **67**
NAME: **ST LUKES HOSPITAL**
ADDRESS: **601 E 19 AVE**
**DENVER, CO 80203**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **4/14/1997**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **2800.50** CLEANUP ACRES: **6.5**

OTHER ISSUES: **UNDERGROUND STORAGE TANK;#3**
LAND USE RESTRICTIONS: **NOT REPORTED**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **HYDRAULIC OIL;#20**
MEDIA GROUND WATER: **NOT REPORTED**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **HYDRAULIC OIL;#20**

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 24** **Distance from Property: 0.1 mi. (528 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **13856**
NAME: **ST LUKES HOSPITAL**
ADDRESS: **601 E 19TH AVE**
**DENVER, CO 80203**
COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=13856

**OWNER INFORMATION**

OWNER ID: **NOT REPORTED**
NAME: **COLUMBIA HEALTHONE LLC**
ADDRESS: **600 S CHERRY ST #217**
**DENVER, CO 80222**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 25** **Distance from Property: 0.1 mi. (528 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **13678LST**

FACILITY ID: **13678**

NAME: **BURLINGTON NORTHERN RAILYARD**

ADDRESS: **2565 BLAKE ST**
**DENVER, CO 80205**

SITE NAME: **BURLINGTON NORTHERN RAILYARD**

LOCATION: **2565 BLAKE ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **2808** | **CLOSED** | **5/6/1997** | **BURLINGTON NORTHERN RAILYARD** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=2808

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 25** **Distance from Property: 0.1 mi. (528 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **13678**

NAME: **BURLINGTON NORTHERN RAILYARD**

ADDRESS: **2565 BLAKE ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=13678

**OWNER INFORMATION**

OWNER ID: **5458**

NAME: **UNION PACIFIC RAILROAD**

ADDRESS: **280 SOUTH 400 WEST STE 250**
**SALT LAKE CITY, UT 84101**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 26** **Distance from Property: 0.11 mi. (581 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **13652LST**
FACILITY ID: **13652**
NAME: **CCOD**
ADDRESS: **2564 BLAKE ST**
**DENVER, CO 80205**
SITE NAME: **CCOD**
LOCATION: **2564 BLAKE ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **2636** | **CLOSED** | **2/16/1996** | **CCOD** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=2636

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 26** **Distance from Property: 0.11 mi. (581 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **13652**

NAME: **CCOD**

ADDRESS: **2564 BLAKE ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=13652

**OWNER INFORMATION**

OWNER ID: **1000**

NAME: **DENVER DEPT OF ENVIRONMENTAL HEALTH**

ADDRESS: **200 W 14TH AVE STE 310**
**DENVER, CO 80204**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# Spills Listing (SPILLS)

**MAP ID# 27** **Distance from Property: 0.11 mi. (581 ft.) SW**

## INCIDENT INFORMATION

CASE NUMBER: **CO90-187** NRC NUMBER: **NONE**

SPILL DATE: **08/06/90**

SPILL LOCATION: **1116 26TH ST**

SPILL CITY/STATE/ZIP: **DENVER, CO NOT REPORTED**

SPILL COUNTY: **DENVER**

## RESPONSIBLE PARTY

NAME: **CHILDREN**

ADDRESS: **STREET NOT REPORTED**
**DENVER, CO**

COUNTY: **DENVER**

CONTACT: **NOT REPORTED**

PHONE: **NOT REPORTED**

## INCIDENT DETAILS

SOURCE: **UNKNOWN**

SOURCE TYPE: **SOURCE OF MATERIAL UNKNOWN**

MEDIUM: **LAND**

WATERWAY: **NONE**

CAUSE: **O**

MATERIAL TYPE: **HAZARDOUS**

| MATERIAL DESCRIPTION: | MATERIAL QUANTITY: | WATER QUANTITY: |
|---|---|---|
| **TITANIUM DIOXIDE** | **50 P** | **NOT REPORTED** |

CAUSE INFORMATION:

**KIDS PLAYING WITH TITANIUM DIOXIDE POWDER**

ACTION:

**DECON. CHILDREN; HOLD FOR OBSERVATION OF ANY SYMPTOMS**

RESPONSE COMMENTS:

**NOT REPORTED**

COMMENTS:

**TITANIUM DIOXIDE IS NON-TOXIC AND SLIGHT SKIN IRRITANT.**

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# Superfund Enterprise Management System Archived Site Inventory (SEMSARCH)

**MAP ID# 28** **Distance from Property: 0.11 mi. (581 ft.) NE**

**FACILITY INFORMATION**

EPA ID#: **COD983768359**

SITE ID#: **0801078**

NAME: **STOUT STREET DRUMS**

ADDRESS: **2801 STOUT STREET**
**DENVER, CO 80202**

COUNTY: **DENVER**

FEDERAL FACILITY: **NOT A FEDERAL FACILITY**

NPL: **NOT ON THE NPL**

NON NPL STATUS: **NFRAP-SITE DOES NOT QUALIFY FOR THE NPL BASED ON EXISTING INFORMATION**

Below information was gathered from the prior NFRAP update completed in 10/2013 update:

| ACTION | START DATE | COMPLETION DATE | RESPONSIBILITY |
|---|---|---|---|
| **RV - REMOVAL** | **7/27/1990** | **3/1/1991** | **EPA FUND** |
| **AR - ADMINISTRATIVE RECORDS** | **7/27/1990** | **11/14/1990** | **EPA FUND** |
| **DS - DISCOVERY** | **NOT REPORTED** | **7/27/1990** | **EPA FUND** |
| **PA - PRELIMINARY ASSESSMENT** | **NOT REPORTED** | **4/23/1992** | **EPA FUND** |
| **VS - ARCHIVE SITE** | **NOT REPORTED** | **10/10/1996** | **EPA IN-HOUSE** |

ACTION DESCRIPTIONS

**RV - (REMOVAL) - RESPONSE ACTION THAT REQUIRES EXPEDITIOUS ATTENTION TO REDUCE IMMINENT AND SUBSTANTIAL DANGERS TO HUMAN HEALTH, WELFARE, OR THE ENVIRONMENT OR AN EMERGENCY RESPONSE REQUIRED WITHIN HOURS OR DAYS TO ADDRESS ACUTE SITUATIONS INVOLVING ACTUAL OR POTENTIAL THREAT TO HUMAN HEALTH, THE ENVIRONMENT, OR REAL OR PERSONAL PROPERTY DUE TO THE RELEASE OF A HAZARDOUS SUBSTANCE. CHARACTERIZATION OF A REMOVAL ACTION AS REMOVAL, NOT IMMEDIATE REMOVAL OR PLANNED REMOVAL, STARTED AT THE BEGINNING OF FY 1987. THIS CODE NOW TAKES THE PLACE OF IMMEDIATE REMOVAL (IR) AND PLANNED REMOVAL (PR).**

**AR - (ADMINISTRATIVE RECORDS) - SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

**DS - (DISCOVERY) - THE PROCESS BY WHICH A POTENTIAL HAZARDOUS WASTE SITE IS BROUGHT TO THE ATTENTION OF THE EPA. THE PROCESS CAN OCCUR THROUGH THE USE OF SEVERAL MECHANISMS SUCH AS A PHONE CALL OR REFERRAL BY ANOTHER GOVERNMENT AGENCY.**

**PA - (PRELIMINARY ASSESSMENT) - COLLECTION OF DIVERSE EXISTING INFORMATION ABOUT THE SOURCE AND NATURE OF THE SITE HAZARD. IT IS EPA POLICY TO COMPLETE THE PRELIMINARY ASSESSMENT WITHIN ONE YEAR OF SITE DISCOVERY.**

**VS - (ARCHIVE SITE) - THE DECISION IS MADE THAT NO FURTHER ACTIVITY IS PLANNED AT THE SITE.**

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# Spills Listing (SPILLS)

**MAP ID# 28** **Distance from Property: 0.11 mi. (581 ft.) NE**

## INCIDENT INFORMATION

CASE NUMBER: **CO90-162** NRC NUMBER: **NONE**

SPILL DATE: **07/19/90**

SPILL LOCATION: **2801, 05, 11 STOUT ST**

SPILL CITY/STATE/ZIP: **DENVER, CO NOT REPORTED**

SPILL COUNTY: **DENVER**

## RESPONSIBLE PARTY

NAME: **UNKNOWN**

ADDRESS: **STREET NOT REPORTED**
**DENVER, CO**

COUNTY: **DENVER**

CONTACT: **NOT REPORTED**

PHONE: **NOT REPORTED**

## INCIDENT DETAILS

SOURCE: **UNKNOWN**

SOURCE TYPE: **MIDNIGHT DUMP**

MEDIUM: **LAND**

WATERWAY: **NONE**

CAUSE: **D**

MATERIAL TYPE: **UNKNOWN**

| MATERIAL DESCRIPTION: | MATERIAL QUANTITY: | WATER QUANTITY: |
|---|---|---|
| **PURPLE JELLY-LIKE MATERIAL** | **3 D** | **NOT REPORTED** |

CAUSE INFORMATION:

**NOT REPORTED**

ACTION:

**UNDER INVESTIGATION BY DENVER HEALTH AND HOSPITALS (GORDON RICKMAN)**

RESPONSE COMMENTS:

**NOT REPORTED**

COMMENTS:

**EPA ALSO WAS NOTIFIED.**

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# Spills Listing (SPILLS)

**MAP ID# 29** **Distance from Property: 0.11 mi. (581 ft.) W**

## INCIDENT INFORMATION

CASE NUMBER: **2011-0441** NRC NUMBER: **NOT REPORTED**

SPILL DATE: **07/07/11**

SPILL LOCATION: **DHA BLOCK5, 290 PARK AVE WEST**

SPILL CITY/STATE/ZIP: **DENVER, CO NOT REPORTED**

SPILL COUNTY: **DENVER**

## RESPONSIBLE PARTY

NAME: **AMI MECHANICAL**

ADDRESS: **12141 PENNSYLVANIA ST.**
**THORNTON, CO 80241**

COUNTY: **NOT REPORTED**

CONTACT: **ALLAN INGE**

PHONE: **303-280-1401**

## INCIDENT DETAILS

SOURCE: **OTHER**

SOURCE TYPE: **TRUCK WITH TANK**

MEDIUM: **WATER**

WATERWAY: **RETENTION PONDS**

CAUSE: **ERROR OPERATOR**

MATERIAL TYPE: **INCIDENT WITH RELEASE**

| MATERIAL DESCRIPTION: | MATERIAL QUANTITY: | WATER QUANTITY: |
|---|---|---|
| **METHANOL** | **200 GALLONS** | **200 G** |

CAUSE INFORMATION:

**COMPANY IS INSTALLING A GEOTHERMAL SYSTEM. THE USUAL PROCEDURE IS TO RUN A METHANOL THROUGH THE LINE AFTER IT IS INSTALLED, UNTIL IT REACHES THE OTHER END. A LARGE TANKER TRUCK BRINGS THE METHANOL WHEN THEY ARE READY FOR IT. THIS TIME THE OPERATOR DID**

ACTION:

**A CLEAN UP CONTRACTOR IS PLANNED.**

RESPONSE COMMENTS:

**NOT REPORTED**

COMMENTS:

**NOT REPORTED**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 30** **Distance from Property: 0.12 mi. (634 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **5234LST**
FACILITY ID: **5234**
NAME: **GOLD STAR SAUSAGE CO**
ADDRESS: **2800 WALNUT ST**
**DENVER, CO 80205**
SITE NAME: **GOLD STAR SAUSAGE CO**
LOCATION: **2800 WALNUT ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **6701** | **CLOSED** | **7/15/1998** | **GOLD STAR SAUSAGE CO** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=6701

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# Underground Storage Tank Facilities (UST)

**MAP ID# 30** **Distance from Property: 0.12 mi. (634 ft.) NE**

**FACILITY INFORMATION**

FACILITY ID: **5234**

NAME: **GOLD STAR SAUSAGE CO**

ADDRESS: **2800 WALNUT ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=5234

**OWNER INFORMATION**

OWNER ID: **4287**

NAME: **PERA**

ADDRESS: **1300 LOGAN ST**
**DENVER, CO 80203**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **14430** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **500** | **CLOSED** | **NOT REPORTED** |
| **14431** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **500** | **CLOSED** | **NOT REPORTED** |

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# No Longer Regulated RCRA Generator Facilities (NLRRCRAG)

**MAP ID# 30** **Distance from Property: 0.12 mi. (634 ft.) NE**

**FACILITY INFORMATION**

EPA ID#: **COD983796194**
NAME: **GOLD STAR SAUSAGE COMPANY**
ADDRESS: **2800 WALNUT ST**
**DENVER, CO 80205**
CONTACT NAME: **HERN BOLTON**
CONTACT ADDRESS: **2800 WALNUT ST**
**DENVER CO 80205**
CONTACT PHONE: **303-295-6400**
NON-NOTIFIER: **NOT A NON-NOTIFIER**
DATE RECEIVED BY AGENCY: **01/18/2012**

OWNER TYPE: **OTHER**
OWNER NAME: **GOLD STAR SAUSAGE COMPANY**
OPERATOR TYPE: **NOT REPORTED**
OPERATOR NAME: **NOT REPORTED**

CERTIFICATION

| CERTIFICATION NAME: | CERTIFICATION TITLE: | CERTIFICATION SIGNED DATE: |
|---|---|---|
| **J N** | **MGR** | **01/04/2012** |

INDUSTRY CLASSIFICATION (NAICS)

**31111 - ANIMAL FOOD MANUFACTURING**

SITE HISTORY (INCLUDES GENERATORS AND NON-GENERATORS)

DATE RECEIVED BY AGENCY: **01/18/2012**
NAME: **GOLD STAR SAUSAGE COMPANY**
DATE RECEIVED BY AGENCY: **09/11/1992**
NAME: **GOLD STAR SAUSAGE COMPANY**

CURRENT ACTIVITY INFORMATION

GENERATOR STATUS: **NOT A GENERATOR** LAST UPDATED DATE: **01/20/2012**
SUBJECT TO CORRECTIVE ACTION UNIVERSE: **NO**
TDSFs POTENTIALLY SUBJECT TO CORRECTIVE ACTION UNDER 3004 (u)/(v) UNIVERSE: **NO**
TDSFs ONLY SUBJECT TO CORRECTIVE ACTION UNDER DISCRETIONARY AUTHORITIES UNIVERSE: **NO**
NON TSDFs WHERE RCRA CORRECTIVE ACTION HAS BEEN IMPOSED UNIVERSE: **NO**
CORRECTIVE ACTION WORKLOAD UNIVERSE: **NO**

IMPORTER: **NO**
MIXED WASTE GENERATOR: **NO**
RECYCLER: **NO**
TRANSPORTER: **NO**
ONSITE BURNER EXEMPTION: **NO**
FURNACE EXEMPTION: **NO**
USED OIL REFINER: **NO**
USED OIL TRANSFER FACILITY: **NO**

UNDERGROUND INJECTION: **NO**
UNIVERSAL WASTE DESTINATION FACILITY: **NO**
TRANSFER FACILITY: **NO**
USED OIL FUEL BURNER: **NO**
USED OIL PROCESSOR: **NO**
USED OIL FUEL MARKETER TO BURNER: **NO**
SPECIFICATION USED OIL MARKETER: **NO**
USED OIL TRANSPORTER: **NO**

COMPLIANCE, MONITORING AND ENFORCEMENT INFORMATION

EVALUATIONS

| | | |
|---|---|---|
| **01/04/2012** | **CEI** | **COMPLIANCE EVALUATION INSPECTION ON-SITE** |
| **08/23/2011** | **FSD** | **FACILITY SELF DISCLOSURE** |
| **11/25/2008** | **FCI** | **FOCUSED COMPLIANCE INSPECTION** |
| **09/23/2008** | **FSD** | **FACILITY SELF DISCLOSURE** |

VIOLATIONS **- NO VIOLATIONS REPORTED -**

ENFORCEMENTS **- NO ENFORCEMENTS REPORTED -**

HAZARDOUS WASTE

| | |
|---|---|
| **D001** | **IGNITABLE WASTE** |
| **F003** | **THE FOLLOWING SPENT NON-HALOGENATED SOLVENTS: XYLENE, ACETONE, ETHYL ACETATE, ETHYL BENZENE, ETHYL ETHER, METHYL ISOBUTYL KETONE, N-BUTYL ALCOHOL, CYCLOHEXANONE, AND METHANOL; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONLY THE ABOVE SPENT NONHALOGENATED SOLVENTS; AND ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS, AND A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THOSE SOLVENTS LISTED IN F001, F002, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.** |

UNIVERSAL WASTE **- NO UNIVERSAL WASTE REPORTED -**

CORRECTIVE ACTION AREA **- NO CORRECTIVE ACTION AREA INFORMATION REPORTED -**

CORRECTIVE ACTION EVENT **- NO CORRECTIVE ACTION EVENT REPORTED -**

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# *Hazardous Waste Sites- Generator (HWSG)*

**MAP ID# 30** **Distance from Property: 0.12 mi. (634 ft.) NE**

**SITE INFORMATION**

EPA ID: **COD983796194**

SITE NAME: **GOLD STAR SAUSAGE COMPANY**

SITE ADDRESS: **2800 WALNUT STREET**
**DENVER, CO 80205**

SITE COUNTY: **DENVER**

FACILITY TYPE: **SQG**

STATUS: **ACTIVE**

LINKS: **http://www.epa.gov/cgi-bin/get1cReport.cgi?tool=echo&IDNumber=COD983796194**

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# Underground Storage Tank Facilities (UST)

**MAP ID# 31** **Distance from Property: 0.12 mi. (634 ft.) W**

## FACILITY INFORMATION

FACILITY ID: **9512**

NAME: **COASTAL MART #1222**

ADDRESS: **2460 WELTON ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=9512

## OWNER INFORMATION

OWNER ID: **1235**

NAME: **COASTAL MART INC**

ADDRESS: **9 GREENWAY PLAZA STE 2086**
**HOUSTON, TX 77046**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **25276** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **10000** | **CLOSED** | **NOT REPORTED** |
| **25277** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **4000** | **CLOSED** | **NOT REPORTED** |
| **25278** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **4000** | **CLOSED** | **NOT REPORTED** |
| **25279** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **4000** | **CLOSED** | **NOT REPORTED** |

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 31** **Distance from Property: 0.12 mi. (634 ft.) W**

## SITE INFORMATION

FILE NUMBER: **150520-1**
SITE NO: **709**
NAME: **2560 WELTON LLC**
ADDRESS: **2430-2560 WELTON ST.**
**DENVER, CO 80246**
COUNTY: **DENVER**

## SITE DETAILS

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **7/4/2015**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **1140.00** CLEANUP ACRES: **1.0**

OTHER ISSUES: **DRY CLEANER;#8**
LAND USE RESTRICTIONS: **MIXED - COM+RES**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **VOC'S;#4**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **NOT REPORTED**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 31** **Distance from Property: 0.12 mi. (634 ft.) W**

**FACILITY INFORMATION**

UNIQUE ID: **9512LST**

FACILITY ID: **9512**

NAME: **COASTAL MART #1222**

ADDRESS: **2460 WELTON ST**
**DENVER, CO 80205**

SITE NAME: **PESTER #222**

LOCATION: **2460 WELTON ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **3148** | **CLOSED** | **12/13/1991** | **PESTER #222** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=3148

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 32** **Distance from Property: 0.12 mi. (634 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **5035LST**
FACILITY ID: **5035**
NAME: **LAUNDRY SERVICES**
ADDRESS: **2863 WELTON ST**
**DENVER, CO 80205**
SITE NAME: **SHIRT LAUNDRY**
LOCATION: **2863 WELTON ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **933** | **CLOSED** | **4/13/1992** | **SHIRT LAUNDRY** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=933

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# Underground Storage Tank Facilities (UST)

**MAP ID# 32** **Distance from Property: 0.12 mi. (634 ft.) NE**

**FACILITY INFORMATION**

FACILITY ID: **5035**

NAME: **LAUNDRY SERVICES**

ADDRESS: **2863 WELTON ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=5035

**OWNER INFORMATION**

OWNER ID: **4958**

NAME: **LAUNDRY SERVICES**

ADDRESS: **2863 WELTON ST**
**DENVER, CO 80205**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **13979** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **550** | **CLOSED** | **NOT REPORTED** |
| **13980** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **550** | **CLOSED** | **NOT REPORTED** |
| **13981** | **UNDERGROUND STORAGE TANK** | **SOLVENT** | **2000** | **CLOSED** | **NOT REPORTED** |
| **13982** | **UNDERGROUND STORAGE TANK** | **SOLVENT** | **2000** | **CLOSED** | **NOT REPORTED** |

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 32** **Distance from Property: 0.12 mi. (634 ft.) NE**

**SITE INFORMATION**

FILE NUMBER: **140612-1**

SITE NO: **658**

NAME: **MARKEL HOMES**

ADDRESS: **2821-2843 WELTON ST.**
**DENVER, CO 80205**

COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**

REVIEW DATE DUE: **7/27/2014**

DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**

ACTUAL COST: **1140.00** CLEANUP ACRES: **1.0**

OTHER ISSUES: **NOT REPORTED**

LAND USE RESTRICTIONS: **MIXED - COM+RES**

PROJECT MANAGER: **APOSTOLOPOULOS**

INDOOR AIR: **NOT REPORTED**

MEDIA SEDIMENT: **NOT REPORTED**

MEDIA GROUND WATER: **PCE;#12**

MEDIA SURFACE WATER: **NOT REPORTED**

MEDIA SOIL: **NOT REPORTED**

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# No Longer Regulated RCRA Generator Facilities (NLRRCRAG)

**MAP ID# 32** **Distance from Property: 0.12 mi. (634 ft.) NE**

**FACILITY INFORMATION**

EPA ID#: **CO0001014984**
NAME: **LEAVE IT TO US LAUNDRY & CLEANERS**
ADDRESS: **2863 WELTON ST**
**DENVER, CO 80205-3019**
CONTACT NAME: **JOSEPH LOUGH**
CONTACT ADDRESS: **2863 WELTON ST**
**DENVER CO 802053019**
CONTACT PHONE: **303-295-2217**
NON-NOTIFIER: **NON-NOTIFIER**
DATE RECEIVED BY AGENCY: **05/01/2009**

OWNER TYPE: **PRIVATE**
OWNER NAME: **LAUNDRY SERVICES INC**
OPERATOR TYPE: **NOT REPORTED**
OPERATOR NAME: **NOT REPORTED**

CERTIFICATION **- NO CERTIFICATION REPORTED -**

INDUSTRY CLASSIFICATION (NAICS) **- NO NAICS INFORMATION REPORTED -**

SITE HISTORY (INCLUDES GENERATORS AND NON-GENERATORS)

DATE RECEIVED BY AGENCY: **05/01/2009**
NAME: **LAUNDRY SERVICES INC**
DATE RECEIVED BY AGENCY: **01/26/1995**
NAME: **LAUNDRY SERVICES INC**

CURRENT ACTIVITY INFORMATION

GENERATOR STATUS: **NOT A GENERATOR** LAST UPDATED DATE: **06/15/2009**
SUBJECT TO CORRECTIVE ACTION UNIVERSE: **NO**
TDSFs POTENTIALLY SUBJECT TO CORRECTIVE ACTION UNDER 3004 (u)/(v) UNIVERSE: **NO**
TDSFs ONLY SUBJECT TO CORRECTIVE ACTION UNDER DISCRETIONARY AUTHORITIES UNIVERSE: **NO**
NON TSDFs WHERE RCRA CORRECTIVE ACTION HAS BEEN IMPOSED UNIVERSE: **NO**
CORRECTIVE ACTION WORKLOAD UNIVERSE: **NO**

IMPORTER: **NO**
MIXED WASTE GENERATOR: **NO**
RECYCLER: **NO**
TRANSPORTER: **NO**
ONSITE BURNER EXEMPTION: **NO**
FURNACE EXEMPTION: **NO**
USED OIL REFINER: **NO**
USED OIL TRANSFER FACILITY: **NO**

UNDERGROUND INJECTION: **NO**
UNIVERSAL WASTE DESTINATION FACILITY: **NO**
TRANSFER FACILITY: **NO**
USED OIL FUEL BURNER: **NO**
USED OIL PROCESSOR: **NO**
USED OIL FUEL MARKETER TO BURNER: **NO**
SPECIFICATION USED OIL MARKETER: **NO**
USED OIL TRANSPORTER: **NO**

COMPLIANCE, MONITORING AND ENFORCEMENT INFORMATION

EVALUATIONS
**05/01/2009** **NRR NON-FINANCIAL RECORD REVIEW**

VIOLATIONS **- NO VIOLATIONS REPORTED -**

ENFORCEMENTS **- NO ENFORCEMENTS REPORTED -**

HAZARDOUS WASTE

**D007** **CHROMIUM**
**D039** **TETRACHLOROETHYLENE**

| | |
|---|---|
| **D040** | **TRICHLORETHYLENE** |
| **F002** | **THE FOLLOWING SPENT HALOGENATED SOLVENTS: TETRACHLOROETHYLENE, METHYLENE CHLORIDE,TRICHLOROETHYLENE, 1,1,1-TRICHLOROETHANE,CHLOROBENZENE, 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE, ORTHO-DICHLOROBENZENE, TRICHLOROFLUOROMETHANE, AND 1,1,2, TRICHLOROETHANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001,F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.** |

UNIVERSAL WASTE

| WASTE TYPE: | ACCUMULATED WASTE ON-SITE: | GENERATED WASTE ON-SITE: | SOURCE TYPE: |
|---|---|---|---|
| **NOT REPORTED** | **NO** | **NO** | **IMPLEMENTER** |
| **BATTERIES** | **NO** | **NOT REPORTED** | **IMPLEMENTER** |
| **OTHER** | **NO** | **NO** | **IMPLEMENTER** |
| **LAMPS** | **NO** | **NOT REPORTED** | **IMPLEMENTER** |
| **MERCURY-CONTAINING DEVICES** | **NO** | **NO** | **IMPLEMENTER** |
| **PESTICIDES** | **NO** | **NOT REPORTED** | **IMPLEMENTER** |
| **MERCURY CONTAINING EQUIPMENT** | **NO** | **NOT REPORTED** | **IMPLEMENTER** |

CORRECTIVE ACTION AREA **- NO CORRECTIVE ACTION AREA INFORMATION REPORTED -**

CORRECTIVE ACTION EVENT **- NO CORRECTIVE ACTION EVENT REPORTED -**

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# *Dry Cleaning Facilities (CLEANERS)*

**MAP ID# 32** **Distance from Property: 0.12 mi. (634 ft.) NE**

## SITE INFORMATION

UNIQUEID: **031-1642CL**

FACILITY ID: **031-1642**

NAME: **LAUNDRY SVCS INC**

ADDRESS: **2863 WELTON ST**
**DENVER, CO 80205-3019**

CONTACT: **MOREY TROY**

## SITE DETAILS

MAKE/MODEL/SERIAL: **NOT REPORTED**

CONSTRUCTION PERMIT #: **94DE770**

EMISSION UNIT ID: **001**

EMISSION UNIT DESCRIPTION: **DRY CLEANER-PERC.CN**

EMISSION PROCESS DESCRIPTION: **DRY CLEANER-PERC**

ANNUAL THROUGHPUT: **0 GALLONS SOLVENT CONSUMED**

## OWNER INFORMATION

ADDRESS: **2863 WELTON ST**
**DENVER, CO 80205**

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# Underground Storage Tank Facilities (UST)

**MAP ID# 33** **Distance from Property: 0.14 mi. (739 ft.) SW**

## FACILITY INFORMATION

FACILITY ID: **4573**

NAME: **BENJAMIN MOORE & CO**

ADDRESS: **2555 LARIMER ST**
**DENVER, CO 80201**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=4573

## OWNER INFORMATION

OWNER ID: **2152**

NAME: **BENJAMIN MOORE & CO**

ADDRESS: **2500 WALNUT ST BOX 1888**
**DENVER, CO 80201**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **12860** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **2000** | **CLOSED** | **NOT REPORTED** |
| **12861** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **2000** | **CLOSED** | **NOT REPORTED** |
| **12862** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **2000** | **CLOSED** | **NOT REPORTED** |

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 33** **Distance from Property: 0.14 mi. (739 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **4573LST**
FACILITY ID: **4573**
NAME: **BENJAMIN MOORE & CO**
ADDRESS: **2555 LARIMER ST**
**DENVER, CO 80205**
SITE NAME: **BENJAMIN MOORE CO**
LOCATION: **2555 LARIMER ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **5484** | **CLOSED** | **4/23/1993** | **BENJAMIN MOORE CO** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=5484

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# Underground Storage Tank Facilities (UST)

**MAP ID# 34** **Distance from Property: 0.14 mi. (739 ft.) W**

## FACILITY INFORMATION

FACILITY ID: **1972**

NAME: **GREYHOUND LINES INC**

ADDRESS: **2901 BROADWAY**
**DENVER, CO 80216**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=1972

## OWNER INFORMATION

OWNER ID: **2635**

NAME: **GREYHOUND LINES INC**

ADDRESS: **110 PERIMETER PARK STE E**
**KNOXVILLE, TN 37922**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **5580** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **15000** | **CLOSED** | **NOT REPORTED** |
| **5581** | **UNDERGROUND STORAGE TANK** | **6 - USED OIL (WASTE OIL)** | **500** | **CLOSED** | **NOT REPORTED** |
| **5582** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **500** | **CLOSED** | **NOT REPORTED** |

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# Underground Storage Tank Facilities (UST)

**MAP ID# 35** **Distance from Property: 0.14 mi. (739 ft.) NE**

## FACILITY INFORMATION

FACILITY ID: **194**

NAME: **A R WILFLEY AND SONS**

ADDRESS: **2850 BLAKE ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=194

## OWNER INFORMATION

OWNER ID: **69**

NAME: **A R WILFLEY & SONS INC**

ADDRESS: **PO BOX 2330**
**DENVER, CO 80201**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **584** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **8000** | **CLOSED** | **NOT REPORTED** |
| **585** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **4000** | **CLOSED** | **NOT REPORTED** |
| **586** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **4000** | **CLOSED** | **NOT REPORTED** |

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 35** **Distance from Property: 0.14 mi. (739 ft.) NE**

## SITE INFORMATION

FILE NUMBER: **160407-1**
SITE NO: **762**
NAME: **2840 BLAKE ST.**
ADDRESS: **2840 BLAKE ST.**
**DENVER, CO 80205**
COUNTY: **DENVER**

## SITE DETAILS

APPLICATION TYPE: **VOLUNTARY CLEANUP PROGRAM**
REVIEW DATE DUE: **5/22/2016**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **1425.00** CLEANUP ACRES: **2.0**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **MIXED - COM+RES**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **PCE;#12**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **COAL FILL;#23**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 35** **Distance from Property: 0.14 mi. (739 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **194LST**
FACILITY ID: **194**
NAME: **A R WILFLEY AND SONS**
ADDRESS: **2850 BLAKE ST**
**DENVER, CO 80205**
SITE NAME: **A R WILFLEY AND SONS**
LOCATION: **2850 BLAKE ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **12101** | **CLOSED** | **8/21/2014 15:15** | **A R WILFLEY AND SONS** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=12101

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 36** **Distance from Property: 0.14 mi. (739 ft.) NE**

**SITE INFORMATION**

FILE NUMBER: **080228-1**
SITE NO: **413**
NAME: **TOTAL LONGTERM CARE**
ADDRESS: **2819 LARIMER STREET**
**DENVER, CO 80205**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **4/13/2008**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **765.00** CLEANUP ACRES: **0.5**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **NOT REPORTED**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **PCE;#12**
MEDIA GROUND WATER: **PCE;#12**
MEDIA SURFACE WATER: **PCE;#12**
MEDIA SOIL: **PCE;#12**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 37** **Distance from Property: 0.16 mi. (845 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **15108LST**

FACILITY ID: **15108**

NAME: **INTERSECTION OF WALNUT ST & BROADWAY**

ADDRESS: **2519 WALNUT ST**
**DENVER, CO 80202**

SITE NAME: **INTERSECTION OF WALNUT ST & BROADWAY**

LOCATION: **2519 WALNUT ST, DENVER 80202**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **8012** | **CLOSED** | **1/13/2000** | **INTERSECTION OF WALNUT ST & BROADWAY** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=8012

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 37** **Distance from Property: 0.18 mi. (950 ft.) SW**

## SITE INFORMATION

FILE NUMBER: **030814-1**
SITE NO: **275**
NAME: **BENJAMIN MOORE PAINT**
ADDRESS: **2500 WALNUT STREET**
**DENVER, CO 80205**
COUNTY: **DENVER**

## SITE DETAILS

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **9/28/2003**
DECISION: **APPROVAL**

REMEDY START DATE: **1/1/2006** REMEDY END DATE: **2/1/2009**
ACTUAL COST: **2296.41** CLEANUP ACRES: **3.0**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **NOT REPORTED**
PROJECT MANAGER: **RUDOLPH**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **OTHER;#18**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **NOT REPORTED**

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# Superfund Enterprise Management System Archived Site Inventory (SEMSARCH)

**MAP ID# 37** **Distance from Property: 0.18 mi. (950 ft.) SW**

**FACILITY INFORMATION**

EPA ID#: **COD007068372**

SITE ID#: **0800082**

NAME: **BENJAMIN MOORE & CO**

ADDRESS: **2500 WALNUT**
**DENVER, CO 80205**

COUNTY: **DENVER**

FEDERAL FACILITY: **NOT A FEDERAL FACILITY**

NPL: **NOT ON THE NPL**

NON NPL STATUS: **NFRAP-SITE DOES NOT QUALIFY FOR THE NPL BASED ON EXISTING INFORMATION**

Below information was gathered from the prior NFRAP update completed in 10/2013 update:

| ACTION | START DATE | COMPLETION DATE | RESPONSIBILITY |
|---|---|---|---|
| **DS - DISCOVERY** | **NOT REPORTED** | **8/1/1980** | **EPA FUND** |
| **PA - PRELIMINARY ASSESSMENT** | **NOT REPORTED** | **12/1/1984** | **STATE (FUND)** |
| **VS - ARCHIVE SITE** | **NOT REPORTED** | **12/1/1984** | **EPA IN-HOUSE** |

ACTION DESCRIPTIONS

**DS - (DISCOVERY) - THE PROCESS BY WHICH A POTENTIAL HAZARDOUS WASTE SITE IS BROUGHT TO THE ATTENTION OF THE EPA. THE PROCESS CAN OCCUR THROUGH THE USE OF SEVERAL MECHANISMS SUCH AS A PHONE CALL OR REFERRAL BY ANOTHER GOVERNMENT AGENCY.**

**PA - (PRELIMINARY ASSESSMENT) - COLLECTION OF DIVERSE EXISTING INFORMATION ABOUT THE SOURCE AND NATURE OF THE SITE HAZARD. IT IS EPA POLICY TO COMPLETE THE PRELIMINARY ASSESSMENT WITHIN ONE YEAR OF SITE DISCOVERY.**

**VS - (ARCHIVE SITE) - THE DECISION IS MADE THAT NO FURTHER ACTIVITY IS PLANNED AT THE SITE.**

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 37** **Distance from Property: 0.16 mi. (845 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **15108**

NAME: **INTERSECTION OF WALNUT ST & BROADWAY**

ADDRESS: **2519 WALNUT ST**
**DENVER, CO 80202**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=15108

**OWNER INFORMATION**

OWNER ID: **1000**

NAME: **DENVER DEPT OF ENVIRONMENTAL HEALTH**

ADDRESS: **200 W 14TH AVE STE 310**
**DENVER, CO 80204**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# Solid Waste Facilities (SWF)

**MAP ID# 38** **Distance from Property: 0.17 mi. (898 ft.) NE**

**SITE INFORMATION**

GEOSEARCH ID: **1208WTR**
NAME: **ERICO MOTORSPORTS**
ADDRESS: **2855 WALNUT ST**
**DENVER, CO 80205**
COUNTY: **NOT REPORTED**
CERTIFICATION ID: **1208**
FACILITY TYPE: **REGISTERED TIRE HAULER**
TIRE RETAILER/WHOLESALER: **YES**
HAULER: **NO**
END USER: **NO**
COLLECTION: **NO**
PROCESSOR: **NO**
MONOFILL: **NO**

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# Underground Storage Tank Facilities (UST)

**MAP ID# 39** **Distance from Property: 0.17 mi. (898 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **15052**

NAME: **ERROL CEROVSKI**

ADDRESS: **2501 CHAMPA ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=15052

**OWNER INFORMATION**

OWNER ID: **9999**

NAME: **UNKNOWN**

ADDRESS: **UNKNOWN**
**ZIPCODE UNKNOWN, XX 99999**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **33033** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **500** | **CLOSED** | **NOT REPORTED** |

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 39** **Distance from Property: 0.17 mi. (898 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **15052LST**
FACILITY ID: **15052**
NAME: **ERROL CEROVSKI**
ADDRESS: **2501 CHAMPA ST**
**DENVER, CO 80205**
SITE NAME: **ERROL CEROVSKI**
LOCATION: **2501 CHAMPA ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **8033** | **CLOSED** | **2/1/2000** | **ERROL CEROVSKI** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=8033

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 40** **Distance from Property: 0.17 mi. (898 ft.) N**

**SITE INFORMATION**

FILE NUMBER: **060601-1**

SITE NO: **368**

NAME: **DENARGO MARKET**

ADDRESS: **SW CORNER OF 29TH ST., AND BRIGHTON BLVD.**
**DENVER, CO 80216**

COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **VOLUNTARY CLEANUP PROGRAM**

REVIEW DATE DUE: **7/16/2006**

DECISION: **APPROVAL**

REMEDY START DATE: **12/28/2006** REMEDY END DATE: **12/29/2016**

ACTUAL COST: **1487.50** CLEANUP ACRES: **35.0**

OTHER ISSUES: **LANDFILL;#9**

LAND USE RESTRICTIONS: **NOT REPORTED**

PROJECT MANAGER: **APOSTOLOPOULOS**

INDOOR AIR: **NOT REPORTED**

MEDIA SEDIMENT: **NOT REPORTED**

MEDIA GROUND WATER: **NOT REPORTED**

MEDIA SURFACE WATER: **NOT REPORTED**

MEDIA SOIL: **NOT REPORTED**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 40** **Distance from Property: 0.17 mi. (898 ft.) N**

**SITE INFORMATION**

FILE NUMBER: **130328-1**

SITE NO: **368**

NAME: **DENARGO MARKET ROADWAYS AND UTILITIES**

ADDRESS: **SW CORNER OF 29TH ST., AND BRIGHTON BLVD.**
**DENVER, CO 80216**

COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**

REVIEW DATE DUE: **5/12/2013**

DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**

ACTUAL COST: **765.00** CLEANUP ACRES: **NOT REPORTED**

OTHER ISSUES: **NOT REPORTED**

LAND USE RESTRICTIONS: **COMMERCIAL**

PROJECT MANAGER: **APOSTOLOPOULOS**

INDOOR AIR: **NOT REPORTED**

MEDIA SEDIMENT: **NOT REPORTED**

MEDIA GROUND WATER: **NOT REPORTED**

MEDIA SURFACE WATER: **NOT REPORTED**

MEDIA SOIL: **ASBESTOS CONTAMINATED MATERIALS;#25;#HEAVY METALS;#9**

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 41** **Distance from Property: 0.18 mi. (950 ft.) SW**

## FACILITY INFORMATION

FACILITY ID: **19378**

NAME: **LEVEL 3 COMMUNICATIONS - DNVTCO56**

ADDRESS: **1850 PEARL ST**
**DENVER, CO 80203**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=19378

## OWNER INFORMATION

OWNER ID: **18439**

NAME: **LEVEL 3 COMMUNICATIONS LLC**

ADDRESS: **1025 ELDORADO BLVD 43C-325**
**BROOMFIELD, CO 80021**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **44504** | **ABOVEGROUND STORAGE TANK** | **4 - DIESEL** | **3000** | **OPEN** | **NOT REPORTED** |
| **44505** | **ABOVEGROUND STORAGE TANK** | **4 - DIESEL** | **2600** | **OPEN** | **NOT REPORTED** |
| **46663** | **ABOVEGROUND STORAGE TANK** | **4 - DIESEL** | **5760** | **NOT REPORTED** | **NOT REPORTED** |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 41** **Distance from Property: 0.18 mi. (950 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **11934LST**
FACILITY ID: **11934**
NAME: **MCI TELECOMMUNICATIONS**
ADDRESS: **601 E 18TH AVE**
**DENVER, CO 80203**
SITE NAME: **MCI TELECOMMUNICATIONS**
LOCATION: **601 E 18TH AVE, DENVER 80203**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **292** | **CLOSED** | **1/4/1991** | **MCI TELECOMMUNICATIONS** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=292

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 41** **Distance from Property: 0.18 mi. (950 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **11934**

NAME: **MCI TELECOMMUNICATIONS**

ADDRESS: **601 E 18TH AVE**
**DENVER, CO 80203**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=11934

**OWNER INFORMATION**

OWNER ID: **17558**

NAME: **MCI TELECOMMUNICATIONS**

ADDRESS: **707 17TH ST #4200**
**DENVER, CO 80202**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# Historical Solid Waste Landfills (HISTSWLF)

**MAP ID# 42** **Distance from Property: 0.18 mi. (950 ft.) W**

**SITE INFORMATION**

UNIQUE ID: **00070-0001202**

NAME: **2900 N. BROADWAY**

ADDRESS: **2900 N.BROADWAY**
**DENVER, CO**

DIRECTIONS: **NOT REPORTED**

COUNTY: **DENVER**

**SITE DETAILS**

AGENCY SOURCE: **NOT REPORTED**

DETAIL1:

**COVERED DAILY: NO. OPEN BURNING: YES. WASTE IMPOUNDMENT: NO.**

DETAIL2:

**TYPE- LANDFILL; FILL- FLY ASH: NO. BIOMEDICAL: NO. ; MONITORED- GROUNDWATER: NO. METHANE: NO. LINER: NO. LEACHATE COLLECTION: NO.; OPER/OWNR/OTHR- , ,**

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# Historical Solid Waste Landfills (HISTSWLF)

**MAP ID# 42** **Distance from Property: 0.18 mi. (950 ft.) W**

**SITE INFORMATION**

UNIQUE ID: **00070-0000638**

NAME: **ARTIFICIAL FILL**

ADDRESS: **FROM RR TRACKS ON WEST TO DENARGO MARKET, SOUTH TO UPRR AND SLIG**
**DENVER, CO**

DIRECTIONS: **NOT REPORTED**

COUNTY: **DENVER**

**SITE DETAILS**

AGENCY SOURCE: **NOT REPORTED**

DETAIL1:

**; FILL- DOMESTIC REFUSE: NO. CONSTRUCTION DEBRIS: NO. LIQUIDS: NO. HAZARDOUS WASTE: NO. INDUSTRIAL WASTE: NO. ARTIFICIAL FILL. UNKNOWN: NO. CLAY, SILT, SAND, GRAVEL AND A VARIETY OF DEBRIS CONSISTING OF WOOD, BRICK, METAL, PLASTIC, GLASS, VEGETATIO**

DETAIL2:

**ARTIFICIAL FILL. INCLUDES EMBANKMENTS, DAMS, AND OTHER ENGINEERED FILLS; COMPACTED LANDFILLS, AND UNCOMPACTED RUBBISH DUMPS. CONFIDENCE IN THIS INFO: HIGH.; OPENED- CLOSED-**

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# Denver County Historic Landfills (DCHISTLF)

**MAP ID# 42** **Distance from Property: 0.18 mi. (950 ft.) W**

**SITE INFORMATION**

LANDFILL ID: **93**

LANDFILL NAME: **3S-68W-27SW2**

DATE ENTERED: **04/28/1997**

TYPE OF LANDFILL: **OTHER**

DESCRIPTION:

**FROM RR TRACKS ON WEST TO DENARGO MARKET, SOUTH TO UPRR AND SLIGHTLY N OF DELGANY**

TYPE REMARKS:

**INCLUDES EMBANKMENTS, DAMS, AND OTHER ENGINEERED FILLS; COMPACTED LANDFILLS, AND UNCOMPACTED RUBBISH DUMPS.**

DOMESTIC: **NO**

HAZARDOUS: **NO**

CONSTRUCTION: **NO**

INDUSTRIAL: **NO**

LIQUIDS: **NO**

UNKNOWN: **NO**

OTHER: **ARTIFICIAL FILL**

MATERIAL RECEIVED:

**CLAY, SILT, SAND, GRAVEL AND A VARIETY OF DEBRIS CONSISTING OF WOOD, BRICK, METAL, PLASTIC, GLASS, VEGETATION, AND OTHER TRASH.**

START DATE: **NOT REPORTED**

END DATE: **NOT REPORTED**

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# Underground Storage Tank Facilities (UST)

**MAP ID# 43** **Distance from Property: 0.18 mi. (950 ft.) E**

**FACILITY INFORMATION**

FACILITY ID: **16047**

NAME: **PIPKIN MORTUARY**

ADDRESS: **2531 OGDEN ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=16047

**OWNER INFORMATION**

OWNER ID: **19160**

NAME: **PIPKIN MORTUARY**

ADDRESS: **2531 OGDEN ST**
**DENVER, CO 80205**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **35168** | **UNDERGROUND STORAGE TANK** | **NOT REPORTED** | **1000** | **CLOSED** | **NOT REPORTED** |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 43** **Distance from Property: 0.18 mi. (950 ft.) E**

**FACILITY INFORMATION**

UNIQUE ID: **16047LST**
FACILITY ID: **16047**
NAME: **PIPKIN MORTUARY**
ADDRESS: **2531 OGDEN ST**
**DENVER, CO 80205**
SITE NAME: **PIPKIN MORTUARY**
LOCATION: **2531 OGDEN ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **9274** | **CLOSED** | **7/21/2003 16:52** | **PIPKIN MORTUARY** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=9274

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 44** **Distance from Property: 0.18 mi. (950 ft.) NW**

**SITE INFORMATION**

FILE NUMBER: **130104-1**
SITE NO: **368**
NAME: **YARDS AT DENARGO MARKET**
ADDRESS: **2797 WEWATTA WAY, LOT1, BLOCK 3**
**DENVER, CO 80216**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **2/18/2013**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **765.00** CLEANUP ACRES: **3.0**

OTHER ISSUES: **LANDFILL;#9**
LAND USE RESTRICTIONS: **MIXED - COM+RES**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **METHANE;#4**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **VOC'S;#4**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **NOT REPORTED**

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**MAP ID# 45** **Distance from Property: 0.19 mi. (1,003 ft.) NE**

**SITE INFORMATION**

ID#: **138663**

NAME: **CURTIS PARK COMMUNITY CENTER AND ADMIN BUILDING**

ADDRESS: **929 29TH ST**
**DENVER, CO 80205**

TYPE FUNDING: **HAZARDOUS**

PREDOMINANT PAST USE (ACREAGE):

| GREENSPACE: | RESIDENTIAL: | COMMERCIAL: | INDUSTRIAL: |
|---|---|---|---|
| **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

FUTURE USE (ACREAGE):

| GREENSPACE: | RESIDENTIAL: | COMMERCIAL: | INDUSTRIAL: |
|---|---|---|---|
| **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

PROPERTY HIGHLIGHT:
**NOT REPORTED**

PROPERTY SIZE (Acres): **0.86**

CURRENT OWNER: **NOT REPORTED**

PROPERTY DESCRIPTION/ FORMER USE:
**THE URBAN LAND CONSERVANCY IS IN THE PROCESS OF ACQUIRING THE PROPERTY AND WILL CONVERT THE COMMUNITY CENTER INTO A PRE-SCHOOL AND THE OTHER BUILDING WILL BE RENOVATED AND UPDATED FOR CONTINUED USE AS AN ADMINISTRATION BUILDING.**

CONTAMINATE(S): **ASBESTOS, PCBS, LEAD**

CONTAMINATE(S) CLEANED UP: **NOT REPORTED**

MEDIA(S) AFFECTED: **NOT REPORTED**

MEDIA(S) CLEANED UP: **NOT REPORTED**

TYPE OF BROWNFIELD GRANT: **TBA**

ENVIRONMENTAL ASSESSMENT ACTIVITY: **PHASE I ENVIRONMENTAL ASSESSMENT**

ASSESSMENT START DATE: **9/13/2011 0:00**

ASSESSMENT COMPLETION DATE: **1/11/2012 0:00**

CLEANUP REQUIRED: **NO**

STATE & TRIBAL ENROLLMENT ID: **NOT REPORTED**

STATE & TRIBAL ENROLLMENT DATE: **NOT REPORTED**

PROPERTY ENROLLED IN A STATE & TRIBAL PROGRAM?: **NOT REPORTED**

ARE INSTITUTIONAL CONTROLS REQUIRED?: **NO**

TYPE OF BROWNFIELD GRANT: **TBA**

ENVIRONMENTAL ASSESSMENT ACTIVITY: **PHASE II ENVIRONMENTAL ASSESSMENT**

ASSESSMENT START DATE: **9/13/2011 0:00**

ASSESSMENT COMPLETION DATE: **1/11/2012 0:00**

CLEANUP REQUIRED: **NO**

STATE & TRIBAL ENROLLMENT ID: **NOT REPORTED**

STATE & TRIBAL ENROLLMENT DATE: **NOT REPORTED**

PROPERTY ENROLLED IN A STATE & TRIBAL PROGRAM?: **NOT REPORTED**

ARE INSTITUTIONAL CONTROLS REQUIRED?: **NO**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 46** **Distance from Property: 0.2 mi. (1,056 ft.) SW**

## FACILITY INFORMATION

UNIQUE ID: **6841LST**
FACILITY ID: **6841**
NAME: **GREYHOUND LINES INC**
ADDRESS: **2450 CURTIS ST**
**DENVER, CO 80205**
SITE NAME: **GREYHOUND LINES INC**
LOCATION: **2450 CURTIS ST, DENVER 80205**

## LEAKING INFORMATION

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **8977** | **CLOSED** | **6/25/2002 15:43** | **GREYHOUND LINES INC** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=8977 | | | |
| **5274** | **CLOSED** | **10/30/1995** | **TRAILWAYS INC** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=5274 | | | |
| **5241** | **CLOSED** | **2/12/1994** | **TRAILWAYS INC** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=5241 | | | |
| **5233** | **CLOSED** | **8/29/1991** | **TRAILWAYS INC** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=5233 | | | |

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# Underground Storage Tank Facilities (UST)

**MAP ID# 46** **Distance from Property: 0.2 mi. (1,056 ft.) SW**

## FACILITY INFORMATION

FACILITY ID: **6841**

NAME: **GREYHOUND LINES INC**

ADDRESS: **2450 CURTIS ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=6841

## OWNER INFORMATION

OWNER ID: **2635**

NAME: **GREYHOUND LINES INC**

ADDRESS: **110 PERIMETER PARK STE E**
**KNOXVILLE, TN 37922**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **18189** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **10000** | **CLOSED** | **NOT REPORTED** |
| **18190** | **UNDERGROUND STORAGE TANK** | **6 - USED OIL (WASTE OIL)** | **2000** | **CLOSED** | **NOT REPORTED** |
| **18191** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **8000** | **CLOSED** | **NOT REPORTED** |
| **18192** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **8000** | **CLOSED** | **NOT REPORTED** |
| **18193** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **8000** | **CLOSED** | **NOT REPORTED** |
| **18194** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **12000** | **OPEN** | **NOT REPORTED** |
| **18195** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **12000** | **OPEN** | **NOT REPORTED** |
| **18196** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **500** | **CLOSED** | **NOT REPORTED** |
| **18197** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **500** | **CLOSED** | **NOT REPORTED** |
| **18198** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **500** | **CLOSED** | **NOT REPORTED** |

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**MAP ID# 46** **Distance from Property: 0.2 mi. (1,056 ft.) SW**

**SITE INFORMATION**

EPA ID: **COD980958904**
SITE NAME: **GREYHOUND LINES INC**
SITE ADDRESS: **2450 CURTIS**
**DENVER, CO 80205**
SITE COUNTY: **DENVER**
FACILITY TYPE: **CA**
STATUS: **HISTORIC**
LINKS: **http://www.epa.gov/cgi-bin/get1cReport.cgi?tool=echo&IDNumber=COD980958904**

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# Underground Storage Tank Facilities (UST)

**MAP ID# 47** **Distance from Property: 0.2 mi. (1,056 ft.) NE**

**FACILITY INFORMATION**

FACILITY ID: **3077**

NAME: **REPUBLIC NATIONAL BANK**

ADDRESS: **2901 WALNUT ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=3077

**OWNER INFORMATION**

OWNER ID: **2641**

NAME: **REPUBLIC NATIONAL BANK**

ADDRESS: **501 W HAMPDEN AVE BOX 1418**
**ENGLEWOOD, CO 80110**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **8449** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **1000** | **CLOSED** | **NOT REPORTED** |

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 47** **Distance from Property: 0.2 mi. (1,056 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **3077LST**
FACILITY ID: **3077**
NAME: **REPUBLIC NATIONAL BANK**
ADDRESS: **2901 WALNUT ST**
**DENVER, CO 80205**
SITE NAME: **REPUBLIC NATIONAL BANK**
LOCATION: **2901 WALNUT ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **8583** | **CLOSED** | **6/26/2001** | **REPUBLIC NATIONAL BANK** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=8583

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 48** **Distance from Property: 0.2 mi. (1,056 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **2041LST**
FACILITY ID: **2041**
NAME: **MILE HIGH AUTO**
ADDRESS: **2903 LARIMER ST**
**DENVER, CO 80205**
SITE NAME: **MILE HIGH AUTO**
LOCATION: **2903 LARIMER ST DENVER CO 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **12410** | **OPEN** | **12/16/2015 10:53** | **MILE HIGH AUTO** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=12410

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 48** **Distance from Property: 0.2 mi. (1,056 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **17775LST**

FACILITY ID: **17775**

NAME: **ORIGINAL VENETIAN BLIND LAUNDRY COMPANY**

ADDRESS: **2900 LARIMER ST**
**DENVER, CO 80205**

SITE NAME: **ORIGINAL VENETIAN BLIND LAUNDRY COMPANY**

LOCATION: **2900 LARIMER ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **9756** | **CLOSED** | **3/22/2005 8:47** | **ORIGINAL VENETIAN BLIND LAUNDRY COMPANY** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=9756

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# Underground Storage Tank Facilities (UST)

**MAP ID# 48** **Distance from Property: 0.2 mi. (1,056 ft.) NE**

## FACILITY INFORMATION

FACILITY ID: **17775**

NAME: **ORIGINAL VENETIAN BLIND LAUNDRY COMPANY**

ADDRESS: **2900 LARIMER ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=17775

## OWNER INFORMATION

OWNER ID: **NOT REPORTED**

NAME: **ORIGINAL VENETIAN BLIND LAUNDRY COMPANY**

ADDRESS: **2900 LARIMER ST**
**DENVER, CO 80205**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **1000** | **PERMANENTLY CLOSED** | **01-JAN-40** |

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# Underground Storage Tank Facilities (UST)

**MAP ID# 48** **Distance from Property: 0.2 mi. (1,056 ft.) NE**

**FACILITY INFORMATION**

FACILITY ID: **2041**

NAME: **MILE HIGH AUTO**

ADDRESS: **2903 LARIMER ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=2041

**OWNER INFORMATION**

OWNER ID: **3677**

NAME: **MICHIO IWAHASKI**

ADDRESS: **2903 LARIMER ST**
**DENVER, CO 80205**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **5733** | **UNDERGROUND STORAGE TANK** | **1 - UNLEADED REGULAR (RUL)** | **4000** | **CLOSED** | **NOT REPORTED** |
| **5734** | **UNDERGROUND STORAGE TANK** | **2 - UNLEADED MID-GRADE (MUL)** | **4000** | **CLOSED** | **NOT REPORTED** |
| **5735** | **UNDERGROUND STORAGE TANK** | **3 - UNLEADED PREMIUM (PUL)** | **4000** | **CLOSED** | **NOT REPORTED** |
| **5736** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **4000** | **CLOSED** | **NOT REPORTED** |
| **39414** | **UNDERGROUND STORAGE TANK** | **6 - USED OIL (WASTE OIL)** | **550** | **CLOSED** | **NOT REPORTED** |

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 48** **Distance from Property: 0.23 mi. (1,214 ft.) NE**

**SITE INFORMATION**

FILE NUMBER: **160613-1**

SITE NO: **773**

NAME: **2929 LARIMER ST.**

ADDRESS: **2929, 2937, 2945, & 2951 LARIMER ST**
**DENVER, CO 80205**

COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**

REVIEW DATE DUE: **7/28/2016**

DECISION: **NOT REPORTED**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**

ACTUAL COST: **NOT REPORTED** CLEANUP ACRES: **1.0**

OTHER ISSUES: **NOT REPORTED**

LAND USE RESTRICTIONS: **MIXED - COM+RES**

PROJECT MANAGER: **APOSTOLOPOULOS**

INDOOR AIR: **NOT REPORTED**

MEDIA SEDIMENT: **NOT REPORTED**

MEDIA GROUND WATER: **VOC'S;#4**

MEDIA SURFACE WATER: **NOT REPORTED**

MEDIA SOIL: **NOT REPORTED**

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 48** **Distance from Property: 0.2 mi. (1,056 ft.) NE**

**FACILITY INFORMATION**

FACILITY ID: **17775**

NAME: **ORIGINAL VENETIAN BLIND LAUNDRY COMPANY**

ADDRESS: **2900 LARIMER ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=17775

**OWNER INFORMATION**

OWNER ID: **20113**

NAME: **ORIGINAL VENETIAN BLIND LAUNDRY COMPANY**

ADDRESS: **2900 LARIMER ST**
**DENVER, CO 80205**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# Underground Storage Tank Facilities (UST)

**MAP ID# 49** **Distance from Property: 0.2 mi. (1,056 ft.) SW**

## FACILITY INFORMATION

FACILITY ID: **18833**

NAME: **COMMERCIAL WAREHOUSE BUILDING**

ADDRESS: **2450 LARIMER ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=18833

## OWNER INFORMATION

OWNER ID: **21629**

NAME: **GRAVITAS-2450 LARIMER STREET LLC**

ADDRESS: **600 17TH ST STE 2800**
**DENVER, CO 80202**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **42131** | **UNDERGROUND STORAGE TANK** | **6 - USED OIL (WASTE OIL)** | **1000** | **CLOSED** | **NOT REPORTED** |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 49** **Distance from Property: 0.2 mi. (1,056 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **18833LST**
FACILITY ID: **18833**
NAME: **COMMERCIAL WAREHOUSE BUILDING**
ADDRESS: **2450 LARIMER STREET**
**DENVER, CO 80205**
SITE NAME: **COMMERCIAL WAREHOUSE BUILDING**
LOCATION: **2450 LARIMER STREET, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **10961** | **CLOSED** | **10/6/2009 11:48** | **COMMERCIAL WAREHOUSE BUILDING** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=10961

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# Underground Storage Tank Facilities (UST)

**MAP ID# 50** **Distance from Property: 0.2 mi. (1,056 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **15388**

NAME: **BALL PARK LOFTS**

ADDRESS: **2465 BLAKE ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=15388

**OWNER INFORMATION**

OWNER ID: **18508**

NAME: **LEGACY RESIDENTIAL PARTNERS**

ADDRESS: **2465 BLAKE ST**
**DENVER, CO 80205**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **34499** | **UNDERGROUND STORAGE TANK** | **NOT REPORTED** | **0** | **CLOSED** | **NOT REPORTED** |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 50** **Distance from Property: 0.2 mi. (1,056 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **15388LST**
FACILITY ID: **15388**
NAME: **BALL PARK LOFTS**
ADDRESS: **2465 BLAKE STREET**
**DENVER, CO 80205**
SITE NAME: **BALL PARK LOFTS**
LOCATION: **2465 BLAKE STREET, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **8483** | **CLOSED** | **3/20/2001** | **BALL PARK LOFTS** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=8483

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# Underground Storage Tank Facilities (UST)

**MAP ID# 51** **Distance from Property: 0.2 mi. (1,056 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **15426**

NAME: **UNKNOWN**

ADDRESS: **1451 24TH ST**
**DENVER, CO 80202**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=15426

**OWNER INFORMATION**

OWNER ID: **18508**

NAME: **LEGACY RESIDENTIAL PARTNERS**

ADDRESS: **2465 BLAKE ST**
**DENVER, CO 80205**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **34498** | **UNDERGROUND STORAGE TANK** | **NOT REPORTED** | **1000** | **CLOSED** | **NOT REPORTED** |

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 52** **Distance from Property: 0.21 mi. (1,109 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **734LST**

FACILITY ID: **734**

NAME: **THREEWIT - COOPER CEMENT CO**

ADDRESS: **2900 WALNUT ST**
**DENVER, CO 80205**

SITE NAME: **THREEWITT COOPER CEMENT CO**

LOCATION: **2900 WALNUT ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **6872** | **CLOSED** | **9/17/1998** | **THREEWITT COOPER CEMENT CO** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=6872

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# Underground Storage Tank Facilities (UST)

**MAP ID# 52** **Distance from Property: 0.21 mi. (1,109 ft.) NE**

## FACILITY INFORMATION

FACILITY ID: **734**

NAME: **THREEWIT - COOPER CEMENT CO**

ADDRESS: **2900 WALNUT ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=734

## OWNER INFORMATION

OWNER ID: **5265**

NAME: **THREEWIT COOPER CEMENT CO**

ADDRESS: **2900 WALNUT ST**
**DENVER, CO 80205**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **2230** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **3000** | **CLOSED** | **NOT REPORTED** |
| **2231** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **6000** | **CLOSED** | **NOT REPORTED** |

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 52** **Distance from Property: 0.21 mi. (1,109 ft.) NE**

## FACILITY INFORMATION

FACILITY ID: **734**

NAME: **THREEWIT - COOPER CEMENT CO**

ADDRESS: **2900 WALNUT ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=734

## OWNER INFORMATION

OWNER ID: **5265**

NAME: **THREEWIT COOPER CEMENT CO**

ADDRESS: **2900 WALNUT ST**
**DENVER, CO 80205**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **2232** | **ABOVEGROUND STORAGE TANK** | **4 - DIESEL** | **6000** | **OPEN** | **NOT REPORTED** |
| **46251** | **LIQUEFIED PETROLEUM GAS -LPG ABOVEGROUND** | | **500** | **OPEN** | **NOT REPORTED** |

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# Underground Storage Tank Facilities (UST)

**MAP ID# 53** **Distance from Property: 0.21 mi. (1,109 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **5486**

NAME: **RESOLUTION TRUST CORP PROPERTY**

ADDRESS: **PEARL & PENNSLYVANIA 18TH & 19TH**
**DENVER, CO 80203**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=5486

**OWNER INFORMATION**

OWNER ID: **17702**

NAME: **UNKNOWN #2**

ADDRESS: **UNKNOWN #2**
**GREELEY, CO 80631**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **15014** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **500** | **CLOSED** | **NOT REPORTED** |

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# Underground Storage Tank Facilities (UST)

**MAP ID# 54** **Distance from Property: 0.21 mi. (1,109 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **9824**

NAME: **DENVER CURTIS PARK CENTRAL OFFICE**

ADDRESS: **2485 CURTIS ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=9824

**OWNER INFORMATION**

OWNER ID: **8025**

NAME: **CENTURYLINK QC**

ADDRESS: **100 CENTURYTEL DR**
**MONROE, LA 71203**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **26260** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **560** | **CLOSED** | **NOT REPORTED** |
| **26261** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **4000** | **OPEN** | **NOT REPORTED** |

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# Underground Storage Tank Facilities (UST)

**MAP ID# 55** **Distance from Property: 0.21 mi. (1,109 ft.) E**

**FACILITY INFORMATION**

FACILITY ID: **8077**

NAME: **REMAX SOUTHEAST INC**

ADDRESS: **CORNER LOT 2202 OR 2216 OGDEN ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=8077

**OWNER INFORMATION**

OWNER ID: **7988**

NAME: **REMAX SOUTHEAST INC**

ADDRESS: **2202 - 2216 OGDEN ST**
**DENVER, CO 80205**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **21104** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **999999999** | **CLOSED** | **NOT REPORTED** |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 56** **Distance from Property: 0.22 mi. (1,162 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **15461LST**

FACILITY ID: **15461**

NAME: **NE CORNER OF LARIMER & BROADWA**

ADDRESS: **2445 LARIMER ST**
**DENVER, CO 80202**

SITE NAME: **NE CORNER OF LARIMER & BROADWAY**

LOCATION: **2445 LARIMER ST, DENVER 80202**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **8539** | **CLOSED** | **5/16/2001** | **NE CORNER OF LARIMER & BROADWAY** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=8539

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# Underground Storage Tank Facilities (UST)

**MAP ID# 56** **Distance from Property: 0.22 mi. (1,162 ft.) SW**

## FACILITY INFORMATION

FACILITY ID: **18311**

NAME: **ABANDONED TANK**

ADDRESS: **2452 BROADWAY ST**
**DENVER, CO 80223**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=18311

## OWNER INFORMATION

OWNER ID: **20947**

NAME: **FOCUS PROPERTY GROUP - RYEL KESTENBAUN**

ADDRESS: **2737 LARIMER STE - C**
**DENVER, CO 80205**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **40621** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **2000** | **NOT REPORTED** | **NOT REPORTED** |

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 56** **Distance from Property: 0.22 mi. (1,162 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **15461**

NAME: **NE CORNER OF LARIMER & BROADWA**

ADDRESS: **2445 LARIMER ST**
**DENVER, CO 80202**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=15461

**OWNER INFORMATION**

OWNER ID: **18571**

NAME: **NE CORNER OF LARIMER & BROADWA**

ADDRESS: **2445 LARIMER ST**
**DENVER, CO 80202**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 57** **Distance from Property: 0.23 mi. (1,214 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **1272LST**
FACILITY ID: **1272**
NAME: **RECYCLE AMERICA OF DENVER**
ADDRESS: **2441 BROADWAY**
**DENVER, CO 80205**
SITE NAME: **SILVER STATE LAUNDRY**
LOCATION: **2441 BROADWAY, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **624** | **CLOSED** | **6/21/1991** | **SILVER STATE LAUNDRY** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=624

Back to Report Summary

# Underground Storage Tank Facilities (UST)

**MAP ID# 57** **Distance from Property: 0.23 mi. (1,214 ft.) SW**

## FACILITY INFORMATION

FACILITY ID: **1272**

NAME: **RECYCLE AMERICA OF DENVER**

ADDRESS: **2441 BROADWAY**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=1272

## OWNER INFORMATION

OWNER ID: **1373**

NAME: **RECYCLE AMERICA**

ADDRESS: **2441 BROADWAY**
**DENVER, CO 80205**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **3574** | **UNDERGROUND STORAGE TANK** | **6 - USED OIL (WASTE OIL)** | **2000** | **CLOSED** | **NOT REPORTED** |
| **3575** | **UNDERGROUND STORAGE TANK** | **6 - USED OIL (WASTE OIL)** | **2000** | **CLOSED** | **NOT REPORTED** |

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 57** **Distance from Property: 0.23 mi. (1,214 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **11752**
NAME: **SILVER STATE LAUNDRY**
ADDRESS: **2441 BROADWAY**
**DENVER, CO 80205**
COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=11752

**OWNER INFORMATION**

OWNER ID: **NOT REPORTED**
NAME: **SILVER STATE LAUNDRY**
ADDRESS: **2441 BROADWAY**
**DENVER, CO 80205**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 58** **Distance from Property: 0.23 mi. (1,214 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **8052LST**
FACILITY ID: **8052**
NAME: **WHOLESALE SPECIALTIES**
ADDRESS: **2950 BLAKE ST**
**DENVER, CO 80205**
SITE NAME: **WHOLESALE SPECIALTIES INC**
LOCATION: **2950 BLAKE ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **285** | **CLOSED** | **5/9/1997** | **WHOLESALE SPECIALTIES INC** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=285

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# Underground Storage Tank Facilities (UST)

**MAP ID# 58** **Distance from Property: 0.23 mi. (1,214 ft.) NE**

**FACILITY INFORMATION**

FACILITY ID: **8052**

NAME: **WHOLESALE SPECIALTIES**

ADDRESS: **2950 BLAKE ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=8052

**OWNER INFORMATION**

OWNER ID: **7957**

NAME: **WHOLESALE SPECIALTIES**

ADDRESS: **2950 BLAKE ST**
**DENVER, CO 80205**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **21033** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **999999999** | **CLOSED** | **NOT REPORTED** |
| **21034** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **999999999** | **CLOSED** | **NOT REPORTED** |
| **21035** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **999999999** | **CLOSED** | **NOT REPORTED** |

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 58** **Distance from Property: 0.23 mi. (1,214 ft.) NE**

**FACILITY INFORMATION**

FACILITY ID: **13809**

NAME: **WHOLESALE SPECIALTIES INC**

ADDRESS: **2950 BLAKE ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=13809

**OWNER INFORMATION**

OWNER ID: **NOT REPORTED**

NAME: **WHOLESALE SPECIALTIES INC**

ADDRESS: **2950 BLAKE ST**
**DENVER, CO 80205**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 59** **Distance from Property: 0.24 mi. (1,267 ft.) N**

**FACILITY INFORMATION**

FACILITY ID: **11964**

NAME: **CALLAHAN WHOLESALE FLORISTS**

ADDRESS: **1850 29TH ST**
**DENVER, CO 80216**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=11964

**OWNER INFORMATION**

OWNER ID: **17584**

NAME: **CALLAHAN WHOLESALE FLORISTS**

ADDRESS: **1850 29TH ST**
**DENVER, CO 80216**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 59** **Distance from Property: 0.23 mi. (1,214 ft.) N**

**FACILITY INFORMATION**

UNIQUE ID: **11859LST**

FACILITY ID: **11859**

NAME: **ROCKY MOUNTAIN FRUIT & PRODUCE**

ADDRESS: **1800 29TH ST**
**DENVER, CO 80216**

SITE NAME: **ROCKY MOUNTAIN FRUIT & PRODUCE**

LOCATION: **1800 29TH ST, DENVER 80216**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **2294** | **CLOSED** | **11/30/1990** | **ROCKY MOUNTAIN FRUIT & PRODUCE** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=2294

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 59** **Distance from Property: 0.24 mi. (1,267 ft.) N**

**FACILITY INFORMATION**

UNIQUE ID: **11964LST**

FACILITY ID: **11964**

NAME: **CALLAHAN WHOLESALE FLORISTS**

ADDRESS: **1850 29TH ST**
**DENVER, CO 80216**

SITE NAME: **CALLAHAN WHOLESALE FLORISTS**

LOCATION: **1850 29TH ST, DENVER 80216**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **1133** | **CLOSED** | **2/4/1991** | **CALLAHAN WHOLESALE FLORISTS** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=1133

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 59** **Distance from Property: 0.23 mi. (1,214 ft.) N**

**FACILITY INFORMATION**

FACILITY ID: **11859**

NAME: **ROCKY MOUNTAIN FRUIT & PRODUCE**

ADDRESS: **1800 29TH ST**
**DENVER, CO 80216**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=11859

**OWNER INFORMATION**

OWNER ID: **17479**

NAME: **EATON CONSTRUCTION**

ADDRESS: **4800 YORK**
**DENVER, CO 80216**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# Superfund Enterprise Management System Archived Site Inventory (SEMSARCH)

**MAP ID# 60** **Distance from Property: 0.23 mi. (1,214 ft.) W**

**FACILITY INFORMATION**

EPA ID#: **CO0010164098**

SITE ID#: **0801843**

NAME: **24TH & CALIFORNIA MERCURY SPILL**

ADDRESS: **2417 CALIFORNIA APT #5**
**DENVER, CO 80205-6203**

COUNTY: **DENVER**

FEDERAL FACILITY: **NOT A FEDERAL FACILITY**

NPL: **NOT ON THE NPL**

NON NPL STATUS: **REMOVAL ONLY SITE (NO SITE ASSESSMENT WORK NEEDED)**

Below information was gathered from the prior NFRAP update completed in 10/2013 update:

| ACTION | START DATE | COMPLETION DATE | RESPONSIBILITY |
|---|---|---|---|
| **RV - REMOVAL** | **2/7/2001** | **5/5/2001** | **EPA FUND** |
| **VS - ARCHIVE SITE** | **NOT REPORTED** | **3/13/2006** | **EPA IN-HOUSE** |

ACTION DESCRIPTIONS

**RV - (REMOVAL) - RESPONSE ACTION THAT REQUIRES EXPEDITIOUS ATTENTION TO REDUCE IMMINENT AND SUBSTANTIAL DANGERS TO HUMAN HEALTH, WELFARE, OR THE ENVIRONMENT OR AN EMERGENCY RESPONSE REQUIRED WITHIN HOURS OR DAYS TO ADDRESS ACUTE SITUATIONS INVOLVING ACTUAL OR POTENTIAL THREAT TO HUMAN HEALTH, THE ENVIRONMENT, OR REAL OR PERSONAL PROPERTY DUE TO THE RELEASE OF A HAZARDOUS SUBSTANCE. CHARACTERIZATION OF A REMOVAL ACTION AS REMOVAL, NOT IMMEDIATE REMOVAL OR PLANNED REMOVAL, STARTED AT THE BEGINNING OF FY 1987. THIS CODE NOW TAKES THE PLACE OF IMMEDIATE REMOVAL (IR) AND PLANNED REMOVAL (PR).**

**VS - (ARCHIVE SITE) - THE DECISION IS MADE THAT NO FURTHER ACTIVITY IS PLANNED AT THE SITE.**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 61** **Distance from Property: 0.24 mi. (1,267 ft.) E**

**FACILITY INFORMATION**

UNIQUE ID: **12396LST**
FACILITY ID: **12396**
NAME: **ARTISTIC PLUMBING**
ADDRESS: **2655 DOWNING ST**
**DENVER, CO 80205**
SITE NAME: **ARTISTIC PLUMBING**
LOCATION: **2655 DOWNING ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **557** | **CLOSED** | **2/1/1993** | **ARTISTIC PLUMBING** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=557

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 61** **Distance from Property: 0.24 mi. (1,267 ft.) E**

**FACILITY INFORMATION**

FACILITY ID: **12396**
NAME: **ARTISTIC PLUMBING**
ADDRESS: **2655 DOWNING ST**
**DENVER, CO 80205**
COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=12396

**OWNER INFORMATION**

OWNER ID: **16817**
NAME: **ARTISTIC PLUMBING**
ADDRESS: **2655 DOWNING ST**
**DENVER, CO 80205**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# *Historical Solid Waste Landfills (HISTSWLF)*

**MAP ID# 62** **Distance from Property: 0.24 mi. (1,267 ft.) NW**

**SITE INFORMATION**

UNIQUE ID: **00070-0000627**

NAME: **KNOWN LANDFILL**

ADDRESS: **BOUNDARIES APPROXIMATE: W: DENARGO ST. N: ARKINS CT.; E: J**
**DENVER, CO**

DIRECTIONS: **NOT REPORTED**

COUNTY: **DENVER**

**SITE DETAILS**

AGENCY SOURCE: **NOT REPORTED**

DETAIL1:

**; FILL- DOMESTIC REFUSE: NO. CONSTRUCTION DEBRIS: NO. LIQUIDS: NO. HAZARDOUS WASTE: NO. INDUSTRIAL WASTE: NO. UNKNOWN: YES. CONFIDENCE IN THIS INFO: LOW.**

DETAIL2:

**KNOWN LANDFILL. COMMERCIAL/ INDUSTRIAL AREA. CONFIDENCE IN THIS INFO: MEDIUM.; OPENED- CLOSED-**

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# Denver County Historic Landfills (DCHISTLF)

**MAP ID# 62** **Distance from Property: 0.24 mi. (1,267 ft.) NW**

**SITE INFORMATION**

LANDFILL ID: **82**

LANDFILL NAME: **3S-68W-27NW**

DATE ENTERED: **02/25/1997**

TYPE OF LANDFILL: **KNOWN LANDFILL**

DESCRIPTION:

**BOUNDARIES APPROXIMATE: W: DENARGO ST. N: ARKINS CT.; E: JUST EAST OF DENARGO MARKET**

TYPE REMARKS:

**COMMERCIAL/ INDUSTRIAL AREA**

DOMESTIC: **NO**

HAZARDOUS: **NO**

CONSTRUCTION: **NO**

INDUSTRIAL: **NO**

LIQUIDS: **NO**

UNKNOWN: **YES**

OTHER: **NOT REPORTED**

MATERIAL RECEIVED:

**NOT REPORTED**

START DATE: **NOT REPORTED**

END DATE: **NOT REPORTED**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 63** **Distance from Property: 0.26 mi. (1,373 ft.) SE**

**FACILITY INFORMATION**

UNIQUE ID: **19151LST**
FACILITY ID: **19151**
NAME: **ORPHAN TANK**
ADDRESS: **E 18TH AVE @ NW CORNER OF OGDEN ST**
**DENVER, CO 80218**
SITE NAME: **ORPHAN TANK**
LOCATION: **E 18TH AVE @ NW CORNER OF OGDEN ST, DENVER 80218**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **11556** | **CLOSED** | **12/6/2011 15:14** | **ORPHAN TANK** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=11556

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 63** **Distance from Property: 0.24 mi. (1,267 ft.) SE**

**SITE INFORMATION**

FILE NUMBER: **080125-1**

SITE NO: **408**

NAME: **CHILDRENS HOSPITAL PARCEL A AND B**

ADDRESS: **NW CORNER OF PARK AVE AND OGDEN ST;**
**DENVER, CO 80218**

COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**

REVIEW DATE DUE: **3/10/2008**

DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**

ACTUAL COST: **807.50** CLEANUP ACRES: **3.6**

OTHER ISSUES: **UP GRADIENT SOURCE;#10**

LAND USE RESTRICTIONS: **NOT REPORTED**

PROJECT MANAGER: **APOSTOLOPOULOS**

INDOOR AIR: **VOC'S;#6**

MEDIA SEDIMENT: **VOC'S;#4**

MEDIA GROUND WATER: **VOC'S;#4**

MEDIA SURFACE WATER: **VOC'S;#4**

MEDIA SOIL: **VOC'S;#4**

Back to Report Summary

# Aboveground Storage Tank Facilities (AST)

**MAP ID# 63** **Distance from Property: 0.26 mi. (1,373 ft.) SE**

**FACILITY INFORMATION**

FACILITY ID: **19151**

NAME: **ORPHAN TANK**

ADDRESS: **E 18TH AVE @ NW CORNER OF OGDEN ST**
**DENVER, CO 80218**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=19151

**OWNER INFORMATION**

OWNER ID: **1000**

NAME: **DENVER DEPT OF ENVIRONMENTAL HEALTH**

ADDRESS: **200 W 14TH AVE STE 310**
**DENVER, CO 80204**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 64** **Distance from Property: 0.25 mi. (1,320 ft.) NE**

**FACILITY INFORMATION**

FACILITY ID: **13773**

NAME: **PIPER PROPERTY**

ADDRESS: **2975 WELTON ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=13773

**OWNER INFORMATION**

OWNER ID: **NOT REPORTED**

NAME: **PIPER**

ADDRESS: **6230 E 17TH AVE**
**DENVER, CO 80220**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 64** **Distance from Property: 0.25 mi. (1,320 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **13769LST**
FACILITY ID: **13769**
NAME: **PIPER PROPERTY**
ADDRESS: **2975 WELTON ST**
**DENVER, CO 80205**
SITE NAME: **PIPER PROPERTY**
LOCATION: **2975 WELTON ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **4908** | **CLOSED** | **11/5/1996** | **PIPER PROPERTY** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=4908 | | | |
| **1310** | **CLOSED** | **10/18/1996** | **PIPER PROPERTY** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=1310 | | | |

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# Underground Storage Tank Facilities (UST)

**MAP ID# 64** **Distance from Property: 0.25 mi. (1,320 ft.) NE**

## FACILITY INFORMATION

FACILITY ID: **7444**

NAME: **UNKNOWN**

ADDRESS: **2975 WELTON ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=7444

## OWNER INFORMATION

OWNER ID: **6118**

NAME: **BILL PIPER / JOSEPHINE PIPER**

ADDRESS: **6230 E 17TH**
**DENVER, CO 80220**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **19620** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **999999999** | **CLOSED** | **NOT REPORTED** |
| **19621** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **999999999** | **CLOSED** | **NOT REPORTED** |
| **19622** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **999999999** | **CLOSED** | **NOT REPORTED** |
| **19623** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **999999999** | **CLOSED** | **NOT REPORTED** |

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 64** **Distance from Property: 0.25 mi. (1,320 ft.) NE**

**FACILITY INFORMATION**

FACILITY ID: **13769**
NAME: **PIPER PROPERTY**
ADDRESS: **2975 WELTON ST**
**DENVER, CO 80205**
COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=13769

**OWNER INFORMATION**

OWNER ID: **17471**
NAME: **BILL PIPER**
ADDRESS: **6230 E 17TH AVE**
**DENVER, CO 80220**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# Underground Storage Tank Facilities (UST)

**MAP ID# 65** **Distance from Property: 0.25 mi. (1,320 ft.) N**

## FACILITY INFORMATION

FACILITY ID: **11**

NAME: **WEICKER MOVING & STORAGE**

ADDRESS: **2900 BRIGHTON BLVD**
**DENVER, CO 80216**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=11

## OWNER INFORMATION

OWNER ID: **5753**

NAME: **WEICKER INVESTMENTS**

ADDRESS: **36 STEELE ST STE 18**
**DENVER, CO 80206**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **20** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **8000** | **CLOSED** | **NOT REPORTED** |
| **21** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **10000** | **CLOSED** | **NOT REPORTED** |
| **22** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **6000** | **CLOSED** | **NOT REPORTED** |
| **23** | **UNDERGROUND STORAGE TANK** | **4 - DIESEL** | **12000** | **CLOSED** | **NOT REPORTED** |
| **24** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **1000** | **CLOSED** | **NOT REPORTED** |
| **25** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **1000** | **CLOSED** | **NOT REPORTED** |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 65** **Distance from Property: 0.25 mi. (1,320 ft.) N**

**FACILITY INFORMATION**

UNIQUE ID: **11LST**

FACILITY ID: **11**

NAME: **WEICKER MOVING & STORAGE**

ADDRESS: **2900 BRIGHTON BLVD**
**DENVER, CO 80216**

SITE NAME: **METRO TAXI**

LOCATION: **2900 BRIGHTON BLVD, DENVER 80216**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **692** | **CLOSED** | **10/31/1995** | **METRO TAXI** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=692

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# Underground Storage Tank Facilities (UST)

**MAP ID# 66** **Distance from Property: 0.25 mi. (1,320 ft.) N**

## FACILITY INFORMATION

FACILITY ID: **5225**

NAME: **BRIGHTON BLVD INVESTMENT PARTNERSHIP**

ADDRESS: **3001 BRIGHTON BLVD**
**DENVER, CO 80206**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=5225

## OWNER INFORMATION

OWNER ID: **2562**

NAME: **BRIGHTON BLVD INVESTMENT PARTNERSHIP**

ADDRESS: **3001 BRIGHTON BLVD**
**DENVER, CO 80206**

## TANK INFORMATION

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **14414** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **1000** | **CLOSED** | **NOT REPORTED** |

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 66** **Distance from Property: 0.25 mi. (1,320 ft.) N**

**SITE INFORMATION**

FILE NUMBER: **150317-1**
SITE NO: **614**
NAME: **INDUSTRY DENVER II**
ADDRESS: **3001 BRIGHTON BLVD.**
**DENVER, CO 80216**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **5/1/2015**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **1045.00** CLEANUP ACRES: **NOT REPORTED**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **COMMERCIAL**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **PAH'S;#13**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **BTEX;#6;#PAH'S;#13;#LEAD;#7;#ASBESTOS CONTAMINATED MATERIALS;#25**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 66** **Distance from Property: 0.25 mi. (1,320 ft.) N**

## SITE INFORMATION

FILE NUMBER: **130830-1**

SITE NO: **614**

NAME: **INDUSTRY DENVER**

ADDRESS: **3001, 3063 BRIGHTON BLVD.,1855 29TH ST.,AND 2800-2900 ARKIS CT.**
**DENVER, CO 80216**

COUNTY: **DENVER**

## SITE DETAILS

APPLICATION TYPE: **VOLUNTARY CLEANUP PROGRAM**

REVIEW DATE DUE: **10/14/2013**

DECISION: **APPROVAL**

REMEDY START DATE: **9/30/2013** REMEDY END DATE: **9/30/2017**

ACTUAL COST: **680.00** CLEANUP ACRES: **5.5**

OTHER ISSUES: **NOT REPORTED**

LAND USE RESTRICTIONS: **RESIDENTIAL**

PROJECT MANAGER: **APOSTOLOPOULOS**

INDOOR AIR: **NOT REPORTED**

MEDIA SEDIMENT: **NOT REPORTED**

MEDIA GROUND WATER: **PCE;#12;#HEAVY METALS;#9**

MEDIA SURFACE WATER: **NOT REPORTED**

MEDIA SOIL: **ASBESTOS CONTAMINATED MATERIALS;#25;#PAH'S;#13;#TPH;#10**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 66** **Distance from Property: 0.25 mi. (1,320 ft.) N**

**FACILITY INFORMATION**

UNIQUE ID: **5225LST**

FACILITY ID: **5225**

NAME: **BRIGHTON BLVD INVESTMENT PARTNERSHIP**

ADDRESS: **3001 BRIGHTON BLVD**
**DENVER, CO 80216**

SITE NAME: **FRANKLIN FURNITURE**

LOCATION: **3001 BRIGHTON BLVD, DENVER 80216**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **3486** | **CLOSED** | **11/3/1993** | **FRANKLIN FURNITURE** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=3486

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 67** **Distance from Property: 0.25 mi. (1,320 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **13386LST**
FACILITY ID: **13386**
NAME: **NOT REPORTED**
ADDRESS: **2450 BLAKE ST**
**DENVER, CO 80205**
SITE NAME: **BACKER ROD CO**
LOCATION: **2450 BLAKE ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **1709** | **CLOSED** | **4/10/1995** | **BACKER ROD CO** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=1709

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# Underground Storage Tank Facilities (UST)

**MAP ID# 67** **Distance from Property: 0.25 mi. (1,320 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **7004**

NAME: **BACKER ROD CO**

ADDRESS: **2450 BLAKE ST**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=7004

**OWNER INFORMATION**

OWNER ID: **16829**

NAME: **BACKER ROD CO**

ADDRESS: **2450 BLAKE ST**
**DENVER, CO 80205**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **18594** | **UNDERGROUND STORAGE TANK** | **UNKNOWN** | **750** | **CLOSED** | **NOT REPORTED** |

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 67** **Distance from Property: 0.25 mi. (1,320 ft.) SW**

**SITE INFORMATION**

FILE NUMBER: **000824-1**
SITE NO: **180**
NAME: **BALLPARK LOFTS I**
ADDRESS: **WALNUT-BLAKE, 24ST-BROADWAY**
**DENVER, CO**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **VOLUNTARY CLEANUP PROGRAM**
REVIEW DATE DUE: **10/8/2000**
DECISION: **APPROVAL**

REMEDY START DATE: **10/27/2001** REMEDY END DATE: **10/27/2002**
ACTUAL COST: **933.50** CLEANUP ACRES: **3.0**

OTHER ISSUES: **UP GRADIENT SOURCE;#10**
LAND USE RESTRICTIONS: **NOT REPORTED**
PROJECT MANAGER: **WALKER**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **PETROLEUM CONTAMINATED SOILS;#360**
MEDIA GROUND WATER: **PETROLEUM CONTAMINATED SOILS;#360**
MEDIA SURFACE WATER: **PETROLEUM CONTAMINATED SOILS;#360**
MEDIA SOIL: **PETROLEUM CONTAMINATED SOILS;#360**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 67** **Distance from Property: 0.25 mi. (1,320 ft.) SW**

**SITE INFORMATION**

FILE NUMBER: **010507-1**
SITE NO: **180**
NAME: **BALLPARK LOFTS II**
ADDRESS: **WALNUT-BLAKE, 24ST-BROADWAY**
**DENVER, CO**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **6/21/2001**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **970.84** CLEANUP ACRES: **NOT REPORTED**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **NOT REPORTED**
PROJECT MANAGER: **WALKER**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **NOT REPORTED**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **NOT REPORTED**

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# Aboveground Storage Tank Facilities (AST)

**MAP ID# 67** **Distance from Property: 0.25 mi. (1,320 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **13386**
NAME: **BACKER ROD CO**
ADDRESS: **2450 BLAKE ST**
**DENVER, CO 80205**
COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=13386

**OWNER INFORMATION**

OWNER ID: **NOT REPORTED**
NAME: **BACKER ROD CO**
ADDRESS: **2450 BLAKE ST**
**DENVER, CO 80205**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **NR** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

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# Underground Storage Tank Facilities (UST)

**MAP ID# 68** **Distance from Property: 0.25 mi. (1,320 ft.) SW**

**FACILITY INFORMATION**

FACILITY ID: **10076**

NAME: **INTERSTATE CONOCO**

ADDRESS: **2435 BROADWAY**
**DENVER, CO 80205**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=10076

**OWNER INFORMATION**

OWNER ID: **5925**

NAME: **YVONNE MCGOW**

ADDRESS: **3131 UVALDA ST**
**AURORA, CO 80011**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **27103** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **3000** | **CLOSED** | **NOT REPORTED** |
| **27104** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **3000** | **CLOSED** | **NOT REPORTED** |
| **27105** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **1000** | **CLOSED** | **NOT REPORTED** |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 68** **Distance from Property: 0.25 mi. (1,320 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **10076LST**
FACILITY ID: **10076**
NAME: **INTERSTATE CONOCO**
ADDRESS: **2435 N BROADWAY**
**DENVER, CO 80205**
SITE NAME: **INTERSTATE CONOCO**
LOCATION: **2435 N BROADWAY, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **7528** | **CLOSED** | **6/28/1999** | **INTERSTATE CONOCO** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=7528

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# Underground Storage Tank Facilities (UST)

**MAP ID# 69** **Distance from Property: 0.25 mi. (1,320 ft.) E**

**FACILITY INFORMATION**

FACILITY ID: **8648**

NAME: **AMBULANCE SERVICE CO**

ADDRESS: **2045 DOWNING ST**
**DENVER, CO 80218**

COSTIS LINK: http://costis.cdle.state.co.us/facility.asp?h_id=8648

**OWNER INFORMATION**

OWNER ID: **193**

NAME: **AMBULANCE SERVICE CO**

ADDRESS: **2045 DOWNING ST BOX 18190**
**DENVER, CO 80218**

**TANK INFORMATION**

| TANK ID: | TANK TYPE: | TANK PRODUCT: | TANK CAPACITY: | TANK STATUS: | INSTALLATION DATE: |
|---|---|---|---|---|---|
| **22615** | **UNDERGROUND STORAGE TANK** | **GASOLINE** | **2000** | **CLOSED** | **NOT REPORTED** |

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# Superfund Enterprise Management System Archived Site Inventory (SEMSARCH)

**MAP ID# 70** **Distance from Property: 0.25 mi. (1,320 ft.) NE**

**FACILITY INFORMATION**

EPA ID#: **COD980635072**

SITE ID#: **0800206**

NAME: **MAGNUS CO INC**

ADDRESS: **2945 BLAKE ST**
**DENVER, CO 80205**

COUNTY: **DENVER**

FEDERAL FACILITY: **NOT A FEDERAL FACILITY**

NPL: **NOT ON THE NPL**

NON NPL STATUS: **NFRAP-SITE DOES NOT QUALIFY FOR THE NPL BASED ON EXISTING INFORMATION**

Below information was gathered from the prior NFRAP update completed in 10/2013 update:

| ACTION | START DATE | COMPLETION DATE | RESPONSIBILITY |
|---|---|---|---|
| **DS - DISCOVERY** | **NOT REPORTED** | **6/1/1981** | **EPA FUND** |
| **PA - PRELIMINARY ASSESSMENT** | **NOT REPORTED** | **3/1/1984** | **STATE (FUND)** |
| **VS - ARCHIVE SITE** | **NOT REPORTED** | **3/1/1984** | **EPA IN-HOUSE** |

ACTION DESCRIPTIONS

**DS - (DISCOVERY) - THE PROCESS BY WHICH A POTENTIAL HAZARDOUS WASTE SITE IS BROUGHT TO THE ATTENTION OF THE EPA. THE PROCESS CAN OCCUR THROUGH THE USE OF SEVERAL MECHANISMS SUCH AS A PHONE CALL OR REFERRAL BY ANOTHER GOVERNMENT AGENCY.**

**PA - (PRELIMINARY ASSESSMENT) - COLLECTION OF DIVERSE EXISTING INFORMATION ABOUT THE SOURCE AND NATURE OF THE SITE HAZARD. IT IS EPA POLICY TO COMPLETE THE PRELIMINARY ASSESSMENT WITHIN ONE YEAR OF SITE DISCOVERY.**

**VS - (ARCHIVE SITE) - THE DECISION IS MADE THAT NO FURTHER ACTIVITY IS PLANNED AT THE SITE.**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 71** **Distance from Property: 0.26 mi. (1,373 ft.) E**

## FACILITY INFORMATION

UNIQUE ID: **2694LST**
FACILITY ID: **2694**
NAME: **SAINT JOSEPH HOSPITAL**
ADDRESS: **1925 DOWNING ST**
**DENVER, CO 80218**
SITE NAME: **SAINT JOSEPH HOSPITAL**
LOCATION: **1925 DOWNING ST<BR>DENVER 80218**

## LEAKING INFORMATION

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **12608** | **CLOSED** | **9/28/2016 10:00** | **SAINT JOSEPH HOSPITAL** |
| COSTIS LINK: | http://costis.cdle.state.co.us/event.asp?h_id=12608 | | |
| **10122** | **CLOSED** | **6/22/2006 12:18** | **SAINT JOSEPH HOSPITAL** |
| COSTIS LINK: | http://costis.cdle.state.co.us/event.asp?h_id=10122 | | |
| **8771** | **CLOSED** | **10/22/2001** | **SAINT JOSEPH HOSPITAL** |
| COSTIS LINK: | http://costis.cdle.state.co.us/event.asp?h_id=8771 | | |
| **6740** | **CLOSED** | **7/24/1998** | **EXEMPLA HEALTHCARE SAINT JOSEPH HOSPITAL** |
| COSTIS LINK: | http://costis.cdle.state.co.us/event.asp?h_id=6740 | | |

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 72** **Distance from Property: 0.26 mi. (1,373 ft.) SE**

**FACILITY INFORMATION**

UNIQUE ID: **6660LST**
FACILITY ID: **6660**
NAME: **CHILDRENS HOSPITAL**
ADDRESS: **1056 E 19TH AVE**
**DENVER, CO 80218**
SITE NAME: **CHILDRENS HOSPITAL**
LOCATION: **1056 E 19TH AVE, DENVER 80218**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **11454** | **CLOSED** | **6/30/2011 10:41** | **CHILDRENS HOSPITAL** |
| COSTIS LINK: | http://costis.cdle.state.co.us/event.asp?h_id=11454 | | |
| **10753** | **CLOSED** | **11/25/2008 12:43** | **CHILDRENS HOSPITAL** |
| COSTIS LINK: | http://costis.cdle.state.co.us/event.asp?h_id=10753 | | |

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**MAP ID# 73** **Distance from Property: 0.26 mi. (1,373 ft.) SW**

**SITE INFORMATION**

ID#: **136601**

NAME: **TEMPLE EMANUEL**

ADDRESS: **2400 CURTIS STREET**
**DENVER, CO 80205**

TYPE FUNDING: **N/A**

PREDOMINANT PAST USE (ACREAGE):

| GREENSPACE: | RESIDENTIAL: | COMMERCIAL: | INDUSTRIAL: |
|---|---|---|---|
| **NOT REPORTED** | **NOT REPORTED** | **0.22** | **NOT REPORTED** |

FUTURE USE (ACREAGE):

| GREENSPACE: | RESIDENTIAL: | COMMERCIAL: | INDUSTRIAL: |
|---|---|---|---|
| **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

PROPERTY HIGHLIGHT:
**NOT REPORTED**

PROPERTY SIZE (Acres): **0.22**

CURRENT OWNER: **EL CARRO LLC**

PROPERTY DESCRIPTION/ FORMER USE:
**TEMPLE EMANUEL PROPERTY WAS BUILT FOR USE AS A JEWISH SYNAGOGUE IN 1882. CURRENTLY,THE PROPERTY IS USED FOR STORAGE WITH A CARETAKER LIVING ONSITE. THE TEMPLE EMANUEL PROPERTY HAS BEEN USED FOR MANY DIFFERENT THINGS SINCE ITS CONSTRUCTION IN 1882. SEE THE PHASE I REPORT FOR MORE INFORMATION.**

CONTAMINATE(S): **NOT REPORTED**

CONTAMINATE(S) CLEANED UP: **NOT REPORTED**

MEDIA(S) AFFECTED: **AIR**

MEDIA(S) CLEANED UP: **NOT REPORTED**

TYPE OF BROWNFIELD GRANT: **TBA**
ENVIRONMENTAL ASSESSMENT ACTIVITY: **PHASE I ENVIRONMENTAL ASSESSMENT**
ASSESSMENT START DATE: **6/27/2011 0:00**
ASSESSMENT COMPLETION DATE: **7/21/2011 0:00**
CLEANUP REQUIRED: **YES**
STATE & TRIBAL ENROLLMENT ID: **NOT REPORTED**
STATE & TRIBAL ENROLLMENT DATE: **NOT REPORTED**
PROPERTY ENROLLED IN A STATE & TRIBAL PROGRAM?: **NOT REPORTED**
ARE INSTITUTIONAL CONTROLS REQUIRED?: **NO**

TYPE OF BROWNFIELD GRANT: **TBA**
ENVIRONMENTAL ASSESSMENT ACTIVITY: **PHASE II ENVIRONMENTAL ASSESSMENT**
ASSESSMENT START DATE: **6/27/2011 0:00**
ASSESSMENT COMPLETION DATE: **11/11/2011 0:00**
CLEANUP REQUIRED: **YES**
STATE & TRIBAL ENROLLMENT ID: **NOT REPORTED**
STATE & TRIBAL ENROLLMENT DATE: **NOT REPORTED**
PROPERTY ENROLLED IN A STATE & TRIBAL PROGRAM?: **NOT REPORTED**
ARE INSTITUTIONAL CONTROLS REQUIRED?: **NO**

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# Superfund Enterprise Management System Archived Site Inventory (SEMSARCH)

**MAP ID# 74** **Distance from Property: 0.27 mi. (1,426 ft.) NW**

**FACILITY INFORMATION**

EPA ID#: **COD087372512**

SITE ID#: **0800162**

NAME: **B-D CHEM CO**

ADDRESS: **699 DENARGO MARKET**
**DENVER, CO 80216**

COUNTY: **DENVER**

FEDERAL FACILITY: **NOT A FEDERAL FACILITY**

NPL: **NOT ON THE NPL**

NON NPL STATUS: **NFRAP-SITE DOES NOT QUALIFY FOR THE NPL BASED ON EXISTING INFORMATION**

Below information was gathered from the prior NFRAP update completed in 10/2013 update:

| ACTION | START DATE | COMPLETION DATE | RESPONSIBILITY |
|---|---|---|---|
| **DS - DISCOVERY** | **NOT REPORTED** | **11/1/1980** | **EPA FUND** |
| **PA - PRELIMINARY ASSESSMENT** | **NOT REPORTED** | **12/1/1984** | **STATE (FUND)** |
| **VS - ARCHIVE SITE** | **NOT REPORTED** | **12/1/1984** | **EPA IN-HOUSE** |

ACTION DESCRIPTIONS

**DS - (DISCOVERY) - THE PROCESS BY WHICH A POTENTIAL HAZARDOUS WASTE SITE IS BROUGHT TO THE ATTENTION OF THE EPA. THE PROCESS CAN OCCUR THROUGH THE USE OF SEVERAL MECHANISMS SUCH AS A PHONE CALL OR REFERRAL BY ANOTHER GOVERNMENT AGENCY.**

**PA - (PRELIMINARY ASSESSMENT) - COLLECTION OF DIVERSE EXISTING INFORMATION ABOUT THE SOURCE AND NATURE OF THE SITE HAZARD. IT IS EPA POLICY TO COMPLETE THE PRELIMINARY ASSESSMENT WITHIN ONE YEAR OF SITE DISCOVERY.**

**VS - (ARCHIVE SITE) - THE DECISION IS MADE THAT NO FURTHER ACTIVITY IS PLANNED AT THE SITE.**

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# Dry Cleaning Facilities (CLEANERS)

**MAP ID# 75** **Distance from Property: 0.27 mi. (1,426 ft.) NE**

## SITE INFORMATION

UNIQUEID: **031-1981CL**

FACILITY ID: **031-1981**

NAME: **COLORADO CLEANERS**

ADDRESS: **1220 30TH ST**
**DENVER, CO 80205-2348**

CONTACT: **GREGORY SHEA**

## OWNER INFORMATION

ADDRESS: **1220 30TH ST**
**DENVER, CO 80205**

## SITE DETAILS

MAKE/MODEL/SERIAL: **COLUMBIA DRY-DRY UNIT/TDR1351/90312M2547**
CONSTRUCTION PERMIT #: **05DE0872.CN**
EMISSION UNIT ID: **001**
EMISSION UNIT DESCRIPTION: **(2) DRY CLEANING UNITS.CN**
EMISSION PROCESS DESCRIPTION: **(2) DRY-DRY UNITS.CN**
ANNUAL THROUGHPUT: **0 GALLONS SOLVENT CONSUMED**

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MAKE/MODEL/SERIAL: **SAILSTAR DRY-DRY UNIT/P440/0340700**
CONSTRUCTION PERMIT #: **05DE0872.CN**
EMISSION UNIT ID: **001**
EMISSION UNIT DESCRIPTION: **(2) DRY CLEANING UNITS.CN**
EMISSION PROCESS DESCRIPTION: **(2) DRY-DRY UNITS.CN**
ANNUAL THROUGHPUT: **0 GALLONS SOLVENT CONSUMED**

---

MAKE/MODEL/SERIAL: **COLUMBIA DRY-DRY UNIT/TDR1351/90312M2547**
CONSTRUCTION PERMIT #: **05DE0872**
EMISSION UNIT ID: **001**
EMISSION UNIT DESCRIPTION: **NOT REPORTED**
EMISSION PROCESS DESCRIPTION: **(2) DRY-DRY UNITS**
ANNUAL THROUGHPUT: **270 GALLONS SOLVENT CONSUMED**

---

MAKE/MODEL/SERIAL: **SAILSTAR DRY-DRY UNIT/P440/0340700**
CONSTRUCTION PERMIT #: **05DE0872**
EMISSION UNIT ID: **001**
EMISSION UNIT DESCRIPTION: **NOT REPORTED**
EMISSION PROCESS DESCRIPTION: **(2) DRY-DRY UNITS**
ANNUAL THROUGHPUT: **270 GALLONS SOLVENT CONSUMED**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 76** **Distance from Property: 0.28 mi. (1,478 ft.) SE**

**SITE INFORMATION**

FILE NUMBER: **950811-1**
SITE NO: **17**
NAME: **CHILDRENS HOSPITAL ASSOC**
ADDRESS: **18TH & DOWNING,**
**DENVER, CO 80218**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **9/25/1995**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **989.51** CLEANUP ACRES: **0.9**

OTHER ISSUES: **UP GRADIENT SOURCE;#10**
LAND USE RESTRICTIONS: **NOT REPORTED**
PROJECT MANAGER: **WALKER**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **NOT REPORTED**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **NOT REPORTED**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 76** **Distance from Property: 0.28 mi. (1,478 ft.) SE**

**SITE INFORMATION**

FILE NUMBER: **090115-1**

SITE NO: **443**

NAME: **CHILDRENS HOSPITAL PARCEL MAIN**

ADDRESS: **NE CORNER OF 18TH AVE AND OGDEN STREET**
**DENVER, CO 80218**

COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**

REVIEW DATE DUE: **3/1/2009**

DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**

ACTUAL COST: **850.00** CLEANUP ACRES: **5.0**

OTHER ISSUES: **NOT REPORTED**

LAND USE RESTRICTIONS: **NOT REPORTED**

PROJECT MANAGER: **APOSTOLOPOULOS**

INDOOR AIR: **VOC'S;#6**

MEDIA SEDIMENT: **VOC'S;#4**

MEDIA GROUND WATER: **VOC'S;#4**

MEDIA SURFACE WATER: **VOC'S;#4**

MEDIA SOIL: **VOC'S;#4**

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# Historical Solid Waste Landfills (HISTSWLF)

**MAP ID# 77** **Distance from Property: 0.29 mi. (1,531 ft.) NW**

**SITE INFORMATION**

UNIQUE ID: **00070-0000632**

NAME: **ARTIFICIAL FILL**

ADDRESS: **W OF DENARGO ST; S OF PLATTE RIVER; E OF BNRR; AND NORTH OF WHER**
**DENVER, CO**

DIRECTIONS: **NOT REPORTED**

COUNTY: **DENVER**

**SITE DETAILS**

AGENCY SOURCE: **NOT REPORTED**

DETAIL1:

**; FILL- DOMESTIC REFUSE: NO. CONSTRUCTION DEBRIS: NO. LIQUIDS: NO. HAZARDOUS WASTE: NO. INDUSTRIAL WASTE: NO. ARTIFICIAL FILL. UNKNOWN: NO. CLAY, SILT, SAND, GRAVEL AND A VARIETY OF DEBRIS CONSISTING OF WOOD, BRICK, METAL, PLASTIC, GLASS, VEGETATIO**

DETAIL2:

**ARTIFICIAL FILL. INCLUDES EMBANKMENTS, DAMS, AND OTHER ENGINEERED FILLS; COMPACTED LANDFILLS, AND UNCOMPACTED RUBBISH DUMPS. CONFIDENCE IN THIS INFO: HIGH.; OPENED- CLOSED-**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 77** **Distance from Property: 0.29 mi. (1,531 ft.) NW**

## FACILITY INFORMATION

UNIQUE ID: **84LST**
FACILITY ID: **84**
NAME: **FORMER KING SOOPERS GARAGE**
ADDRESS: **3325 DENARGO ST**
**DENVER, CO 80216**
SITE NAME: **FORMER KING SOOPERS GARAGE**
LOCATION: **3325 DENARGO ST, DENVER 80216**

## LEAKING INFORMATION

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **12157** | **OPEN** | **11/14/2014 11:05** | **FORMER KING SOOPERS GARAGE** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=12157 | | | |
| **11389** | **CLOSED** | **3/21/2011 11:50** | **FORMER KING SOOPERS GARAGE** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=11389 | | | |

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# Denver County Historic Landfills (DCHISTLF)

**MAP ID# 77** **Distance from Property: 0.29 mi. (1,531 ft.) NW**

**SITE INFORMATION**

LANDFILL ID: **87**

LANDFILL NAME: **3S-68W-27NW3**

DATE ENTERED: **04/28/1997**

TYPE OF LANDFILL: **OTHER**

DESCRIPTION:

**W OF DENARGO ST; S OF PLATTE RIVER; E OF BNRR; AND NORTH OF WHERE 33RD WOULD EXTEND.**

TYPE REMARKS:

**INCLUDES EMBANKMENTS, DAMS, AND OTHER ENGINEERED FILLS; COMPACTED LANDFILLS, AND UNCOMPACTED RUBBISH DUMPS.**

DOMESTIC: **NO**

HAZARDOUS: **NO**

CONSTRUCTION: **NO**

INDUSTRIAL: **NO**

LIQUIDS: **NO**

UNKNOWN: **NO**

OTHER: **ARTIFICIAL FILL**

MATERIAL RECEIVED:

**CLAY, SILT, SAND, GRAVEL AND A VARIETY OF DEBRIS CONSISTING OF WOOD, BRICK, METAL, PLASTIC, GLASS, VEGETATION, AND OTHER TRASH.**

START DATE: **NOT REPORTED**

END DATE: **NOT REPORTED**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 78** **Distance from Property: 0.29 mi. (1,531 ft.) E**

**FACILITY INFORMATION**

UNIQUE ID: **7425LST**
FACILITY ID: **7425**
NAME: **BOETTCHER**
ADDRESS: **1900 DOWNING ST**
**DENVER, CO 80218**
SITE NAME: **BOETTCHER**
LOCATION: **1900 DOWNING ST, DENVER 80218**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **4200** | **CLOSED** | **1/24/1990** | **BOETTCHER** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=4200

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 79** **Distance from Property: 0.29 mi. (1,531 ft.) W**

**FACILITY INFORMATION**

UNIQUE ID: **15776LST**
FACILITY ID: **15776**
NAME: **1900 GRANT LTD**
ADDRESS: **1900 GRANT**
**DENVER, CO 80203**
SITE NAME: **1900 GRANT LTD**
LOCATION: **1900 GRANT, DENVER 80203**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **8992** | **CLOSED** | **7/15/2002 15:22** | **1900 GRANT LTD** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=8992

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**MAP ID# 80** **Distance from Property: 0.29 mi. (1,531 ft.) S**

**FACILITY INFORMATION**

EPA ID#: **COD980716955**
SITE ID#: **0800247**
NAME: **DENVER RADIUM SITE**
ADDRESS: **VARIOUS PLACES IN DENVER**
**DENVER, CO 80204**
COUNTY: **DENVER**
NATIONAL PRIORITY LISTING: **F - CURRENTLY ON THE FINAL NPL**
FEDERAL FACILITY CLASSIFICATION: **NO - NOT A FEDERAL FACILITY**
NON-NPL STATUS: **NOT REPORTED -**
NON-NPL STATUS DATE: **NOT REPORTED**
PHYSICAL CLASSIFICATION OF SITE / INCIDENT: **MINES/TAILINGS**

FEDERAL REGISTER INFORMATION

| DATE | VOLUME | PAGE # | ACTION | HRS SCORE |
|---|---|---|---|---|
| **12/30/1982** | **47** | **58476** | **PROPOSED TO THE FINAL NPL** | **44.00000** |
| **09/08/1983** | **48** | **40658** | **PROMULGATED TO THE FINAL NPL** | **44.11000** |

SITE DESCRIPTION

**BECAUSE OF THE ENORMITY AND COMPLEXITY OF THE DENVER RADIUM SITE, EPA DETERMINED THAT RESPONSE ACTIONS UNDERTAKEN IN OPERABLE UNITS WOULD BE COST-EFFECTIVE AND CONSISTENT WITH A PERMANENT REMEDY FOR THE ENTIRE DENVER RADIUM SITE. THUS, THE ORIGINAL DENVER RADIUM SITE PROPERTIES PLUS THE SEVERAL CONTIGUOUS PROPERTIES WHERE CONTAMINATION WAS DISCOVERED SUBSEQUENT TO THE INITIAL LISTING OF THE SITE ON THE INTERIM PRIORITIES LIST WERE DIVIDED INTO ELEVEN OPERABLE UNITS. THE PROPERTIES WERE DIVIDED BASED PRIMARILY UPON SITE CONDITIONS AND PROXIMITY TO OTHER DENVER RADIUM SITE PROPERTIES.**

**OPERABLE UNIT 1:**

**OPERABLE UNIT 1 CONSISTS OF THE FOLLOWING DENVER RADIUM SITE PROPERTIES, ALSO KNOWN COLLECTIVELY AS THE 12TH AND QUIVAS PROPERTIES:**
**- B&C METAL PRODUCTS**
**- ERICKSON MONUMENTS**
**- MATERIALS HANDLING EQUIPMENT COMPANY**
**- RUDD INVESTMENTS**
**- DENVER AND RIO GRANDE WESTERN RAILROAD (DRGRR)**

**THE 12TH AND QUIVAS PROPERTIES ARE LOCATED IN THE PLATTE RIVER VALLEY BUT ARE NOT WITHIN THE DESIGNATED 100-YEAR FLOOD PLAIN. THE PROPERTIES ARE UNDERLAIN BY FILL MATERIAL, ALLUVIUM, AND THE DENVER FORMATION SANDSTONE. DEPTH TO GROUND WATER IS 14 FEET AND DEPTH TO BEDROCK IS 16 FEET. THE TOPOGRAPHY OF THE OF THE SITE IS PREDOMINATELY FLAT, HOWEVER, A NORTH-SOUTH RIDGE OF APPROXIMATELY TEN FEET IN HEIGHT RUNS ALONG THE EASTERN PORTION OF THE SITE. THERE IS NO SURFACE WATER ON THE 12TH AND QUIVAS PROPERTIES; HOWEVER, OCCUPANTS OF SOME OF THE PROPERTIES REPORT THAT STORM WATER DRAINAGE IN THE AREA CAN BE A PROBLEM AT TIMES. THE CLIMATE OF THE AREA IS TYPIFIED BY LOW ANNUAL PRECIPITATION, AVERAGING ABOUT 14 INCHES PER YEAR.**

**THE 12TH AND QUIVAS PROPERTIES ARE LOCATED IN AN AREA OF DENVER CURRENTLY ZONED 1-1 FOR INDUSTRIAL USE. THE PROPERTIES COVER APPROXIMATELY 8.1 ACRES AND ARE BOUNDED ON THE EAST BY QUIVAS STREET, ON THE NORTH BY WEST 13TH AVENUE, ON THE WEST BY SHOSHONE STREET, AND ON THE SOUTH BY WEST 12TH AVENUE.**

THERE ARE BURIED MUNICIPAL UTILITIES WITHIN THESE BOUNDARIES.

B &C METAL PRODUCTS IS LOCATED AT 1623 WEST 12TH AVENUE. THE PROPERTY IS SPARSELY VEGETATED WITH WEEDS AND TREES. THE ONLY STRUCTURES ON THE PROPERTY ARE A TWO-STORY STONE AND BRICK BUILDING WITH A BASEMENT AND A STORAGE SHED. THE BUILDING IS OCCUPIED BY 12 PEOPLE APPROXIMATELY 40 HOURS PER WEEK. THE BUILDING COVERS 20,700 SQUARE FEET OF THE 33,100-SQUARE-FOOT LOT OWNED BY B&C METAL PRODUCTS.

THE ERICKSON MONUMENTS PROPERTY, LOCATED AT 1241 QUIVAS STREET, COVERS APPROXIMATELY 29,800 SQUARE FEET. A RAILROAD SPUR CUTS DIAGONALLY ACROSS THE PROPERTY. SANDBLASTING GRIT AND WASTE GRANITE, MIXED WITH FILL MATERIAL, HAS BEEN REGRADED TO CREATE AN AREA ON THE NORTHERN END OF THE PROPERTY WHICH IS THREE TO FIVE FEET HIGHER IN ELEVATION THAN THE SURROUNDING PROPERTY. SPENT SILICON CARBIDE SANDBLASTING GRIT HAS BEEN SCATTERED OVER THE ENTIRE PROPERTY. BOTH FINISHED AND UNFINISHED MONUMENTS HAVE BEEN PLACED OVER A LARGE PORTION OF THE PROPERTY. THERE ARE TWO CONNECTING, SINGLE-STORY BUILDINGS ON THE PROPERTY. ONE IS MADE OF FRAME AND STEEL AND THE OTHER IS A SMALL BRICK BUILDING. SIX PEOPLE WORK AT THE PROPERTY APPROXIMATELY 40 HOURS PER WEEK.

THE MATERIALS HANDLING PROPERTY IS THE LARGEST OF THE 12TH AND QUIVAS PROPERTIES, OCCUPYING 5.4 ACRES AT 1740 WEST 13TH AVENUE. THE COMPANY EMPLOYS 65 PEOPLE 40 HOURS PER WEEK. THESE PEOPLE WORK IN A SINGLE BRICK AND CONCRETE BUILDING ON THE PROPERTY.

THE RUDD INVESTMENTS PROPERTY IS LOCATED AT 1229 QUIVAS STREET. A BRICK BUILDING ON THE PROPERTY IS OCCUPIED BY 16 TO 18 PEOPLE BETWEEN 40 AND 50 HOURS PER WEEK. THE WEST PART OF THE PROPERTY IS AN ASPHALT-PAVED, FENCED, STORAGE AREA WHICH CONTAINS ONE SHEET-METAL STORAGE SHED.

THE DRGRR PROPERTY IS A ROAD EASEMENT THAT WAS ONCE USED FOR RAILROAD ACCESS. WITH TIME AND DISUSE, THE TRACKS HAVE BECOME COVERED WITH DIRT AND ARE ONLY VISIBLE IN CERTAIN AREAS.

A DETAILED RESPONSIBLE PARTY SEARCH FOR THE ENTIRE DENVER RADIUM SITE HAS BEEN INITIATED. REGARDING THE 12TH AND QUIVAS PROPER TIES, RECORDS SHOW THAT PITTSBURGH RADIUM COMPANY OPERATED A PROCESSING FACILITY AT THIS LOCATION AT THE TIME OF APPARENT DISPOSAL OF ORE PROCESSING WASTES CONTAINING, AMONG OTHER CONTAMINANTS, RADIUM, THE HAZARDOUS SUBSTANCE OF CONCERN. ALTHOUGH EXTENSIVE INVESTIGATION HAS BEEN CONDUCTED, THE RESPONSIBLE PARTY SEARCH HAS YET TO TRACE THE PITTSBURGH RADIUM COMPANY TO A VIABLE, PRESENT-DAY COMPANY. AT THIS POINT, THE RESPONSIBLE PARTY SEARCH HAS NOT REVEALED THAT THE PRESENT OWNERS OF THE 12TH AND QUIVAS PROPERTIES HAVE ANY RECORD OF HAVING BEEN CONNECTED WITH THE ACTIVITIES THAT CAUSED THE SITE TO BE RADIOLOGICALLY CONTAMINATED.

EPA DOES NOT FEEL THAT RESPONSE ACTIONS SHOULD BE DELAYED PENDING FINALIZATION OF THE RESPONSIBLE PARTY SEARCH. UPON FINALIZATION OF THE SEARCH, THE STATUS OF RESPONSIBLE PARTIES WILL BE DETERMINED AND EVALUATED AND, IF APPROPRIATE, EPA WILL FORMALLY NOTIFY THEM OF THE SELECTED REMEDY FOR THE 12TH AND QUIVAS PROPERTIES AND INITIATE NEGOTIATIONS FOR THE IMPLEMENTATION OF THE REMEDY. IF THE RESPONSIBLE PARTIES DO NOT FORMALLY COMMIT TO PERFORMING THE REMEDY IN A TIMELY MANNER, EPA WILL PROCEED WITH A FUND-FINANCED REMEDIAL DESIGN AND REMEDIAL ACTION AND WILL ATTEMPT TO RECOVER EPA'S RESPONSE COSTS FROM THE RESPONSIBLE PARTIES.

A RECORD OF DECISION ADDRESSING OPERABLE UNIT 1 WAS COMPLETED IN SEPTEMBER 2007.

OU 2:

OPERABLE UNIT 2 IS COMPRISED OF THE FOLLOWING DENVER RADIUM SITE PROPERTIES KNOWN COLLECTIVELY AS THE 11TH AND UMATILLA PROPERTIES:
- DUWALD STEEL

- ROCKY MOUNTAIN RESEARCH
- G & K SERVICES
- JENKINS PROPERTY
- STAAB BUILDING
- AIR CONDITIONING, INC.
- JEROME PARK MAINTENANCE YARD
- BURLINGTON NORTHERN RAILROAD
- FLAME SPRAY, INC.
- CAPITAL MANAGEMENT REALITY
- ALPHA OMEGA ELECTRONICS

THE 11TH AND UMATILLA PROPERTIES ARE BOUNDED ON THE EAST BY THE BURLINGTON NORTHERN RAILROAD, ON THE NORTH BY WEST 11TH AVENUE, ON THE WEST BY YUMA STREET, AND ON THE SOUTH BY WEST 10TH AVENUE. INTERSTATE-25 IS LOCATED APPROXIMAT ELY 75 FEET WEST OF THE WESTERN PORTION OF THE PROPERTY. THE DENVER WATER DEPARTMENT HEADQUARTERS' OFFICES AND FACILITY ARE ADJACENT TO THE SOUTHEAST CORNER OF THE PROPERTIES. THE PROPERTIES COVER APPROXIMATELY 24 ACRES IN AN AREA ZONED I-2 FOR HEAVY INDUSTRIAL USE. THERE ARE SEVERAL BURIED MUNICIPAL UTILITIES WITHIN THE PROPERTY BOUNDARIES.

TWO-THIRDS OF THE 11TH AND UMATILLA PROPERTIES ARE LOCATED WITHIN THE DESIGNATED 100-YEAR FLOODPLAIN. THE ENTIRE AREA OF THE 11TH AND UMATILLA PROPERTIES IS WITHIN THE 500-YEAR FLOODPLAIN. THE PROPERTIES ARE UNDERLAIN BY ALLUVIUM AND THE DENVER FORMATION SANDSTONE. THE DEPTH TO GROUND WATER IS GREATER THAN 10 FEET AND DEPTH TO BEDROCK IS APPROXIMATELY 10 TO 30 FEET. THERE IS NO SURFACE WATER ON THE PROPERTIES. THE CLIMATE OF THE AREA IS TYPIFIED BY LOW ANNUAL PRECIPITATION, AVERAGING ABOUT 14 INCHES PER YEAR.

THE DUWALD STEEL PROPERTY LOCATED ON THE CORNER OF 11TH AVENUE AND UMATILLA STREET COVERS 10.5 ACRES. THE PROPERTY IS USED AS A COMMERCIAL FACILITY THAT BUYS AND SELLS SCRAP METAL. SCRAP METAL IS STACKED IN PILES AS HIGH AS 40 FEET OVER MUCH OF THE PROPERTY. A PORTION OF THE PROPERTY IS COVERED WITH REINFORCED CONCRETE. THE TOPOGRAPHY IS FAIRLY LEVEL WITH A SLIGHT WESTERLY SLOPE. TWO MAJOR WATER CONDUITS, DENVER WATER DEPARTMENT CONDUIT 12 AND CONDUIT 18, RUN EAST-WEST ACROSS THE CENTER OF THE DUWALD STEEL PROPERTY. BOTH OF THE CONDUITS ARE APPROXIMATELY FIVE FEET DEEP AND CARRY TREATED WATER FOR WATER SUPPLY. THERE IS ANOTHER CONDUIT RUNNING NORTH-SOUTH ON THE EASTERN BOUNDARY OF THE PROPERTY AND A 100-FOOT, DENVER WATER DEPARTMENT RIGHT-OF-WAY LOCATED ON DUWALD STEEL PROPERTY JUST SOUTH OF 12TH AVENUE. THERE IS APPROXIMATELY 0.3 MILE OF RAILROAD TRACK ON THE PROPERTY. THERE ARE SIX PERMANENT STRUCTURES ON THE DUWALD STEEL PROPERTY. THESE INCLUDE FOUR BUILDINGS, AN ALUMINUM SCRAP SMELTER COMPLEX, AND ONE PERMANENT SCRAP METAL CRANE AND SHREDDER COMPLEX. THE NUMBER OF FULL-TIME EMPLOYEES ON THE PREMISES VARIES BETWEEN 35 AND 40.

IN 1982, CONTAMINATED SOIL WAS EXCAVATED FROM THE DUWALD STEEL PROPERTY DURING CONSTRUCTION OF AN ADDITION. THE MATERIAL WAS PLACED ALONG THE FENCE IN THE SOUTHWEST CORNER AND THEN REGRADED. DURING REMODELING OF ONE OF THE BUILDINGS ON THE DUWALD STEEL PROPERTY, SUBFLOOR VENTING MEASURES WERE TAKEN AND A VAPOR BARRIER WAS INSTALLED TO PREVENT RADON FROM ENTERING THE BUILDING. THE COLORADO DEPARTMENT OF HEALTH AND EPA JOINTLY PERFORMED OVERSIGHT OF THIS WORK.

THE ROCKY MOUNTAIN RESEARCH PROPERTY IS LOCATED AT 1020 YUMA STREET AND COVERS APPROXIMATELY 13,200 SQUARE FEET. THERE IS A 3,160 SQUARE-FOOT MAIN BUILDING AND THREE STORAGE SHEDS LOCATED ON THE PROPERTY. THE MAJORITY OF THE OPEN SPACE IS CONCRETE PAVEMENT. FOUR EMPLOYEES ARE PRESENT ON THE PROPERTY FOR AN ESTIMATED 40 HOURS PER WEEK.

THE G & K SERVICES PROPERTY COVERS APPROXIMATELY 1.4 ACRES AND IS LOCATED AT 999 VALLEJO STREET. A ONE-STORY BUILDING WITH TWO, TWO-STORY ADDITIONS SITS ON THE PROPERTY.

THE JENKINS PROPERTY AT 2177-2191 WEST 10TH AVENUE COVERS LESS THAN ONE ACRE. A ONE-STORY OFFICE BUILDING HOUSES FOUR FULL-TIME EMPLOYEES 40 HOURS PER WEEK AND TWO EMPLOYEES PART TIME.

THE STAAB PROPERTY IS LOCATED AT 2121-2125 WEST 10TH AVENUE AND COVERS LESS THAN ONE ACRE. APPROXIMATELY NINE PEOPLE WORK 40 HOURS PER WEEK IN A ONE-STORY CINDER BLOCK BUILDING. THE FLOOR OF THE BUILDING IS A SIX-INCH CONCRETE SLAB ABOUT FOUR FEET ABOVE GRADE ON THE WESTERN SIDE OF THE BUILDING AND DECREASING TO ABOUT ONE FOOT ABOVE GRADE ON THE EASTERN SIDE.

LOCATED AT 1001 TEJON STREET IS THE AIR CONDITIONING, INC., PROPERTY WHICH COVERS LESS THAN ONE ACRE. A ONE-STORY BUILDING IS OCCUPIED BY FOUR FULL-TIME WORKERS.

THE JEROME PARK MAINTENANCE YARD AT 2300 WEST 11TH AVENUE COVERS APPROXIMATELY THREE ACRES AND IS OWNED BY THE COLORADO DEPARTMENT OF HIGHWAYS. LOCATED ON THE PROPERTY ARE TWO VEHICLE AND EQUIPMENT STORAGE BUILDINGS AND A SMALL TWO-STORY BUILDING. ON THE SOUTH END OF THE PROPERTY IS A DO ME-SHAPED STRUCTURE WHICH IS USED TO STORE SAND. THERE ARE SEVERAL PILES OF SAND, DIRT, AND GRAVEL SITUATED THROUGHOUT THE PROPERTY. AN ESTIMATED 20 WORKERS ARE ON THE PROPERTY 40 HOURS PER WEEK, EXCEPT DURING STORM CONDITIONS WHEN THE PROPERTY IS OCCUPIED AROUND THE CLOCK.

THE BURLINGTON NORTHERN RAILROAD PROPERTY IS 2.2 ACRES OF ACTIVE RAILROAD. THIS PROPERTY IS BETWEEN 10TH AND 12TH AVENUES TO THE EAST OF THE DUWALD STEEL PROPERTY. A SPUR OF THE RAILROAD EXTENDS ONTO THE DUWALD STEEL PROPERTY.

THE CAPITAL MANAGEMENT REALTY PROPERTY AT 1050 YUMA STREET COVERS LESS THAN ONE ACRE. THE ONLY STRUCTURE ON THE PROPERTY IS AN OFFICE BUILDING WITH A FINISHED GARDEN LEVEL BASEMENT. THE BUILDING IS PRESENTLY UNOCCUPIED.

AT 1010 YUMA STREET IS THE ALPHA OMEGA ELECTRONICS PROPERTY. THIS PROPERTY IS LESS THAN ONE ACRE IN SIZE. A ONE-STORY OFFICE AND A STORAGE BUILDING ARE THE ONLY STRUCTURES ON THE PROPERTY. THE OFFICE HOUSES NINE EMPLOYEES 40 HOURS PER WEEK. MOST OF THE GROUND SURROUNDING THE BUILDINGS IS COVERED WITH CONCRETE WALKWAYS AND AN ASPHALT PAVEMENT.

INITIAL INVESTIGATIONS REGARDING THE 11TH AND UMATILLA PROPERTIES INDICATE THAT THE SCHLESINGER RADIUM COMPANY AND ITS SUCCESSOR, RADIUM COMPANY OF COLORADO, OPERATED A PROCESSING FACILITY AT THIS LOCATION FROM APPROXIMATELY 1915 TO 1921, THE TIME OF APPARENT DISPOSAL OF ORE PROCESSING WASTES CONTAINING, AMONG OTHER CONTAMINANTS, RADIUM, THE HAZARDOUS SUBSTANCE OF CONCERN. THE RESPONSIBLE PARTY SEARCH HAS YET TO TRACE EITHER OF THESE COMPANIES OR ANY ASSOCIATED COMPANIES TO A VIABLE, PRESENT-DAY ENTITY. AT THIS TIME, THE RESPONSIBLE PARTY SEARCH HAS NOT REVEALED THAT THE PRESENT OWNERS OF THE 11TH AND UMATILLA PROPERTIES HAVE ANY RECORD OF HAVING BEEN CONNECTED WITH THE ACTIVITIES THAT CAUSED THE SITE TO BE CONTAMINATED WITH RADIOACTIVITY.

EPA DOES NOT FEEL THAT RESPONSE ACTIONS SHOULD BE DELAYED PENDING FINALIZATION OF THE RESPONSIBLE PARTY SEARCH. IF, UPON FINALIZATION OF THE SEARCH, RESPONSIBLE PARTIES ARE CLEARLY IDENTIFIED, EPA WILL FORMALLY NOTIFY THEM OF THE SELECTED REMEDY FOR THE 11TH AND UMATILLA PROPERTIES AND INITIATE NEGOTIATIONS FOR THE IMPLEMENTATION OF THE REMEDY. IF THE RESPONSIBLE PARTIES DO NOT FORMALLY COMMIT TO PERFORMING THE REMEDY IN A TIMELY MANNER, EPA WILL PROCEED WITH A FUND-FINANCED REMEDIAL DESIGN AND REMEDIAL ACTION AND WILL ATTEMPT TO RECOVER EPA'S RESPONSE COSTS FROM THE RESPONSIBLE PARTIES.

A RECORD OF DECISION ADDRESSING OPERABLE UNIT 2 WAS COMPLETED IN SEPTEMBER 1987.

ADDITIONAL CHARACTERIZATION OF THE RADIOLOGIC CONTAMINATION WAS CONDUCTED DURING THE DESIGN OF THE REMEDY, AND IS DOCUMENTED IN SUPPLEMENTA1 DATA RELEASE FOR OPERABLE UNIT II. THE DISCOVERY OF NON-RADIOLOGIC CONTAMINATION (PRIMARILY LEAD) ON THE DU-WALD PROPERTY PROMPTED MORE DATA GATHERING WHICH IS PRESENTED IN "RADIOLOGIC AND SELECTED METALS ASSESSMENT OF THE DU-WALD STEEL CORPORATION PROPERTY, OU-2".

LEAD, RADIUM AND RADIUM'S ASSOCIATED DECAY PRODUCTS ARE THE PRIMARY CONTAMINANTS OF CONCERN AT THE DU-WALD PROPERTY. THE REMEDIAL INVESTIGATION FOR THE DENVER RADIUM SITE ESTIMATED THAT 15,400 CUBIC YARDS (23,100 TONS) OF RADIUM CONTAMINATED SOILS AND DEBRIS WERE PRESENT ON THE OU II PROPERTIES. ADDITIONAL CHARACTERIZATION DATA GATHERED AFTER THE SIGNING OF THE RECORD OF DECISION (ROD) RESULTED IN THE ESTIMATE BEING REVISED UPWARD TO 80,000 TONS.

AN EXPLANATION OF SIGNIFICANT DIFFERENCES ADDRESSING OU-02 WAS COMPLETED IN SEPTEMBER 1993.

OU 3:

OPERABLE UNIT 3 IS COMPRISED OF THE 1000 WEST LOUISIANA VACANT LOT AND THE CREATIVE ILLUMINATION PROPERTY, AS WELL AS TWO CONTIGUOUS PROPERTIES WHICH ARE THE PACKAGING CORPORATION OF AMERICA (PCA) AND THE COLORADO SOUTHERN RAILROAD (CSRR) PROPERTIES. A PROPERTY ADJACENT TO THE RAILROAD, TITAN LABELS, INC., IS INCLUDED IN ALL DISCUSSIONS OF THE CSRR PROPERTY. THESE PROPERTIES ARE KNOWN COLLECTIVELY AS THE 1000 WEST LOUISIANA PROPERTIES. THE 1000 WEST LOUISIANA PROPERTIES ARE BOUNDED ON THE EAST BY JASON STREET, ON THE NORTH BY MISSISSIPPI AVENUE, ON THE WEST BY LIPAN STREET, AND ON THE SOUTH BY PLATTE RIVER DRIVE. THE PROPERTIES COVER APPROXIMATELY 11 ACRES IN AN AREA ZONED FOR INDUSTRIAL USE. THERE ARE SEVERAL BURIED MUNICIPAL UTILITIES WITHIN THE PROPERTY BOUNDARIES.

THE 1000 WEST LOUISIANA PROPERTIES ARE LOCATED OUTSIDE THE 500-YEAR FLOODPLAIN. THE PROPERTIES ARE UNDERLAIN BY ALLUVIUM AND THE DENVER FORMATION SANDSTONE. THE APPROXIMATE DEPTH TO GROUND WATER IS 15 FEET. A SMALL DRAINAGE DITCH, WHICH RUNS THROUGH AN UNCONTAMINATED AREA, DRAINS EAST TO THE SOUTH PLATTE RIVER. THE CLIMATE OF THE AREA IS TYPIFIED BY LOW ANNUAL PRECIPITATION, AVERAGING ABOUT 14 INCHES PER YEAR.

THE VACANT LOT AT 1000 WEST LOUISIANA COVERS 3.4 ACRES AND IS CURRENTLY OWNED BY TENNECO CORPORATION. THE LOT IS NEARLY FLAT WITH A SLIGHT SLOPE TOWARD JASON STREET. ACCESS TO THE PROPERTY IS RESTRICTED BY A WIRE FENCE. RADIATION WARNING SIGNS ARE POSTED ON THIS FENCE. THE PROPERTY IS COVERED WITH GRASSES, SCRUB GROWTH, AND A FEW SMALL TREES. A CITY OF DENVER ORDINANCE CONCERNING WEED GROWTH CANNOT BE ENFORCED BECAUSE THE CONTAMINATED SOILS SHOULD NOT BE DISTURBED. HISTORICAL AERIAL PHOTOGRAPHS SHOW THAT A FACTORY WAS ONCE LOCATED IN THE AREA OF THE VACANT LOT. THIS FACTORY WAS REPORTED TO HAVE BEEN DESTROYED BY FIRE AND THE REMAINS BULLDOZED INTO THE BASEMENT CAVITY.

CREATIVE ILLUMINATION IS A SMALL COMMERCIAL FACILITY AT 1298 SOUTH KALAMATH STREET. THE PROPERTY COVERS APPROXIMATELY 0.46 ACRE AND CONTAINS A SINGLE PERMANENT STRUCTURE. THE STRUCTURE CONSISTS OF A THREE-STORY BRICK BUILDING WHICH WAS CONSTRUCTED IN 1896 AND CURRENTLY SERVES AS OFFICES AND STORAGE SPACE. A CONCRETE BLOCK ADDITION SERVES AS A WORKSHOP AND SALES SHOWROOM, AND AN ALUMINUM STRUCTURE SERVES AS A WORKSHOP. THE THREE-STORY BRICK BUILDING IS OCCUPIED BY 12 PEOPLE FOR APPROXIMATELY 30 HOURS PER WEEK. MOST OF THE AREA SURROUNDING THE BUILDING IS PAVED. A PORTION OF THE GROUNDS ARE USED FOR EQUIPMENT STORAGE.

PCA, WHICH PRINTS AND FOLDS PAPERBOARD BOXES, IS A SUBSIDIARY OF TENNECO. THE PCA PROPERTY IS A 5.6 ACRE SITE LOCATED AT 1377 SOUTH JASON STREET. EXISTING STRUCTURES INCLUDE A SMALL CHEMICAL STORAGE SHED AND A MAIN BUILDING THAT HOUSES AN OFFICE AS WELL AS PRODUCTION AND STORAGE AREAS. THE FACTORY PORTION OF THE PCA BUILDING IS OCCUPIED BY 94 EMPLOYEES FOR 40 HOURS PER WEEK, AND THE OFFICE PORTION OF

THE PCA BUILDING IS OCCUPIED BY 25 TO 30 EMPLOYEES FOR 40 HOURS PER WEEK. THE NORTHERN AND EASTERN PORTIONS OF THE PROPERTY ARE PAVED WITH ASPHALT AND SERVE AS A PARKING AND DRIVE AREA. A CSRR TRACK SPUR RUNS ALONG THE WEST SIDE OF THE PCA BUILDING. SOME UNDEVELOPED LAND WITHIN THE PROPERTY BOUNDARIES IS LOCATED SOUTH OF THE PLANT. HISTORICAL AERIAL PHOTOGRAPHS REVEAL THAT A POND WAS AT ONE TIME LOCATED ON THE PCA PROPERTY.

THE CSRR PROPERTY IS 1.43 ACRES OF ACTIVE RAILROAD TRACKS NOW OWNED BY BURLINGTON NORTHERN RAILROAD AND LOCATED ADJACENT (WEST) TO THE VACANT LOT AND THE PCA PLANT. TITAN LABELS, INC. OWNS PROPERTY ADJACENT TO THE CSRR PROPERTY.

REGARDING THE 1000 WEST LOUISIANA PROPERTIES, RECORDS INDICATE THAT THE CHEMICAL PRODUCTS COMPANY, WHICH MAY HAVE BEEN A DIVISION OF THE LUDLUM STEEL COMPANY, OPERATED A PROCESSING FACILITY AT THIS LOCATION FROM 1918 TO 1921, THE TIME OF APPARENT DISPOSAL OF ORE PROCESSING WASTES CONTAINING, AMONG OTHER CONTAMINANTS, RADIUM, THE HAZARDOUS SUBSTANCE OF CONCERN. SOURCES ALSO INDICATE THAT THE CHEMICAL PRODUCTS COMPANY MAY HAVE BEEN ASSOCIATED WITH THE ORE PRODUCTS COMPANY. EPA IS ATTEMPTING THROUGH THE RESPONSIBLE PARTY SEARCH TO TRACE THE CHEMICAL PRODUCTS COMPANY OR ANY ASSOCIATED COMPANIES TO A VIABLE, PRESENT-DAY ENTITY. AT THIS TIME, THE RESPONSIBLE PARTY SEARCH HAS NOT REVEALED THAT THE PRESENT OWNERS OF THE 1000 WEST LOUISIANA PROPERTIES HAVE ANY RECORD OF HAVING BEEN CONNECTED WITH THE ACTIVITIES THAT CAUSED THE SITE TO BE RADIOLOGICALLY CONTAMINATED.

EPA DOES NOT FEEL THAT RESPONSE ACTIONS SHOULD BE DELAYED PENDING FINA LIZATION OF THE RESPONSIBLE PARTY SEARCH. UPON FINALIZATION OF THE SEARCH, THE STATUS OF RESPONSIBLE PARTIES WILL BE DETERMINED AND EVALUATED AND, IF APPROPRIATE, EPA WILL FORMALLY NOTIFY THEM OF THE SELECTED REMEDY FOR THE 1000 WEST LOUISIANA PROPERTIES AND INITIATE NEGOTIATIONS FOR THE IMPLEMENTATION OF THE REMEDY. IF THE RESPONSIBLE PARTIES DO NOT FORMALLY COMMIT TO PERFORMING THE REMEDY IN A TIMELY MANNER, EPA WILL PROCEED WITH A FUND-FINANCED REMEDIAL DESIGN AND REMEDIAL ACTION AND WILL ATTEMPT TO RECOVER EPA'S RESPONSE COSTS FROM THE RESPONSIBLE PARTIES.

A RECORD OF DECISION ADDRESSING OPERABLE UNIT 3 WAS COMPLETED IN SEPTEMBER 1987.

ADDITIONAL CHARACTERIZATION OF THE RADIOLOGIC CONTAMINATION WAS CONDUCTED DURING THE DESIGN OF THE REMEDY, AND IS DOCUMENTED IN. SUPPLEMENTAL DATA RELEASES FOR OPERABLE UNIT III BY UNC GEOTECH DATED APRIL 1989 AND MAY 1989.

AN EXPLANATION OF SIGNIFICANT DIFFERENCES ADDRESSING OPERABLE UNIT 3 OF THE DENVER RADIUM SUPERFUND SITE WAS COMPLETED IN DECEMBER 1993.

IN APRIL, 1986, THE DENVER RADIUM SITE REMEDIAL INVESTIGATION, WHICH ADDRESSES ALL ELEVEN OPERABLE UNITS, WAS RELEASED FOR PUBLIC COMMENT. OPERABLE UNIT IV, ROBINSON BRICK COMPANY, AND OPERABLE UNIT V, THE DENVER & RIO GRANDE WESTERN RAILROAD, ARE ADDRESSED TOGETHER IN THE REVISED GROUP IV & V FEASIBILITY STUDY DATED APRIL 18, 1986, AND RELEASED FOR PUBLIC COMMENT IN APRIL, 1986. THE FINAL GROUP IV & V FEASIBILITY STUDY AND ENDANGERMENT ASSESSMENT INCORPORATE RESPONSES TO UPDATED EPA GUIDANCE AND COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD ON THE REVISED GROUP IV & V FEASIBILITY STUDY AND WILL BE RELEASED FOR INFORMATIONAL PURPOSES ONLY ALONG WITH THIS RECORD OF DECISION (ROD) AND THE RESPONSIVENESS SUMMARY.

OVER THE LAST SEVERAL YEARS SINCE THE DISCOVERY OF THE DENVER RADIUM SITE, ROBINSON BRICK COMPANY HAS MADE EFFORTS TOWARDS THE VOLUNTARY CLEANUP OF THEIR PROPERTY. THESE EFFORTS HAVE THUS FAR BEEN UNSUCCESSFUL. IN AN ATTEMPT TO RECOVER THEIR COSTS FOR THESE ACTIONS, AND BASED UPON ROBINSON'S PREMISE THAT THE U.S. BUREAU OF MINES IS RESPONSIBLE FOR THE CONTAMINATION, THE ROBINSON BRICK COMPANY FILED A CERCLA SECTION 107 COST RECOVERY SUIT AGAINST THE UNITED STATES OF AMERICA ON APRIL 28, 1986, IN

THE FEDERAL DISTRICT COURT IN DENVER.

THROUGHOUT THE REMAINDER OF THIS SUMMARY, "ROBCO" WILL BE USED TO DENOTE THE CONTAMINATED AREAS ON BOTH THE ROBINSON BRICK COMPANY AND DENVER & RIO GRANDE WESTERN RAILROAD PROPERTIES.

THE RESPONSIBLE PARTY SEARCH THUS FAR HAS IDENTIFIED ONLY THE U.S. BUREAU OF MINES AS A POTENTIALLY RESPONSIBLE PARTY. THE U.S. BUREAU OF MINES MAY HAVE BEEN AN "OPERATOR" OF THE DENVER PROCESSING PLANT WITHIN THE MEANING OF CERCLA SECTION 107(A). ROBINSON BRICK COMPANY AND DENVER & RIO GRANDE WESTERN RAILROAD COULD BE CONSIDERED RESPONSIBLE PARTIES UNDER CERCLA SECTION 107(A)(1) BY VIRTUE OF THEIR CURRENT OWNERSHIP OF THE CONTAMINATED PROPERTIES. THE RESPONSIBLE PARTY SEARCH WAS DISCONTINUED IN JUNE 1986 WHEN THE TES I CONTRACT EXPIRED. THE EPA PLANS TO RESUME THE SEARCH IN THE FUTURE. HOWEVER, THE EPA DOES NOT SEE THAT REMEDIAL ACTION SHOULD BE DELAYED IN ANTICIPATION OF FINDING OTHER RESPONSIBLE PARTIES. UPON FINALIZATION OF THE RESPONSIBLE PARTY SEARCH, THE EPA INTENDS TO FORMALLY NOTIFY RESPONSIBLE PARTIES WHICH MAY HAVE BEEN IDENTIFIED OF THE REMEDY SELECTED IN THIS ROD AND INITIATE NEGOTIATIONS FOR EITHER THE IMPLEMENTATION OF THE REMEDY OR RECOVERY OF THE EPA'S RESPONSE COSTS. NEGOTIATIONS WILL NOT EXCEED SIXTY DAYS. THEREAFTER, IF THE RESPONSIBLE PARTIES DO NOT FORMALLY COMMIT TO PERFORMING THE REMEDY IN A TIMELY MANNER, THE EPA WILL PROCEED WITH A FUND-FINANCED REMEDIAL DESIGN AND REMEDIAL ACTION.

A ROD ADDRESSING OPERABLE UNIT 4 WAS COMPLETED IN SEPTEMBER 1986.

OU 6:

THE DENVER RADIUM SITE, LOCATED IN DENVER, COLORADO, (POPULATION 509,000) CONSISTS OF MORE THAN 40 CONTAMINATED PROPERTIES. THESE PROPERTIES HAVE BEEN GROUPED INTO OPERABLE UNITS. OPERABLE UNIT VI IS COMPRISED OF T HE FOLLOWING PROPERTIES:
- ALLIED CHEMICAL AND DYE CORPORATION
- BRANNAN SAND AND GRAVEL
- COLORADO AND SOUTHERN RAILROAD
- DENVER WATER DEPARTMENT
- PUBLIC SERVICE COMPANY
- RUBY HILL PARK
- ALLEY BETWEEN MARIPOSA AND LIPAN STREETS

OPERABLE UNIT IX INCLUDES THE INTERNATIONAL HOUSE OF PANCAKES (IHOP) AND LARRY'S TRADING POST AND EAST SIDE AMUSEMENT CENTER (LARRY'S). LARRY'S IS A CONTIGUOUS PROPERTY SOMETIMES REFERRED TO AS CONTIGUOUS PROPERTY NO. 8 (CP NO. 8). OPERABLE UNIT XI CONSISTS OF THE THOMAS REAL ESTATE COMPANY (THOMAS REALTY) PROPERTY. THESE PROPERTIES ARE KNOWN COLLECTIVELY AS THE OPEN SPACE PROPERTIES.

SINCE THE RI WAS INITIATED, OWNERSHIP OF SEVERAL OF THE PROPERTIES HAS CHANGED. THE ALLIED CHEMICAL AND DYE CORPORATION PROPERTY IS CURRENTLY OWNED BY GENERAL CHEMICAL, THE COLORADO AND SOUTHERN RAILROAD PROPERTY IS PRESENTLY OWNED BY BURLINGTON NORTHERN RAILROAD, AND THE THOMAS REALTY PROPERTY IS NOW OWNED BY COMMERCIAL INVESTORS REALTY. FOR THE PURPOSE OF THIS RECORD OF DECISION, HOWEVER, THE ORIGINAL NAMES WILL BE USED.

THE ALLIED CHEMICAL AND DYE COMPANY (ALLIED) PROPERTY COVERS AN AREA OF 21.5 ACRES AND IS LOCATED AT 1271 WEST BAYAUD AVENUE. THE PROPERTY IS BOUND ON THE NORTHEAST BY THE SOUTH PLATTE RIVER, ON THE SOUTHWEST BY A RAILROAD, AND ON THE SOUTH BY WEST BAYAUD AVENUE. THE NORTH END OF THE PROPERTY IS LEASED TO DENVER WOOD PRODUCTS. THE ALLIED PROPERTY IS PRIMARILY OPEN LAND WITH OCCASIONAL TREES, ROADWAYS, RAILROAD TRACKS, AND PAVED AREAS. THERE ARE APPROXIMATELY TEN STRUCTURES ONSITE AND CURRENTLY NINE EMPLOYEES WORKING 40 HOURS PER WEEK ON THE PROPERTY. THERE ARE NO BURIED MUNICIPAL

UTILITIES IN CONTAMINATED AREAS OF THE SITE, ALTHOUGH 13 KILOVOLT OVERHEAD LINES ARE PRESENT ALONG THE NORTHERN AND NORTHWESTERN PERIMETERS OF THE PROPERTY. THE PROPERTY IS ZONED 1-1 FOR INDUSTRIAL USE.

THE BRANNAN SAND AND GRAVEL (BRANNAN) PROPERTY IS A 47.5-ACRE PARCEL THAT LIES BETWEEN CLEAR CREEK AND 61ST AVENUE ABOUT 300 FEET EAST OF FEDER AL BOULEVARD. THE PROPERTY CONTAINS APPROXIMATELY 10 ACRES OF OPEN LAND WHICH BECAME A MUNICIPAL DUMP IN THE EARLY 1960'S. WHEN THE DUMP WAS CLOSED IN 1982, IT CONTAINED 10 TO 15 FEET OF REFUSE AND WAS BEING COVERED WITH CONSTRUCTION DEBRIS. THE BRANNAN PROPERTY IS CURRENTLY ZONED 1-1 FOR INDUSTRIAL USE. THERE ARE NO BURIED MUNICIPAL UTILITIES ON THE PROPERTY.

THE COLORADO AND SOUTHERN RAILROAD (CSRR) PROPERTY IS BOUND TO THE NORTHEAST AND SOUTHWEST BY 16TH STREET AND 15TH STREET, RESPECTIVELY, BY PLATTE RIVER DRIVE TO THE NORTHWEST, AND BY THE SOUTH PLATTE RIVER TO THE SOUTHEAST. A BURIED CONCRETE CONDUIT PARALLELS THE CSRR RIGHT-OF-WAY AND IS APPROXIMATELY 50 FEET FROM THE RIVER BANK. NO OTHER BURIED MUNICIPAL UTILITIES HAVE BEEN IDENTIFIED ON THE PROPERTY. THE RAILROAD TRACKS ON THE PROPERTY ARE NOT CURRENTLY IN USE, ALTHOUGH BOTH THE TRACKS AND THE RIGHT-OF-WAY ARE MAINTAINED. THE CSRR PROPERTY IS ZONED 1-1 FOR INDUSTRIAL USE.

THE DENVER WATER DEPARTMENT (DWD) OWNS A 0.1-ACRE LOT NEAR THE CORNER OF YUMA COURT AND 12TH AVENUE. THIS LOT IS PAVED AND IS PRESENTLY USED AS A PARKING LOT FOR NEIGHBORING BUSINESSES. THE EAST END OF THE LOT IS BORDERED BY A PAVED ALLEY AND THE WEST END BY YUMA STREET. A 54-INCH CONCRETE WATER MAIN TENDING ROUGHLY EAST-WEST BISECTS THE LOT. THE LOT IS CURRENTLY ZONED 1-1 FOR INDUSTRIAL USE.

THE PUBLIC SERVICE COMPANY OF COLORADO (PSCO) OWNS A VACANT LOT ADJACENT TO ITS SOUTH SUBSTATION AT SOUTH PECOS STREET AND WEST ARIZONA AVENUE. A RESIDENTIAL AREA LIES TO THE WEST OF THE LOT ON SOUTH PECOS STREET. SURFACE DRAINAGE ON THE PROPERTY RUNS FROM TOPOGRAPHIC HIGHS ALONG THE NORTH AND SOUTH BOUNDARIES TOWARDS THE CENTER OF THE LOT WHERE A LARGE EAST-WEST TENDING GULLY IS LOCATED. THE PROPERTY IS ZONED 1-1 FOR INDUSTRIAL USE AND SEVERAL FOUR-INCH WATER MAINS ARE BURIED ON THE PROPERTY. SEVERAL OVERHEAD 13 KILOVOLT TRANSMISSION LINES CROSS THE WESTERN PORTION OF THE PROPERTY.

RUBY HILL PARK IS AN ACTIVE CITY PARK BOUND BY WEST JEWEL L AVENUE, SOUTH PECOS STREET, WEST FLORIDA AVENUE, AND SOUTH PLATTE RIVER DRIVE. THE PARK COVERS AN AREA OF APPROXIMATELY 90 ACRES AND IS BORDERED BY A RESIDENTIAL AREA ON THE SOUTH PECOS STREET SIDE. THE PARK IS CHARACTERIZED BY ROLLING, OPEN TERRAIN WITH THE ONLY SIGNIFICANT STRUCTURE BEING A ONE-STORY MAINTENANCE BUILDING. THERE ARE FOUR BASEBALL FIELDS ON THE PROPERTY AS WELL AS A NETWORK OF PAVED ROADWAYS AND PARKING AREAS. THERE ARE NO BURIED UTILITY LINES IN THE PARK.

THE ALLEY BETWEEN MARIPOSA AND LIPAN STREETS EXTENDS FROM 5TH AVENUE TO 6TH AVENUE AND UNDERNEATH THE 6TH AVENUE OVERPASS. A METAL SCRAP STORAGE YARD LIES TO THE EAST OF THE ALLEY, WHILE AN AUTOMOBILE SALVAGE OPERATION AND A STOVE PRODUCTS COMPANY ARE SITUATED TO THE WEST. A ONE-STORY BRICK APARTMENT BUILDING IS LOCATED AT THE NORTHEAST CORNER OF THE INTERSECTION OF THE ALLEY AND THE 6TH AVENUE RIGHT-OF-WAY. THE APARTMENTS ARE UNOCCUPIED EXCEPT FOR ONE UNIT. THERE ARE BURIED MUNICIPAL UTILITIES IN THE ALLEY.

THE IHOP PROPERTY IS LOCATED AT 2001 EAST COIFAX AVENUE. THE SITE COVERS 0.38 ACRE AND CONSISTS OF A RESTAURANT AND A PAVED PARKING LOT. THE PROPERTY IS BOUND ON THE SOUTH BY EAST COIFAX AVENUE, ON THE NORTH BY RESIDENCES, ON THE WEST BY RACE STREET, AND ON THE EAST BY LARRY'S. THE IHOP RESTAURANT IS A TWO-STORY BUILDING THAT OPERATES 24 HOURS A DAY. THE RESTAURANT EMPLOYS APPROXIMATELY 15 PEOPLE WHO ARE DIVIDED INTO THREE WORK SHIFTS. BURIED WATER LINES ARE PRESENT ON THE IHOP PROPERTY AND THE PROPERTY IS ZONED B-4 FOR GENERAL BUSINESS USE. LARRY'S, WHICH SHARES A DRIVEWAY AND PARKING LOT WITH IHOP, IS A SINGLE-STORY STRUCTURE WHICH HOUSES AN ARCADE, POOL HALL, SNACK BAR, AND A USED CLOTHING STORE. THE NUMBER OF OCCUPANTS OF THIS BUILDING VARIES.

THE THOMAS REALTY PROPERTY IS A TRIANGULAR SHAPED, 1.25-ACRE LOT LOCATED AT 1285-1295 SOUTH SANTA FE DRIVE. THE PROPERTY IS BORDERED BY SOUTH PLATTE RIVER DRIVE ON THE NORTHWEST, BY SOUTH SANTA FE DRIVE ON THE EAST, AND BY DESKS, INC., A C OMMERCIAL ESTABLISHMENT ON THE SOUTH. A TWO-STORY, BUILDING IS SITUATED ON THE SOUTHERN PORTION OF THE THOMAS PROPERTY. THE BUILDING IS CURRENTLY OCCUPIED BY 13 PEOPLE FOR 40 HOURS PER WEEK. A BILLBOARD IS LOCATED ON THE NORTHERN END OF THE PROPERTY. APPROXIMATELY 30, 30-GALLON DRUMS, FILLED WITH RADIUM-CONTAMINATED SOIL EXCAVATED FROM THE PROPERTY BY THE PREVIOUS OWNER, ARE STORED BENEATH THE BILLBOARD. NATURAL GAS AND WATER LINES ARE BURIED ON THE PROPERTY.

THE MAJORITY OF THE OPEN SPACE PROPERTIES ARE UNDERLAIN BY ALLUVIUM AND THE DENVER FORMATION SANDSTONE. THE APPROXIMATE DEPTH TO GROUND WATER RANGES FROM FIVE FEET AT THE DWD PROPERTY TO 75 FEET AT RUBY HILL PARK. THREE OF THE PROPERTIES, ALLIED, BRANNAN, AND DWD, LIE WITHIN THE DESIGNATED 100-YEAR FLOOD PLAIN. THE CLIMATE OF THE DENVER AREA IS TYPIFIED BY LOW ANNUAL PRECIPITATION AVERAGING ABOUT 14 INCHES PER YEAR.

A RECORD OF DECISION ADDRESSING OPERABLE UNITS VI, IX, AND XI  OF THE DENVER RADIUM SITE WAS COMPLETED IN SEPTEMBER 1987.

OU 7

STREET SEGMENTS IN OPERABLE UNIT VII (OU7) CONTAIN A 4 TO 6 INCH LAYER OF RADIUM-CONTAMINATED ASPHALT. THIS CONTAMINATED LAYER IS UNDERLAIN BY COMPACTED GRAVEL ROAD BASE MATERIAL AND IS USUALLY OVERLAIN BY 4 TO 12 INCHES OF UNCONTAMINATED ASPHALT PAVEMENT. ESTIMATES INDICATE THAT OPERABLE UNIT VII - STREETS CONTAIN APPROXIMATELY 38,500 CUBIC YARDS OF RADIUM-CONTAMINATED MATERIAL COVERING SOME 832,000 SQUARE FEET. RADIUM CONTAMINATION DOES NOT EXTEND BEYOND THE PAVED RIGHT-OF-WAY OF THE STREETS AND DOES NOT APPEAR TO HAVE MIGRATED INTO THE SOILS BELOW THE CONTAMINATED ASPHALT.

THE ROD SIGNED IN MARCH 1986, CALLED FOR RADIUM-CONTAMINATED MATERIAL IN THE STREETS TO BE LEFT IN PLACE WITH THE EXCEPTION OF MATERIAL EXCAVATED DURING ROUTINE MAINTENANCE, REPAIR OR OTHER CONSTRUCTION ACTIVITIES. SUCH MATERIAL WAS TO BE REMOVED TO AN OFFSITE REPOSITORY APPROVED FOR STORAGE OR DISPOSAL OF RADIUM-CONTAMINATED MATERIAL.

AN EXPLANATION OF SIGNIFICANT DIFFERENCES ADDRESSI NG OU7 AT THE DENVER RADIUM SITE WAS COMPLETED IN SEPTEMBER 1992.

OU 8:

THE SHATTUCK CHEMICAL SITE, OPERABLE UNIT (OU) 8 OF THE DENVER RADIUM SUPERFUND SITE, IS LOCATED APPROXIMATELY 6 MILES SOUTHWEST OF DOWNTOWN DENVER, COLORADO. THE PROPERTY WAS THE LOCATION OF THE S.W. SHATTUCK CHEMICAL COMPANY, INC., WHICH PROCESSED A VARIETY OF RADIOACTIVE MATERIALS FROM 1917 TO 1984. MINERAL ORES PROCESSED INCLUDED TUNGSTEN AND CARNOTITE ORES, RADIUM SLIMES, MOLYBDENUM ORES AND DEPLETED URANIUM. A SUMMARY OF THE PROCESSING HISTORY IS PROVIDED BELOW.
- 1920'S - MOLYBDENUM ORE PROCESSING
- 1930'S - RADIUM SLIME PROCESSING
- 1940'S - URANIUM AND MOLYBDENUM PROCESSING
- 1950'S - URANIUM PROCESSING
- 1960'S - MOLYBDENUM PROCESSING
- 1970'S AND 1980'S - URANIUM, MOLYBDENUM, AND RHENIUM PROCESSING

MANY OF THE PROCESSED ORE RESIDUES REMAINED ON-SITE AND BECAME INTERMIXED WITH SITE SOILS.

ADDITIONALLY, A DETENTION POND TO HOLD MOLYBDENUM SLIME WASTES WAS LOCATED AT THE NORTHERN END OF THE PROPERTY. PROCESSING OPERATIONS RESULTED IN CONTAMINATION OF THE SITE WITH RADIOACTIVE ELEMENTS, INCLUDING RADIUM (RA) -226, THORIUM (TH) -230, VARIOUS URANIUM ISOTOPES, AND NON-RADIOACTIVE METALS SUCH AS LEAD, ARSENIC, AND SELENIUM. THE PROPERTY IS ZONED FOR MIXED RESIDENTIAL, COMMERCIAL, AND LIGHT INDUSTRIAL USE. RESIDENTIAL AREAS ARE LOCATED ONE BLOCK SOUTH, ONE BLOCK EAST, AND APPROXIMATELY 1/2 MILE TO THE WEST. THE SITE IS DIRECTLY EAST OF AN ACTIVE BURLINGTON NORTHERN SANTA FE (BNSF) RAIL SPUR AND RTD MASS TRANSIT RAIL LINES. THE TOPOGRAPHY OF THE SURROUNDING AREA IS RELATIVELY FLAT. THE AREA GENERALLY SLOPES TOWARD THE NORTH AND WEST. THE SITE IS LOCATED WITHIN THE DRAINAGE BASIN OF THE SOUTH PLATTE RIVER, WHICH IS LOCATED APPROXIMATELY 3000 FEET TO THE WEST. A SHALLOW UNCONFINED AQUIFER EXISTS BELOW THE SITE, PERCHED ON BEDROCK, AND MERGES WITH THE ALLUVIAL AQUIFER BENEATH THE FLOODPLAIN OF THE SOUTH PLATTE RIVER. GROUNDWATER IN THE AREA IS NOT USED AS A DRINKING WATER SOURCE.

IN 1988, THE STATE CONDUCTED A REMEDIAL INVESTIGATION (RI) AT SHATTUCK. FURTHER STUDY OF THE SITE WAS COMPLETED IN 1991. THOSE STUDIES FOUND THAT RADIOLOGICAL CONTAMINATION WAS PRESENT IN SITE SOILS OVER AN AREA OF APPROXIMATELY 230,000 SQUARE FEET. THE CONTAMINATION WAS FOUND TO EXTEND FROM GROUND SURFACE TO DEPTHS OVER 14.5 FEET (FT) BELOW THE SURFACE. ESTIMATED VOLUME OF CONTAMINATED SOIL AT THE SITE WAS 38,500 CUBIC YARDS. BASED ON THOSE INVESTIGATIONS, A REMEDY WAS SELECTED IN A RECORD OF DECISION (ROD) IN JANUARY 1992. THIS REMEDY STIPULATED THAT ALL BUILDINGS AND FACILITIES BE DEMOLISHED AND DISPOSED OF OFF-SITE. ADDITIONALLY, CONTAMINATED SOILS WERE TO BE STABILIZED AND SOLIDIFIED ON-SITE. INSTITUTIONAL CONTROLS (ICS), MAINTENANCE, AND MONITORING WERE ALSO USED TO SUPPLEMENT THE REMEDY. THE REMEDY WAS LARGELY COMPLETED IN SEPTEMBER 1998 AND CREATED A ROLLER COMPACTED CEMENT/SOIL MONOLITH OF APPROXIMATELY 5 ACRES. GROUNDWATER CONTAMINATION PRESENT BENEATH THE SITE WAS TO BE ADDRESSED BY NATURAL ATTENUATION.

IN DECEMBER 1983, EPA BEGAN A REMEDIAL INVESTIGATION TO DETERMINE THE NATURE AND EXTENT OF THE CONTAMINATION PRESENT ON THOSE PROPERTIES WHICH THE STATE DID NOT PREVIOUSLY STUDY, AS WELL AS SEVERAL ADDITIONAL PROPERTIES WHERE CONTAMINATION WAS SUSPECTED. WITH THE ADDITIONAL PROPERTIES, THE DENVER RADIUM SITE INCLUDED MORE THAN FORTY PROPERTIES.

BECAUSE OF THE COMPLEXITY OF THE DENVER RADIUM SITE, RESPONSE ACTIONS WERE DIVIDED INTO OPERABLE UNITS BASED PRIMARILY UPON SITE CONDITIONS AND LOCATION. THE SITE WAS GROUPED INTO ELEVEN OPERABLE UNITS; THE PROPERTY LOCATED AT 1805 SOUTH BANNOCK STREET BEING OPERABLE UNIT VIII. IN APRIL 1986, EPA PUBLISHED THE DENVER RADIUM SITE REMEDIAL INVESTIGATION (RI) REPORT WHICH ADDRESSED ALL ELEVEN OPERABLE UNITS.

PRIOR TO PROCEEDING WITH THE CLEANUP OF OPERABLE UNIT VIII, THE EPA NOTIFIED POTENTIALLY RESPONSIBLE PARTIES (PRPS) OF THE OPPORTUNITY TO PERFORM A MORE DETAILED REMEDIAL INVESTIGATION AND FEASIBILITY ST UDY. ALTHOUGH NEGOTIATIONS TOOK PLACE WITH THE S.W. SHATTUCK CHEMICAL COMPANY, INC., NO POTENTIALLY RESPONSIBLE PARTIES ELECTED TO PERFORM THE STUDIES. UNDER A COOPERATIVE AGREEMENT WITH THE EPA, CDPHE PERFORMED THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY WHICH SUPPORTED THE ORIGINAL ROD.

CDPHE BEGAN THE REMEDIAL INVESTIGATION IN NOVEMBER 1988. SINCE 1979, CDPHE, EPA, AND SHATTUCK HAVE CONDUCTED VARIOUS STUDIES OF THE SITE MEDIA, WHICH HAVE INCLUDED A SUBSTANTIAL NUMBER OF SOIL AND GROUNDWATER SAMPLES. THE REMEDIAL INVESTIGATION STUDIES EVALUATED THE EXISTING DATA AND INCLUDED COLLECTION OF ADDITIONAL DATA TO CHARACTERIZE THE NATURE AND EXTENT OF THE CONTAMINATION.

THE S.W. SHATTUCK CHEMICAL COMPANY WAS INVITED TO ENTER INTO A CONSENT DECREE WITH THE UNITED STATES TO CONDUCT THE RESPONSE ACTION AND TO REIMBURSE EPA FOR ITS OVERSIGHT COSTS. NEGOTIATIONS WITH SHATTUCK WERE UNSUCCESSFUL, AND A UNILATERAL ADMINISTRATIVE ORDER WAS ISSUED TO THE COMPANY EFFECTIVE AUGUST 31, 1992. LATER, THE UNITED STATES AND SHATTUCK ENTERED INTO A CONSENT DECREE ON JANUARY 22, 1996, UNDER WHICH THE COMPANY REIMBURSED EPA FOR ITS RESPONSE COSTS THROUGH MARCH 31, 1995.

THE SHATTUCK PROPERTY HAS BEEN THE LOCATION OF SEVERAL MINERAL-PROCESSING OPERATIONS, INCLUDING THE PROCESSING OF TUNGSTEN ORES, CARNOTITE ORES (FOR URANIUM AND VANADIUM), RADIUM SLIMES, MOLYBDENUM ORES, AND DEPLETED URANIUM.

THE DENVER RADIUM SITE (SITE) CONSISTS OF MORE THAN 40 PROPERTIES GROUPED INTO 11 OPERABLE UNITS. THE RECORD OF DECISIONS (RODS) FOR THE OTHER OPERABLE UNITS ADDRESSING RADIOLOGIC CONTAMINATION IDENTIFIED EXCAVATION AND PERMANENT OFFSITE DISPOSAL AS THE PRINCIPAL REMEDY IN EACH CASE, EXCEPT OPERABLE UNIT (OU) VII. OPERABLE UNIT VII INCLUDES SECTIONS OF NINE DENVER STREETS WHERE CONTAMINATED MATERIALS WERE LEFT IN PLACE BASED ON THE LIMITED THREAT THEY POSE TO PUBLIC HEALTH AND THE ENVIRONMENT. THE RODS INCORPORATED VARIOUS COMBINATIONS OF CONSOLIDATION AND TEMPORARY STORAGE UNITS UNTIL A PERMANENT OFFSITE REPOSITORY WOULD BE AVAILABLE. REMEDIAL ACTION AT THESE OPERABLE UNITS HAS NOW BEEN COMPLETED AND SITE-SPECIFIC SUPPLEMENTAL STANDARDS HAVE BEEN DEVELOPED AT SOME OF THESE OPERABLE UNITS WHERE HAZARDOUS SUBSTANCES, POLLUTANTS, OR CONTAMINANTS COULD NOT BE REMOVED WITHOUT UNACCEPTABLE DISTURBANCE TO BURIED INFRASTRUCTURE OR EXISTING BUILDINGS. IN THESE CASES, RADIOACTIVE MATERIALS WERE LEFT BURIED IN SOILS ABOVE LEVELS THAT ALLOW UNLIMITED USE AND UNRESTRICTED EXPOSURE.

A ROD AMENDMENT FOR OPERABLE UNIT 8 OF THE DENVER RADIUM SITE WAS COMPLETED IN JUNE 2000.

THE AMENDED ROD STIPULATED THAT THE MONOLITH MATERIAL BE REMOVED FROM THE SITE ALONG WITH ANY ADDITIONALLY IDENTIFIED CONTAMINANTS IN EXCESS OF CLEANUP LEVELS SPECIFIED IN THE AMENDED ROD.

SINCE WASTE MATERIAL WAS LEFT ON SITE, CERCLA REQUIRES THAT FIVE-YEAR REVIEWS BE CONDUCTED TO DETERMINE WHETHER THE REMEDY REMAINS PROTECTIVE. A FIVE-YEAR REVIEW CONDUCTED IN 1999 IDENTIFIED A NUMBER OF CONCERNS RELATING TO THE LONG-TERM PROTECTIVENESS OF THE MONOLITH AND THE RELIABILITY OF ICS IMPOSED IN THE ORIGINAL ROD. ADDITIONALLY, THE STATE OF COLORADO, THE CITY AND COUNTY OF DENVER, STAKEHOLDERS, AND THE LOCAL COMMUNITY REQUESTED OTHER ALTERNATIVES TO THE EXISTING REMEDY BE CONSIDERED. THE COMBINATION OF TECHNICAL CONCERNS, REQUESTS TO RECONSIDER THE REMEDY, AND PRESSURE FROM THE SURROUNDING COMMUNITY RESULTED IN THE DECISION TO AMEND THE ORIGINAL ROD.

THE ORIGINAL ROD WAS SIGNED IN JANUARY 1992 AND SELECTED ON-SITE STABILIZATION AND SOLIDIFICATION AS THE REMEDY FOR SOILS AND NATURAL ATTENUATION WITH MONITORING FOR GROUNDWATER. ALSO, ALL BUILDINGS AND FACILITIES ON THE PROPERTY WERE TO BE DEMOLISHED AND DISPOSED OF OFF-SITE. INSTITUTIONAL CONTROLS, MAINTENANCE, AND MONITORING WERE ALSO USED TO SUPPLEMENT THE REMEDY. THE ORIGINAL REMEDIAL ACTION WAS LARGELY COMPLETED IN SEPTEMBER 1998 WITH THE CREATION OF A CEMENT/SOIL MONOLITH ON THE SITE OF APPROXIMATELY 5 ACRES. IN NOVEMBER 1999, EPA C OMPLETED A 5-YEAR REVIEW OF THE REMEDY AND IDENTIFIED CONCERNS RELATED TO THE LONG-TERM EFFECTIVENESS OF THE MONOLITH AND THE RELIABILITY OF THE IC'S IMPOSED IN THE ORIGINAL ROD. ADDITIONALLY, THE STATE, CITY AND COUNTY OF DENVER, STAKEHOLDERS, AND THE LOCAL COMMUNITY REQUESTED OTHER ALTERNATIVES TO THE ON-SITE CONTAINMENT REMEDY. THE COMBINATION OF TECHNICAL CONCERNS, REQUESTS TO RECONSIDER THE ORIGINAL REMEDY, AND THE STATE'S WITHDRAWAL OF SUPPORT RESULTED IN THE EPA AMENDING THE ORIGINAL ROD. THE AMENDED ROD WAS SIGNED ON JUNE 16, 2000 AND EPA SELECTED OFF-SITE REMOVAL TO BEST MEET SUPERFUND'S EVALUATION CRITERIA. THE AMENDED ROD STIPULATED THAT THE MONOLITH AT OU 8 BE REMOVED FROM THE SITE ALONG WITH ANY ADDITIONAL IDENTIFIED CONTAMINANTS IN EXCESS OF CLEANUP LEVELS SPECIFIED IN THE AMENDED ROD.

AS OF SEPTEMBER 2006, THE REMEDY SELECTED IN THE AMENDED ROD HAD BEEN COMPLETED AND ALL WASTE MATERIAL HAD BEEN REMOVED FROM THE PROPERTY. IN FEBRUARY OF 2007 THE PROPERTY BECAME READY FOR REUSE. A SALE IS PENDING WITH A LAND DEVELOPER WHO INTENDS TO DEVELOP THE PROPERTY FOR MIXED RESIDENTIAL AND LIGHT COMMERCIAL USE. THERE ARE CURRENTLY NO RESTRICTIONS ON USE OR INSTITUTIONAL CONTROLS, OTHER THAN GROUNDWATER, FOR THE PROPERTY. THE STATE OF COLORADO HAS ASSUMED THE RESPONSIBILITY FOR THE LONG-TERM OPERATIONS AND MAINTENANCE (O&M), INCLUDING THE REQUIRED QUARTERLY

GROUNDWATER MONITORING. THE GROUNDWATER SURVEY WORK FOR THE PLUME LEAVING THE SITE HAS BEEN STARTED BY THE STATE, WITH ONE ROUND OF GROUNDWATER MONITORING COMPLETED. THE STATE WILL COMPLETE THREE ADDITIONAL ROUNDS OF SAMPLING TO ESTABLISH A BASELINE FOR THE PLUME.

THE FACILITIES LOCATED ON THE SHATTUCK PROPERTY INCLUDE: SIX PERMANENT BUILDINGS; MISCELLANEOUS STORAGE SHEDS; UNDERGROUND STORAGE FACILITIES; ABOVE GROUND STORAGE TANKS; PROCESS EQUIPMENT AND PIPING; AND ASPHALT AND CONCRETE PAVING. SURFACE WATER ON THE SITE GENERALLY FOLLOWS THE TOPOGRAPHY TOWARD THE NORTHWEST. A RUNOFF CATCHMENT BASIN, WHICH C APTURES A LIMITED AMOUNT OF SURFACE RUNOFF, IS LOCATED ON THE SHATTUCK PROPERTY SOUTH OF BUILDING 6. THE RAIL LINES ARE ELEVATED ABOVE THE SURROUNDING GRADE, IMPEDING THE FLOW OF SURFACE RUNOFF, AND CREATING SOME PONDING DURING RAINFALL.

AN EXPLANATION OF SIGNIFICANT DIFFERENCES ADDRESSING OU 8 WAS COMPLETED IN MARCH 2007.

OPERABLE UNIT (OU) 9 OF THE DENVER RADIUM SITE IS LOCATED IN THE SOUTH-CENTRAL PART OF DENVER, COLORADO AT 500 SOUTH SANTA FE DRIVE, NEAR THE INTERSECTION OF WEST ALAMEDA AVENUE AND INTERSTATE 25. THE 17 ACRE OU, REFERRED TO IN THIS DOCUMENT AS THE "SITE", CONSISTS OF THE ROBINSON BRICK COMPANY (ROBCO) PROPERTY. IT IS BOUNDED ON THE WEST BY A FRONTAGE ROAD ADJACENT TO INTERSTATE 25, ON THE EAST BY THE MAIN NORTH/SOUTH RAIL CORRIDOR OWNED BY THE DENVER & RIO GRANDE WESTERN RAILROAD, AND ON THE SOUTH BY THE U.S. WELDING COMPANY PROPERTY. TO THE NORTHWEST IS A VACANT REGIONAL TRANSPORTATION DISTRICT (RTD) FACILITY.

THE ABANDONED BRICK PLANT AND A FEW SMALL STRUCTURES ARE PRESENTLY STANDING AT THE SITE. AN ASPHALT PARKING LOT IS LOCATED ADJACENT TO THE BRICK PLANT. HOWEVER, THE SITE IS MOSTLY UNDEVELOPED. COMMERCIAL AND INDUSTRIAL LAND USES DOMINATE THE AREA SURROUNDING THE SITE. THE NEAREST RESIDENTIAL POPULATION IS LOCATED SEVERAL BLOCKS EAST OF THE SITE.

THE SITE SLOPES GENTLY TO THE WEST TOWARD THE SOUTH PLATTE RIVER WHICH IS ABOUT 1000 FEET FROM THE ROBINSON BRICK COMPANY PROPERTY BOUNDARY. THE SITE DOES NOT LIE WITHIN A FLOOD PLAIN. GROUND WATER AT THE SITE IS FOUND IN THE ALLUVIUM AT DEPTHS OF 10 TO 20 FEET BELOW GROUND SURFACE. THERE IS NO CURRENT USE OF GROUND WATER AT THE SITE.

INDUSTRIAL ACTIVITY AT THE SITE BEGAN IN 1886 WITH THE CONSTRUCTION OF THE BAILEY SMELTER. THE BAILEY SMELTER APPEARS TO HAVE OPERATED ONLY SPORADICALLY IN THE LATE 1880'S. IN 1890, THE GOLD & SILVER EXTRACTION COMPANY BEGAN A CYANIDE LEACHING OPERATIONS A SITE USING THE MCARTHUR FORREST, CHEMICAL CYANIDE PROCESS. IN 1901, THE BAILEY SMELTER BURNED DO WN. BY 1903, THE COLORADO ZINC COMPANY HAD CONSTRUCTED A MILL ON THE SITE OF THE OLD BAILEY SMELTER. ZINC MILLING OPERATIONS CONTINUED UNTIL ABOUT 1910. FROM 1914 TO 1917, THE U.S. BUREAU OF MINES OPERATED A RADIUM PROCESSING FACILITY (THE NATIONAL RADIUM INSTITUTE) ON SITE. OTHER INDUSTRIAL ACTIVITIES AT THE SITE HAVE INCLUDED MINERALS RECOVERY, MANUFACTURING AND SERVICING OF STORAGE BATTERIES, TREATING AND SACKING OF METALLIC ORE INSULATION, OIL RECLAMATION, AND LAND FILLING. IN 1941, THE ROBINSON BRICK COMPANY ACQUIRED 13.5 ACRES OF THE SITE AND IN 1951 ACQUIRED AN ADDITIONAL 3.5 CONTIGUOUS ACRES AND MANUFACTURED BRICKS ON THE SITE UNTIL 1980. THE ROBINSON BRICK COMPANY IS THE PRESENT OWNER OF THE SITE.

IN 1979, RESEARCH BY EPA LED TO THE REDISCOVERY OF THE FORMER NATIONAL RADIUM INSTITUTE (NRI). BY 1983, THIRTY PROPERTIES, INCLUDING THE ROBCO PROPERTY, WERE FOUND TO HAVE RADIOLOGIC CONTAMINANTS IN THE SOILS AND WERE PLACED ON THE NATIONAL PRIORITIES LIST FOR SUPERFUND CLEANUP. DUE TO THEIR ASSOCIATION WITH THE NRI, THE U.S. BUREAU OF MINES WAS NAMED AS A RESPONSIBLE PARTY FOR THE RADIOLOGIC CONTAMINATION AT OU 9 AND THE BUREAU HAS AGREED, PURSUANT TO A MEMORANDUM OF UNDERSTANDING, TO PAY FOR THE RADIOLOGIC CLEAN UP AT THE SITE. IN MAY 1988, EXCAVATION OF THE RADIOLOGICALLY CONTAMINATED SOILS AT OU 9 BEGAN. IN SEPTEMBER OF THAT YEAR, DURING THE COURSE OF THE RADIUM CLEANUP, METALS CONTAMINATION WAS DISCOVERED ON SITE. AN INVESTIGATION TO CHARACTERIZE THE NATURE AND EXTENT OF

METALS CONTAMINATION WAS CONDUCTED IN 1989 AND 1990. THE INVESTIGATION RESULTED IN A FEASIBILITY STUDY (JULY 1991) OUTLINING A NUMBER OF ALTERNATIVES FOR THE CLEANUP OF APPROXIMATELY 16,540 CUBIC YARDS OF METALS-CONTAMINATED SOILS REMAINING IN PLACE ON THE SITE. THE EXCAVATION OF THE RADIOLOGICALLY CONTAMINATED MATERIALS WAS COMPLETED IN MARCH 1991 AS PART OF OPERABLE UNITS 4 AND 5.

A RECORD OF DECISION (ROD) FOR DENVER RADIUM SITE ADDRESSES SOIL, AS OPERABLE UNIT (OU) 09. THE SITE WAS PLACED ON THE NATIONAL PRIORITIES LIST (NPL) IN 1983 AND A RECORD OF DECISION (ROD) WAS SIGNED IN JANUARY 1992.

OU10:

THIS OPERABLE UNIT OF THE DENVER RADIUM SITE ADDRESSES THE CONTAMINATION PRESENT ON THE CARD CORPORATION PROPERTY ("CARD PROPERTY"). THE HAZARDOUS SUBSTANCES OF PRIMARY CONCERN THAT HAVE BEEN RELEASED AND CONTINUE TO POSE A SIGNIFICANT THREAT OF BEING RELEASED INTO THE ENVIRONMENT ARE RADIUM AND ITS ASSOCIATED DECAY PRODUCTS.

THE EPA IS UNDERTAKING ADDITIONAL FEASIBILITY STUDIES TO EVALUATE REMEDIAL ACTION ALTERNATIVES AT THE OTHER DENVER RADIUM SITE OPERABLE UNITS AND WILL COMPLETE A RECORD OF DECISION OR AN ACTION MEMORANDUM FOR EACH OF THE OPERABLE UNITS FOR WHICH A REMEDY HAS NOT ALREADY BEEN SELECTED.

THE CARD CORPORATION PROPERTY ("CARD PROPERTY") IS A 17.2-ACRE SITE LOCATED AT 1314 WEST EVANS AVENUE. THE SITE IS IN AN AREA OF DENVER ZONED I-2 FOR INDUSTRIAL USE. ITS OWNERSHIP IS CURRENTLY DIVIDED BETWEEN MENTOR CORPORATION, WHICH OWNS 13.7 ACRES, AND CONSOLIDATED FREIGHTWAYS, WHICH OWNS THE REST. MENTOR RENTS ITS PORTION OF THE SITE TO VARIOUS LIGHT MANUFACTURING AND WAREHOUSING COMPANIES. CONSOLIDATED FREIGHTWAYS OPERATES A TRUCKING TERMINAL ON THE SOUTHERN END OF THE PROPERTY. THERE ARE CURRENTLY FIVE BUILDINGS ON THE CARD PROPERTY THE BRICK COMMERCIAL BUILDING, THE OFFICE BUILDING, THE UPL BUILDING, THE TRUE TRUSS BUILDING, AND THE CONSOLIDATED FREIGHTWAYS FACILITY. THERE IS A SMALL OIL AND WASTE WATER POND ON THE EASTERN SIDE OF THE PROPERTY. THE PROPERTY IS CROSSED BY SEVERAL CURRENTLY UNUSED RAIL SPURS.

THE SITE IS BOUNDED ON THE NORTH AND EAST BY COMMERCIAL OFFICES AND SOME LIGHT MANUFACTURING AND STORAGE BUILDINGS. TO THE WEST IS THE COLORADO AND SOUTHERN RAILROAD PROPERTY, AND TO THE SOUTH IS WEST WESLEY AVENUE AND THE ARAPAHOE GENERATING STATION OF THE PUBLIC SERVICE COMPANY OF COLORADO. THE NEAREST RESIDENCES ARE TWO BLOCKS EAST OF THE SITE.

THE CARD PROPERTY IS LOCATED WITHIN THE PLATTE RIVER VALLEY BUT IS NO T WITHIN THE DESIGNATED 100-YEAR FLOOD PLAIN. THE SITE IS UNDERLAIN BY FILL MATERIAL, ALLUVIUM, AND THE DENVER FORMATION SANDSTONE. DEPTH TO BEDROCK IS APPROXIMATELY 10 FEET AND DEPTH TO GROUND WATER IS APPROXIMATELY 20 FEET. THE TOPOGRAPHY OF THE SITE IS PREDOMINANTLY FLAT ALTHOUGH SURFACE RUNOFF TENDS EASTWARD TOWARD A STORM SEWER NEAR THE INTERSECTION OF WEST ILIFF AVENUE AND SOUTH NAVAJO STREET. THERE IS NO SURFACE WATER ON THE SITE OTHER THAN THE SMALL OIL AND WASTE WATER POND MENTIONED EARLIER.

A ROD ADDRESSING THE DENVER RADIUM SITE WAS COMPLETED IN JUNE, 1987.

SITE HISTORY

WHAT IS KNOWN TODAY AS THE DENVER RADIUM SITE HAS ITS ROOTS IN THE ROBUST U.S. RADIUM PRODUCING INDUSTRY OF THE EARLY 1900'S. AT THAT TIME, RADIUM WAS CONSIDERED TO BE A WONDER DRUG, A CURE-ALL FOR EVERY AILMENT FROM THE COMMON COLD TO CANCER. A MERE GRAM OF THE RADIOACTIVE ELEMENT SOLD FOR $325,000.

PRIOR TO 1914, THERE WAS NO U.S. PRODUCTION OF RADIUM. RATHER, RADIUM-BEARING ORE WAS SHIPPED FROM THE U.S. TO EUROPE WHERE IT WAS REFINED. FEARING THAT A EUROPEAN WAR MIGHT STYMIE U.S. IMPORTATION OF

RADIUM, THE U.S. BUREAU OF MINES ENTERED INTO A COOPERATIVE AGREEMENT WITH A PRIVATE CORPORATION, THE NATIONAL RADIUM INSTITUTE TO DEVELOP AND OPERATE A RADIUM PROCESSING PLANT IN THE UNITED STATES.

DENVER WAS THE CHOSEN LOCATION FOR THE INSTITUTE DUE TO ITS PROXIMITY TO CARNOTITE, A RADIUM-BEARING ORE OF THE COLORADO PLATEAU. SOON THERE WERE AT LEAST EIGHT OTHER RADIUM PROCESSING OPERATIONS IN DENVER. ONE OF THOSE RADIUM PRODUCERS WAS PITTSBURGH RADIUM COMPANY. USING EQUIPMENT PURCHASED FROM THE INSTITUTE, PITTSBURGH RADIUM COMPANY BEGAN OPERATIONS IN 1920 IN WHAT HAD BEEN THE OVERLAND COTTON MILL BUILDING.

THE DENVER RADIUM INDUSTRY REMAINED STRONG UNTIL AROUND 1920 WHEN EXTREMELY RICH DEPOSITS OF THE RADIUM-BEARING ORE, PITCHBLENDE, BEGAN TO BE DEVELOPED IN THE BELGIAN CONGO. MOST DENVER RADIUM PRODUCERS WERE NOT ABLE TO COMPETE WITH THEIR AFRICAN COUNTERPARTS AND WERE FORCED OUT OF BUSINESS. THE PITTSBURGH RADIUM COMPANY WAS ONE PRODUCER WHICH WAS ABLE TO CONTINUE OPERATIONS BECAUSE, UNLIKE THE OTHER RADIUM PRODUCERS WHO PROCESSED CARNOTITE FOR RADIUM, PITTSBURGH RADIUM COMPANY PROCESSED ROSCOELITE FOR VANADIUM. HOWEVER, PITTSBURGH RADIUM COMPANY, TOO, WAS EVENTUALLY FORCED TO CLOSE. RECORDS SHOW THAT THE COMPANY SOLD THE OVERLAND COTTON MILL BUILDING IN 1924.

SINCE 1924, THE PROPERTY HAS HAD VARIOUS INDUSTRIAL USES INCLUDING WORLD WAR II AND KOREAN WAR MUNITIONS MANUFACTURING, HARDWARE MANUFACTURING, AND FABRICATION OF HEAVY MINING EQUIPMENT. THE PROPERTY BECAME KNOWN AS THE CARD PROPERTY BECAUSE CARD CORPORATION OWNED THE PROPERTY IN 1979, WHEN THE RADIOLOGICAL CONTAMINATION WAS DISCOVERED THERE. THE PROPERTY WILL BE REFERRED TO THROUGHOUT THE REMAINDER OF THIS SUMMARY AS THE CARD PROPERTY.

IN 1979, THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA) DISCOVERED A REFERENCE TO THE NATIONAL RADIUM INSTITUTE IN A 1916 U.S. BUREAU OF MINES REPORT. SUBSEQUENT FIELD RESEARCH REVEALED THE PRESENCE OF THIRTY-ONE RADIOACTIVE SITES IN THE DENVER METROPOLITAN AREA, ONE OF THESE BEING THE CARD PROPERTY, THE LOCATION OF THE ORIGINAL PITTSBURGH RADIUM COMPANY PROCESSING FACILITY. IMMEDIATELY FOLLOWING THESE DISCOVERIES, THE RADIATION CONTROL DIVISION OF THE COLORADO DEPARTMENT OF HEALTH OFFICIALLY NOTIFIED THE AFFECTED PROPERTY OWNERS OF THE PRESENCE OF CONTAMINATION ON THEIR PROPERTIES. THE LETTERS REQUESTED THAT NO EXCAVATION OR SOIL MOVEMENT BE UNDERTAKEN WITHOUT FIRST CONTACTING THE DIVISION.

THE DENVER RADIUM SITE WAS PLACED ON THE INTERIM PRIORITIES LIST IN OCTOBER, 1981, AND FINAL PROMULGATION OF THE NATIONAL PRIORITIES LIST OCCURRED ON SEPTEMBER 8, 1983. THE COLORADO DEPARTMENT OF HEALTH, UNDER A COOPERATIVE AGREEMENT WITH THE EPA, ASSUMED LEAD ACTIVITIES AND INITIATED ENGINEERING ASSESSMENTS OF THE VARIOUS PROPERTIES IN AUGUST, 1981. HOWEVER, MENTOR CORPORATION, OWNER OF THE CARD PROPERTY, DENIED THE STATE ACCESS TO THE SITE.

THE EPA RESUMED FUND-LEAD ACTIVITIES IN JUNE, 1983, BECAUSE THE COLORADO STATE LEGISLATURE FAILED TO APPROPRIATE THE STATE COST SHARE FOR REMEDIAL PLANNING REQUIRED BY EPA POLICY AT THE TIME. IN DECEMBER, 1983, THE EPA DIRECTED ITS CONTRACTOR, CH2M HILL, TO CONDUCT A REMEDIAL INVESTIGATION (RI) OF THE DENVER RADIUM SITE TO DETERMINE THE NATURE AND EXTENT OF THE THREAT PRESENTED BY THE CONTAMINATION AND A FEASIBILITY STUDY (FS) TO EVALUATE PROPOSED REMEDIES. DURING THE RI, MENTOR CORPORATION ALLOWED EPA ACCESS TO THE CARD PROPERTY SO THAT THE EXTENT OF THE CONTAMINATION PRESENT ON THE PR OPERTY COULD BE DETERMINED.

DUE TO THE ENORMITY AND COMPLEXITY OF THE DENVER RADIUM SITE, THE EPA DETERMINED THAT RESPONSE ACTIONS COULD BE UNDERTAKEN AS OPERABLE UNITS IN A COST-EFFECTIVE MANNER, CONSISTENT WITH A PERMANENT REMEDY FOR THE ENTIRE DENVER RADIUM SITE, AND WOULD DECREASE THE RELEASE, THREAT OF RELEASE, AND PATHWAYS OF EXPOSURE. THUS, THE ORIGINAL DENVER RADIUM SITE PROPERTIES PLUS SEVERAL

CONTIGUOUS PROPERTIES WHERE CONTAMINATION WAS DISCOVERED SUBSEQUENT TO THE INITIAL LISTING OF THE SITE ON THE INTERIM PRIORITIES LIST WERE DIVIDED INTO ELEVEN OPERABLE UNITS, THE CARD PROPERTY BEING OPERABLE UNIT X.

IN APRIL, 1986, THE DENVER RADIUM SITE REMEDIAL INVESTIGATION REPORT, WHICH ADDRESSES ALL ELEVEN OPERABLE UNITS, WAS RELEASED TO THE PUBLIC. A DRAFT CARD CORPORATION OPERABLE UNIT X FEASIBILITY STUDY WAS RELEASED FOR PUBLIC REVIEW ON OCTOBER 1, 1986. A SECOND DRAFT CARD CORPORATION OPERABLE UNIT X FEASIBILITY STUDY WAS RELEASED FOR PUBLIC COMMENT ON APRIL 24, 1987. THE SECOND DRAFT REPORT REFLECTED PUBLIC COMMENTS RECEIVED ON THE FIRST DRAFT REPORT AND INCORPORATED NEW REQUIREMENTS MANDATED BY THE PASSAGE OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) IN OCTOBER, 1986. THE FINAL CARD CORPORATION OPERABLE UNIT X FEASIBILITY STUDY WHICH INCORPORATES RESPONSES TO COMMENTS RECEIVED DURING THE BOTH PUBLIC COMMENT PERIODS WILL BE RELEASED ALONG WITH THE RECORD OF DECISION (ROD) FOR THE CARD PROPERTY.
A DETAILED RESPONSIBLE PARTY SEARCH FOR THE ENTIRE DENVER RADIUM SITE HAS BEEN INITIATED. THUS FAR, THE SEARCH HAS NOT IDENTIFIED ANY PARTIES RESPONSIBLE FOR THE CONTAMINATION ON THE CARD PROPERTY. RECORDS SHOW THAT PITTSBURGH RADIUM COMPANY OWNED AND OPERATED THE RADIUM PROCESSING FACILITY AT THE TIME OF DISPOSAL (CIRCA 1920-1924) OF RADIUM, THE HAZARDOUS SUBSTANCE OF CONCERN. ALTHOUGH EXTENSIVE INVESTIGATION HAS BEEN CONDUCTED, THE RESPONSIBLE PARTY SEARCH HAS YET TO TRACE THE CORPORATE HISTORY OF PITTSBURGH RADIUM COMPANY TO A VIABLE, PRESENT-D AY COMPANY.

MENTOR CORPORATION IS A CURRENT OWNER OF A LARGE PORTION OF THE SITE. THE RESPONSIBLE PARTY SEARCH INDICATES THAT MENTOR CORPORATION ACQUIRED THE PROPERTY IN 1977 WITHOUT KNOWLEDGE OF THE CONTAMINATION ON THE SITE. FURTHER, IT DOES NOT APPEAR THAT (1) MENTOR CORPORATION CONDUCTED OR PERMITTED THE GENERATION, TRANSPORTATION, STORAGE, TREATMENT, OR DISPOSAL OF ANY HAZARDOUS SUBSTANCE AT THE CARD PROPERTY OR THAT (2) MENTOR CORPORATION, SINCE BECOMING AWARE OF THE CONTAMINATION ON ITS PROPERTY, CONTRIBUTED TO THE RELEASE OR THREAT OF RELEASE OF A HAZARDOUS SUBSTANCE AT THE FACILITY THROUGH ANY ACTION OR OMISSION.

BASED UPON THESE INITIAL FINDINGS, EPA HAS BEGUN NEGOTIATIONS WITH MENTOR CORPORATION CONCERNING A COVENANT NOT TO SUE FOR POTENTIAL LIABILITY TO THE UNITED STATES, INCLUDING FUTURE LIABILITY, RESULTING FROM THE RELEASE OR THREATENED RELEASE OF THE HAZARDOUS SUBSTANCE TO BE ADDRESSED BY REMEDIAL ACTION AT THE CARD PROPERTY. THE TERMS OF THIS COVENANT NOT TO SUE ARE EMBODIED IN A DRAFT ADMINISTRATIVE ORDER ON CONSENT WHICH IS ATTACHED TO THE ROD. UPON SELECTION OF THE REMEDY AND FINALIZATION OF THE RESPONSIBLE PARTY SEARCH FOR THE CARD PROPERTY, EPA WILL REVISE THE DRAFT ADMINISTRATIVE ORDER TO COMPORT WITH THE ROD AND CURRENT LAWS. IN EXCHANGE FOR THIS COVENANT NOT TO SUE, MENTOR CORPORATION WOULD AGREE TO PROVIDE ACCESS TO ITS PROPERTY TO ENABLE EPA TO UNDERTAKE REMEDIAL ACTION AT THE CARD PROPERTY AND, AT EPA'S DISCRETION, PERMIT EPA TO DELIVER FOR STORAGE AT THE MENTOR PROPERTY RADIUM-CONTAMINATED MATERIALS FROM OTHER PROPERTIES INCLUDED IN THE DENVER RADIUM SITE.

CONSOLIDATED FREIGHTWAYS IS A CURRENT OWNER OF A PORTION OF THE CARD PROPERTY. CONSOLIDATED FREIGHTWAYS BOUGHT ITS PORTION OF THE PROPERTY IN MARCH, 1985, NEARLY TWO YEARS AFTER THE FORMAL LISTING OF THE DENVER RADIUM SITE ON THE NATIONAL PRIORITIES LIST. DURING THE SUMMER OF 1985, THE COMPANY PROCEEDED TO CONSTRUCT A TRUCKING TERMINAL ON THE PROPERTY AND AS A RESULT TWO AREAS OF CONTAMINATION ON THE SITE CAN NO LONGER BE IDENTIFIED.

THE EPA DOES NOT FEEL THAT REMEDIAL ACTION SHOULD BE DELAYED PENDING FINALIZATION OF THE RESPONSIBLE PARTY SEARCH. EPA ANTICIPATES DISCUSSIONS AND NEGOTIATIONS WITH BOTH MENTOR CORPORATION AND CONSOLIDATED FREIGHTWAYS.

FURTHER, IF UPON FINALIZATION OF THE SEARCH, THE EPA IDENTIFIES ADDITIONAL RESPONSIBLE PARTIES, THE EPA

**WILL FORMALLY NOTIFY THEM OF THE REMEDY SELECTED IN THE ROD AND INITIATE NEGOTIATIONS FOR THE IMPLEMENTATION OF THE REMEDY. NEGOTIATIONS WILL NOT EXCEED SIXTY DAYS. THEREAFTER, IF THE RESPONSIBLE PARTIES DO NOT FORMALLY COMMIT TO PERFORMING THE REMEDY IN A TIMELY MANNER, THE EPA WILL PROCEED WITH A FUND-FINANCED REMEDIAL DESIGN AND REMEDIAL ACTION AND WILL ATTEMPT TO RECOVER EPA'S RESPONSE COSTS FROM THE RESPONSIBLE PARTIES.**

**A ROD ADDRESSING THE DENVER RADIUM SITE WAS COMPLETED IN JUNE, 1987.**

**A RECORD OF DECISION ADDRESSING OPERABLE UNITS VI, IX, AND XI OF THE DENVER RADIUM SITE WAS COMPLETED IN SEPTEMBER 1987.**

ACTIONS

TYPE: **QX - PROSPECTIVE PURCHASER AGREEMENT ASSESSMENT**
START DATE: **11/26/2002**
COMPLETION DATE: **06/03/2005**
ACTION TYPE DEFINITION:
**EPA REVIEWS A FORMAL REQUEST FOR A PROSPECTIVE PURCHASER AGREEMENT (PPA), RESULTING IN A DECISION TO GRANT OR DENY THE REQUEST.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/17/1989**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/17/1989**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/17/1989**
COMPLETION DATE: **10/15/1990**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/17/1989**
COMPLETION DATE: **08/31/1990**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/17/1989**
COMPLETION DATE: **12/15/1989**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/16/1989**
COMPLETION DATE: **08/15/1990**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **02/29/1988**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/30/1989**
COMPLETION DATE: **10/03/1989**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **08/24/1992**
COMPLETION DATE: **03/29/1994**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **PC - PREPARATION OF COST DOCUMENT PACKAGE**
START DATE: **09/02/2000**
COMPLETION DATE: **10/19/2001**
ACTION TYPE DEFINITION:
**PACKAGE PREPARED IN SUPPORT OF COST RECOVERY ACTIONS CONTAINING SITE-SPECIFIC COST DOCUMENTATION INFORMATION FOR DIRECT EXPENDITURES (I.E., AGENCY PAYROLL AND TRAVEL, CONTRACTING COSTS) AND INDIRECT COSTS. DOCUMENTATION MAY BE CONDENSED PER RULE 1006 OF THE FEDERAL RULES OF EVIDENCE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/31/1988**
COMPLETION DATE: **10/03/1989**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/30/1989**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/30/1989**
COMPLETION DATE: **06/14/1993**

ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/30/1989**
COMPLETION DATE: **09/14/1993**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/31/1989**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **10/13/1989**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **05/23/1990**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **04/02/1991**
COMPLETION DATE: **06/14/1993**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **08/24/1992**
COMPLETION DATE: **09/14/1993**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/30/1990**
COMPLETION DATE: **03/29/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**

START DATE: **09/30/1988**
COMPLETION DATE: **09/22/1989**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION - LONG TERM ACTION**
START DATE: **06/28/1991**
COMPLETION DATE: **08/30/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION - LONG TERM ACTION**
START DATE: **05/29/2001**
COMPLETION DATE: **09/29/2006**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **07/22/1987**
COMPLETION DATE: **08/25/1987**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **06/04/1992**
COMPLETION DATE: **03/30/1996**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **05/24/1991**
COMPLETION DATE: **05/24/1991**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NR**
COMPLETION DATE: **12/28/1984**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **NJ - NOTICE LETTERS ISSUED**

START DATE: **NR**
COMPLETION DATE: **05/14/1992**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **NP - PROPOSAL TO NATIONAL PRIORITIES LIST**
START DATE: **NR**
COMPLETION DATE: **12/30/1982**
ACTION TYPE DEFINITION:
**SITE PROPOSED FOR INCLUSION ON THE NATIONAL PRIORITY LIST BASED ON THE HAZARD RANKING SYSTEM (HRS) SCORE FOR THE SITE.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **09/12/1986**
COMPLETION DATE: **03/01/1990**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **01/21/1991**
COMPLETION DATE: **07/23/1991**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **03/08/1995**
COMPLETION DATE: **03/30/1995**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **03/24/1987**
COMPLETION DATE: **06/02/1987**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **07/01/1988**
COMPLETION DATE: **09/12/1988**

ACTION TYPE DEFINITION:

**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**

START DATE: **01/09/1991**

COMPLETION DATE: **06/21/1991**

ACTION TYPE DEFINITION:

**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**

START DATE: **01/09/1991**

COMPLETION DATE: **05/29/1992**

ACTION TYPE DEFINITION:

**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**

START DATE: **06/11/1991**

COMPLETION DATE: **08/08/1991**

ACTION TYPE DEFINITION:

**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **RI - REMEDIAL INVESTIGATION**

START DATE: **04/19/1988**

COMPLETION DATE: **09/27/1989**

ACTION TYPE DEFINITION:

**AN INVESTIGATION INTENDED TO GATHER THE DATA NECESSARY TO: (1) DETERMINE THE NATURE AND EXTENT OF PROBLEMS AT THE SITE; ( 2) ESTABLISH CLEANUP CRITERIA FOR THE SITE; (3) IDENTIFY PRELIMINARY ALTERNATIVE REMEDIAL ACTIONS; AND (4) SUPPORT THE TECHNICAL AND COST ANALYSES OF THE ALTERNATIVES.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**

START DATE: **06/26/1991**

COMPLETION DATE: **09/09/1991**

ACTION TYPE DEFINITION:

**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **RD - REMEDIAL DESIGN**

START DATE: **04/22/1987**

COMPLETION DATE: **02/18/1988**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **PC - PREPARATION OF COST DOCUMENT PACKAGE**
START DATE: **10/21/1998**
COMPLETION DATE: **12/15/1998**
ACTION TYPE DEFINITION:
**PACKAGE PREPARED IN SUPPORT OF COST RECOVERY ACTIONS CONTAINING SITE-SPECIFIC COST DOCUMENTATION INFORMATION FOR DIRECT EXPENDITURES (I.E., AGENCY PAYROLL AND TRAVEL, CONTRACTING COSTS) AND INDIRECT COSTS. DOCUMENTATION MAY BE CONDENSED PER RULE 1006 OF THE FEDERAL RULES OF EVIDENCE.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **01/16/1985**
COMPLETION DATE: **05/08/1986**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **01/16/1985**
COMPLETION DATE: **01/16/1987**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **05/08/1986**
COMPLETION DATE: **01/16/1987**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **11/26/1984**
COMPLETION DATE: **01/16/1985**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **03/01/2000**
COMPLETION DATE: **03/28/2000**
ACTION TYPE DEFINITION:

**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **03/02/2000**
COMPLETION DATE: **03/28/2000**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **OF - OPERATIONAL & FUNCTIONAL**
START DATE: **02/08/1999**
COMPLETION DATE: **02/08/1999**
ACTION TYPE DEFINITION:
**MEASURES TAKEN TO ENSURE THAT THE REMEDY IS FUNCTIONING PROPERLY AND IS PERFORMING AS DESIGNED. EPA WILL FUND UP TO ONE YEAR OF OF OR UP TO TEN YEARS OF OF IF THE REMEDY INVOLVES RESTORATION OF GROUND OR SURFACE WATER.**

TYPE: **PA - PRELIMINARY ASSESSMENT**
START DATE: **NR**
COMPLETION DATE: **11/01/1979**
ACTION TYPE DEFINITION:
**COLLECTION OF DIVERSE EXISTING INFORMATION ABOUT THE SOURCE AND NATURE OF THE SITE HAZARD. IT IS EPA POLICY TO COMPLETE THE PRELIMINARY ASSESSMENT WITHIN ONE YEAR OF SITE DISCOVERY.**

TYPE: **PC - PREPARATION OF COST DOCUMENT PACKAGE**
START DATE: **03/30/1991**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**PACKAGE PREPARED IN SUPPORT OF COST RECOVERY ACTIONS CONTAINING SITE-SPECIFIC COST DOCUMENTATION INFORMATION FOR DIRECT EXPENDITURES (I.E., AGENCY PAYROLL AND TRAVEL, CONTRACTING COSTS) AND INDIRECT COSTS. DOCUMENTATION MAY BE CONDENSED PER RULE 1006 OF THE FEDERAL RULES OF EVIDENCE.**

TYPE: **PC - PREPARATION OF COST DOCUMENT PACKAGE**
START DATE: **12/30/1991**
COMPLETION DATE: **02/11/1994**
ACTION TYPE DEFINITION:
**PACKAGE PREPARED IN SUPPORT OF COST RECOVERY ACTIONS CONTAINING SITE-SPECIFIC COST DOCUMENTATION INFORMATION FOR DIRECT EXPENDITURES (I.E., AGENCY PAYROLL AND TRAVEL, CONTRACTING COSTS) AND INDIRECT COSTS. DOCUMENTATION MAY BE CONDENSED PER RULE 1006 OF THE FEDERAL RULES OF EVIDENCE.**

TYPE: **PC - PREPARATION OF COST DOCUMENT PACKAGE**
START DATE: **12/31/1993**
COMPLETION DATE: **02/25/1994**
ACTION TYPE DEFINITION:
**PACKAGE PREPARED IN SUPPORT OF COST RECOVERY ACTIONS CONTAINING SITE-SPECIFIC COST DOCUMENTATION INFORMATION FOR DIRECT EXPENDITURES (I.E., AGENCY PAYROLL AND TRAVEL, CONTRACTING COSTS) AND INDIRECT COSTS. DOCUMENTATION MAY BE CONDENSED PER RULE 1006 OF THE FEDERAL RULES OF EVIDENCE.**

TYPE: **PC - PREPARATION OF COST DOCUMENT PACKAGE**
START DATE: **02/26/1994**
COMPLETION DATE: **07/11/1994**
ACTION TYPE DEFINITION:
**PACKAGE PREPARED IN SUPPORT OF COST RECOVERY ACTIONS CONTAINING SITE-SPECIFIC COST DOCUMENTATION INFORMATION FOR DIRECT EXPENDITURES (I.E., AGENCY PAYROLL AND TRAVEL, CONTRACTING COSTS) AND INDIRECT COSTS. DOCUMENTATION MAY BE CONDENSED PER RULE 1006 OF THE FEDERAL RULES OF EVIDENCE.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **06/26/1991**
COMPLETION DATE: **07/17/1991**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **TA - TECHNICAL ASSISTANCE**
START DATE: **08/15/2011**
COMPLETION DATE: **NR**
ACTION TYPE DEFINITION:
**PARTICIPATION IN THE CONDUCT OF FUND-FINANCED REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS).**

TYPE: **RV - REMOVAL - TIME CRITICAL**
START DATE: **08/21/1985**
COMPLETION DATE: **09/27/1985**
ACTION TYPE DEFINITION:
**RESPONSE ACTION THAT REQUIRES EXPEDITIOUS ATTENTION TO REDUCE IMMINENT AND SUBSTANTIAL DANGERS TO HUMAN HEALTH, WELFARE, OR THE ENVIRONMENT OR AN EMERGENCY RESPONSE REQUIRED WITHIN HOURS OR DAYS TO ADDRESS ACUTE SITUATIONS INVOLVING ACTUAL OR POTENTIAL THREAT TO HUMAN HEALTH, THE ENVIRONMENT, OR REAL OR PERSONAL PROPERTY DUE TO THE RELEASE OF A HAZARDOUS SUBSTANCE. CHARACTERIZATION OF A REMOVAL ACTION AS REMOVAL, NOT IMMEDIATE REMOVAL OR PLANNED REMOVAL, STARTED AT THE BEGINNING OF FY 1987. THIS CODE NOW TAKES THE PLACE OF IMMEDIATE REMOVAL (IR) AND PLANNED REMOVAL (PR).**

TYPE: **RV - REMOVAL - EMERGENCY**
START DATE: **08/22/1989**
COMPLETION DATE: **08/30/1989**
ACTION TYPE DEFINITION:
**RESPONSE ACTION THAT REQUIRES EXPEDITIOUS ATTENTION TO REDUCE IMMINENT AND SUBSTANTIAL DANGERS TO HUMAN HEALTH, WELFARE, OR THE ENVIRONMENT OR AN EMERGENCY RESPONSE REQUIRED WITHIN HOURS OR DAYS TO ADDRESS ACUTE SITUATIONS INVOLVING ACTUAL OR POTENTIAL THREAT TO HUMAN HEALTH, THE ENVIRONMENT, OR REAL OR PERSONAL PROPERTY DUE TO THE RELEASE OF A HAZARDOUS SUBSTANCE. CHARACTERIZATION OF A REMOVAL ACTION AS REMOVAL, NOT IMMEDIATE REMOVAL OR PLANNED REMOVAL, STARTED AT THE BEGINNING OF FY 1987. THIS CODE NOW TAKES THE PLACE OF IMMEDIATE REMOVAL (IR) AND PLANNED REMOVAL (PR).**

TYPE: **SG - SPECIAL NOTICE ISSUED**
START DATE: **NR**
COMPLETION DATE: **01/29/1992**
ACTION TYPE DEFINITION:
**ISSUANCE UNDER CERCLA SECTION 122 OF A SPECIAL NOTICE LETTER TO POTENTIALLY RESPONSIBLE PARTIES (PRPS). THE ISSUANCE OF A SPECIAL NOTICE LETTER BY EPA TRIGGERS A NEGOTIATION MORATORIUM. SPECIAL NOTICE**

**LETTERS CAN BE ISSUED FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, REMEDIAL DESIGN/REMEDIAL ACTION NEGOTIATIONS.**

TYPE: **SG - SPECIAL NOTICE ISSUED**
START DATE: **NR**
COMPLETION DATE: **01/29/1992**
ACTION TYPE DEFINITION:
**ISSUANCE UNDER CERCLA SECTION 122 OF A SPECIAL NOTICE LETTER TO POTENTIALLY RESPONSIBLE PARTIES (PRPS). THE ISSUANCE OF A SPECIAL NOTICE LETTER BY EPA TRIGGERS A NEGOTIATION MORATORIUM. SPECIAL NOTICE LETTERS CAN BE ISSUED FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, REMEDIAL DESIGN/REMEDIAL ACTION NEGOTIATIONS.**

TYPE: **SG - SPECIAL NOTICE ISSUED**
START DATE: **NR**
COMPLETION DATE: **07/01/1987**
ACTION TYPE DEFINITION:
**ISSUANCE UNDER CERCLA SECTION 122 OF A SPECIAL NOTICE LETTER TO POTENTIALLY RESPONSIBLE PARTIES (PRPS). THE ISSUANCE OF A SPECIAL NOTICE LETTER BY EPA TRIGGERS A NEGOTIATION MORATORIUM. SPECIAL NOTICE LETTERS CAN BE ISSUED FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, REMEDIAL DESIGN/REMEDIAL ACTION NEGOTIATIONS.**

TYPE: **SI - SITE INSPECTION**
START DATE: **NR**
COMPLETION DATE: **12/01/1982**
ACTION TYPE DEFINITION:
**THE PROCESS OF COLLECTING SITE DATA AND SAMPLES TO CHARACTERIZE THE SEVERITY OF THE HAZARD FOR THE HAZARD RANKING SCORE AND/OR ENFORCEMENT SUPPORT.**

TYPE: **SI - SITE INSPECTION**
START DATE: **NR**
COMPLETION DATE: **12/01/1982**
ACTION TYPE DEFINITION:
**THE PROCESS OF COLLECTING SITE DATA AND SAMPLES TO CHARACTERIZE THE SEVERITY OF THE HAZARD FOR THE HAZARD RANKING SCORE AND/OR ENFORCEMENT SUPPORT.**

TYPE: **SV - SECTION 107 LITIGATION**
START DATE: **03/01/1995**
COMPLETION DATE: **01/22/1996**
ACTION TYPE DEFINITION:
**JUDICIAL REFERRAL UNDER S107 TO RECOVERY FROM POTENTIALLY RESPONSIBLE PARTIES (PRPS).**

TYPE: **TA - TECHNICAL ASSISTANCE**
START DATE: **11/24/1998**
COMPLETION DATE: **02/07/2001**
ACTION TYPE DEFINITION:
**PARTICIPATION IN THE CONDUCT OF FUND-FINANCED REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS).**

TYPE: **TA - TECHNICAL ASSISTANCE**
START DATE: **04/15/1987**
COMPLETION DATE: **09/30/1987**
ACTION TYPE DEFINITION:
**PARTICIPATION IN THE CONDUCT OF FUND-FINANCED REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS).**

TYPE: **TA - TECHNICAL ASSISTANCE**

START DATE: **09/21/1988**
COMPLETION DATE: **10/01/1996**
ACTION TYPE DEFINITION:
**PARTICIPATION IN THE CONDUCT OF FUND-FINANCED REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS).**

TYPE: **RI - REMEDIAL INVESTIGATION**
START DATE: **08/19/1983**
COMPLETION DATE: **03/24/1986**
ACTION TYPE DEFINITION:
**AN INVESTIGATION INTENDED TO GATHER THE DATA NECESSARY TO: (1) DETERMINE THE NATURE AND EXTENT OF PROBLEMS AT THE SITE; ( 2) ESTABLISH CLEANUP CRITERIA FOR THE SITE; (3) IDENTIFY PRELIMINARY ALTERNATIVE REMEDIAL ACTIONS; AND (4) SUPPORT THE TECHNICAL AND COST ANALYSES OF THE ALTERNATIVES.**

TYPE: **TA - TECHNICAL ASSISTANCE**
START DATE: **09/27/2000**
COMPLETION DATE: **09/27/2006**
ACTION TYPE DEFINITION:
**PARTICIPATION IN THE CONDUCT OF FUND-FINANCED REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS).**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NR**
COMPLETION DATE: **06/30/1987**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **TG - TECHNICAL ASSISTANCE GRANT**
START DATE: **11/04/1996**
COMPLETION DATE: **08/03/2010**
ACTION TYPE DEFINITION:
**A GRANT OF UP TO $50,000 PROVIDED UNDER SARA TO A COMMUNITY FOR TECHNICAL ASSISTANCE IN DEALING WITH SUPERFUND ISSUES AT A NATIONAL PRIORITY LIST (NPL) SITE.**

TYPE: **TS - TREATABILITY STUDY**
START DATE: **09/11/1989**
COMPLETION DATE: **01/31/1991**
ACTION TYPE DEFINITION:
**THE FIELD EFFORTS TO SUPPORT THE EVALUATION OF ALTERNATIVES TO DETERMINE THEIR APPLICABILITY FOR THE SITE.**

TYPE: **TT - NOTICE OF INTENT BY ALL PARTIES**
START DATE: **NR**
COMPLETION DATE: **04/26/2001**
ACTION TYPE DEFINITION:
**THE POINT AT WHICH ALL PARTIES HAVE RESPONDED TO A NOTICE OF INTENT TO COMPLY WITH AN ENFORCEMENT ACTION.**

TYPE: **TV - NOTICE OF INTENT TO PARTIALLY DELETE**
START DATE: **NR**
COMPLETION DATE: **09/09/2010**
ACTION TYPE DEFINITION:
**EPA PUBLISHES THE NOTICE OF INTENT TO PARTIALLY DELETE A PORTION OF A SITE FROM THE NPL IN THE FEDERAL REGISTER.**

TYPE: **UA - UNILATERAL ADMIN ORDER**
START DATE: **NR**
COMPLETION DATE: **08/21/1992**
ACTION TYPE DEFINITION:
**ADMINISTRATIVE ORDER ISSUED BY EPA UNILATERALLY (UNDER SECTION 106 OF SARA). UNILATERAL ORDERS CAN COMPEL POTENTIALLY RESPONSIBLE PARTIES (PRPS) TO CONDUCT REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, REMEDIAL DESIGN/REMEDIAL ACTION, AND MAY INCLUDE COST RECOVERY. COMMONLY ABBREVIATED UAO.**

TYPE: **UA - UNILATERAL ADMIN ORDER**
START DATE: **NR**
COMPLETION DATE: **07/10/2000**
ACTION TYPE DEFINITION:
**ADMINISTRATIVE ORDER ISSUED BY EPA UNILATERALLY (UNDER SECTION 106 OF SARA). UNILATERAL ORDERS CAN COMPEL POTENTIALLY RESPONSIBLE PARTIES (PRPS) TO CONDUCT REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, REMEDIAL DESIGN/REMEDIAL ACTION, AND MAY INCLUDE COST RECOVERY. COMMONLY ABBREVIATED UAO.**

TYPE: **UA - UNILATERAL ADMIN ORDER**
START DATE: **NR**
COMPLETION DATE: **07/10/2000**
ACTION TYPE DEFINITION:
**ADMINISTRATIVE ORDER ISSUED BY EPA UNILATERALLY (UNDER SECTION 106 OF SARA). UNILATERAL ORDERS CAN COMPEL POTENTIALLY RESPONSIBLE PARTIES (PRPS) TO CONDUCT REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, REMEDIAL DESIGN/REMEDIAL ACTION, AND MAY INCLUDE COST RECOVERY. COMMONLY ABBREVIATED UAO.**

TYPE: **UA - UNILATERAL ADMIN ORDER**
START DATE: **NR**
COMPLETION DATE: **07/10/2000**
ACTION TYPE DEFINITION:
**ADMINISTRATIVE ORDER ISSUED BY EPA UNILATERALLY (UNDER SECTION 106 OF SARA). UNILATERAL ORDERS CAN COMPEL POTENTIALLY RESPONSIBLE PARTIES (PRPS) TO CONDUCT REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, REMEDIAL DESIGN/REMEDIAL ACTION, AND MAY INCLUDE COST RECOVERY. COMMONLY ABBREVIATED UAO.**

TYPE: **UA - UNILATERAL ADMIN ORDER**
START DATE: **NR**
COMPLETION DATE: **04/20/2001**
ACTION TYPE DEFINITION:
**ADMINISTRATIVE ORDER ISSUED BY EPA UNILATERALLY (UNDER SECTION 106 OF SARA). UNILATERAL ORDERS CAN COMPEL POTENTIALLY RESPONSIBLE PARTIES (PRPS) TO CONDUCT REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, REMEDIAL DESIGN/REMEDIAL ACTION, AND MAY INCLUDE COST RECOVERY. COMMONLY ABBREVIATED UAO.**

TYPE: **WP - REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORKPLAN APPROVAL BY HQ**
START DATE: **12/31/1981**
COMPLETION DATE: **12/31/1981**
ACTION TYPE DEFINITION:
**APPROVAL OF THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) WORKPLAN, WHICH IS A DESCRIPTION OF THE TASKS AND RESOURCES PLANNED FOR THE RI/FS.**

TYPE: **WP - REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORKPLAN APPROVAL BY HQ**
START DATE: **01/03/1984**
COMPLETION DATE: **01/03/1984**
ACTION TYPE DEFINITION:
**APPROVAL OF THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) WORKPLAN, WHICH IS A DESCRIPTION OF THE**

**TASKS AND RESOURCES PLANNED FOR THE RI/FS.**

TYPE: **WP - REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORKPLAN APPROVAL BY HQ**
START DATE: **04/30/1987**
COMPLETION DATE: **06/29/1987**
ACTION TYPE DEFINITION:
**APPROVAL OF THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) WORKPLAN, WHICH IS A DESCRIPTION OF THE TASKS AND RESOURCES PLANNED FOR THE RI/FS.**

TYPE: **TA - TECHNICAL ASSISTANCE**
START DATE: **11/19/1998**
COMPLETION DATE: **09/07/2005**
ACTION TYPE DEFINITION:
**PARTICIPATION IN THE CONDUCT OF FUND-FINANCED REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS).**

TYPE: **RI - REMEDIAL INVESTIGATION**
START DATE: **05/15/1985**
COMPLETION DATE: **06/30/1986**
ACTION TYPE DEFINITION:
**AN INVESTIGATION INTENDED TO GATHER THE DATA NECESSARY TO: (1) DETERMINE THE NATURE AND EXTENT OF PROBLEMS AT THE SITE; ( 2) ESTABLISH CLEANUP CRITERIA FOR THE SITE; (3) IDENTIFY PRELIMINARY ALTERNATIVE REMEDIAL ACTIONS; AND (4) SUPPORT THE TECHNICAL AND COST ANALYSES OF THE ALTERNATIVES.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **12/11/1987**
COMPLETION DATE: **03/16/1989**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **12/11/1987**
COMPLETION DATE: **03/23/1989**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **12/11/1987**
COMPLETION DATE: **08/15/1989**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **12/11/1987**
COMPLETION DATE: **10/04/1989**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **03/17/1989**
COMPLETION DATE: **09/03/1991**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **12/15/1989**

COMPLETION DATE: **11/21/1990**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **04/07/1991**
COMPLETION DATE: **05/15/1992**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **02/03/1992**
COMPLETION DATE: **09/30/1992**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **09/30/1992**
COMPLETION DATE: **03/31/1993**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **07/05/2000**
COMPLETION DATE: **09/30/2002**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **06/30/1987**
COMPLETION DATE: **06/17/1988**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **06/30/1988**
COMPLETION DATE: **06/30/1989**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RS - REMOVAL ASSESSMENT**
START DATE: **01/01/1992**
COMPLETION DATE: **08/03/1992**
ACTION TYPE DEFINITION:
**COLLECTING SITE CHARACTERISTICS TO DETERMINE WHETHER OR NOT A REMOVAL MUST BE PERFORMED.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NR**
COMPLETION DATE: **10/29/1987**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **RS - REMOVAL ASSESSMENT**
START DATE: **08/30/1989**

COMPLETION DATE: **08/30/1989**
ACTION TYPE DEFINITION:
**COLLECTING SITE CHARACTERISTICS TO DETERMINE WHETHER OR NOT A REMOVAL MUST BE PERFORMED.**

TYPE: **PC - PREPARATION OF COST DOCUMENT PACKAGE**
START DATE: **11/29/1999**
COMPLETION DATE: **01/25/2000**
ACTION TYPE DEFINITION:
**PACKAGE PREPARED IN SUPPORT OF COST RECOVERY ACTIONS CONTAINING SITE-SPECIFIC COST DOCUMENTATION INFORMATION FOR DIRECT EXPENDITURES (I.E., AGENCY PAYROLL AND TRAVEL, CONTRACTING COSTS) AND INDIRECT COSTS. DOCUMENTATION MAY BE CONDENSED PER RULE 1006 OF THE FEDERAL RULES OF EVIDENCE.**

TYPE: **RI - REMEDIAL INVESTIGATION**
START DATE: **03/22/1989**
COMPLETION DATE: **07/24/1990**
ACTION TYPE DEFINITION:
**AN INVESTIGATION INTENDED TO GATHER THE DATA NECESSARY TO: (1) DETERMINE THE NATURE AND EXTENT OF PROBLEMS AT THE SITE; ( 2) ESTABLISH CLEANUP CRITERIA FOR THE SITE; (3) IDENTIFY PRELIMINARY ALTERNATIVE REMEDIAL ACTIONS; AND (4) SUPPORT THE TECHNICAL AND COST ANALYSES OF THE ALTERNATIVES.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NR**
COMPLETION DATE: **03/24/1986**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NR**
COMPLETION DATE: **09/30/1986**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NR**
COMPLETION DATE: **06/30/1987**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NR**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NR**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS**

**CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NR**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NR**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NR**
COMPLETION DATE: **12/23/1991**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NR**
COMPLETION DATE: **01/28/1992**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **12/11/1987**
COMPLETION DATE: **02/01/1989**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RI - REMEDIAL INVESTIGATION**
START DATE: **06/11/1981**
COMPLETION DATE: **08/17/1982**
ACTION TYPE DEFINITION:
**AN INVESTIGATION INTENDED TO GATHER THE DATA NECESSARY TO: (1) DETERMINE THE NATURE AND EXTENT OF PROBLEMS AT THE SITE; ( 2) ESTABLISH CLEANUP CRITERIA FOR THE SITE; (3) IDENTIFY PRELIMINARY ALTERNATIVE REMEDIAL ACTIONS; AND (4) SUPPORT THE TECHNICAL AND COST ANALYSES OF THE ALTERNATIVES.**

TYPE: **CR - COMMUNITY INVOLVEMENT**
START DATE: **03/06/2000**
COMPLETION DATE: **01/29/2003**
ACTION TYPE DEFINITION:
**THE COMMUNITY RELATIONS ACTIVITIES, I.E., PLAN, IMPLEMENTATION AND RESPONSIVENESS SUMMARY THAT MUST BE COMPLETED AT A SITE TO ADDRESS COMMUNITY CONCERNS.**

TYPE: **FE - FIVE-YEAR REVIEW**
START DATE: **06/01/1993**
COMPLETION DATE: **09/30/1993**

ACTION TYPE DEFINITION:
**A REVIEW THAT IS CONDUCTED AT A MINIMUM OF EVERY FIVE YEARS TO DETERMINE IF THE IMPLEMENTATION AND PERFORMANCE OF A REMEDY IS PROTECTIVE OR WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.**

TYPE: **CA - CONSENT AGREEMENT (ADMINISTRATIVE)**
START DATE: **NR**
COMPLETION DATE: **07/26/1995**
ACTION TYPE DEFINITION:
**INFORMAL AGREEMENT USED TO INITIATE POTENTIALLY RESPONSIBLE PARTY (PRP) RESPONSE OR COST RECOVERY.**

TYPE: **CD - CONSENT DECREE**
START DATE: **NR**
COMPLETION DATE: **01/22/1996**
ACTION TYPE DEFINITION:
**JUDICIAL AGREEMENT BETWEEN THE FEDERAL GOVERNMENT AND THE POTENTIALLY RESPONSIBLE PARTIES (PRPS) FULLY OR PARTIALLY SETTLING A CLAIM UNDER CERCLA. THIS AGREEMENT MAY SETTLE LITIGATION OR MAY BE PRESENTED CONCURRENTLY WITH THE COMPLAINT (ACHIEVED THROUGH NEGOTIATIONS). THE AGREEMENT MAY BE FOR RESPONSE WORK, COST RECOVERY, OR BOTH.**

TYPE: **CD - CONSENT DECREE**
START DATE: **NR**
COMPLETION DATE: **08/19/1988**
ACTION TYPE DEFINITION:
**JUDICIAL AGREEMENT BETWEEN THE FEDERAL GOVERNMENT AND THE POTENTIALLY RESPONSIBLE PARTIES (PRPS) FULLY OR PARTIALLY SETTLING A CLAIM UNDER CERCLA. THIS AGREEMENT MAY SETTLE LITIGATION OR MAY BE PRESENTED CONCURRENTLY WITH THE COMPLAINT (ACHIEVED THROUGH NEGOTIATIONS). THE AGREEMENT MAY BE FOR RESPONSE WORK, COST RECOVERY, OR BOTH.**

TYPE: **CD - CONSENT DECREE**
START DATE: **10/10/2001**
COMPLETION DATE: **08/26/2002**
ACTION TYPE DEFINITION:
**JUDICIAL AGREEMENT BETWEEN THE FEDERAL GOVERNMENT AND THE POTENTIALLY RESPONSIBLE PARTIES (PRPS) FULLY OR PARTIALLY SETTLING A CLAIM UNDER CERCLA. THIS AGREEMENT MAY SETTLE LITIGATION OR MAY BE PRESENTED CONCURRENTLY WITH THE COMPLAINT (ACHIEVED THROUGH NEGOTIATIONS). THE AGREEMENT MAY BE FOR RESPONSE WORK, COST RECOVERY, OR BOTH.**

TYPE: **CD - CONSENT DECREE**
START DATE: **08/20/2009**
COMPLETION DATE: **04/01/2010**
ACTION TYPE DEFINITION:
**JUDICIAL AGREEMENT BETWEEN THE FEDERAL GOVERNMENT AND THE POTENTIALLY RESPONSIBLE PARTIES (PRPS) FULLY OR PARTIALLY SETTLING A CLAIM UNDER CERCLA. THIS AGREEMENT MAY SETTLE LITIGATION OR MAY BE PRESENTED CONCURRENTLY WITH THE COMPLAINT (ACHIEVED THROUGH NEGOTIATIONS). THE AGREEMENT MAY BE FOR RESPONSE WORK, COST RECOVERY, OR BOTH.**

TYPE: **CL - SECTION 106 107 LITIGATION**
START DATE: **09/30/1987**
COMPLETION DATE: **08/19/1988**
ACTION TYPE DEFINITION:
**REFERRAL TO OECM OR DOJ, WITHOUT SETTLEMENT, OF A CIVIL ACTION ADDRESSING A SITE UNDER SECTIONS 106 AND 107 OF CERCLA.**

TYPE: **CL - SECTION 106 107 LITIGATION**
START DATE: **10/25/2001**
COMPLETION DATE: **08/26/2002**
ACTION TYPE DEFINITION:
**REFERRAL TO OECM OR DOJ, WITHOUT SETTLEMENT, OF A CIVIL ACTION ADDRESSING A SITE UNDER SECTIONS 106 AND 107 OF CERCLA.**

TYPE: **CM - PRELIMINARY CLOSE-OUT REPORT PREPARED**
START DATE: **NR**
COMPLETION DATE: **09/27/2006**
ACTION TYPE DEFINITION:
**A REPORT PREPARED BY THE REMEDIAL PROGRAM MANAGER (RPM) VERIFYING THAT PHYSICAL CONSTRUCTION OF THE REMEDY IS COMPLETE, INDICATING MINOR PUNCH LIST ITEMS THAT REMAIN AND OUTLINING A SCHEDULE OF THE OUTSTANDING ACTIVITIES.**

TYPE: **CO - COMBINED REMEDIAL INVESTIGATION/FEASIBILITY STUDY**
START DATE: **11/15/1999**
COMPLETION DATE: **06/16/2000**
ACTION TYPE DEFINITION:
**THE PROCESS OF DATA COLLECTION AND ANALYSES OF THE SITE PROBLEM, IDENTIFICATION OF PRELIMINARY REMEDIAL ALTERNATIVES, AND RECOMMENDATION OF A COST-EFFECTIVE REMEDY. THERE CAN BE MULTIPLE REMEDIAL INVESTIGATION/FEASIBILITY STUDIES (RI/FS) CONDUCTED AT A SITE.**

TYPE: **CQ - CLOSE OUT REPORT**
START DATE: **NR**
COMPLETION DATE: **09/27/2006**
ACTION TYPE DEFINITION:
**A REPORT SUBMITTED BY THE REMEDIAL PROGRAM MANAGER (RPM) VERIFYING THAT THE CONDITIONS OF THE SITE COMPLY WITH THE RECORD OF DECISION (ROD) FINDINGS AND DESIGN SPECIFICATIONS AND THAT ACTIVITIES PERFORMED AT THE SITE ARE SUFFICIENT TO ACHIEVE PROTECTION OF PUBLIC HEALTH AND THE ENVIRONMENT. THIS IS A REMEDIAL ACTION (RA) OR ROD SUBEVENT.**

TYPE: **BF - POTENTIALLY RESPONSIBLE PARTY REMEDIAL ACTION**
START DATE: **10/26/1992**
COMPLETION DATE: **06/29/1994**
ACTION TYPE DEFINITION:
**PROVIDES FOR OVERSIGHT OF POTENTIALLY RESPONSIBLE PARTY (PRP) RESPONSE ACTION FOR REMEDIAL ACTION (RA), INCLUDING ALL ACTIVITIES FOR MONITORING AND SUPERVISING THE PERFORMANCE OF THE RESPONSIBLE PARTIES TO DETERMINE WHETHER SUCH PERFORMANCE IS CONSISTENT WITH THE REQUIREMENTS OF THE ADMINISTRATIVE ORDERS ON CONSENT, UNILATERAL ADMINISTRATIVE ORDERS, CONSENT DECREES, JUDICIAL DECREES, INFORMATION AGREEMENTS, AND COMPLIANCE SCHEDULES.**

TYPE: **CR - COMMUNITY INVOLVEMENT**
START DATE: **05/15/1985**
COMPLETION DATE: **03/06/2000**
ACTION TYPE DEFINITION:
**THE COMMUNITY RELATIONS ACTIVITIES, I.E., PLAN, IMPLEMENTATION AND RESPONSIVENESS SUMMARY THAT MUST BE COMPLETED AT A SITE TO ADDRESS COMMUNITY CONCERNS.**

TYPE: **BE - POTENTIALLY RESPONSIBLE PARTY REMEDIAL DESIGN**
START DATE: **06/07/1992**
COMPLETION DATE: **06/27/1996**

ACTION TYPE DEFINITION:
**PROVIDES FOR OVERSIGHT OF POTENTIALLY RESPONSIBLE PARTY (PRP) RESPONSE ACTION FOR REMEDIAL DESIGN (RD), INCLUDING ALL ACTIVITIES FOR MONITORING AND SUPERVISING THE PERFORMANCE OF THE RESPONSIBLE PARTIES TO DETERMINE WHETHER SUCH PERFORMANCE IS CONSISTENT WITH THE REQUIREMENTS OF THE ADMINISTRATIVE ORDERS ON CONSENT, UNILATERAL ADMINISTRATIVE ORDERS, CONSENT DECREES, JUDICIAL DECREES, INFORMATION AGREEMENTS, AND COMPLIANCE SCHEDULES.**

TYPE: **DP - PUBLIC NOTICE PUBLISHED**
START DATE: **NR**
COMPLETION DATE: **09/20/1989**
ACTION TYPE DEFINITION:
**PUBLICATION IN THE LOCAL NEWSPAPER OF THE AVAILABILITY OF DOCUMENTS FOR PUBLIC REVIEW, SUCH AS THE ADMINISTRATIVE RECORD, PROPOSED PLAN, AND DELETION PACKAGE.**

TYPE: **DS - DISCOVERY**
START DATE: **NR**
COMPLETION DATE: **03/01/1979**
ACTION TYPE DEFINITION:
**THE PROCESS BY WHICH A POTENTIAL HAZARDOUS WASTE SITE IS BROUGHT TO THE ATTENTION OF THE EPA. THE PROCESS CAN OCCUR THROUGH THE USE OF SEVERAL MECHANISMS SUCH AS A PHONE CALL OR REFERRAL BY ANOTHER GOVERNMENT AGENCY.**

TYPE: **ED - RISK/HEALTH ASSESSMENT**
START DATE: **04/12/2005**
COMPLETION DATE: **10/13/2005**
ACTION TYPE DEFINITION:
**ASSESSMENT OF THE BASELINE RISKS POSED BY THE SITE TO HUMAN HEALTH.**

TYPE: **EH - EXPLANATION OF SIGNIFICANT DIFFERENCES**
START DATE: **NR**
COMPLETION DATE: **09/15/1992**
ACTION TYPE DEFINITION:
**MINOR CHANGE FROM THE ORIGINAL REMEDY SELECTED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS CONTINGENT REMEDY.**

TYPE: **EH - EXPLANATION OF SIGNIFICANT DIFFERENCES**
START DATE: **NR**
COMPLETION DATE: **09/13/1993**
ACTION TYPE DEFINITION:
**MINOR CHANGE FROM THE ORIGINAL REMEDY SELECTED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS CONTINGENT REMEDY.**

TYPE: **EH - EXPLANATION OF SIGNIFICANT DIFFERENCES**
START DATE: **NR**
COMPLETION DATE: **12/13/1993**
ACTION TYPE DEFINITION:
**MINOR CHANGE FROM THE ORIGINAL REMEDY SELECTED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS CONTINGENT REMEDY.**

TYPE: **EH - EXPLANATION OF SIGNIFICANT DIFFERENCES**
START DATE: **NR**
COMPLETION DATE: **12/01/1994**
ACTION TYPE DEFINITION:

**MINOR CHANGE FROM THE ORIGINAL REMEDY SELECTED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS CONTINGENT REMEDY.**

TYPE: **EH - EXPLANATION OF SIGNIFICANT DIFFERENCES**
START DATE: **NR**
COMPLETION DATE: **12/01/1994**
ACTION TYPE DEFINITION:
**MINOR CHANGE FROM THE ORIGINAL REMEDY SELECTED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS CONTINGENT REMEDY.**

TYPE: **EH - EXPLANATION OF SIGNIFICANT DIFFERENCES**
START DATE: **NR**
COMPLETION DATE: **01/17/1995**
ACTION TYPE DEFINITION:
**MINOR CHANGE FROM THE ORIGINAL REMEDY SELECTED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS CONTINGENT REMEDY.**

TYPE: **EH - EXPLANATION OF SIGNIFICANT DIFFERENCES**
START DATE: **NR**
COMPLETION DATE: **01/17/1995**
ACTION TYPE DEFINITION:
**MINOR CHANGE FROM THE ORIGINAL REMEDY SELECTED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS CONTINGENT REMEDY.**

TYPE: **EH - EXPLANATION OF SIGNIFICANT DIFFERENCES**
START DATE: **NR**
COMPLETION DATE: **03/12/2007**
ACTION TYPE DEFINITION:
**MINOR CHANGE FROM THE ORIGINAL REMEDY SELECTED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS CONTINGENT REMEDY.**

TYPE: **FE - FIVE-YEAR REVIEW**
START DATE: **04/05/1993**
COMPLETION DATE: **09/12/1994**
ACTION TYPE DEFINITION:
**A REVIEW THAT IS CONDUCTED AT A MINIMUM OF EVERY FIVE YEARS TO DETERMINE IF THE IMPLEMENTATION AND PERFORMANCE OF A REMEDY IS PROTECTIVE OR WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.**

TYPE: **CR - COMMUNITY INVOLVEMENT**
START DATE: **03/16/1984**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**THE COMMUNITY RELATIONS ACTIVITIES, I.E., PLAN, IMPLEMENTATION AND RESPONSIVENESS SUMMARY THAT MUST BE COMPLETED AT A SITE TO ADDRESS COMMUNITY CONCERNS.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **09/29/1987**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AC - ADMINISTRATIVE ORDER ON CONSENT**

START DATE: **NR**
COMPLETION DATE: **07/22/1988**
ACTION TYPE DEFINITION:
**A VOLUNTARY AND ENFORCEABLE AGREEMENT PURSUANT TO CERCLA, SIGNED BY EPA AND POTENTIALLY RESPONSIBLE PARTIES (PRPS), WHEREBY THE PRPS AGREE TO PERFORM AND/OR PAY FOR SOME OR ALL OF THE RESPONSE COSTS INVOLVED IN SITE CLEANUP. THE ORDER DESCRIBES THE PRP RESPONSE TO BE TAKEN AT A SITE, STIPULATED PENALTIES, INDEMNIFICATION, EFFECTIVE DATE, AND MAY BE SUBJECT TO PUBLIC COMMENT. IT CAN BE FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), REMEDIAL DESIGN (RD), AND REMEDIAL ACTION (RA),PRE-SARA; BUT ONLY REMOVAL AND RI/FS, POST-SARA.**

TYPE: **AC - ADMINISTRATIVE ORDER ON CONSENT**
START DATE: **NR**
COMPLETION DATE: **06/14/1993**
ACTION TYPE DEFINITION:
**A VOLUNTARY AND ENFORCEABLE AGREEMENT PURSUANT TO CERCLA, SIGNED BY EPA AND POTENTIALLY RESPONSIBLE PARTIES (PRPS), WHEREBY THE PRPS AGREE TO PERFORM AND/OR PAY FOR SOME OR ALL OF THE RESPONSE COSTS INVOLVED IN SITE CLEANUP. THE ORDER DESCRIBES THE PRP RESPONSE TO BE TAKEN AT A SITE, STIPULATED PENALTIES, INDEMNIFICATION, EFFECTIVE DATE, AND MAY BE SUBJECT TO PUBLIC COMMENT. IT CAN BE FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), REMEDIAL DESIGN (RD), AND REMEDIAL ACTION (RA),PRE-SARA; BUT ONLY REMOVAL AND RI/FS, POST-SARA.**

TYPE: **AC - ADMINISTRATIVE ORDER ON CONSENT**
START DATE: **NR**
COMPLETION DATE: **09/09/1997**
ACTION TYPE DEFINITION:
**A VOLUNTARY AND ENFORCEABLE AGREEMENT PURSUANT TO CERCLA, SIGNED BY EPA AND POTENTIALLY RESPONSIBLE PARTIES (PRPS), WHEREBY THE PRPS AGREE TO PERFORM AND/OR PAY FOR SOME OR ALL OF THE RESPONSE COSTS INVOLVED IN SITE CLEANUP. THE ORDER DESCRIBES THE PRP RESPONSE TO BE TAKEN AT A SITE, STIPULATED PENALTIES, INDEMNIFICATION, EFFECTIVE DATE, AND MAY BE SUBJECT TO PUBLIC COMMENT. IT CAN BE FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), REMEDIAL DESIGN (RD), AND REMEDIAL ACTION (RA),PRE-SARA; BUT ONLY REMOVAL AND RI/FS, POST-SARA.**

TYPE: **AC - ADMINISTRATIVE ORDER ON CONSENT**
START DATE: **NR**
COMPLETION DATE: **08/30/1991**
ACTION TYPE DEFINITION:
**A VOLUNTARY AND ENFORCEABLE AGREEMENT PURSUANT TO CERCLA, SIGNED BY EPA AND POTENTIALLY RESPONSIBLE PARTIES (PRPS), WHEREBY THE PRPS AGREE TO PERFORM AND/OR PAY FOR SOME OR ALL OF THE RESPONSE COSTS INVOLVED IN SITE CLEANUP. THE ORDER DESCRIBES THE PRP RESPONSE TO BE TAKEN AT A SITE, STIPULATED PENALTIES, INDEMNIFICATION, EFFECTIVE DATE, AND MAY BE SUBJECT TO PUBLIC COMMENT. IT CAN BE FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), REMEDIAL DESIGN (RD), AND REMEDIAL ACTION (RA),PRE-SARA; BUT ONLY REMOVAL AND RI/FS, POST-SARA.**

TYPE: **AC - ADMINISTRATIVE ORDER ON CONSENT**
START DATE: **NR**
COMPLETION DATE: **07/15/1996**
ACTION TYPE DEFINITION:
**A VOLUNTARY AND ENFORCEABLE AGREEMENT PURSUANT TO CERCLA, SIGNED BY EPA AND POTENTIALLY RESPONSIBLE PARTIES (PRPS), WHEREBY THE PRPS AGREE TO PERFORM AND/OR PAY FOR SOME OR ALL OF THE RESPONSE COSTS INVOLVED IN SITE CLEANUP. THE ORDER DESCRIBES THE PRP RESPONSE TO BE TAKEN AT A SITE, STIPULATED PENALTIES, INDEMNIFICATION, EFFECTIVE DATE, AND MAY BE SUBJECT TO PUBLIC COMMENT. IT CAN BE**

**FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), REMEDIAL DESIGN (RD), AND REMEDIAL ACTION (RA),PRE-SARA; BUT ONLY REMOVAL AND RI/FS, POST-SARA.**

TYPE: **AC - ADMINISTRATIVE ORDER ON CONSENT**
START DATE: **NR**
COMPLETION DATE: **08/29/2005**
ACTION TYPE DEFINITION:
**A VOLUNTARY AND ENFORCEABLE AGREEMENT PURSUANT TO CERCLA, SIGNED BY EPA AND POTENTIALLY RESPONSIBLE PARTIES (PRPS), WHEREBY THE PRPS AGREE TO PERFORM AND/OR PAY FOR SOME OR ALL OF THE RESPONSE COSTS INVOLVED IN SITE CLEANUP. THE ORDER DESCRIBES THE PRP RESPONSE TO BE TAKEN AT A SITE, STIPULATED PENALTIES, INDEMNIFICATION, EFFECTIVE DATE, AND MAY BE SUBJECT TO PUBLIC COMMENT. IT CAN BE FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), REMEDIAL DESIGN (RD), AND REMEDIAL ACTION (RA),PRE-SARA; BUT ONLY REMOVAL AND RI/FS, POST-SARA.**

TYPE: **AD - ALTERNATIVE DISPUTE RESOLUTION**
START DATE: **10/01/1998**
COMPLETION DATE: **11/15/1999**
ACTION TYPE DEFINITION:
**DECISION TO TAKE COST RECOVERY ACTION BY USE OF ALTERNATIVE DISPUTE RESOLUTION (ADR) INCLUDING MEDIATION, ARBITRATION AND MINI-TRIAL.**

TYPE: **AD - ALTERNATIVE DISPUTE RESOLUTION**
START DATE: **07/20/1999**
COMPLETION DATE: **04/10/2002**
ACTION TYPE DEFINITION:
**DECISION TO TAKE COST RECOVERY ACTION BY USE OF ALTERNATIVE DISPUTE RESOLUTION (ADR) INCLUDING MEDIATION, ARBITRATION AND MINI-TRIAL.**

TYPE: **QN - COMMUNITY ADVISORY GROUP**
START DATE: **01/01/2000**
COMPLETION DATE: **08/16/2006**
ACTION TYPE DEFINITION:
**THE FORMATION OF A COMMUNITY ADVISORY GROUP TO PRESENT COMMUNITY INTERESTS RELATED TO A SITE UNDERGOING CLEANUP TO EPA**

TYPE: **AN - REMEDIAL DESIGN/REMEDIAL ACTION NEGOTIATIONS**
START DATE: **01/28/1992**
COMPLETION DATE: **08/21/1992**
ACTION TYPE DEFINITION:
**DISCUSSIONS AND INFORMATION EXCHANGE BETWEEN POTENTIALLY RESPONSIBLE PARTIES (PRPS) AND EPA (OR STATE) OVER THE LIABILITY OF THE PRP, WILLINGNESS, AND ABILITY TO CONDUCT THE REMEDIAL DESIGN AND/OR THE REMEDIAL ACTION AS IDENTIFIED IN THE RECORD OF DECISION (ROD).**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NR**
COMPLETION DATE: **08/10/1982**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **BF - POTENTIALLY RESPONSIBLE PARTY REMEDIAL ACTION**
START DATE: **03/31/1993**
COMPLETION DATE: **06/16/2000**

ACTION TYPE DEFINITION:
**PROVIDES FOR OVERSIGHT OF POTENTIALLY RESPONSIBLE PARTY (PRP) RESPONSE ACTION FOR REMEDIAL ACTION (RA), INCLUDING ALL ACTIVITIES FOR MONITORING AND SUPERVISING THE PERFORMANCE OF THE RESPONSIBLE PARTIES TO DETERMINE WHETHER SUCH PERFORMANCE IS CONSISTENT WITH THE REQUIREMENTS OF THE ADMINISTRATIVE ORDERS ON CONSENT, UNILATERAL ADMINISTRATIVE ORDERS, CONSENT DECREES, JUDICIAL DECREES, INFORMATION AGREEMENTS, AND COMPLIANCE SCHEDULES.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **04/30/1986**
COMPLETION DATE: **09/30/1986**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AN - REMEDIAL DESIGN/REMEDIAL ACTION NEGOTIATIONS**
START DATE: **06/15/2000**
COMPLETION DATE: **10/10/2001**
ACTION TYPE DEFINITION:
**DISCUSSIONS AND INFORMATION EXCHANGE BETWEEN POTENTIALLY RESPONSIBLE PARTIES (PRPS) AND EPA (OR STATE) OVER THE LIABILITY OF THE PRP, WILLINGNESS, AND ABILITY TO CONDUCT THE REMEDIAL DESIGN AND/OR THE REMEDIAL ACTION AS IDENTIFIED IN THE RECORD OF DECISION (ROD).**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **09/29/1987**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **09/29/1987**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **09/30/1987**
COMPLETION DATE: **09/30/1987**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **09/30/1987**
COMPLETION DATE: **09/30/1987**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL**

**RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **09/30/1987**
COMPLETION DATE: **09/30/1987**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **08/15/1988**
COMPLETION DATE: **01/28/1992**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **08/22/1989**
COMPLETION DATE: **08/22/1989**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **07/31/1991**
COMPLETION DATE: **12/23/1991**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **12/31/1991**
COMPLETION DATE: **03/29/1993**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **BB - POTENTIALLY RESPONSIBLE PARTY REMOVAL - TIME CRITICAL**
START DATE: **06/29/1993**
COMPLETION DATE: **08/27/1993**
ACTION TYPE DEFINITION:
**PROVIDES FOR OVERSIGHT OF POTENTIALLY RESPONSIBLE PARTY (PRP) RESPONSE ACTION FOR REMOVALS, INCLUDING ALL ACTIVITIES FOR MONITORING AND SUPERVISING THE PERFORMANCE OF PRPS TO DETERMINE WHETHER SUCH PERFORMANCE IS CONSISTENT WITH THE REQUIREMENTS OF THE ADMINISTRATIVE ORDERS ON CONSENT, UNILATERAL ADMINISTRATIVE ORDERS, CONSENT DECREES, JUDICIAL DECREES, INFORMATION AGREEMENTS, AND COMPLIANCE SCHEDULES.**

TYPE: **BE - POTENTIALLY RESPONSIBLE PARTY REMEDIAL DESIGN**
START DATE: **12/11/1987**
COMPLETION DATE: **03/01/1990**
ACTION TYPE DEFINITION:
**PROVIDES FOR OVERSIGHT OF POTENTIALLY RESPONSIBLE PARTY (PRP) RESPONSE ACTION FOR REMEDIAL DESIGN (RD), INCLUDING ALL ACTIVITIES FOR MONITORING AND SUPERVISING THE PERFORMANCE OF THE RESPONSIBLE PARTIES TO DETERMINE WHETHER SUCH PERFORMANCE IS CONSISTENT WITH THE REQUIREMENTS OF THE ADMINISTRATIVE ORDERS ON CONSENT, UNILATERAL ADMINISTRATIVE ORDERS, CONSENT DECREES, JUDICIAL DECREES, INFORMATION AGREEMENTS, AND COMPLIANCE SCHEDULES.**

TYPE: **BE - POTENTIALLY RESPONSIBLE PARTY REMEDIAL DESIGN**
START DATE: **06/07/1992**
COMPLETION DATE: **03/31/1993**
ACTION TYPE DEFINITION:
**PROVIDES FOR OVERSIGHT OF POTENTIALLY RESPONSIBLE PARTY (PRP) RESPONSE ACTION FOR REMEDIAL DESIGN (RD), INCLUDING ALL ACTIVITIES FOR MONITORING AND SUPERVISING THE PERFORMANCE OF THE RESPONSIBLE PARTIES TO DETERMINE WHETHER SUCH PERFORMANCE IS CONSISTENT WITH THE REQUIREMENTS OF THE ADMINISTRATIVE ORDERS ON CONSENT, UNILATERAL ADMINISTRATIVE ORDERS, CONSENT DECREES, JUDICIAL DECREES, INFORMATION AGREEMENTS, AND COMPLIANCE SCHEDULES.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **NR**
COMPLETION DATE: **09/28/1990**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **NE - COST RECOVERY NEGOTIATIONS**
START DATE: **06/15/2000**
COMPLETION DATE: **08/26/2002**
ACTION TYPE DEFINITION:
**NEGOTIATIONS BETWEEN EPA AND THE PRPS ON THE LIABILITY FOR REIMBURSEMENT TO THE FUND OF PAST EPA EXPENDITURES INVOLVED IN SITE CLEANUP.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **03/28/2000**
COMPLETION DATE: **03/28/2000**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NR**
COMPLETION DATE: **03/28/2000**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR**

**OR TO PERFORM A CLEANUP.**

TYPE: **JQ - RECORD OF DECISION AMENDMENT**
START DATE: **NR**
COMPLETION DATE: **06/16/2000**
ACTION TYPE DEFINITION:
**SIGNIFICANT CHANGE FROM THE ORIGINAL SELECTED REMEDY STATED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS NEW TECHNOLOGY OR NEW MEDIUM.**

TYPE: **LO - LODGED BY DOJ**
START DATE: **NR**
COMPLETION DATE: **10/31/1995**
ACTION TYPE DEFINITION:
**AN ENFORCEMENT INSTRUMENT (E.G. CONSENT DECREE) IS LODGED BY DOJ WITH THE COURT.**

TYPE: **LO - LODGED BY DOJ**
START DATE: **NR**
COMPLETION DATE: **12/12/2001**
ACTION TYPE DEFINITION:
**AN ENFORCEMENT INSTRUMENT (E.G. CONSENT DECREE) IS LODGED BY DOJ WITH THE COURT.**

TYPE: **LO - LODGED BY DOJ**
START DATE: **NR**
COMPLETION DATE: **01/19/2010**
ACTION TYPE DEFINITION:
**AN ENFORCEMENT INSTRUMENT (E.G. CONSENT DECREE) IS LODGED BY DOJ WITH THE COURT.**

TYPE: **LT - LITIGATION (GENERIC)**
START DATE: **02/23/1999**
COMPLETION DATE: **08/24/2000**
ACTION TYPE DEFINITION:
**THIS ACTIVITY IS USED TO CODE REFERRALS FOR LITIGATION THAT COVER ANY COMBINATION OF REMEDIES OR STATUTES (CERCLA, SARA, RCRA) NOT REFLECTED IN THE CONVENTIONAL ACTIVITY TYPES OF SX (SECTION 106), SV (SECTION 107), CL (COMBINED 106/107), AND SF (SECTION 104). IF PREFERRED, THIS ACTIVITY CAN BE USED TO CODE ALL REFERRAL TYPES INSTEAD OF USING THE CONVENTIONAL SX, SV, CL, SF CODES. BECAUSE THIS ACTIVITY IS GENERIC, CODING THE STATUTES (STATUTE) AND THE REMEDY TYPES (REMEDY) CORRECTLY IS MANDATORY. ALL OTHER EDIT CHECKS AND CODING REQUIREMENTS THAT APPLY TO SX, SV, CL, AND SF APPLY TO LT AS WELL. EXAMPLES: ACTION=LT, STATUTE=106, REMEDY=RA IS EQUIVALENT TO SX; ACTION=LT, STATUTE=107, REMEDY=VA IS EQUIVALENT TO SV; ACTION=LT, STATUTE=106,107, REMEDY=VD, RA IS EQUIVALENT TO CL; ACTION=LT, STATUTE=104, REMEDY=SE, DE IS EQUIVALENT TO SF; ACTION=LT, STATUTE=104,107,106, REMEDY=DE, VM, RD, RA, IS A COMBINATION NOT COVERED BY SX, SV, CL, SF.**

TYPE: **MA - STATE SUPPORT AGENCY COOPERATIVE AGREEMENT**
START DATE: **08/19/1983**
COMPLETION DATE: **11/14/2000**
ACTION TYPE DEFINITION:
**FEDERAL RENUMERATION OF STATE ADMINISTRATIVE COSTS OF PARTICIPATION IN SITE-SPECIFIC REMEDIAL PLANNING OR IMPLEMENTATION ACTIVITIES.**

TYPE: **MA - STATE SUPPORT AGENCY COOPERATIVE AGREEMENT**
START DATE: **04/10/1986**
COMPLETION DATE: **04/11/1991**
ACTION TYPE DEFINITION:

**FEDERAL RENUMERATION OF STATE ADMINISTRATIVE COSTS OF PARTICIPATION IN SITE-SPECIFIC REMEDIAL PLANNING OR IMPLEMENTATION ACTIVITIES.**

TYPE: **MA - STATE SUPPORT AGENCY COOPERATIVE AGREEMENT**
START DATE: **02/12/1988**
COMPLETION DATE: **07/20/1989**
ACTION TYPE DEFINITION:
**FEDERAL RENUMERATION OF STATE ADMINISTRATIVE COSTS OF PARTICIPATION IN SITE-SPECIFIC REMEDIAL PLANNING OR IMPLEMENTATION ACTIVITIES.**

TYPE: **MA - STATE SUPPORT AGENCY COOPERATIVE AGREEMENT**
START DATE: **08/06/1990**
COMPLETION DATE: **09/29/1992**
ACTION TYPE DEFINITION:
**FEDERAL RENUMERATION OF STATE ADMINISTRATIVE COSTS OF PARTICIPATION IN SITE-SPECIFIC REMEDIAL PLANNING OR IMPLEMENTATION ACTIVITIES.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NR**
COMPLETION DATE: **03/28/2000**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **MA - STATE SUPPORT AGENCY COOPERATIVE AGREEMENT**
START DATE: **07/25/1991**
COMPLETION DATE: **09/25/2000**
ACTION TYPE DEFINITION:
**FEDERAL RENUMERATION OF STATE ADMINISTRATIVE COSTS OF PARTICIPATION IN SITE-SPECIFIC REMEDIAL PLANNING OR IMPLEMENTATION ACTIVITIES.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NR**
COMPLETION DATE: **05/22/1987**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **NE - COST RECOVERY NEGOTIATIONS**
START DATE: **10/06/1994**
COMPLETION DATE: **07/15/1996**
ACTION TYPE DEFINITION:
**NEGOTIATIONS BETWEEN EPA AND THE PRPS ON THE LIABILITY FOR REIMBURSEMENT TO THE FUND OF PAST EPA EXPENDITURES INVOLVED IN SITE CLEANUP.**

TYPE: **NE - COST RECOVERY NEGOTIATIONS**
START DATE: **10/24/1994**
COMPLETION DATE: **09/28/1995**
ACTION TYPE DEFINITION:
**NEGOTIATIONS BETWEEN EPA AND THE PRPS ON THE LIABILITY FOR REIMBURSEMENT TO THE FUND OF PAST EPA EXPENDITURES INVOLVED IN SITE CLEANUP.**

TYPE: **NE - COST RECOVERY NEGOTIATIONS**
START DATE: **01/29/1992**
COMPLETION DATE: **03/01/1995**
ACTION TYPE DEFINITION:
**NEGOTIATIONS BETWEEN EPA AND THE PRPS ON THE LIABILITY FOR REIMBURSEMENT TO THE FUND OF PAST EPA EXPENDITURES INVOLVED IN SITE CLEANUP.**

TYPE: **NF - FINAL LISTING ON NATIONAL PRIORITIES LIST**
START DATE: **NR**
COMPLETION DATE: **09/08/1983**
ACTION TYPE DEFINITION:
**SITE MOVED FROM PROPOSED LIST TO FINAL NATIONAL PRIORITY LIST.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NR**
COMPLETION DATE: **08/10/1982**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NR**
COMPLETION DATE: **12/28/1984**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NR**
COMPLETION DATE: **10/29/1987**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NR**
COMPLETION DATE: **02/03/1992**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NR**
COMPLETION DATE: **05/22/1987**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NR**
COMPLETION DATE: **07/23/1991**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY**

**UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **FE - FIVE-YEAR REVIEW**
START DATE: **06/01/1993**
COMPLETION DATE: **09/30/1993**
ACTION TYPE DEFINITION:
**A REVIEW THAT IS CONDUCTED AT A MINIMUM OF EVERY FIVE YEARS TO DETERMINE IF THE IMPLEMENTATION AND PERFORMANCE OF A REMEDY IS PROTECTIVE OR WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.**

TYPE: **AD - ALTERNATIVE DISPUTE RESOLUTION**
START DATE: **12/04/1998**
COMPLETION DATE: **06/21/1999**
ACTION TYPE DEFINITION:
**DECISION TO TAKE COST RECOVERY ACTION BY USE OF ALTERNATIVE DISPUTE RESOLUTION (ADR) INCLUDING MEDIATION, ARBITRATION AND MINI-TRIAL.**

TYPE: **MA - STATE SUPPORT AGENCY COOPERATIVE AGREEMENT**
START DATE: **07/12/1991**
COMPLETION DATE: **09/13/2012**
ACTION TYPE DEFINITION:
**FEDERAL RENUMERATION OF STATE ADMINISTRATIVE COSTS OF PARTICIPATION IN SITE-SPECIFIC REMEDIAL PLANNING OR IMPLEMENTATION ACTIVITIES.**

TYPE: **FM - FORWARD PLANNING ACTIVITY/MANAGEMENT ASSISTANCE**
START DATE: **09/15/2000**
COMPLETION DATE: **09/27/2000**
ACTION TYPE DEFINITION:
**THE PROCESS WHICH IDENTIFIES AND PLANS PROJECTS NECESSARY TO RESTORE A HAZARDOUS WASTE SITE AND THE FEDERAL RENUMERATION OF STATE ADMINISTRATIVE COSTS FOR PARTICIPATING IN THESE ACTIVITIES OR PROJECTS.**

TYPE: **FE - FIVE-YEAR REVIEW**
START DATE: **01/15/1998**
COMPLETION DATE: **09/30/2003**
ACTION TYPE DEFINITION:
**A REVIEW THAT IS CONDUCTED AT A MINIMUM OF EVERY FIVE YEARS TO DETERMINE IF THE IMPLEMENTATION AND PERFORMANCE OF A REMEDY IS PROTECTIVE OR WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.**

TYPE: **FE - FIVE-YEAR REVIEW**
START DATE: **06/10/1999**
COMPLETION DATE: **12/21/1999**
ACTION TYPE DEFINITION:
**A REVIEW THAT IS CONDUCTED AT A MINIMUM OF EVERY FIVE YEARS TO DETERMINE IF THE IMPLEMENTATION AND PERFORMANCE OF A REMEDY IS PROTECTIVE OR WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NR**
COMPLETION DATE: **07/23/1991**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NR**
COMPLETION DATE: **12/30/1992**

ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **FE - FIVE-YEAR REVIEW**
START DATE: **11/13/2012**
COMPLETION DATE: **09/24/2013**
ACTION TYPE DEFINITION:
**A REVIEW THAT IS CONDUCTED AT A MINIMUM OF EVERY FIVE YEARS TO DETERMINE IF THE IMPLEMENTATION AND PERFORMANCE OF A REMEDY IS PROTECTIVE OR WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.**

TYPE: **FN - REMEDIAL INVESTIGATION/FEASIBILITY STUDY NEGOTIATIONS**
START DATE: **08/03/1987**
COMPLETION DATE: **03/31/1988**
ACTION TYPE DEFINITION:
**DISCUSSIONS BETWEEN EPA AND THE POTENTIALLY RESPONSIBLE PARTIES (PRPS) ON LIABILITY FOR AND CONDUCT OF A REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS).**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **08/19/1983**
COMPLETION DATE: **08/19/1983**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **03/15/1985**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **05/15/1985**
COMPLETION DATE: **03/24/1986**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **05/15/1985**
COMPLETION DATE: **09/30/1986**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM**

**TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **05/15/1985**
COMPLETION DATE: **06/30/1987**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **05/15/1985**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **05/15/1985**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NR**
COMPLETION DATE: **03/02/1992**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NR**
COMPLETION DATE: **05/13/1988**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **FE - FIVE-YEAR REVIEW**
START DATE: **04/15/2008**
COMPLETION DATE: **09/30/2008**

ACTION TYPE DEFINITION:
**A REVIEW THAT IS CONDUCTED AT A MINIMUM OF EVERY FIVE YEARS TO DETERMINE IF THE IMPLEMENTATION AND PERFORMANCE OF A REMEDY IS PROTECTIVE OR WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **09/05/1985**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NR**
COMPLETION DATE: **07/23/1987**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NR**
COMPLETION DATE: **12/28/1984**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NR**
COMPLETION DATE: **06/03/1987**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NR**
COMPLETION DATE: **03/08/1995**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **GM - GROUNDWATER MONITORING (POST-RECORD OF DECISION)**
START DATE: **02/28/2000**
COMPLETION DATE: **08/26/2002**

ACTION TYPE DEFINITION:

**GROUNDWATER MONITORING AS SPECIFIED IN THE RECORD OF DECISION (ROD), WHEN NO OTHER GROUNDWATER CLEANUP IS SPECIFIED. ALSO, WHERE THERE IS NO APPROPRIATE DESIGN AND CLEANUP CONSISTENT WITH GROUNDWATER MONITORING AS PART OF THE REMEDY (E.G., WHEN THEROD SPECIFIES NO ACTION OR A REMOVAL ACTION PLUS GROUNDWATER MONITORING.)**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**

START DATE: **NR**

COMPLETION DATE: **05/22/1987**

ACTION TYPE DEFINITION:

**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **FS - FEASIBILITY STUDY**

START DATE: **06/24/1988**

COMPLETION DATE: **01/28/1992**

ACTION TYPE DEFINITION:

**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **HR - HAZARD RANKING SYSTEM PACKAGE**

START DATE: **NR**

COMPLETION DATE: **12/01/1982**

ACTION TYPE DEFINITION:

**A NUMERIC ESTIMATE OF THE RELATIVE SEVERITY OF A HAZARDOUS SUBSTANCE RELEASE OR POTENTIAL RELEASE BASED ON: (1) THE RELATIVE POTENTIAL OF SUBSTANCES TO CAUSE HAZARDOUS SITUATIONS; (2) THE LIKELIHOOD AND RATE AT WHICH THE SUBSTANCES MAY AFFECT HUMAN AND ENVIRONMENTAL RECEPTORS; AND (3) THE SEVERITY AND MAGNITUDE OF POTENTIAL EFFECTS. THE SCORE IS COMPUTED USING THE HAZARD RANKING SYSTEM (HRS).**

TYPE: **GR - PARTIAL NATIONAL PRIORITIES LIST DELETION**

START DATE: **NR**

COMPLETION DATE: **11/08/2010**

ACTION TYPE DEFINITION:

**NO FURTHER RESPONSE IS APPROPRIATE FOR A PORTION OF A FINAL NPL SITE. THE PORTION MAY BE A DEFINED GEOGRAPHIC UNIT OF THE SITE, PERHAPS AS SMALL AS A RESIDENTIAL UNIT, OR THE PORTION MAY BE A SPECIFIC MEDIUM AT THE SITE, SUCH AS GROUNDWATER, DEPENDING ON THE NATURE OR EXTENT OF THE RELEASE. THE CRITERIA FOR PARTIAL DELETION ARE THE SAME AS FOR FINAL DELETION. THE START DATE IS THE DATE A NOTICE OF INTENT TO DELETE IS PUBLISHED IN THE FEDERAL REGISTER FOR THE SPECIFIED PORTION OF THE SITE. THE COMPLETION DATE IS THE DATE A NOTICE OF DELETION IS PUBLISHED IN THE FEDERAL REGISTER FOR THAT SPECIFIED PORTION OF THE SITE.**

TYPE: **FS - FEASIBILITY STUDY**

START DATE: **09/10/1990**

COMPLETION DATE: **12/23/1991**

ACTION TYPE DEFINITION:

**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE**

**REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **FS - FEASIBILITY STUDY**

START DATE: **03/24/1986**

COMPLETION DATE: **06/30/1987**

ACTION TYPE DEFINITION:

**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

CONTAMINANTS

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 08 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **107 NOT DOCUME**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **490 MG/KG**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **ARSENIC**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **35800 MG/KG**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **LEAD, INORGANIC**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**

CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **32050 MG/KG**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **ZINC**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **598 MG/KG**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **ARSENIC**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **1260 MG/KG**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **LEAD, INORGANIC**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **MOLYBDENUM**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **7980 MG/KG**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **SELENIUM**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **1460 NOT DOCUME**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA-BHC**
CONTAMINANT GROUP NAME: **PESTICIDES**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM-226**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADON**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **VOC**
CONTAMINANT GROUP NAME: **VOC**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 2**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **51 NOT DOCUME**

CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 3**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **29 NOT DOCUME**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 4**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **275 NOT DOCUME**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 4**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **198 PCI/G**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 5**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **1900 NOT DOCUME**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 5**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **2775 PCI/G**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **1920 PCI/G**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **690 PCI/G**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **2120 PCI/G**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **MONOLITH MATERIAL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**

HAZARDOUS SUBSTANCE NAME: **RADIUM-226**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **MONOLITH MATERIAL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **THORIUM-230**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOLID WASTE**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **57 NOT DOCUME**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOLID WASTE**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **79 PCI/G**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOLID WASTE**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **AIR 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **INORGANICS**
CONTAMINANT GROUP NAME: **INORGANICS**
WASTE SOURCE MEDIA CONTAMINATED NAME: **AIR 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **AIR 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **BUILDING/STRUCTURE**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **2800 OTHER**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **BUILDINGS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**

CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **BUILDING DEBRIS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **BUILDING DEBRIS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **DEBRIS 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **GROUNDWATER 01 MEDEX**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **GROUNDWATER 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **ANTIMONY**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **GROUNDWATER 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **ARSENIC**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **GROUNDWATER 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **MOLYBDENUM**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **GROUNDWATER 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **GROUNDWATER 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **URANIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**

CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **CARD PROP SOILS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **95 NOT DOCUME**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **CARD PROP SOILS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **960 PCI/G**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OU IV & V SOIL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **1059 OTHER**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OU IV & V SOIL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OU IV & V SOIL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **1260 PCI/G**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OU8 SHATTUCK SOILS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **ARSENIC**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OU8 SHATTUCK SOILS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **LEAD**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OU8 SHATTUCK SOILS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **LEAD-210**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OU8 SHATTUCK SOILS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**

CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **THORIUM-230**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OU8 SHATTUCK SOILS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **URANIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **METALS**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**

HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**

CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 RVNEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **INORGANICS**
CONTAMINANT GROUP NAME: **INORGANICS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 RVNEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SURFACE WATER 01 MED**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

LISTING OF PUBLISHED INSTITUTIONAL CONTROL SITE REPORT
REPORT TYPE: **ICS REQUIRED AND IMPLEMENTED**
URL LINK: **http://www.epa.gov/ictssw07/public/export/08/COD980716955/COD980716955_report.HTM**

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Back to Report Summary

**MAP ID# 80** **Distance from Property: 0.29 mi. (1,531 ft.) S**

EPA ID: **COD980716955**
NAME: **DENVER RADIUM SITE**
ADDRESS: **VARIOUS PLACES IN DENVER, DENVER, CO**
COUNTY: **DENVER**
ROD DATE: **01/28/92**
ROD TYPE: **RECORD OF DECISION**
ROD ID: **08002471992ROD063**
**DENVER RADIUM SITE**
**ABSTRACT SITE NAME: DENVER RADIUM SITE**
**ADDRESS: VARIOUS PLACES IN DENVER**
**CITY & STATE: DENVER CO 80204**
**COUNTY: DENVER**

**EPA ID: COD980716955**
**EPA REGION: 08**

**NPL STATUS: CURRENTLY ON THE FINAL NPL**

**ROD TYPE: RECORD OF DECISION**
**ROD ID: EPA/ROD/R08-92/063**
**ROD DATE: 01/28/1992**
**OPERABLE UNIT(S): 08**

**MEDIA: SOIL, DEBRIS, GROUND WATER**

**CONTAMINANT: METALS, INORGANICS, RADIOACTIVE MATERIALS**

**ABSTRACT:**
**SITE HISTORY/DESCRIPTION: THE 10-ACRE DENVER RADIUM (OPERABLE UNIT 8) SITE IS A FORMER RADIOACTIVE EXTRACTION INDUSTRY LOCATED IN DENVER, DENVER COUNTY, COLORADO. THE SITE IS DIVIDED INTO THREE AREAS: THE 5.9-ACRE S.W. SHATTUCK CHEMICAL INC. (SHATTUCK) PROPERTY; THE 4.3-ACRE RAILROAD RIGHT -OF-WAY WEST OF THE SHATTUCK PROPERTY; AND NEARBY "VICINITY" PROPERTIES. LAND USE SURROUNDING THE SITE IS PREDOMINANTLY INDUSTRIAL, WITH SOME RESIDENTIAL AREAS. THE SITE IS LOCATED WITHIN THE SOUTH PLATTE RIVER DRAINAGE BASIN. FROM THE 1920'S TO 1984, THE SHATTUCK PROPERTY WAS USED TO TREAT AND PROCESS MOLYBDENUM ORES, RADIUM SLIMES, AND URANIUM COMPOUNDS AND ORES. THE RAILROAD RIGHT-OF-WAY HAS BEEN OPERATIONAL DAILY SINCE THE LATE 19TH CENTURY WITH A SPUR TO THE SHATTUCK PROPERTY. AS A RESULT OF EXTENSIVE MINING AND PROCESSING, RADIOACTIVE CONTAMINATED SOIL IS WIDELYSCATTERED RESULTING IN A VARIETY OF RADIATION LEVELS. A U.S. BUREAU OF MINES REPORT LED EPA TO FIELD RESEARCH 31 RADIOACTIVE SITES IN DENVER AND DENVER COUNTY. IN 1983, EPA CONDUCTED REMEDIAL INVESTIGATIONS, WHICH DETECTED ELEVATED LEVELS OF RADON GAS AND GAMMA RADIATION. A 1989 EMERGENCY REMOVAL ACTION AT ONE OF THE VICINITY PROPERTIES INCLUDED RADON MITIGATION MEASURES. THIS ROD ADDRESSES A FINAL REMEDY FOR RADIOACTIVE CONTAMINATED DEBRIS, GROUND WATER, AND SOIL, AS OU8. FUTURE RODS WILL ADDRESS THE REMAINING CONTAMINATED MEDIA AT 11 OUS NOT ADDRESSED BY THE PREVIOUS SEVEN RODS AT THE DENVER RADIUM SITES. THE PRIMARY CONTAMINANTS OF CONCERN AFFECTING THE SOIL, DEBRIS, AND GROUND WATER ARE METALS INCLUDING**

**ARSENIC AND LEAD; INORGANICS, INCLUDING ASBESTOS; AND RADIOACTIVE MATERIALS. PERFORMANCE STANDARDS OR GOALS: CHEMICAL-SPECIFIC SOIL ACTION LEVELS ARE BASED ON NUCLEAR REGULATORY COMMISSION AND DEPARTMENT OF ENERGY STANDARDS FOR RADIUM-226, EXCEEDING 5 PCI/G ABOVE BACKGROUND IN THE TOP 15 CM OF SOIL AND 15 PCI/G ABOVE BACKGROUND IN ANY LAYER BELOW THE TOP 15 CM; THORIUM-230, 42 PCI/G; URANIUM; 75 PCI/G; AND RISK-BASED STANDARDS FOR ARSENIC 160 MG/KG; SELENIUM 490 MG/KG; AND LEAD 540 MG/KG. INSTITUTIONAL CONTROLS: DEED, LAND USE, AND GROUND WATER USE RESTRICTIONS WILL BE IMPLEMENTED TO PREVENT EXCAVATION OF THE COVER AND STABILIZED MATERIALS AND TO PROHIBIT CONSTRUCTION OF ENCLOSED STRUCTURES AND AGRICULTURAL USE ON THE DISPOSAL SITE.**

**REMEDY:**
**SELECTED REMEDIAL ACTION: THE SELECTED REMEDIAL ACTION FOR THIS SITE INCLUDES DEMOLISHING AND DECONTAMINATING BUILDINGS, TANKS, AND EQUIPMENT ONSITE; TEMPORARILY STORING DEBRIS FROM VICINITY PROPERTIES ONSITE AT THE SHATTUCK AREA, PENDING EITHER OFFSITE DISPOSAL AND/OR SCRAP RECYCLING, OR SALVAGING OF DEBRIS; DISPOSING OF ASBESTOS-CONTAINING MATERIAL FROM BUILDINGS OFFSITE; CONDUCTING PILOT SCALE TREATABILITY STUDIES DURING REMEDIAL DESIGN TO OPTIMIZE STABILIZATION DESIGN; EXCAVATING AND TRANSPORTING 5,000 CUBIC YARDS OF RADIUMCONTAMINATED SOIL FROM THE RAILROAD RIGHTS-OF-WAY AND 6,000 CUBIC YARDS FROM THE VICINITY PROPERTIES; CONSOLIDATING THESE WITH 38,500 CUBIC YARDS OF SOIL FROM THE SHATTUCK PROPERTY, AND TREATING THE SOIL ONSITE USING CEMENT-BASED STABILIZATION; PLACING A CAP OVER THE STABILIZED MATERIAL, AND REVEGETATING THE AREA; FILLING PREVIOUSLY EXCAVATED AREAS WITH CLEAN FILL; TESTING FOR, REMEDIATING AND DISPOSING OF ANY RCRA HAZARDOUS WASTE OFFSITE; ALLOWING THE GROUND WATER TO NATURALLY ATTENUATE; MONITORING GROUND WATER AND AIR; AND IMPLEMENTING INSTITUTIONAL CONTROLS, INCLUDING DEED, LAND, AND GROUND WATER USE RESTRICTIONS. THE ESTIMATED PRESENT WORTH COST FOR THIS REMEDIAL ACTION IS $26,600,000, WHICH INCLUDES AN ANNUAL O&M COST OF $120,000 FOR 200 YEARS.**
ROD DATE: **12/23/91**
ROD TYPE: **RECORD OF DECISION**
ROD ID: **08002471992ROD062**
**DENVER RADIUM SITE**
**ABSTRACT SITE NAME: DENVER RADIUM SITE**
**ADDRESS: VARIOUS PLACES IN DENVER**
**CITY & STATE: DENVER CO 80204**
**COUNTY: DENVER**

**EPA ID: COD980716955**
**EPA REGION: 08**

**NPL STATUS: CURRENTLY ON THE FINAL NPL**

**ROD TYPE: RECORD OF DECISION**
**ROD ID: EPA/ROD/R08-92/062**
**ROD DATE: 12/23/1991**
**OPERABLE UNIT(S): 09**

**MEDIA: SOIL**

**CONTAMINANT: METALS**

**ABSTRACT:**

**SITE HISTORY/DESCRIPTION: THE DENVER RADIUM (OPERABLE UNIT 9) SITE IS A FORMER RADIOACTIVE MINING SITE LOCATED IN DENVER, DENVER COUNTY, COLORADO. THE SITE INCLUDES A 17-ACRE FORMER BRICK PLANT, A PARKING LOT, AND A LARGE AMOUNT OF EXPOSED SOIL. LAND USE IN THE AREA IS PREDOMINANTLY COMMERCIAL AND INDUSTRIAL, WITH A RESIDENTIAL AREA LOCATED SEVERAL BLOCKS EAST OF THE SITE. THE SOUTH PLATTE RIVER LIES 1,000 FEET FROM THE FORMER BRICK PLANT. INDUSTRIAL ACTIVITIES COMMENCED AT THE SITE IN 1886 WITH THE CONSTRUCTION OF THE BAILEY SMELTER. IN 1890, THE GOLD AND SILVER EXTRACTION COMPANY BEGAN A CYANIDE LEACHING OPERATION ONSITE. IN 1901, THE BAILEY SMELTER BURNED DOWN. BY 1903, THE COLORADO ZINC COMPANY HAD CONSTRUCTED A MILL ON THE SITE OF THE BAILEY SMELTER, AND ZINC MILLING OPERATIONS CONTINUED UNTIL 1910. FROM 1914 TO 1917, THE U.S. BUREAU OF MINES OPERATED A RADIUM PROCESSING FACILITY ONSITE, KNOWN AS THE NATIONAL RADIUM INSTITUTE (NRI). OTHER ONSITE INDUSTRIAL ACTIVITIES INCLUDED MINERALS RECOVERY, MANUFACTURING AND SERVICING OF STORAGE BATTERIES, TREATING AND SACKING OF METALLIC ORE INSULATION, OIL RECLAMATION, AND LANDFILLING. ROBINSON BRICK COMPANY (ROBCO) ACQUIRED 13.5 ACRES OF THE SITE IN 1941 AND A CONTIGUOUS 3.5 -ACRE PARCEL IN 1951. ROBCO, THE PRESENT OWNER OF THE SITE, UTILIZED THE SITE UNTIL 1980 TO MANUFACTURE BRICKS. IN 1983, EPA DISCOVERED THAT 30 PROPERTIES, INCLUDING THE ROBCO PROPERTY, CONTAINED RADIOLOGIC CONTAMINATION IN THE SOIL ATTRIBUTABLE TO PRIOR NRI OPERATIONS. IN 1988, THE U.S. BUREAU OF MINES INITIATED EXCAVATION OF THE RADIOLOGICALLY CONTAMINATED MATERIAL. IN THE COURSE OF THE RADIUM CLEANUP, METALS CONTAMINATION, RESULTING FROM MINING WASTES DISPOSED OF AND USED AS FILL FROM THE MID-1880'S TO THE EARLY 1920'S, WAS DISCOVERED ONSITE. EXCAVATION OF THE RADIOLOGICALLY CONTAMINATED MATERIALS WAS COMPLETED IN 1991 AS PART OF OUS 4 AND 5. THIS ROD ADDRESSES APPROXIMATELY 16,500 CUBIC YARDS OF METAL-CONTAMINATED SOIL AS OU9, ON OF 11 OUS PLANNED FOR THE SITE. THE PRIMARY CONTAMINANTS OF CONCERN AFFECTING THE SOIL ARE METALS, INCLUDING ARSENIC AND LEAD. PERFORMANCE STANDARDS OR GOALS:DESIGN OF THE CAP WILL COMPLY WITH RCRA AND STATE REQUIREMENTS. CHEMICAL- SPECIFIC SOIL REMEDIATION GOALS, WHICH ARE BASED ON HEALTH CRITERIA, INCLUDE PREVENTION OF EXPOSURE AND DIRECT CONTACT WITH ACTION LEVEL CONCENTRATIONS EXCEEDING ARSENIC 79 UG/L; LEAD 1,000 UG/L; AND ZINC 17,000 UG/L. INSTITUTIONAL CONTROLS: DEED RESTRICTIONS WILL BE IMPLEMENTED TO PREVENT USING THE SITE FOR COMMERCIAL OR INDUSTRIAL PURPOSES AND TO PREVENT FUTURE DEVELOPMENT OF THE CAPPED AREA, WHICH COULD IMPAIR THE EFFECTIVENESS OF THE REMEDIAL ACTION. ADDITIONALLY, THE DEED RESTRICTION WILL PROHIBIT PLACEMENT OF WELLS ONSITE FOR THE PURPOSE OF SUPPLYING DRINKING WATER.**

**REMEDY:**
**SELECTED REMEDIAL ACTION: THE SELECTED REMEDIAL ACTION FOR THE SITE INCLUDES CONSTRUCTING A 3.7-ACRE MULTI-MEDIA CAP OVER ONSITE CONTAMINATED SOIL WITH METAL CONCENTRATIONS EXCEEDING ACTION LEVELS; UTILIZING THE EXISTING CONCRETE FLOOR OF THE BRICK PLANT AND ASPHALT PARKING LOT IN CONCERT WITH THE BACKFILLED SOIL CAP; PROVIDING INSPECTION AND REPAIR OF THE CONCRETE FLOOR, AS NECESSARY;UPGRADING THE ASPHALT WITH GEOTEXTILE FABRIC AND AN ADDITIONAL 6-INCH LAYER OF ASPHALT; MONITORING DOWNGRADIENT GROUND WATER; LONG-TERM MONITORING TO ENSURE EFFECTIVENESS OF THE CAP; AND IMPLEMENTING INSTITUTIONAL CONTROLS INCLUDING DEED RESTRICTIONS TO LIMIT THE GROUND WATER USE AND TO MAINTAIN THE INTEGRITY OF THE CAP. THE ESTIMATED PRESENT WORTH COST FOR THIS REMEDIAL ACTION IS $1,702,000.**

ROD DATE: **09/29/87**
ROD TYPE: **RECORD OF DECISION**
ROD ID: **08002471987ROD013**
**DENVER RADIUM SITE**
**ABSTRACT SITE NAME: DENVER RADIUM SITE**
**ADDRESS: VARIOUS PLACES IN DENVER**
**CITY & STATE: DENVER CO 80204**
**COUNTY: DENVER**

EPA ID: COD980716955
EPA REGION: 08

NPL STATUS: CURRENTLY ON THE FINAL NPL

ROD TYPE: RECORD OF DECISION
ROD ID: EPA/ROD/R08-87/013
ROD DATE: 09/29/1987
OPERABLE UNIT(S): 01

MEDIA: AIR DEBRIS SOIL

CONTAMINANT: ASSOCIATED DECAY PRODUCTS, RADIUM

ABSTRACT:
THE DENVER RADIUM SITE, LOCATED IN DENVER, COLORADO, CONSISTS OF MORE THAN 40 CONTAMINATED PROPERTIES. THESE PROPERTIES HAVE BEEN GROUPED INTO ELEVEN OPERABLE UNITS. THIS OPERABLE UNIT CONSISTS OF FIVE DENVER RADIUM SITE PROPERTIES WHICH ARE KNOWN COLLECTIVELY AS THE 12TH AND QUIVAS PROPERTIES. THE 12TH AND QUIVAS PROPERTY SITE CONSISTS OF APPROXIMATELY 8.1 ACRES IN AN INDUSTRIAL USE AREA. IN 1979 EPA NOTED A REFERENCE TO THE NATIONAL RADIUM INSTITUTE (NRI) IN A 1916 U.S. BUREAU OF MINES REPORT. THIS REFERENCE REVEALED THE PRESENCE OF 31 RADIOACTIVE SITES IN THE DENVER METROPOLITAN AREA. IN 1913 THE NRI WAS ESTABLISHED IN DENVER AS A DOMESTIC SOURCE OF RADIUM WHICH WAS IN HIGH DEMAND AS A WONDER DRUG FOR THE TREATMENT OF CANCER. SUBSEQUENTLY THE DENVER RADIUM, VANADIUM AND URANIUM INDUSTRY THRIVED UNTIL THE EARLY 1920S, WHEN RICH DEPOSITS OF ORE WERE DISCOVERED IN AFRICA. THE PITTSBURGH RADIUM COMPANY (PRC), A DIVISION OF THE NATIONAL VANADIUM PRODUCTS COMPANY, REFINED ORE ON QUIVAS STREET UNTIL 1924 AND IS CONSIDERED THE SOURCE OF CONTAMINATION ON THE FIVE 12TH AND QUIVAS PROPERTIES. THERE IS NO SERIOUS PUBLIC HEALTH RISK AT PRESENT FROM RADIUM AND ITS ASSOCIATED DECAY PRODUCTS. HOWEVER, SINCE RADIUM HAS A HALF-LIFE OF 1,600 YEARS, THERE IS A LONG-TERM POTENTIAL FOR INCREASED PUBLIC HEALTH RISK IF THE CONTAMINATED MEDIA AND DEBRIS WERE TO BE MISUSED OR INADVERTENTLY SPREAD. THE PRIMARY CONTAMINANTS OF CONCERN AFFECTING APPROXIMATELY 11,000 YD3 OF SOIL IS RADIUM AND ITS ASSOCIATED DECAY PRODUCTS.

THE SELECTED REMEDIAL ACTION FOR THIS SITE INCLUDES; CAPPING OPEN AREAS OF SOIL CONTAMINATION (7,600 YD3); EXCAVATION OF CONTAMINATED SOIL LYING UNDER STRUCTURES ON THE PROPERTIES (3,400 YD3) AND PLACING THIS MATERIAL INTO AN ONSITE TEMPORARY STORAGE FACILITY; MAINTENANCE OF THE CAP AND TEMPORARY STORAGE FACILITY UNTIL A FACILITY SUITABLE FOR THE PERMANENT DISPOSAL OF DENVER RADIUM SITE WASTE BECOMES AVAILABLE; AND FINAL OFFSITE DISPOSAL OF THE CONTAMINATED MATERIAL TO A PERMANENT DISPOSAL FACILITY. THE ESTIMATED PRESENT WORTH COST FOR THIS REMEDIAL ACTION IS $3,702,800 WITH 5-YEAR O&M OF $290,000.

REMEDY:
THIS RECORD OF DECISION ADDRESSES THE CONTAMINATION PRESENT ON WHAT IS KNOWN AS THE 12TH AND QUIVAS PROPERTIES, OPERABLE UNIT I OF THE DENVER RADIUM SITE. THIS IS THE FOURTH OPERABLE UNIT OF THE DENVER RADIUM SITE FOR WHICH EPA HAS SELECTED A REMEDY. THE EPA IS UNDERTAKING ADDITIONAL FEASIBILITY STUDIES TO EVALUATE REMEDIAL ACTION ALTERNATIVES AT THE OTHER DENVER RADIUM SITE OPERABLE UNITS AND WILL COMPLETE A RECORD OF DECISION OR AN ACTION MEMORANDUM FOR EACH OF THE OPERABLE UNITS FOR WHICH A REMEDY HAS NOT ALREADY BEEN SELECTED.

RADIUM AND ITS ASSOCIATED DECAY PRODUCTS ARE THE HAZARDOUS SUBSTANCES OF PRIMARY CONCERN THAT HAVE

**BEEN RELEASED AND CONTINUE TO BE RELEASED INTO THE ENVIRONMENT AT THE 12TH AND QUIVAS PROPERTIES. LONG-TERM EXPOSURE TO RADIUM AND ITS DECAY PRODUCTS HAS BEEN SHOWN CONCLUSIVELY TO INCREASE THE RISK OF CONTRACTING LUNG CANCER.**

**EPA'S PREFERRED REMEDIAL ACTION ALTERNATIVE FOR THE 12TH AND QUIVAS PROPERTIES IS OFFSITE PERMANENT DISPOSAL. HOWEVER, UNTIL A FACILITY SUITABLE FOR PERMANENT DISPOSAL OF THE 12TH AND QUIVAS PROPERTIES MATERIAL IS DESIGNATED AND, IF NECESSARY, ACQUIRED AND DEVELOPED, THIS ALTERNATIVE CANNOT BE IMPLEMENTED. PURSUANT TO CERCLA SECTION 104(C)(3)(C)(II), IT IS THE RESPONSIBILITY OF THE STATE OF COLORADO TO ASSURE THE AVAILABILITY OF A FACILITY FOR OFFSITE DISPOSAL OF THE DENVER RADIUM SITE MATERIAL. ALTHOUGH BOTH THE EPA AND STATE OF COLORADO ARE CONTINUING TO SEEK A PERMANENT DISPOSAL SITE, THE STATE ESTIMATES THAT THIS PROCESS COULD TAKE UP TO FIVE YEARS. GIVEN THE LENGTH OF TIME WHICH MAY PASS BEFORE THE STATE ASSURES THE AVAILABILITY OF AN OFFSITE PERMANENT DISPOSAL FACILITY, AND IN ORDER TO PREVENT OR MINIMIZE THE THREAT TO PUBLIC HEALTH AND THE ENVIRONMENT, THE EPA HAS DETERMINED THAT A REMEDIAL ACTION ALTERNATIVE WHICH INCLUDES TEMPORARY RESPONSE ACTIONS SHOULD BE IMPLEMENTED AT THE 12TH AND QUIVAS PROPERTIES.**

**THE SELECTED REMEDY FOR THE 12TH AND QUIVAS PROPERTIES IS ONSITE TEMPORARY CONTAINMENT (CAPPING), OFFSITE PERMANENT DISPOSAL. THIS REMEDIAL ACTION ALTERNATIVE WILL ATTAIN A DEGREE OF CLEANUP OF THE HAZARDOUS SUBSTANCES WHICH WILL ASSURE BOTH SHORT-TERM AND LONG-TERM PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. THE PRESENT-WORTH COST OF THIS ALTERNATIVE IS $3,702,800 BASED UPON A TEN-PERCENT INTEREST RATE, A FIVE-YEAR DISCOUNT PERIOD, AND A PERPETUAL MONITORING PERIOD. THIS REMEDY ENTAILS; -**
**PLACING A CAP OVER THE IDENTIFIED OPEN AREAS OF SOIL CONTAMINATION;**
**- EXCAVATING THE CONTAMINATED SOIL LYING UNDER SEVERAL STRUCTURES ON THE PROPERTIES AND PLACING THIS MATERIAL INTO A TEMPORARY STORAGE FACILITY ONSITE;**
**- MAINTAINING THE CAP AND TEMPORARY STORAGE FACILITY UNTIL A FACILITY SUITABLE FOR THE PERMANENT DISPOSAL OF DENVER RADIUM SITE WASTES BECOMES AVAILABLE; AND**
**- FINAL REMOVAL OF THE CONTAMINATED MATERIAL TO THE PERMANENT DISPOSAL FACILITY.**

**REMEDIAL DESIGN FOR THE 12TH AND QUIVAS PROPERTIES WILL INCLUDE THE SELECTED REMEDY DESCRIBED ABOVE AND EPA'S PREFERRED REMEDIAL ACTION ALTERNATIVE, OFFSITE PERMANENT DISPOSAL. SHOULD THE STATE OF COLORADO FULFILL ITS OBLIGATION TO ASSURE THE AVAILABILITY OF A SUITABLE DISPOSAL FACILITY FOR MATERIAL FROM THE DENVER RADIUM SITE BY THE TIME EPA HAS CONCLUDED REMEDIAL DESIGN FOR THE 12TH AND QUIVAS PROPERTIES, THE EPA MAY IMMEDIATELY IMPLEMENT ITS PREFERRED ALTERNATIVE, OFFSITE PERMANENT DISPOSAL.**

**OPERATION AND MAINTENANCE ACTIVITIES WILL BE REQUIRED TO ENSURE THE EFFECTIVENESS OF THE TEMPORARY RESPONSE ACTIONS. THESE ACTIVITIES INCLUDE SITE INSPECTIONS, ONGOING RADIOLOGICAL MONITORING, AND POSSIBLE MINOR REPAIRS TO THE CAP OR TEMPORARY STORAGE FACILITY. ALSO INCLUDED AS AN OPERATION AND MAINTENANCE ACTIVITY IS A REVIEW OF THE PROPERTIES WHICH, PURSUANT TO SARA SECTION 121(C), MUST BE CONDUCTED NO LESS THAN EVERY FIVE YEARS IF A REMEDIAL ACTION IS SELECTED THAT RESULTS IN ANY HAZARDOUS SUBSTANCES REMAINING ONSITE. SINCE EPA DOES NOT ANTICIPATE THAT ANY HAZARDOUS SUBSTANCES WILL REMAIN ONSITE LONGER THAN FIVE YEARS, THE COST OF THIS REVIEW IS CONSIDERED A CONTINGENCY. THE MAXIMUM TOTAL OF THE DISCOUNTED ANNUAL OPERATION AND MAINTENANCE COSTS OF THESE ACTIVITIES USING A FIVE-YEAR DISCOUNT PERIOD AND A TEN-PERCENT DISCOUNT RATE IS $290,000. THIS OPERATION AND MAINTENANCE COST IS INCLUDED WITH THE PRESENT-WORTH TOTAL ALTERNATIVE COST MENTIONED ABOVE.**

ROD DATE: **09/29/87**
ROD TYPE: **RECORD OF DECISION**
ROD ID: **08002471987ROD015**

DENVER RADIUM SITE
ABSTRACT SITE NAME: DENVER RADIUM SITE
ADDRESS: VARIOUS PLACES IN DENVER
CITY & STATE: DENVER CO 80204
COUNTY: DENVER

EPA ID: COD980716955
EPA REGION: 08

NPL STATUS: CURRENTLY ON THE FINAL NPL

ROD TYPE: RECORD OF DECISION
ROD ID: EPA/ROD/R08-87/015
ROD DATE: 09/29/1987
OPERABLE UNIT(S): 02

MEDIA: AIR DEBRIS SOIL

CONTAMINANT: ASSOCIATED DECAY PRODUCTS, RADIUM, RADON GAS

ABSTRACT:
THE DENVER RADIUM SITE, LOCATED IN DENVER, COLORADO, CONSISTS OF MORE THAN 40 CONTAMINATED PROPERTIES. THESE PROPERTIES HAVE BEEN GROUPED INTO ELEVEN OPERABLE UNITS. THIS OPERABLE UNIT CONSISTS OF ELEVEN DENVER RADIUM SITE PROPERTIES WHICH ARE KNOWN COLLECTIVELY AS THE 11TH AND UMATILLA PROPERTIES. THE 11TH AND UMATILLA PROPERTIES SITE CONSISTS OF APPROXIMATELY 24 ACRES IN AN AREA ZONED FOR HEAVY INDUSTRIAL USE. TWO-THIRDS OF THE 11TH AND UMATILLA PROPERTIES ARE LOCATED WITHIN THE DESIGNATED 100-YEAR FLOOD PLAIN. IN 1979 EPA NOTED A REFERENCE TO THE NATIONAL RADIUM INSTITUTE (NRI) IN A 1916 U.S. BUREAU OF MINES REPORT. THIS REFERENCE REVEALED THE PRESENCE OF 31 RADIOACTIVE SITES IN THE DENVER METROPOLITAN AREA. IN 1913 THE NRI WAS ESTABLISHED IN DENVER AS A DOMESTIC SOURCE OF RADIUM, WHICH WAS IN HIGH DEMAND AS A WONDER DRUG FOR THE TREATMENT OF CANCER. SUBSEQUENTLY, THE DENVER RADIUM, VANADIUM AND URANIUM INDUSTRY THRIVED UNTIL THE EARLY 1920S, WHEN RICH DEPOSITS OF ORE WERE DISCOVERED IN AFRICA. THE SCHLESINGER RADIUM COMPANY AND ITS SUCCESSOR, RADIUM COMPANY OF COLORADO, PRODUCED RADIUM ON THE 11TH AND UMATILLA PROPERTIES FROM 1915 TO 1921 AND IS CONSIDERED TO BE THE SOURCE OF CONTAMINATION OF THE ELEVEN 11TH AND UMATILLA PROPERTIES. THERE ARE APPROXIMATELY 15,400 YD3 OF CONTAMINATED MATERIAL OF WHICH 1,000 YD3 LIE UNDER STRUCTURES AND MATERIAL AND 11 FT2 CONSIST OF CONTAMINATED ROOFING FROM THE ROCKY MOUNTAIN RESEARCH BUILDING. THE PRIMARY CONTAMINANTS OF CONCERN ARE RADIUM, RADON GAS AND ITS DECAY PRODUCTS. ALTHOUGH PRESENTLY NO SERIOUS PUBLIC HEALTH RISK FROM RADON DECAY PRODUCTS EXPOSURE EXISTS, A SIGNIFICANT INCREASE IN RISK WOULD OCCUR IF ANY OF THE CONTAMINATED MATERIAL AND DEBRIS WERE TO BE MISUSED OR INADVERTENTLY SPREAD.

THE SELECTED REMEDIAL ACTION FOR THIS SITE INCLUDES; EXCAVATING CONTAMINATED SOIL FROM OPEN AREAS AND FROM UNDER BUILDINGS AND PLACING THIS MATERIAL INTO AN ONSITE TEMPORARY STORAGE FACILITY; DECONTAMINATING THE ROOF IN THE ROCKY MOUNTAIN RESEARCH BUILDING (APPROXIMATELY 11 FT2) AND PLACING THIS MATERIAL IN THE TEMPORARY ONSITE FACILITY; MAINTAINING AN ALREADY EXISTING CONCRETE CAP; MAINTAINING THE TEMPORARY STORAGE FACILITY UNTIL A FACILITY SUITABLE FOR THE PERMANENT DISPOSAL OF SITE WASTES BECOMES AVAILABLE; AND FINAL OFFSITE DISPOSAL OF THE CONTAMINATED MATERIAL (15,400 YD3) TO A PERMANENT DISPOSAL FACILITY. THE ESTIMATED PRESENT WORTH COST FOR THIS REMEDIAL ACTION IS $4,230,300 WITH

5-YEAR PRESENT WORTH O&M OF $194,700.

REMEDY:
THIS RECORD OF DECISION ADDRESSES THE CONTAMINATION PRESENT ON THE 11TH AND UMATILLA PROPERTIES, OPERABLE UNIT II OF THE DENVER RADIUM SITE. THIS IS THE SIXTH OPERABLE UNIT OF THE DENVER RADIUM SITE FOR WHICH EPA HAS SELECTED A REMEDY. EPA IS UNDERTAKING ADDITIONAL FEASIBILITY STUDIES TO EVALUATE REMEDIAL ACTION ALTERNATIVES AT THE OTHER DENVER RADIUM SITE OPERABLE UNITS AND WILL COMPLETE A RECORD OF DECISION OR AN ACTION MEMORANDUM FOR EACH OF THE OPERABLE UNITS FOR WHICH A REMEDY HAS NOT ALREADY BEEN SELECTED.

RADIUM AND ITS ASSOCIATED DECAY PRODUCTS ARE THE HAZARDOUS SUBSTANCES OF PRIMARY CONCERN THAT HAVE BEEN RELEASED AND CONTINUE TO BE RELEASED INTO THE ENVIRONMENT AT THE 11TH AND UMATILLA PROPERTIES. LONG-TERM EXPOSURE TO RADIUM AND ITS DECAY PRODUCTS HAS BEEN SHOWN CONCLUSIVELY TO INCREASE THE RISK OF CONTRACTING LUNG CANCER.

EPA'S PREFERRED REMEDIAL ACTION ALTERNATIVE FOR THE 11TH AND UMATILLA PROPERTIES IS OFFSITE PERMANENT DISPOSAL. HOWEVER, UNTIL A FACILITY SUITABLE FOR PERMANENT DISPOSAL OF THE 11TH AND UMATILLA PROPERTIES MATERIAL IS DESIGNATED AND, IF NECESSARY, ACQUIRED AND DEVELOPED, THIS ALTERNATIVE CANNOT BE IMPLEMENTED. PURSUANT TO CERCLA SECTION 104(C)(3)(C)(II), IT IS THE RESPONSIBILITY OF THE STATE OF COLORADO TO ASSURE THE AVAILABILITY OF A FACILITY FOR OFFSITE DISPOSAL OF THE 11TH AND UMATILLA PROPERTIES MATERIAL. ALTHOUGH BOTH EPA AND STATE OF COLORADO ARE CONTINUING TO SEEK A PERMANENT DISPOSAL SITE, THE STATE ESTIMATES THAT THIS PROCESS COULD TAKE UP TO FIVE YEARS. GIVEN THE LENGTH OF TIME WHICH MAY PASS BEFORE THE STATE ASSURES THE AVAILABILITY OF AN OFFSITE PERMANENT DISPOSAL FACILITY, AND IN ORDER TO PREVENT OR MINIMIZE THE THREAT TO PUBLIC HEALTH AND THE ENVIRONMENT, EPA HAS DETERMINED THAT A REMEDIAL ACTION ALTERNATIVE WHICH INCLUDES TEMPORARY RESPONSE ACTIONS SHOULD BE IMPLEMENTED AT THE 11TH AND UMATILLA PROPERTIES.

THE SELECTED REMEDY FOR THE 11TH AND UMATILLA PROPERTIES IS ONSITE TEMPORARY LAND STORAGE, OFFSITE PERMANENT DISPOSAL. THIS REMEDIAL ACTION ALTERNATIVE WILL ATTAIN A DEGREE OF CLEANUP OF THE HAZARDOUS SUBSTANCES WHICH WILL ASSURE BOTH SHORT-TERM AND LONG-TERM PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. THE PRESENT-WORTH COST OF THIS ALTERNATIVE IS $4,230,300 BASED UPON A TEN-PERCENT INTEREST RATE, A FIVE-YEAR DISCOUNT PERIOD, AND A PERPETUAL MONITORING PERIOD. THIS ALTERNATIVE ENTAILS;

- EXCAVATING THE CONTAMINATED SOIL FROM THE OPEN AREAS AND FROM UNDER THE BUILDINGS ON THE 11TH AND UMATILLA PROPERTIES AND PLACING THIS MATERIAL IN A TEMPORARY LAND-STORAGE FACILITY TO BE CONSTRUCTED ON THE 11TH AND UMATILLA PROPERTIES;
- DECONTAMINATING THE APPROXIMATELY 11 SQUARE FEET OF CONTAMINATED ROOF IN THE ROCKY MOUNTAIN RESEARCH BUILDING AND PLACING THIS MATERIAL IN THE TEMPORARY LAND-STORAGE FACILITY;
- MAINTAINING THE CONCRETE CAP WHICH ALREADY COVERS A PORTION OF THE CONTAMINATED MATERIAL PRESENT ON THE DUWALD STEEL PROPERTY;
- MAINTAINING THE TEMPORARY LAND-STORAGE FACILITY UNTIL A FACILITY SUITABLE FOR THE PERMANENT DISPOSAL OF DENVER RADIUM SITE WASTES BECOMES AVAILABLE; AND
- FINAL REMOVAL OF THE ESTIMATED 15,400 CUBIC YARDS OF CONTAMINATED MATERIAL FROM THE TEMPORARY LAND-STORAGE FACILITY AND FROM UNDER THE CONCRETE CAP TO THE PERMANENT DISPOSAL FACILITY.

REMEDIAL DESIGN FOR THIS OPERABLE UNIT WILL INCLUDE THE SELECTED REMEDY DESCRIBED ABOVE AND EPA'S PREFERRED REMEDIAL ACTION ALTERNATIVE, OFFSITE PERMANENT DISPOSAL. SHOULD THE STATE OF COLORADO

**FULFILL ITS OBLIGATION TO ASSURE THE AVAILABILITY OF A SUITABLE DISPOSAL FACILITY FOR MATERIAL FROM THE DENVER RADIUM SITE BY THE TIME EPA HAS CONCLUDED REMEDIAL DESIGN FOR THE 11TH AND UMATILLA PROPERTIES, EPA MAY IMPLEMENT ITS PREFERRED ALTERNATIVE, OFFSITE PERMANENT DISPOSAL.**

**OPERATION AND MAINTENANCE ACTIVITIES WILL BE REQUIRED TO ENSURE THE EFFECTIVENESS OF THE TEMPORARY RESPONSE ACTIONS. THESE ACTIVITIES INCLUDE SITE INSPECTIONS, ONGOING RADIOLOGICAL MONITORING, AND POSSIBLE MINOR REPAIRS TO THE CONCRETE CAP WHICH IS ALREADY IN PLACE ON THE DUWALD STEEL PROPERTY OR THE TEMPORARY LAND-STORAGE FACILITY TO BE CONSTRUCTED ON THE 11TH AND UMATILLA PROPERTIES. ALSO INCLUDED AS AN OPERATION AND MAINTENANCE ACTIVITY FOR COST ESTIMATING PURPOSES IS A REVIEW OF THE PROPERTIES WHICH, PURSUANT TO SARA SECTION 121(C), MUST BE CONDUCTED NO LESS THAN EVERY FIVE YEARS IF A REMEDIAL ACTION IS SELECTED THAT RESULTS IN ANY HAZARDOUS SUBSTANCES REMAINING ONSITE. SINCE EPA DOES NOT ANTICIPATE THAT ANY HAZARDOUS SUBSTANCES WILL REMAIN ONSITE LONGER THAN FIVE YEARS, THE COST OF THIS REVIEW IS CONSIDERED A CONTINGENCY. THE MAXIMUM TOTAL OF THE DISCOUNTED ANNUAL OPERATION AND MAINTENANCE COSTS OF THESE ACTIVITIES USING A FIVE-YEAR DISCOUNT PERIOD AND A TEN-PERCENT DISCOUNT RATE IS $194,700. THIS OPERATION AND MAINTENANCE COST IS INCLUDED WITH THE PRESENT-WORTH TOTAL ALTERNATIVE COST MENTIONED ABOVE.**

ROD DATE: **09/29/87**
ROD TYPE: **RECORD OF DECISION**
ROD ID: **08002471987ROD017**
**DENVER RADIUM SITE**
**ABSTRACT SITE NAME: DENVER RADIUM SITE**
**ADDRESS: VARIOUS PLACES IN DENVER**
**CITY & STATE: DENVER CO 80204**
**COUNTY: DENVER**

**EPA ID: COD980716955**
**EPA REGION: 08**

**NPL STATUS: CURRENTLY ON THE FINAL NPL**

**ROD TYPE: RECORD OF DECISION**
**ROD ID: EPA/ROD/R08-87/017**
**ROD DATE: 09/29/1987**
**OPERABLE UNIT(S): 03**

**MEDIA: AIR DEBRIS SOIL**

**CONTAMINANT: RADIOACTIVE MATERIALS, RADIUM**

**ABSTRACT:**
**THE DENVER RADIUM SITE, LOCATED IN DENVER, COLORADO, CONSISTS OF MORE THAN 40 CONTAMINATED PROPERTIES THAT HAVE BEEN GROUPED INTO OPERABLE UNITS. THIS IS THE THIRD OPERABLE UNIT OF THE DENVER RADIUM SITE FOR WHICH EPA HAS SELECTED A REMEDY AND IS COMPRISED OF THE 3.4-ACRE 1000 WEST LOUISIANA VACANT LOT AND THE 0.46-ACRE CREATIVE ILLUMINATION PROPERTY, AS WELL AS TWO CONTINUOUS PROPERTIES, THE PACKAGING CORPORATION OF AMERICA AND THE COLORADO SOUTHERN RAILROAD (CSR). A PROPERTY ADJACENT TO THE RAILROAD, TITAN LABELS, INC., IS INCLUDED IN ALL DISCUSSIONS OF THE CSR PROPERTY. THE PROPERTIES COVER APPROXIMATELY 11 ACRES IN AN AREA ZONED FOR INDUSTRIAL USE. THE DENVER RADIUM SITE BEGINNINGS MIRROR**

THE UNITED STATES RADIUM PRODUCING INDUSTRY OF THE EARLY 1900S. PRIOR TO 1914, RADIUM-BEARING ORE WAS SHIPPED FROM THE U.S. TO EUROPE WHERE IT WAS REFINED. THE UNITED STATES BUREAU OF MINES ENTERED INTO A COOPERATIVE AGREEMENT WITH A PRIVATE CORPORATION ESTABLISHING THE NATIONAL RADIUM INSTITUTE IN DENVER, WHICH SUCCESSFULLY DEVELOPED AND OPERATED A RADIUM PROCESSING PLANT IN THE UNITED STATES. THE DENVER RADIUM, VANADIUM AND URANIUM INDUSTRY REMAINED STRONG UNTIL THE EARLY 1920S WHEN RICH ORE DEPOSITS WERE DISCOVERED IN WHAT WAS THEN THE BELGIAN CONGO. THE DENVER PRODUCERS WERE UNABLE TO REMAIN ECONOMICALLY COMPETITIVE AND THE INDUSTRY IN DENVER COLLAPSED. IN 1979, EPA NOTED A REFERENCE TO THE NATIONAL RADIUM INSTITUTE IN A 1916 UNITED STATES BUREAU OF MINES REPORT. SUBSEQUENT FIELD RESEARCH REVEALED THE PRESENCE OF 31 RADIOACTIVE SITES IN THE DENVER METROPOLITAN AREA, TWO OF WHICH ARE NOW INCLUDED WITH THE 1000 WEST LOUISIANA PROPERTIES.

IMMEDIATELY AFTER IDENTIFYING THESE PROPERTIES, THE RADIATION CONTROL DIVISION OF THE COLORADO DEPARTMENT OF HEALTH NOTIFIED THE AFFECTED PROPERTY OWNERS OF THE PRESENCE OF RADIOLOGICAL CONTAMINATION ON THEIR PROPERTIES. THE LETTERS REQUESTED THAT NO EXCAVATION OR SOIL MOVEMENT BE UNDERTAKEN WITHOUT FIRST CONTACTING THE DIVISION. AN ESTIMATED 16,000 YD3 OF SOIL AND DEBRIS ARE CONTAMINATED WITH RADIUM AND ITS ASSOCIATED DECAY PRODUCTS.

EPA'S PREFERRED REMEDIAL ACTION FOR THIS SITE IS PERMANENT OFFSITE DISPOSAL. HOWEVER, UNTIL A FACILITY SUITABLE FOR PERMANENT DISPOSAL OF THE 1000 WEST LOUISIANA PROPERTIES MATERIAL IS DESIGNATED AND, IF NECESSARY, ACQUIRED AND DEVELOPED, THIS ALTERNATIVE CANNOT BE IMPLEMENTED. THE STATE OF COLORADO ESTIMATES FACILITY SELECTION TO TAKE UP TO FIVE YEARS TO COMPLETE. THE SELECTED INTERIM REMEDY IS TEMPORARY BUILDING STORAGE ON THE CARD CORPORATION PROPERTY WHICH INCLUDES; CLEANUP OF THE CREATIVE ILLUMINATION PROPERTY WITH STORAGE OF APPROXIMATELY 200 YD3 OF CONTAMINATED MATERIAL; EXCAVATION OF THE CONTAMINATED SOIL REMAINING ON THE 1000 WEST LOUISIANA PROPERTIES WITH CONSOLIDATION AND CAPPING ON THE VACANT LOT AT 1000 WEST LOUISIANA AVENUE; CAP AND STORAGE FACILITY MAINTENANCE UNTIL A SUITABLE PERMANENT OFFSITE FACILITY BECOMES AVAILABLE; AND FINAL REMOVAL OF THE CONTAMINATED MATERIAL FROM BOTH PROPERTIES TO THE PERMANENT DISPOSAL FACILITY. THE ESTIMATED CAPITAL COST FOR THIS REMEDIAL ACTION IS $2,172,800 WITH 5-YEAR PRESENT WORTH O&M OF $305,800.

REMEDY:
THIS RECORD OF DECISION ADDRESSES THE CONTAMINATION PRESENT ON WHAT IS KNOWN AS THE 1000 WEST LOUISIANA PROPERTIES, OPERABLE UNIT III OF THE DENVER RADIUM SITE. THIS IS THE FIFTH OPERABLE UNIT OF THE DENVER RADIUM SITE FOR WHICH EPA HAS SELECTED A REMEDY. EPA IS UNDERTAKING ADDITIONAL FEASIBILITY STUDIES TO EVALUATE REMEDIAL ACTION ALTERNATIVES AT THE OTHER DENVER RADIUM SITE OPERABLE UNITS AND WILL COMPLETE A RECORD OF DECISION OR AN ACTION MEMORANDUM FOR EACH OF THE OPERABLE UNITS FOR WHICH A REMEDY HAS NOT ALREADY BEEN SELECTED.

RADIUM AND ITS ASSOCIATED DECAY PRODUCTS ARE THE HAZARDOUS SUBSTANCES OF PRIMARY CONCERN THAT HAVE BEEN RELEASED AND CONTINUE TO BE RELEASED INTO THE ENVIRONMENT AT THE 1000 WEST LOUISIANA PROPERTIES. LONG-TERM EXPOSURE TO RADIUM AND ITS DECAY PRODUCTS HAVE BEEN SHOWN CONCLUSIVELY TO INCREASE THE RISK OF CONTRACTING LUNG CANCER.

EPA'S PREFERRED REMEDIAL ACTION ALTERNATIVE FOR THE 1000 WEST LOUISIANA PROPERTIES IS OFFSITE PERMANENT DISPOSAL. HOWEVER, UNTIL A FACILITY SUITABLE FOR PERMANENT DISPOSAL OF THE 1000 WEST LOUISIANA PROPERTIES MATERIAL IS DESIGNATED AND, IF NECESSARY, ACQUIRED AND DEVELOPED, THIS ALTERNATIVE CANNOT BE IMPLEMENTED. PURSUANT TO CERCLA SECTION 104(C)(3)(C)(II), IT IS THE RESPONSIBILITY OF THE STATE OF COLORADO TO ASSURE THE AVAILABILITY OF A FACILITY FOR OFFSITE DISPOSAL OF THE 1000 WEST LOUISIANA

PROPERTIES MATERIAL. ALTHOUGH BOTH EPA AND STATE OF COLORADO ARE CONTINUING TO SEEK A PERMANENT DISPOSAL SITE, THE STATE ESTIMATES THAT THIS PROCESS COULD TAKE UP TO FIVE YEARS. GIVEN THE LENGTH OF TIME WHICH MAY PASS BEFORE THE STATE ASSURES THE AVAILABILITY OF AN OFFSITE PERMANENT DISPOSAL FACILITY, AND IN ORDER TO PREVENT OR MINIMIZE THE THREAT TO PUBLIC HEALTH AND THE ENVIRONMENT, EPA HAS DETERMINED THAT A REMEDIAL ACTION ALTERNATIVE WHICH INCLUDES TEMPORARY RESPONSE ACTIONS SHOULD BE IMPLEMENTED AT THE 1000 WEST LOUISIANA PROPERTIES.

THE SELECTED REMEDY FOR THE 1000 WEST LOUISIANA PROPERTIES IS TEMPORARY BUILDING STORAGE ON THE CARD CORPORATION PROPERTY (OPERABLE UNIT X), OFFSITE PERMANENT DISPOSAL. THIS REMEDIAL ACTION ALTERNATIVE WILL ATTAIN A DEGREE OF CLEANUP OF THE HAZARDOUS SUBSTANCES WHICH WILL ASSURE BOTH SHORT-TERM AND LONG-TERM PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. THE PRESENT-WORTH COST OF THIS ALTERNATIVE IS $3,406,100 BASED UPON A TEN-PERCENT INTEREST RATE, A FIVE-YEAR DISCOUNT PERIOD, AND A PERPETUAL MONITORING PERIOD. THIS ALTERNATIVE ENTAILS;

- CLEANUP OF THE CREATIVE ILLUMINATION PROPERTY AND STORAGE OF THE APPROXIMATELY 200 CUBIC YARDS OF CONTAMINATED MATERIAL IN A TEMPORARY STORAGE FACILITY ON THE CARD CORPORATION PROPERTY, OPERABLE UNIT X OF THE DENVER RADIUM SITE;
- EXCAVATING THE CONTAMINATED SOIL REMAINING ON THE 1000 WEST LOUISIANA PROPERTIES AND CONSOLIDATING AND CAPPING THIS MATERIAL ON THE VACANT LOT AT 1000 WEST LOUISIANA AVENUE;
- MAINTAINING THE CAP AT 1000 WEST LOUISIANA AND THE TEMPORARY STORAGE FACILITY AT THE CARD CORPORATION PROPERTY UNTIL A FACILITY SUITABLE FOR PERMANENT DISPOSAL OF DENVER RADIUM SITE WASTES BECOMES AVAILABLE; AND
- FINAL REMOVAL OF THE CONTAMINATED MATERIAL FROM BOTH PROPERTIES TO THE PERMANENT DISPOSAL FACILITY.

REMEDIAL DESIGN FOR THIS OPERABLE UNIT WILL INCLUDE THE SELECTED REMEDY DESCRIBED ABOVE AND EPA'S PREFERRED REMEDIAL ACTION ALTERNATIVE, OFFSITE PERMANENT DISPOSAL. SHOULD THE STATE OF COLORADO FULFILL ITS OBLIGATION TO ASSURE THE AVAILABILITY OF A SUITABLE DISPOSAL FACILITY FOR MATERIAL FROM THE DENVER RADIUM SITE BY THE TIME EPA HAS CONCLUDED REMEDIAL DESIGN FOR THE 1000 WEST LOUISIANA PROPERTIES, EPA MAY IMPLEMENT ITS PREFERRED ALTERNATIVE, OFFSITE PERMANENT DISPOSAL.

OPERATION AND MAINTENANCE ACTIVITIES WILL BE REQUIRED TO ENSURE THE EFFECTIVENESS OF THE TEMPORARY RESPONSE ACTION. THESE ACTIVITIES INCLUDE SITE INSPECTIONS, ONGOING RADIOLOGICAL MONITORING, AND POSSIBLE MINOR REPAIRS TO THE CAP ON THE 1000 WEST LOUISIANA PROPERTIES OR THE TEMPORARY STORAGE FACILITY ON THE CARD CORPORATION PROPERTY. ALSO INCLUDED AS AN OPERATION AND MAINTENANCE ACTIVITY FOR COST ESTIMATING PURPOSES IS A REVIEW OF THE PROPERTIES WHICH, PURSUANT TO SARA SECTION 121(C), MUST BE CONDUCTED NO LESS THAN EVERY FIVE YEARS IF A REMEDIAL ACTION IS SELECTED THAT RESULTS IN ANY HAZARDOUS SUBSTANCES REMAINING ONSITE. SINCE EPA DOES NOT ANTICIPATE THAT ANY HAZARDOUS SUBSTANCES WILL REMAIN ONSITE LONGER THAN FIVE YEARS, THE COST OF THIS REVIEW IS CONSIDERED A CONTINGENCY. THE MAXIMUM TOTAL OF THE DISCOUNTED ANNUAL OPERATION AND MAINTENANCE COSTS OF THESE ACTIVITIES USING A FIVE-YEAR DISCOUNT PERIOD AND A TEN-PERCENT DISCOUNT RATE IS $305,800. THIS OPERATION AND MAINTENANCE COST IS INCLUDED WITH THE PRESENT-WORTH TOTAL ALTERNATIVE COST MENTIONED ABOVE.

ROD DATE: **09/29/87**
ROD TYPE: **RECORD OF DECISION**
ROD ID: **08002471987ROD014**
**DENVER RADIUM SITE**
**ABSTRACT SITE NAME: DENVER RADIUM SITE**
**ADDRESS: VARIOUS PLACES IN DENVER**

# Record of Decision System (RODS)

**CITY & STATE: DENVER CO 80204**
**COUNTY: DENVER**

**EPA ID: COD980716955**
**EPA REGION: 08**

**NPL STATUS: CURRENTLY ON THE FINAL NPL**

**ROD TYPE: RECORD OF DECISION**
**ROD ID: EPA/ROD/R08-87/014**
**ROD DATE: 09/29/1987**
**OPERABLE UNIT(S): 06**

**MEDIA: AIR DEBRIS SOIL**

**CONTAMINANT: ASSOCIATED DECAY PRODUCTS, RADIUM**

**ABSTRACT:**
**THE DENVER RADIUM SITE, LOCATED IN DENVER, COLORADO, CONSISTS OF MORE THAN 40 CONTAMINATED PROPERTIES. THESE PROPERTIES HAVE BEEN GROUPED INTO ELEVEN OPERABLE UNITS. THIS OPERABLE UNIT CONSISTS OF ELEVEN DENVER RADIUM PROPERTIES IN AN INDUSTRIAL USE AREA, WHICH ARE KNOWN COLLECTIVELY AS OPEN SPACE PROPERTIES. THREE OF THE PROPERTIES LIE WITHIN THE DESIGNATED 100-YEAR FLOOD PLAIN. IN 1979 EPA NOTED A REFERENCE TO THE NATIONAL RADIUM INSTITUTE (NRI) IN THE 1916 BUREAU OF MINES REPORT. THIS REFERENCE REVEALED THE PRESENCE OF 31 RADIOACTIVE SITES IN THE DENVER METROPOLITAN AREA. IN 1913 THE NRI WAS ESTABLISHED IN DENVER AS A DOMESTIC SOURCE OF RADIUM WHICH WAS IN HIGH DEMAND AS A WONDER DRUG FOR THE TREATMENT OF CANCER. SUBSEQUENTLY, THE DENVER RADIUM, VANADIUM AND URANIUM INDUSTRY THRIVED UNTIL THE EARLY 1920S WHEN RICH DEPOSITS OF ORE WERE DISCOVERED IN AFRICA. RECORDS INDICATE THAT ONE SOURCE OF CONTAMINATION AT THE OPEN SPACE PROPERTIES RESULTS FROM THE RADIUM, VANADIUM AND URANIUM PROCESSING CONDUCTED BY THE NATIONAL RADIUM CORPORATION, RADIUM COMPANY OF COLORADO, SCHLESINGER RADIUM COMPANY AND ROCKY MOUNTAIN RADIUM PRODUCTS COMPANY. ADDITIONALLY THE ALLIED PROPERTY, A 21.5-ACRE PORTION OF THE OPEN SPACE PROPERTIES SITE, CONTAINS CONTAMINATED FILL BROUGHT IN FROM AN UNKNOWN CONSTRUCTION SITE IN THE EARLY 1960S. THE BRANNAN PROPERTY, A 47.5-ACRE PORTION OF THE SITE, IS SUSPECTED TO CONTAIN RADIOLOGICAL HOSPITAL WASTE. OTHER SOURCES OF RADIOACTIVE MATERIALS PRESENT AT THE SITE HAVE NOT BEEN DETERMINED. ALTHOUGH PRESENTLY NO SERIOUS PUBLIC HEALTH RISK FROM RADON DECAY PRODUCT/EXPOSURE EXISTS, A SIGNIFICANT INCREASE IN RISK COULD OCCUR IF THE CONTAMINATED MATERIALS WERE TO BE MISUSED OR INADVERTENTLY SPREAD.**

**THE SELECTED REMEDIAL ACTION FOR THIS SITE INCLUDES; ONSITE TEMPORARY CONTAINMENT (CAPPING) OF APPROXIMATELY 4,320 FT2 (290 YD3) OF CONTAMINATED MATERIAL FOLLOWED BY OFFSITE PERMANENT DISPOSAL CONSISTING OF CAP REMOVAL, EXCAVATION AND OFFSITE TRANSPORTATION; AND REMOVAL OF APPROXIMATELY 1,020 YD3 OF MATERIAL WITH PLACEMENT IN CONTAINERS AND OFFSITE DISPOSAL AT THE CARD CORPORATION PROPERTY, UNTIL AN OFFSITE PERMANENT DISPOSAL FACILITY BECOMES AVAILABLE. AT THAT TIME, THE TEMPORARY STORAGE FACILITY ON THE CARD CORPORATION PROPERTY WILL BE DECONTAMINATED AND, IF NECESSARY, DISMANTLED AND DISPOSED OF AT AN OFFSITE SOLID WASTE DISPOSAL FACILITY. THE ESTIMATED PRESENT WORTH COST FOR THIS REMEDIAL ACTION IS $955,400, WHICH INCLUDES 5-YEAR O&M.**

**REMEDY:**

**REMEDY IS IN TEXT FIELD WITH SEGMENT MARKER #REM.**
ROD DATE: **06/30/87**
ROD TYPE: **RECORD OF DECISION**
ROD ID: **08002471987ROD012**
**DENVER RADIUM SITE**
**ABSTRACT SITE NAME: DENVER RADIUM SITE**
**ADDRESS: VARIOUS PLACES IN DENVER**
**CITY & STATE: DENVER CO 80204**
**COUNTY: DENVER**

**EPA ID: COD980716955**
**EPA REGION: 08**

**NPL STATUS: CURRENTLY ON THE FINAL NPL**

**ROD TYPE: RECORD OF DECISION**
**ROD ID: EPA/ROD/R08-87/012**
**ROD DATE: 06/30/1987**
**OPERABLE UNIT(S): 10**

**MEDIA: DEBRIS (BUILDING) SEDIMENT SOIL**

**CONTAMINANT: RADIUM**

**ABSTRACT:**
**THE DENVER RADIUM/CARD CORPORATION PROPERTY IS A 17.2-ACRE SITE LOCATED IN DENVER, COLORADO. IN 1979, THE EPA DISCOVERED A REFERENCE TO THE NATIONAL RADIUM INSTITUTE IN A 1916 U.S. BUREAU OF MINES REPORT. SUBSEQUENT FIELD RESEARCH REVEALED THE PRESENCE OF THIRTY-ONE RADIOACTIVE SITES IN THE DENVER METROPOLITAN AREA, ONE OF THESE BEING CARD PROPERTY, THE LOCATION OF THE ORIGINAL PITTSBURGH RADIUM COMPANY PROCESSING FACILITY. THE SITE CONSISTS OF FIVE BUILDINGS AND AN OIL AND WASTE WATER POND AT THE EASTERN BOUNDARY. THERE IS NO SERIOUS PUBLIC HEALTH RISK AT PRESENT FROM RADIUM OR ITS DECAY PRODUCTS, MOST NOTABLE RADION GAS. HOWEVER, THERE IS THE POTENTIAL FOR INCREASED PUBLIC HEALTH RISK IF THE RADIUM CONTAMINATED MATERIALS ARE MISUSED OR INADVERTENTLY SPREAD. CURRENTLY, RADIUM HAS BEEN DETECTED IN THE SOIL, SEDIMENT AND UNDERNEATH THE TRUE TRUSS BUILDING.**

**EPA'S PREFERRED REMEDIAL ACTION FOR THE CARD PROPERTY IS PERMANENT OFFSITE DISPOSAL. HOWEVER, THIS ALTERNATIVE CAN NOT BE IMPLEMENTED UNTIL A SUITABLE OFFSITE FACILITY IS DESIGNATED. IN THE INTERIM, THE SELECTED REMEDY IS TEMPORARY ONSITE BUILDING STORAGE. THIS INCLUDES; EXCAVATION OF APPROXIMATELY 4,000 CUBIC YARDS OF RADIUM-CONTAMINATED SOIL AND SEDIMENT; STORAGE OF THE CONTAMINATED MATERIAL WITHIN REINFORCED SYNTHETIC BAGS PLACED WITHIN THE TRUE TRUSS BUILDING AND WITHIN POSSIBLE ADDITIONS TO THE BUILDING; OPTIONAL STAGING OR STORAGE OF CONTAMINATED MATERIAL FROM SELECTED OTHER DENVER RADIUM SITE PROPERTIES ON THE CARD PROPERTY; FINAL OFFSITE DISPOSAL OF ALL CONTAMINATED MATERIAL TO A FACILITY SUITABLE FOR THE PERMANENT WASTE DISPOSAL; AND DECONTAMINATION AND DISMANTLING OF TRUE TRUSS BUILDING AND ANY ADDITIONS WITH DISPOSAL OF THE MATERIAL IN A SANITARY LANDFILL. THE PRESENT WORTH COST FOR THE SELECTED REMEDY IS $1,148,000 WITH PRESENT WORTH O&M COSTS OF $89,500.**

**REMEDY:**

THIS OPERABLE UNIT OF THE DENVER RADIUM SITE ADDRESSES THE CONTAMINATION PRESENT ON THE CARD CORPORATION PROPERTY ("CARD PROPERTY"). THE HAZARDOUS SUBSTANCES OF PRIMARY CONCERN THAT HAVE BEEN RELEASED AND CONTINUE TO POSE A SIGNIFICANT THREAT OF BEING RELEASED INTO THE ENVIRONMENT ARE RADIUM AND ITS ASSOCIATED DECAY PRODUCTS.

EPA'S PREFERRED REMEDIAL ACTION ALTERNATIVE FOR THE CARD PROPERTY IS PERMANENT OFFSITE DISPOSAL. HOWEVER, UNTIL A FACILITY SUITABLE FOR PERMANENT DISPOSAL OF THE CARD PROPERTY MATERIAL IS DESIGNATED AND, IF NECESSARY, ACQUIRED AND DEVELOPED, THIS ALTERNATIVE CANNOT BE IMPLEMENTED. PURSUANT TO CERCLA SECTION 104(C)(3)(C)(II), IT IS THE RESPONSIBILITY OF THE STATE OF COLORADO TO ASSURE THE AVAILABILITY OF THE DISPOSAL FACILITIES FOR OFFSITE DISPOSAL OF THE CARD PROPERTY MATERIAL. ALTHOUGH BOTH THE EPA AND THE STATE OF COLORADO ARE CONTINUING TO SEEK A PERMANENT DISPOSAL SITE, THE STATE PREDICTS THAT THIS PROCESS COULD TAKE UP TO FIVE YEARS. IN ORDER TO PREVENT OR MINIMIZE THE THREAT TO PUBLIC HEALTH, WELFARE, AND THE ENVIRONMENT, GIVEN THE LENGTH OF TIME UNTIL PERMANENT OFFSITE DISPOSAL OF THE MATERIAL CAN BE IMPLEMENTED, THE EPA DETERMINED THAT A REMEDIAL ACTION ALTERNATIVE WHICH INCLUDES A TEMPORARY RESPONSE ACTION SHOULD BE IMPLEMENTED AT THE CARD PROPERTY.

THE SELECTED REMEDY FOR THE CARD PROPERTY IS TEMPORARY ONSITE BUILDING STORAGE/PERMANENT OFFSITE DISPOSAL. THIS ALTERNATIVE WILL ATTAIN A DEGREE OF CLEANUP OF THE HAZARDOUS SUBSTANCES WHICH WILL ASSURE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. THIS REMEDIAL ACTION ALTERNATIVE ENTAILS;

- EXCAVATION OF APPROXIMATELY 4,000 CUBIC YARDS OF RADIUM-CONTAMINATED SOIL AND SEDIMENT FROM THE CARD PROPERTY;
- STORAGE OF THE CONTAMINATED MATERIAL WITHIN REINFORCED SYNTHETIC BAGS PLACED WITHIN THE TRUE TRUSS BUILDING AND WITHIN POSSIBLE ADDITIONS TO THE BUILDING;
- OPTIONAL STAGING OR STORAGE OF CONTAMINATED MATERIAL FROM SELECTED OTHER DENVER RADIUM SITE PROPERTIES ON THE CARD PROPERTY
- THE TOTAL AMOUNT OF MATERIAL TO BE STAGED OR STORED ON THE CARD PROPERTY NOT TO EXCEED 13,000 CUBIC YARDS INCLUDING THE CONTAMINATED MATERIAL ALREADY PRESENT ON THE CARD PROPERTY;
- FINAL REMOVAL OF ALL CONTAMINATED MATERIAL TO A FACILITY SUITABLE FOR THE PERMANENT DISPOSAL OF DENVER RADIUM SITE WASTES; AND
- DECONTAMINATION AND DISMANTLING OF TRUE TRUSS BUILDING AND ANY ADDITIONS AND DISPOSAL OF THE MATERIAL IN A SANITARY LANDFILL.

THE PRESENT WORTH COST OF THE SELECTED REMEDY IS $1,148,000 ASSUMING A DISCOUNT PERIOD OF FIVE YEARS AND A DISCOUNT RATE OF 10%. THE COST INCLUDES EXCAVATION OF ALL CONTAMINATED MATERIAL, PLACEMENT OF THE MATERIAL IN REINFORCED SYNTHETIC BAGS, PLACEMENT OF THE BAGS IN THE TRUE TRUSS BUILDING, AND MAINTENANCE AND MONITORING OF THE BAGS AND BUILDING FOR 5 YEARS. THE COST ALSO INCLUDES REMOVAL AND TRANSPORTATION OF THE CONTAMINATED MATERIAL TO AN OFFSITE DISPOSAL FACILITY, AS WELL AS DISMANTLING AND DECONTAMINATING THE BUILDING AND TRANSPORTING THE BUILDING MATERIAL TO A SANITARY LANDFILL.

OPERATION AND MAINTENANCE ACTIVITIES WILL BE REQUIRED TO ENSURE THE EFFECTIVENESS OF THE TEMPORARY STORAGE FACILITY. THE MAXIMUM TOTAL OF DISCOUNTED ANNUAL OPERATION AND MAINTENANCE COSTS, USING A DISCOUNT PERIOD OF FIVE YEARS AND A DISCOUNT RATE OF 10%, IS $89,500. OPERATION AND MAINTENANCE ACTIVITIES INCLUDE SITE INSPECTIONS AND POSSIBLE MINOR STRUCTURAL REPAIRS TO THE TEMPORARY STORAGE FACILITY. THESE ACTIVITIES WILL BE CONSIDERED PART OF THE APPROVED REMEDY AND WILL BE ELIGIBLE FOR TRUST FUND MONIES FOR THE ENTIRE PERIOD THAT THE TEMPORARY STORAGE FACILITY IS OPERATIONAL. THE STATE OF COLORADO WILL SHARE RESPONSIBILITY FOR ALL OPERATION AND MAINTENANCE COSTS OF THE TEMPORARY FACILITY

**IN THE SAME MANNER AS OTHER ASPECTS OF REMEDIAL ACTION.**

**THE EPA IS UNDERTAKING ADDITIONAL FEASIBILITY STUDIES TO EVALUATE REMEDIAL ACTION ALTERNATIVES AT THE OTHER DENVER RADIUM SITE OPERABLE UNITS AND WILL COMPLETE A RECORD OF DECISION OR AN ACTION MEMORANDUM FOR EACH OF THE OPERABLE UNITS FOR WHICH A REMEDY HAS NOT ALREADY BEEN SELECTED.**

ROD DATE: **09/30/86**
ROD TYPE: **RECORD OF DECISION**
ROD ID: **08002471986ROD009**
**DENVER RADIUM SITE**
**ABSTRACT SITE NAME: DENVER RADIUM SITE**
**ADDRESS: VARIOUS PLACES IN DENVER**
**CITY & STATE: DENVER CO 80204**
**COUNTY: DENVER**

**EPA ID: COD980716955**
**EPA REGION: 08**

**NPL STATUS: CURRENTLY ON THE FINAL NPL**

**ROD TYPE: RECORD OF DECISION**
**ROD ID: EPA/ROD/R08-86/009**
**ROD DATE: 09/30/1986**
**OPERABLE UNIT(S): 04**

**MEDIA: DEBRIS SOILS**

**CONTAMINANT: RADIUM**

**ABSTRACT:**
**THE DENVER RADIUM/ROBCO SITE ENCOMPASSES BOTH THE ROBINSON BRICK COMPANY FACILITY (ROBCO) AND THE DENVER AND RIO GRANDE WESTERN RAILROAD (DRGWR) RIGHT-OF-WAY IN DENVER, CO. THE ROBCO PROPERTY IS LOCATED ON THE SITE OF THE FORMER NATIONAL RADIUM INSTITUTE (NRI) FACILITY, A PRIVATE CORPORATION OPERATING BETWEEN 1914 AND 1920 WHICH PRODUCED RADIUM UNDER AN AGREEMENT WITH THE U.S. BUREAU OF MINES. IN 1979 THE EPA DISCOVERED A REFERENCE TO THE NRI IN A 1916 U.S. BUREAU OF MINES REPORT. SUBSEQUENT RESEARCH REVEALED THE ROBCO PROPERTY AS ONE OF THIRTY-ONE RADIOACTIVE SITES IN THE DENVER METROPOLITAN AREA. THERE ARE SEVENTEEN BUILDINGS AND SHEDS ON SITE. TWO OF THE BUILDINGS, THE LABORATORY AND OFFICE, ARE ORIGINAL NRI STRUCTURES. THERE IS NO SERIOUS PUBLIC HEALTH RISK AT PRESENT FROM THE RADON GAS AND ITS DECAY PRODUCTS FOUND ONSITE. HOWEVER, SINCE RADIUM HAS A HALF-LIFE OF 1600 YEARS, THERE IS A LONG-TERM POTENTIAL FOR INCREASED PUBLIC HEALTH RISK IF THE RADIUM-CONTAMINATED MATERIALS WERE MISUSED OR INADVERTENTLY SPREAD.**

**THE EPA PREFERRED ALTERNATIVE, FULL REMOVAL AND PERMANENT OFFSITE DISPOSAL, ENTAILS: REMOVAL OF APPROXIMATELY 6400 CUBIC YARDS OF RADIUM CONTAMINATED SOIL FROM THE ROBCO PROPERTY AND APPROXIMATELY 600 CUBIC YARDS OF RADIUM CONTAMINATED SOIL FROM THE DRGWR RIGHT OF WAY; REMOVAL OF APPROXIMATELY 200 CUBIC YARDS OF DEBRIS FROM THE DEMOLITION OF THE RADIOACTIVELY CONTAMINATED LABORATORY AND OFFICE BUILDINGS ON THE ROBCO PROPERTY; AND DISPOSAL OF THE CONTAMINATED SOIL AND DEBRIS AT A FACILITY SUITABLE FOR THE PERMANENT DISPOSAL OF LOW LEVEL RADIOACTIVE WASTE. UNTIL A COST-**

EFFECTIVE SITE SUITABLE FOR PERMANENT DISPOSAL IS SELECTED AND, IF NECESSARY, ACQUIRED AND DEVELOPED, THIS REMEDY CANNOT BE IMPLEMENTED. THEREFORE, THE EPA IS ACTIVELY PURSUING A TEMPORARY OFFSITE STORAGE REMEDY. IF A TEMPORARY OFFSITE FACILITY DOES NOT BECOME AVAILABLE WITHIN A REASONABLE PERIOD OF TIME, IMPLEMENTATION OF A TEMPORARY ONSITE RESPONSE ACTION WILL BE THOROUGHLY EVALUATED. THE ESTIMATED DEFERRED CAPITAL COST FOR THE FULL REMOVAL AND PERMANENT OFFSITE DISPOSAL IS $1,417,700 WITH NO ANNUAL O&M. THE ESTIMATED CAPITAL COSTS FOR THE TEMPORARY REMEDIES ARE $2,019,900 FOR OFFSITE STORAGE AND $1,912,400 FOR ONSITE STORAGE. THESE COSTS INCLUDE FUTURE TRANSPORT COSTS OF THE WASTE MATERIAL TO A PERMANENT STORAGE FACILITY. FOR EITHER TEMPORARY REMEDY, THERE WILL BE AN ESTIMATED ANNUAL O&M COST OF $6,000 WHICH WILL BE INCURRED FOR THREE TO SEVEN YEARS DEPENDING UPON THE TIME NEEDED TO IDENTIFY A PERMANENT STORAGE FACILITY.

REMEDY:
THE EPA PREFERRED ALTERNATIVE FOR ROBCO IS FULL REMOVAL AND PERMANENT OFF-SITE DISPOSAL. THIS ALTERNATIVE ATTAINS OR EXCEEDS THE EPA STANDARDS FOR REMEDIAL ACTION AT INACTIVE URANIUM PROCESSING SITES, 40 CFR PART 192, WHICH HAVE BEEN IDENTIFIED AS THE RELEVANT AND APPROPRIATE FEDERAL PUBLIC HEALTH OR ENVIRONMENTAL REQUIREMENTS FOR THE SITE. BY ATTAINING THESE STANDARDS, THIS ALTERNATIVE EFFECTIVELY MINIMIZES THE RELEASE OF THE RADIOACTIVE SUBSTANCES SO THAT THEY DO NOT MIGRATE TO CAUSE SUBSTANTIAL DANGER TO PRESENT OR FUTURE PUBLIC HEALTH, WELFARE, OR THE ENVIRONMENT (40 CFR SECTION 300.68(A)(1)). FULL REMOVAL AND PERMANENT OFF-SITE DISPOSAL ENTAILS:

- REMOVAL OF APPROXIMATELY 6400 CUBIC YARDS OF RADIUM-CONTAMINATED SOIL FROM THE ROBINSON BRICK COMPANY PROPERTY AND APPROXIMATELY 600 CUBIC YARDS OF RADIUM-CONTAMINATED SOIL FROM THE DENVER & RIO GRANDE WESTERN RAILROAD RIGHT-OF-WAY;
- REMOVAL OF APPROXIMATELY 200 CUBIC YARDS OF DEBRIS FROM THE DEMOLITION OF THE RADIOACTIVELY CONTAMINATED LABORATORY AND OFFICE BUILDINGS ON THE ROBINSON BRICK COMPANY PROPERTY; AND
- DISPOSAL OF THE CONTAMINATED SOIL AND DEBRIS AT A FACILITY SUITABLE FOR THE PERMANENT DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE.

UNTIL A COST-EFFECTIVE SITE SUITABLE FOR THE PERMANENT DISPOSAL OF THE ROBCO LOW-LEVEL RADIOACTIVE WASTE IS SELECTED AND, IF NECESSARY, ACQUIRED AND DEVELOPED, THE FULL REMOVAL AND PERMANENT OFF-SITE DISPOSAL ALTERNATIVE CANNOT BE IMPLEMENTED. PURSUANT TO CERCLA SECTION 104(C)(3)(C)(II), IT IS THE RESPONSIBILITY OF THE STATE OF COLORADO TO ASSURE THE AVAILABILITY OF THE DISPOSAL SITE. THE STATE PREDICTS THAT THIS PROCESS COULD TAKE UP TO SEVEN YEARS. IN ORDER TO PREVENT OR MINIMIZE THE THREAT TO PUBLIC HEALTH, WELFARE, AND THE ENVIRONMENT, GIVEN THE INDEFINITE AMOUNT OF TIME UNTIL FULL REMOVAL AND PERMANENT OFF-SITE DISPOSAL CAN BE IMPLEMENTED, THE EPA DETERMINED THAT A TEMPORARY RESPONSE ACTION SHOULD BE IMPLEMENTED AT THE SITE.

WHILE BOTH THE EPA AND THE STATE OF COLORADO ARE CONTINUING TO SEEK A PERMANENT DISPOSAL SITE, THE EPA IS ACTIVELY PURSUING AN ENVIRONMENTALLY SAFE LOCATION TO CONSOLIDATE AND TEMPORARILY STORE THE DENVER RADIUM SITE WASTE MATERIALS. IF A TEMPORARY OFF-SITE STORAGE FACILITY BECOMES AVAILABLE WITHIN A REASONABLE TIME AFTER THE SIGNING OF THIS ROD AND SUCH ACTION DOES NOT USE STORAGE CAPACITY NEEDED FOR MATERIALS FROM OTHER DENVER RADIUM SITE PROPERTIES THAT POSE A GREATER CURRENT PUBLIC HEALTH THREAT TO SITE OCCUPANTS, THEN THE EPA WILL IMPLEMENT THE TEMPORARY OFF-SITE STORAGE RESPONSE ACTION AT ROBCO. TEMPORARY OFF-SITE STORAGE ENTAILS REMOVAL OF ALL OF THE RADIUM-CONTAMINATED SOIL FROM BOTH PROPERTIES AND THE RADIOACTIVELY CONTAMINATED DEBRIS FROM THE DEMOLITION OF THE LABORATORY AND OFFICE BUILDINGS AND TEMPORARILY STORING THE MATERIAL, APPROXIMATELY 7200 CUBIC YARDS, IN AN OFF-SITE FACILITY.

**IF A TEMPORARY OFF-SITE STORAGE FACILITY DOES NOT BECOME AVAILABLE WITHIN A REASONABLE TIME AFTER THE SIGNING OF THIS ROD OR SUCH ACTION USES STORAGE CAPACITY NEEDED FOR MATERIALS FROM OTHER DENVER RADIUM SITE PROPERTIES THAT POSE A GREATER CURRENT PUBLIC HEALTH THREAT TO SITE OCCUPANTS, THEN THE EPA WILL IMPLEMENT A COST-EFFECTIVE TEMPORARY ON-SITE RESPONSE ACTION AT ROBCO. BEFORE CHOOSING WHICH TEMPORARY ON-SITE RESPONSE ACTION IS MOST APPROPRIATE, THE EPA WILL COMPLETE CONCEPTUAL DESIGNS OF SEVERAL ON-SITE STORAGE OR STABILIZATION OPTIONS.**

**THIS MULTI-SOLUTION APPROACH ALLOWS THE EPA FLEXIBILITY TO CHOOSE AND IMPLEMENT A COST-EFFECTIVE REMEDIAL RESPONSE UNDER CHANGING CIRCUMSTANCES.**

ROD DATE: **03/24/86**
ROD TYPE: **RECORD OF DECISION**
ROD ID: **08002471986ROD004**
**DENVER RADIUM SITE**
**ABSTRACT SITE NAME: DENVER RADIUM SITE**
**ADDRESS: VARIOUS PLACES IN DENVER**
**CITY & STATE: DENVER CO 80204**
**COUNTY: DENVER**

**EPA ID: COD980716955**
**EPA REGION: 08**

**NPL STATUS: CURRENTLY ON THE FINAL NPL**

**ROD TYPE: RECORD OF DECISION**
**ROD ID: EPA/ROD/R08-86/004**
**ROD DATE: 03/24/1986**
**OPERABLE UNIT(S): 07**

**MEDIA: ASPHALT**

**CONTAMINANT: RADIUM**

**ABSTRACT:**
**DENVER RADIUM SITE STREETS IS LOCATED IN DENVER, COLORADO. THIS OPERABLE UNIT IS COMPRISED OF EIGHT STREET SEGMENTS IN THE CHEESMAN PARK AREA AND ONE SEGMENT IN THE UPPER DOWNTOWN AREA. THE NINE CONTAMINATED STREET SEGMENTS ARE OWNED BY THE CITY AND COUNTY OF DENVER AND EXTEND APPROXIMATELY 4.5 MILES THROUGH LARGELY RESIDENTIAL AREAS. THE DENVER RADIUM SITE STREETS CONTAIN A 4- TO 6-INCH LAYER OF RADIUM CONTAMINATED ASPHALT. THE CONTAMINATED LAYER IS UNDERLAIN BY COMPACTED GRAVEL ROAD BASE AND IS USUALLY OVERLAIN BY 4 TO 12 INCHES OF UNCONTAMINATED ASPHALT PAVEMENT. THERE IS AN ESTIMATED 38,500 CUBIC YARDS OF CONTAMINATED MATERIAL COVERING APPROXIMATELY 832,000 SQUARE FEET. RADIOACTIVE CONTAMINATION DOES NOT EXTEND BEYOND THE PAVED RIGHT-OF-WAY OF THE STREETS AND GENERALLY DOES NOT APPEAR TO HAVE MIGRATED INTO THE SOILS BELOW THE CONTAMINATED ASPHALT. RADIUM CONCENTRATIONS AT REPRESENTATIVE LOCATIONS ON THE STREETS RANGE FROM 4 TO 79 PICOCURIES PER GRAM. SURFACE GAMMA RADIATION READINGS GENERALLY FALL BELOW 20 MICROROENTGENS PER HOUR ABOVE BACKGROUND.**

**THE SELECTED REMEDIAL ACTION FOR THIS SITE INCLUDES: LEAVING THE CONTAMINATED MATERIAL IN PLACE;**

IMPROVING INSTITUTIONAL CONTROLS; AND REMOVING ANY CONTAMINATED MATERIAL EXCAVATED DURING ROUTINE MAINTENANCE, REPAIR, OR CONSTRUCTION ACTIVITIES IN THE AFFECTED STREETS TO A FACILITY APPROVED FOR STORAGE OR DISPOSAL OF CONTAMINATED MATERIAL. THE ESTIMATED INITIAL COST OF THE REMEDY IS $30,000. THIS INCLUDES THE COST OF STUDYING AND THEN ESTABLISHING THE INSTITUTIONAL CONTROLS WHICH WOULD MONITOR ALL CONSTRUCTION AND UTILITY WORK FOR THE AFFECTED STREETS. THE ANNUAL OPERATION AND MAINTENANCE COST WILL VARY DEPENDING UPON THE AMOUNT OF MATERIAL EXCAVATED DURING ANY PARTICULAR YEAR.

REMEDY:
THE EPA SELECTED REMEDY COMBINES FEATURES OF EXCAVATION AND DISPOSAL WITH THE MODIFIED NO ACTION ALTERNATIVE. THIS REMEDY ENTAILS:

- LEAVING THE CONTAMINATED MATERIAL IN PLACE; - IMPROVING INSTITUTIONAL CONTROLS SO THAT ALL ROUTINE MAINTENANCE, REPAIR, OR CONSTRUCTION ACTIVITIES IN THE AFFECTED STREETS BY GOVERNMENT AGENCIES, UTILITY COMPANIES, CONTRACTING COMPANIES, AND PRIVATE INDIVIDUALS WILL BE MONITORED, AND
- REMOVING ANY CONTAMINATED MATERIAL EXCAVATED DURING ROUTINE MAINTENANCE, REPAIR, OR CONSTRUCTION ACTIVITIES IN THE AFFECTED STREETS TO A FACILITY APPROVED FOR STORAGE OR DISPOSAL OF CONTAMINATED MATERIAL.

THE EPA MAY SHARE IN THE CAPITAL COSTS OF DESIGNING IMPROVED INSTITUTIONAL CONTROLS TO BE IMPLEMENTED BY THE CITY AND COUNTY OF DENVER. CONSISTENT WITH CERCLA SECTION 104(C)(3), FOR THE STATE OF COLORADO OR THE CITY AND COUNTY OF DENVER WILL BE RESPONSIBLE FOR ASSURING THE PAYMENT OF ALL FUTURE COSTS OF MAINTAINING AND OPERATING THE INSTITUTIONAL CONTROLS, INCLUDING PROPER DISPOSAL OF ANY CONTAMINATED MATERIAL EXCAVATED DURING ROUTINE MAINTENANCE, REPAIR, OR CONSTRUCTION ACTIVITIES IN THE AFFECTED STREETS.

Back to Report Summary

**MAP ID# 80** **Distance from Property: 0.29 mi. (1,531 ft.) S**

## FACILITY INFORMATION

EPA ID#: **COD980716955**
SITE ID#: **0800247**
NAME: **DENVER RADIUM SITE**
ADDRESS: **VARIOUS PLACES IN DENVER**
**DENVER, CO 80204**
COUNTY: **DENVER**
FEDERAL FACILITY: **NO - NOT A FEDERAL FACILITY**
NPL: **CURRENTLY ON THE FINAL NPL**
NON NPL STATUS: **NOT REPORTED**

Below information was gathered from the prior CERCLIS update completed in 10/2013 update:
NON-NPL STATUS DATE: **NOT REPORTED**
PHYSICAL CLASSIFICATION OF SITE / INCIDENT: **MINES/TAILINGS**

## FEDERAL REGISTER INFORMATION

| DATE | VOLUME | PAGE # | ACTION | HRS SCORE |
|---|---|---|---|---|
| **19821230** | **47** | **58476** | **PROPOSED TO THE FINAL NPL** | **44.00000** |
| **19830908** | **48** | **40658** | **PROMULGATED TO THE FINAL NPL** | **44.11000** |

SITE DESCRIPTION

**BECAUSE OF THE ENORMITY AND COMPLEXITY OF THE DENVER RADIUM SITE, EPA DETERMINED THAT RESPONSE ACTIONS UNDERTAKEN IN OPERABLE UNITS WOULD BE COST-EFFECTIVE AND CONSISTENT WITH A PERMANENT REMEDY FOR THE ENTIRE DENVER RADIUM SITE. THUS, THE ORIGINAL DENVER RADIUM SITE PROPERTIES PLUS THE SEVERAL CONTIGUOUS PROPERTIES WHERE CONTAMINATION WAS DISCOVERED SUBSEQUENT TO THE INITIAL LISTING OF THE SITE ON THE INTERIM PRIORITIES LIST WERE DIVIDED INTO ELEVEN OPERABLE UNITS. THE PROPERTIES WERE DIVIDED BASED PRIMARILY UPON SITE CONDITIONS AND PROXIMITY TO OTHER DENVER RADIUM SITE PROPERTIES.**

**OPERABLE UNIT 1:**

**OPERABLE UNIT 1 CONSISTS OF THE FOLLOWING DENVER RADIUM SITE PROPERTIES, ALSO KNOWN COLLECTIVELY AS THE 12TH AND QUIVAS PROPERTIES:**
**- B&C METAL PRODUCTS**
**- ERICKSON MONUMENTS**
**- MATERIALS HANDLING EQUIPMENT COMPANY**
**- RUDD INVESTMENTS**
**- DENVER AND RIO GRANDE WESTERN RAILROAD (DRGRR)**

**THE 12TH AND QUIVAS PROPERTIES ARE LOCATED IN THE PLATTE RIVER VALLEY BUT ARE NOT WITHIN THE DESIGNATED 100-YEAR FLOOD PLAIN. THE PROPERTIES ARE UNDERLAIN BY FILL MATERIAL, ALLUVIUM, AND THE DENVER FORMATION SANDSTONE. DEPTH TO GROUND WATER IS 14 FEET AND DEPTH TO BEDROCK IS 16 FEET. THE TOPOGRAPHY OF THE OF THE SITE IS PREDOMINATELY FLAT, HOWEVER, A NORTH-SOUTH RIDGE OF APPROXIMATELY TEN FEET IN HEIGHT RUNS ALONG THE EASTERN PORTION OF THE SITE. THERE IS NO SURFACE WATER ON THE 12TH AND QUIVAS PROPERTIES; HOWEVER, OCCUPANTS OF SOME OF THE PROPERTIES REPORT THAT STORM WATER DRAINAGE IN THE AREA CAN BE A PROBLEM AT TIMES. THE CLIMATE OF THE AREA IS TYPIFIED BY LOW ANNUAL PRECIPITATION, AVERAGING ABOUT 14 INCHES PER YEAR.**

**THE 12TH AND QUIVAS PROPERTIES ARE LOCATED IN AN AREA OF DENVER CURRENTLY ZONED 1-1 FOR INDUSTRIAL USE.**

THE PROPERTIES COVER APPROXIMATELY 8.1 ACRES AND ARE BOUNDED ON THE EAST BY QUIVAS STREET, ON THE NORTH BY WEST 13TH AVENUE, ON THE WEST BY SHOSHONE STREET, AND ON THE SOUTH BY WEST 12TH AVENUE. THERE ARE BURIED MUNICIPAL UTILITIES WITHIN THESE BOUNDARIES.

B &C METAL PRODUCTS IS LOCATED AT 1623 WEST 12TH AVENUE. THE PROPERTY IS SPARSELY VEGETATED WITH WEEDS AND TREES. THE ONLY STRUCTURES ON THE PROPERTY ARE A TWO-STORY STONE AND BRICK BUILDING WITH A BASEMENT AND A STORAGE SHED. THE BUILDING IS OCCUPIED BY 12 PEOPLE APPROXIMATELY 40 HOURS PER WEEK. THE BUILDING COVERS 20,700 SQUARE FEET OF THE 33,100-SQUARE-FOOT LOT OWNED BY B&C METAL PRODUCTS.

THE ERICKSON MONUMENTS PROPERTY, LOCATED AT 1241 QUIVAS STREET, COVERS APPROXIMATELY 29,800 SQUARE FEET. A RAILROAD SPUR CUTS DIAGONALLY ACROSS THE PROPERTY. SANDBLASTING GRIT AND WASTE GRANITE, MIXED WITH FILL MATERIAL, HAS BEEN REGRADED TO CREATE AN AREA ON THE NORTHERN END OF THE PROPERTY WHICH IS THREE TO FIVE FEET HIGHER IN ELEVATION THAN THE SURROUNDING PROPERTY. SPENT SILICON CARBIDE SANDBLASTING GRIT HAS BEEN SCATTERED OVER THE ENTIRE PROPERTY. BOTH FINISHED AND UNFINISHED MONUMENTS HAVE BEEN PLACED OVER A LARGE PORTION OF THE PROPERTY. THERE ARE TWO CONNECTING, SINGLE-STORY BUILDINGS ON THE PROPERTY. ONE IS MADE OF FRAME AND STEEL AND THE OTHER IS A SMALL BRICK BUILDING. SIX PEOPLE WORK AT THE PROPERTY APPROXIMATELY 40 HOURS PER WEEK.

THE MATERIALS HANDLING PROPERTY IS THE LARGEST OF THE 12TH AND QUIVAS PROPERTIES, OCCUPYING 5.4 ACRES AT 1740 WEST 13TH AVENUE. THE COMPANY EMPLOYS 65 PEOPLE 40 HOURS PER WEEK. THESE PEOPLE WORK IN A SINGLE BRICK AND CONCRETE BUILDING ON THE PROPERTY.

THE RUDD INVESTMENTS PROPERTY IS LOCATED AT 1229 QUIVAS STREET. A BRICK BUILDING ON THE PROPERTY IS OCCUPIED BY 16 TO 18 PEOPLE BETWEEN 40 AND 50 HOURS PER WEEK. THE WEST PART OF THE PROPERTY IS AN ASPHALT-PAVED, FENCED, STORAGE AREA WHICH CONTAINS ONE SHEET-METAL STORAGE SHED.

THE DRGRR PROPERTY IS A ROAD EASEMENT THAT WAS ONCE USED FOR RAILROAD ACCESS. WITH TIME AND DISUSE, THE TRACKS HAVE BECOME COVERED WITH DIRT AND ARE ONLY VISIBLE IN CERTAIN AREAS.

A DETAILED RESPONSIBLE PARTY SEARCH FOR THE ENTIRE DENVER RADIUM SITE HAS BEEN INITIATED. REGARDING THE 12TH AND QUIVAS PROPER TIES, RECORDS SHOW THAT PITTSBURGH RADIUM COMPANY OPERATED A PROCESSING FACILITY AT THIS LOCATION AT THE TIME OF APPARENT DISPOSAL OF ORE PROCESSING WASTES CONTAINING, AMONG OTHER CONTAMINANTS, RADIUM, THE HAZARDOUS SUBSTANCE OF CONCERN. ALTHOUGH EXTENSIVE INVESTIGATION HAS BEEN CONDUCTED, THE RESPONSIBLE PARTY SEARCH HAS YET TO TRACE THE PITTSBURGH RADIUM COMPANY TO A VIABLE, PRESENT-DAY COMPANY. AT THIS POINT, THE RESPONSIBLE PARTY SEARCH HAS NOT REVEALED THAT THE PRESENT OWNERS OF THE 12TH AND QUIVAS PROPERTIES HAVE ANY RECORD OF HAVING BEEN CONNECTED WITH THE ACTIVITIES THAT CAUSED THE SITE TO BE RADIOLOGICALLY CONTAMINATED.

EPA DOES NOT FEEL THAT RESPONSE ACTIONS SHOULD BE DELAYED PENDING FINALIZATION OF THE RESPONSIBLE PARTY SEARCH. UPON FINALIZATION OF THE SEARCH, THE STATUS OF RESPONSIBLE PARTIES WILL BE DETERMINED AND EVALUATED AND, IF APPROPRIATE, EPA WILL FORMALLY NOTIFY THEM OF THE SELECTED REMEDY FOR THE 12TH AND QUIVAS PROPERTIES AND INITIATE NEGOTIATIONS FOR THE IMPLEMENTATION OF THE REMEDY. IF THE RESPONSIBLE PARTIES DO NOT FORMALLY COMMIT TO PERFORMING THE REMEDY IN A TIMELY MANNER, EPA WILL PROCEED WITH A FUND-FINANCED REMEDIAL DESIGN AND REMEDIAL ACTION AND WILL ATTEMPT TO RECOVER EPA'S RESPONSE COSTS FROM THE RESPONSIBLE PARTIES.

A RECORD OF DECISION ADDRESSING OPERABLE UNIT 1 WAS COMPLETED IN SEPTEMBER 2007.

OU 2:

OPERABLE UNIT 2 IS COMPRISED OF THE FOLLOWING DENVER RADIUM SITE PROPERTIES KNOWN COLLECTIVELY AS THE

**11TH AND UMATILLA PROPERTIES:**
**- DUWALD STEEL**
**- ROCKY MOUNTAIN RESEARCH**
**- G & K SERVICES**
**- JENKINS PROPERTY**
**- STAAB BUILDING**
**- AIR CONDITIONING, INC.**
**- JEROME PARK MAINTENANCE YARD**
**- BURLINGTON NORTHERN RAILROAD**
**- FLAME SPRAY, INC.**
**- CAPITAL MANAGEMENT REALITY**
**- ALPHA OMEGA ELECTRONICS**

**THE 11TH AND UMATILLA PROPERTIES ARE BOUNDED ON THE EAST BY THE BURLINGTON NORTHERN RAILROAD, ON THE NORTH BY WEST 11TH AVENUE, ON THE WEST BY YUMA STREET, AND ON THE SOUTH BY WEST 10TH AVENUE. INTERSTATE-25 IS LOCATED APPROXIMAT ELY 75 FEET WEST OF THE WESTERN PORTION OF THE PROPERTY. THE DENVER WATER DEPARTMENT HEADQUARTERS' OFFICES AND FACILITY ARE ADJACENT TO THE SOUTHEAST CORNER OF THE PROPERTIES. THE PROPERTIES COVER APPROXIMATELY 24 ACRES IN AN AREA ZONED I-2 FOR HEAVY INDUSTRIAL USE. THERE ARE SEVERAL BURIED MUNICIPAL UTILITIES WITHIN THE PROPERTY BOUNDARIES.**

**TWO-THIRDS OF THE 11TH AND UMATILLA PROPERTIES ARE LOCATED WITHIN THE DESIGNATED 100-YEAR FLOODPLAIN. THE ENTIRE AREA OF THE 11TH AND UMATILLA PROPERTIES IS WITHIN THE 500-YEAR FLOODPLAIN. THE PROPERTIES ARE UNDERLAIN BY ALLUVIUM AND THE DENVER FORMATION SANDSTONE. THE DEPTH TO GROUND WATER IS GREATER THAN 10 FEET AND DEPTH TO BEDROCK IS APPROXIMATELY 10 TO 30 FEET. THERE IS NO SURFACE WATER ON THE PROPERTIES. THE CLIMATE OF THE AREA IS TYPIFIED BY LOW ANNUAL PRECIPITATION, AVERAGING ABOUT 14 INCHES PER YEAR.**

**THE DUWALD STEEL PROPERTY LOCATED ON THE CORNER OF 11TH AVENUE AND UMATILLA STREET COVERS 10.5 ACRES. THE PROPERTY IS USED AS A COMMERCIAL FACILITY THAT BUYS AND SELLS SCRAP METAL. SCRAP METAL IS STACKED IN PILES AS HIGH AS 40 FEET OVER MUCH OF THE PROPERTY. A PORTION OF THE PROPERTY IS COVERED WITH REINFORCED CONCRETE. THE TOPOGRAPHY IS FAIRLY LEVEL WITH A SLIGHT WESTERLY SLOPE. TWO MAJOR WATER CONDUITS, DENVER WATER DEPARTMENT CONDUIT 12 AND CONDUIT 18, RUN EAST-WEST ACROSS THE CENTER OF THE DUWALD STEEL PROPERTY. BOTH OF THE CONDUITS ARE APPROXIMATELY FIVE FEET DEEP AND CARRY TREATED WATER FOR WATER SUPPLY. THERE IS ANOTHER CONDUIT RUNNING NORTH-SOUTH ON THE EASTERN BOUNDARY OF THE PROPERTY AND A 100-FOOT, DENVER WATER DEPARTMENT RIGHT-OF-WAY LOCATED ON DUWALD STEEL PROPERTY JUST SOUTH OF 12TH AVENUE. THERE IS APPROXIMATELY 0.3 MILE OF RAILROAD TRACK ON THE PROPERTY. THERE ARE SIX PERMANENT STRUCTURES ON THE DUWALD STEEL PROPERTY. THESE INCLUDE FOUR BUILDINGS, AN ALUMINUM SCRAP SMELTER COMPLEX, AND ONE PERMANENT SCRAP METAL CRANE AND SHREDDER COMPLEX. THE NUMBER OF FULL-TIME EMPLOYEES ON THE PREMISES VARIES BETWEEN 35 AND 40.**

**IN 1982, CONTAMINATED SOIL WAS EXCAVATED FROM THE DUWALD STEEL PROPERTY DURING CONSTRUCTION OF AN ADDITION. THE MATERIAL WAS PLACED ALONG THE FENCE IN THE SOUTHWEST CORNER AND THEN REGRADED. DURING REMODELING OF ONE OF THE BUILDINGS ON THE DUWALD STEEL PROPERTY, SUBFLOOR VENTING MEASURES WERE TAKEN AND A VAPOR BARRIER WAS INSTALLED TO PREVENT RADON FROM ENTERING THE BUILDING. THE COLORADO DEPARTMENT OF HEALTH AND EPA JOINTLY PERFORMED OVERSIGHT OF THIS WORK.**

**THE ROCKY MOUNTAIN RESEARCH PROPERTY IS LOCATED AT 1020 YUMA STREET AND COVERS APPROXIMATELY 13,200 SQUARE FEET. THERE IS A 3,160 SQUARE-FOOT MAIN BUILDING AND THREE STORAGE SHEDS LOCATED ON THE PROPERTY. THE MAJORITY OF THE OPEN SPACE IS CONCRETE PAVEMENT. FOUR EMPLOYEES ARE PRESENT ON THE PROPERTY FOR AN ESTIMATED 40 HOURS PER WEEK.**

THE G & K SERVICES PROPERTY COVERS APPROXIMATELY 1.4 ACRES AND IS LOCATED AT 999 VALLEJO STREET. A ONE-STORY BUILDING WITH TWO, TWO-STORY ADDITIONS SITS ON THE PROPERTY.

THE JENKINS PROPERTY AT 2177-2191 WEST 10TH AVENUE COVERS LESS THAN ONE ACRE. A ONE-STORY OFFICE BUILDING HOUSES FOUR FULL-TIME EMPLOYEES 40 HOURS PER WEEK AND TWO EMPLOYEES PART TIME.

THE STAAB PROPERTY IS LOCATED AT 2121-2125 WEST 10TH AVENUE AND COVERS LESS THAN ONE ACRE. APPROXIMATELY NINE PEOPLE WORK 40 HOURS PER WEEK IN A ONE-STORY CINDER BLOCK BUILDING. THE FLOOR OF THE BUILDING IS A SIX-INCH CONCRETE SLAB ABOUT FOUR FEET ABOVE GRADE ON THE WESTERN SIDE OF THE BUILDING AND DECREASING TO ABOUT ONE FOOT ABOVE GRADE ON THE EASTERN SIDE.

LOCATED AT 1001 TEJON STREET IS THE AIR CONDITIONING, INC., PROPERTY WHICH COVERS LESS THAN ONE ACRE. A ONE-STORY BUILDING IS OCCUPIED BY FOUR FULL-TIME WORKERS.

THE JEROME PARK MAINTENANCE YARD AT 2300 WEST 11TH AVENUE COVERS APPROXIMATELY THREE ACRES AND IS OWNED BY THE COLORADO DEPARTMENT OF HIGHWAYS. LOCATED ON THE PROPERTY ARE TWO VEHICLE AND EQUIPMENT STORAGE BUILDINGS AND A SMALL TWO-STORY BUILDING. ON THE SOUTH END OF THE PROPERTY IS A DO ME-SHAPED STRUCTURE WHICH IS USED TO STORE SAND. THERE ARE SEVERAL PILES OF SAND, DIRT, AND GRAVEL SITUATED THROUGHOUT THE PROPERTY. AN ESTIMATED 20 WORKERS ARE ON THE PROPERTY 40 HOURS PER WEEK, EXCEPT DURING STORM CONDITIONS WHEN THE PROPERTY IS OCCUPIED AROUND THE CLOCK.

THE BURLINGTON NORTHERN RAILROAD PROPERTY IS 2.2 ACRES OF ACTIVE RAILROAD. THIS PROPERTY IS BETWEEN 10TH AND 12TH AVENUES TO THE EAST OF THE DUWALD STEEL PROPERTY. A SPUR OF THE RAILROAD EXTENDS ONTO THE DUWALD STEEL PROPERTY.

THE CAPITAL MANAGEMENT REALTY PROPERTY AT 1050 YUMA STREET COVERS LESS THAN ONE ACRE. THE ONLY STRUCTURE ON THE PROPERTY IS AN OFFICE BUILDING WITH A FINISHED GARDEN LEVEL BASEMENT. THE BUILDING IS PRESENTLY UNOCCUPIED.

AT 1010 YUMA STREET IS THE ALPHA OMEGA ELECTRONICS PROPERTY. THIS PROPERTY IS LESS THAN ONE ACRE IN SIZE. A ONE-STORY OFFICE AND A STORAGE BUILDING ARE THE ONLY STRUCTURES ON THE PROPERTY. THE OFFICE HOUSES NINE EMPLOYEES 40 HOURS PER WEEK. MOST OF THE GROUND SURROUNDING THE BUILDINGS IS COVERED WITH CONCRETE WALKWAYS AND AN ASPHALT PAVEMENT.

INITIAL INVESTIGATIONS REGARDING THE 11TH AND UMATILLA PROPERTIES INDICATE THAT THE SCHLESINGER RADIUM COMPANY AND ITS SUCCESSOR, RADIUM COMPANY OF COLORADO, OPERATED A PROCESSING FACILITY AT THIS LOCATION FROM APPROXIMATELY 1915 TO 1921, THE TIME OF APPARENT DISPOSAL OF ORE PROCESSING WASTES CONTAINING, AMONG OTHER CONTAMINANTS, RADIUM, THE HAZARDOUS SUBSTANCE OF CONCERN. THE RESPONSIBLE PARTY SEARCH HAS YET TO TRACE EITHER OF THESE COMPANIES OR ANY ASSOCIATED COMPANIES TO A VIABLE, PRESENT-DAY ENTITY. AT THIS TIME, THE RESPONSIBLE PARTY SEARCH HAS NOT REVEALED THAT THE PRESENT OWNERS OF THE 11TH AND UMATILLA PROPERTIES HAVE ANY RECORD OF HAVING BEEN CONNECTED WITH THE ACTIVITIES THAT CAUSED THE SITE TO BE CONTAMINATED WITH RADIOACTIVITY.

EPA DOES NOT FEEL THAT RESPONSE ACTIONS SHOULD BE DELAYED PENDING FINALIZATION OF THE RESPONSIBLE PARTY SEARCH. IF, UPON FINALIZATION OF THE SEARCH, RESPONSIBLE PARTIES ARE CLEARLY IDENTIFIED, EPA WILL FORMALLY NOTIFY THEM OF THE SELECTED REMEDY FOR THE 11TH AND UMATILLA PROPERTIES AND INITIATE NEGOTIATIONS FOR THE IMPLEMENTATION OF THE REMEDY. IF THE RESPONSIBLE PARTIES DO NOT FORMALLY COMMIT TO PERFORMING THE REMEDY IN A TIMELY MANNER, EPA WILL PROCEED WITH A FUND-FINANCED REMEDIAL DESIGN AND REMEDIAL ACTION AND WILL ATTEMPT TO RECOVER EPA'S RESPONSE COSTS FROM THE RESPONSIBLE PARTIES.

A RECORD OF DECISION ADDRESSING OPERABLE UNIT 2 WAS COMPLETED IN SEPTEMBER 1987.

ADDITIONAL CHARACTERIZATION OF THE RADIOLOGIC CONTAMINATION WAS CONDUCTED DURING THE DESIGN OF THE REMEDY, AND IS DOCUMENTED IN SUPPLEMENTA1 DATA RELEASE FOR OPERABLE UNIT II. THE DISCOVERY OF NON-RADIOLOGIC CONTAMINATION (PRIMARILY LEAD) ON THE DU-WALD PROPERTY PROMPTED MORE DATA GATHERING WHICH IS PRESENTED IN "RADIOLOGIC AND SELECTED METALS ASSESSMENT OF THE DU-WALD STEEL CORPORATION PROPERTY, OU-2".

LEAD, RADIUM AND RADIUM'S ASSOCIATED DECAY PRODUCTS ARE THE PRIMARY CONTAMINANTS OF CONCERN AT THE DU-WALD PROPERTY. THE REMEDIAL INVESTIGATION FOR THE DENVER RADIUM SITE ESTIMATED THAT 15,400 CUBIC YARDS (23,100 TONS) OF RADIUM CONTAMINATED SOILS AND DEBRIS WERE PRESENT ON THE OU II PROPERTIES. ADDITIONAL CHARACTERIZATION DATA GATHERED AFTER THE SIGNING OF THE RECORD OF DECISION (ROD) RESULTED IN THE ESTIMATE BEING REVISED UPWARD TO 80,000 TONS.

AN EXPLANATION OF SIGNIFICANT DIFFERENCES ADDRESSING OU-02 WAS COMPLETED IN SEPTEMBER 1993.

OU 3:

OPERABLE UNIT 3 IS COMPRISED OF THE 1000 WEST LOUISIANA VACANT LOT AND THE CREATIVE ILLUMINATION PROPERTY, AS WELL AS TWO CONTIGUOUS PROPERTIES WHICH ARE THE PACKAGING CORPORATION OF AMERICA (PCA) AND THE COLORADO SOUTHERN RAILROAD (CSRR) PROPERTIES. A PROPERTY ADJACENT TO THE RAILROAD, TITAN LABELS, INC., IS INCLUDED IN ALL DISCUSSIONS OF THE CSRR PROPERTY. THESE PROPERTIES ARE KNOWN COLLECTIVELY AS THE 1000 WEST LOUISIANA PROPERTIES. THE 1000 WEST LOUISIANA PROPERTIES ARE BOUNDED ON THE EAST BY JASON STREET, ON THE NORTH BY MISSISSIPPI AVENUE, ON THE WEST BY LIPAN STREET, AND ON THE SOUTH BY PLATTE RIVER DRIVE. THE PROPERTIES COVER APPROXIMATELY 11 ACRES IN AN AREA ZONED FOR INDUSTRIAL USE. THERE ARE SEVERAL BURIED MUNICIPAL UTILITIES WITHIN THE PROPERTY BOUNDARIES.

THE 1000 WEST LOUISIANA PROPERTIES ARE LOCATED OUTSIDE THE 500-YEAR FLOODPLAIN. THE PROPERTIES ARE UNDERLAIN BY ALLUVIUM AND THE DENVER FORMATION SANDSTONE. THE APPROXIMATE DEPTH TO GROUND WATER IS 15 FEET. A SMALL DRAINAGE DITCH, WHICH RUNS THROUGH AN UNCONTAMINATED AREA, DRAINS EAST TO THE SOUTH PLATTE RIVER. THE CLIMATE OF THE AREA IS TYPIFIED BY LOW ANNUAL PRECIPITATION, AVERAGING ABOUT 14 INCHES PER YEAR.

THE VACANT LOT AT 1000 WEST LOUISIANA COVERS 3.4 ACRES AND IS CURRENTLY OWNED BY TENNECO CORPORATION. THE LOT IS NEARLY FLAT WITH A SLIGHT SLOPE TOWARD JASON STREET. ACCESS TO THE PROPERTY IS RESTRICTED BY A WIRE FENCE. RADIATION WARNING SIGNS ARE POSTED ON THIS FENCE. THE PROPERTY IS COVERED WITH GRASSES, SCRUB GROWTH, AND A FEW SMALL TREES. A CITY OF DENVER ORDINANCE CONCERNING WEED GROWTH CANNOT BE ENFORCED BECAUSE THE CONTAMINATED SOILS SHOULD NOT BE DISTURBED. HISTORICAL AERIAL PHOTOGRAPHS SHOW THAT A FACTORY WAS ONCE LOCATED IN THE AREA OF THE VACANT LOT. THIS FACTORY WAS REPORTED TO HAVE BEEN DESTROYED BY FIRE AND THE REMAINS BULLDOZED INTO THE BASEMENT CAVITY.

CREATIVE ILLUMINATION IS A SMALL COMMERCIAL FACILITY AT 1298 SOUTH KALAMATH STREET. THE PROPERTY COVERS APPROXIMATELY 0.46 ACRE AND CONTAINS A SINGLE PERMANENT STRUCTURE. THE STRUCTURE CONSISTS OF A THREE-STORY BRICK BUILDING WHICH WAS CONSTRUCTED IN 1896 AND CURRENTLY SERVES AS OFFICES AND STORAGE SPACE. A CONCRETE BLOCK ADDITION SERVES AS A WORKSHOP AND SALES SHOWROOM, AND AN ALUMINUM STRUCTURE SERVES AS A WORKSHOP. THE THREE-STORY BRICK BUILDING IS OCCUPIED BY 12 PEOPLE FOR APPROXIMATELY 30 HOURS PER WEEK. MOST OF THE AREA SURROUNDING THE BUILDING IS PAVED. A PORTION OF THE GROUNDS ARE USED FOR EQUIPMENT STORAGE.

PCA, WHICH PRINTS AND FOLDS PAPERBOARD BOXES, IS A SUBSIDIARY OF TENNECO. THE PCA PROPERTY IS A 5.6 ACRE SITE LOCATED AT 1377 SOUTH JASON STREET. EXISTING STRUCTURES INCLUDE A SMALL CHEMICAL STORAGE SHED

AND A MAIN BUILDING THAT HOUSES AN OFFICE AS WELL AS PRODUCTION AND STORAGE AREAS. THE FACTORY PORTION OF THE PCA BUILDING IS OCCUPIED BY 94 EMPLOYEES FOR 40 HOURS PER WEEK, AND THE OFFICE PORTION OF THE PCA BUILDING IS OCCUPIED BY 25 TO 30 EMPLOYEES FOR 40 HOURS PER WEEK. THE NORTHERN AND EASTERN PORTIONS OF THE PROPERTY ARE PAVED WITH ASPHALT AND SERVE AS A PARKING AND DRIVE AREA. A CSRR TRACK SPUR RUNS ALONG THE WEST SIDE OF THE PCA BUILDING. SOME UNDEVELOPED LAND WITHIN THE PROPERTY BOUNDARIES IS LOCATED SOUTH OF THE PLANT. HISTORICAL AERIAL PHOTOGRAPHS REVEAL THAT A POND WAS AT ONE TIME LOCATED ON THE PCA PROPERTY.

THE CSRR PROPERTY IS 1.43 ACRES OF ACTIVE RAILROAD TRACKS NOW OWNED BY BURLINGTON NORTHERN RAILROAD AND LOCATED ADJACENT (WEST) TO THE VACANT LOT AND THE PCA PLANT. TITAN LABELS, INC. OWNS PROPERTY ADJACENT TO THE CSRR PROPERTY.

REGARDING THE 1000 WEST LOUISIANA PROPERTIES, RECORDS INDICATE THAT THE CHEMICAL PRODUCTS COMPANY, WHICH MAY HAVE BEEN A DIVISION OF THE LUDLUM STEEL COMPANY, OPERATED A PROCESSING FACILITY AT THIS LOCATION FROM 1918 TO 1921, THE TIME OF APPARENT DISPOSAL OF ORE PROCESSING WASTES CONTAINING, AMONG OTHER CONTAMINANTS, RADIUM, THE HAZARDOUS SUBSTANCE OF CONCERN. SOURCES ALSO INDICATE THAT THE CHEMICAL PRODUCTS COMPANY MAY HAVE BEEN ASSOCIATED WITH THE ORE PRODUCTS COMPANY. EPA IS ATTEMPTING THROUGH THE RESPONSIBLE PARTY SEARCH TO TRACE THE CHEMICAL PRODUCTS COMPANY OR ANY ASSOCIATED COMPANIES TO A VIABLE, PRESENT-DAY ENTITY. AT THIS TIME, THE RESPONSIBLE PARTY SEARCH HAS NOT REVEALED THAT THE PRESENT OWNERS OF THE 1000 WEST LOUISIANA PROPERTIES HAVE ANY RECORD OF HAVING BEEN CONNECTED WITH THE ACTIVITIES THAT CAUSED THE SITE TO BE RADIOLOGICALLY CONTAMINATED.

EPA DOES NOT FEEL THAT RESPONSE ACTIONS SHOULD BE DELAYED PENDING FINA LIZATION OF THE RESPONSIBLE PARTY SEARCH. UPON FINALIZATION OF THE SEARCH, THE STATUS OF RESPONSIBLE PARTIES WILL BE DETERMINED AND EVALUATED AND, IF APPROPRIATE, EPA WILL FORMALLY NOTIFY THEM OF THE SELECTED REMEDY FOR THE 1000 WEST LOUISIANA PROPERTIES AND INITIATE NEGOTIATIONS FOR THE IMPLEMENTATION OF THE REMEDY. IF THE RESPONSIBLE PARTIES DO NOT FORMALLY COMMIT TO PERFORMING THE REMEDY IN A TIMELY MANNER, EPA WILL PROCEED WITH A FUND-FINANCED REMEDIAL DESIGN AND REMEDIAL ACTION AND WILL ATTEMPT TO RECOVER EPA'S RESPONSE COSTS FROM THE RESPONSIBLE PARTIES.

A RECORD OF DECISION ADDRESSING OPERABLE UNIT 3 WAS COMPLETED IN SEPTEMBER 1987.

ADDITIONAL CHARACTERIZATION OF THE RADIOLOGIC CONTAMINATION WAS CONDUCTED DURING THE DESIGN OF THE REMEDY, AND IS DOCUMENTED IN. SUPPLEMENTAL DATA RELEASES FOR OPERABLE UNIT III BY UNC GEOTECH DATED APRIL 1989 AND MAY 1989.

AN EXPLANATION OF SIGNIFICANT DIFFERENCES ADDRESSING OPERABLE UNIT 3 OF THE DENVER RADIUM SUPERFUND SITE WAS COMPLETED IN DECEMBER 1993.

IN APRIL, 1986, THE DENVER RADIUM SITE REMEDIAL INVESTIGATION, WHICH ADDRESSES ALL ELEVEN OPERABLE UNITS, WAS RELEASED FOR PUBLIC COMMENT. OPERABLE UNIT IV, ROBINSON BRICK COMPANY, AND OPERABLE UNIT V, THE DENVER & RIO GRANDE WESTERN RAILROAD, ARE ADDRESSED TOGETHER IN THE REVISED GROUP IV & V FEASIBILITY STUDY DATED APRIL 18, 1986, AND RELEASED FOR PUBLIC COMMENT IN APRIL, 1986. THE FINAL GROUP IV & V FEASIBILITY STUDY AND ENDANGERMENT ASSESSMENT INCORPORATE RESPONSES TO UPDATED EPA GUIDANCE AND COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD ON THE REVISED GROUP IV & V FEASIBILITY STUDY AND WILL BE RELEASED FOR INFORMATIONAL PURPOSES ONLY ALONG WITH THIS RECORD OF DECISION (ROD) AND THE RESPONSIVENESS SUMMARY.

OVER THE LAST SEVERAL YEARS SINCE THE DISCOVERY OF THE DENVER RADIUM SITE, ROBINSON BRICK COMPANY HAS MADE EFFORTS TOWARDS THE VOLUNTARY CLEANUP OF THEIR PROPERTY. THESE EFFORTS HAVE THUS FAR BEEN UNSUCCESSFUL. IN AN ATTEMPT TO RECOVER THEIR COSTS FOR THESE ACTIONS, AND BASED UPON ROBINSON'S

PREMISE THAT THE U.S. BUREAU OF MINES IS RESPONSIBLE FOR THE CONTAMINATION, THE ROBINSON BRICK COMPANY FILED A CERCLA SECTION 107 COST RECOVERY SUIT AGAINST THE UNITED STATES OF AMERICA ON APRIL 28, 1986, IN THE FEDERAL DISTRICT COURT IN DENVER.

THROUGHOUT THE REMAINDER OF THIS SUMMARY, "ROBCO" WILL BE USED TO DENOTE THE CONTAMINATED AREAS ON BOTH THE ROBINSON BRICK COMPANY AND DENVER & RIO GRANDE WESTERN RAILROAD PROPERTIES.

THE RESPONSIBLE PARTY SEARCH THUS FAR HAS IDENTIFIED ONLY THE U.S. BUREAU OF MINES AS A POTENTIALLY RESPONSIBLE PARTY. THE U.S. BUREAU OF MINES MAY HAVE BEEN AN "OPERATOR" OF THE DENVER PROCESSING PLANT WITHIN THE MEANING OF CERCLA SECTION 107(A). ROBINSON BRICK COMPANY AND DENVER & RIO GRANDE WESTERN RAILROAD COULD BE CONSIDERED RESPONSIBLE PARTIES UNDER CERCLA SECTION 107(A)(1) BY VIRTUE OF THEIR CURRENT OWNERSHIP OF THE CONTAMINATED PROPERTIES. THE RESPONSIBLE PARTY SEARCH WAS DISCONTINUED IN JUNE 1986 WHEN THE TES I CONTRACT EXPIRED. THE EPA PLANS TO RESUME THE SEARCH IN THE FUTURE. HOWEVER, THE EPA DOES NOT SEE THAT REMEDIAL ACTION SHOULD BE DELAYED IN ANTICIPATION OF FINDING OTHER RESPONSIBLE PARTIES. UPON FINALIZATION OF THE RESPONSIBLE PARTY SEARCH, THE EPA INTENDS TO FORMALLY NOTIFY RESPONSIBLE PARTIES WHICH MAY HAVE BEEN IDENTIFIED OF THE REMEDY SELECTED IN THIS ROD AND INITIATE NEGOTIATIONS FOR EITHER THE IMPLEMENTATION OF THE REMEDY OR RECOVERY OF THE EPA'S RESPONSE COSTS. NEGOTIATIONS WILL NOT EXCEED SIXTY DAYS. THEREAFTER, IF THE RESPONSIBLE PARTIES DO NOT FORMALLY COMMIT TO PERFORMING THE REMEDY IN A TIMELY MANNER, THE EPA WILL PROCEED WITH A FUND-FINANCED REMEDIAL DESIGN AND REMEDIAL ACTION.

A ROD ADDRESSING OPERABLE UNIT 4 WAS COMPLETED IN SEPTEMBER 1986.

OU 6:

THE DENVER RADIUM SITE, LOCATED IN DENVER, COLORADO, (POPULATION 509,000) CONSISTS OF MORE THAN 40 CONTAMINATED PROPERTIES. THESE PROPERTIES HAVE BEEN GROUPED INTO OPERABLE UNITS. OPERABLE UNIT VI IS COMPRISED OF T HE FOLLOWING PROPERTIES:
- ALLIED CHEMICAL AND DYE CORPORATION
- BRANNAN SAND AND GRAVEL
- COLORADO AND SOUTHERN RAILROAD
- DENVER WATER DEPARTMENT
- PUBLIC SERVICE COMPANY
- RUBY HILL PARK
- ALLEY BETWEEN MARIPOSA AND LIPAN STREETS

OPERABLE UNIT IX INCLUDES THE INTERNATIONAL HOUSE OF PANCAKES (IHOP) AND LARRY'S TRADING POST AND EAST SIDE AMUSEMENT CENTER (LARRY'S). LARRY'S IS A CONTIGUOUS PROPERTY SOMETIMES REFERRED TO AS CONTIGUOUS PROPERTY NO. 8 (CP NO. 8). OPERABLE UNIT XI CONSISTS OF THE THOMAS REAL ESTATE COMPANY (THOMAS REALTY) PROPERTY. THESE PROPERTIES ARE KNOWN COLLECTIVELY AS THE OPEN SPACE PROPERTIES.

SINCE THE RI WAS INITIATED, OWNERSHIP OF SEVERAL OF THE PROPERTIES HAS CHANGED. THE ALLIED CHEMICAL AND DYE CORPORATION PROPERTY IS CURRENTLY OWNED BY GENERAL CHEMICAL, THE COLORADO AND SOUTHERN RAILROAD PROPERTY IS PRESENTLY OWNED BY BURLINGTON NORTHERN RAILROAD, AND THE THOMAS REALTY PROPERTY IS NOW OWNED BY COMMERCIAL INVESTORS REALTY. FOR THE PURPOSE OF THIS RECORD OF DECISION, HOWEVER, THE ORIGINAL NAMES WILL BE USED.

THE ALLIED CHEMICAL AND DYE COMPANY (ALLIED) PROPERTY COVERS AN AREA OF 21.5 ACRES AND IS LOCATED AT 1271 WEST BAYAUD AVENUE. THE PROPERTY IS BOUND ON THE NORTHEAST BY THE SOUTH PLATTE RIVER, ON THE SOUTHWEST BY A RAILROAD, AND ON THE SOUTH BY WEST BAYAUD AVENUE. THE NORTH END OF THE PROPERTY IS LEASED TO DENVER WOOD PRODUCTS. THE ALLIED PROPERTY IS PRIMARILY OPEN LAND WITH OCCASIONAL TREES,

ROADWAYS, RAILROAD TRACKS, AND PAVED AREAS. THERE ARE APPROXIMATELY TEN STRUCTURES ONSITE AND CURRENTLY NINE EMPLOYEES WORKING 40 HOURS PER WEEK ON THE PROPERTY. THERE ARE NO BURIED MUNICIPAL UTILITIES IN CONTAMINATED AREAS OF THE SITE, ALTHOUGH 13 KILOVOLT OVERHEAD LINES ARE PRESENT ALONG THE NORTHERN AND NORTHWESTERN PERIMETERS OF THE PROPERTY. THE PROPERTY IS ZONED 1-1 FOR INDUSTRIAL USE.

THE BRANNAN SAND AND GRAVEL (BRANNAN) PROPERTY IS A 47.5-ACRE PARCEL THAT LIES BETWEEN CLEAR CREEK AND 61ST AVENUE ABOUT 300 FEET EAST OF FEDER AL BOULEVARD. THE PROPERTY CONTAINS APPROXIMATELY 10 ACRES OF OPEN LAND WHICH BECAME A MUNICIPAL DUMP IN THE EARLY 1960'S. WHEN THE DUMP WAS CLOSED IN 1982, IT CONTAINED 10 TO 15 FEET OF REFUSE AND WAS BEING COVERED WITH CONSTRUCTION DEBRIS. THE BRANNAN PROPERTY IS CURRENTLY ZONED 1-1 FOR INDUSTRIAL USE. THERE ARE NO BURIED MUNICIPAL UTILITIES ON THE PROPERTY.

THE COLORADO AND SOUTHERN RAILROAD (CSRR) PROPERTY IS BOUND TO THE NORTHEAST AND SOUTHWEST BY 16TH STREET AND 15TH STREET, RESPECTIVELY, BY PLATTE RIVER DRIVE TO THE NORTHWEST, AND BY THE SOUTH PLATTE RIVER TO THE SOUTHEAST. A BURIED CONCRETE CONDUIT PARALLELS THE CSRR RIGHT-OF-WAY AND IS APPROXIMATELY 50 FEET FROM THE RIVER BANK. NO OTHER BURIED MUNICIPAL UTILITIES HAVE BEEN IDENTIFIED ON THE PROPERTY. THE RAILROAD TRACKS ON THE PROPERTY ARE NOT CURRENTLY IN USE, ALTHOUGH BOTH THE TRACKS AND THE RIGHT-OF-WAY ARE MAINTAINED. THE CSRR PROPERTY IS ZONED 1-1 FOR INDUSTRIAL USE.

THE DENVER WATER DEPARTMENT (DWD) OWNS A 0.1-ACRE LOT NEAR THE CORNER OF YUMA COURT AND 12TH AVENUE. THIS LOT IS PAVED AND IS PRESENTLY USED AS A PARKING LOT FOR NEIGHBORING BUSINESSES. THE EAST END OF THE LOT IS BORDERED BY A PAVED ALLEY AND THE WEST END BY YUMA STREET. A 54-INCH CONCRETE WATER MAIN TENDING ROUGHLY EAST-WEST BISECTS THE LOT. THE LOT IS CURRENTLY ZONED 1-1 FOR INDUSTRIAL USE.

THE PUBLIC SERVICE COMPANY OF COLORADO (PSCO) OWNS A VACANT LOT ADJACENT TO ITS SOUTH SUBSTATION AT SOUTH PECOS STREET AND WEST ARIZONA AVENUE. A RESIDENTIAL AREA LIES TO THE WEST OF THE LOT ON SOUTH PECOS STREET. SURFACE DRAINAGE ON THE PROPERTY RUNS FROM TOPOGRAPHIC HIGHS ALONG THE NORTH AND SOUTH BOUNDARIES TOWARDS THE CENTER OF THE LOT WHERE A LARGE EAST-WEST TENDING GULLY IS LOCATED. THE PROPERTY IS ZONED 1-1 FOR INDUSTRIAL USE AND SEVERAL FOUR-INCH WATER MAINS ARE BURIED ON THE PROPERTY. SEVERAL OVERHEAD 13 KILOVOLT TRANSMISSION LINES CROSS THE WESTERN PORTION OF THE PROPERTY.

RUBY HILL PARK IS AN ACTIVE CITY PARK BOUND BY WEST JEWEL L AVENUE, SOUTH PECOS STREET, WEST FLORIDA AVENUE, AND SOUTH PLATTE RIVER DRIVE. THE PARK COVERS AN AREA OF APPROXIMATELY 90 ACRES AND IS BORDERED BY A RESIDENTIAL AREA ON THE SOUTH PECOS STREET SIDE. THE PARK IS CHARACTERIZED BY ROLLING, OPEN TERRAIN WITH THE ONLY SIGNIFICANT STRUCTURE BEING A ONE-STORY MAINTENANCE BUILDING. THERE ARE FOUR BASEBALL FIELDS ON THE PROPERTY AS WELL AS A NETWORK OF PAVED ROADWAYS AND PARKING AREAS. THERE ARE NO BURIED UTILITY LINES IN THE PARK.

THE ALLEY BETWEEN MARIPOSA AND LIPAN STREETS EXTENDS FROM 5TH AVENUE TO 6TH AVENUE AND UNDERNEATH THE 6TH AVENUE OVERPASS. A METAL SCRAP STORAGE YARD LIES TO THE EAST OF THE ALLEY, WHILE AN AUTOMOBILE SALVAGE OPERATION AND A STOVE PRODUCTS COMPANY ARE SITUATED TO THE WEST. A ONE-STORY BRICK APARTMENT BUILDING IS LOCATED AT THE NORTHEAST CORNER OF THE INTERSECTION OF THE ALLEY AND THE 6TH AVENUE RIGHT-OF-WAY. THE APARTMENTS ARE UNOCCUPIED EXCEPT FOR ONE UNIT. THERE ARE BURIED MUNICIPAL UTILITIES IN THE ALLEY.

THE IHOP PROPERTY IS LOCATED AT 2001 EAST COIFAX AVENUE. THE SITE COVERS 0.38 ACRE AND CONSISTS OF A RESTAURANT AND A PAVED PARKING LOT. THE PROPERTY IS BOUND ON THE SOUTH BY EAST COIFAX AVENUE, ON THE NORTH BY RESIDENCES, ON THE WEST BY RACE STREET, AND ON THE EAST BY LARRY'S. THE IHOP RESTAURANT IS A TWO-STORY BUILDING THAT OPERATES 24 HOURS A DAY. THE RESTAURANT EMPLOYS APPROXIMATELY 15 PEOPLE WHO ARE DIVIDED INTO THREE WORK SHIFTS. BURIED WATER LINES ARE PRESENT ON THE IHOP PROPERTY AND THE PROPERTY IS ZONED B-4 FOR GENERAL BUSINESS USE. LARRY'S, WHICH SHARES A DRIVEWAY AND PARKING LOT WITH

IHOP, IS A SINGLE-STORY STRUCTURE WHICH HOUSES AN ARCADE, POOL HALL, SNACK BAR, AND A USED CLOTHING STORE. THE NUMBER OF OCCUPANTS OF THIS BUILDING VARIES.

THE THOMAS REALTY PROPERTY IS A TRIANGULAR SHAPED, 1.25-ACRE LOT LOCATED AT 1285-1295 SOUTH SANTA FE DRIVE. THE PROPERTY IS BORDERED BY SOUTH PLATTE RIVER DRIVE ON THE NORTHWEST, BY SOUTH SANTA FE DRIVE ON THE EAST, AND BY DESKS, INC., A C OMMERCIAL ESTABLISHMENT ON THE SOUTH. A TWO-STORY, BUILDING IS SITUATED ON THE SOUTHERN PORTION OF THE THOMAS PROPERTY. THE BUILDING IS CURRENTLY OCCUPIED BY 13 PEOPLE FOR 40 HOURS PER WEEK. A BILLBOARD IS LOCATED ON THE NORTHERN END OF THE PROPERTY. APPROXIMATELY 30, 30-GALLON DRUMS, FILLED WITH RADIUM-CONTAMINATED SOIL EXCAVATED FROM THE PROPERTY BY THE PREVIOUS OWNER, ARE STORED BENEATH THE BILLBOARD. NATURAL GAS AND WATER LINES ARE BURIED ON THE PROPERTY.

THE MAJORITY OF THE OPEN SPACE PROPERTIES ARE UNDERLAIN BY ALLUVIUM AND THE DENVER FORMATION SANDSTONE. THE APPROXIMATE DEPTH TO GROUND WATER RANGES FROM FIVE FEET AT THE DWD PROPERTY TO 75 FEET AT RUBY HILL PARK. THREE OF THE PROPERTIES, ALLIED, BRANNAN, AND DWD, LIE WITHIN THE DESIGNATED 100-YEAR FLOOD PLAIN. THE CLIMATE OF THE DENVER AREA IS TYPIFIED BY LOW ANNUAL PRECIPITATION AVERAGING ABOUT 14 INCHES PER YEAR.

A RECORD OF DECISION ADDRESSING OPERABLE UNITS VI, IX, AND XI OF THE DENVER RADIUM SITE WAS COMPLETED IN SEPTEMBER 1987.

OU 7

STREET SEGMENTS IN OPERABLE UNIT VII (OU7) CONTAIN A 4 TO 6 INCH LAYER OF RADIUM-CONTAMINATED ASPHALT. THIS CONTAMINATED LAYER IS UNDERLAIN BY COMPACTED GRAVEL ROAD BASE MATERIAL AND IS USUALLY OVERLAIN BY 4 TO 12 INCHES OF UNCONTAMINATED ASPHALT PAVEMENT. ESTIMATES INDICATE THAT OPERABLE UNIT VII - STREETS CONTAIN APPROXIMATELY 38,500 CUBIC YARDS OF RADIUM-CONTAMINATED MATERIAL COVERING SOME 832,000 SQUARE FEET. RADIUM CONTAMINATION DOES NOT EXTEND BEYOND THE PAVED RIGHT-OF-WAY OF THE STREETS AND DOES NOT APPEAR TO HAVE MIGRATED INTO THE SOILS BELOW THE CONTAMINATED ASPHALT.

THE ROD SIGNED IN MARCH 1986, CALLED FOR RADIUM-CONTAMINATED MATERIAL IN THE STREETS TO BE LEFT IN PLACE WITH THE EXCEPTION OF MATERIAL EXCAVATED DURING ROUTINE MAINTENANCE, REPAIR OR OTHER CONSTRUCTION ACTIVITIES. SUCH MATERIAL WAS TO BE REMOVED TO AN OFFSITE REPOSITORY APPROVED FOR STORAGE OR DISPOSAL OF RADIUM-CONTAMINATED MATERIAL.

AN EXPLANATION OF SIGNIFICANT DIFFERENCES ADDRESSI NG OU7 AT THE DENVER RADIUM SITE WAS COMPLETED IN SEPTEMBER 1992.

OU 8:

THE SHATTUCK CHEMICAL SITE, OPERABLE UNIT (OU) 8 OF THE DENVER RADIUM SUPERFUND SITE, IS LOCATED APPROXIMATELY 6 MILES SOUTHWEST OF DOWNTOWN DENVER, COLORADO. THE PROPERTY WAS THE LOCATION OF THE S.W. SHATTUCK CHEMICAL COMPANY, INC., WHICH PROCESSED A VARIETY OF RADIOACTIVE MATERIALS FROM 1917 TO 1984. MINERAL ORES PROCESSED INCLUDED TUNGSTEN AND CARNOTITE ORES, RADIUM SLIMES, MOLYBDENUM ORES AND DEPLETED URANIUM. A SUMMARY OF THE PROCESSING HISTORY IS PROVIDED BELOW.
- 1920'S - MOLYBDENUM ORE PROCESSING
- 1930'S - RADIUM SLIME PROCESSING
- 1940'S - URANIUM AND MOLYBDENUM PROCESSING
- 1950'S - URANIUM PROCESSING
- 1960'S - MOLYBDENUM PROCESSING
- 1970'S AND 1980'S - URANIUM, MOLYBDENUM, AND RHENIUM PROCESSING

MANY OF THE PROCESSED ORE RESIDUES REMAINED ON-SITE AND BECAME INTERMIXED WITH SITE SOILS. ADDITIONALLY, A DETENTION POND TO HOLD MOLYBDENUM SLIME WASTES WAS LOCATED AT THE NORTHERN END OF THE PROPERTY. PROCESSING OPERATIONS RESULTED IN CONTAMINATION OF THE SITE WITH RADIOACTIVE ELEMENTS, INCLUDING RADIUM (RA) -226, THORIUM (TH) -230, VARIOUS URANIUM ISOTOPES, AND NON-RADIOACTIVE METALS SUCH AS LEAD, ARSENIC, AND SELENIUM. THE PROPERTY IS ZONED FOR MIXED RESIDENTIAL, COMMERCIAL, AND LIGHT INDUSTRIAL USE. RESIDENTIAL AREAS ARE LOCATED ONE BLOCK SOUTH, ONE BLOCK EAST, AND APPROXIMATELY 1/2 MILE TO THE WEST. THE SITE IS DIRECTLY EAST OF AN ACTIVE BURLINGTON NORTHERN SANTA FE (BNSF) RAIL SPUR AND RTD MASS TRANSIT RAIL LINES. THE TOPOGRAPHY OF THE SURROUNDING AREA IS RELATIVELY FLAT. THE AREA GENERALLY SLOPES TOWARD THE NORTH AND WEST. THE SITE IS LOCATED WITHIN THE DRAINAGE BASIN OF THE SOUTH PLATTE RIVER, WHICH IS LOCATED APPROXIMATELY 3000 FEET TO THE WEST. A SHALLOW UNCONFINED AQUIFER EXISTS BELOW THE SITE, PERCHED ON BEDROCK, AND MERGES WITH THE ALLUVIAL AQUIFER BENEATH THE FLOODPLAIN OF THE SOUTH PLATTE RIVER. GROUNDWATER IN THE AREA IS NOT USED AS A DRINKING WATER SOURCE.

IN 1988, THE STATE CONDUCTED A REMEDIAL INVESTIGATION (RI) AT SHATTUCK. FURTHER STUDY OF THE SITE WAS COMPLETED IN 1991. THOSE STUDIES FOUND THAT RADIOLOGICAL CONTAMINATION WAS PRESENT IN SITE SOILS OVER AN AREA OF APPROXIMATELY 230,000 SQUARE FEET. THE CONTAMINATION WAS FOUND TO EXTEND FROM GROUND SURFACE TO DEPTHS OVER 14.5 FEET (FT) BELOW THE SURFACE. ESTIMATED VOLUME OF CONTAMINATED SOIL AT THE SITE WAS 38,500 CUBIC YARDS. BASED ON THOSE INVESTIGATIONS, A REMEDY WAS SELECTED IN A RECORD OF DECISION (ROD) IN JANUARY 1992. THIS REMEDY STIPULATED THAT ALL BUILDINGS AND FACILITIES BE DEMOLISHED AND DISPOSED OF OFF-SITE. ADDITIONALLY, CONTAMINATED SOILS WERE TO BE STABILIZED AND SOLIDIFIED ON-SITE. INSTITUTIONAL CONTROLS (ICS), MAINTENANCE, AND MONITORING WERE ALSO USED TO SUPPLEMENT THE REMEDY. THE REMEDY WAS LARGELY COMPLETED IN SEPTEMBER 1998 AND CREATED A ROLLER COMPACTED CEMENT/SOIL MONOLITH OF APPROXIMATELY 5 ACRES. GROUNDWATER CONTAMINATION PRESENT BENEATH THE SITE WAS TO BE ADDRESSED BY NATURAL ATTENUATION.

IN DECEMBER 1983, EPA BEGAN A REMEDIAL INVESTIGATION TO DETERMINE THE NATURE AND EXTENT OF THE CONTAMINATION PRESENT ON THOSE PROPERTIES WHICH THE STATE DID NOT PREVIOUSLY STUDY, AS WELL AS SEVERAL ADDITIONAL PROPERTIES WHERE CONTAMINATION WAS SUSPECTED. WITH THE ADDITIONAL PROPERTIES, THE DENVER RADIUM SITE INCLUDED MORE THAN FORTY PROPERTIES.

BECAUSE OF THE COMPLEXITY OF THE DENVER RADIUM SITE, RESPONSE ACTIONS WERE DIVIDED INTO OPERABLE UNITS BASED PRIMARILY UPON SITE CONDITIONS AND LOCATION. THE SITE WAS GROUPED INTO ELEVEN OPERABLE UNITS; THE PROPERTY LOCATED AT 1805 SOUTH BANNOCK STREET BEING OPERABLE UNIT VIII. IN APRIL 1986, EPA PUBLISHED THE DENVER RADIUM SITE REMEDIAL INVESTIGATION (RI) REPORT WHICH ADDRESSED ALL ELEVEN OPERABLE UNITS.

PRIOR TO PROCEEDING WITH THE CLEANUP OF OPERABLE UNIT VIII, THE EPA NOTIFIED POTENTIALLY RESPONSIBLE PARTIES (PRPS) OF THE OPPORTUNITY TO PERFORM A MORE DETAILED REMEDIAL INVESTIGATION AND FEASIBILITY ST UDY. ALTHOUGH NEGOTIATIONS TOOK PLACE WITH THE S.W. SHATTUCK CHEMICAL COMPANY, INC., NO POTENTIALLY RESPONSIBLE PARTIES ELECTED TO PERFORM THE STUDIES. UNDER A COOPERATIVE AGREEMENT WITH THE EPA, CDPHE PERFORMED THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY WHICH SUPPORTED THE ORIGINAL ROD.

CDPHE BEGAN THE REMEDIAL INVESTIGATION IN NOVEMBER 1988. SINCE 1979, CDPHE, EPA, AND SHATTUCK HAVE CONDUCTED VARIOUS STUDIES OF THE SITE MEDIA, WHICH HAVE INCLUDED A SUBSTANTIAL NUMBER OF SOIL AND GROUNDWATER SAMPLES. THE REMEDIAL INVESTIGATION STUDIES EVALUATED THE EXISTING DATA AND INCLUDED COLLECTION OF ADDITIONAL DATA TO CHARACTERIZE THE NATURE AND EXTENT OF THE CONTAMINATION.

THE S.W. SHATTUCK CHEMICAL COMPANY WAS INVITED TO ENTER INTO A CONSENT DECREE WITH THE UNITED STATES TO CONDUCT THE RESPONSE ACTION AND TO REIMBURSE EPA FOR ITS OVERSIGHT COSTS. NEGOTIATIONS WITH SHATTUCK WERE UNSUCCESSFUL, AND A UNILATERAL ADMINISTRATIVE ORDER WAS ISSUED TO THE COMPANY EFFECTIVE AUGUST 31, 1992. LATER, THE UNITED STATES AND SHATTUCK ENTERED INTO A CONSENT DECREE ON

JANUARY 22, 1996, UNDER WHICH THE COMPANY REIMBURSED EPA FOR ITS RESPONSE COSTS THROUGH MARCH 31, 1995.

THE SHATTUCK PROPERTY HAS BEEN THE LOCATION OF SEVERAL MINERAL-PROCESSING OPERATIONS, INCLUDING THE PROCESSING OF TUNGSTEN ORES, CARNOTITE ORES (FOR URANIUM AND VANADIUM), RADIUM SLIMES, MOLYBDENUM ORES, AND DEPLETED URANIUM.

THE DENVER RADIUM SITE (SITE) CONSISTS OF MORE THAN 40 PROPERTIES GROUPED INTO 11 OPERABLE UNITS. THE RECORD OF DECISIONS (RODS) FOR THE OTHER OPERABLE UNITS ADDRESSING RADIOLOGIC CONTAMINATION IDENTIFIED EXCAVATION AND PERMANENT OFFSITE DISPOSAL AS THE PRINCIPAL REMEDY IN EACH CASE, EXCEPT OPERABLE UNIT (OU) VII. OPERABLE UNIT VII INCLUDES SECTIONS OF NINE DENVER STREETS WHERE CONTAMINATED MATERIALS WERE LEFT IN PLACE BASED ON THE LIMITED THREAT THEY POSE TO PUBLIC HEALTH AND THE ENVIRONMENT. THE RODS INCORPORATED VARIOUS COMBINATIONS OF CONSOLIDATION AND TEMPORARY STORAGE UNITS UNTIL A PERMANENT OFFSITE REPOSITORY WOULD BE AVAILABLE. REMEDIAL ACTION AT THESE OPERABLE UNITS HAS NOW BEEN COMPLETED AND SITE-SPECIFIC SUPPLEMENTAL STANDARDS HAVE BEEN DEVELOPED AT SOME OF THESE OPERABLE UNITS WHERE HAZARDOUS SUBSTANCES, POLLUTANTS, OR CONTAMINANTS COULD NOT BE REMOVED WITHOUT UNACCEPTABLE DISTURBANCE TO BURIED INFRASTRUCTURE OR EXISTING BUILDINGS. IN THESE CASES, RADIOACTIVE MATERIALS WERE LEFT BURIED IN SOILS ABOVE LEVELS THAT ALLOW UNLIMITED USE AND UNRESTRICTED EXPOSURE.

A ROD AMENDMENT FOR OPERABLE UNIT 8 OF THE DENVER RADIUM SITE WAS COMPLETED IN JUNE 2000.

THE AMENDED ROD STIPULATED THAT THE MONOLITH MATERIAL BE REMOVED FROM THE SITE ALONG WITH ANY ADDITIONALLY IDENTIFIED CONTAMINANTS IN EXCESS OF CLEANUP LEVELS SPECIFIED IN THE AMENDED ROD.

SINCE WASTE MATERIAL WAS LEFT ON SITE, CERCLA REQUIRES THAT FIVE-YEAR REVIEWS BE CONDUCTED TO DETERMINE WHETHER THE REMEDY REMAINS PROTECTIVE. A FIVE-YEAR REVIEW CONDUCTED IN 1999 IDENTIFIED A NUMBER OF CONCERNS RELATING TO THE LONG-TERM PROTECTIVENESS OF THE MONOLITH AND THE RELIABILITY OF ICS IMPOSED IN THE ORIGINAL ROD. ADDITIONALLY, THE STATE OF COLORADO, THE CITY AND COUNTY OF DENVER, STAKEHOLDERS, AND THE LOCAL COMMUNITY REQUESTED OTHER ALTERNATIVES TO THE EXISTING REMEDY BE CONSIDERED. THE COMBINATION OF TECHNICAL CONCERNS, REQUESTS TO RECONSIDER THE REMEDY, AND PRESSURE FROM THE SURROUNDING COMMUNITY RESULTED IN THE DECISION TO AMEND THE ORIGINAL ROD.

THE ORIGINAL ROD WAS SIGNED IN JANUARY 1992 AND SELECTED ON-SITE STABILIZATION AND SOLIDIFICATION AS THE REMEDY FOR SOILS AND NATURAL ATTENUATION WITH MONITORING FOR GROUNDWATER. ALSO, ALL BUILDINGS AND FACILITIES ON THE PROPERTY WERE TO BE DEMOLISHED AND DISPOSED OF OFF-SITE. INSTITUTIONAL CONTROLS, MAINTENANCE, AND MONITORING WERE ALSO USED TO SUPPLEMENT THE REMEDY. THE ORIGINAL REMEDIAL ACTION WAS LARGELY COMPLETED IN SEPTEMBER 1998 WITH THE CREATION OF A CEMENT/SOIL MONOLITH ON THE SITE OF APPROXIMATELY 5 ACRES. IN NOVEMBER 1999, EPA C OMPLETED A 5-YEAR REVIEW OF THE REMEDY AND IDENTIFIED CONCERNS RELATED TO THE LONG-TERM EFFECTIVENESS OF THE MONOLITH AND THE RELIABILITY OF THE IC'S IMPOSED IN THE ORIGINAL ROD. ADDITIONALLY, THE STATE, CITY AND COUNTY OF DENVER, STAKEHOLDERS, AND THE LOCAL COMMUNITY REQUESTED OTHER ALTERNATIVES TO THE ON-SITE CONTAINMENT REMEDY. THE COMBINATION OF TECHNICAL CONCERNS, REQUESTS TO RECONSIDER THE ORIGINAL REMEDY, AND THE STATE'S WITHDRAWAL OF SUPPORT RESULTED IN THE EPA AMENDING THE ORIGINAL ROD. THE AMENDED ROD WAS SIGNED ON JUNE 16, 2000 AND EPA SELECTED OFF-SITE REMOVAL TO BEST MEET SUPERFUND'S EVALUATION CRITERIA. THE AMENDED ROD STIPULATED THAT THE MONOLITH AT OU 8 BE REMOVED FROM THE SITE ALONG WITH ANY ADDITIONAL IDENTIFIED CONTAMINANTS IN EXCESS OF CLEANUP LEVELS SPECIFIED IN THE AMENDED ROD.

AS OF SEPTEMBER 2006, THE REMEDY SELECTED IN THE AMENDED ROD HAD BEEN COMPLETED AND ALL WASTE MATERIAL HAD BEEN REMOVED FROM THE PROPERTY. IN FEBRUARY OF 2007 THE PROPERTY BECAME READY FOR REUSE. A SALE IS PENDING WITH A LAND DEVELOPER WHO INTENDS TO DEVELOP THE PROPERTY FOR MIXED RESIDENTIAL AND LIGHT COMMERCIAL USE. THERE ARE CURRENTLY NO RESTRICTIONS ON USE OR INSTITUTIONAL

CONTROLS, OTHER THAN GROUNDWATER, FOR THE PROPERTY. THE STATE OF COLORADO HAS ASSUMED THE RESPONSIBILITY FOR THE LONG-TERM OPERATIONS AND MAINTENANCE (O&M), INCLUDING THE REQUIRED QUARTERLY GROUNDWATER MONITORING. THE GROUNDWATER SURVEY WORK FOR THE PLUME LEAVING THE SITE HAS BEEN STARTED BY THE STATE, WITH ONE ROUND OF GROUNDWATER MONITORING COMPLETED. THE STATE WILL COMPLETE THREE ADDITIONAL ROUNDS OF SAMPLING TO ESTABLISH A BASELINE FOR THE PLUME.

THE FACILITIES LOCATED ON THE SHATTUCK PROPERTY INCLUDE: SIX PERMANENT BUILDINGS; MISCELLANEOUS STORAGE SHEDS; UNDERGROUND STORAGE FACILITIES; ABOVE GROUND STORAGE TANKS; PROCESS EQUIPMENT AND PIPING; AND ASPHALT AND CONCRETE PAVING. SURFACE WATER ON THE SITE GENERALLY FOLLOWS THE TOPOGRAPHY TOWARD THE NORTHWEST. A RUNOFF CATCHMENT BASIN, WHICH C APTURES A LIMITED AMOUNT OF SURFACE RUNOFF, IS LOCATED ON THE SHATTUCK PROPERTY SOUTH OF BUILDING 6. THE RAIL LINES ARE ELEVATED ABOVE THE SURROUNDING GRADE, IMPEDING THE FLOW OF SURFACE RUNOFF, AND CREATING SOME PONDING DURING RAINFALL.

AN EXPLANATION OF SIGNIFICANT DIFFERENCES ADDRESSING OU 8 WAS COMPLETED IN MARCH 2007.

OPERABLE UNIT (OU) 9 OF THE DENVER RADIUM SITE IS LOCATED IN THE SOUTH-CENTRAL PART OF DENVER, COLORADO AT 500 SOUTH SANTA FE DRIVE, NEAR THE INTERSECTION OF WEST ALAMEDA AVENUE AND INTERSTATE 25. THE 17 ACRE OU, REFERRED TO IN THIS DOCUMENT AS THE "SITE", CONSISTS OF THE ROBINSON BRICK COMPANY (ROBCO) PROPERTY. IT IS BOUNDED ON THE WEST BY A FRONTAGE ROAD ADJACENT TO INTERSTATE 25, ON THE EAST BY THE MAIN NORTH/SOUTH RAIL CORRIDOR OWNED BY THE DENVER & RIO GRANDE WESTERN RAILROAD, AND ON THE SOUTH BY THE U.S. WELDING COMPANY PROPERTY. TO THE NORTHWEST IS A VACANT REGIONAL TRANSPORTATION DISTRICT (RTD) FACILITY.

THE ABANDONED BRICK PLANT AND A FEW SMALL STRUCTURES ARE PRESENTLY STANDING AT THE SITE. AN ASPHALT PARKING LOT IS LOCATED ADJACENT TO THE BRICK PLANT. HOWEVER, THE SITE IS MOSTLY UNDEVELOPED. COMMERCIAL AND INDUSTRIAL LAND USES DOMINATE THE AREA SURROUNDING THE SITE. THE NEAREST RESIDENTIAL POPULATION IS LOCATED SEVERAL BLOCKS EAST OF THE SITE.

THE SITE SLOPES GENTLY TO THE WEST TOWARD THE SOUTH PLATTE RIVER WHICH IS ABOUT 1000 FEET FROM THE ROBINSON BRICK COMPANY PROPERTY BOUNDARY. THE SITE DOES NOT LIE WITHIN A FLOOD PLAIN. GROUND WATER AT THE SITE IS FOUND IN THE ALLUVIUM AT DEPTHS OF 10 TO 20 FEET BELOW GROUND SURFACE. THERE IS NO CURRENT USE OF GROUND WATER AT THE SITE.

INDUSTRIAL ACTIVITY AT THE SITE BEGAN IN 1886 WITH THE CONSTRUCTION OF THE BAILEY SMELTER. THE BAILEY SMELTER APPEARS TO HAVE OPERATED ONLY SPORADICALLY IN THE LATE 1880'S. IN 1890, THE GOLD & SILVER EXTRACTION COMPANY BEGAN A CYANIDE LEACHING OPERATIONS A SITE USING THE MCARTHUR FORREST, CHEMICAL CYANIDE PROCESS. IN 1901, THE BAILEY SMELTER BURNED DO WN. BY 1903, THE COLORADO ZINC COMPANY HAD CONSTRUCTED A MILL ON THE SITE OF THE OLD BAILEY SMELTER. ZINC MILLING OPERATIONS CONTINUED UNTIL ABOUT 1910. FROM 1914 TO 1917, THE U.S. BUREAU OF MINES OPERATED A RADIUM PROCESSING FACILITY (THE NATIONAL RADIUM INSTITUTE) ON SITE. OTHER INDUSTRIAL ACTIVITIES AT THE SITE HAVE INCLUDED MINERALS RECOVERY, MANUFACTURING AND SERVICING OF STORAGE BATTERIES, TREATING AND SACKING OF METALLIC ORE INSULATION, OIL RECLAMATION, AND LAND FILLING. IN 1941, THE ROBINSON BRICK COMPANY ACQUIRED 13.5 ACRES OF THE SITE AND IN 1951 ACQUIRED AN ADDITIONAL 3.5 CONTIGUOUS ACRES AND MANUFACTURED BRICKS ON THE SITE UNTIL 1980. THE ROBINSON BRICK COMPANY IS THE PRESENT OWNER OF THE SITE.

IN 1979, RESEARCH BY EPA LED TO THE REDISCOVERY OF THE FORMER NATIONAL RADIUM INSTITUTE (NRI). BY 1983, THIRTY PROPERTIES, INCLUDING THE ROBCO PROPERTY, WERE FOUND TO HAVE RADIOLOGIC CONTAMINANTS IN THE SOILS AND WERE PLACED ON THE NATIONAL PRIORITIES LIST FOR SUPERFUND CLEANUP. DUE TO THEIR ASSOCIATION WITH THE NRI, THE U.S. BUREAU OF MINES WAS NAMED AS A RESPONSIBLE PARTY FOR THE RADIOLOGIC CONTAMINATION AT OU 9 AND THE BUREAU HAS AGREED, PURSUANT TO A MEMORANDUM OF UNDERSTANDING, TO PAY FOR THE RADIOLOGIC CLEAN UP AT THE SITE. IN MAY 1988, EXCAVATION OF THE RADIOLOGICALLY CONTAMINATED

SOILS AT OU 9 BEGAN. IN SEPTEMBER OF THAT YEAR, DURING THE COURSE OF THE RADIUM CLEANUP, METALS CONTAMINATION WAS DISCOVERED ON SITE. AN INVESTIGATION TO CHARACTERIZE THE NATURE AND EXTENT OF METALS CONTAMINATION WAS CONDUCTED IN 1989 AND 1990. THE INVESTIGATION RESULTED IN A FEASIBILITY STUDY (JULY 1991) OUTLINING A NUMBER OF ALTERNATIVES FOR THE CLEANUP OF APPROXIMATELY 16,540 CUBIC YARDS OF METALS-CONTAMINATED SOILS REMAINING IN PLACE ON THE SITE. THE EXCAVATION OF THE RADIOLOGICALLY CONTAMINATED MATERIALS WAS COMPLETED IN MARCH 1991 AS PART OF OPERABLE UNITS 4 AND 5.

A RECORD OF DECISION (ROD) FOR DENVER RADIUM SITE ADDRESSES SOIL, AS OPERABLE UNIT (OU) 09. THE SITE WAS PLACED ON THE NATIONAL PRIORITIES LIST (NPL) IN 1983 AND A RECORD OF DECISION (ROD) WAS SIGNED IN JANUARY 1992.

OU10:

THIS OPERABLE UNIT OF THE DENVER RADIUM SITE ADDRESSES THE CONTAMINATION PRESENT ON THE CARD CORPORATION PROPERTY ("CARD PROPERTY"). THE HAZARDOUS SUBSTANCES OF PRIMARY CONCERN THAT HAVE BEEN RELEASED AND CONTINUE TO POSE A SIGNIFICANT THREAT OF BEING RELEASED INTO THE ENVIRONMENT ARE RADIUM AND ITS ASSOCIATED DECAY PRODUCTS.

THE EPA IS UNDERTAKING ADDITIONAL FEASIBILITY STUDIES TO EVALUATE REMEDIAL ACTION ALTERNATIVES AT THE OTHER DENVER RADIUM SITE OPERABLE UNITS AND WILL COMPLETE A RECORD OF DECISION OR AN ACTION MEMORANDUM FOR EACH OF THE OPERABLE UNITS FOR WHICH A REMEDY HAS NOT ALREADY BEEN SELECTED.

THE CARD CORPORATION PROPERTY ("CARD PROPERTY") IS A 17.2-ACRE SITE LOCATED AT 1314 WEST EVANS AVENUE. THE SITE IS IN AN AREA OF DENVER ZONED I-2 FOR INDUSTRIAL USE. ITS OWNERSHIP IS CURRENTLY DIVIDED BETWEEN MENTOR CORPORATION, WHICH OWNS 13.7 ACRES, AND CONSOLIDATED FREIGHTWAYS, WHICH OWNS THE REST. MENTOR RENTS ITS PORTION OF THE SITE TO VARIOUS LIGHT MANUFACTURING AND WAREHOUSING COMPANIES. CONSOLIDATED FREIGHTWAYS OPERATES A TRUCKING TERMINAL ON THE SOUTHERN END OF THE PROPERTY. THERE ARE CURRENTLY FIVE BUILDINGS ON THE CARD PROPERTY THE BRICK COMMERCIAL BUILDING, THE OFFICE BUILDING, THE UPL BUILDING, THE TRUE TRUSS BUILDING, AND THE CONSOLIDATED FREIGHTWAYS FACILITY. THERE IS A SMALL OIL AND WASTE WATER POND ON THE EASTERN SIDE OF THE PROPERTY. THE PROPERTY IS CROSSED BY SEVERAL CURRENTLY UNUSED RAIL SPURS.

THE SITE IS BOUNDED ON THE NORTH AND EAST BY COMMERCIAL OFFICES AND SOME LIGHT MANUFACTURING AND STORAGE BUILDINGS. TO THE WEST IS THE COLORADO AND SOUTHERN RAILROAD PROPERTY, AND TO THE SOUTH IS WEST WESLEY AVENUE AND THE ARAPAHOE GENERATING STATION OF THE PUBLIC SERVICE COMPANY OF COLORADO. THE NEAREST RESIDENCES ARE TWO BLOCKS EAST OF THE SITE.

THE CARD PROPERTY IS LOCATED WITHIN THE PLATTE RIVER VALLEY BUT IS NO T WITHIN THE DESIGNATED 100-YEAR FLOOD PLAIN. THE SITE IS UNDERLAIN BY FILL MATERIAL, ALLUVIUM, AND THE DENVER FORMATION SANDSTONE. DEPTH TO BEDROCK IS APPROXIMATELY 10 FEET AND DEPTH TO GROUND WATER IS APPROXIMATELY 20 FEET. THE TOPOGRAPHY OF THE SITE IS PREDOMINANTLY FLAT ALTHOUGH SURFACE RUNOFF TENDS EASTWARD TOWARD A STORM SEWER NEAR THE INTERSECTION OF WEST ILIFF AVENUE AND SOUTH NAVAJO STREET. THERE IS NO SURFACE WATER ON THE SITE OTHER THAN THE SMALL OIL AND WASTE WATER POND MENTIONED EARLIER.

A ROD ADDRESSING THE DENVER RADIUM SITE WAS COMPLETED IN JUNE, 1987.

SITE HISTORY

WHAT IS KNOWN TODAY AS THE DENVER RADIUM SITE HAS ITS ROOTS IN THE ROBUST U.S. RADIUM PRODUCING INDUSTRY OF THE EARLY 1900'S. AT THAT TIME, RADIUM WAS CONSIDERED TO BE A WONDER DRUG, A CURE-ALL FOR EVERY AILMENT FROM THE COMMON COLD TO CANCER. A MERE GRAM OF THE RADIOACTIVE ELEMENT SOLD FOR $325,000.

PRIOR TO 1914, THERE WAS NO U.S. PRODUCTION OF RADIUM. RATHER, RADIUM-BEARING ORE WAS SHIPPED FROM THE U.S. TO EUROPE WHERE IT WAS REFINED. FEARING THAT A EUROPEAN WAR MIGHT STYMIE U.S. IMPORTATION OF RADIUM, THE U.S. BUREAU OF MINES ENTERED INTO A COOPERATIVE AGREEMENT WITH A PRIVATE CORPORATION, THE NATIONAL RADIUM INSTITUTE TO DEVELOP AND OPERATE A RADIUM PROCESSING PLANT IN THE UNITED STATES.

DENVER WAS THE CHOSEN LOCATION FOR THE INSTITUTE DUE TO ITS PROXIMITY TO CARNOTITE, A RADIUM-BEARING ORE OF THE COLORADO PLATEAU. SOON THERE WERE AT LEAST EIGHT OTHER RADIUM PROCESSING OPERATIONS IN DENVER. ONE OF THOSE RADIUM PRODUCERS WAS PITTSBURGH RADIUM COMPANY. USING EQUIPMENT PURCHASED FROM THE INSTITUTE, PITTSBURGH RADIUM COMPANY BEGAN OPERATIONS IN 1920 IN WHAT HAD BEEN THE OVERLAND COTTON MILL BUILDING.

THE DENVER RADIUM INDUSTRY REMAINED STRONG UNTIL AROUND 1920 WHEN EXTREMELY RICH DEPOSITS OF THE RADIUM-BEARING ORE, PITCHBLENDE, BEGAN TO BE DEVELOPED IN THE BELGIAN CONGO. MOST DENVER RADIUM PRODUCERS WERE NOT ABLE TO COMPETE WITH THEIR AFRICAN COUNTERPARTS AND WERE FORCED OUT OF BUSINESS. THE PITTSBURGH RADIUM COMPANY WAS ONE PRODUCER WHICH WAS ABLE TO CONTINUE OPERATIONS BECAUSE, UNLIKE THE OTHER RADIUM PRODUCERS WHO PROCESSED CARNOTITE FOR RADIUM, PITTSBURGH RADIUM COMPANY PROCESSED ROSCOELITE FOR VANADIUM. HOWEVER, PITTSBURGH RADIUM COMPANY, TOO, WAS EVENTUALLY FORCED TO CLOSE. RECORDS SHOW THAT THE COMPANY SOLD THE OVERLAND COTTON MILL BUILDING IN 1924.

SINCE 1924, THE PROPERTY HAS HAD VARIOUS INDUSTRIAL USES INCLUDING WORLD WAR II AND KOREAN WAR MUNITIONS MANUFACTURING, HARDWARE MANUFACTURING, AND FABRICATION OF HEAVY MINING EQUIPMENT. THE PROPERTY BECAME KNOWN AS THE CARD PROPERTY BECAUSE CARD CORPORATION OWNED THE PROPERTY IN 1979, WHEN THE RADIOLOGICAL CONTAMINATION WAS DISCOVERED THERE. THE PROPERTY WILL BE REFERRED TO THROUGHOUT THE REMAINDER OF THIS SUMMARY AS THE CARD PROPERTY.

IN 1979, THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA) DISCOVERED A REFERENCE TO THE NATIONAL RADIUM INSTITUTE IN A 1916 U.S. BUREAU OF MINES REPORT. SUBSEQUENT FIELD RESEARCH REVEALED THE PRESENCE OF THIRTY-ONE RADIOACTIVE SITES IN THE DENVER METROPOLITAN AREA, ONE OF THESE BEING THE CARD PROPERTY, THE LOCATION OF THE ORIGINAL PITTSBURGH RADIUM COMPANY PROCESSING FACILITY. IMMEDIATELY FOLLOWING THESE DISCOVERIES, THE RADIATION CONTROL DIVISION OF THE COLORADO DEPARTMENT OF HEALTH OFFICIALLY NOTIFIED THE AFFECTED PROPERTY OWNERS OF THE PRESENCE OF CONTAMINATION ON THEIR PROPERTIES. THE LETTERS REQUESTED THAT NO EXCAVATION OR SOIL MOVEMENT BE UNDERTAKEN WITHOUT FIRST CONTACTING THE DIVISION.

THE DENVER RADIUM SITE WAS PLACED ON THE INTERIM PRIORITIES LIST IN OCTOBER, 1981, AND FINAL PROMULGATION OF THE NATIONAL PRIORITIES LIST OCCURRED ON SEPTEMBER 8, 1983. THE COLORADO DEPARTMENT OF HEALTH, UNDER A COOPERATIVE AGREEMENT WITH THE EPA, ASSUMED LEAD ACTIVITIES AND INITIATED ENGINEERING ASSESSMENTS OF THE VARIOUS PROPERTIES IN AUGUST, 1981. HOWEVER, MENTOR CORPORATION, OWNER OF THE CARD PROPERTY, DENIED THE STATE ACCESS TO THE SITE.

THE EPA RESUMED FUND-LEAD ACTIVITIES IN JUNE, 1983, BECAUSE THE COLORADO STATE LEGISLATURE FAILED TO APPROPRIATE THE STATE COST SHARE FOR REMEDIAL PLANNING REQUIRED BY EPA POLICY AT THE TIME. IN DECEMBER, 1983, THE EPA DIRECTED ITS CONTRACTOR, CH2M HILL, TO CONDUCT A REMEDIAL INVESTIGATION (RI) OF THE DENVER RADIUM SITE TO DETERMINE THE NATURE AND EXTENT OF THE THREAT PRESENTED BY THE CONTAMINATION AND A FEASIBILITY STUDY (FS) TO EVALUATE PROPOSED REMEDIES. DURING THE RI, MENTOR CORPORATION ALLOWED EPA ACCESS TO THE CARD PROPERTY SO THAT THE EXTENT OF THE CONTAMINATION PRESENT ON THE PR OPERTY COULD BE DETERMINED.

DUE TO THE ENORMITY AND COMPLEXITY OF THE DENVER RADIUM SITE, THE EPA DETERMINED THAT RESPONSE

ACTIONS COULD BE UNDERTAKEN AS OPERABLE UNITS IN A COST-EFFECTIVE MANNER, CONSISTENT WITH A PERMANENT REMEDY FOR THE ENTIRE DENVER RADIUM SITE, AND WOULD DECREASE THE RELEASE, THREAT OF RELEASE, AND PATHWAYS OF EXPOSURE. THUS, THE ORIGINAL DENVER RADIUM SITE PROPERTIES PLUS SEVERAL CONTIGUOUS PROPERTIES WHERE CONTAMINATION WAS DISCOVERED SUBSEQUENT TO THE INITIAL LISTING OF THE SITE ON THE INTERIM PRIORITIES LIST WERE DIVIDED INTO ELEVEN OPERABLE UNITS, THE CARD PROPERTY BEING OPERABLE UNIT X.

IN APRIL, 1986, THE DENVER RADIUM SITE REMEDIAL INVESTIGATION REPORT, WHICH ADDRESSES ALL ELEVEN OPERABLE UNITS, WAS RELEASED TO THE PUBLIC. A DRAFT CARD CORPORATION OPERABLE UNIT X FEASIBILITY STUDY WAS RELEASED FOR PUBLIC REVIEW ON OCTOBER 1, 1986. A SECOND DRAFT CARD CORPORATION OPERABLE UNIT X FEASIBILITY STUDY WAS RELEASED FOR PUBLIC COMMENT ON APRIL 24, 1987. THE SECOND DRAFT REPORT REFLECTED PUBLIC COMMENTS RECEIVED ON THE FIRST DRAFT REPORT AND INCORPORATED NEW REQUIREMENTS MANDATED BY THE PASSAGE OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) IN OCTOBER, 1986. THE FINAL CARD CORPORATION OPERABLE UNIT X FEASIBILITY STUDY WHICH INCORPORATES RESPONSES TO COMMENTS RECEIVED DURING THE BOTH PUBLIC COMMENT PERIODS WILL BE RELEASED ALONG WITH THE RECORD OF DECISION (ROD) FOR THE CARD PROPERTY.
A DETAILED RESPONSIBLE PARTY SEARCH FOR THE ENTIRE DENVER RADIUM SITE HAS BEEN INITIATED. THUS FAR, THE SEARCH HAS NOT IDENTIFIED ANY PARTIES RESPONSIBLE FOR THE CONTAMINATION ON THE CARD PROPERTY. RECORDS SHOW THAT PITTSBURGH RADIUM COMPANY OWNED AND OPERATED THE RADIUM PROCESSING FACILITY AT THE TIME OF DISPOSAL (CIRCA 1920-1924) OF RADIUM, THE HAZARDOUS SUBSTANCE OF CONCERN. ALTHOUGH EXTENSIVE INVESTIGATION HAS BEEN CONDUCTED, THE RESPONSIBLE PARTY SEARCH HAS YET TO TRACE THE CORPORATE HISTORY OF PITTSBURGH RADIUM COMPANY TO A VIABLE, PRESENT-D AY COMPANY.

MENTOR CORPORATION IS A CURRENT OWNER OF A LARGE PORTION OF THE SITE. THE RESPONSIBLE PARTY SEARCH INDICATES THAT MENTOR CORPORATION ACQUIRED THE PROPERTY IN 1977 WITHOUT KNOWLEDGE OF THE CONTAMINATION ON THE SITE. FURTHER, IT DOES NOT APPEAR THAT (1) MENTOR CORPORATION CONDUCTED OR PERMITTED THE GENERATION, TRANSPORTATION, STORAGE, TREATMENT, OR DISPOSAL OF ANY HAZARDOUS SUBSTANCE AT THE CARD PROPERTY OR THAT (2) MENTOR CORPORATION, SINCE BECOMING AWARE OF THE CONTAMINATION ON ITS PROPERTY, CONTRIBUTED TO THE RELEASE OR THREAT OF RELEASE OF A HAZARDOUS SUBSTANCE AT THE FACILITY THROUGH ANY ACTION OR OMISSION.

BASED UPON THESE INITIAL FINDINGS, EPA HAS BEGUN NEGOTIATIONS WITH MENTOR CORPORATION CONCERNING A COVENANT NOT TO SUE FOR POTENTIAL LIABILITY TO THE UNITED STATES, INCLUDING FUTURE LIABILITY, RESULTING FROM THE RELEASE OR THREATENED RELEASE OF THE HAZARDOUS SUBSTANCE TO BE ADDRESSED BY REMEDIAL ACTION AT THE CARD PROPERTY. THE TERMS OF THIS COVENANT NOT TO SUE ARE EMBODIED IN A DRAFT ADMINISTRATIVE ORDER ON CONSENT WHICH IS ATTACHED TO THE ROD. UPON SELECTION OF THE REMEDY AND FINALIZATION OF THE RESPONSIBLE PARTY SEARCH FOR THE CARD PROPERTY, EPA WILL REVISE THE DRAFT ADMINISTRATIVE ORDER TO COMPORT WITH THE ROD AND CURRENT LAWS. IN EXCHANGE FOR THIS COVENANT NOT TO SUE, MENTOR CORPORATION WOULD AGREE TO PROVIDE ACCESS TO ITS PROPERTY TO ENABLE EPA TO UNDERTAKE REMEDIAL ACTION AT THE CARD PROPERTY AND, AT EPA'S DISCRETION, PERMIT EPA TO DELIVER FOR STORAGE AT THE MENTOR PROPERTY RADIUM-CONTAMINATED MATERIALS FROM OTHER PROPERTIES INCLUDED IN THE DENVER RADIUM SITE.

CONSOLIDATED FREIGHTWAYS IS A CURRENT OWNER OF A PORTION OF THE CARD PROPERTY. CONSOLIDATED FREIGHTWAYS BOUGHT ITS PORTION OF THE PROPERTY IN MARCH, 1985, NEARLY TWO YEARS AFTER THE FORMAL LISTING OF THE DENVER RADIUM SITE ON THE NATIONAL PRIORITIES LIST. DURING THE SUMMER OF 1985, THE COMPANY PROCEEDED TO CONSTRUCT A TRUCKING TERMINAL ON THE PROPERTY AND AS A RESULT TWO AREAS OF CONTAMINATION ON THE SITE CAN NO LONGER BE IDENTIFIED.

THE EPA DOES NOT FEEL THAT REMEDIAL ACTION SHOULD BE DELAYED PENDING FINALIZATION OF THE RESPONSIBLE PARTY SEARCH. EPA ANTICIPATES DISCUSSIONS AND NEGOTIATIONS WITH BOTH MENTOR CORPORATION AND

**CONSOLIDATED FREIGHTWAYS.**

**FURTHER, IF UPON FINALIZATION OF THE SEARCH, THE EPA IDENTIFIES ADDITIONAL RESPONSIBLE PARTIES, THE EPA WILL FORMALLY NOTIFY THEM OF THE REMEDY SELECTED IN THE ROD AND INITIATE NEGOTIATIONS FOR THE IMPLEMENTATION OF THE REMEDY. NEGOTIATIONS WILL NOT EXCEED SIXTY DAYS. THEREAFTER, IF THE RESPONSIBLE PARTIES DO NOT FORMALLY COMMIT TO PERFORMING THE REMEDY IN A TIMELY MANNER, THE EPA WILL PROCEED WITH A FUND-FINANCED REMEDIAL DESIGN AND REMEDIAL ACTION AND WILL ATTEMPT TO RECOVER EPA'S RESPONSE COSTS FROM THE RESPONSIBLE PARTIES.**

**A ROD ADDRESSING THE DENVER RADIUM SITE WAS COMPLETED IN JUNE, 1987.**

**A RECORD OF DECISION ADDRESSING OPERABLE UNITS VI, IX, AND XI OF THE DENVER RADIUM SITE WAS COMPLETED IN SEPTEMBER 1987.**

ACTIONS

TYPE: **QX - PROSPECTIVE PURCHASER AGREEMENT ASSESSMENT**
START DATE: **11/26/2002**
COMPLETION DATE: **06/03/2005**
ACTION TYPE DEFINITION:
**EPA REVIEWS A FORMAL REQUEST FOR A PROSPECTIVE PURCHASER AGREEMENT (PPA), RESULTING IN A DECISION TO GRANT OR DENY THE REQUEST.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/17/1989**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/17/1989**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/17/1989**
COMPLETION DATE: **10/15/1990**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/17/1989**
COMPLETION DATE: **08/31/1990**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A**

**HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/17/1989**
COMPLETION DATE: **12/15/1989**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/16/1989**
COMPLETION DATE: **08/15/1990**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **02/29/1988**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/30/1989**
COMPLETION DATE: **10/03/1989**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **08/24/1992**
COMPLETION DATE: **03/29/1994**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **PC - PREPARATION OF COST DOCUMENT PACKAGE**
START DATE: **09/02/2000**
COMPLETION DATE: **10/19/2001**
ACTION TYPE DEFINITION:
**PACKAGE PREPARED IN SUPPORT OF COST RECOVERY ACTIONS CONTAINING SITE-SPECIFIC COST DOCUMENTATION INFORMATION FOR DIRECT EXPENDITURES (I.E., AGENCY PAYROLL AND TRAVEL, CONTRACTING COSTS) AND INDIRECT COSTS. DOCUMENTATION MAY BE CONDENSED PER RULE 1006 OF THE FEDERAL RULES OF EVIDENCE.**

TYPE: **RA - REMEDIAL ACTION**

START DATE: **03/31/1988**
COMPLETION DATE: **10/03/1989**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/30/1989**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/30/1989**
COMPLETION DATE: **06/14/1993**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/30/1989**
COMPLETION DATE: **09/14/1993**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/31/1989**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **10/13/1989**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **05/23/1990**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A**

**HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **04/02/1991**
COMPLETION DATE: **06/14/1993**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **08/24/1992**
COMPLETION DATE: **09/14/1993**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **03/30/1990**
COMPLETION DATE: **03/29/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **09/30/1988**
COMPLETION DATE: **09/22/1989**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION - LONG TERM ACTION**
START DATE: **06/28/1991**
COMPLETION DATE: **08/30/1991**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RA - REMEDIAL ACTION - LONG TERM ACTION**
START DATE: **05/29/2001**
COMPLETION DATE: **09/29/2006**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **07/22/1987**

COMPLETION DATE: **08/25/1987**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **RA - REMEDIAL ACTION**
START DATE: **06/04/1992**
COMPLETION DATE: **03/30/1996**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **05/24/1991**
COMPLETION DATE: **05/24/1991**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NOT REPORTED**
COMPLETION DATE: **12/28/1984**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NOT REPORTED**
COMPLETION DATE: **05/14/1992**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **NP - PROPOSAL TO NATIONAL PRIORITIES LIST**
START DATE: **NOT REPORTED**
COMPLETION DATE: **12/30/1982**
ACTION TYPE DEFINITION:
**SITE PROPOSED FOR INCLUSION ON THE NATIONAL PRIORITY LIST BASED ON THE HAZARD RANKING SYSTEM (HRS) SCORE FOR THE SITE.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **09/12/1986**

COMPLETION DATE: **03/01/1990**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **01/21/1991**
COMPLETION DATE: **07/23/1991**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **03/08/1995**
COMPLETION DATE: **03/30/1995**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **03/24/1987**
COMPLETION DATE: **06/02/1987**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **07/01/1988**
COMPLETION DATE: **09/12/1988**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **01/09/1991**
COMPLETION DATE: **06/21/1991**

ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **01/09/1991**
COMPLETION DATE: **05/29/1992**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **06/11/1991**
COMPLETION DATE: **08/08/1991**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **RI - REMEDIAL INVESTIGATION**
START DATE: **04/19/1988**
COMPLETION DATE: **09/27/1989**
ACTION TYPE DEFINITION:
**AN INVESTIGATION INTENDED TO GATHER THE DATA NECESSARY TO: (1) DETERMINE THE NATURE AND EXTENT OF PROBLEMS AT THE SITE; ( 2) ESTABLISH CLEANUP CRITERIA FOR THE SITE; (3) IDENTIFY PRELIMINARY ALTERNATIVE REMEDIAL ACTIONS; AND (4) SUPPORT THE TECHNICAL AND COST ANALYSES OF THE ALTERNATIVES.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **06/26/1991**
COMPLETION DATE: **09/09/1991**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **04/22/1987**
COMPLETION DATE: **02/18/1988**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **PC - PREPARATION OF COST DOCUMENT PACKAGE**
START DATE: **10/21/1998**
COMPLETION DATE: **12/15/1998**
ACTION TYPE DEFINITION:
**PACKAGE PREPARED IN SUPPORT OF COST RECOVERY ACTIONS CONTAINING SITE-SPECIFIC COST DOCUMENTATION INFORMATION FOR DIRECT EXPENDITURES (I.E., AGENCY PAYROLL AND TRAVEL, CONTRACTING COSTS) AND INDIRECT COSTS. DOCUMENTATION MAY BE CONDENSED PER RULE 1006 OF THE FEDERAL RULES OF EVIDENCE.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **01/16/1985**
COMPLETION DATE: **05/08/1986**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **01/16/1985**
COMPLETION DATE: **01/16/1987**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **05/08/1986**
COMPLETION DATE: **01/16/1987**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **11/26/1984**
COMPLETION DATE: **01/16/1985**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**

START DATE: **03/01/2000**
COMPLETION DATE: **03/28/2000**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **03/02/2000**
COMPLETION DATE: **03/28/2000**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **OF - OPERATIONAL & FUNCTIONAL**
START DATE: **02/08/1999**
COMPLETION DATE: **02/08/1999**
ACTION TYPE DEFINITION:
**MEASURES TAKEN TO ENSURE THAT THE REMEDY IS FUNCTIONING PROPERLY AND IS PERFORMING AS DESIGNED. EPA WILL FUND UP TO ONE YEAR OF OF OR UP TO TEN YEARS OF OF IF THE REMEDY INVOLVES RESTORATION OF GROUND OR SURFACE WATER.**

TYPE: **PA - PRELIMINARY ASSESSMENT**
START DATE: **NOT REPORTED**
COMPLETION DATE: **11/01/1979**
ACTION TYPE DEFINITION:
**COLLECTION OF DIVERSE EXISTING INFORMATION ABOUT THE SOURCE AND NATURE OF THE SITE HAZARD. IT IS EPA POLICY TO COMPLETE THE PRELIMINARY ASSESSMENT WITHIN ONE YEAR OF SITE DISCOVERY.**

TYPE: **PC - PREPARATION OF COST DOCUMENT PACKAGE**
START DATE: **03/30/1991**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**PACKAGE PREPARED IN SUPPORT OF COST RECOVERY ACTIONS CONTAINING SITE-SPECIFIC COST DOCUMENTATION INFORMATION FOR DIRECT EXPENDITURES (I.E., AGENCY PAYROLL AND TRAVEL, CONTRACTING COSTS) AND INDIRECT COSTS. DOCUMENTATION MAY BE CONDENSED PER RULE 1006 OF THE FEDERAL RULES OF EVIDENCE.**

TYPE: **PC - PREPARATION OF COST DOCUMENT PACKAGE**
START DATE: **12/30/1991**
COMPLETION DATE: **02/11/1994**
ACTION TYPE DEFINITION:
**PACKAGE PREPARED IN SUPPORT OF COST RECOVERY ACTIONS CONTAINING SITE-SPECIFIC COST DOCUMENTATION INFORMATION FOR DIRECT EXPENDITURES (I.E., AGENCY PAYROLL AND TRAVEL, CONTRACTING COSTS) AND INDIRECT**

**COSTS. DOCUMENTATION MAY BE CONDENSED PER RULE 1006 OF THE FEDERAL RULES OF EVIDENCE.**

TYPE: **PC - PREPARATION OF COST DOCUMENT PACKAGE**
START DATE: **12/31/1993**
COMPLETION DATE: **02/25/1994**
ACTION TYPE DEFINITION:
**PACKAGE PREPARED IN SUPPORT OF COST RECOVERY ACTIONS CONTAINING SITE-SPECIFIC COST DOCUMENTATION INFORMATION FOR DIRECT EXPENDITURES (I.E., AGENCY PAYROLL AND TRAVEL, CONTRACTING COSTS) AND INDIRECT COSTS. DOCUMENTATION MAY BE CONDENSED PER RULE 1006 OF THE FEDERAL RULES OF EVIDENCE.**

TYPE: **PC - PREPARATION OF COST DOCUMENT PACKAGE**
START DATE: **02/26/1994**
COMPLETION DATE: **07/11/1994**
ACTION TYPE DEFINITION:
**PACKAGE PREPARED IN SUPPORT OF COST RECOVERY ACTIONS CONTAINING SITE-SPECIFIC COST DOCUMENTATION INFORMATION FOR DIRECT EXPENDITURES (I.E., AGENCY PAYROLL AND TRAVEL, CONTRACTING COSTS) AND INDIRECT COSTS. DOCUMENTATION MAY BE CONDENSED PER RULE 1006 OF THE FEDERAL RULES OF EVIDENCE.**

TYPE: **NS - NATIONAL PRIORITIES LIST RESPONSIBLE PARTY SEARCH**
START DATE: **06/26/1991**
COMPLETION DATE: **07/17/1991**
ACTION TYPE DEFINITION:
**THE NATIONAL PRIORITY LIST (NPL) POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS USED TO IDENTIFY PRPS AT A FINAL NPL OR PROPOSED NPL SITE. ACTIONS TYPICALLY INCLUDE TITLE SEARCH, FINANCIAL ASSESSMENTS, AND REVIEW OF APPLICABLE RECORDS. THE NPL PRP SEARCH SHOULD BEGIN UPON COMPLETION OF THE SCREENING SITE INVESTIGATION AND SHOULD BE CONDUCTED CONCURRENT WITH THE NATIONAL PRIORITIES LISTING PROCESS.**

TYPE: **TA - TECHNICAL ASSISTANCE**
START DATE: **08/15/2011**
COMPLETION DATE: **NOT REPORTED**
ACTION TYPE DEFINITION:
**PARTICIPATION IN THE CONDUCT OF FUND-FINANCED REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS).**

TYPE: **RV - REMOVAL - TIME CRITICAL**
START DATE: **08/21/1985**
COMPLETION DATE: **09/27/1985**
ACTION TYPE DEFINITION:
**RESPONSE ACTION THAT REQUIRES EXPEDITIOUS ATTENTION TO REDUCE IMMINENT AND SUBSTANTIAL DANGERS TO HUMAN HEALTH, WELFARE, OR THE ENVIRONMENT OR AN EMERGENCY RESPONSE REQUIRED WITHIN HOURS OR DAYS TO ADDRESS ACUTE SITUATIONS INVOLVING ACTUAL OR POTENTIAL THREAT TO HUMAN HEALTH, THE ENVIRONMENT, OR REAL OR PERSONAL PROPERTY DUE TO THE RELEASE OF A HAZARDOUS SUBSTANCE. CHARACTERIZATION OF A REMOVAL ACTION AS REMOVAL, NOT IMMEDIATE REMOVAL OR PLANNED REMOVAL, STARTED AT THE BEGINNING OF FY 1987. THIS CODE NOW TAKES THE PLACE OF IMMEDIATE REMOVAL (IR) AND PLANNED REMOVAL (PR).**

TYPE: **RV - REMOVAL - EMERGENCY**
START DATE: **08/22/1989**

COMPLETION DATE: **08/30/1989**
ACTION TYPE DEFINITION:
**RESPONSE ACTION THAT REQUIRES EXPEDITIOUS ATTENTION TO REDUCE IMMINENT AND SUBSTANTIAL DANGERS TO HUMAN HEALTH, WELFARE, OR THE ENVIRONMENT OR AN EMERGENCY RESPONSE REQUIRED WITHIN HOURS OR DAYS TO ADDRESS ACUTE SITUATIONS INVOLVING ACTUAL OR POTENTIAL THREAT TO HUMAN HEALTH, THE ENVIRONMENT, OR REAL OR PERSONAL PROPERTY DUE TO THE RELEASE OF A HAZARDOUS SUBSTANCE. CHARACTERIZATION OF A REMOVAL ACTION AS REMOVAL, NOT IMMEDIATE REMOVAL OR PLANNED REMOVAL, STARTED AT THE BEGINNING OF FY 1987. THIS CODE NOW TAKES THE PLACE OF IMMEDIATE REMOVAL (IR) AND PLANNED REMOVAL (PR).**

TYPE: **SG - SPECIAL NOTICE ISSUED**
START DATE: **NOT REPORTED**
COMPLETION DATE: **01/29/1992**
ACTION TYPE DEFINITION:
**ISSUANCE UNDER CERCLA SECTION 122 OF A SPECIAL NOTICE LETTER TO POTENTIALLY RESPONSIBLE PARTIES (PRPS). THE ISSUANCE OF A SPECIAL NOTICE LETTER BY EPA TRIGGERS A NEGOTIATION MORATORIUM. SPECIAL NOTICE LETTERS CAN BE ISSUED FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, REMEDIAL DESIGN/REMEDIAL ACTION NEGOTIATIONS.**

TYPE: **SG - SPECIAL NOTICE ISSUED**
START DATE: **NOT REPORTED**
COMPLETION DATE: **01/29/1992**
ACTION TYPE DEFINITION:
**ISSUANCE UNDER CERCLA SECTION 122 OF A SPECIAL NOTICE LETTER TO POTENTIALLY RESPONSIBLE PARTIES (PRPS). THE ISSUANCE OF A SPECIAL NOTICE LETTER BY EPA TRIGGERS A NEGOTIATION MORATORIUM. SPECIAL NOTICE LETTERS CAN BE ISSUED FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, REMEDIAL DESIGN/REMEDIAL ACTION NEGOTIATIONS.**

TYPE: **SG - SPECIAL NOTICE ISSUED**
START DATE: **NOT REPORTED**
COMPLETION DATE: **07/01/1987**
ACTION TYPE DEFINITION:
**ISSUANCE UNDER CERCLA SECTION 122 OF A SPECIAL NOTICE LETTER TO POTENTIALLY RESPONSIBLE PARTIES (PRPS). THE ISSUANCE OF A SPECIAL NOTICE LETTER BY EPA TRIGGERS A NEGOTIATION MORATORIUM. SPECIAL NOTICE LETTERS CAN BE ISSUED FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, REMEDIAL DESIGN/REMEDIAL ACTION NEGOTIATIONS.**

TYPE: **SI - SITE INSPECTION**
START DATE: **NOT REPORTED**
COMPLETION DATE: **12/01/1982**
ACTION TYPE DEFINITION:
**THE PROCESS OF COLLECTING SITE DATA AND SAMPLES TO CHARACTERIZE THE SEVERITY OF THE HAZARD FOR THE HAZARD RANKING SCORE AND/OR ENFORCEMENT SUPPORT.**

TYPE: **SI - SITE INSPECTION**
START DATE: **NOT REPORTED**
COMPLETION DATE: **12/01/1982**

ACTION TYPE DEFINITION:
**THE PROCESS OF COLLECTING SITE DATA AND SAMPLES TO CHARACTERIZE THE SEVERITY OF THE HAZARD FOR THE HAZARD RANKING SCORE AND/OR ENFORCEMENT SUPPORT.**

TYPE: **SV - SECTION 107 LITIGATION**
START DATE: **03/01/1995**
COMPLETION DATE: **01/22/1996**
ACTION TYPE DEFINITION:
**JUDICIAL REFERRAL UNDER S107 TO RECOVERY FROM POTENTIALLY RESPONSIBLE PARTIES (PRPS).**

TYPE: **TA - TECHNICAL ASSISTANCE**
START DATE: **11/24/1998**
COMPLETION DATE: **02/07/2001**
ACTION TYPE DEFINITION:
**PARTICIPATION IN THE CONDUCT OF FUND-FINANCED REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS).**

TYPE: **TA - TECHNICAL ASSISTANCE**
START DATE: **04/15/1987**
COMPLETION DATE: **09/30/1987**
ACTION TYPE DEFINITION:
**PARTICIPATION IN THE CONDUCT OF FUND-FINANCED REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS).**

TYPE: **TA - TECHNICAL ASSISTANCE**
START DATE: **09/21/1988**
COMPLETION DATE: **10/01/1996**
ACTION TYPE DEFINITION:
**PARTICIPATION IN THE CONDUCT OF FUND-FINANCED REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS).**

TYPE: **RI - REMEDIAL INVESTIGATION**
START DATE: **08/19/1983**
COMPLETION DATE: **03/24/1986**
ACTION TYPE DEFINITION:
**AN INVESTIGATION INTENDED TO GATHER THE DATA NECESSARY TO: (1) DETERMINE THE NATURE AND EXTENT OF PROBLEMS AT THE SITE; ( 2) ESTABLISH CLEANUP CRITERIA FOR THE SITE; (3) IDENTIFY PRELIMINARY ALTERNATIVE REMEDIAL ACTIONS; AND (4) SUPPORT THE TECHNICAL AND COST ANALYSES OF THE ALTERNATIVES.**

TYPE: **TA - TECHNICAL ASSISTANCE**
START DATE: **09/27/2000**
COMPLETION DATE: **09/27/2006**
ACTION TYPE DEFINITION:
**PARTICIPATION IN THE CONDUCT OF FUND-FINANCED REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS).**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NOT REPORTED**
COMPLETION DATE: **06/30/1987**
ACTION TYPE DEFINITION:

**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **TG - TECHNICAL ASSISTANCE GRANT**
START DATE: **11/04/1996**
COMPLETION DATE: **08/03/2010**
ACTION TYPE DEFINITION:
**A GRANT OF UP TO $50,000 PROVIDED UNDER SARA TO A COMMUNITY FOR TECHNICAL ASSISTANCE IN DEALING WITH SUPERFUND ISSUES AT A NATIONAL PRIORITY LIST (NPL) SITE.**

TYPE: **TS - TREATABILITY STUDY**
START DATE: **09/11/1989**
COMPLETION DATE: **01/31/1991**
ACTION TYPE DEFINITION:
**THE FIELD EFFORTS TO SUPPORT THE EVALUATION OF ALTERNATIVES TO DETERMINE THEIR APPLICABILITY FOR THE SITE.**

TYPE: **TT - NOTICE OF INTENT BY ALL PARTIES**
START DATE: **NOT REPORTED**
COMPLETION DATE: **04/26/2001**
ACTION TYPE DEFINITION:
**THE POINT AT WHICH ALL PARTIES HAVE RESPONDED TO A NOTICE OF INTENT TO COMPLY WITH AN ENFORCEMENT ACTION.**

TYPE: **TV - NOTICE OF INTENT TO PARTIALLY DELETE**
START DATE: **NOT REPORTED**
COMPLETION DATE: **09/09/2010**
ACTION TYPE DEFINITION:
**EPA PUBLISHES THE NOTICE OF INTENT TO PARTIALLY DELETE A PORTION OF A SITE FROM THE NPL IN THE FEDERAL REGISTER.**

TYPE: **UA - UNILATERAL ADMIN ORDER**
START DATE: **NOT REPORTED**
COMPLETION DATE: **08/21/1992**
ACTION TYPE DEFINITION:
**ADMINISTRATIVE ORDER ISSUED BY EPA UNILATERALLY (UNDER SECTION 106 OF SARA). UNILATERAL ORDERS CAN COMPEL POTENTIALLY RESPONSIBLE PARTIES (PRPS) TO CONDUCT REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, REMEDIAL DESIGN/REMEDIAL ACTION, AND MAY INCLUDE COST RECOVERY. COMMONLY ABBREVIATED UAO.**

TYPE: **UA - UNILATERAL ADMIN ORDER**
START DATE: **NOT REPORTED**
COMPLETION DATE: **07/10/2000**
ACTION TYPE DEFINITION:
**ADMINISTRATIVE ORDER ISSUED BY EPA UNILATERALLY (UNDER SECTION 106 OF SARA). UNILATERAL ORDERS CAN COMPEL POTENTIALLY RESPONSIBLE PARTIES (PRPS) TO CONDUCT REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, REMEDIAL DESIGN/REMEDIAL ACTION, AND MAY INCLUDE COST RECOVERY. COMMONLY ABBREVIATED UAO.**

TYPE: **UA - UNILATERAL ADMIN ORDER**
START DATE: **NOT REPORTED**
COMPLETION DATE: **07/10/2000**
ACTION TYPE DEFINITION:
**ADMINISTRATIVE ORDER ISSUED BY EPA UNILATERALLY (UNDER SECTION 106 OF SARA). UNILATERAL ORDERS CAN COMPEL POTENTIALLY RESPONSIBLE PARTIES (PRPS) TO CONDUCT REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, REMEDIAL DESIGN/REMEDIAL ACTION, AND MAY INCLUDE COST RECOVERY. COMMONLY ABBREVIATED UAO.**

TYPE: **UA - UNILATERAL ADMIN ORDER**
START DATE: **NOT REPORTED**
COMPLETION DATE: **07/10/2000**
ACTION TYPE DEFINITION:
**ADMINISTRATIVE ORDER ISSUED BY EPA UNILATERALLY (UNDER SECTION 106 OF SARA). UNILATERAL ORDERS CAN COMPEL POTENTIALLY RESPONSIBLE PARTIES (PRPS) TO CONDUCT REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, REMEDIAL DESIGN/REMEDIAL ACTION, AND MAY INCLUDE COST RECOVERY. COMMONLY ABBREVIATED UAO.**

TYPE: **UA - UNILATERAL ADMIN ORDER**
START DATE: **NOT REPORTED**
COMPLETION DATE: **04/20/2001**
ACTION TYPE DEFINITION:
**ADMINISTRATIVE ORDER ISSUED BY EPA UNILATERALLY (UNDER SECTION 106 OF SARA). UNILATERAL ORDERS CAN COMPEL POTENTIALLY RESPONSIBLE PARTIES (PRPS) TO CONDUCT REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY, REMEDIAL DESIGN/REMEDIAL ACTION, AND MAY INCLUDE COST RECOVERY. COMMONLY ABBREVIATED UAO.**

TYPE: **WP - REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORKPLAN APPROVAL BY HQ**
START DATE: **12/31/1981**
COMPLETION DATE: **12/31/1981**
ACTION TYPE DEFINITION:
**APPROVAL OF THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) WORKPLAN, WHICH IS A DESCRIPTION OF THE TASKS AND RESOURCES PLANNED FOR THE RI/FS.**

TYPE: **WP - REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORKPLAN APPROVAL BY HQ**
START DATE: **01/03/1984**
COMPLETION DATE: **01/03/1984**
ACTION TYPE DEFINITION:
**APPROVAL OF THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) WORKPLAN, WHICH IS A DESCRIPTION OF THE TASKS AND RESOURCES PLANNED FOR THE RI/FS.**

TYPE: **WP - REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORKPLAN APPROVAL BY HQ**
START DATE: **04/30/1987**
COMPLETION DATE: **06/29/1987**
ACTION TYPE DEFINITION:
**APPROVAL OF THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) WORKPLAN, WHICH IS A DESCRIPTION OF THE TASKS AND RESOURCES PLANNED FOR THE RI/FS.**

TYPE: **TA - TECHNICAL ASSISTANCE**
START DATE: **11/19/1998**
COMPLETION DATE: **09/07/2005**
ACTION TYPE DEFINITION:
**PARTICIPATION IN THE CONDUCT OF FUND-FINANCED REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS).**

TYPE: **RI - REMEDIAL INVESTIGATION**
START DATE: **05/15/1985**
COMPLETION DATE: **06/30/1986**
ACTION TYPE DEFINITION:
**AN INVESTIGATION INTENDED TO GATHER THE DATA NECESSARY TO: (1) DETERMINE THE NATURE AND EXTENT OF PROBLEMS AT THE SITE; ( 2) ESTABLISH CLEANUP CRITERIA FOR THE SITE; (3) IDENTIFY PRELIMINARY ALTERNATIVE REMEDIAL ACTIONS; AND (4) SUPPORT THE TECHNICAL AND COST ANALYSES OF THE ALTERNATIVES.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **12/11/1987**
COMPLETION DATE: **03/16/1989**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **12/11/1987**
COMPLETION DATE: **03/23/1989**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **12/11/1987**
COMPLETION DATE: **08/15/1989**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **12/11/1987**
COMPLETION DATE: **10/04/1989**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **03/17/1989**
COMPLETION DATE: **09/03/1991**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **12/15/1989**

COMPLETION DATE: **11/21/1990**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **04/07/1991**
COMPLETION DATE: **05/15/1992**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **02/03/1992**
COMPLETION DATE: **09/30/1992**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **09/30/1992**
COMPLETION DATE: **03/31/1993**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **07/05/2000**
COMPLETION DATE: **09/30/2002**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **06/30/1987**
COMPLETION DATE: **06/17/1988**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **06/30/1988**
COMPLETION DATE: **06/30/1989**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RS - REMOVAL ASSESSMENT**
START DATE: **01/01/1992**
COMPLETION DATE: **08/03/1992**
ACTION TYPE DEFINITION:
**COLLECTING SITE CHARACTERISTICS TO DETERMINE WHETHER OR NOT A REMOVAL MUST BE PERFORMED.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NOT REPORTED**
COMPLETION DATE: **10/29/1987**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **RS - REMOVAL ASSESSMENT**
START DATE: **08/30/1989**
COMPLETION DATE: **08/30/1989**
ACTION TYPE DEFINITION:
**COLLECTING SITE CHARACTERISTICS TO DETERMINE WHETHER OR NOT A REMOVAL MUST BE PERFORMED.**

TYPE: **PC - PREPARATION OF COST DOCUMENT PACKAGE**
START DATE: **11/29/1999**
COMPLETION DATE: **01/25/2000**
ACTION TYPE DEFINITION:
**PACKAGE PREPARED IN SUPPORT OF COST RECOVERY ACTIONS CONTAINING SITE-SPECIFIC COST DOCUMENTATION INFORMATION FOR DIRECT EXPENDITURES (I.E., AGENCY PAYROLL AND TRAVEL, CONTRACTING COSTS) AND INDIRECT COSTS. DOCUMENTATION MAY BE CONDENSED PER RULE 1006 OF THE FEDERAL RULES OF EVIDENCE.**

TYPE: **RI - REMEDIAL INVESTIGATION**
START DATE: **03/22/1989**
COMPLETION DATE: **07/24/1990**
ACTION TYPE DEFINITION:
**AN INVESTIGATION INTENDED TO GATHER THE DATA NECESSARY TO: (1) DETERMINE THE NATURE AND EXTENT OF PROBLEMS AT THE SITE; ( 2) ESTABLISH CLEANUP CRITERIA FOR THE SITE; (3) IDENTIFY PRELIMINARY ALTERNATIVE REMEDIAL ACTIONS; AND (4) SUPPORT THE TECHNICAL AND COST ANALYSES OF THE ALTERNATIVES.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NOT REPORTED**
COMPLETION DATE: **03/24/1986**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NOT REPORTED**
COMPLETION DATE: **09/30/1986**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NOT REPORTED**
COMPLETION DATE: **06/30/1987**

ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NOT REPORTED**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NOT REPORTED**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NOT REPORTED**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NOT REPORTED**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NOT REPORTED**
COMPLETION DATE: **12/23/1991**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NOT REPORTED**
COMPLETION DATE: **01/28/1992**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **12/11/1987**
COMPLETION DATE: **02/01/1989**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RI - REMEDIAL INVESTIGATION**
START DATE: **06/11/1981**
COMPLETION DATE: **08/17/1982**
ACTION TYPE DEFINITION:
**AN INVESTIGATION INTENDED TO GATHER THE DATA NECESSARY TO: (1) DETERMINE THE NATURE AND EXTENT OF PROBLEMS AT THE SITE; ( 2) ESTABLISH CLEANUP CRITERIA FOR THE SITE; (3) IDENTIFY PRELIMINARY ALTERNATIVE REMEDIAL ACTIONS; AND (4) SUPPORT THE TECHNICAL AND COST ANALYSES OF THE ALTERNATIVES.**

TYPE: **CR - COMMUNITY INVOLVEMENT**
START DATE: **03/06/2000**
COMPLETION DATE: **01/29/2003**
ACTION TYPE DEFINITION:
**THE COMMUNITY RELATIONS ACTIVITIES, I.E., PLAN, IMPLEMENTATION AND RESPONSIVENESS SUMMARY THAT MUST BE COMPLETED AT A SITE TO ADDRESS COMMUNITY CONCERNS.**

TYPE: **FE - FIVE-YEAR REVIEW**
START DATE: **06/01/1993**
COMPLETION DATE: **09/30/1993**
ACTION TYPE DEFINITION:
**A REVIEW THAT IS CONDUCTED AT A MINIMUM OF EVERY FIVE YEARS TO DETERMINE IF THE IMPLEMENTATION AND PERFORMANCE OF A REMEDY IS PROTECTIVE OR WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.**

TYPE: **CA - CONSENT AGREEMENT (ADMINISTRATIVE)**
START DATE: **NOT REPORTED**
COMPLETION DATE: **07/26/1995**
ACTION TYPE DEFINITION:
**INFORMAL AGREEMENT USED TO INITIATE POTENTIALLY RESPONSIBLE PARTY (PRP) RESPONSE OR COST RECOVERY.**

TYPE: **CD - CONSENT DECREE**
START DATE: **NOT REPORTED**
COMPLETION DATE: **01/22/1996**
ACTION TYPE DEFINITION:
**JUDICIAL AGREEMENT BETWEEN THE FEDERAL GOVERNMENT AND THE POTENTIALLY RESPONSIBLE PARTIES (PRPS) FULLY OR PARTIALLY SETTLING A CLAIM UNDER CERCLA. THIS AGREEMENT MAY SETTLE LITIGATION OR MAY BE PRESENTED CONCURRENTLY WITH THE COMPLAINT (ACHIEVED THROUGH NEGOTIATIONS). THE AGREEMENT MAY BE FOR RESPONSE WORK, COST RECOVERY, OR BOTH.**

TYPE: **CD - CONSENT DECREE**
START DATE: **NOT REPORTED**
COMPLETION DATE: **08/19/1988**

ACTION TYPE DEFINITION:
**JUDICIAL AGREEMENT BETWEEN THE FEDERAL GOVERNMENT AND THE POTENTIALLY RESPONSIBLE PARTIES (PRPS) FULLY OR PARTIALLY SETTLING A CLAIM UNDER CERCLA. THIS AGREEMENT MAY SETTLE LITIGATION OR MAY BE PRESENTED CONCURRENTLY WITH THE COMPLAINT (ACHIEVED THROUGH NEGOTIATIONS). THE AGREEMENT MAY BE FOR RESPONSE WORK, COST RECOVERY, OR BOTH.**

TYPE: **CD - CONSENT DECREE**
START DATE: **10/10/2001**
COMPLETION DATE: **08/26/2002**
ACTION TYPE DEFINITION:
**JUDICIAL AGREEMENT BETWEEN THE FEDERAL GOVERNMENT AND THE POTENTIALLY RESPONSIBLE PARTIES (PRPS) FULLY OR PARTIALLY SETTLING A CLAIM UNDER CERCLA. THIS AGREEMENT MAY SETTLE LITIGATION OR MAY BE PRESENTED CONCURRENTLY WITH THE COMPLAINT (ACHIEVED THROUGH NEGOTIATIONS). THE AGREEMENT MAY BE FOR RESPONSE WORK, COST RECOVERY, OR BOTH.**

TYPE: **CD - CONSENT DECREE**
START DATE: **08/20/2009**
COMPLETION DATE: **04/01/2010**
ACTION TYPE DEFINITION:
**JUDICIAL AGREEMENT BETWEEN THE FEDERAL GOVERNMENT AND THE POTENTIALLY RESPONSIBLE PARTIES (PRPS) FULLY OR PARTIALLY SETTLING A CLAIM UNDER CERCLA. THIS AGREEMENT MAY SETTLE LITIGATION OR MAY BE PRESENTED CONCURRENTLY WITH THE COMPLAINT (ACHIEVED THROUGH NEGOTIATIONS). THE AGREEMENT MAY BE FOR RESPONSE WORK, COST RECOVERY, OR BOTH.**

TYPE: **CL - SECTION 106 107 LITIGATION**
START DATE: **09/30/1987**
COMPLETION DATE: **08/19/1988**
ACTION TYPE DEFINITION:
**REFERRAL TO OECM OR DOJ, WITHOUT SETTLEMENT, OF A CIVIL ACTION ADDRESSING A SITE UNDER SECTIONS 106 AND 107 OF CERCLA.**

TYPE: **CL - SECTION 106 107 LITIGATION**
START DATE: **10/25/2001**
COMPLETION DATE: **08/26/2002**
ACTION TYPE DEFINITION:
**REFERRAL TO OECM OR DOJ, WITHOUT SETTLEMENT, OF A CIVIL ACTION ADDRESSING A SITE UNDER SECTIONS 106 AND 107 OF CERCLA.**

TYPE: **CM - PRELIMINARY CLOSE-OUT REPORT PREPARED**
START DATE: **NOT REPORTED**
COMPLETION DATE: **09/27/2006**
ACTION TYPE DEFINITION:
**A REPORT PREPARED BY THE REMEDIAL PROGRAM MANAGER (RPM) VERIFYING THAT PHYSICAL CONSTRUCTION OF THE REMEDY IS COMPLETE, INDICATING MINOR PUNCH LIST ITEMS THAT REMAIN AND OUTLINING A SCHEDULE OF THE OUTSTANDING ACTIVITIES.**

TYPE: **CO - COMBINED REMEDIAL INVESTIGATION/FEASIBILITY STUDY**
START DATE: **11/15/1999**
COMPLETION DATE: **06/16/2000**
ACTION TYPE DEFINITION:
**THE PROCESS OF DATA COLLECTION AND ANALYSES OF THE SITE PROBLEM, IDENTIFICATION OF PRELIMINARY REMEDIAL ALTERNATIVES, AND RECOMMENDATION OF A COST-EFFECTIVE REMEDY. THERE CAN BE MULTIPLE REMEDIAL INVESTIGATION/FEASIBILITY STUDIES (RI/FS) CONDUCTED AT A SITE.**

TYPE: **CQ - CLOSE OUT REPORT**
START DATE: **NOT REPORTED**
COMPLETION DATE: **09/27/2006**
ACTION TYPE DEFINITION:
**A REPORT SUBMITTED BY THE REMEDIAL PROGRAM MANAGER (RPM) VERIFYING THAT THE CONDITIONS OF THE SITE COMPLY WITH THE RECORD OF DECISION (ROD) FINDINGS AND DESIGN SPECIFICATIONS AND THAT ACTIVITIES PERFORMED AT THE SITE ARE SUFFICIENT TO ACHIEVE PROTECTION OF PUBLIC HEALTH AND THE ENVIRONMENT. THIS IS A REMEDIAL ACTION (RA) OR ROD SUBEVENT.**

TYPE: **BF - POTENTIALLY RESPONSIBLE PARTY REMEDIAL ACTION**
START DATE: **10/26/1992**
COMPLETION DATE: **06/29/1994**
ACTION TYPE DEFINITION:
**PROVIDES FOR OVERSIGHT OF POTENTIALLY RESPONSIBLE PARTY (PRP) RESPONSE ACTION FOR REMEDIAL ACTION (RA), INCLUDING ALL ACTIVITIES FOR MONITORING AND SUPERVISING THE PERFORMANCE OF THE RESPONSIBLE PARTIES TO DETERMINE WHETHER SUCH PERFORMANCE IS CONSISTENT WITH THE REQUIREMENTS OF THE ADMINISTRATIVE ORDERS ON CONSENT, UNILATERAL ADMINISTRATIVE ORDERS, CONSENT DECREES, JUDICIAL DECREES, INFORMATION AGREEMENTS, AND COMPLIANCE SCHEDULES.**

TYPE: **CR - COMMUNITY INVOLVEMENT**
START DATE: **05/15/1985**
COMPLETION DATE: **03/06/2000**
ACTION TYPE DEFINITION:
**THE COMMUNITY RELATIONS ACTIVITIES, I.E., PLAN, IMPLEMENTATION AND RESPONSIVENESS SUMMARY THAT MUST BE COMPLETED AT A SITE TO ADDRESS COMMUNITY CONCERNS.**

TYPE: **BE - POTENTIALLY RESPONSIBLE PARTY REMEDIAL DESIGN**
START DATE: **06/07/1992**
COMPLETION DATE: **06/27/1996**
ACTION TYPE DEFINITION:
**PROVIDES FOR OVERSIGHT OF POTENTIALLY RESPONSIBLE PARTY (PRP) RESPONSE ACTION FOR REMEDIAL DESIGN (RD), INCLUDING ALL ACTIVITIES FOR MONITORING AND SUPERVISING THE PERFORMANCE OF THE RESPONSIBLE PARTIES TO DETERMINE WHETHER SUCH PERFORMANCE IS CONSISTENT WITH THE REQUIREMENTS OF THE ADMINISTRATIVE ORDERS ON CONSENT, UNILATERAL ADMINISTRATIVE ORDERS, CONSENT DECREES, JUDICIAL DECREES, INFORMATION AGREEMENTS, AND COMPLIANCE SCHEDULES.**

TYPE: **DP - PUBLIC NOTICE PUBLISHED**
START DATE: **NOT REPORTED**

COMPLETION DATE: **09/20/1989**
ACTION TYPE DEFINITION:
**PUBLICATION IN THE LOCAL NEWSPAPER OF THE AVAILABILITY OF DOCUMENTS FOR PUBLIC REVIEW, SUCH AS THE ADMINISTRATIVE RECORD, PROPOSED PLAN, AND DELETION PACKAGE.**

TYPE: **DS - DISCOVERY**
START DATE: **NOT REPORTED**
COMPLETION DATE: **03/01/1979**
ACTION TYPE DEFINITION:
**THE PROCESS BY WHICH A POTENTIAL HAZARDOUS WASTE SITE IS BROUGHT TO THE ATTENTION OF THE EPA. THE PROCESS CAN OCCUR THROUGH THE USE OF SEVERAL MECHANISMS SUCH AS A PHONE CALL OR REFERRAL BY ANOTHER GOVERNMENT AGENCY.**

TYPE: **ED - RISK/HEALTH ASSESSMENT**
START DATE: **04/12/2005**
COMPLETION DATE: **10/13/2005**
ACTION TYPE DEFINITION:
**ASSESSMENT OF THE BASELINE RISKS POSED BY THE SITE TO HUMAN HEALTH.**

TYPE: **EH - EXPLANATION OF SIGNIFICANT DIFFERENCES**
START DATE: **NOT REPORTED**
COMPLETION DATE: **09/15/1992**
ACTION TYPE DEFINITION:
**MINOR CHANGE FROM THE ORIGINAL REMEDY SELECTED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS CONTINGENT REMEDY.**

TYPE: **EH - EXPLANATION OF SIGNIFICANT DIFFERENCES**
START DATE: **NOT REPORTED**
COMPLETION DATE: **09/13/1993**
ACTION TYPE DEFINITION:
**MINOR CHANGE FROM THE ORIGINAL REMEDY SELECTED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS CONTINGENT REMEDY.**

TYPE: **EH - EXPLANATION OF SIGNIFICANT DIFFERENCES**
START DATE: **NOT REPORTED**
COMPLETION DATE: **12/13/1993**
ACTION TYPE DEFINITION:
**MINOR CHANGE FROM THE ORIGINAL REMEDY SELECTED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS CONTINGENT REMEDY.**

TYPE: **EH - EXPLANATION OF SIGNIFICANT DIFFERENCES**
START DATE: **NOT REPORTED**
COMPLETION DATE: **12/01/1994**
ACTION TYPE DEFINITION:
**MINOR CHANGE FROM THE ORIGINAL REMEDY SELECTED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS CONTINGENT REMEDY.**

TYPE: **EH - EXPLANATION OF SIGNIFICANT DIFFERENCES**
START DATE: **NOT REPORTED**
COMPLETION DATE: **12/01/1994**
ACTION TYPE DEFINITION:
**MINOR CHANGE FROM THE ORIGINAL REMEDY SELECTED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS CONTINGENT REMEDY.**

TYPE: **EH - EXPLANATION OF SIGNIFICANT DIFFERENCES**
START DATE: **NOT REPORTED**
COMPLETION DATE: **01/17/1995**
ACTION TYPE DEFINITION:
**MINOR CHANGE FROM THE ORIGINAL REMEDY SELECTED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS CONTINGENT REMEDY.**

TYPE: **EH - EXPLANATION OF SIGNIFICANT DIFFERENCES**
START DATE: **NOT REPORTED**
COMPLETION DATE: **01/17/1995**
ACTION TYPE DEFINITION:
**MINOR CHANGE FROM THE ORIGINAL REMEDY SELECTED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS CONTINGENT REMEDY.**

TYPE: **EH - EXPLANATION OF SIGNIFICANT DIFFERENCES**
START DATE: **NOT REPORTED**
COMPLETION DATE: **03/12/2007**
ACTION TYPE DEFINITION:
**MINOR CHANGE FROM THE ORIGINAL REMEDY SELECTED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS CONTINGENT REMEDY.**

TYPE: **FE - FIVE-YEAR REVIEW**
START DATE: **04/05/1993**
COMPLETION DATE: **09/12/1994**
ACTION TYPE DEFINITION:
**A REVIEW THAT IS CONDUCTED AT A MINIMUM OF EVERY FIVE YEARS TO DETERMINE IF THE IMPLEMENTATION AND PERFORMANCE OF A REMEDY IS PROTECTIVE OR WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.**

TYPE: **CR - COMMUNITY INVOLVEMENT**
START DATE: **03/16/1984**
COMPLETION DATE: **09/30/1991**
ACTION TYPE DEFINITION:
**THE COMMUNITY RELATIONS ACTIVITIES, I.E., PLAN, IMPLEMENTATION AND RESPONSIVENESS SUMMARY THAT MUST BE COMPLETED AT A SITE TO ADDRESS COMMUNITY CONCERNS.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **09/29/1987**
COMPLETION DATE: **09/29/1987**

ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AC - ADMINISTRATIVE ORDER ON CONSENT**
START DATE: **NOT REPORTED**
COMPLETION DATE: **07/22/1988**
ACTION TYPE DEFINITION:
**A VOLUNTARY AND ENFORCEABLE AGREEMENT PURSUANT TO CERCLA, SIGNED BY EPA AND POTENTIALLY RESPONSIBLE PARTIES (PRPS), WHEREBY THE PRPS AGREE TO PERFORM AND/OR PAY FOR SOME OR ALL OF THE RESPONSE COSTS INVOLVED IN SITE CLEANUP. THE ORDER DESCRIBES THE PRP RESPONSE TO BE TAKEN AT A SITE, STIPULATED PENALTIES, INDEMNIFICATION, EFFECTIVE DATE, AND MAY BE SUBJECT TO PUBLIC COMMENT. IT CAN BE FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), REMEDIAL DESIGN (RD), AND REMEDIAL ACTION (RA),PRE-SARA; BUT ONLY REMOVAL AND RI/FS, POST-SARA.**

TYPE: **AC - ADMINISTRATIVE ORDER ON CONSENT**
START DATE: **NOT REPORTED**
COMPLETION DATE: **06/14/1993**
ACTION TYPE DEFINITION:
**A VOLUNTARY AND ENFORCEABLE AGREEMENT PURSUANT TO CERCLA, SIGNED BY EPA AND POTENTIALLY RESPONSIBLE PARTIES (PRPS), WHEREBY THE PRPS AGREE TO PERFORM AND/OR PAY FOR SOME OR ALL OF THE RESPONSE COSTS INVOLVED IN SITE CLEANUP. THE ORDER DESCRIBES THE PRP RESPONSE TO BE TAKEN AT A SITE, STIPULATED PENALTIES, INDEMNIFICATION, EFFECTIVE DATE, AND MAY BE SUBJECT TO PUBLIC COMMENT. IT CAN BE FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), REMEDIAL DESIGN (RD), AND REMEDIAL ACTION (RA),PRE-SARA; BUT ONLY REMOVAL AND RI/FS, POST-SARA.**

TYPE: **AC - ADMINISTRATIVE ORDER ON CONSENT**
START DATE: **NOT REPORTED**
COMPLETION DATE: **09/09/1997**
ACTION TYPE DEFINITION:
**A VOLUNTARY AND ENFORCEABLE AGREEMENT PURSUANT TO CERCLA, SIGNED BY EPA AND POTENTIALLY RESPONSIBLE PARTIES (PRPS), WHEREBY THE PRPS AGREE TO PERFORM AND/OR PAY FOR SOME OR ALL OF THE RESPONSE COSTS INVOLVED IN SITE CLEANUP. THE ORDER DESCRIBES THE PRP RESPONSE TO BE TAKEN AT A SITE, STIPULATED PENALTIES, INDEMNIFICATION, EFFECTIVE DATE, AND MAY BE SUBJECT TO PUBLIC COMMENT. IT CAN BE FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), REMEDIAL DESIGN (RD), AND REMEDIAL ACTION (RA),PRE-SARA; BUT ONLY REMOVAL AND RI/FS, POST-SARA.**

TYPE: **AC - ADMINISTRATIVE ORDER ON CONSENT**
START DATE: **NOT REPORTED**
COMPLETION DATE: **08/30/1991**
ACTION TYPE DEFINITION:
**A VOLUNTARY AND ENFORCEABLE AGREEMENT PURSUANT TO CERCLA, SIGNED BY EPA AND POTENTIALLY RESPONSIBLE PARTIES (PRPS), WHEREBY THE PRPS AGREE TO PERFORM AND/OR PAY FOR SOME OR ALL OF THE RESPONSE COSTS INVOLVED IN SITE CLEANUP. THE ORDER DESCRIBES THE PRP RESPONSE TO BE TAKEN AT A SITE, STIPULATED PENALTIES, INDEMNIFICATION, EFFECTIVE DATE, AND MAY BE SUBJECT TO PUBLIC COMMENT. IT CAN BE FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), REMEDIAL DESIGN (RD), AND REMEDIAL ACTION**

**(RA),PRE-SARA; BUT ONLY REMOVAL AND RI/FS, POST-SARA.**

TYPE: **AC - ADMINISTRATIVE ORDER ON CONSENT**
START DATE: **NOT REPORTED**
COMPLETION DATE: **07/15/1996**
ACTION TYPE DEFINITION:
**A VOLUNTARY AND ENFORCEABLE AGREEMENT PURSUANT TO CERCLA, SIGNED BY EPA AND POTENTIALLY RESPONSIBLE PARTIES (PRPS), WHEREBY THE PRPS AGREE TO PERFORM AND/OR PAY FOR SOME OR ALL OF THE RESPONSE COSTS INVOLVED IN SITE CLEANUP. THE ORDER DESCRIBES THE PRP RESPONSE TO BE TAKEN AT A SITE, STIPULATED PENALTIES, INDEMNIFICATION, EFFECTIVE DATE, AND MAY BE SUBJECT TO PUBLIC COMMENT. IT CAN BE FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), REMEDIAL DESIGN (RD), AND REMEDIAL ACTION (RA),PRE-SARA; BUT ONLY REMOVAL AND RI/FS, POST-SARA.**

TYPE: **AC - ADMINISTRATIVE ORDER ON CONSENT**
START DATE: **NOT REPORTED**
COMPLETION DATE: **08/29/2005**
ACTION TYPE DEFINITION:
**A VOLUNTARY AND ENFORCEABLE AGREEMENT PURSUANT TO CERCLA, SIGNED BY EPA AND POTENTIALLY RESPONSIBLE PARTIES (PRPS), WHEREBY THE PRPS AGREE TO PERFORM AND/OR PAY FOR SOME OR ALL OF THE RESPONSE COSTS INVOLVED IN SITE CLEANUP. THE ORDER DESCRIBES THE PRP RESPONSE TO BE TAKEN AT A SITE, STIPULATED PENALTIES, INDEMNIFICATION, EFFECTIVE DATE, AND MAY BE SUBJECT TO PUBLIC COMMENT. IT CAN BE FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), REMEDIAL DESIGN (RD), AND REMEDIAL ACTION (RA),PRE-SARA; BUT ONLY REMOVAL AND RI/FS, POST-SARA.**

TYPE: **AD - ALTERNATIVE DISPUTE RESOLUTION**
START DATE: **10/01/1998**
COMPLETION DATE: **11/15/1999**
ACTION TYPE DEFINITION:
**DECISION TO TAKE COST RECOVERY ACTION BY USE OF ALTERNATIVE DISPUTE RESOLUTION (ADR) INCLUDING MEDIATION, ARBITRATION AND MINI-TRIAL.**

TYPE: **AD - ALTERNATIVE DISPUTE RESOLUTION**
START DATE: **07/20/1999**
COMPLETION DATE: **04/10/2002**
ACTION TYPE DEFINITION:
**DECISION TO TAKE COST RECOVERY ACTION BY USE OF ALTERNATIVE DISPUTE RESOLUTION (ADR) INCLUDING MEDIATION, ARBITRATION AND MINI-TRIAL.**

TYPE: **QN - COMMUNITY ADVISORY GROUP**
START DATE: **01/01/2000**
COMPLETION DATE: **08/16/2006**
ACTION TYPE DEFINITION:
**THE FORMATION OF A COMMUNITY ADVISORY GROUP TO PRESENT COMMUNITY INTERESTS RELATED TO A SITE UNDERGOING CLEANUP TO EPA**

TYPE: **AN - REMEDIAL DESIGN/REMEDIAL ACTION NEGOTIATIONS**

START DATE: **01/28/1992**
COMPLETION DATE: **08/21/1992**
ACTION TYPE DEFINITION:
**DISCUSSIONS AND INFORMATION EXCHANGE BETWEEN POTENTIALLY RESPONSIBLE PARTIES (PRPS) AND EPA (OR STATE) OVER THE LIABILITY OF THE PRP, WILLINGNESS, AND ABILITY TO CONDUCT THE REMEDIAL DESIGN AND/OR THE REMEDIAL ACTION AS IDENTIFIED IN THE RECORD OF DECISION (ROD).**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NOT REPORTED**
COMPLETION DATE: **08/10/1982**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **BF - POTENTIALLY RESPONSIBLE PARTY REMEDIAL ACTION**
START DATE: **03/31/1993**
COMPLETION DATE: **06/16/2000**
ACTION TYPE DEFINITION:
**PROVIDES FOR OVERSIGHT OF POTENTIALLY RESPONSIBLE PARTY (PRP) RESPONSE ACTION FOR REMEDIAL ACTION (RA), INCLUDING ALL ACTIVITIES FOR MONITORING AND SUPERVISING THE PERFORMANCE OF THE RESPONSIBLE PARTIES TO DETERMINE WHETHER SUCH PERFORMANCE IS CONSISTENT WITH THE REQUIREMENTS OF THE ADMINISTRATIVE ORDERS ON CONSENT, UNILATERAL ADMINISTRATIVE ORDERS, CONSENT DECREES, JUDICIAL DECREES, INFORMATION AGREEMENTS, AND COMPLIANCE SCHEDULES.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **04/30/1986**
COMPLETION DATE: **09/30/1986**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AN - REMEDIAL DESIGN/REMEDIAL ACTION NEGOTIATIONS**
START DATE: **06/15/2000**
COMPLETION DATE: **10/10/2001**
ACTION TYPE DEFINITION:
**DISCUSSIONS AND INFORMATION EXCHANGE BETWEEN POTENTIALLY RESPONSIBLE PARTIES (PRPS) AND EPA (OR STATE) OVER THE LIABILITY OF THE PRP, WILLINGNESS, AND ABILITY TO CONDUCT THE REMEDIAL DESIGN AND/OR THE REMEDIAL ACTION AS IDENTIFIED IN THE RECORD OF DECISION (ROD).**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **09/29/1987**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING**

**LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **09/29/1987**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **09/30/1987**
COMPLETION DATE: **09/30/1987**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **09/30/1987**
COMPLETION DATE: **09/30/1987**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **09/30/1987**
COMPLETION DATE: **09/30/1987**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **08/15/1988**
COMPLETION DATE: **01/28/1992**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **08/22/1989**
COMPLETION DATE: **08/22/1989**
ACTION TYPE DEFINITION:

**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **07/31/1991**
COMPLETION DATE: **12/23/1991**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **12/31/1991**
COMPLETION DATE: **03/29/1993**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **BB - POTENTIALLY RESPONSIBLE PARTY REMOVAL - TIME CRITICAL**
START DATE: **06/29/1993**
COMPLETION DATE: **08/27/1993**
ACTION TYPE DEFINITION:
**PROVIDES FOR OVERSIGHT OF POTENTIALLY RESPONSIBLE PARTY (PRP) RESPONSE ACTION FOR REMOVALS, INCLUDING ALL ACTIVITIES FOR MONITORING AND SUPERVISING THE PERFORMANCE OF PRPS TO DETERMINE WHETHER SUCH PERFORMANCE IS CONSISTENT WITH THE REQUIREMENTS OF THE ADMINISTRATIVE ORDERS ON CONSENT, UNILATERAL ADMINISTRATIVE ORDERS, CONSENT DECREES, JUDICIAL DECREES, INFORMATION AGREEMENTS, AND COMPLIANCE SCHEDULES.**

TYPE: **BE - POTENTIALLY RESPONSIBLE PARTY REMEDIAL DESIGN**
START DATE: **12/11/1987**
COMPLETION DATE: **03/01/1990**
ACTION TYPE DEFINITION:
**PROVIDES FOR OVERSIGHT OF POTENTIALLY RESPONSIBLE PARTY (PRP) RESPONSE ACTION FOR REMEDIAL DESIGN (RD), INCLUDING ALL ACTIVITIES FOR MONITORING AND SUPERVISING THE PERFORMANCE OF THE RESPONSIBLE PARTIES TO DETERMINE WHETHER SUCH PERFORMANCE IS CONSISTENT WITH THE REQUIREMENTS OF THE ADMINISTRATIVE ORDERS ON CONSENT, UNILATERAL ADMINISTRATIVE ORDERS, CONSENT DECREES, JUDICIAL DECREES, INFORMATION AGREEMENTS, AND COMPLIANCE SCHEDULES.**

TYPE: **BE - POTENTIALLY RESPONSIBLE PARTY REMEDIAL DESIGN**
START DATE: **06/07/1992**
COMPLETION DATE: **03/31/1993**
ACTION TYPE DEFINITION:
**PROVIDES FOR OVERSIGHT OF POTENTIALLY RESPONSIBLE PARTY (PRP) RESPONSE ACTION FOR REMEDIAL DESIGN (RD), INCLUDING ALL ACTIVITIES FOR MONITORING AND SUPERVISING THE PERFORMANCE OF THE RESPONSIBLE**

**PARTIES TO DETERMINE WHETHER SUCH PERFORMANCE IS CONSISTENT WITH THE REQUIREMENTS OF THE ADMINISTRATIVE ORDERS ON CONSENT, UNILATERAL ADMINISTRATIVE ORDERS, CONSENT DECREES, JUDICIAL DECREES, INFORMATION AGREEMENTS, AND COMPLIANCE SCHEDULES.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **NOT REPORTED**
COMPLETION DATE: **09/28/1990**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **NE - COST RECOVERY NEGOTIATIONS**
START DATE: **06/15/2000**
COMPLETION DATE: **08/26/2002**
ACTION TYPE DEFINITION:
**NEGOTIATIONS BETWEEN EPA AND THE PRPS ON THE LIABILITY FOR REIMBURSEMENT TO THE FUND OF PAST EPA EXPENDITURES INVOLVED IN SITE CLEANUP.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **03/28/2000**
COMPLETION DATE: **03/28/2000**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NOT REPORTED**
COMPLETION DATE: **03/28/2000**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **JQ - RECORD OF DECISION AMENDMENT**
START DATE: **NOT REPORTED**
COMPLETION DATE: **06/16/2000**
ACTION TYPE DEFINITION:
**SIGNIFICANT CHANGE FROM THE ORIGINAL SELECTED REMEDY STATED IN THE ORIGINAL RECORD OF DECISION (ROD), SUCH AS NEW TECHNOLOGY OR NEW MEDIUM.**

TYPE: **LO - LODGED BY DOJ**
START DATE: **NOT REPORTED**

COMPLETION DATE: **10/31/1995**
ACTION TYPE DEFINITION:
**AN ENFORCEMENT INSTRUMENT (E.G. CONSENT DECREE) IS LODGED BY DOJ WITH THE COURT.**

TYPE: **LO - LODGED BY DOJ**
START DATE: **NOT REPORTED**
COMPLETION DATE: **12/12/2001**
ACTION TYPE DEFINITION:
**AN ENFORCEMENT INSTRUMENT (E.G. CONSENT DECREE) IS LODGED BY DOJ WITH THE COURT.**

TYPE: **LO - LODGED BY DOJ**
START DATE: **NOT REPORTED**
COMPLETION DATE: **01/19/2010**
ACTION TYPE DEFINITION:
**AN ENFORCEMENT INSTRUMENT (E.G. CONSENT DECREE) IS LODGED BY DOJ WITH THE COURT.**

TYPE: **LT - LITIGATION (GENERIC)**
START DATE: **02/23/1999**
COMPLETION DATE: **08/24/2000**
ACTION TYPE DEFINITION:
**THIS ACTIVITY IS USED TO CODE REFERRALS FOR LITIGATION THAT COVER ANY COMBINATION OF REMEDIES OR STATUTES (CERCLA, SARA, RCRA) NOT REFLECTED IN THE CONVENTIONAL ACTIVITY TYPES OF SX (SECTION 106), SV (SECTION 107), CL (COMBINED 106/107), AND SF (SECTION 104). IF PREFERRED, THIS ACTIVITY CAN BE USED TO CODE ALL REFERRAL TYPES INSTEAD OF USING THE CONVENTIONAL SX, SV, CL, SF CODES. BECAUSE THIS ACTIVITY IS GENERIC, CODING THE STATUTES (STATUTE) AND THE REMEDY TYPES (REMEDY) CORRECTLY IS MANDATORY. ALL OTHER EDIT CHECKS AND CODING REQUIREMENTS THAT APPLY TO SX, SV, CL, AND SF APPLY TO LT AS WELL. EXAMPLES: ACTION=LT, STATUTE=106, REMEDY=RA IS EQUIVALENT TO SX; ACTION=LT, STATUTE=107, REMEDY=VA IS EQUIVALENT TO SV; ACTION=LT, STATUTE=106,107, REMEDY=VD, RA IS EQUIVALENT TO CL; ACTION=LT, STATUTE=104, REMEDY=SE, DE IS EQUIVALENT TO SF; ACTION=LT, STATUTE=104,107,106, REMEDY=DE, VM, RD, RA, IS A COMBINATION NOT COVERED BY SX, SV, CL, SF.**

TYPE: **MA - STATE SUPPORT AGENCY COOPERATIVE AGREEMENT**
START DATE: **08/19/1983**
COMPLETION DATE: **11/14/2000**
ACTION TYPE DEFINITION:
**FEDERAL RENUMERATION OF STATE ADMINISTRATIVE COSTS OF PARTICIPATION IN SITE-SPECIFIC REMEDIAL PLANNING OR IMPLEMENTATION ACTIVITIES.**

TYPE: **MA - STATE SUPPORT AGENCY COOPERATIVE AGREEMENT**
START DATE: **04/10/1986**
COMPLETION DATE: **04/11/1991**
ACTION TYPE DEFINITION:
**FEDERAL RENUMERATION OF STATE ADMINISTRATIVE COSTS OF PARTICIPATION IN SITE-SPECIFIC REMEDIAL PLANNING OR IMPLEMENTATION ACTIVITIES.**

TYPE: **MA - STATE SUPPORT AGENCY COOPERATIVE AGREEMENT**

START DATE: **02/12/1988**
COMPLETION DATE: **07/20/1989**
ACTION TYPE DEFINITION:
**FEDERAL RENUMERATION OF STATE ADMINISTRATIVE COSTS OF PARTICIPATION IN SITE-SPECIFIC REMEDIAL PLANNING OR IMPLEMENTATION ACTIVITIES.**

TYPE: **MA - STATE SUPPORT AGENCY COOPERATIVE AGREEMENT**
START DATE: **08/06/1990**
COMPLETION DATE: **09/29/1992**
ACTION TYPE DEFINITION:
**FEDERAL RENUMERATION OF STATE ADMINISTRATIVE COSTS OF PARTICIPATION IN SITE-SPECIFIC REMEDIAL PLANNING OR IMPLEMENTATION ACTIVITIES.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NOT REPORTED**
COMPLETION DATE: **03/28/2000**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **MA - STATE SUPPORT AGENCY COOPERATIVE AGREEMENT**
START DATE: **07/25/1991**
COMPLETION DATE: **09/25/2000**
ACTION TYPE DEFINITION:
**FEDERAL RENUMERATION OF STATE ADMINISTRATIVE COSTS OF PARTICIPATION IN SITE-SPECIFIC REMEDIAL PLANNING OR IMPLEMENTATION ACTIVITIES.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NOT REPORTED**
COMPLETION DATE: **05/22/1987**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **NE - COST RECOVERY NEGOTIATIONS**
START DATE: **10/06/1994**
COMPLETION DATE: **07/15/1996**
ACTION TYPE DEFINITION:
**NEGOTIATIONS BETWEEN EPA AND THE PRPS ON THE LIABILITY FOR REIMBURSEMENT TO THE FUND OF PAST EPA EXPENDITURES INVOLVED IN SITE CLEANUP.**

TYPE: **NE - COST RECOVERY NEGOTIATIONS**
START DATE: **10/24/1994**
COMPLETION DATE: **09/28/1995**

ACTION TYPE DEFINITION:
**NEGOTIATIONS BETWEEN EPA AND THE PRPS ON THE LIABILITY FOR REIMBURSEMENT TO THE FUND OF PAST EPA EXPENDITURES INVOLVED IN SITE CLEANUP.**

TYPE: **NE - COST RECOVERY NEGOTIATIONS**
START DATE: **01/29/1992**
COMPLETION DATE: **03/01/1995**
ACTION TYPE DEFINITION:
**NEGOTIATIONS BETWEEN EPA AND THE PRPS ON THE LIABILITY FOR REIMBURSEMENT TO THE FUND OF PAST EPA EXPENDITURES INVOLVED IN SITE CLEANUP.**

TYPE: **NF - FINAL LISTING ON NATIONAL PRIORITIES LIST**
START DATE: **NOT REPORTED**
COMPLETION DATE: **09/08/1983**
ACTION TYPE DEFINITION:
**SITE MOVED FROM PROPOSED LIST TO FINAL NATIONAL PRIORITY LIST.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NOT REPORTED**
COMPLETION DATE: **08/10/1982**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NOT REPORTED**
COMPLETION DATE: **12/28/1984**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NOT REPORTED**
COMPLETION DATE: **10/29/1987**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NOT REPORTED**
COMPLETION DATE: **02/03/1992**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **NJ - NOTICE LETTERS ISSUED**

START DATE: **NOT REPORTED**
COMPLETION DATE: **05/22/1987**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NOT REPORTED**
COMPLETION DATE: **07/23/1991**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **FE - FIVE-YEAR REVIEW**
START DATE: **06/01/1993**
COMPLETION DATE: **09/30/1993**
ACTION TYPE DEFINITION:
**A REVIEW THAT IS CONDUCTED AT A MINIMUM OF EVERY FIVE YEARS TO DETERMINE IF THE IMPLEMENTATION AND PERFORMANCE OF A REMEDY IS PROTECTIVE OR WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.**

TYPE: **AD - ALTERNATIVE DISPUTE RESOLUTION**
START DATE: **12/04/1998**
COMPLETION DATE: **06/21/1999**
ACTION TYPE DEFINITION:
**DECISION TO TAKE COST RECOVERY ACTION BY USE OF ALTERNATIVE DISPUTE RESOLUTION (ADR) INCLUDING MEDIATION, ARBITRATION AND MINI-TRIAL.**

TYPE: **MA - STATE SUPPORT AGENCY COOPERATIVE AGREEMENT**
START DATE: **07/12/1991**
COMPLETION DATE: **09/13/2012**
ACTION TYPE DEFINITION:
**FEDERAL RENUMERATION OF STATE ADMINISTRATIVE COSTS OF PARTICIPATION IN SITE-SPECIFIC REMEDIAL PLANNING OR IMPLEMENTATION ACTIVITIES.**

TYPE: **FM - FORWARD PLANNING ACTIVITY/MANAGEMENT ASSISTANCE**
START DATE: **09/15/2000**
COMPLETION DATE: **09/27/2000**
ACTION TYPE DEFINITION:
**THE PROCESS WHICH IDENTIFIES AND PLANS PROJECTS NECESSARY TO RESTORE A HAZARDOUS WASTE SITE AND THE FEDERAL RENUMERATION OF STATE ADMINISTRATIVE COSTS FOR PARTICIPATING IN THESE ACTIVITIES OR PROJECTS.**

TYPE: **FE - FIVE-YEAR REVIEW**
START DATE: **01/15/1998**
COMPLETION DATE: **09/30/2003**
ACTION TYPE DEFINITION:
**A REVIEW THAT IS CONDUCTED AT A MINIMUM OF EVERY FIVE YEARS TO DETERMINE IF THE IMPLEMENTATION AND**

**PERFORMANCE OF A REMEDY IS PROTECTIVE OR WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.**

TYPE: **FE - FIVE-YEAR REVIEW**
START DATE: **06/10/1999**
COMPLETION DATE: **12/21/1999**
ACTION TYPE DEFINITION:
**A REVIEW THAT IS CONDUCTED AT A MINIMUM OF EVERY FIVE YEARS TO DETERMINE IF THE IMPLEMENTATION AND PERFORMANCE OF A REMEDY IS PROTECTIVE OR WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.**

TYPE: **NJ - NOTICE LETTERS ISSUED**
START DATE: **NOT REPORTED**
COMPLETION DATE: **07/23/1991**
ACTION TYPE DEFINITION:
**EPA ISSUES NOTICE LETTERS TO POTENTIALLY RESPONSIBLE PARTIES INFORMING THEM OF THEIR POTENTIAL LIABILITY UNDER CERCLA AND INVITING THEM TO DISCUSS INVOLVEMENT AT THE SITE.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NOT REPORTED**
COMPLETION DATE: **12/30/1992**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **FE - FIVE-YEAR REVIEW**
START DATE: **11/13/2012**
COMPLETION DATE: **09/24/2013**
ACTION TYPE DEFINITION:
**A REVIEW THAT IS CONDUCTED AT A MINIMUM OF EVERY FIVE YEARS TO DETERMINE IF THE IMPLEMENTATION AND PERFORMANCE OF A REMEDY IS PROTECTIVE OR WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.**

TYPE: **FN - REMEDIAL INVESTIGATION/FEASIBILITY STUDY NEGOTIATIONS**
START DATE: **08/03/1987**
COMPLETION DATE: **03/31/1988**
ACTION TYPE DEFINITION:
**DISCUSSIONS BETWEEN EPA AND THE POTENTIALLY RESPONSIBLE PARTIES (PRPS) ON LIABILITY FOR AND CONDUCT OF A REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS).**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **08/19/1983**
COMPLETION DATE: **08/19/1983**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A**

**PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **03/15/1985**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **05/15/1985**
COMPLETION DATE: **03/24/1986**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **05/15/1985**
COMPLETION DATE: **09/30/1986**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **05/15/1985**
COMPLETION DATE: **06/30/1987**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **05/15/1985**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **05/15/1985**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NOT REPORTED**
COMPLETION DATE: **03/02/1992**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NOT REPORTED**
COMPLETION DATE: **05/13/1988**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **FE - FIVE-YEAR REVIEW**
START DATE: **04/15/2008**
COMPLETION DATE: **09/30/2008**
ACTION TYPE DEFINITION:
**A REVIEW THAT IS CONDUCTED AT A MINIMUM OF EVERY FIVE YEARS TO DETERMINE IF THE IMPLEMENTATION AND PERFORMANCE OF A REMEDY IS PROTECTIVE OR WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **09/05/1985**
COMPLETION DATE: **09/29/1987**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NOT REPORTED**

COMPLETION DATE: **07/23/1987**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NOT REPORTED**
COMPLETION DATE: **12/28/1984**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NOT REPORTED**
COMPLETION DATE: **06/03/1987**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NOT REPORTED**
COMPLETION DATE: **03/08/1995**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **GM - GROUNDWATER MONITORING (POST-RECORD OF DECISION)**
START DATE: **02/28/2000**
COMPLETION DATE: **08/26/2002**
ACTION TYPE DEFINITION:
**GROUNDWATER MONITORING AS SPECIFIED IN THE RECORD OF DECISION (ROD), WHEN NO OTHER GROUNDWATER CLEANUP IS SPECIFIED. ALSO, WHERE THERE IS NO APPROPRIATE DESIGN AND CLEANUP CONSISTENT WITH GROUNDWATER MONITORING AS PART OF THE REMEDY (E.G., WHEN THEROD SPECIFIES NO ACTION OR A REMOVAL ACTION PLUS GROUNDWATER MONITORING.)**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NOT REPORTED**
COMPLETION DATE: **05/22/1987**

ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **06/24/1988**
COMPLETION DATE: **01/28/1992**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **HR - HAZARD RANKING SYSTEM PACKAGE**
START DATE: **NOT REPORTED**
COMPLETION DATE: **12/01/1982**
ACTION TYPE DEFINITION:
**A NUMERIC ESTIMATE OF THE RELATIVE SEVERITY OF A HAZARDOUS SUBSTANCE RELEASE OR POTENTIAL RELEASE BASED ON: (1) THE RELATIVE POTENTIAL OF SUBSTANCES TO CAUSE HAZARDOUS SITUATIONS; (2) THE LIKELIHOOD AND RATE AT WHICH THE SUBSTANCES MAY AFFECT HUMAN AND ENVIRONMENTAL RECEPTORS; AND (3) THE SEVERITY AND MAGNITUDE OF POTENTIAL EFFECTS. THE SCORE IS COMPUTED USING THE HAZARD RANKING SYSTEM (HRS).**

TYPE: **GR - PARTIAL NATIONAL PRIORITIES LIST DELETION**
START DATE: **NOT REPORTED**
COMPLETION DATE: **11/08/2010**
ACTION TYPE DEFINITION:
**NO FURTHER RESPONSE IS APPROPRIATE FOR A PORTION OF A FINAL NPL SITE. THE PORTION MAY BE A DEFINED GEOGRAPHIC UNIT OF THE SITE, PERHAPS AS SMALL AS A RESIDENTIAL UNIT, OR THE PORTION MAY BE A SPECIFIC MEDIUM AT THE SITE, SUCH AS GROUNDWATER, DEPENDING ON THE NATURE OR EXTENT OF THE RELEASE. THE CRITERIA FOR PARTIAL DELETION ARE THE SAME AS FOR FINAL DELETION. THE START DATE IS THE DATE A NOTICE OF INTENT TO DELETE IS PUBLISHED IN THE FEDERAL REGISTER FOR THE SPECIFIED PORTION OF THE SITE. THE COMPLETION DATE IS THE DATE A NOTICE OF DELETION IS PUBLISHED IN THE FEDERAL REGISTER FOR THAT SPECIFIED PORTION OF THE SITE.**

TYPE: **FS - FEASIBILITY STUDY**
START DATE: **09/10/1990**
COMPLETION DATE: **12/23/1991**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

TYPE: **FS - FEASIBILITY STUDY**

START DATE: **03/24/1986**
COMPLETION DATE: **06/30/1987**
ACTION TYPE DEFINITION:
**A STUDY OF A HAZARDOUS WASTE SITE INTENDED TO (1) EVALUATE ALTERNATIVE REMEDIAL ACTIONS FROM TECHNICAL, ENVIRONMENTAL, AND COST-EFFECTIVENESS PERSPECTIVES; (2) RECOMMEND THE COST-EFFECTIVE REMEDIAL ACTION; AND (3) PREPARE A CONCEPTUAL DESIGN, A COSTESTIMATE FOR BUDGETARY PURPOSES, AND A PRELIMINARY CONSTRUCTION SCHEDULE.**

CONTAMINANTS
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**

CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 08 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **107 NOT DOCUME**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **490 MG/KG**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **ARSENIC**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **35800 MG/KG**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **LEAD, INORGANIC**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **32050 MG/KG**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**

HAZARDOUS SUBSTANCE NAME: **ZINC**
CONTAMINANT GROUP NAME: **METALS**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **598 MG/KG**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **ARSENIC**
CONTAMINANT GROUP NAME: **METALS**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **1260 MG/KG**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **LEAD, INORGANIC**
CONTAMINANT GROUP NAME: **METALS**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **MOLYBDENUM**
CONTAMINANT GROUP NAME: **METALS**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **7980 MG/KG**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **SELENIUM**
CONTAMINANT GROUP NAME: **METALS**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **1460 NOT DOCUME**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA-BHC**
CONTAMINANT GROUP NAME: **PESTICIDES**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM-226**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADON**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **VOC**
CONTAMINANT GROUP NAME: **VOC**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 2**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **51 NOT DOCUME**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**

CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 3**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **29 NOT DOCUME**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 4**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **275 NOT DOCUME**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 4**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **198 PCI/G**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 5**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **1900 NOT DOCUME**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 5**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **2775 PCI/G**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **1920 PCI/G**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **690 PCI/G**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **2120 PCI/G**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**
WASTE SOURCE MEDIA CONTAMINATED NAME: **MONOLITH MATERIAL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM-226**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **MONOLITH MATERIAL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **THORIUM-230**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOLID WASTE**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **57 NOT DOCUME**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOLID WASTE**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **79 PCI/G**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOLID WASTE**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **AIR 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **INORGANICS**
CONTAMINANT GROUP NAME: **INORGANICS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **AIR 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **AIR 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **BUILDING/STRUCTURE**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **2800 OTHER**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **BUILDINGS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **BUILDING DEBRIS**

CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **BUILDING DEBRIS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **DEBRIS 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **GROUNDWATER 01 MEDEX**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **GROUNDWATER 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **ANTIMONY**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **GROUNDWATER 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **ARSENIC**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **GROUNDWATER 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **MOLYBDENUM**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **GROUNDWATER 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **GROUNDWATER 1**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **URANIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**

CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OTHER 01 NEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**

HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **CARD PROP SOILS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **95 NOT DOCUME**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **CARD PROP SOILS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **960 PCI/G**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OU IV & V SOIL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **1059 OTHER**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **GAMMA RADIOACTIVITY EMITTERS**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OU IV & V SOIL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OU IV & V SOIL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **1260 PCI/G**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **RADIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OU8 SHATTUCK SOILS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **ARSENIC**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OU8 SHATTUCK SOILS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **LEAD**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OU8 SHATTUCK SOILS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **LEAD-210**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OU8 SHATTUCK SOILS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **THORIUM-230**

CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **OU8 SHATTUCK SOILS**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**
HAZARDOUS SUBSTANCE NAME: **URANIUM**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **METALS**
CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**

CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 RVNEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **INORGANICS**
CONTAMINANT GROUP NAME: **INORGANICS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 01 RVNEI**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL 02 MATRL**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SURFACE WATER 01 MED**
CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **NOT REPORTED**
CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **NOT REPORTED**
HAZARDOUS SUBSTANCE NAME: **RADIOACTIVE**
CONTAMINANT GROUP NAME: **RADIOACTIVE**

LISTING OF PUBLISHED INSTITUTIONAL CONTROL SITE REPORT
REPORT TYPE: **ICS REQUIRED AND IMPLEMENTED**
URL LINK: **http://www.epa.gov/ictssw07/public/export/08/COD980716955/COD980716955_report.HTM**

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**MAP ID# 80** **Distance from Property: 0.29 mi. (1,531 ft.) S**

## SITE INFORMATION

EPA ID: **COD980716955** SITE ID: **0800247**

SITE NAME: **DENVER RADIUM**

SITE ADDRESS: **VARIOUS PLACES IN DENVER**
**DENVER, CO 80204**

SITE COUNTY: **DENVER**

ADDITIONAL INFORMATION: **ACTIVE SUPERFUND SITES**

MAP LINKS: **HTTP://EMAPS.DPHE.STATE.CO.US/HMSITEMAP/NPL/DENVERRADIUM.HTM**

## CONTACT INFORMATION

NAME: **MARK RUDOLPH**

PHONE: **(303) 692-3311**

## SITE SUMMARY

LOCATION:

**THE DENVER RADIUM SITE CONSISTS OF NUMEROUS SITES IN THE DENVER AREA WHICH ARE CONTAMINATED WITH RADIOACTIVE SOILS AND DEBRIS. THERE ARE ABOUT 65 PROPERTIES ORGANIZED INTO 11 OPERABLE UNITS (OUS).**

HISTORY:

**DURING THE EARLY 1900'S, DENVER WAS THE SITE OF RADIUM PROCESSING ACTIVITIES. THE INDUSTRY DIED OUT IN THE 1920'S, AND THE LOCATIONS OF THE PROCESSING SITES AND DEBRIS WERE FORGOTTEN. IN 1979 EPA DISCOVERED THE SITUATION DURING REVIEW OF OLD DOCUMENTS. THE STATE OF COLORADO, WITH HELP FROM NUMEROUS AGENCIES, CONDUCTED SEVERAL STUDIES TO LOCATE THE DENVER AREA PROPERTIES. THE SITE WAS ADDED TO THE LIST OF SUPERFUND SITES IN SEPTEMBER 1983.**

## ENVIRONMETAL CONCERNS

CHEMICALS:

**SOILS WERE CONTAMINATED WITH THE RADIOACTIVE ELEMENTS RADIUM, THORIUM, AND URANIUM. THE RADIOACTIVE DECAY OF THESE ELEMENTS PRODUCES RADON GAS AND RADON DAUGHTERS.**

EXPOSURE:

**THE CRITICAL PATHWAY IS THE POTENTIAL FOR BUILDUP OF RADON GAS AND RADON DAUGHTERS IN STRUCTURES BUILT OVER CONTAMINATED DEPOSITS. CHRONIC EXPOSURE TO RADON HAS BEEN SHOWN TO CAUSE LUNG CANCER. IN ADDITION, DIRECT CONTACT WITH THE CONTAMINATED SOILS OR DEBRIS MAY POSE A RISK.**

SITE REMEDIATION:

**THE REMEDIAL ACTION FOR MOST OF THE OPERABLE UNITS (OUS) CONSISTED OF EXCAVATION OF CONTAMINATED MATERIALS AND DISPOSAL AT A LICENSED FACILITY IN WESTERN UTAH. CLEANUP ACTIVITIES HAVE BEEN COMPLETED AT ALL OPERABLE UNITS EXCEPT OPERABLE UNIT 8. REMEDIATION AT OPERABLE UNIT 8, SHATTUCK CHEMICAL COMPANY, INVOLVED EXCAVATING AND TREATING THE CONTAMINATED SOILS WITH CEMENT AND FLY ASH AND PLACING THE SOLIDIFIED AND STABILIZED SOILS BACK ON SITE, CREATING A STRUCTURE WHICH WAS CAPPED. FURTHER REVIEW OF THIS REMEDY AND CONCERNS RAISED BY THE COMMUNITY HAVE CAUSED EPA TO RECONSIDER THE ORIGINAL DECISION. EPA CONCLUDED THAT THE LONG-TERM PROTECTIVENESS OF THE REMEDY COULD NOT BE GUARANTEED, AND THEREFORE DECIDED TO REMOVE THE STABILIZED WASTE TO A LICENSED DISPOSAL OR RECYCLING FACILITY. WORK TO REMEDIATE THE FIVE-ACRE SITE STARTED IN MARCH 2003. THIS CONSISTED OF REMOVAL OF THE RIP-RAP, SAND AND GRAVEL LAYER IN SECTIONS BELOW A BUILDING USED TO ENCLOSE THE SITE. THE BUILDING STARTED AT THE SOUTHERN SECTION OF THE SITE AND MOVED FORWARD AS THE SECTIONS OF THE MONOLITH WERE MINED, PLACED IN A RAILROAD GONDOLA CAR AND SHIPPED TO A LICENSED DISPOSAL FACILITY IN IDAHO (USECOLOGY) SHORTLY AFTER. THE COMMUNITY WILL TAKE AN ACTIVE ROLE IN THE FUTURE PLANS FOR THE PROPERTY. INSTITUTIONAL CONTROLS HAVE BEEN SET UP TO ENSURE THAT ANY DISRUPTION OF THE CONTAMINATED DENVER**

STREETS IN OPERABLE UNIT 7 WILL RESULT IN APPROPRIATE EXCAVATION PROCEDURES AND EITHER REBURIAL OR OFF-SITE DISPOSAL OF CONTAMINATED MATERIALS. THE CITY AND COUNTY OF DENVER IS SYSTEMATICALLY REMOVING ALL CONTAMINATION IN THE DENVER RADIUM STREETS OU7 AS PART OF THE OPERATION AND MAINTENANCE OF THEIR STREETS TO ENSURE THAT ALL PUBLIC UTILITIES MEET CURRENT STANDARDS AND GUIDELINES. THE CITY HAS BEEN ACTIVELY MANAGING THE RADIUM MATERIALS FOR ABOUT EIGHT YEARS. THIS EFFORT REQUIRES ANNUAL TRAINING FOR CITY AND UTILITY WORKERS AND A SIGNIFICANT FINANCIAL COMMITMENT BY THE CITY. TO ENSURE LONG TERM PUBLIC HEALTH AND SAFETY, THE CITY BELIEVES THAT REMOVING THE CONTAMINATED MATERIAL WILL ENSURE BETTER MANAGEMENT OF THE MATERIAL AND ALLOW FUTURE GENERAL MAINTENANCE ACTIVITY TO PROCEED WITH SIGNIFICANT COST SAVINGS TO THE PUBLIC.

A FIVE-YEAR REVIEW HAS BEEN COMPLETED FOR THE DENVER RADIUM SITE. THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT, WITH ASSISTANCE FROM EPA, HAD THE LEAD IN CONDUCTING THE REVIEW. FIVE-YEAR REVIEWS ARE COMPLETED AT SITES OR OPERABLE UNITS WHERE SOME WASTE WAS LEFT; WHERE ALL THE WASTE WAS REMOVED, A REVIEW IS NOT REQUIRED. EIGHT OF THE 11 DENVER RADIUM OPERATING UNITS ARE INCLUDED IN THE FIVE-YEAR REVIEW.

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 81** **Distance from Property: 0.29 mi. (1,531 ft.) SW**

**SITE INFORMATION**

FILE NUMBER: **030610-1**
SITE NO: **271**
NAME: **PROFESSIONAL OFFICE BLDG.**
ADDRESS: **2399 BLAKE STREET**
**DENVER, CO 80205**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **7/25/2003**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **1754.98** CLEANUP ACRES: **3.0**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **NOT REPORTED**
PROJECT MANAGER: **RUDOLPH**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **NOT REPORTED**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **NOT REPORTED**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 81** **Distance from Property: 0.3 mi. (1,584 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **12987LST**
FACILITY ID: **12987**
NAME: **24TH & BLAKE STREET CO**
ADDRESS: **2340 BLAKE ST**
**DENVER, CO 80205**
SITE NAME: **24TH & BLAKE STREET CO**
LOCATION: **2340 BLAKE ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **1599** | **CLOSED** | **1/7/1994** | **24TH & BLAKE STREET CO** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=1599

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 82** **Distance from Property: 0.29 mi. (1,531 ft.) W**

## SITE INFORMATION

FILE NUMBER: **150601-1**
SITE NO: **711**
NAME: **2200 WELTON ST.**
ADDRESS: **2200-2250 WELTON AND 600-602 PARK AVE. WEST**
**DENVER, CO 80205**
COUNTY: **DENVER**

## SITE DETAILS

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **7/16/2015**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **1140.00** CLEANUP ACRES: **2.0**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **MIXED - COM+RES**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **NOT REPORTED**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **PAH'S;#13**

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**MAP ID# 83** **Distance from Property: 0.29 mi. (1,531 ft.) NE**

**FACILITY INFORMATION**

EPA ID#: **CO0001844422**
SITE ID#: **0801738**
NAME: **WELTON STREET CHEMICAL**
ADDRESS: **3001 WELTON STREET**
**DENVER, CO 80205**
COUNTY: **DENVER**
FEDERAL FACILITY: **NO - NOT A FEDERAL FACILITY**
NPL: **NOT ON THE NPL**
NON NPL STATUS: **REMOVAL ONLY SITE (NO SITE ASSESSMENT WORK NEEDED)**

Below information was gathered from the prior CERCLIS update completed in 10/2013 update:
NON-NPL STATUS DATE: **01/04/00**
PHYSICAL CLASSIFICATION OF SITE / INCIDENT: **OTHER**
SITE DESCRIPTION **- NO SITE DESCRIPTION INFORMATION AVAILABLE -**
SITE HISTORY **- NO SITE HISTORY INFORMATION AVAILABLE -**
ACTIONS
TYPE: **PJ - POTENTIALLY RESPONSIBLE PARTY EMERGENCY REMOVAL**
START DATE: **04/23/1996**
COMPLETION DATE: **08/31/1996**
ACTION TYPE DEFINITION:
**THE PRP OR THEIR CONTRACTORS HAVE BEGUN CONSTRUCTION WORK ON-SITE IN RESPONSE TO AN EMERGENCY INCIDENT, AND EPA PROVIDES ON-SITE TECHNICAL OVERSIGHT AND/OR IS PART OF AN INCIDENT COMMAND SYSTEM/UNIFIED COMMAND. THE DATE OF CONSTRUCTION IS REPORTED IN WASTELAN AS THE PRP EMERGENCY REMOVAL ACTUAL START DATE.**

CONTAMINANTS **- NO CONTAMINATION INFORMATION AVAILABLE -**
LISTING OF PUBLISHED INSTITUTIONAL CONTROL SITE REPORT **- NOT AN INSTITUTIONAL CONTROL SITE -**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 84** **Distance from Property: 0.3 mi. (1,584 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **15185LST**
FACILITY ID: **15185**
NAME: **WAREHOUSE**
ADDRESS: **3001 LARIMER ST**
**DENVER, CO 80227**
SITE NAME: **WAREHOUSE**
LOCATION: **3001 LARIMER ST, DENVER 80227**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **8248** | **CLOSED** | **6/21/2000** | **WAREHOUSE** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=8248

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# Historical Solid Waste Landfills (HISTSWLF)

**MAP ID# 85** **Distance from Property: 0.3 mi. (1,584 ft.) NE**

**SITE INFORMATION**

UNIQUE ID: **00070-0000910**

NAME: **3001 WALNUT**

ADDRESS: **ADDRESS NOT REPORTED**

**CITY NOT REPORTED, CO**

DIRECTIONS: **NOT REPORTED**

COUNTY: **ADAMS**

**SITE DETAILS**

AGENCY SOURCE: **NOT REPORTED**

DETAIL1:

**NOT REPORTED**

DETAIL2:

**TYPE- LANDFILL; FILL- REFUSE. ; OPER/OWNR/OTHR- / / LANDFILL INC, ,**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 86** **Distance from Property: 0.31 mi. (1,637 ft.) N**

**FACILITY INFORMATION**

UNIQUE ID: **14024LST**

FACILITY ID: **14024**

NAME: **PEPPER TANK CO**

ADDRESS: **3063 OR 3099 BRIGHTON BLVD**
**DENVER, CO 80216**

SITE NAME: **PEPPER TANK CO**

LOCATION: **3063 OR 3099 BRIGHTON BLVD, DENVER 80216**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **417** | **CLOSED** | **5/1/1990** | **PEPPER TANK CO** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=417

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# Superfund Enterprise Management System Archived Site Inventory (SEMSARCH)

**MAP ID# 86** **Distance from Property: 0.31 mi. (1,637 ft.) N**

**FACILITY INFORMATION**

EPA ID#: **CO0009625352**

SITE ID#: **0801786**

NAME: **BRIGHTON BLVD SOLVENTS**

ADDRESS: **3099 BRIGHTON BOULEVARD**
**DENVER, CO 80216**

COUNTY: **DENVER**

FEDERAL FACILITY: **NOT A FEDERAL FACILITY**

NPL: **NOT ON THE NPL**

NON NPL STATUS: **REMOVAL ONLY SITE (NO SITE ASSESSMENT WORK NEEDED)**

Below information was gathered from the prior NFRAP update completed in 10/2013 update:

| ACTION | START DATE | COMPLETION DATE | RESPONSIBILITY |
|---|---|---|---|
| **RS - REMOVAL ASSESSMENT** | **4/14/2000** | **4/1/2001** | **EPA FUND** |
| **VS - ARCHIVE SITE** | **NOT REPORTED** | **3/14/2006** | **EPA IN-HOUSE** |

ACTION DESCRIPTIONS

**RS - (REMOVAL ASSESSMENT) - COLLECTING SITE CHARACTERISTICS TO DETERMINE WHETHER OR NOT A REMOVAL MUST BE PERFORMED.**

**VS - (ARCHIVE SITE) - THE DECISION IS MADE THAT NO FURTHER ACTIVITY IS PLANNED AT THE SITE.**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 86** **Distance from Property: 0.31 mi. (1,637 ft.) N**

## FACILITY INFORMATION

UNIQUE ID: **2938LST**
FACILITY ID: **2938**
NAME: **KATHY & JOHNNY'S INC**
ADDRESS: **3083 BRIGHTON BLVD**
**DENVER, CO 80205**
SITE NAME: **KATHY & JOHNNY'S INC**
LOCATION: **3083 BRIGHTON BLVD, DENVER 80205**

## LEAKING INFORMATION

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **12129** | **OPEN** | **10/8/2014 8:38** | **KATHY & JOHNNY'S INC** |
| COSTIS LINK: | http://costis.cdle.state.co.us/event.asp?h_id=12129 | | |
| **11687** | **CLOSED** | **7/23/2012 8:47** | **KATHY & JOHNNY'S INC** |
| COSTIS LINK: | http://costis.cdle.state.co.us/event.asp?h_id=11687 | | |
| **8266** | **CLOSED** | **7/7/2000** | **TOTAL/ FOSSIL FUELS LLC** |
| COSTIS LINK: | http://costis.cdle.state.co.us/event.asp?h_id=8266 | | |

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 87** **Distance from Property: 0.31 mi. (1,637 ft.) W**

## SITE INFORMATION

FILE NUMBER: **130809-1**
SITE NO: **613**
NAME: **MILE HIGH UNITE WAY HEADQUARTERS**
ADDRESS: **711 PARK AVENUE AND 2350 STOUT STREET**
**DENVER, CO 80205**
COUNTY: **DENVER**

## SITE DETAILS

APPLICATION TYPE: **VOLUNTARY CLEANUP PROGRAM**
REVIEW DATE DUE: **9/23/2013**
DECISION: **WITHDRAWN**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **425.00** CLEANUP ACRES: **1.5**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **COMMERCIAL**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **NOT REPORTED**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **ASBESTOS CONTAMINATED MATERIALS;#25;#BTEX;#6**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 88** **Distance from Property: 0.32 mi. (1,690 ft.) S**

**FACILITY INFORMATION**

UNIQUE ID: **14725LST**

FACILITY ID: **14725**

NAME: **MOORE HOWARD MORTUARY**

ADDRESS: **800 E 17TH AVE**
**DENVER, CO 80202**

SITE NAME: **MOORE HOWARD MORTUARY**

LOCATION: **800 E 17TH AVE, DENVER 80202**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **7234** | **CLOSED** | **2/3/1999** | **MOORE HOWARD MORTUARY** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=7234

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 89** **Distance from Property: 0.32 mi. (1,690 ft.) W**

**FACILITY INFORMATION**

UNIQUE ID: **17958LST**
FACILITY ID: **17958**
NAME: **BILL JACKSON PROPERTY**
ADDRESS: **2220 CALIFORNIA**
**DENVER, CO 80205**
SITE NAME: **BILL JACKSON PROPERTY**
LOCATION: **2220 CALIFORNIA, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **10019** | **CLOSED** | **2/24/2006 7:27** | **BILL JACKSON PROPERTY** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=10019

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 90** **Distance from Property: 0.32 mi. (1,690 ft.) SE**

**FACILITY INFORMATION**

UNIQUE ID: **7536LST**

FACILITY ID: **7536**

NAME: **ROBERT L NAIMAN CO**

ADDRESS: **1000 E 18TH AVE**
**DENVER, CO 80218**

SITE NAME: **MASTERTECH AUTO SERVICE INC**

LOCATION: **1000 E 18TH AVE, DENVER 80218**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **2507** | **CLOSED** | **6/24/1996** | **MASTERTECH AUTO SERVICE INC** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=2507

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 91** **Distance from Property: 0.33 mi. (1,742 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **14681LST**
FACILITY ID: **14681**
NAME: **DENVER HOUSING AUTHORITY**
ADDRESS: **501 E 17TH AVE**
**DENVER, CO 80203**
SITE NAME: **DENVER HOUSING AUTHORITY**
LOCATION: **501 E 17TH AVE, DENVER 80203**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **7507** | **CLOSED** | **6/15/1999** | **DENVER HOUSING AUTHORITY** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=7507

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# *Solid Waste Facilities (SWF)*

**MAP ID# 92** **Distance from Property: 0.33 mi. (1,742 ft.) N**

**SITE INFORMATION**

GEOSEARCH ID: **1788264177REC**

NAME: **REPSCO INC**

ADDRESS: **2950 ARKINS CT**
**DENVER, CO 80216**

COUNTY: **DENVER**

FACILITY TYPE: **RECYCLING FACILITY**

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# No Longer Regulated RCRA Corrective Action Facilities (NLRRCRAC)

**MAP ID# 93** **Distance from Property: 0.33 mi. (1,742 ft.) NE**

**FACILITY INFORMATION**

EPA ID#: **COD007088503**
NAME: **UNIVERSAL CHEMICAL AND SUPPLIES CO**
ADDRESS: **3043 WALNUT ST**
**DENVER, CO 80205**
CONTACT NAME: **JACK GUNDERSON**
CONTACT ADDRESS: **3043 WALNUT ST**
**DENVER CO 80205**
CONTACT PHONE: **303-534-7653**
NON-NOTIFIER: **NOT A NON-NOTIFIER**
DATE RECEIVED BY AGENCY: **01/10/2007**

OWNER TYPE: **PRIVATE**
OWNER NAME: **JACK GUNDERSON**
OPERATOR TYPE: **NOT REPORTED**
OPERATOR NAME: **NOT REPORTED**

CERTIFICATION **- NO CERTIFICATION REPORTED -**

INDUSTRY CLASSIFICATION (NAICS) **- NO NAICS INFORMATION REPORTED -**

SITE HISTORY (INCLUDES GENERATORS AND NON-GENERATORS)

DATE RECEIVED BY AGENCY: **01/10/2007**
NAME: **UNIVERSAL CHEMICAL AND SUPPLIES CO**
DATE RECEIVED BY AGENCY: **04/08/1982**
NAME: **UNIVERSAL CHEMICAL AND SUPPLIES CO**

## CURRENT ACTIVITY INFORMATION

GENERATOR STATUS: **NOT A GENERATOR** LAST UPDATED DATE: **01/10/2007**
SUBJECT TO CORRECTIVE ACTION UNIVERSE: **YES**
TDSFs POTENTIALLY SUBJECT TO CORRECTIVE ACTION UNDER 3004 (u)/(v) UNIVERSE: **NO**
TDSFs ONLY SUBJECT TO CORRECTIVE ACTION UNDER DISCRETIONARY AUTHORITIES UNIVERSE: **NO**
NON TSDFs WHERE RCRA CORRECTIVE ACTION HAS BEEN IMPOSED UNIVERSE: **YES**
CORRECTIVE ACTION WORKLOAD UNIVERSE: **YES**

IMPORTER: **NO**
MIXED WASTE GENERATOR: **NO**
RECYCLER: **NO**
TRANSPORTER: **NO**
ONSITE BURNER EXEMPTION: **NO**
FURNACE EXEMPTION: **NO**
USED OIL REFINER: **NO**
USED OIL TRANSFER FACILITY: **NO**

UNDERGROUND INJECTION: **NO**
UNIVERSAL WASTE DESTINATION FACILITY: **NO**
TRANSFER FACILITY: **NO**
USED OIL FUEL BURNER: **NO**
USED OIL PROCESSOR: **NO**
USED OIL FUEL MARKETER TO BURNER: **NO**
SPECIFICATION USED OIL MARKETER: **NO**
USED OIL TRANSPORTER: **NO**

## COMPLIANCE, MONITORING AND ENFORCEMENT INFORMATION

EVALUATIONS

| | | |
|---|---|---|
| **07/22/2005** | **FCI** | **FOCUSED COMPLIANCE INSPECTION** |
| **08/06/2003** | **CEI** | **COMPLIANCE EVALUATION INSPECTION ON-SITE** |
| **03/28/2001** | **CEI** | **COMPLIANCE EVALUATION INSPECTION ON-SITE** |

VIOLATIONS **- NO VIOLATIONS REPORTED -**

ENFORCEMENTS **- NO ENFORCEMENTS REPORTED -**

## HAZARDOUS WASTE

| | |
|---|---|
| **D001** | **IGNITABLE WASTE** |
| **F002** | **THE FOLLOWING SPENT HALOGENATED SOLVENTS: TETRACHLOROETHYLENE, METHYLENE CHLORIDE,TRICHLOROETHYLENE, 1,1,1-TRICHLOROETHANE,CHLOROBENZENE, 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE, ORTHO-DICHLOROBENZENE, TRICHLOROFLUOROMETHANE, AND 1,1,2, TRICHLOROETHANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001,F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.** |

UNIVERSAL WASTE **- NO UNIVERSAL WASTE REPORTED -**

CORRECTIVE ACTION AREA (RELEASE)

| AREA NAME: | AIR: | GROUNDWATER: | SOIL: | SURFACE WASTE: |
|---|---|---|---|---|
| **ENTIRE FACILITY** | **-----** | **Y** | **Y** | **-----** |

CORRECTIVE ACTION EVENT

| CA EVENT: | DATE: | EVENT DESCRIPTION: |
|---|---|---|
| **CA200** | **07/21/2005** | **INVESTIGATION COMPLETE** |
| **CA375** | **07/21/2005** | **INTERIM DECISION FOR NO FURTHER ACTION** |
| **CA900NC** | **07/21/2005** | **CA PERFORMANCE STANDARDS ATTAINED - NO CONTROLS NECESSARY** |
| **CA999NF** | **07/21/2005** | **CA PROCESS IS TERMINATED-NO FURTHER ACTION** |
| **CA100** | **07/19/2005** | **INVESTIGATION IMPOSITION** |
| **CA370** | **07/19/2005** | **PETITION FOR NO FUR. ACTION RECEIPT DATE** |
| **CA006AC** | **06/10/2005** | **TYPE OF UNIT - AREA OF CONCERN** |
| **CA075LO** | **06/10/2005** | **CA PRIORITIZATION-LOW CA PRIORITY** |
| **CA060** | **06/08/2005** | **NOTICE OF CONTAMINATION** |
| **CA190** | **06/08/2005** | **INVESTIGATION REPORT RECEIVED** |

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 94** **Distance from Property: 0.33 mi. (1,742 ft.) S**

**FACILITY INFORMATION**

UNIQUE ID: **9302LST**

FACILITY ID: **9302**

NAME: **7-ELEVEN #22537**

ADDRESS: **1690 PEARL ST**
**DENVER, CO 80203**

SITE NAME: **7-ELEVEN #22537**

LOCATION: **1690 PEARL ST, DENVER 80203**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **11527** | **CLOSED** | **10/12/2011 11:14** | **7-ELEVEN #22537** |
| COSTIS LINK: | http://costis.cdle.state.co.us/event.asp?h_id=11527 | | |
| **11100** | **CLOSED** | **3/8/2010 10:15** | **7-ELEVEN #22537** |
| COSTIS LINK: | http://costis.cdle.state.co.us/event.asp?h_id=11100 | | |
| **2432** | **CLOSED** | **10/1/1990** | **7-ELEVEN #1823-22537** |
| COSTIS LINK: | http://costis.cdle.state.co.us/event.asp?h_id=2432 | | |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 95** **Distance from Property: 0.34 mi. (1,795 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **4249LST**

FACILITY ID: **4249**

NAME: **DENVER BURGLAR ALARM CO**

ADDRESS: **3040 BLAKE ST**
**DENVER, CO 80205**

SITE NAME: **DENVER BURGLAR ALARM CO INC**

LOCATION: **3040 BLAKE ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **5626** | **CLOSED** | **8/11/1993** | **DENVER BURGLAR ALARM CO INC** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=5626

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 96** **Distance from Property: 0.34 mi. (1,795 ft.) SE**

**SITE INFORMATION**

FILE NUMBER: **141104-1**
SITE NO: **660**
NAME: **METRO CARERING II**
ADDRESS: **1100 E. 18TH AVE.**
**DENVER, CO 80218**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **12/19/2014**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED**
REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **1092.50**
CLEANUP ACRES: **NOT REPORTED**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **RESIDENTIAL**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **ASBESTOS;#2**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **NOT REPORTED**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 96** **Distance from Property: 0.34 mi. (1,795 ft.) SE**

**SITE INFORMATION**

FILE NUMBER: **140623-1**
SITE NO: **660**
NAME: **METRO CARERING**
ADDRESS: **1100 E. 18TH AVE**
**DENVER, CO 80218**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **VOLUNTARY CLEANUP PROGRAM**
REVIEW DATE DUE: **8/7/2014**
DECISION: **APPROVAL**

REMEDY START DATE: **7/30/2014** REMEDY END DATE: **7/30/2016**
ACTUAL COST: **1045.00** CLEANUP ACRES: **65.0**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **COMMERCIAL**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **NOT REPORTED**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **VOC'S;#4**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 96** **Distance from Property: 0.36 mi. (1,901 ft.) SE**

**FACILITY INFORMATION**

UNIQUE ID: **6115LST**
FACILITY ID: **6115**
NAME: **AAMCO**
ADDRESS: **1780 DOWNING ST**
**DENVER, CO 80218**
SITE NAME: **AAMCO TRANSMISSION**
LOCATION: **1780 DOWNING ST, DENVER 80218**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **6578** | **CLOSED** | **5/27/1998** | **AAMCO TRANSMISSION** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=6578

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# *Dry Cleaning Facilities (CLEANERS)*

**MAP ID# 97** **Distance from Property: 0.34 mi. (1,795 ft.) SW**

## SITE INFORMATION

UNIQUEID: **031-0737CL**

FACILITY ID: **031-0737**

NAME: **ORLINS CLEANERY CLEANING & LAUNDRY**

ADDRESS: **411 E 17TH AVE**
**DENVER, CO 80203-1213**

CONTACT: **MERYL ORLIN**

## SITE DETAILS

MAKE/MODEL/SERIAL: **NOT REPORTED**

CONSTRUCTION PERMIT #: **NOT REPORTED**

EMISSION UNIT ID: **001**

EMISSION UNIT DESCRIPTION: **VIBRATIC DRY-TO-DRY UNIT**

EMISSION PROCESS DESCRIPTION: **DRY CLEANING**

ANNUAL THROUGHPUT: **0 TONS SOLVENT CONSUMED**

## OWNER INFORMATION

ADDRESS: **411 E 17TH AVE**
**DENVER, CO 80000-0000**

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# Brownfields Management System (BF)

**MAP ID# 98** **Distance from Property: 0.35 mi. (1,848 ft.) SW**

**SITE INFORMATION**

ID#: **176190**

NAME: **EDDIE MAESTAS TRIANGLE PARK**

ADDRESS: **2317 LAWRENCE ST**
**DENVER, CO 80202**

TYPE FUNDING: **N/A**

PREDOMINANT PAST USE (ACREAGE):

| GREENSPACE: | RESIDENTIAL: | COMMERCIAL: | INDUSTRIAL: |
|---|---|---|---|
| **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

FUTURE USE (ACREAGE):

| GREENSPACE: | RESIDENTIAL: | COMMERCIAL: | INDUSTRIAL: |
|---|---|---|---|
| **0.5** | **NOT REPORTED** | **NOT REPORTED** | **NOT REPORTED** |

PROPERTY HIGHLIGHT:
**NOT REPORTED**

PROPERTY SIZE (Acres): **0.5**

CURRENT OWNER: **NOT REPORTED**

PROPERTY DESCRIPTION/ FORMER USE:
**NOT REPORTED**

CONTAMINATE(S): **OTHER METALS, PAHS**

CONTAMINATE(S) CLEANED UP: **NOT REPORTED**

MEDIA(S) AFFECTED: **NOT REPORTED**

MEDIA(S) CLEANED UP: **NOT REPORTED**

TYPE OF BROWNFIELD GRANT: **TBA**

ENVIRONMENTAL ASSESSMENT ACTIVITY: **PHASE II ENVIRONMENTAL ASSESSMENT**

ASSESSMENT START DATE: **1/21/2014 0:00**

ASSESSMENT COMPLETION DATE: **3/28/2014 0:00**

CLEANUP REQUIRED: **NO**

STATE & TRIBAL ENROLLMENT ID: **NOT REPORTED**

STATE & TRIBAL ENROLLMENT DATE: **NOT REPORTED**

PROPERTY ENROLLED IN A STATE & TRIBAL PROGRAM?: **NOT REPORTED**

ARE INSTITUTIONAL CONTROLS REQUIRED?: **NO**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 98** **Distance from Property: 0.38 mi. (2,006 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **17869LST**
FACILITY ID: **17869**
NAME: **BROADWAY TRIANGE PARK**
ADDRESS: **23RD & LAWRENCE**
**DENVER, CO 80202**
SITE NAME: **BROADWAY TRIANGE PARK**
LOCATION: **23RD & LAWRENCE, DENVER 80202**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **10206** | **CLOSED** | **9/20/2006 12:41** | **BROADWAY TRIANGE PARK** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=10206 | | | |
| **9883** | **CLOSED** | **8/24/2005 10:25** | **BROADWAY TRIANGE PARK** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=9883 | | | |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 99** **Distance from Property: 0.36 mi. (1,901 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **13589LST**
FACILITY ID: **13589**
NAME: **TIRE STORE BLDG**
ADDRESS: **2300 ARAPAHOE ST**
**DENVER, CO 80205**
SITE NAME: **TIRE STORE BLDG**
LOCATION: **2300 ARAPAHOE ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **5475** | **CLOSED** | **11/30/1995** | **TIRE STORE BLDG** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=5475

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 100** **Distance from Property: 0.36 mi. (1,901 ft.) SW**

## SITE INFORMATION

FILE NUMBER: **121109-1**
SITE NO: **536**
NAME: **ARAPAHOE SQUARE DEVELOPMENT II**
ADDRESS: **2300 WALNUT STREET**
**DENVER, CO 80205**
COUNTY: **DENVER**

## SITE DETAILS

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **12/24/2012**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **850.00** CLEANUP ACRES: **2.3**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **MIXED - COM+RES**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **VOC'S;#4**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **ASBESTOS CONTAMINATED MATERIALS;#25;#COAL FILL;#23**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 100** **Distance from Property: 0.36 mi. (1,901 ft.) SW**

**SITE INFORMATION**

FILE NUMBER: **111128-1**

SITE NO: **536**

NAME: **ARAPAHOE SQUARE DEVELOPMENT**

ADDRESS: **2300 WALNUT STREET**
**DENVER, CO 80205**

COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **VOLUNTARY CLEANUP PROGRAM**

REVIEW DATE DUE: **1/12/2012**

DECISION: **APPROVAL**

REMEDY START DATE: **1/17/2013** REMEDY END DATE: **1/17/2014**

ACTUAL COST: **1360.00** CLEANUP ACRES: **2.3**

OTHER ISSUES: **INDOOR AIR;#11**

LAND USE RESTRICTIONS: **RESIDENTIAL**

PROJECT MANAGER: **GANDER**

INDOOR AIR: **NOT REPORTED**

MEDIA SEDIMENT: **NOT REPORTED**

MEDIA GROUND WATER: **NOT REPORTED**

MEDIA SURFACE WATER: **NOT REPORTED**

MEDIA SOIL: **ARSENIC;#8;#SEMI VOC'S;#16;#O&G;#24**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 100** **Distance from Property: 0.36 mi. (1,901 ft.) SW**

**SITE INFORMATION**

FILE NUMBER: **140415-1**
SITE NO: **536**
NAME: **ARAPAHOE SQUARE DEVELOPMENT III**
ADDRESS: **2300 WALNUT STREET**
**DENVER, CO 80205**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **5/30/2014**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED**
REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **950.00**
CLEANUP ACRES: **NOT REPORTED**

OTHER ISSUES: **INDOOR AIR;#11**
LAND USE RESTRICTIONS: **RESIDENTIAL**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **VOC'S;#6**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **NOT REPORTED**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **NOT REPORTED**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 101** **Distance from Property: 0.36 mi. (1,901 ft.) W**

**FACILITY INFORMATION**

UNIQUE ID: **11748LST**

FACILITY ID: **11748**

NAME: **RYDER TRUCK RENTAL INC**

ADDRESS: **2215 CALIFORNIA ST**
**DENVER, CO 80205**

SITE NAME: **RYDER TRUCK RENTAL INC**

LOCATION: **2215 CALIFORNIA ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **5790** | **CLOSED** | **10/22/1990** | **RYDER TRUCK RENTAL INC** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=5790

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 102** **Distance from Property: 0.37 mi. (1,954 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **9596LST**

FACILITY ID: **9596**

NAME: **STARR REALTY MANAGEMENT CORP**

ADDRESS: **303 E 17TH AVE**
**DENVER, CO 80203**

SITE NAME: **STARR REALTY MANAGEMENT CORP**

LOCATION: **303 E 17TH AVE, DENVER 80203**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **7152** | **CLOSED** | **12/30/1998** | **STARR REALTY MANAGEMENT CORP** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=7152

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 103** **Distance from Property: 0.38 mi. (2,006 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **2668LST**
FACILITY ID: **2668**
NAME: **BIG STEVE AUTO SALON**
ADDRESS: **2955 DOWNING**
**DENVER, CO 80205**
SITE NAME: **BIG STEVE**
LOCATION: **2955 DOWNING, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **8132** | **CLOSED** | **3/17/2000** | **BIG STEVE** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=8132

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 104** **Distance from Property: 0.38 mi. (2,006 ft.) W**

**FACILITY INFORMATION**

UNIQUE ID: **2686LST**
FACILITY ID: **2686**
NAME: **DENVER BURGLAR ALARM CO INC**
ADDRESS: **1955 SHERMAN ST**
**DENVER, CO 80203**
SITE NAME: **DENVER BURGLAR ALARM**
LOCATION: **1955 SHERMAN ST, DENVER 80203**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **6289** | **CLOSED** | **2/9/1998** | **DENVER BURGLAR ALARM** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=6289

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 105** **Distance from Property: 0.39 mi. (2,059 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **17952LST**

FACILITY ID: **17952**

NAME: **PARKING LOT/FORMER GAS STATION**

ADDRESS: **2256 CURTIS ST**
**DENVER, CO 80205**

SITE NAME: **PARKING LOT/FORMER GAS STATION**

LOCATION: **2256 CURTIS ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **9934** | **CLOSED** | **10/28/2005 12:27** | **PARKING LOT/FORMER GAS STATION** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=9934

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 106** **Distance from Property: 0.39 mi. (2,059 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **15857LST**
FACILITY ID: **15857**
NAME: **FIRE CLAY LOFTS**
ADDRESS: **3100 BLAKE ST**
**DENVER, CO 80205**
SITE NAME: **FIRE CLAY LOFTS**
LOCATION: **3100 BLAKE ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **9052** | **CLOSED** | **10/15/2002 12:39** | **FIRE CLAY LOFTS** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=9052

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 107** **Distance from Property: 0.39 mi. (2,059 ft.) W**

**FACILITY INFORMATION**

UNIQUE ID: **2012LST**

FACILITY ID: **2012**

NAME: **GEORGES SUPER CONOCO**

ADDRESS: **838 PARK AVE**
**DENVER, CO 80205**

SITE NAME: **GEORGES SUPER CONOCO**

LOCATION: **838 PARK AVE<BR>DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **12179** | **OPEN** | **12/29/2014 8:28:40 AM** | **GEORGES SUPER CONOCO** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=12179

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# Historical Solid Waste Landfills (HISTSWLF)

**MAP ID# 108** **Distance from Property: 0.4 mi. (2,112 ft.) N**

**SITE INFORMATION**

UNIQUE ID: **00070-0000620**

NAME: **ARTIFICIAL FILL**

ADDRESS: **NORTH AND WEST OF PLATTE RIVER; SOUTH OF 31ST STREET; EAST OF BN**
**DENVER, CO**

DIRECTIONS: **NOT REPORTED**

COUNTY: **DENVER**

**SITE DETAILS**

AGENCY SOURCE: **NOT REPORTED**

DETAIL1:

**; FILL- DOMESTIC REFUSE: NO. CONSTRUCTION DEBRIS: NO. LIQUIDS: NO. HAZARDOUS WASTE: NO. INDUSTRIAL WASTE: NO. ARTIFICIAL FILL. UNKNOWN: NO. CLAY, SILT, SAND, GRAVEL AND A VARIETY OF DEBRIS CONSISTING OF WOOD, BRICK, METAL, PLASTIC, GLASS, VEGETATIO**

DETAIL2:

**ARTIFICIAL FILL. INCLUDES EMBANKMENTS, DAMS, AND OTHER ENGINEERED FILLS; COMPACTED LANDFILLS, AND UNCOMPACTED RUBBISH DUMPS. CONFIDENCE IN THIS INFO: HIGH.; OPENED- CLOSED-**

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# Denver County Historic Landfills (DCHISTLF)

**MAP ID# 108** **Distance from Property: 0.4 mi. (2,112 ft.) N**

**SITE INFORMATION**

LANDFILL ID: **75**

LANDFILL NAME: **3S-68W-27NW2**

DATE ENTERED: **04/28/1997**

TYPE OF LANDFILL: **OTHER**

DESCRIPTION:

**NORTH AND WEST OF PLATTE RIVER; SOUTH OF 31ST STREET; EAST OF BNRR, ENCOMPASSING WESTON ST.**

TYPE REMARKS:

**INCLUDES EMBANKMENTS, DAMS, AND OTHER ENGINEERED FILLS; COMPACTED LANDFILLS, AND UNCOMPACTED RUBBISH DUMPS.**

DOMESTIC: **NO**

HAZARDOUS: **NO**

CONSTRUCTION: **NO**

INDUSTRIAL: **NO**

LIQUIDS: **NO**

UNKNOWN: **NO**

OTHER: **ARTIFICIAL FILL**

MATERIAL RECEIVED:

**CLAY, SILT, SAND, GRAVEL AND A VARIETY OF DEBRIS CONSISTING OF WOOD, BRICK, METAL, PLASTIC, GLASS, VEGETATION, AND OTHER TRASH.**

START DATE: **NOT REPORTED**

END DATE: **NOT REPORTED**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 109** **Distance from Property: 0.4 mi. (2,112 ft.) E**

**FACILITY INFORMATION**

UNIQUE ID: **11954LST**
FACILITY ID: **11954**
NAME: **KAISER PERMANENTE**
ADDRESS: **2000 LAFAYETTE ST**
**DENVER, CO 80205**
SITE NAME: **KAISER PERMANENTE**
LOCATION: **2000 LAFAYETTE ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **4588** | **CLOSED** | **2/1/1991** | **KAISER PERMANENTE** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=4588

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 110** **Distance from Property: 0.4 mi. (2,112 ft.) W**

**FACILITY INFORMATION**

UNIQUE ID: **9639LST**
FACILITY ID: **9639**
NAME: **EUROMONT GROUP (THE)**
ADDRESS: **140 E 19TH ST**
**DENVER, CO 80203**
SITE NAME: **EUROMONT GROUP (THE)**
LOCATION: **140 E 19TH ST, DENVER 80203**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **3896** | **CLOSED** | **6/17/1991** | **EUROMONT GROUP (THE)** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=3896

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 111** **Distance from Property: 0.41 mi. (2,165 ft.) N**

**FACILITY INFORMATION**

UNIQUE ID: **9980LST**

FACILITY ID: **9980**

NAME: **H & N CONOCO**

ADDRESS: **3101 BRIGHTON BLVD**
**DENVER, CO 80216**

SITE NAME: **H & N CONOCO**

LOCATION: **3101 BRIGHTON BLVD, DENVER 80216**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **9841** | **CLOSED** | **7/27/2005 8:14** | **H & N CONOCO** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=9841 | | | |
| **3036** | **CLOSED** | **7/25/1995** | **CONOCO** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=3036 | | | |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 112** **Distance from Property: 0.42 mi. (2,218 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **13316LST**

FACILITY ID: **13316**

NAME: **RTD OFFICE**

ADDRESS: **1520 20TH ST**

**2001 BLAKE ST**

**DENVER, CO 80202**

SITE NAME: **RTD**

LOCATION: **1520 20TH ST**

**2001 BLAKE ST, DENVER 80202**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **5614** | **CLOSED** | **2/2/1994** | **RTD** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=5614

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# No Longer Regulated RCRA Corrective Action Facilities (NLRRCRAC)

**MAP ID# 112** **Distance from Property: 0.42 mi. (2,218 ft.) SW**

**FACILITY INFORMATION**

EPA ID#: **COD983796954**

NAME: **COORS FIELD BASEBALL STADIUM**

ADDRESS: **2139 BLAKE ST**
**DENVER, CO 80202**

CONTACT NAME: **JOHN LEHIGH**

CONTACT ADDRESS: **1660 17TH ST STE 100**
**DENVER CO 80202**

CONTACT PHONE: **303-825-0401**

NON-NOTIFIER: **NOT A NON-NOTIFIER**

DATE RECEIVED BY AGENCY: **10/30/1992**

OWNER TYPE: **DISTRICT**

OWNER NAME: **DEN METRO MAJOR LEAGUE BASEBALL STADIUM**

OPERATOR TYPE: **NOT REPORTED**

OPERATOR NAME: **NOT REPORTED**

CERTIFICATION **- NO CERTIFICATION REPORTED -**

INDUSTRY CLASSIFICATION (NAICS) **- NO NAICS INFORMATION REPORTED -**

SITE HISTORY (INCLUDES GENERATORS AND NON-GENERATORS)

DATE RECEIVED BY AGENCY: **10/30/1992**

NAME: **COORS FIELD BASEBALL STADIUM**

CURRENT ACTIVITY INFORMATION

GENERATOR STATUS: **NOT A GENERATOR** LAST UPDATED DATE: **03/18/2004**

SUBJECT TO CORRECTIVE ACTION UNIVERSE: **YES**

TDSFs POTENTIALLY SUBJECT TO CORRECTIVE ACTION UNDER 3004 (u)/(v) UNIVERSE: **NO**

TDSFs ONLY SUBJECT TO CORRECTIVE ACTION UNDER DISCRETIONARY AUTHORITIES UNIVERSE: **NO**

NON TSDFs WHERE RCRA CORRECTIVE ACTION HAS BEEN IMPOSED UNIVERSE: **YES**

CORRECTIVE ACTION WORKLOAD UNIVERSE: **YES**

IMPORTER: **NO**
MIXED WASTE GENERATOR: **NO**
RECYCLER: **NO**
TRANSPORTER: **NO**
ONSITE BURNER EXEMPTION: **NO**
FURNACE EXEMPTION: **NO**
USED OIL REFINER: **NO**
USED OIL TRANSFER FACILITY: **NO**

UNDERGROUND INJECTION: **NO**
UNIVERSAL WASTE DESTINATION FACILITY: **NO**
TRANSFER FACILITY: **NO**
USED OIL FUEL BURNER: **NO**
USED OIL PROCESSOR: **NO**
USED OIL FUEL MARKETER TO BURNER: **NO**
SPECIFICATION USED OIL MARKETER: **NO**
USED OIL TRANSPORTER: **NO**

COMPLIANCE, MONITORING AND ENFORCEMENT INFORMATION

EVALUATIONS

| | | |
|---|---|---|
| **05/10/1993** | **CAC** | **CORRECTIVE ACTION COMPLIANCE EVALUATION** |
| **02/05/1993** | **CAC** | **CORRECTIVE ACTION COMPLIANCE EVALUATION** |
| **12/21/1992** | **CAC** | **CORRECTIVE ACTION COMPLIANCE EVALUATION** |
| **12/18/1992** | **CAC** | **CORRECTIVE ACTION COMPLIANCE EVALUATION** |
| **12/17/1992** | **CAC** | **CORRECTIVE ACTION COMPLIANCE EVALUATION** |

VIOLATIONS **- NO VIOLATIONS REPORTED -**

ENFORCEMENTS **- NO ENFORCEMENTS REPORTED -**

HAZARDOUS WASTE

| | |
|---|---|
| **P004** | **1,4,5,8-DIMETHANONAPHTHALENE, 1,2,3,4,10,10-HEXA-CHLORO-1,4,4A,5,8,8A,-HEXAHYDRO-, (1ALPHA, 4ALPHA, 4ABETA, 5ALPHA, 8ALPHA, 8ABETA)-** |
| **P004** | **ALDRIN** |
| **P037** | **2,7:3,6-DIMETHANONAPHTH[2,3-B]OXIRENE, 3,4,5,6,9,9-HEXACHLORO-1A,2,2A,3,6,6A,7,7AOCTAHYDRO-, (1AALPHA, 2BETA, 2AALPHA, 3BETA, 6BETA, 6AALPHA, 7BETA, 7AALPHA)-** |
| **P037** | **DIELDRIN** |
| **P051** | **2,7:3,6-DIMETHANONAPHTH[2,3-B]OXIRENE, 3,4,5,6,9,9-HEXACHLORO-1A,2,2A,3,6,6A,7,7AOCTAHYDRO-, (1AALPHA, 2BETA, 2ABETA, 3ALPHA, 6ALPHA, 6ABETA, 7BETA, 7AALPHA)- & METABOLITES** |
| **P051** | **ENDRIN** |
| **P051** | **ENDRIN, & METABOLITES** |
| **U022** | **BENZO[A]PYRENE** |
| **U050** | **CHRYSENE** |
| **U137** | **INDENO[1,2,3-CD]PYRENE** |

UNIVERSAL WASTE **- NO UNIVERSAL WASTE REPORTED -**

CORRECTIVE ACTION AREA (RELEASE)

| AREA NAME: | AIR: | GROUNDWATER: | SOIL: | SURFACE WASTE: |
|---|---|---|---|---|
| **TEPPER PROPERTY** | **-----** | **-----** | **Y** | **-----** |
| **ENTIRE FACILITY** | **-----** | **Y** | **Y** | **-----** |

CORRECTIVE ACTION EVENT

| CA EVENT: | DATE: | EVENT DESCRIPTION: |
|---|---|---|
| **CA006OU** | **04/19/1995** | **TYPE OF UNIT - OPERABLE UNIT** |
| **CA550** | **04/30/1993** | **REMEDY CONSTRUCTION** |
| **CA725YE** | **04/30/1993** | **HUMAN EXPOSURES CONTROLLED DETERMINATION-YES, APPLICABLE AS OF THIS DATE** |
| **CA750YE** | **04/30/1993** | **RELEASE TO GW CONTROLLED DETERMINATION-YES, APPLICABLE AS OF THIS DATE** |
| **CA999** | **04/30/1993** | **CA PROCESS IS TERMINATED** |
| **CA999NF** | **04/30/1993** | **CA PROCESS IS TERMINATED-NO FURTHER ACTION** |
| **CA300** | **02/05/1993** | **CMS WORKPLAN APPROVED** |
| **CA500** | **02/05/1993** | **CMI WORKPLAN APPROVED** |
| **CA200** | **02/04/1993** | **INVESTIGATION COMPLETE** |
| **CA250** | **02/04/1993** | **CMS IMPOSITION** |
| **CA100** | **12/23/1992** | **INVESTIGATION IMPOSITION** |
| **CA060** | **12/09/1992** | **NOTICE OF CONTAMINATION** |
| **CA070YE** | **12/09/1992** | **DETERMINATION OF NEED FOR AN INVESTIGATION-INVESTIGATION IS NECESSARY** |
| **CA075LO** | **12/09/1992** | **CA PRIORITIZATION-LOW CA PRIORITY** |

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# *Hazardous Waste Sites- Corrective Action (HWSCA)*

**MAP ID# 112** **Distance from Property: 0.42 mi. (2,218 ft.) SW**

**SITE INFORMATION**

EPA ID: **COD983796954**

SITE NAME: **COORS FIELD BASEBALL STADIUM**

SITE ADDRESS: **2139 BLAKE STREET**
**DENVER, CO 80202**

SITE COUNTY: **DENVER**

FACILITY TYPE: **CA**

STATUS: **ACTIVE**

LINKS: **http://www.epa.gov/cgi-bin/get1cReport.cgi?tool=echo&IDNumber=COD983796954**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 113** **Distance from Property: 0.42 mi. (2,218 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **10377LST**

FACILITY ID: **10377**

NAME: **CAPRA PLUMBING & HEATING INC**

ADDRESS: **2235 ARAPAHOE ST**
**DENVER, CO 80205**

SITE NAME: **CAPRA PLUMBING & HEATING INC**

LOCATION: **2235 ARAPAHOE ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **1556** | **CLOSED** | **5/1/1995** | **CAPRA PLUMBING & HEATING INC** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=1556

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 114** **Distance from Property: 0.43 mi. (2,270 ft.) W**

**FACILITY INFORMATION**

UNIQUE ID: **2690LST**
FACILITY ID: **2690**
NAME: **DENVER BURGLAR ALARM CO INC**
ADDRESS: **2025 WELTON ST**
**DENVER, CO 80205**
SITE NAME: **DENVER BURGLAR ALARM CO INC**
LOCATION: **2025 WELTON ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **4198** | **CLOSED** | **5/7/1996** | **DENVER BURGLAR ALARM CO INC** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=4198

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 114** **Distance from Property: 0.44 mi. (2,323 ft.) W**

**FACILITY INFORMATION**

UNIQUE ID: **8531LST**

FACILITY ID: **8531**

NAME: **HERTZ CORP**

ADDRESS: **2017 WELTON ST**
**DENVER, CO 80205**

SITE NAME: **HERTZ CORP**

LOCATION: **2017 WELTON ST<BR>DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **12277** | **CLOSED** | **6/15/2015 2:04:05 PM** | **HERTZ CORP** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=12277

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 115** **Distance from Property: 0.43 mi. (2,270 ft.) NE**

**SITE INFORMATION**

FILE NUMBER: **010110-1**
SITE NO: **151**
NAME: **BRICK PLANT II**
ADDRESS: **3101-3225 BLAKE**
**DENVER, CO 80205**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **2/24/2001**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **373.40** CLEANUP ACRES: **NOT REPORTED**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **NOT REPORTED**
PROJECT MANAGER: **WALKER**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **NOT REPORTED**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **NOT REPORTED**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 115** **Distance from Property: 0.43 mi. (2,270 ft.) NE**

**SITE INFORMATION**

FILE NUMBER: **991018-1**
SITE NO: **151**
NAME: **BRICK PLANT I**
ADDRESS: **3101-3225 BLAKE**
**DENVER, CO 80205**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **VOLUNTARY CLEANUP PROGRAM**
REVIEW DATE DUE: **12/2/1999**
DECISION: **APPROVAL**

REMEDY START DATE: **12/21/2000** REMEDY END DATE: **12/21/2001**
ACTUAL COST: **709.46** CLEANUP ACRES: **4.0**

OTHER ISSUES: **UP GRADIENT SOURCE;#10**
LAND USE RESTRICTIONS: **NOT REPORTED**
PROJECT MANAGER: **WALKER**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **NOT REPORTED**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **NOT REPORTED**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 115** **Distance from Property: 0.45 mi. (2,376 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **15113LST**

FACILITY ID: **15113**

NAME: **SIEGEL INVESTMENTS CO LLC**

ADDRESS: **3225 BLAKE ST**
**DENVER, CO 80205**

SITE NAME: **SIEGEL INVESTMENTS CO LLC**

LOCATION: **3225 BLAKE ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **8021** | **CLOSED** | **1/21/2000** | **SIEGEL INVESTMENTS CO LLC** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=8021

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 116** **Distance from Property: 0.43 mi. (2,270 ft.) SE**

**FACILITY INFORMATION**

UNIQUE ID: **13771LST**
FACILITY ID: **13771**
NAME: **BECHTOLD PROPERTY**
ADDRESS: **1775 LAFAYETTE ST**
**DENVER, CO 80218**
SITE NAME: **BECHTOLD PROPERTY**
LOCATION: **1775 LAFAYETTE ST, DENVER 80218**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **475** | **CLOSED** | **10/10/1996** | **BECHTOLD PROPERTY** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=475

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 117** **Distance from Property: 0.44 mi. (2,323 ft.) W**

**FACILITY INFORMATION**

UNIQUE ID: **18713LST**
FACILITY ID: **18713**
NAME: **2130 STOUT ST**
ADDRESS: **2130 STOUT ST**
**DENVER, CO 80202**
SITE NAME: **2130 STOUT ST**
LOCATION: **2130 STOUT ST, DENVER 80202**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **10806** | **CLOSED** | **2/18/2009 14:43** | **2130 STOUT ST** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=10806

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 118** **Distance from Property: 0.44 mi. (2,323 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **11531LST**
FACILITY ID: **11531**
NAME: **EQUITABLE REAL ESTATE**
ADDRESS: **1775 SHERMAN ST**
**DENVER, CO 80203**
SITE NAME: **EQUITABLE REAL ESTATE**
LOCATION: **1775 SHERMAN ST, DENVER 80203**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **1668** | **CLOSED** | **7/16/1996** | **EQUITABLE REAL ESTATE** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=1668

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 119** **Distance from Property: 0.44 mi. (2,323 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **3545LST**
FACILITY ID: **3545**
NAME: **SWANK REALTY**
ADDRESS: **3021 N DOWNING**
**DENVER, CO 80205**
SITE NAME: **SWANK REALTY**
LOCATION: **3021 N DOWNING, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **8131** | **CLOSED** | **3/17/2000** | **SWANK REALTY** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=8131

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 120** **Distance from Property: 0.44 mi. (2,323 ft.) E**

**FACILITY INFORMATION**

UNIQUE ID: **15960LST**
FACILITY ID: **15960**
NAME: **BONNER PROPERTY**
ADDRESS: **2201 HUMBOLDT STREET**
**DENVER, CO 80205**
SITE NAME: **BONNER PROPERTY**
LOCATION: **2201 HUMBOLDT STREET, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **9156** | **CLOSED** | **3/11/2003 13:13** | **BONNER PROPERTY** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=9156

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# *Leaking Underground Storage Tanks Trust Fund Sites (LUSTTRUST)*

**MAP ID# 121** **Distance from Property: 0.44 mi. (2,323 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **00177-0005174**

AGENCY ID: **5512**

NAME: **CARROLL L CLARK**

ADDRESS: **3108 BRIGHTON BLVD**
**DENVER, CO 80216**

COUNTY: **DENVER**

COMMENTS: **EVENT DATE: 8/29/91**
**NOT REPORTED**

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=5512

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 121** **Distance from Property: 0.44 mi. (2,323 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **10023LST**
FACILITY ID: **10023**
NAME: **MOREWEST PROPERTIES**
ADDRESS: **3108 BRIGHTON BLVD**
**DENVER, CO 80216**
SITE NAME: **CARROLL L CLARK**
LOCATION: **3108 BRIGHTON BLVD, DENVER 80216**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **5512** | **CLOSED** | **8/29/1991** | **CARROLL L CLARK** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=5512

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 122** **Distance from Property: 0.44 mi. (2,323 ft.) NE**

**SITE INFORMATION**

FILE NUMBER: **070917-1**
SITE NO: **398**
NAME: **VILLAGE FLATS**
ADDRESS: **3198 BLAKE STREET**
**DENVER, CO 80211**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **11/1/2007**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **892.50** CLEANUP ACRES: **0.5**

OTHER ISSUES: **UP GRADIENT SOURCE;#10**
LAND USE RESTRICTIONS: **NOT REPORTED**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **VOC'S;#6**
MEDIA SEDIMENT: **VOC'S;#4**
MEDIA GROUND WATER: **VOC'S;#4**
MEDIA SURFACE WATER: **VOC'S;#4**
MEDIA SOIL: **VOC'S;#4**

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# Solid Waste Facilities (SWF)

**MAP ID# 122** **Distance from Property: 0.45 mi. (2,376 ft.) NE**

**SITE INFORMATION**

GEOSEARCH ID: **31WGR**
NAME: **DENVER SANITARY CO**
ADDRESS: **3161 WALNUT ST**
**DENVER, CO 80205**
COUNTY: **NOT REPORTED**
CERTIFICATION ID: **31**
FACILITY TYPE: **WASTE GREASE REGISTRANT FACILITY**
WASTE GREASE FACILITY: **NO**
WASTE GREASE TRANSPORTER: **YES**
WASTE GREASE PERSONAL USER: **NO**

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# Historical Solid Waste Landfills (HISTSWLF)

**MAP ID# 123** **Distance from Property: 0.45 mi. (2,376 ft.) W**

**SITE INFORMATION**

UNIQUE ID: **00070-0000637**

NAME: **ARTIFICIAL FILL**

ADDRESS: **EAST OF FOX ST. TO RR; NORTH TO RR ON SOUTH SIDE OF PLATTE, AND**
**DENVER, CO**

DIRECTIONS: **NOT REPORTED**

COUNTY: **DENVER**

**SITE DETAILS**

AGENCY SOURCE: **NOT REPORTED**

DETAIL1:

**; FILL- DOMESTIC REFUSE: NO. CONSTRUCTION DEBRIS: NO. LIQUIDS: NO. HAZARDOUS WASTE: NO. INDUSTRIAL WASTE: NO. ARTIFICIAL FILL. UNKNOWN: NO. CLAY, SILT, SAND, GRAVEL AND A VARIETY OF DEBRIS CONSISTING OF WOOD, BRICK, METAL, PLASTIC, GLASS, VEGETATIO**

DETAIL2:

**ARTIFICIAL FILL. INCLUDES EMBANKMENTS, DAMS, AND OTHER ENGINEERED FILLS; COMPACTED LANDFILLS, AND UNCOMPACTED RUBBISH DUMPS. CONFIDENCE IN THIS INFO: HIGH.; OPENED- CLOSED-**

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# Denver County Historic Landfills (DCHISTLF)

**MAP ID# 123** **Distance from Property: 0.45 mi. (2,376 ft.) W**

**SITE INFORMATION**

LANDFILL ID: **92**

LANDFILL NAME: **3S-68W-27SW1**

DATE ENTERED: **04/28/1997**

TYPE OF LANDFILL: **OTHER**

DESCRIPTION:

**EAST OF FOX ST. TO RR; NORTH TO RR ON SOUTH SIDE OF PLATTE, AND SOUTH TO DELGANEY**

TYPE REMARKS:

**INCLUDES EMBANKMENTS, DAMS, AND OTHER ENGINEERED FILLS; COMPACTED LANDFILLS, AND UNCOMPACTED RUBBISH DUMPS.**

DOMESTIC: **NO**

HAZARDOUS: **NO**

CONSTRUCTION: **NO**

INDUSTRIAL: **NO**

LIQUIDS: **NO**

UNKNOWN: **NO**

OTHER: **ARTIFICIAL FILL**

MATERIAL RECEIVED:

**CLAY, SILT, SAND, GRAVEL AND A VARIETY OF DEBRIS CONSISTING OF WOOD, BRICK, METAL, PLASTIC, GLASS, VEGETATION, AND OTHER TRASH.**

START DATE: **NOT REPORTED**

END DATE: **NOT REPORTED**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 124** **Distance from Property: 0.48 mi. (2,534 ft.) W**

**FACILITY INFORMATION**

UNIQUE ID: **14780LST**
FACILITY ID: **14780**
NAME: **ANT PROPERTIES LLC**
ADDRESS: **31ST & FOX ST**
**DENVER, CO 80216**
SITE NAME: **ANT PROPERTIES LLC**
LOCATION: **31ST & FOX ST, DENVER 80216**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **7159** | **CLOSED** | **1/5/1999** | **ANT PROPERTIES LLC** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=7159

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 125** **Distance from Property: 0.45 mi. (2,376 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **15276LST**
FACILITY ID: **15276**
NAME: **2201 ARAPAHOE LLC**
ADDRESS: **2201 ARAPAHOE**
**DENVER, CO 80205**
SITE NAME: **GREAT DIVIDE BREWERY**
LOCATION: **2201 ARAPAHOE, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **8571** | **CLOSED** | **6/15/2001** | **GREAT DIVIDE BREWERY** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=8571

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 126** **Distance from Property: 0.45 mi. (2,376 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **15275LST**
FACILITY ID: **15275**
NAME: **PARK ALL DAY**
ADDRESS: **2202 LAWRENCE ST**
**DENVER, CO 80205**
SITE NAME: **LAWRENCE STREET PARKING LOT**
LOCATION: **2202 LAWRENCE ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **8379** | **CLOSED** | **11/14/2000** | **LAWRENCE STREET PARKING LOT** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=8379

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 127** **Distance from Property: 0.46 mi. (2,429 ft.) W**

**FACILITY INFORMATION**

UNIQUE ID: **14151LST**
FACILITY ID: **14151**
NAME: **GARRISON PROP**
ADDRESS: **1950 WELTON ST**
**DENVER, CO 80202**
SITE NAME: **GARRISON PROP**
LOCATION: **1950 WELTON ST, DENVER 80202**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **5860** | **CLOSED** | **7/29/1997** | **GARRISON PROP** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=5860

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 128** **Distance from Property: 0.46 mi. (2,429 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **17757LST**
FACILITY ID: **17757**
NAME: **LOGAN TOWER**
ADDRESS: **1580 LOGAN ST**
**DENVER, CO 80202**
SITE NAME: **LOGAN TOWER**
LOCATION: **1580 LOGAN ST, DENVER 80202**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **11654** | **CLOSED** | **5/24/2012 8:02** | **LOGAN TOWER** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=11654

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 129** **Distance from Property: 0.46 mi. (2,429 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **5499LST**

FACILITY ID: **5499**

NAME: **M B GLASSMAN**

ADDRESS: **2201 BLAKE ST**
**DENVER, CO 80205**

SITE NAME: **MB GLASSMAN**

LOCATION: **2201 BLAKE ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **999** | **CLOSED** | **8/25/1993** | **MB GLASSMAN** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=999

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**MAP ID# 129** **Distance from Property: 0.46 mi. (2,429 ft.) SW**

**SITE INFORMATION**

EPA ID: **COD032004137**

SITE NAME: **VANASK WAREHOUSE CO**

SITE ADDRESS: **2201 BLAKE ST**
**DENVER, CO 80205**

SITE COUNTY: **DENVER**

FACILITY TYPE: **CA**

STATUS: **HISTORIC**

LINKS: **http://www.epa.gov/cgi-bin/get1cReport.cgi?tool=echo&IDNumber=COD032004137**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 130** **Distance from Property: 0.46 mi. (2,429 ft.) SW**

**SITE INFORMATION**

FILE NUMBER: **150219-1**
SITE NO: **700**
NAME: **BALTAR INC.**
ADDRESS: **2200 BROADWAY**
**DENVER, CO 80205**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **4/5/2015**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED**
REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **1235.00**
CLEANUP ACRES: **1.0**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **COMMERCIAL**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **BTEX;#6**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **BTEX;#6**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 131** **Distance from Property: 0.47 mi. (2,482 ft.) SE**

**FACILITY INFORMATION**

UNIQUE ID: **3322LST**
FACILITY ID: **3322**
NAME: **MOORE-HOWARD MORTUARIES**
ADDRESS: **1711 LAFAYETTE ST**
**DENVER, CO 80218**
SITE NAME: **MOORE-HOWARD MORTUARY/GARAGE**
LOCATION: **1711 LAFAYETTE ST, DENVER 80218**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **1839** | **CLOSED** | **9/12/1990** | **MOORE-HOWARD MORTUARY/GARAGE** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=1839

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 132** **Distance from Property: 0.47 mi. (2,482 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **16001LST**
FACILITY ID: **16001**
NAME: **WELLS FARGO CENTER**
ADDRESS: **1700 LINCOLN STREET**
**DENVER, CO 80203**
SITE NAME: **WELLS FARGO CENTER**
LOCATION: **1700 LINCOLN STREET, DENVER 80203**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **9232** | **CLOSED** | **6/19/2003 9:58** | **WELLS FARGO CENTER** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=9232

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 133** **Distance from Property: 0.47 mi. (2,482 ft.) N**

**FACILITY INFORMATION**

UNIQUE ID: **9502LST**
FACILITY ID: **9502**
NAME: **RTD DISTRICT SHOPS**
ADDRESS: **1900 31ST ST**
**DENVER, CO 80216**
SITE NAME: **RTD DISTRICT SHOPS**
LOCATION: **1900 31ST ST, DENVER 80216**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **6704** | **CLOSED** | **7/16/1998** | **RTD DISTRICT SHOPS** |
| COSTIS LINK: | http://costis.cdle.state.co.us/event.asp?h_id=6704 | | |
| **6575** | **CLOSED** | **5/20/1998** | **RTD DISTRICT SHOPS** |
| COSTIS LINK: | http://costis.cdle.state.co.us/event.asp?h_id=6575 | | |
| **2400** | **CLOSED** | **8/4/1993** | **RTD DISTRICT SHOPS** |
| COSTIS LINK: | http://costis.cdle.state.co.us/event.asp?h_id=2400 | | |

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 134** **Distance from Property: 0.47 mi. (2,482 ft.) NW**

**FACILITY INFORMATION**

UNIQUE ID: **6613LST**

FACILITY ID: **6613**

NAME: **COLORADO ALL STATE TRANSPORTATION**

ADDRESS: **1960 31ST ST**
**DENVER, CO 80216**

SITE NAME: **COLORADO ALLSTATE TRANSPORTATION**

LOCATION: **1960 31ST ST, DENVER 80216**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **795** | **CLOSED** | **2/3/1995** | **COLORADO ALLSTATE TRANSPORTATION** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=795

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# Solid Waste Facilities (SWF)

**MAP ID# 135** **Distance from Property: 0.47 mi. (2,482 ft.) W**

**SITE INFORMATION**

GEOSEARCH ID: **297WTR**
NAME: **BRIDGESTONE RETAIL OPERATIONS, L**
ADDRESS: **2000 BROADWAY**
**DENVER, CO 80205**
COUNTY: **NOT REPORTED**
CERTIFICATION ID: **297**
FACILITY TYPE: **REGISTERED TIRE HAULER**
TIRE RETAILER/WHOLESALER: **YES**
HAULER: **NO**
END USER: **NO**
COLLECTION: **NO**
PROCESSOR: **NO**
MONOFILL: **NO**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 135** **Distance from Property: 0.47 mi. (2,482 ft.) W**

**FACILITY INFORMATION**

UNIQUE ID: **7585LST**

FACILITY ID: **7585**

NAME: **FIRESTONE STORE #2823**

ADDRESS: **2000 BROADWAY**
**DENVER, CO 80205**

SITE NAME: **FIRESTONE #2823**

LOCATION: **2000 BROADWAY, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **6643** | **CLOSED** | **6/25/1998** | **FIRESTONE #2823** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=6643 | | | |
| **3869** | **CLOSED** | **3/23/1995** | **FIRESTONE STORE #2823** |
| COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=3869 | | | |

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# Historical Solid Waste Landfills (HISTSWLF)

**MAP ID# 136** **Distance from Property: 0.48 mi. (2,534 ft.) N**

**SITE INFORMATION**

UNIQUE ID: **00070-0000616**

NAME: **ARTIFICIAL FILL**

ADDRESS: **NORTH OF 31ST ST. TO APPROXIMATELY 34TH ST., EAST TO PLATTE RIV**
**DENVER, CO**

DIRECTIONS: **NOT REPORTED**

COUNTY: **DENVER**

**SITE DETAILS**

AGENCY SOURCE: **NOT REPORTED**

DETAIL1:

**; FILL- DOMESTIC REFUSE: NO. CONSTRUCTION DEBRIS: NO. LIQUIDS: NO. HAZARDOUS WASTE: NO. INDUSTRIAL WASTE: NO. ARTIFICIAL FILL. UNKNOWN: NO. CLAY, SILT, SAND, GRAVEL AND A VARIETY OF DEBRIS CONSISTING OF WOOD, BRICK, METAL, PLASTIC, GLASS, VEGETATIO**

DETAIL2:

**ARTIFICIAL FILL. INCLUDES EMBANKMENTS, DAMS, AND OTHER ENGINEERED FILLS; COMPACTED LANDFILLS, AND UNCOMPACTED RUBBISH DUMPS. CONFIDENCE IN THIS INFO: HIGH.; OPENED- CLOSED-**

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# Denver County Historic Landfills (DCHISTLF)

**MAP ID# 136** **Distance from Property: 0.48 mi. (2,534 ft.) N**

**SITE INFORMATION**

LANDFILL ID: **71**

LANDFILL NAME: **3S-68W-22SE2**

DATE ENTERED: **04/28/1997**

TYPE OF LANDFILL: **OTHER**

DESCRIPTION:

**NORTH OF 31ST ST. TO APPROXIMATELY 34TH ST., EAST TO PLATTE RIVER AND WEST TO PERKINS ST.**

TYPE REMARKS:

**INCLUDES EMBANKMENTS, DAMS, AND OTHER ENGINEERED FILLS; COMPACTED LANDFILLS, AND UNCOMPACTED RUBBISH DUMPS.**

DOMESTIC: **NO**

HAZARDOUS: **NO**

CONSTRUCTION: **NO**

INDUSTRIAL: **NO**

LIQUIDS: **NO**

UNKNOWN: **NO**

OTHER: **ARTIFICIAL FILL**

MATERIAL RECEIVED:

**CLAY, SILT, SAND, GRAVEL AND A VARIETY OF DEBRIS CONSISTING OF WOOD, BRICK, METAL, PLASTIC, GLASS, VEGETATION, AND OTHER TRASH.**

START DATE: **NOT REPORTED**

END DATE: **NOT REPORTED**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 137** **Distance from Property: 0.48 mi. (2,534 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **9810LST**
FACILITY ID: **9810**
NAME: **DENVER HARDWARE CO**
ADDRESS: **3200 WALNUT ST**
**DENVER, CO 80205**
SITE NAME: **DENVER HARDWARE CO**
LOCATION: **3200 WALNUT ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **5796** | **CLOSED** | **4/20/1992** | **DENVER HARDWARE CO** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=5796

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# *Leaking Underground Storage Tanks Trust Fund Sites (LUSTTRUST)*

**MAP ID# 138** **Distance from Property: 0.48 mi. (2,534 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **00023-0000076**

AGENCY ID: **NOT REPORTED**

NAME: **23RD ST. VIADUCT**

ADDRESS: **23RD ST. VIADUCT**
**DENVER, CO 80000**

COUNTY: **DENVER**

COMMENTS: **FROM AN OLD CDPHE LIST OF LOCATIONS WHERE TANK LEAKS WERE SUSPECTED AND LUST TRUST FUNDS WERE USED IN AN EFFORT TO IDENTIFY THE SOURCE. OFTEN, THE SOURCE WAS FOUND NEARBY AND WAS ENTERED IN THE LUST DATABASE (NOW COSTIS).**
**THIS LISTING NOT ENTERED INTO COSTIS BACK WHEN CDPHE TRANSFERRED RESPONSIBILITY FOR TANK LEAKS TO OPS. FEW PEOPLE AT OPS KNOW OF THIS OLD CDPHE LIST, AND ANY ASSOCIATED FILES ARE THOUGHT TO HAVE BEEN DISPOSED OF OR MISPLACED.**

COSTIS LINK: **NOT REPORTED**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 138** **Distance from Property: 0.48 mi. (2,534 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **13138LST**
FACILITY ID: **13138**
NAME: **CDOT 23RD STREET VIADUCT**
ADDRESS: **2155 LAWRENCE**
**DENVER, CO 80205**
SITE NAME: **CDOT 23RD STREET VIADUCT**
LOCATION: **2155 LAWRENCE, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **5745** | **CLOSED** | **5/1/1994** | **CDOT 23RD STREET VIADUCT** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=5745

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 139** **Distance from Property: 0.48 mi. (2,534 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **6837LST**
FACILITY ID: **6837**
NAME: **BUDGET RENT A CAR SYSTEMS**
ADDRESS: **2150 BROADWAY**
**DENVER, CO 80205**
SITE NAME: **BUDGET RENT-A-CAR**
LOCATION: **2150 BROADWAY, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **3918** | **CLOSED** | **5/16/1994** | **BUDGET RENT-A-CAR** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=3918

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 140** **Distance from Property: 0.48 mi. (2,534 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **12903LST**
FACILITY ID: **12903**
NAME: **NOT REPORTED**
ADDRESS: **3200 CURTIS ST**
**DENVER, CO 80205**
SITE NAME: **CCOD FIRE STATION #10**
LOCATION: **3200 CURTIS ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **4735** | **CLOSED** | **4/2/1992** | **CCOD FIRE STATION #10** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=4735

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# Historical Solid Waste Landfills (HISTSWLF)

**MAP ID# 141** **Distance from Property: 0.49 mi. (2,587 ft.) NE**

**SITE INFORMATION**

UNIQUE ID: **00070-0000624**

NAME: **ARTIFICIAL FILL**

ADDRESS: **SOUTH OF BRIGHTON BLVD; BETWEEN 32ND & 33RD STREETS, ONE BLOCK T**
**DENVER, CO**

DIRECTIONS: **NOT REPORTED**

COUNTY: **DENVER**

**SITE DETAILS**

AGENCY SOURCE: **NOT REPORTED**

DETAIL1:

**; FILL- DOMESTIC REFUSE: NO. CONSTRUCTION DEBRIS: NO. LIQUIDS: NO. HAZARDOUS WASTE: NO. INDUSTRIAL WASTE: NO. ARTIFICIAL FILL. UNKNOWN: NO. CLAY, SILT, SAND, GRAVEL AND A VARIETY OF DEBRIS CONSISTING OF WOOD, BRICK, CONCRETE, METAL, PLASTIC, GLASS,**

DETAIL2:

**ARTIFICIAL FILL. INCLUDES EMBANKMENTS, DAMS, AND OTHER ENGINEERED FILLS; COMPACTED LANDFILLS, AND UNCOMPACTED RUBBISH DUMPS. CONFIDENCE IN THIS INFO: HIGH.; OPENED- CLOSED-**

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# Denver County Historic Landfills (DCHISTLF)

**MAP ID# 141** **Distance from Property: 0.49 mi. (2,587 ft.) NE**

**SITE INFORMATION**

LANDFILL ID: **79**

LANDFILL NAME: **3S-68W-27NE**

DATE ENTERED: **04/28/1997**

TYPE OF LANDFILL: **OTHER**

DESCRIPTION:

**SOUTH OF BRIGHTON BLVD; BETWEEN 32ND & 33RD STREETS, ONE BLOCK TO SE TO WYNKOOP.**

TYPE REMARKS:

**INCLUDES EMBANKMENTS, DAMS, AND OTHER ENGINEERED FILLS; COMPACTED LANDFILLS, AND UNCOMPACTED RUBBISH DUMPS.**

DOMESTIC: **NO**

HAZARDOUS: **NO**

CONSTRUCTION: **NO**

INDUSTRIAL: **NO**

LIQUIDS: **NO**

UNKNOWN: **NO**

OTHER: **ARTIFICIAL FILL**

MATERIAL RECEIVED:

**CLAY, SILT, SAND, GRAVEL AND A VARIETY OF DEBRIS CONSISTING OF WOOD, BRICK, CONCRETE, METAL, PLASTIC, GLASS, VEGETATION, AND OTHER TRASH.**

START DATE: **NOT REPORTED**

END DATE: **NOT REPORTED**

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**MAP ID# 142** **Distance from Property: 0.53 mi. (2,798 ft.) NE**

**SITE INFORMATION**

EPA ID: **COD063350854**

SITE NAME: **MCCANDLESS INT'L TRUCKS OF COLO**

SITE ADDRESS: **3280 BRIGHTON BOULEVARD**
**DENVER, CO 80216**

SITE COUNTY: **DENVER**

FACILITY TYPE: **CA**

STATUS: **HISTORIC**

LINKS: **http://www.epa.gov/cgi-bin/get1cReport.cgi?tool=echo&IDNumber=COD063350854**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 143** **Distance from Property: 0.49 mi. (2,587 ft.) NW**

**FACILITY INFORMATION**

UNIQUE ID: **18434LST**
FACILITY ID: **18434**
NAME: **RENAISSANCE RIVERFRONT**
ADDRESS: **3400 PARK AVE WEST**
**DENVER, CO 80216**
SITE NAME: **RENAISSANCE RIVERFRONT**
LOCATION: **3400 PARK AVE WEST, DENVER 80216**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **10552** | **CLOSED** | **12/24/2007 8:18** | **RENAISSANCE RIVERFRONT** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=10552

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 144** **Distance from Property: 0.49 mi. (2,587 ft.) W**

**FACILITY INFORMATION**

UNIQUE ID: **1735LST**

FACILITY ID: **1735**

NAME: **AVIS RENT A CAR SYSTEM LLC**

ADDRESS: **1900 BROADWAY**
**DENVER, CO 80202**

SITE NAME: **AVIS RENT-A-CAR**

LOCATION: **1900 BROADWAY, DENVER 80202**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **1183** | **CLOSED** | **8/30/1991** | **AVIS RENT-A-CAR** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=1183

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 145** **Distance from Property: 0.49 mi. (2,587 ft.) W**

**FACILITY INFORMATION**

UNIQUE ID: **8843EVENTID**

FACILITY ID: **NOT ASSIGNED**

NAME: **NOT REPORTED**

ADDRESS: **FOX ST AT E 30TH AVE**
**DENVER, CO 80201**

SITE NAME: **LINCOLN PROPERTIES**

LOCATION: **FOX ST AT E 30TH AVE, DENVER 80201**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **8843** | **CLOSED** | **1/25/2002** | **LINCOLN PROPERTIES** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=8843

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# Solid Waste Facilities (SWF)

**MAP ID# 146** **Distance from Property: 0.49 mi. (2,587 ft.) N**

**SITE INFORMATION**

GEOSEARCH ID: **1178WTR**
NAME: **FEDEX EXPRESS - BKFA**
ADDRESS: **2100 31ST STREET**
**DENVER, CO 80216**
COUNTY: **NOT REPORTED**
CERTIFICATION ID: **1178**
FACILITY TYPE: **REGISTERED TIRE HAULER**
TIRE RETAILER/WHOLESALER: **YES**
HAULER: **NO**
END USER: **NO**
COLLECTION: **NO**
PROCESSOR: **NO**
MONOFILL: **NO**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 146** **Distance from Property: 0.49 mi. (2,587 ft.) N**

**FACILITY INFORMATION**

UNIQUE ID: **426LST**

FACILITY ID: **426**

NAME: **COLORADO/DENVER DELIVERY**

ADDRESS: **2100 31ST ST**
**DENVER, CO 80216**

SITE NAME: **CITY ICE CO**

LOCATION: **2100 31ST ST, DENVER 80216**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **4885** | **CLOSED** | **12/16/1993** | **CITY ICE CO** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=4885

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 147** **Distance from Property: 0.49 mi. (2,587 ft.) NE**

**SITE INFORMATION**

FILE NUMBER: **110917-1**

SITE NO: **532**

NAME: **RINO CENTER DEVELOPMENT**

ADDRESS: **3200, 3280, AND 3310 BRIGHTON BLVD.**
**DENVER, CO 80212**

COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **VOLUNTARY CLEANUP PROGRAM**

REVIEW DATE DUE: **11/1/2011**

DECISION: **APPROVAL**

REMEDY START DATE: **10/26/2011** REMEDY END DATE: **10/26/2013**

ACTUAL COST: **807.50** CLEANUP ACRES: **4.3**

OTHER ISSUES: **NOT REPORTED**

LAND USE RESTRICTIONS: **MIXED - COM+RES**

PROJECT MANAGER: **APOSTOLOPOULOS**

INDOOR AIR: **VOC'S;#6**

MEDIA SEDIMENT: **NOT REPORTED**

MEDIA GROUND WATER: **VOC'S;#4**

MEDIA SURFACE WATER: **NOT REPORTED**

MEDIA SOIL: **NOT REPORTED**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 147** **Distance from Property: 0.49 mi. (2,587 ft.) NE**

**SITE INFORMATION**

FILE NUMBER: **120831-1**
SITE NO: **532**
NAME: **RINO CENTER II**
ADDRESS: **3200 BRIGHTON BLVD.**
**DENVER, CO 80212**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **10/15/2012**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **765.00** CLEANUP ACRES: **NOT REPORTED**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **MIXED - COM+RES**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **VOC'S;#4**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **ASBESTOS;#2;#PAH'S;#13**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 148** **Distance from Property: 0.5 mi. (2,640 ft.) E**

**FACILITY INFORMATION**

UNIQUE ID: **18304LST**
FACILITY ID: **18304**
NAME: **FRANKLIN PAVILION**
ADDRESS: **1835 FRANKLIN ST**
**DENVER, CO 80218**
SITE NAME: **SAINT JOSEPH HOSPITAL**
LOCATION: **1830 FRANKLIN ST, DENVER 80218**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **9963** | **OPEN** | **11/30/2005 7:13** | **SAINT JOSEPH HOSPITAL** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=9963

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 149** **Distance from Property: 0.5 mi. (2,640 ft.) NW**

**FACILITY INFORMATION**

UNIQUE ID: **12721LST**
FACILITY ID: **12721**
NAME: **TEXACO**
ADDRESS: **3460 FOX ST**
**DENVER, CO 80216**
SITE NAME: **TEXACO**
LOCATION: **3460 FOX ST, DENVER 80216**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **3931** | **CLOSED** | **1/1/1989** | **TEXACO** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=3931

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 150** **Distance from Property: 0.5 mi. (2,640 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **11069LST**

FACILITY ID: **11069**

NAME: **W S MEGILL**

ADDRESS: **2140 MARKET ST**
**DENVER, CO 80205**

SITE NAME: **WS MEGILL**

LOCATION: **2140 MARKET ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **966** | **CLOSED** | **11/2/1994** | **WS MEGILL** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=966

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 151** **Distance from Property: 0.5 mi. (2,640 ft.) SW**

**FACILITY INFORMATION**

UNIQUE ID: **19906LST**
FACILITY ID: **19906**
NAME: **FORMER GAS STATION**
ADDRESS: **2140 ARAPAHOE ST**
**DENVER, CO 80205**
SITE NAME: **FORMER GAS STATION**
LOCATION: **1030 22ND ST DENVER CO 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **12486** | **BROWNFIELD** | **4/4/2016 2:00:33 PM** | **FORMER GAS STATION** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=12486

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 152** **Distance from Property: 0.5 mi. (2,640 ft.) E**

**FACILITY INFORMATION**

UNIQUE ID: **13011LST**
FACILITY ID: **13011**
NAME: **MANUAL HIGH SCHOOL**
ADDRESS: **1700 E 28TH AVE**
**DENVER, CO 80205**
SITE NAME: **MANUAL HIGH SCHOOL**
LOCATION: **1700 E 28TH AVE, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **997** | **CLOSED** | **7/15/1997** | **MANUAL HIGH SCHOOL** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=997

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 153** **Distance from Property: 0.51 mi. (2,693 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **13284LST**
FACILITY ID: **13284**
NAME: **NOT REPORTED**
ADDRESS: **3200 BLAKE ST**
**DENVER, CO 80205**
SITE NAME: **REI TRUCK DEPOT**
LOCATION: **3200 BLAKE ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **5720** | **CLOSED** | **10/2/1991** | **REI TRUCK DEPOT** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=5720

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 153** **Distance from Property: 0.51 mi. (2,693 ft.) NE**

**SITE INFORMATION**

FILE NUMBER: **060302-1**
SITE NO: **364**
NAME: **CENTEX HOMES**
ADDRESS: **3200 BLAKE STREET**
**DENVER, CO 80205**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **4/16/2006**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **935.00** CLEANUP ACRES: **1.1**

OTHER ISSUES: **DRY CLEANER;#8**
LAND USE RESTRICTIONS: **NOT REPORTED**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **PCE;#12**
MEDIA GROUND WATER: **PCE;#12**
MEDIA SURFACE WATER: **PCE;#12**
MEDIA SOIL: **PCE;#12**

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# *Leaking Storage Tank Facilities (LST)*

**MAP ID# 153** **Distance from Property: 0.51 mi. (2,693 ft.) NE**

**FACILITY INFORMATION**

UNIQUE ID: **3227LST**
FACILITY ID: **3227**
NAME: **SPORT AMERICA**
ADDRESS: **3200 BLAKE ST**
**DENVER, CO 80205**
SITE NAME: **SPORT AMERICA**
LOCATION: **3200 BLAKE ST, DENVER 80205**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **12087** | **CLOSED** | **8/5/2014 14:51** | **SPORT AMERICA** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=12087

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 154** **Distance from Property: 0.51 mi. (2,693 ft.) SW**

**SITE INFORMATION**

FILE NUMBER: **140916-1**
SITE NO: **680**
NAME: **SKYHOUSE DENVER**
ADDRESS: **1756 BROADWAY**
**DENVER, CO 80202**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **VOLUNTARY CLEANUP PROGRAM**
REVIEW DATE DUE: **10/31/2014**
DECISION: **APPROVAL**

REMEDY START DATE: **10/31/2014** REMEDY END DATE: **10/31/2016**
ACTUAL COST: **1330.00** CLEANUP ACRES: **1.2**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **RESIDENTIAL**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **NOT REPORTED**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **BTEX;#6;#COAL FILL;#23;#ASBESTOS CONTAMINATED MATERIALS;#25**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 154** **Distance from Property: 0.51 mi. (2,693 ft.) SW**

**SITE INFORMATION**

FILE NUMBER: **160113-1**
SITE NO: **680**
NAME: **SKYHOUSE DENVER II**
ADDRESS: **1756 BROADWAY**
**DENVER, CO 80202**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**
REVIEW DATE DUE: **2/27/2016**
DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED** REMEDY END DATE: **NOT REPORTED**
ACTUAL COST: **1520.00** CLEANUP ACRES: **NOT REPORTED**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **MIXED - COM+RES**
PROJECT MANAGER: **APOSTOLOPOULOS**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **NOT REPORTED**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **ASBESTOS CONTAMINATED MATERIALS;#25**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 155** **Distance from Property: 0.51 mi. (2,693 ft.) SW**

**SITE INFORMATION**

FILE NUMBER: **051214-1**
SITE NO: **355**
NAME: **FORMER PIGGLY WIGGLY PARCEL I**
ADDRESS: **2101-2163 MARKET STREET**
**DENVER, CO 80205**
COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **VOLUNTARY CLEANUP PROGRAM**
REVIEW DATE DUE: **1/28/2006**
DECISION: **APPROVAL**

REMEDY START DATE: **1/1/2006** REMEDY END DATE: **5/20/2006**
ACTUAL COST: **1275.00** CLEANUP ACRES: **NOT REPORTED**

OTHER ISSUES: **NOT REPORTED**
LAND USE RESTRICTIONS: **NOT REPORTED**
PROJECT MANAGER: **RUDOLPH**
INDOOR AIR: **NOT REPORTED**
MEDIA SEDIMENT: **NOT REPORTED**
MEDIA GROUND WATER: **NOT REPORTED**
MEDIA SURFACE WATER: **NOT REPORTED**
MEDIA SOIL: **NOT REPORTED**

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# Voluntary Cleanup and Redevelopment Program Sites (VCRA)

**MAP ID# 155** **Distance from Property: 0.51 mi. (2,693 ft.) SW**

**SITE INFORMATION**

FILE NUMBER: **060919-1**

SITE NO: **355**

NAME: **FORMER PIGGLY WIGGLY PARCEL II**

ADDRESS: **2101-2163 MARKET STREET**
**DENVER, CO 80205**

COUNTY: **DENVER**

**SITE DETAILS**

APPLICATION TYPE: **NO ACTION DETERMINATION**

REVIEW DATE DUE: **11/3/2006**

DECISION: **APPROVAL**

REMEDY START DATE: **NOT REPORTED**

REMEDY END DATE: **NOT REPORTED**

ACTUAL COST: **1445.00**

CLEANUP ACRES: **NOT REPORTED**

OTHER ISSUES: **NOT REPORTED**

LAND USE RESTRICTIONS: **NOT REPORTED**

PROJECT MANAGER: **RUDOLPH**

INDOOR AIR: **NOT REPORTED**

MEDIA SEDIMENT: **MTBE/TPH;#26**

MEDIA GROUND WATER: **MTBE/TPH;#26**

MEDIA SURFACE WATER: **MTBE/TPH;#26**

MEDIA SOIL: **MTBE/TPH;#26**

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# Leaking Storage Tank Facilities (LST)

**MAP ID# 156** **Distance from Property: 0.51 mi. (2,693 ft.) SE**

**FACILITY INFORMATION**

UNIQUE ID: **8822LST**
FACILITY ID: **8822**
NAME: **CCOD FIRE STATION #8**
ADDRESS: **1616 PARK AVE**
**DENVER, CO 80216**
SITE NAME: **CCOD FIRE STATION #8**
LOCATION: **1616 PARK AVE, DENVER 80216**

**LEAKING INFORMATION**

| EVENT ID: | STATUS: | RELEASE DATE: | ALTERNATE NAME: |
|---|---|---|---|
| **2090** | **CLOSED** | **8/26/1991** | **CCOD FIRE STATION #8** |

COSTIS LINK: http://costis.cdle.state.co.us/event.asp?h_id=2090

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# Hazardous Waste Sites- Corrective Action (HWSCA)

**MAP ID# 157** **Distance from Property: 0.57 mi. (3,010 ft.) NE**

**SITE INFORMATION**

EPA ID: **COD983774035**

SITE NAME: **JEMM COMPANY**

SITE ADDRESS: **3300 WALNUT ST**
**DENVER, CO 80205**

SITE COUNTY: **DENVER**

FACILITY TYPE: **CA**

STATUS: **HISTORIC**

LINKS: **http://www.epa.gov/cgi-bin/get1cReport.cgi?tool=echo&IDNumber=COD983774035**

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# Resource Conservation & Recovery Act - Corrective Action Facilities (RCRAC)

**MAP ID# 158** **Distance from Property: 0.6 mi. (3,168 ft.) SE**

**FACILITY INFORMATION**

EPA ID#: **COD983772468**

NAME: **BRIDENT DENTAL**

ADDRESS: **1080 E COLFAX AVE**
**DENVER, CO 80218**

OWNER TYPE: **PRIVATE**

OWNER NAME: **BRIDENT DENTAL SERVICES OF COLORADO LLC**

OPERATOR TYPE: **PRIVATE**

OPERATOR NAME: **BRIDENT DENTAL**

CONTACT NAME: **EDWARD SALDANA**

CONTACT ADDRESS: **530 S MAIN ST ATTN: NOD DEPT**
**ORANGE CA 92868**

CONTACT PHONE: **714-571-3502**

NON-NOTIFIER: **NOT A NON-NOTIFIER**

DATE RECEIVED BY AGENCY: **06/30/2016**

CERTIFICATION

| CERTIFICATION NAME: | CERTIFICATION TITLE: | CERTIFICATION SIGNED DATE: |
|---|---|---|
| **KAREN NGUYEN** | **REAL ESTATE & NEW OFFICE DEVELOPMENT** | **06/09/2016** |
| **MICHAEL WALLS** | **DIRECTOR - LEASING** | **11/24/2014** |

INDUSTRY CLASSIFICATION (NAICS)

**339114 - DENTAL EQUIPMENT AND SUPPLIES MANUFACTURING**

**81232 - DRYCLEANING AND LAUNDRY SERVICES (EXCEPT COIN-OPERATED)**

SITE HISTORY (INCLUDES GENERATORS AND NON-GENERATORS)

DATE RECEIVED BY AGENCY: **06/30/2016**

NAME: **BRIDENT DENTAL**

DATE RECEIVED BY AGENCY: **11/24/2014**

NAME: **BRIDENT DENTAL**

DATE RECEIVED BY AGENCY: **12/12/2000**

NAME: **SMILEY'S CLEANERS**

DATE RECEIVED BY AGENCY: **10/31/1990**

NAME: **SMILEY'S CLEANERS**

CURRENT ACTIVITY INFORMATION

GENERATOR STATUS: **NOT A GENERATOR** LAST UPDATED DATE: **07/07/2016**

SUBJECT TO CORRECTIVE ACTION UNIVERSE: **NO**

TDSFs POTENTIALLY SUBJECT TO CORRECTIVE ACTION UNDER 3004 (u)/(v) UNIVERSE: **NO**

TDSFs ONLY SUBJECT TO CORRECTIVE ACTION UNDER DISCRETIONARY AUTHORITIES UNIVERSE: **NO**

NON TSDFs WHERE RCRA CORRECTIVE ACTION HAS BEEN IMPOSED UNIVERSE: **YES**

CORRECTIVE ACTION WORKLOAD UNIVERSE: **YES**

IMPORTER: **NO**

MIXED WASTE GENERATOR: **NO**

RECYCLER: **NO**

TRANSPORTER: **NO**

ONSITE BURNER EXEMPTION: **NO**

FURNACE EXEMPTION: **NO**

USED OIL REFINER: **NO**

UNDERGROUND INJECTION: **NO**

UNIVERSAL WASTE DESTINATION FACILITY: **NO**

TRANSFER FACILITY: **NO**

USED OIL FUEL BURNER: **NO**

USED OIL PROCESSOR: **NO**

USED OIL FUEL MARKETER TO BURNER: **NO**

SPECIFICATION USED OIL MARKETER: **NO**

USED OIL TRANSFER FACILITY: **NO** USED OIL TRANSPORTER: **NO**

COMPLIANCE, MONITORING AND ENFORCEMENT INFORMATION

EVALUATIONS

| | | |
|---|---|---|
| **05/31/2005** | **FUI** | **FOLLOW-UP INSPECTION** |
| **05/24/2005** | **CAC** | **CORRECTIVE ACTION COMPLIANCE EVALUATION** |
| **05/23/2005** | **FUI** | **FOLLOW-UP INSPECTION** |
| **02/16/2005** | **FUI** | **FOLLOW-UP INSPECTION** |
| **01/19/2005** | **FCI** | **FOCUSED COMPLIANCE INSPECTION** |

VIOLATIONS **- NO VIOLATIONS REPORTED -**

ENFORCEMENTS **- NO ENFORCEMENTS REPORTED -**

HAZARDOUS WASTE

| | |
|---|---|
| **D002** | **CORROSIVE WASTE** |
| **D009** | **MERCURY** |
| **D011** | **SILVER** |
| **F002** | **THE FOLLOWING SPENT HALOGENATED SOLVENTS: TETRACHLOROETHYLENE, METHYLENE CHLORIDE,TRICHLOROETHYLENE, 1,1,1-TRICHLOROETHANE,CHLOROBENZENE, 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE, ORTHO-DICHLOROBENZENE, TRICHLOROFLUOROMETHANE, AND 1,1,2, TRICHLOROETHANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001,F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.** |

UNIVERSAL WASTE

| WASTE TYPE: | ACCUMULATED WASTE ON-SITE: | GENERATED WASTE ON-SITE: | SOURCE TYPE: |
|---|---|---|---|
| **NOT REPORTED** | **NO** | **NO** | **NOTIFICATION** |
| **BATTERIES** | **NO** | **NOT REPORTED** | **NOTIFICATION** |
| **OTHER** | **NO** | **NO** | **NOTIFICATION** |
| **LAMPS** | **NO** | **NOT REPORTED** | **NOTIFICATION** |
| **MERCURY-CONTAINING DEVICES** | **NO** | **NO** | **NOTIFICATION** |
| **PESTICIDES** | **NO** | **NOT REPORTED** | **NOTIFICATION** |
| **MERCURY CONTAINING EQUIPMENT** | **NO** | **NOT REPORTED** | **NOTIFICATION** |

CORRECTIVE ACTION AREA (RELEASE)

| AREA NAME: | AIR: | GROUNDWATER: | SOIL: | SURFACE WASTE: |
|---|---|---|---|---|
| **GROUNDWATER** | **-----** | **Y** | **-----** | **-----** |
| **SOIL** | **-----** | **-----** | **Y** | **-----** |

CORRECTIVE ACTION EVENT

| CA EVENT: | DATE: | EVENT DESCRIPTION: |
|---|---|---|
| **CA725YE** | **05/31/2005** | **HUMAN EXPOSURES CONTROLLED DETERMINATION-YES, APPLICABLE AS OF THIS DATE** |
| **CA750YE** | **05/31/2005** | **RELEASE TO GW CONTROLLED DETERMINATION-YES, APPLICABLE AS OF THIS DATE** |
| **CA770NG** | **05/31/2005** | **ENGINEERING CONTROLS ESTABLISHED-NON-GROUNDWATER CONTROL** |
| **CA772GC** | **05/31/2005** | **INSTITUTIONAL CONTROLS ESTABLISHED-GOVERNMENTAL CONTROL** |

| | | |
|---|---|---|
| CA999NF | 05/31/2005 | CA PROCESS IS TERMINATED-NO FURTHER ACTION |
| CA160 | 05/26/2005 | INVESTIGATION SUPPLEMENTAL INFORMATION RECEIVED |
| CA155 | 05/23/2005 | INVESTIGATION SUPPLEMENTAL INFO REQ BY AGENCY |
| CA350 | 04/26/2005 | CMS COMPLETE |
| CA831OM | 04/26/2005 | OTHER REPORT RECEIVED |
| CA834AS | 02/16/2005 | OTHER REPORT APPROVED |
| CA834OM | 02/16/2005 | OTHER REPORT APPROVED |
| CA831AS | 02/04/2005 | OTHER REPORT RECEIVED |
| CA831OM | 02/04/2005 | OTHER REPORT RECEIVED |
| CA100 | 12/16/2004 | INVESTIGATION IMPOSITION |

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**MAP ID# 159** **Distance from Property: 0.73 mi. (3,854 ft.) SW**

**SITE INFORMATION**

EPA ID: **COD983777814**

SITE NAME: **DENVER FIRE DEPT LINE SHOP**

SITE ADDRESS: **1331 19TH ST**
**DENVER, CO 80202**

SITE COUNTY: **DENVER**

FACILITY TYPE: **CA**

STATUS: **ACTIVE**

LINKS: **http://www.epa.gov/cgi-bin/get1cReport.cgi?tool=echo&IDNumber=COD983777814**

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**MAP ID# 160** **Distance from Property: 0.8 mi. (4,224 ft.) NE**

**FACILITY INFORMATION**

EPA ID#: **CO0002259588**

SITE ID#: **0801646**

NAME: **VASQUEZ BOULEVARD AND I-70**

ADDRESS: **VASQUEZ BOULEVARD AND 1-70**
**DENVER, CO 80216**

COUNTY: **DENVER**

NATIONAL PRIORITY LISTING: **F - CURRENTLY ON THE FINAL NPL**

FEDERAL FACILITY CLASSIFICATION: **NO - NOT A FEDERAL FACILITY**

NON-NPL STATUS: **NOT REPORTED -**

NON-NPL STATUS DATE: **NOT REPORTED**

PHYSICAL CLASSIFICATION OF SITE / INCIDENT: **NO INFORMATION AVAILABLE**

FEDERAL REGISTER INFORMATION

| DATE | VOLUME | PAGE # | ACTION | HRS SCORE |
|---|---|---|---|---|
| **07/22/1999** | **64** | **39878** | **NOT REPORTED** | **50.00000** |
| **01/19/1999** | **64** | **2950** | **PROPOSED TO THE FINAL NPL** | **50.00000** |

SITE DESCRIPTION

**THE VASQUEZ BOULEVARD AND I-70 (VB/I-70) SUPERFUND SITE (SITE) COMPRISES APPROXIMATELY 4.5 SQUARE MILES, LOCATED IN THE NORTH-CENTRAL SECTION OF THE CITY AND COUNTY OF DENVER, COLORADO.**

**THE VB/I-70 SITE WAS PLACED ON THE NATIONAL PRIORITIES LIST (NPL) DUE TO METALS CONTAMINATION ASSOCIATED WITH HISTORIC SMELTER OPERATIONS. THE PRIMARY CONTAMINANTS OF CONCERN ARE LEAD AND ARSENIC. SUBSEQUENT INVESTIGATIONS INDICATE THAT ARSENIC CONTAMINATION MAY ALSO BE PRESENT AS A RESULT OF APPLICATION OF LAWN CARE PRODUCTS. FOR THE PURPOSES OF INVESTIGATIONS AND REMEDY DEVELOPMENT, THE SITE WAS SEGREGATED INTO THREE OPERABLE UNITS (OUS). THIS RECORD OF DECISION (ROD) IS FOR OU1, OFF-FACILITY (RESIDENTIAL) SOILS OF THE VB/I-70 SITE. OPERABLE UNITS 2 AND 3 ADDRESS ON-FACILITY SOILS AND GROUNDWATER AT THE OMAHA & GRANT SMELTER AND ARGO SMELTER SITES, RESPECTIVELY. THE STRUCTURES ASSOCIATED WITH BOTH OF THESE SMELTERS HAVE BEEN DEMOLISHED AND THE SITES HAVE BEEN REDEVELOPED WITH COMMERCIAL BUSINESSES. OU1 ENCOMPASSES FOUR NEIGHBORHOODS IN NORTH-CENTRAL DENVER THAT ARE LARGELY RESIDENTIAL: SWANSEA, ELYRIA, CLAYTON, AND COLE. OU1 ALSO INCLUDES THE SOUTHWEST PORTION OF THE GLOBEVILLE NEIGHBORHOOD AND THE NORTHERN PORTION OF THE CURTIS PARK NEIGHBORHOOD. THERE ARE APPROXIMATELY 4,000 RESIDENTIAL PROPERTIES, 10 SCHOOLS, AND 7 PARKS WITHIN OU1. MOST RESIDENCES ARE SINGLE-FAMILY DWELLINGS. THERE ARE SOME MULTI-FAMILY HOMES AND APARTMENT BUILDINGS. WHILE NUMEROUS COMMERCIAL AND INDUSTRIAL PROPERTIES ARE ALSO LOCATED WITHIN THE SITE, THE LEVELS OF ARSENIC AND LEAD AT THESE PROPERTIES DO NOT APPEAR TO POSE AN UNACCEPTABLE RISK TO WORKERS IN A COMMERCIAL/INDUSTRIAL SCENARIO BASED ON THE LIMITED SAMPLING THAT WAS PERFORMED.**

**EPA IS THE LEAD AGENCY FOR THIS ACTION. THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT (CDPHE) IS THE SUPPORT AGENCY. IT IS ANTICIPATED THAT EPA AND CDPHE WILL FUND THE CLEAN UP.**

**IN 1998, EPA'S FIRST ACTION AT THE SITE WAS TO MOBILIZE AN EMERGENCY RESPONSE T EAM TO CONDUCT AN EXTENSIVE SOIL SAMPLING EFFORT AND TIME CRITICAL REMOVAL ACTIONS FOR THE HOUSES POSING IMMEDIATE HEALTH RISKS TO LOCAL RESIDENTS.**

**THE EMERGENCY RESPONSE CONSISTED OF TWO PHASES. PHASE I WAS AN EXTENSIVE SCREENING LEVEL SOIL SAMPLING EFFORT. THE OBJECTIVE WAS TO COLLECT SOIL SAMPLES FROM AS MANY RESIDENTIAL PROPERTIES AS**

POSSIBLE TO IDENTIFY PROPERTIES THAT WERE POTENTIAL TIME CRITICAL REMOVAL CANDIDATES ( REMOVE AND REPLACE SOIL).

THE BOUNDARIES OF THE PHASE I SAMPLING PROGRAM WERE ESTABLISHED AS EAST 38TH AVENUE ON THE SOUTH, EAST 56TH AVENUE ON THE NORTH, COLORADO AND VASQUEZ BOULEVARDS ON THE EAST AND THE SOUTH PLATTE RIVER ON THE WEST, AND INCLUDED THE SOUTHWEST PORTION OF GLOBEVILLE, THE ONLY AREA OF GLOBEVILLE NOT YET CHARACTERIZED BY ASARCO.

PHASE I SAMPLING OCCURRED DURING MARCH AND APRIL 1998. A MINIMUM OF THREE GRAB SAMPLES WERE COLLECTED FROM EACH PROPERTY WHERE EPA OBTAINED ACCESS, TWO SAMPLES FROM THE SURFACE AND ONE FROM THE SUBSURFACE. SOIL SAMPLES WERE ALSO COLLECTED FROM ALL SCHOOLS AND PARKS LOCATED WITHIN THE INITIAL STUDY AREA. SAMPLES WERE COLLECTED FROM LOCATIONS JUDGED TO PRESENT A HIGH POTENTIAL FOR EXPOSURE RELATIVE TO OTHER AREAS OF THE PROPERTY (FOR EXAMPLE, AT BARE SPOTS WITHIN THE YARD) AND WERE ANALYZED FOR ARSENIC, LEAD, CADMIUM AND ZINC.

IN SEPTEMBER 1998, EPA ISSUED AN ACTION MEMORANDUM THAT ESTABLISHED THE BASIS FOR CONDUCTING A TIME CRITICAL REMOVAL ACTION. THE ACTION MEMORANDUM REQUIRED THAT SOIL BE REMOVED AND REPLACED AT ANY PROPERTY WITH AN AVERAGE ARSENIC SOIL LEVEL GREATER THAN 450 PPM AND/OR LEAD SOIL LEVELS GREATER THAN 2000 PPM. THESE REMOVAL "ACTION LEVELS" WERE CHOSEN TO PROTECT YOUNG CHILDREN FROM ADVERSE HEALTH EFFECTS RELATED TO SHORT-TERM (SUB-CHRONIC) EXPOSURE. FROM THE PHASE I DATA, 37 PROPERTIES WERE IDENTIFIED AS POTENTIALLY REQUIRING TIME CRITICAL REMOVAL ACTION. THE PHASE II SAMPLING OCCURRED IN JULY AND AUGUST 1998. ADDITIONAL SOIL SAMPLES WERE COLLECTED FROM ANY RESIDENTIAL PROPE RTY THAT HAD A MAXIMUM SURFACE SOIL CONCENTRATION EQUAL TO OR GREATER THAN 450 PPM FOR ARSENIC OR 2000 PPM FOR LEAD, I.E., THE REMOVAL ACTION CANDIDATES. THESE RESIDENTIAL PROPERTIES WERE REVISITED AND A 5-POINT COMPOSITE SAMPLE WAS COLLECTED FROM THE FRONT YARD AND A SECOND 5-POINT COMPOSITE SAMPLE WAS COLLECTED FROM THE BACK YARD OF EACH. ARSENIC AND LEAD LEVELS IN THESE SAMPLES WERE MEASURED. ANY PROPERTY WITH ONE OR MORE COMPOSITE SAMPLES EXCEEDING THE REMOVAL ACTION LEVELS FOR EITHER ARSENIC OR LEAD WAS IDENTIFIED FOR SOIL REMOVAL. ALSO IN PHASE II, THE ON SCENE COORDINATOR EXTENDED THE SITE BOUNDARIES SOUTH TO EAST 35TH AVENUE, ENCOMPASSING A GREATER PORTION OF THE COLE AND CLAYTON NEIGHBORHOODS. PROPERTIES NOT SAMPLED DURING PHASE I WERE TARGETED FOR SCREENING LEVEL SAMPLING USING THE PHASE I PROTOCOLS. IN ALL, 1,393 PROPERTIES WERE SAMPLED AS PART OF THE PHASE I AND II PROGRAMS. TWENTY-ONE ADDITIONAL PROPERTIES WERE IDENTIFIED FOR TIME CRITICAL REMOVAL ACTIONS AS A RESULT OF THE PHASE II SAMPLING EVENT. REMOVALS WERE COMPLETED AT 18 OF THESE PROPERTIES WHERE EPA OBTAINED ACCESS. THE SCHOOLS AND PARKS SAMPLED HAD VERY LOW LEVELS OF ARSENIC AND LEAD AND DID NOT REQUIRE REMOVAL AND REPLACEMENT OF THEIR SOIL.

BASED ON THE RESULTS OF THE PHASE I AND PHASE II SAMPLING PROGRAMS, EPA DETERMINED THAT RESIDENTIAL PROPERTIES WITHIN THE VB/I-70 SITE CONTAINED CONCENTRATIONS OF ARSENIC OR LEAD AT LEVELS THAT COULD PRESENT UNACCEPTABLE HEALTH RISKS TO RESIDENTS WITH LONG TERM EXPOSURES. ON THIS BASIS, THE EPA PROPOSED THE VB/I-70 SITE FOR INCLUSION ON THE NPL IN JANUARY 1999. ANTICIPATING THE NEED FOR LONG-TERM RESPONSE, EPA BEGAN PHASE III REMEDIAL INVESTIGATION ACTIVITIES IN AUGUST 1998 AS REMOVAL ACTIVITIES WERE UNDERWAY.

DURING THE PUBLIC COMMENT PERIOD ON THE PROPOSED NPL LISTING OF THE VB/I-70 SITE, ASARCO SUBMITTED INFORMATION INDICATING THAT THE SOURCE OF THE ARSENIC IN RESIDENTIAL SOIL MAY BE LAWN CARE PRODUCTS THAT WERE READILY AVAILABLE FOR RESIDENTIAL US E IN THE ROCKY MOUNTAIN REGION AND ELSEWHERE IN THE WEST IN THE 1950S AND 1960S. THESE PRODUCTS WERE LEGALLY FORMULATED WITH ARSENIC TRIOXIDE AND LEAD ARSENATE TO BE EFFECTIVE IN CONTROLLING CRABGRASS. THE SPECIFIC PRODUCT IDENTIFIED BY ASARCO WAS "PAX 3-YEAR CRABGRASS CONTROL," AVAILABLE FROM THE 1950'S UNTIL THE EARLY 1970'S, AND FORMULATED WITH 27% ARSENIC TRIOXIDE AND 8% LEAD ARSENIC OXIDE. THE PRODUCT IS NO LONGER AVAILABLE COMMERCIALLY.

**IN ORDER TO ASSESS ASARCO'S ARGUMENTS, EPA'S PHASE III REMEDIAL INVESTIGATION ACTIVITIES WERE FOCUSED ON COLLECTING ALL THE INFORMATION NECESSARY TO ACCURATELY CHARACTERIZE EXPOSURE AND RISK TO RESIDENTS AT THE VB/I-70 SITE TO SUPPORT A QUANTITATIVE BASELINE HUMAN HEALTH RISK ASSESSMENT. SECONDLY, EFFORTS BEGAN TO INVESTIGATE THE SOURCE OF THE ARSENIC AND LEAD IN RESIDENTIAL SOILS. TOWARD THAT END, EPA USED ITS CERCLA SECTION 104(E) INFORMATION GATHERING AUTHORITY TO ACQUIRE A 6-OUNCE SAMPLE OF THE "PAX 3-YEAR CRABGRASS CONTROL" PRODUCT FROM MARTIN RESOURCES, A COMPANY THAT ACQUIRED THE COMPANY THAT HAD MANUFACTURED PAX. TESTS ON THE PAX SAMPLE FORMULATION PROVIDED BY MARTIN RESOURCES WERE HELPFUL TO EPA, BUT BY THEMSELVES PROVED INCONCLUSIVE TO DETERMINE WHETHER ALL ARSENIC AND LEAD FOUND IN THE VB/I-70 RESIDENTIAL SOILS WERE FROM PESTICIDES OR SMELTER EMISSIONS, OR BOTH.**

**ON MARCH 6, 2003, EPA ISSUED AN ACTION MEMORANDUM THAT ESTABLISHED THE BASIS FOR CONDUCTING A NON-TIME CRITICAL REMOVAL ACTION. THE ACTION MEMORANDUM REQUIRED THAT SOIL BE REMOVED AND REPLACED AT ANY PROPERTY THAT HAD AN ARSENIC SOIL LEVEL GREATER THAN 240 PPM AND/OR LEAD SOIL LEVELS GREATER THAN 540 PPM BASED ON THE PHASE III SAMPLING RESULTS. THESE "ACTION LEVELS" WERE CHOSEN TO ADDRESS THE PROPERTIES THAT PRESENT THE HIGHEST RISK OF ADVERSE HEALTH EFFECTS TO CHILDREN AND ADULT RESIDENTS. FROM THE PHASE II SAMPLING RESULTS, 143 PROPERTIES WERE IDENTIFIED AS REQUIRING A NON- TIME CRITICAL REMOVAL ACTION. THIS REMOVAL ACTION IS SCHEDULED TO BE COMPLETED IN THE FALL OF 2003.**

**A ROD ADDRESSING OU 1 WAS COMPLETED IN SEPTEMBER 2003.**

SITE HISTORY **- NO SITE HISTORY INFORMATION AVAILABLE -**

ACTIONS

TYPE: **RS - REMOVAL ASSESSMENT**
START DATE: **04/01/1998**
COMPLETION DATE: **09/21/1998**
ACTION TYPE DEFINITION:
**COLLECTING SITE CHARACTERISTICS TO DETERMINE WHETHER OR NOT A REMOVAL MUST BE PERFORMED.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NR**
COMPLETION DATE: **11/25/1998**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NR**
COMPLETION DATE: **02/15/1999**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **LO - LODGED BY DOJ**
START DATE: **NR**
COMPLETION DATE: **10/06/2004**
ACTION TYPE DEFINITION:
**AN ENFORCEMENT INSTRUMENT (E.G. CONSENT DECREE) IS LODGED BY DOJ WITH THE COURT.**

TYPE: **LO - LODGED BY DOJ**

START DATE: **NR**
COMPLETION DATE: **03/13/2009**
ACTION TYPE DEFINITION:
**AN ENFORCEMENT INSTRUMENT (E.G. CONSENT DECREE) IS LODGED BY DOJ WITH THE COURT.**

TYPE: **NF - FINAL LISTING ON NATIONAL PRIORITIES LIST**
START DATE: **NR**
COMPLETION DATE: **07/22/1999**
ACTION TYPE DEFINITION:
**SITE MOVED FROM PROPOSED LIST TO FINAL NATIONAL PRIORITY LIST.**

TYPE: **NP - PROPOSAL TO NATIONAL PRIORITIES LIST**
START DATE: **NR**
COMPLETION DATE: **01/19/1999**
ACTION TYPE DEFINITION:
**SITE PROPOSED FOR INCLUSION ON THE NATIONAL PRIORITY LIST BASED ON THE HAZARD RANKING SYSTEM (HRS) SCORE FOR THE SITE.**

TYPE: **QN - COMMUNITY ADVISORY GROUP**
START DATE: **08/01/1998**
COMPLETION DATE: **09/21/2006**
ACTION TYPE DEFINITION:
**THE FORMATION OF A COMMUNITY ADVISORY GROUP TO PRESENT COMMUNITY INTERESTS RELATED TO A SITE UNDERGOING CLEANUP TO EPA**

TYPE: **RA - REMEDIAL ACTION - LONG TERM ACTION**
START DATE: **08/21/2012**
COMPLETION DATE: **NR**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **09/25/2001**
COMPLETION DATE: **03/14/2003**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RD - REMEDIAL DESIGN**
START DATE: **09/25/2001**
COMPLETION DATE: **03/27/2003**
ACTION TYPE DEFINITION:
**THE PROCESS OF FULLY DETAILING AND SPECIFYING THE SELECTED REMEDY IDENTIFIED IN THE ROD OR EDD.**

TYPE: **RP - NON-NATIONAL PRIORITIES LIST POTENTIALLY RESPONSIBLE PARTY SEARCH**
START DATE: **07/09/1998**
COMPLETION DATE: **08/24/1998**
ACTION TYPE DEFINITION:
**THE NON-NPL POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IS TO IDENTIFY PRPS AT NON-NPL OR REMOVAL ACTION SITES.**

TYPE: **RV - REMOVAL - TIME CRITICAL**
START DATE: **10/13/1998**
COMPLETION DATE: **10/01/1999**

ACTION TYPE DEFINITION:

**RESPONSE ACTION THAT REQUIRES EXPEDITIOUS ATTENTION TO REDUCE IMMINENT AND SUBSTANTIAL DANGERS TO HUMAN HEALTH, WELFARE, OR THE ENVIRONMENT OR AN EMERGENCY RESPONSE REQUIRED WITHIN HOURS OR DAYS TO ADDRESS ACUTE SITUATIONS INVOLVING ACTUAL OR POTENTIAL THREAT TO HUMAN HEALTH, THE ENVIRONMENT, OR REAL OR PERSONAL PROPERTY DUE TO THE RELEASE OF A HAZARDOUS SUBSTANCE. CHARACTERIZATION OF A REMOVAL ACTION AS REMOVAL, NOT IMMEDIATE REMOVAL OR PLANNED REMOVAL, STARTED AT THE BEGINNING OF FY 1987. THIS CODE NOW TAKES THE PLACE OF IMMEDIATE REMOVAL (IR) AND PLANNED REMOVAL (PR).**

TYPE: **RV - REMOVAL - NON-TIME CRITICAL**

START DATE: **09/27/2000**

COMPLETION DATE: **10/09/2001**

ACTION TYPE DEFINITION:

**RESPONSE ACTION THAT REQUIRES EXPEDITIOUS ATTENTION TO REDUCE IMMINENT AND SUBSTANTIAL DANGERS TO HUMAN HEALTH, WELFARE, OR THE ENVIRONMENT OR AN EMERGENCY RESPONSE REQUIRED WITHIN HOURS OR DAYS TO ADDRESS ACUTE SITUATIONS INVOLVING ACTUAL OR POTENTIAL THREAT TO HUMAN HEALTH, THE ENVIRONMENT, OR REAL OR PERSONAL PROPERTY DUE TO THE RELEASE OF A HAZARDOUS SUBSTANCE. CHARACTERIZATION OF A REMOVAL ACTION AS REMOVAL, NOT IMMEDIATE REMOVAL OR PLANNED REMOVAL, STARTED AT THE BEGINNING OF FY 1987. THIS CODE NOW TAKES THE PLACE OF IMMEDIATE REMOVAL (IR) AND PLANNED REMOVAL (PR).**

TYPE: **RV - REMOVAL - TIME CRITICAL**

START DATE: **10/01/2002**

COMPLETION DATE: **09/23/2003**

ACTION TYPE DEFINITION:

**RESPONSE ACTION THAT REQUIRES EXPEDITIOUS ATTENTION TO REDUCE IMMINENT AND SUBSTANTIAL DANGERS TO HUMAN HEALTH, WELFARE, OR THE ENVIRONMENT OR AN EMERGENCY RESPONSE REQUIRED WITHIN HOURS OR DAYS TO ADDRESS ACUTE SITUATIONS INVOLVING ACTUAL OR POTENTIAL THREAT TO HUMAN HEALTH, THE ENVIRONMENT, OR REAL OR PERSONAL PROPERTY DUE TO THE RELEASE OF A HAZARDOUS SUBSTANCE. CHARACTERIZATION OF A REMOVAL ACTION AS REMOVAL, NOT IMMEDIATE REMOVAL OR PLANNED REMOVAL, STARTED AT THE BEGINNING OF FY 1987. THIS CODE NOW TAKES THE PLACE OF IMMEDIATE REMOVAL (IR) AND PLANNED REMOVAL (PR).**

TYPE: **RV - REMOVAL - NON-TIME CRITICAL**

START DATE: **07/21/2003**

COMPLETION DATE: **03/17/2005**

ACTION TYPE DEFINITION:

**RESPONSE ACTION THAT REQUIRES EXPEDITIOUS ATTENTION TO REDUCE IMMINENT AND SUBSTANTIAL DANGERS TO HUMAN HEALTH, WELFARE, OR THE ENVIRONMENT OR AN EMERGENCY RESPONSE REQUIRED WITHIN HOURS OR DAYS TO ADDRESS ACUTE SITUATIONS INVOLVING ACTUAL OR POTENTIAL THREAT TO HUMAN HEALTH, THE ENVIRONMENT, OR REAL OR PERSONAL PROPERTY DUE TO THE RELEASE OF A HAZARDOUS SUBSTANCE. CHARACTERIZATION OF A REMOVAL ACTION AS REMOVAL, NOT IMMEDIATE REMOVAL OR PLANNED REMOVAL, STARTED AT THE BEGINNING OF FY 1987. THIS CODE NOW TAKES THE PLACE OF IMMEDIATE REMOVAL (IR) AND PLANNED REMOVAL (PR).**

TYPE: **TA - TECHNICAL ASSISTANCE**

START DATE: **03/15/2012**

COMPLETION DATE: **NR**

ACTION TYPE DEFINITION:

**PARTICIPATION IN THE CONDUCT OF FUND-FINANCED REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS).**

TYPE: **TG - TECHNICAL ASSISTANCE GRANT**

START DATE: **03/23/2000**

COMPLETION DATE: **12/28/2006**

ACTION TYPE DEFINITION:

**A GRANT OF UP TO $50,000 PROVIDED UNDER SARA TO A COMMUNITY FOR TECHNICAL ASSISTANCE IN DEALING WITH SUPERFUND ISSUES AT A NATIONAL PRIORITY LIST (NPL) SITE.**

TYPE: **UB - COMFORT/STATUS LETTER**
START DATE: **10/15/2001**
COMPLETION DATE: **12/27/2001**
ACTION TYPE DEFINITION:
**EPA SENDS A LETTER TO PARTIES THAT PROVIDES INFORMATION REGARDING THE POTENTIAL FOR EPA ACTION AT THE PROPERTY.**

TYPE: **UB - COMFORT/STATUS LETTER**
START DATE: **01/14/2002**
COMPLETION DATE: **02/07/2002**
ACTION TYPE DEFINITION:
**EPA SENDS A LETTER TO PARTIES THAT PROVIDES INFORMATION REGARDING THE POTENTIAL FOR EPA ACTION AT THE PROPERTY.**

TYPE: **PC - PREPARATION OF COST DOCUMENT PACKAGE**
START DATE: **03/23/2000**
COMPLETION DATE: **04/17/2000**
ACTION TYPE DEFINITION:
**PACKAGE PREPARED IN SUPPORT OF COST RECOVERY ACTIONS CONTAINING SITE-SPECIFIC COST DOCUMENTATION INFORMATION FOR DIRECT EXPENDITURES (I.E., AGENCY PAYROLL AND TRAVEL, CONTRACTING COSTS) AND INDIRECT COSTS. DOCUMENTATION MAY BE CONDENSED PER RULE 1006 OF THE FEDERAL RULES OF EVIDENCE.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**
START DATE: **NR**
COMPLETION DATE: **10/12/1999**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **RO - RECORD OF DECISION**
START DATE: **NR**
COMPLETION DATE: **09/25/2003**
ACTION TYPE DEFINITION:
**THE FINAL RECORD OF DECISION (ROD) IS SIGNED BY THE APPROPRIATE AGENCY INDICATING THAT THE AGENCY HAS CHOSEN THE REMEDY FOR SITE REMEDIATION. ROD SIGNATURE IS SIGNIFIED BY THE COMPLETE DATE.**

TYPE: **AC - ADMINISTRATIVE ORDER ON CONSENT**
START DATE: **NR**
COMPLETION DATE: **09/29/2008**
ACTION TYPE DEFINITION:
**A VOLUNTARY AND ENFORCEABLE AGREEMENT PURSUANT TO CERCLA, SIGNED BY EPA AND POTENTIALLY RESPONSIBLE PARTIES (PRPS), WHEREBY THE PRPS AGREE TO PERFORM AND/OR PAY FOR SOME OR ALL OF THE RESPONSE COSTS INVOLVED IN SITE CLEANUP. THE ORDER DESCRIBES THE PRP RESPONSE TO BE TAKEN AT A SITE, STIPULATED PENALTIES, INDEMNIFICATION, EFFECTIVE DATE, AND MAY BE SUBJECT TO PUBLIC COMMENT. IT CAN BE FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), REMEDIAL DESIGN (RD), AND REMEDIAL ACTION (RA),PRE-SARA; BUT ONLY REMOVAL AND RI/FS, POST-SARA.**

TYPE: **IC - ISSUE REQUEST LETTERS (104E)**

START DATE: **NR**
COMPLETION DATE: **10/21/1999**
ACTION TYPE DEFINITION:
**EPA ISSUES LETTERS UNDER THE AUTHORITY OF SECTION 104(E) TO GATHER INFORMATION RELATED TO (1) THE IDENTIFICATION, NATURE, AND QUANTITY OF MATERIALS; (2) THE NATURE OR EXTENT OF A RELEASE OR THREATENED RELEASE OF A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT; OR (3) THE ABILITY OF A PERSON TO PAY FOR OR TO PERFORM A CLEANUP.**

TYPE: **AC - ADMINISTRATIVE ORDER ON CONSENT**
START DATE: **NR**
COMPLETION DATE: **07/28/2006**
ACTION TYPE DEFINITION:
**A VOLUNTARY AND ENFORCEABLE AGREEMENT PURSUANT TO CERCLA, SIGNED BY EPA AND POTENTIALLY RESPONSIBLE PARTIES (PRPS), WHEREBY THE PRPS AGREE TO PERFORM AND/OR PAY FOR SOME OR ALL OF THE RESPONSE COSTS INVOLVED IN SITE CLEANUP. THE ORDER DESCRIBES THE PRP RESPONSE TO BE TAKEN AT A SITE, STIPULATED PENALTIES, INDEMNIFICATION, EFFECTIVE DATE, AND MAY BE SUBJECT TO PUBLIC COMMENT. IT CAN BE FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), REMEDIAL DESIGN (RD), AND REMEDIAL ACTION (RA),PRE-SARA; BUT ONLY REMOVAL AND RI/FS, POST-SARA.**

TYPE: **RA - REMEDIAL ACTION - LONG TERM ACTION**
START DATE: **03/18/2004**
COMPLETION DATE: **09/25/2008**
ACTION TYPE DEFINITION:
**THE IMPLEMENTATION OF A PERMANENT RESOLUTION TO ADDRESS A RELEASE OR POTENTIAL RELEASE OF A HAZARDOUS SUBSTANCE FROM A SITE.**

TYPE: **AC - ADMINISTRATIVE ORDER ON CONSENT**
START DATE: **NR**
COMPLETION DATE: **07/28/2006**
ACTION TYPE DEFINITION:
**A VOLUNTARY AND ENFORCEABLE AGREEMENT PURSUANT TO CERCLA, SIGNED BY EPA AND POTENTIALLY RESPONSIBLE PARTIES (PRPS), WHEREBY THE PRPS AGREE TO PERFORM AND/OR PAY FOR SOME OR ALL OF THE RESPONSE COSTS INVOLVED IN SITE CLEANUP. THE ORDER DESCRIBES THE PRP RESPONSE TO BE TAKEN AT A SITE, STIPULATED PENALTIES, INDEMNIFICATION, EFFECTIVE DATE, AND MAY BE SUBJECT TO PUBLIC COMMENT. IT CAN BE FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), REMEDIAL DESIGN (RD), AND REMEDIAL ACTION (RA),PRE-SARA; BUT ONLY REMOVAL AND RI/FS, POST-SARA.**

TYPE: **AD - ALTERNATIVE DISPUTE RESOLUTION**
START DATE: **11/02/1998**
COMPLETION DATE: **12/31/1998**
ACTION TYPE DEFINITION:
**DECISION TO TAKE COST RECOVERY ACTION BY USE OF ALTERNATIVE DISPUTE RESOLUTION (ADR) INCLUDING MEDIATION, ARBITRATION AND MINI-TRIAL.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **09/16/1998**
COMPLETION DATE: **10/01/1999**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **AR - ADMINISTRATIVE RECORDS**
START DATE: **12/18/1998**
COMPLETION DATE: **09/25/2003**
ACTION TYPE DEFINITION:
**SARA SPECIFIES THAT ADMINISTRATIVE RECORDS BE COMPILED AT SUPERFUND SITES WHERE REMEDIAL OR REMOVAL RESPONSES ARE PLANNED, OR ARE OCCURRING, OR WHERE EPA IS ISSUING A UNILATERAL ORDER OR INITIATING LITIGATION TO TRACK ENFORCEMENT CASE BUDGET FUNDS USED FOR ANY RP LEAD ACTIVITY.**

TYPE: **BD - POTENTIALLY RESPONSIBLE PARTY REMEDIAL INVESTIGATION/FEASIBILITY STUDY**
START DATE: **09/25/2001**
COMPLETION DATE: **NR**
ACTION TYPE DEFINITION:
**PROVIDES FOR OVERSIGHT OF POTENTIALLY RESPONSIBLE PARTY (PRP) RESPONSE ACTION FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), INCLUDING ALL ACTIVITIES FOR MONITORING AND SUPERVISING THE PERFORMANCE OF THE RESPONSIBLE PARTIES TO DETERMINE WHETHER SUCH PERFORMANCE IS CONSISTENT WITH THE REQUIREMENTS OF THE ADMINISTRATIVE ORDERS ON CONSENT, UNILATERAL ADMINISTRATIVE ORDERS, CONSENT DECREES, JUDICIAL DECREES, INFORMATION AGREEMENTS, AND COMPLIANCE SCHEDULES.**

TYPE: **BF - POTENTIALLY RESPONSIBLE PARTY REMEDIAL ACTION**
START DATE: **09/30/2004**
COMPLETION DATE: **09/14/2006**
ACTION TYPE DEFINITION:
**PROVIDES FOR OVERSIGHT OF POTENTIALLY RESPONSIBLE PARTY (PRP) RESPONSE ACTION FOR REMEDIAL ACTION (RA), INCLUDING ALL ACTIVITIES FOR MONITORING AND SUPERVISING THE PERFORMANCE OF THE RESPONSIBLE PARTIES TO DETERMINE WHETHER SUCH PERFORMANCE IS CONSISTENT WITH THE REQUIREMENTS OF THE ADMINISTRATIVE ORDERS ON CONSENT, UNILATERAL ADMINISTRATIVE ORDERS, CONSENT DECREES, JUDICIAL DECREES, INFORMATION AGREEMENTS, AND COMPLIANCE SCHEDULES.**

TYPE: **CB - CLAIM IN BANKRUPTCY PROCEEDING**
START DATE: **06/27/2006**
COMPLETION DATE: **06/05/2009**
ACTION TYPE DEFINITION:
**LEGAL ACTION PERFORMED BY EPA REGIONAL ATTORNEYS TO ESTABLISH EPA AS A CREDITOR WHEN POTENTIALLY RESPONSIBLE PARTY (PRP) HAS FILED FOR BANKRUPTCY.**

TYPE: **CD - CONSENT DECREE**
START DATE: **09/30/2004**
COMPLETION DATE: **01/21/2005**
ACTION TYPE DEFINITION:
**JUDICIAL AGREEMENT BETWEEN THE FEDERAL GOVERNMENT AND THE POTENTIALLY RESPONSIBLE PARTIES (PRPS) FULLY OR PARTIALLY SETTLING A CLAIM UNDER CERCLA. THIS AGREEMENT MAY SETTLE LITIGATION OR MAY BE PRESENTED CONCURRENTLY WITH THE COMPLAINT (ACHIEVED THROUGH NEGOTIATIONS). THE AGREEMENT MAY BE FOR RESPONSE WORK, COST RECOVERY, OR BOTH.**

TYPE: **ED - RISK/HEALTH ASSESSMENT**
START DATE: **10/14/1999**
COMPLETION DATE: **05/09/2006**
ACTION TYPE DEFINITION:
**ASSESSMENT OF THE BASELINE RISKS POSED BY THE SITE TO HUMAN HEALTH.**

TYPE: **AC - ADMINISTRATIVE ORDER ON CONSENT**
START DATE: **NR**

COMPLETION DATE: **08/23/2006**

ACTION TYPE DEFINITION:

**A VOLUNTARY AND ENFORCEABLE AGREEMENT PURSUANT TO CERCLA, SIGNED BY EPA AND POTENTIALLY RESPONSIBLE PARTIES (PRPS), WHEREBY THE PRPS AGREE TO PERFORM AND/OR PAY FOR SOME OR ALL OF THE RESPONSE COSTS INVOLVED IN SITE CLEANUP. THE ORDER DESCRIBES THE PRP RESPONSE TO BE TAKEN AT A SITE, STIPULATED PENALTIES, INDEMNIFICATION, EFFECTIVE DATE, AND MAY BE SUBJECT TO PUBLIC COMMENT. IT CAN BE FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), REMEDIAL DESIGN (RD), AND REMEDIAL ACTION (RA),PRE-SARA; BUT ONLY REMOVAL AND RI/FS, POST-SARA.**

TYPE: **CD - CONSENT DECREE**

START DATE: **03/13/2009**

COMPLETION DATE: **06/05/2009**

ACTION TYPE DEFINITION:

**JUDICIAL AGREEMENT BETWEEN THE FEDERAL GOVERNMENT AND THE POTENTIALLY RESPONSIBLE PARTIES (PRPS) FULLY OR PARTIALLY SETTLING A CLAIM UNDER CERCLA. THIS AGREEMENT MAY SETTLE LITIGATION OR MAY BE PRESENTED CONCURRENTLY WITH THE COMPLAINT (ACHIEVED THROUGH NEGOTIATIONS). THE AGREEMENT MAY BE FOR RESPONSE WORK, COST RECOVERY, OR BOTH.**

TYPE: **ED - RISK/HEALTH ASSESSMENT**

START DATE: **04/13/2004**

COMPLETION DATE: **08/28/2009**

ACTION TYPE DEFINITION:

**ASSESSMENT OF THE BASELINE RISKS POSED BY THE SITE TO HUMAN HEALTH.**

TYPE: **DS - DISCOVERY**

START DATE: **NR**

COMPLETION DATE: **12/10/1997**

ACTION TYPE DEFINITION:

**THE PROCESS BY WHICH A POTENTIAL HAZARDOUS WASTE SITE IS BROUGHT TO THE ATTENTION OF THE EPA. THE PROCESS CAN OCCUR THROUGH THE USE OF SEVERAL MECHANISMS SUCH AS A PHONE CALL OR REFERRAL BY ANOTHER GOVERNMENT AGENCY.**

TYPE: **CR - COMMUNITY INVOLVEMENT**

START DATE: **11/02/1998**

COMPLETION DATE: **09/29/2004**

ACTION TYPE DEFINITION:

**THE COMMUNITY RELATIONS ACTIVITIES, I.E., PLAN, IMPLEMENTATION AND RESPONSIVENESS SUMMARY THAT MUST BE COMPLETED AT A SITE TO ADDRESS COMMUNITY CONCERNS.**

TYPE: **AC - ADMINISTRATIVE ORDER ON CONSENT**

START DATE: **NR**

COMPLETION DATE: **09/25/2001**

ACTION TYPE DEFINITION:

**A VOLUNTARY AND ENFORCEABLE AGREEMENT PURSUANT TO CERCLA, SIGNED BY EPA AND POTENTIALLY RESPONSIBLE PARTIES (PRPS), WHEREBY THE PRPS AGREE TO PERFORM AND/OR PAY FOR SOME OR ALL OF THE RESPONSE COSTS INVOLVED IN SITE CLEANUP. THE ORDER DESCRIBES THE PRP RESPONSE TO BE TAKEN AT A SITE, STIPULATED PENALTIES, INDEMNIFICATION, EFFECTIVE DATE, AND MAY BE SUBJECT TO PUBLIC COMMENT. IT CAN BE FOR REMOVAL, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS), REMEDIAL DESIGN (RD), AND REMEDIAL ACTION (RA),PRE-SARA; BUT ONLY REMOVAL AND RI/FS, POST-SARA.**

TYPE: **CO - COMBINED REMEDIAL INVESTIGATION/FEASIBILITY STUDY**

START DATE: **03/14/2003**

COMPLETION DATE: **NR**

ACTION TYPE DEFINITION:

**THE PROCESS OF DATA COLLECTION AND ANALYSES OF THE SITE PROBLEM, IDENTIFICATION OF PRELIMINARY REMEDIAL ALTERNATIVES, AND RECOMMENDATION OF A COST-EFFECTIVE REMEDY. THERE CAN BE MULTIPLE REMEDIAL INVESTIGATION/FEASIBILITY STUDIES (RI/FS) CONDUCTED AT A SITE.**

TYPE: **HR - HAZARD RANKING SYSTEM PACKAGE**

START DATE: **10/01/1998**

COMPLETION DATE: **12/24/1998**

ACTION TYPE DEFINITION:

**A NUMERIC ESTIMATE OF THE RELATIVE SEVERITY OF A HAZARDOUS SUBSTANCE RELEASE OR POTENTIAL RELEASE BASED ON: (1) THE RELATIVE POTENTIAL OF SUBSTANCES TO CAUSE HAZARDOUS SITUATIONS; (2) THE LIKELIHOOD AND RATE AT WHICH THE SUBSTANCES MAY AFFECT HUMAN AND ENVIRONMENTAL RECEPTORS; AND (3) THE SEVERITY AND MAGNITUDE OF POTENTIAL EFFECTS. THE SCORE IS COMPUTED USING THE HAZARD RANKING SYSTEM (HRS).**

TYPE: **CO - COMBINED REMEDIAL INVESTIGATION/FEASIBILITY STUDY**

START DATE: **12/17/1998**

COMPLETION DATE: **09/25/2003**

ACTION TYPE DEFINITION:

**THE PROCESS OF DATA COLLECTION AND ANALYSES OF THE SITE PROBLEM, IDENTIFICATION OF PRELIMINARY REMEDIAL ALTERNATIVES, AND RECOMMENDATION OF A COST-EFFECTIVE REMEDY. THERE CAN BE MULTIPLE REMEDIAL INVESTIGATION/FEASIBILITY STUDIES (RI/FS) CONDUCTED AT A SITE.**

TYPE: **CL - SECTION 106 107 LITIGATION**

START DATE: **09/30/2004**

COMPLETION DATE: **12/21/2004**

ACTION TYPE DEFINITION:

**REFERRAL TO OECM OR DOJ, WITHOUT SETTLEMENT, OF A CIVIL ACTION ADDRESSING A SITE UNDER SECTIONS 106 AND 107 OF CERCLA.**

TYPE: **FE - FIVE-YEAR REVIEW**

START DATE: **05/27/2009**

COMPLETION DATE: **09/30/2009**

ACTION TYPE DEFINITION:

**A REVIEW THAT IS CONDUCTED AT A MINIMUM OF EVERY FIVE YEARS TO DETERMINE IF THE IMPLEMENTATION AND PERFORMANCE OF A REMEDY IS PROTECTIVE OR WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.**

CONTAMINANTS

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL**

CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **758 PPM**

CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**

HAZARDOUS SUBSTANCE NAME: **ARSENIC**

CONTAMINANT GROUP NAME: **METALS**

WASTE SOURCE MEDIA CONTAMINATED NAME: **SOIL**

CONSTITUTENT CONTAMINANT MAXIMUM CONCENTRATION VALUE: **1131 PPM**

CONSTITUTENT CONTAMINANT OF CONCERN FLAG: **YES**

HAZARDOUS SUBSTANCE NAME: **LEAD**

CONTAMINANT GROUP NAME: **METALS**

LISTING OF PUBLISHED INSTITUTIONAL CONTROL SITE REPORT **- NOT AN INSTITUTIONAL CONTROL SITE -**

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# Record of Decision System (RODS)

**MAP ID# 160** **Distance from Property: 0.8 mi. (4,224 ft.) NE**

EPA ID: **CO0002259588**
NAME: **VASQUEZ BOULEVARD AND I-70**
ADDRESS: **VASQUEZ BOULEVARD AND 1-70, DENVER, CO**
COUNTY: **DENVER**
ROD DATE: **09/25/03**
ROD TYPE: **RECORD OF DECISION**
ROD ID: **08016462003ROD014**
**VASQUEZ BOULEVARD AND I-70**
**ABSTRACT SITE NAME: VASQUEZ BOULEVARD AND I-70**
**ADDRESS: VASQUEZ BOULEVARD AND 1-70**
**CITY & STATE: DENVER CO 80216**
**COUNTY: DENVER**

**EPA ID: CO0002259588**
**EPA REGION: 08**

**NPL STATUS: CURRENTLY ON THE FINAL NPL**

**ROD TYPE: RECORD OF DECISION**
**ROD ID: EPA/541/R-03/014**
**ROD DATE: 09/25/2003**
**OPERABLE UNIT(S): 01**

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**MAP ID# 160** **Distance from Property: 0.8 mi. (4,224 ft.) NE**

## SITE INFORMATION

EPA ID: **COD002259588** SITE ID: **0801646**

SITE NAME: **VASQUEZ BOULEVARD/I70**

SITE ADDRESS: **VASQUEZ BLVD AND I-70 BOUNDARY AREA**
**DENVER, CO 80216**

SITE COUNTY: **DENVER**

ADDITIONAL INFORMATION: **ACTIVE SUPERFUND SITES**

MAP LINKS: **HTTP://EMAPS.DPHE.STATE.CO.US/HMSITEMAP/NPL/VBI70.HTM**

## CONTACT INFORMATION

NAME: **FONDA APOSTOLOPOULOS**

PHONE: **(303) 692-3411**

## SITE SUMMARY

LOCATION:

**THE VASQUEZ BOULDEVARD AND I-70 SITE INCLUDES ALL OR PORTIONS OF SEVERAL NORTHEAST DENVER NEIGHBORHOODS: SWANSEA, ELYRIA, CLAYTON, COLE AND WEST GLOBEVILLE. THE STUDY AREA BOUNDARY IS GENERALLY DELINEATED BY THE SOUTH PLATTE RIVER ON THE WEST, COLORADO BOULEVARD ON THE EAST, 52ND AVENUE ON THE NORTH AND MARTIN LUTHER KING BOULEVARD ON THE SOUTH.**

HISTORY:

**THREE SMELTERS (THE OMAHA-GRANT, GLOBE AND ARGO) OPERATED AT VARIOUS TIMES FROM THE 1870'S THROUGH TO THE PRESENT, REFINING A VARIETY OF METALS INCLUDING GOLD, SILVER, COPPER, LEAD, ZINC, ARSENIC AND CADMIUM. ONLY THE GLOBE SMELTER CONTINUES TO OPERATE, REFINING SMALL QUANTITIES OF HIGH PURITY METALS.**

## ENVIRONMETAL CONCERNS

CHEMICALS:

**ARSENIC AND LEAD ARE THE CHEMICALS OF CONCERN FOR THE VASQUEZ BOULEVARD AND I-70 SITE.**

EXPOSURE:

**THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT AND THE EPA SAMPLED SOIL IN RESIDENTIAL YARDS IN THESE NEIGHBORHOODS TO DETERMINE IF ARSENIC, CADMIUM AND LEAD LEVELS POSED A POTENTIAL HEALTH THREAT TO THE COMMUNITY. SAMPLING REVEALED ELEVATED LEVELS OF LEAD AND ARSENIC IN SOME YARDS. RESIDENTS MAY BE EXPOSED TO METALS THROUGH INGESTION OF CONTAMINATED SOIL PARTICLES OR BY INHALATION OF CONTAMINATED AIRBORNE PARTICLES.**

SITE REMEDIATION:

**IN THE FALL OF 1998, EPA REMOVED SOILS FROM 18 RESIDENTIAL PROPERTIES WHERE LEVELS OF ARSENIC AND/OR LEAD EXCEEDED LEVELS THOUGHT TO POSE AN IMMEDIATE THREAT TO THE HEALTH OF RESIDENTS. LEVELS OF ARSENIC AND LEAD PRESENT AT OTHER PROPERTIES MAY POSE A THREAT TO THE HEALTH OF RESIDENTS. ON JANUARY 9, 1999, THE SITE WAS PROPOSED FOR THE EPA SUPERFUND NATIONAL PRIORITIES LIST (NPL). LISTING WAS FINALIZED IN JULY 1999.**

**SINCE AUGUST 1999, OVER 3000 RESIDENTIAL PROPERTIES HAVE BEEN SAMPLED TO DETERMINE ARSENIC AND LEAD LEVELS IN SOIL. EPA HAS COMPLETED THE REMEDIAL INVESTIGATION, BASELINE RISK ASSESSMENT, FEASIBILITY STUDY, PROPOSED PLAN AND REVISED PROPOSED PLAN FOR OPERABLE UNIT 1, RESIDENTIAL SOILS.**

**COMMUNITY MEMBERS AT THE SITE HAVE PLAYED AN IMPORTANT PART IN ALL ASPECTS OF THE DECISION-MAKING AT THE SITE. A TECHNICAL ASSISTANCE GRANT WAS AWARDED TO C.E.A.S.E. INC., A CONCERNED COMMUNITY GROUP, TO HIRE AN INDEPENDENT TECHNICAL ADVISOR. WORK BY THIS AND OTHER COMMUNITY GROUPS HAS RESULTED IN THE**

**IMPLEMENTATION OF A COMMUNITY HEALTH PROGRAM, WHICH INCORPORATES COMMUNITY AND INDIVIDUAL HEALTH EDUCATION, A BIOMONITORING PROGRAM, AS WELL AS A RESPONSE AND REFERRAL PROGRAM. THE COMMUNITY HEALTH PROGRAM WILL BE IMPLEMENTED ON AN ONGOING BASIS UNTIL THE RESIDENTIAL SOIL REMOVAL PORTION OF THE REMEDIAL ACTION HAS BEEN COMPLETED.**

**OPERABLE UNIT 2 IS DEFINED AS THE OMAHA GRANT SMELTER SITE SOILS AND GROUNDWATER. ASARCO LLC AND THE CITY AND COUNTY OF DENVER ARE RESPONSIBLE PARTIES AT THIS OPERABLE UNIT. THE REMEDIAL INVESTIGATION IS BEING CONDUCTED BY ASARCO AND IS UNDERWAY.**

**OPERABLE UNIT 3 IS THE ARGO SMELTER SITE SOILS AND GROUNDWATER. EPA IS CONDUCTING THE REMEDIAL INVESTIGATION.**

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**MAP ID# 161** **Distance from Property: 0.8 mi. (4,224 ft.) N**

**SITE INFORMATION**

EPA ID: **COD097663033**

SITE NAME: **YELLOW CAB CO-OP ASSOC**

SITE ADDRESS: **3455 RINGSBY CT**
**DENVER, CO 80216**

SITE COUNTY: **DENVER**

FACILITY TYPE: **CA**

STATUS: **HISTORIC**

LINKS: **http://www.epa.gov/cgi-bin/get1cReport.cgi?tool=echo&IDNumber=COD097663033**

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# Resource Conservation & Recovery Act - Corrective Action Facilities (RCRAC)

**MAP ID# 162** **Distance from Property: 0.85 mi. (4,488 ft.) NW**

**FACILITY INFORMATION**

EPA ID#: **COD000823492**
NAME: **TEXACO USA A DIVISION OF TEXACO INC**
ADDRESS: **805 W 38TH AVE**
**DENVER, CO 80216**
CONTACT NAME: **R.J WARK**
CONTACT ADDRESS: **3350 WILSHIRE BLVD P O BOX 3756**
**LOS ANGELES CA 90051**
CONTACT PHONE: **213-385-0515**
NON-NOTIFIER: **NOT A NON-NOTIFIER**
DATE RECEIVED BY AGENCY: **08/18/1980**

OWNER TYPE: **PRIVATE**
OWNER NAME: **TEXACO USA**
OPERATOR TYPE: **PRIVATE**
OPERATOR NAME: **TEXACO USA**

CERTIFICATION **- NO CERTIFICATION REPORTED -**

INDUSTRY CLASSIFICATION (NAICS)

**42271 - PETROLEUM BULK STATIONS AND TERMINALS**

SITE HISTORY (INCLUDES GENERATORS AND NON-GENERATORS)

DATE RECEIVED BY AGENCY: **08/18/1980**
NAME: **TEXACO USA A DIVISION OF TEXACO INC**

CURRENT ACTIVITY INFORMATION

GENERATOR STATUS: **NOT A GENERATOR** LAST UPDATED DATE: **07/08/2004**
SUBJECT TO CORRECTIVE ACTION UNIVERSE: **NO**
TDSFs POTENTIALLY SUBJECT TO CORRECTIVE ACTION UNDER 3004 (u)/(v) UNIVERSE: **NO**
TDSFs ONLY SUBJECT TO CORRECTIVE ACTION UNDER DISCRETIONARY AUTHORITIES UNIVERSE: **NO**
NON TSDFs WHERE RCRA CORRECTIVE ACTION HAS BEEN IMPOSED UNIVERSE: **YES**
CORRECTIVE ACTION WORKLOAD UNIVERSE: **YES**

IMPORTER: **NO**
MIXED WASTE GENERATOR: **NO**
RECYCLER: **NO**
TRANSPORTER: **NO**
ONSITE BURNER EXEMPTION: **NO**
FURNACE EXEMPTION: **NO**
USED OIL REFINER: **NO**
USED OIL TRANSFER FACILITY: **NO**

UNDERGROUND INJECTION: **NO**
UNIVERSAL WASTE DESTINATION FACILITY: **NO**
TRANSFER FACILITY: **NO**
USED OIL FUEL BURNER: **NO**
USED OIL PROCESSOR: **NO**
USED OIL FUEL MARKETER TO BURNER: **NO**
SPECIFICATION USED OIL MARKETER: **NO**
USED OIL TRANSPORTER: **NO**

COMPLIANCE, MONITORING AND ENFORCEMENT INFORMATION

EVALUATIONS

| | | |
|---|---|---|
| **11/13/2006** | **FCI** | **FOCUSED COMPLIANCE INSPECTION** |
| **05/08/2006** | **FCI** | **FOCUSED COMPLIANCE INSPECTION** |
| **02/10/2006** | **FCI** | **FOCUSED COMPLIANCE INSPECTION** |
| **11/28/1984** | **CEI** | **COMPLIANCE EVALUATION INSPECTION ON-SITE** |

VIOLATIONS **- NO VIOLATIONS REPORTED -**

ENFORCEMENTS **- NO ENFORCEMENTS REPORTED -**

HAZARDOUS WASTE

| | |
|---|---|
| **D001** | **IGNITABLE WASTE** |
| **D002** | **CORROSIVE WASTE** |
| **D008** | **LEAD** |

UNIVERSAL WASTE **- NO UNIVERSAL WASTE REPORTED -**

CORRECTIVE ACTION AREA (RELEASE)

| AREA NAME: | AIR: | GROUNDWATER: | SOIL: | SURFACE WASTE: |
|---|---|---|---|---|
| **4000 GAL UST** | **-----** | **Y** | **Y** | **-----** |
| **550 GAL UST** | **-----** | **Y** | **Y** | **-----** |
| **(8) 20X20 VERTICAL TANKS** | **-----** | **Y** | **Y** | **-----** |
| **(3) HORIZONTAL TANKS** | **-----** | **Y** | **Y** | **-----** |
| **2000 GAL SLOP TANK** | **-----** | **Y** | **Y** | **-----** |
| **UNDERGROUND PIPELINES** | **-----** | **Y** | **Y** | **-----** |
| **RAILWAY SPUR** | **-----** | **Y** | **Y** | **-----** |
| **GROUNDWATER** | **-----** | **Y** | **-----** | **-----** |
| **LEAD CONTAMINATION BA-20** | **-----** | **-----** | **Y** | **-----** |
| **FORMER SOIL STOCK PILE** | **-----** | **-----** | **Y** | **-----** |
| **ENTIRE FACILITY** | **-----** | **Y** | **Y** | **-----** |

CORRECTIVE ACTION EVENT

| CA EVENT: | DATE: | EVENT DESCRIPTION: |
|---|---|---|
| **CA782PR** | **02/01/2016** | **NOT REPORTED** |
| **CA506** | **01/05/2016** | **CMI SUP WORKPLAN DUE/RECEIVED** |
| **CA550RC** | **01/05/2016** | **REMEDY CONSTRUCTION-REMEDY CONSTRUCTED** |
| **CA772PR** | **01/05/2016** | **INSTITUTIONAL CONTROLS ESTABLISHED-PROPRIETARY CONTROL** |
| **CA350** | **08/06/2015** | **CMS COMPLETE** |
| **CA400** | **08/06/2015** | **REMEDY DECISION** |
| **CA340** | **08/03/2015** | **CMS REPORT RECEIVED** |
| **CA300** | **04/13/2015** | **CMS WORKPLAN APPROVED** |
| **CA260** | **04/02/2015** | **CMS WORKPLAN RECEIVED** |
| **CA300** | **03/02/2015** | **CMS WORKPLAN APPROVED** |
| **CA260** | **02/04/2015** | **CMS WORKPLAN RECEIVED** |
| **CA100** | **11/19/2014** | **INVESTIGATION IMPOSITION** |
| **CA250** | **10/30/2008** | **CMS IMPOSITION** |
| **CA300** | **10/30/2008** | **CMS WORKPLAN APPROVED** |
| **CA400** | **10/30/2008** | **REMEDY DECISION** |
| **CA450** | **10/30/2008** | **CORRECTIVE MEASURES DESIGN APPROVED** |
| **CA500** | **10/30/2008** | **CMI WORKPLAN APPROVED** |
| **CA550NR** | **10/30/2008** | **REMEDY CONSTRUCTION-NO REMEDY CONSTRUCTED** |
| **CA772GC** | **10/30/2008** | **INSTITUTIONAL CONTROLS ESTABLISHED-GOVERNMENTAL CONTROL** |
| **CA999NF** | **10/30/2008** | **CA PROCESS IS TERMINATED-NO FURTHER ACTION** |
| **CA150** | **11/13/2006** | **INVESTIGATION WORKPLAN APPROVED** |
| **CA200** | **11/13/2006** | **INVESTIGATION COMPLETE** |
| **CA300** | **11/13/2006** | **CMS WORKPLAN APPROVED** |
| **CA999NF** | **11/13/2006** | **CA PROCESS IS TERMINATED-NO FURTHER ACTION** |
| **CA150** | **05/08/2006** | **INVESTIGATION WORKPLAN APPROVED** |
| **CA050** | **02/10/2006** | **RFA COMPLETED** |

| | | |
|---|---|---|
| **CA100** | **02/10/2006** | **INVESTIGATION IMPOSITION** |
| **CA250** | **02/10/2006** | **CMS IMPOSITION** |

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# No Longer Regulated RCRA Corrective Action Facilities (NLRRCRAC)

**MAP ID# 163** **Distance from Property: 0.96 mi. (5,069 ft.) SW**

**FACILITY INFORMATION**

EPA ID#: **COD983780180**

NAME: **RTD DENVER UNION TERMINAL**

ADDRESS: **1701 WYNKOOP ST**
**DENVER, CO 80202-1047**

CONTACT NAME: **JAMES HERNANDEZ**

CONTACT ADDRESS: **1701 WYNKOOP ST**
**DENVER CO 802021047**

CONTACT PHONE: **303-299-2202**

NON-NOTIFIER: **NOT A NON-NOTIFIER**

DATE RECEIVED BY AGENCY: **05/13/2003**

OWNER TYPE: **PRIVATE**

OWNER NAME: **REGIONAL TRANSPORTATION DISTRICT**

OPERATOR TYPE: **DISTRICT**

OPERATOR NAME: **RTD DENVER UNION TERMINAL**

CERTIFICATION

| CERTIFICATION NAME: | CERTIFICATION TITLE: | CERTIFICATION SIGNED DATE: |
|---|---|---|
| **DAVID A GENOVA** | **MANAGER, PUBLIC SAFETY** | **04/24/2003** |

INDUSTRY CLASSIFICATION (NAICS)

**485111 - MIXED MODE TRANSIT SYSTEMS**

SITE HISTORY (INCLUDES GENERATORS AND NON-GENERATORS)

DATE RECEIVED BY AGENCY: **05/13/2003**

NAME: **RTD DENVER UNION TERMINAL**

DATE RECEIVED BY AGENCY: **09/28/1992**

NAME: **DENVER UNION TERMINAL RAILWAY**

CURRENT ACTIVITY INFORMATION

GENERATOR STATUS: **CONDITIONALLY EXEMPT SMALL QUANTITY GENERATOR** LAST UPDATED DATE: **03/11/2004**

SUBJECT TO CORRECTIVE ACTION UNIVERSE: **NO**

TDSFs POTENTIALLY SUBJECT TO CORRECTIVE ACTION UNDER 3004 (u)/(v) UNIVERSE: **NO**

TDSFs ONLY SUBJECT TO CORRECTIVE ACTION UNDER DISCRETIONARY AUTHORITIES UNIVERSE: **NO**

NON TSDFs WHERE RCRA CORRECTIVE ACTION HAS BEEN IMPOSED UNIVERSE: **NO**

CORRECTIVE ACTION WORKLOAD UNIVERSE: **YES**

IMPORTER: **NO**
MIXED WASTE GENERATOR: **NO**
RECYCLER: **NO**
TRANSPORTER: **NO**
ONSITE BURNER EXEMPTION: **NO**
FURNACE EXEMPTION: **NO**
USED OIL REFINER: **NO**
USED OIL TRANSFER FACILITY: **NO**

UNDERGROUND INJECTION: **NO**
UNIVERSAL WASTE DESTINATION FACILITY: **NO**
TRANSFER FACILITY: **NO**
USED OIL FUEL BURNER: **NO**
USED OIL PROCESSOR: **NO**
USED OIL FUEL MARKETER TO BURNER: **NO**
SPECIFICATION USED OIL MARKETER: **NO**
USED OIL TRANSPORTER: **NO**

COMPLIANCE, MONITORING AND ENFORCEMENT INFORMATION

EVALUATIONS **- NO EVALUATIONS REPORTED -**

VIOLATIONS **- NO VIOLATIONS REPORTED -**

ENFORCEMENTS **- NO ENFORCEMENTS REPORTED -**

HAZARDOUS WASTE

**D000**

UNIVERSAL WASTE **- NO UNIVERSAL WASTE REPORTED -**

CORRECTIVE ACTION AREA (RELEASE)

| AREA NAME: | AIR: | GROUNDWATER: | SOIL: | SURFACE WASTE: |
|---|---|---|---|---|
| **SULFURIC ACID SPILL** | **-----** | **-----** | **-----** | **-----** |

CORRECTIVE ACTION EVENT

| CA EVENT: | DATE: | EVENT DESCRIPTION: |
|---|---|---|
| **CA550RC** | **04/27/2012** | **REMEDY CONSTRUCTION-REMEDY CONSTRUCTED** |
| **CA650SR** | **04/27/2012** | **STABILIZATION CONSTRUCTION COMPLETED - PRIMARY MEAS SOURCE REMOVAL AND-OR TRTMT** |
| **CA999RM** | **04/27/2012** | **CA PROCESS IS TERMINATED-REMEDIAL ACTIVITIES COMPLETE** |
| **CA060** | **10/29/2011** | **NOTICE OF CONTAMINATION** |

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# *Unlocated Sites Summary*

*This list contains sites that could not be mapped due to limited or incomplete address information.*

*No Records Found*

**RCRANGR08** Resource Conservation & Recovery Act - Non-Generator

VERSION DATE: 07/12/16

This database identifies RCRAInfo system sites that only handle hazardous waste, such as transporters, without generating any amount hazardous waste. The United States Environmental Protection Agency defines RCRAInfo as the comprehensive information system which provides access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. RCRAInfo replaces the data recording and reporting abilities of the Resource Conservation and Recovery Information System (RCRIS) and the Biennial Reporting System (BRS). This database includes sites located in EPA Region 8. This region includes the following states: Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming.

**ERNSCO** Emergency Response Notification System

VERSION DATE: 10/04/16

This National Response Center database contains data on reported releases of oil, chemical, radiological, biological, and/or etiological discharges into the environment anywhere in the United States and its territories. The data comes from spill reports made to the U.S. Environmental Protection Agency, U.S. Coast Guard, the National Response Center and/or the U.S. Department of Transportation.

**HMIRSR08** Hazardous Materials Incident Reporting System

VERSION DATE: 11/29/16

The HMIRS database contains unintentional hazardous materials release information reported to the U.S. Department of Transportation located in EPA Region 8. This region includes the following states: Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming.

**NLRRCRAG** No Longer Regulated RCRA Generator Facilities

VERSION DATE: 07/12/16

This database includes RCRA Generator facilities that are no longer regulated by the United States Environmental Protection Agency or do not meet other RCRA reporting requirements. This listing includes facilities that formerly generated hazardous waste.
Large Quantity Generators: Generate 1,000 kg or more of hazardous waste during any calendar month; or Generate more than 1 kg of acutely hazardous waste during any calendar month; or Generate more than 100 kg of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, or acutely hazardous waste during any calendar month; or Generate 1 kg or less of acutely hazardous waste during any calendar month, and accumulate more than 1kg of acutely hazardous waste at any time; or Generate 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulated more than 100 kg of that material at any time.
Small Quantity Generators: Generate more than 100 and less than 1000 kilograms of hazardous waste during any calendar month and accumulate less than 6000 kg of hazardous waste at any time; or Generate 100 kg or

less of hazardous waste during any calendar month, and accumulate more than 1000 kg of hazardous waste at any time.
Conditionally Exempt Small Quantity Generators: Generate 100 kilograms or less of hazardous waste per calendar month, and accumulate 1000 kg or less of hazardous waste at any time; or Generate one kilogram or less of acutely hazardous waste per calendar month, and accumulate at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, or acutely hazardous waste; or Generate 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, or acutely hazardous waste during any calendar month, and accumulate at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste.

**RCRAGR08** Resource Conservation & Recovery Act - Generator

VERSION DATE: 07/12/16

This database includes sites listed as generators of hazardous waste (large, small, and exempt) in the RCRAInfo system. The United States Environmental Protection Agency defines RCRAInfo as the comprehensive information system which provides access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. RCRAInfo replaces the data recording and reporting abilities of the Resource Conservation and Recovery Information System (RCRIS) and the Biennial Reporting System (BRS). This database includes sites located in EPA Region 8. This region includes the following states: Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming.
Large Quantity Generators: Generate 1,000 kg or more of hazardous waste during any calendar month; or Generate more than 1 kg of acutely hazardous waste during any calendar month; or Generate more than 100 kg of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, or acutely hazardous waste during any calendar month; or Generate 1 kg or less of acutely hazardous waste during any calendar month, and accumulate more than 1kg of acutely hazardous waste at any time; or Generate 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulated more than 100 kg of that material at any time.
Small Quantity Generators: Generate more than 100 and less than 1000 kilograms of hazardous waste during any calendar month and accumulate less than 6000 kg of hazardous waste at any time; or Generate 100 kg or less of hazardous waste during any calendar month, and accumulate more than 1000 kg of hazardous waste at any time.
Conditionally Exempt Small Quantity Generators: Generate 100 kilograms or less of hazardous waste per calendar month, and accumulate 1000 kg or less of hazardous waste at any time; or Generate one kilogram or less of acutely hazardous waste per calendar month, and accumulate at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, or acutely hazardous waste; or Generate 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, or acutely hazardous waste during any calendar month, and accumulate at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste.

# Environmental Records Definitions - FEDERAL

**TRI** Toxics Release Inventory

VERSION DATE: 12/31/14

The Toxics Release Inventory, provided by the United States Environmental Protection Agency, includes data on toxic chemical releases and waste management activities from certain industries as well as federal and tribal facilities. This inventory contains information about the types and amounts of toxic chemicals that are released each year to the air, water, and land as well as information on the quantities of toxic chemicals sent to other facilities for further waste management.

**CDL** Clandestine Drug Laboratory Locations

VERSION DATE: 07/01/16

The U.S. Department of Justice ("the Department") provides this information as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments. The Department does not establish, implement, enforce, or certify compliance with clean-up or remediation standards for contaminated sites; the public should contact a state or local health department or environmental protection agency for that information.

**EC** Federal Engineering Institutional Control Sites

VERSION DATE: 08/03/15

This database includes site locations where Engineering and/or Institutional Controls have been identified as part of a selected remedy for the site as defined by United States Environmental Protection Agency official remedy decision documents. A site listing does not indicate that the institutional and engineering controls are currently in place nor will be in place once the remedy is complete; it only indicates that the decision to include either of them in the remedy is documented as of the completed date of the document. Institutional controls are actions, such as legal controls, that help minimize the potential for human exposure to contamination by ensuring appropriate land or resource use. Engineering controls include caps, barriers, or other device engineering to prevent access, exposure, or continued migration of contamination.

**HISTPST** Historical Gas Stations

VERSION DATE: NR

This historic directory of service stations is provided by the Cities Service Company. The directory includes Cities Service filling stations that were located throughout the United States in 1930.

**LUCIS** Land Use Control Information System

VERSION DATE: 09/01/06

The LUCIS database is maintained by the U.S. Navy and contains information for former Base Realignment and Closure (BRAC) properties across the United States.

**RCRASC** RCRA Sites with Controls

VERSION DATE: 02/23/16

This list of Resource Conservation and Recovery Act sites with institutional controls in place is provided by the U.S. Environmental Protection Agency.

**BF** Brownfields Management System

VERSION DATE: 10/24/16

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. The United States Environmental Protection Agency maintains this database to track activities in the various brown field grant programs including grantee assessment, site cleanup and site redevelopment. This database included tribal brownfield sites.

**NLRRCRAT** No Longer Regulated RCRA Non-CORRACTS TSD Facilities

VERSION DATE: 07/12/16

This database includes RCRA Non-Corrective Action TSD facilities that are no longer regulated by the United States Environmental Protection Agency or do not meet other RCRA reporting requirements. This listing includes facilities that formerly treated, stored or disposed of hazardous waste.

**ODI** Open Dump Inventory

VERSION DATE: 06/01/85

The open dump inventory was published by the United States Environmental Protection Agency. An “open dump” is defined as a facility or site where solid waste is disposed of which is not a sanitary landfill which meets the criteria promulgated under section 4004 of the Solid Waste Disposal Act (42 U.S.C. 6944) and which is not a facility for disposal of hazardous waste. This inventory has not been updated since June 1985.

**RCRAT** Resource Conservation & Recovery Act - Non-CORRACTS Treatment, Storage & Disposal Facilities

VERSION DATE: 07/12/16

This database includes Non-Corrective Action sites listed as treatment, storage and/or disposal facilities of hazardous waste in the RCRAInfo system. The United States Environmental Protection Agency defines RCRAInfo as the comprehensive information system which provides access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. RCRAInfo replaces the data recording and reporting abilities of the Resource Conservation and Recovery

Information System (RCRIS) and the Biennial Reporting System (BRS).

**SEMS** Superfund Enterprise Management System

VERSION DATE: 12/05/16

The U.S. Environmental Protections Agency's (EPA) Office of Solid Waste and Emergency Response, Office of Superfund Remediation and Technology Innovation (OSRTI), has implemented The Superfund Enterprise Management System (SEMS), formerly known as CERCLIS (Comprehensive Environmental Response, Compensation and Liability Information System) to track and report on clean-up and enforcement activities taking place at Superfund sites. SEMS represents a joint development and ongoing collaboration between Superfund's Remedial, Removal, Federal Facilities, Enforcement and Emergency Response programs.

**SEMSARCH** Superfund Enterprise Management System Archived Site Inventory

VERSION DATE: 12/05/16

The Superfund Enterprise Management System Archive listing (SEMS-ARCHIVE) has replaced the CERCLIS NFRAP reporting system in 2015. This listing reflect sites that have been assessed and no further remediation is planned and is of no further interest under the Superfund program.

**DNPL** Delisted National Priorities List

VERSION DATE: 08/05/16

This database includes sites from the United States Environmental Protection Agency's Final National Priorities List (NPL) where remedies have proven to be satisfactory or sites where the original analyses were inaccurate, and the site is no longer appropriate for inclusion on the NPL, and final publication in the Federal Register has occurred.

**NLRRCRAC** No Longer Regulated RCRA Corrective Action Facilities

VERSION DATE: 07/12/16

This database includes RCRA Corrective Action facilities that are no longer regulated by the United States Environmental Protection Agency or do not meet other RCRA reporting requirements.

**NMS** Former Military Nike Missile Sites

VERSION DATE: 12/01/84

This information was taken from report DRXTH-AS-IA-83A016 (Historical Overview of the Nike Missile System, 12/1984) which was performed by Environmental Science and Engineering, Inc. for the U.S. Army Toxic and Hazardous Materials Agency Assessment Division. The Nike system was deployed between 1954 and the mid-1970's.

Among the substances used or stored on Nike sites were liquid missile fuel (JP-4); starter fluids (UDKH, aniline, and furfuryl alcohol); oxidizer (IRFNA); hydrocarbons (motor oil, hydraulic fluid, diesel fuel, gasoline, heating oil);

solvents (carbon tetrachloride, trichloroethylene, trichloroethane, stoddard solvent); and battery electrolyte. The quantities of material a disposed of and procedures for disposal are not documented in published reports. Virtually all information concerning the potential for contamination at Nike sites is confined to personnel who were assigned to Nike sites.
During deactivation most hardware was shipped to depot-level supply points. There were reportedly instances where excess materials were disposed of on or near the site itself at closure. There was reportedly no routine site decontamination.

**NPL** National Priorities List

VERSION DATE: 08/05/16

This database includes United States Environmental Protection Agency (EPA) National Priorities List sites that fall under the EPA's Superfund program, established to fund the cleanup of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action.

**PNPL** Proposed National Priorities List

VERSION DATE: 08/05/16

This database contains sites proposed to be included on the National Priorities List (NPL) in the Federal Register. The United States Environmental Protection Agency investigates these sites to determine if they may present long-term threats to public health or the environment.

**RCRAC** Resource Conservation & Recovery Act - Corrective Action Facilities

VERSION DATE: 07/12/16

This database includes all hazardous waste sites with ongoing corrective action activity and where corrective action is statutorily required to be address but have not had corrective action imposed in the RCRAInfo system. The Corrective Action Program requires owners or operators of RCRA facilities (or treatment, storage, and disposal facilities) to investigate and cleanup contamination in order to protect human health and the environment. The United States Environmental Protection Agency defines RCRAInfo as the comprehensive information system which provides access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. RCRAInfo replaces the data recording and reporting abilities of the Resource Conservation and Recovery Information System (RCRIS) and the Biennial Reporting System (BRS).

**RCRASUBC** Resource Conservation & Recovery Act - Subject to Corrective Action Facilities

VERSION DATE: 07/12/16

This database includes hazardous waste sites which are potentially subject to corrective action regardless of whether they have correction action underway, plus any sites showing a corrective action event of RFI or beyond in the RCRAInfo system. Sites conducting corrective action under analogous state authorities are also included. The United States Environmental Protection Agency defines RCRAInfo as the comprehensive information system which provides access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976

and the Hazardous and Solid Waste Amendments (HSWA) of 1984. RCRAInfo replaces the data recording and reporting abilities of the Resource Conservation and Recovery Information System (RCRIS) and the Biennial Reporting System (BRS).

**RODS** Record of Decision System

VERSION DATE: 07/01/13

These decision documents maintained by the United States Environmental Protection Agency describe the chosen remedy for NPL (Superfund) site remediation. They also include site history, site description, site characteristics, community participation, enforcement activities, past and present activities, contaminated media, the contaminants present, and scope and role of response action.

**HWSG** Hazardous Waste Sites- Generator

VERSION DATE: 06/30/03

The Resource Conservation and Recovery Act (RCRA) was enacted by congress in 1976, followed by the promulgation of implementing regulations in 1980. In 1984, the State was authorized by EPA to implement the RCRA program in Colorado on their behalf. This facility listing includes RCRA sites listed as generators of hazardous waste (Small Quantity Generators and Large Quantity Generators) and was provided by the Colorado Department of Public Health and Environment.
Small Quantity Generators (SQG) generate, in any calendar month, more than 100 kg (220 lbs.) but less than 1,000 kg (2,200 lbs.) of RCRA hazardous waste; and generate, in any calendar month, or accumulate at any time, no more than 1 kg (2.2 lbs.) of acute hazardous waste and no more than 100 kg (220 lbs.) of material from the cleanup of a spill of acute hazardous waste; and accumulate on-site no more than 6000 kg (13,200 lbs) of hazardous waste at any one time; or, the site is a Small Quantity Generator if the site met all other criteria for a Conditionally Exempt Small Quantity Generator, but accumulated, at any time, more than 1,000 kg (2,200 lbs.) of RCRA hazardous waste.
Large Quantity Generators (LQG) generate, in any calendar month, 1,000 kg (2,200 lbs.) or more of RCRA hazardous waste; or generate, in any calendar month, or accumulated at any time, more than 1 kg (2.2 lbs.) of RCRA acute hazardous waste; or generate, in any calendar month, or accumulated at any time, more than 100 kg (220 lbs.) of spill cleanup material contaminated with RCRA acute hazardous waste.

**SPILLS** Spills Listing

VERSION DATE: 10/31/16

The Colorado Department of Public Health and Environment's Division of Emergency Preparedness and Response maintains this listing of chemical spills and/or releases.

**AST** Aboveground Storage Tank Facilities

VERSION DATE: 10/18/16

The Oil and Public Safety Division of the Colorado Department of Labor and Employment maintains this list of aboveground storage tank (AST) facilities. This AST database also includes other types of storage tank facilities such as liquefied petroleum gas (LPG), vehicle tank meters (VTM), and compressed natural gas facilities.

**CDL** Clandestine Drug Laboratory Locations

VERSION DATE: 07/08/16

This list of Methamphetamine lab seizures is provided by multiple sources: the North Metro Task Force, FACTS (Forensic Applications Consulting Technologies, Inc) and the Colorado Springs Police Department. The North Metro Task Force list of Methamphetamine labs were seized between 2001 and 2010. The North Metro area includes the following Cities and Counties of Colorado: Adams County, Broomfield, Brighton, Commerce City, Federal Heights, Northglenn, Thornton, and Westminster. According to Section 2 of Colorado Revised Statutes: "25-18.5-103. Discovery of an illegal drug laboratory - property owner - clean-up - liability. (1) (a) Upon notification from a peace officer that chemicals, equipment, or supplies indicative of an illegal drug laboratory are

located on a property, or when an illegal drug laboratory used to manufacture methamphetamine is otherwise discovered and the property owner has received notice, the owner of any contaminated property shall meet the cleanup standards for property established by the board in section 25-18.5-102". The FACTS and Colorado Springs Police Department Methamphetamine labs were seized between 2001 and 2014.

**COVENANTS** Environmental Real Covenants List

VERSION DATE: 08/25/15

Senate Bill 01-145 gave authority to the Colorado Department of Public Health and Environment to approve requests to restrict the future use of a property using an enforceable agreement called an environmental covenant. These covenants, which are recorded with the deed and run with the land, provide a mechanism to ensure that institutional controls that are part of environmental remediation projects are properly implemented and that engineered structures are protected and maintained, so that implemented remedies continue to be protective of human health and the environment for as long as any residual contamination remains a risk.

**UST** Underground Storage Tank Facilities

VERSION DATE: 10/18/16

The Oil and Public Safety Division of the Colorado Department of Labor and Employment maintains this list of underground storage tank facilities.

**CLEANERS** Dry Cleaning Facilities

VERSION DATE: 11/01/16

This database contains dry cleaners which have obtained an air permit through the Air Pollution Control Division at the Colorado Department of Public Health and Environment.

**HISTSWLF** Historical Solid Waste Landfills

VERSION DATE: NR

This historical solid waste landfills database contains data from the Hazardous Materials Waste Management Division (HMWMD) of the Colorado Department of Public Health and other various state and local agencies. In the early 1980s, the HMWMD conducted a survey of staff members and local agencies to compile this listing of sites that were known or thought to have waste issues. This Solid Waste Historical Data is not considered complete or verifiable and has not been maintained since the late 1980s. The HMWMD is not responsible and shall not be liable to the used for damages of any kind arising out of the use of this data or information.

**HWSTSD** Hazardous Waste Sites- Treatment, Storage & Disposal

VERSION DATE: 06/30/03

The Resource Conservation and Recovery Act (RCRA) was enacted by congress in 1976, followed by the promulgation of implementing regulations in 1980. In 1984, the State was authorized by EPA to implement the

RCRA program in Colorado on their behalf. TSD facilities treat, store, dispose, or recycle hazardous waste on site in units and therefore are subject to RCRA permitting requirements. Historic TSDs are facilities that have completed closure and/or post-closure of the RCRA Subtitle C Regulated Unit(s) or the Treatment/Storage/Disposal Unit is no longer regulated. This database was provided by the Colorado Department of Public Health and Environment.

**LST** Leaking Storage Tank Facilities

VERSION DATE: 10/18/16

The Oil and Public Safety Division of the Colorado Department of Labor and Employment maintains this list of leaking aboveground and underground storage tank facilities.

**LUSTTRUST** Leaking Underground Storage Tanks Trust Fund Sites

VERSION DATE: 01/01/00

Suspected tank leaks have been discovered at the sites included in this database, but the facility responsible for the leak has not been identified. The state's investigtion and search for responsible parties is paid for out of the state's Leaking Underground Storage Tank (LUST) Trust Fund. This database was provided by the Colorado Department of Labor & Employment, Division of Oil and Public Safety, State Fund Section and is no longer updated.

**METHANESITES** Methane Gas Study Sites

VERSION DATE: 01/01/81

This Investigation of Methane Gas Hazards report was prepared by the Denver Office of Emergency Preparedness in 1981. The purpose of this study was to assess the actual and potential generation, migration, explosive and related problems associated with specified landfills, and to identify existing and potential problems, suggested strategies to prevent, abate, and control such problems and recommend investigative and monitoring functions as may be deemed necessary. The Colorado Department of Health selected eight landfills as priorities due to population density and potential hazards to population and property.

**SWF** Solid Waste Facilities

VERSION DATE: 10/14/16

The Colorado Department of Public Health and Environment maintains this database of solid waste disposal facilities, transfer stations, recyclers, waste tire registrants, and waste grease registrants.

**VCRA** Voluntary Cleanup and Redevelopment Program Sites

VERSION DATE: 11/07/16

This site listing is provided by the Colorado Department of Public Health and Environment (CDPHE) and includes both voluntary cleanup and brownfield properties. The Voluntary Cleanup and Redevelopment program

was created in 1994. The objective of the program is to facilitate the redevelopment and transfer of contaminated properties. Properties that sit untouched because of their real or perceived contamination can be rehabilitated using the CDPHE's Brownfields Program in conjunction with the Voluntary Cleanup Program. Cleanup decisions are based on existing standards and the proposed use of the property. The actual cleanup and verification is the owner's responsibility.

**HWSCA** Hazardous Waste Sites- Corrective Action

VERSION DATE: 06/30/03

The Resource Conservation and Recovery Act (RCRA) was enacted by congress in 1976, followed by the promulgation of implementing regulations in 1980. In 1984, the Hazardous and Solid Waste Amendments (HSWA) were added to RCRA providing for corrective action at facilities subject to RCRA. That same year, the State was authorized by EPA to implement the RCRA program in Colorado on their behalf. Corrective action may be implemented as part of a RCRA Hazardous Waste Permit, an Order, or a Corrective Action Plan pursuant to the Colorado Hazardous Waste Regulations. Corrective action is the process by which regulated facilities investigate and remediate, as necessary, all contamination (soil, ground water, surface water, air) associated with their releases into the environment. Historic Corrective Action Sites are facilities that have completed the RCRA Subtitle C corrective Action process. This database was provided by the Colorado Department of Public Health and Environment.

**SF** Superfund Sites

VERSION DATE: 06/01/03

This listing contains active, deleted and proposed "Superfund" hazardous waste sites, as well as those sites identified through the Natural Resource Damages section of Superfund legislation and one Private Non-Superfund Cleanup site. A site qualifies for the National Priorities List (NPL or Superfund list) when the U.S. Environmental Protection Agency (EPA) determines there is a release or threatened release of hazardous substances that may endanger public health, welfare or the environment. In Colorado, the lead agency for Superfund remediation may be either the EPA or the Colorado Department of Public Health and Environment.

**DCHISTLF** Denver County Historic Landfills

VERSION DATE: NR

This historic landfill database was provided by the City and County of Denver GIS Department. The database contains the approximate boundaries of historic landfills which were located in the City and County of Denver (CCoD) based on a study conducted between 1997—2000 by Pinyon Environmental Engineering Resources, Inc. The data is of a general nature and obtained from historic and current documents that may not be accurate or precise. Data is not to be relied upon for engineering, construction, or precision analysis but as a general guide to where landfill material may exist based upon anecdote, historic records, and reports of various agencies. The City and County of Denver is not responsible and shall not be liable to the user for damages of any kind arising out of the use of data or information provided by the City and County of Denver, including the installation of the data or information, its use, or the results obtained from its use.

**USTR08** Underground Storage Tanks On Tribal Lands

VERSION DATE: 10/17/16

This database, provided by the United States Environmental Protection Agency (EPA), contains underground storage tanks on Tribal lands located in EPA Region 8. This region includes the following states: Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming.

**LUSTR08** Leaking Underground Storage Tanks On Tribal Lands

VERSION DATE: 10/17/16

This database, provided by the United States Environmental Protection Agency (EPA), contains leaking underground storage tanks on Tribal lands located in EPA Region 8. This region includes the following states: Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming.

**ODINDIAN** Open Dump Inventory on Tribal Lands

VERSION DATE: 11/08/06

This Indian Health Service database contains information about facilities and sites on tribal lands where solid waste is disposed of, which are not sanitary landfills or hazardous waste disposal facilities, and which meet the criteria promulgated under section 4004 of the Solid Waste Disposal Act (42 U.S.C. 6944).

# Appendix B Site Characterization Technical Memorandum

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# Site Characterization Technical Memorandum

**Date:** May 12, 2017

**To:** Appendix to Materials Management Plan

**Subject:** 27th Street Storm Drain Interceptor Environmental Support Summary Memorandum

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This Memorandum serves as an attachment to the Materials Management Plan (MMP) for the subject project. References noted herein may be found in the references section of the MMP.

# Site Characterization Activities

## Project Background

The City and County of Denver (CCD) has proposed installation of a new storm sewer pipe in 27th Street beginning west of Blake Street to the intersection with Welton Street, then south along Washington Street to Park Avenue (Site) (Figures 1 and 2).

Pinyon Environmental, Inc. (Pinyon), completed a Limited Environmental Screening Memorandum for the Site dated February 17, 2017. Facilities with a high potential to impact the project from an environment perspective were identified for the Site, including: the Coors Parking Garage; Angelica Healthcare Plant 88; and various historical dry cleaning facilities. The subsurface investigation was completed to evaluate potential impacts from the high potential facilities to the proposed project.

***Coors Parking Garage (27th Street and Blake Street)***

This facility was accepted into the Colorado Voluntary Cleanup Program November 9, 2012. Naphthalene and benzo(a)pyrene were detected in soil borings at the facility above their respective Colorado Department of Public Health and Environment (CDPHE) soil values. Trace amount of asbestos were detected in the soil borings. Constituents detected in the groundwater for the facility were at concentrations below the respective CDPHE groundwater standards. Remediation was stated as complete in November 2014, and a no action determination (NAD) letter was issued August 28, 2014. This use of the site is identified as commercial.

Pinyon has previously completed subsurface investigations within the Coors Parking lot on behalf of the City and County of Denver. During those investigations, man-made fill with elevated concentrations of polycyclic aromatic hydrocarbons (PAHs), heavy metals, and asbestos-containing materials (ACMs) were identified; those conditions appeared to be prevalent in that area, and it is possible that those conditions would be present generally west of Blake Street. Further, groundwater in the area was impacted with constituents at concentrations that exceeded either the Colorado Ground Water Standards, and/or the Colorado surface water discharge standards.

***Angelica Healthcare Plant 88 (2701 Lawrence Street)***

City-Elite Laundry was listed at the address in 1946, 1956, 1966, 1976, and 1986. Puritan Laundry Co was also listed at the address in 1956. In addition, the building currently present indicates they have been in business since 1886.

Four USTs were registered at the address to City-Elite Laundry in 1986. Two 1,125-gallon Mintrex tanks and one 1,000-gallon gasoline tank were removed from the facility in October 1990. Soil beneath the tanks was observed to be impacted with hydrocarbons and was excavated. Additional sampling beneath the excavation indicated no risk to human health or the environment. An NFA was issued for the UST closure on June 10, 1991.

The in-place closure of a 7,500-gallon waste oil tank was schedule for October 1993. Drilling activities did not find evidence of a petroleum release and "no contaminants were detected in the soil samples." No additional information was available.

***Various Historical Dry Cleaning Facilities***

- C&B Cleaners located at 2748 Welton Street was listed at the address in 1966, 1976, 1986, and 2006. The facility is classified as a dry cleaning and laundry services facility and is a no longer regulated RCRA generator facility. No violations were reported.
- 2733 Larimer Street was listed as a dry cleaner in 1926 and 1936 as Weber Marcel.
- 2721 Lawrence Street was listed as Tip Top Cleaners in 1946.
- 2552/2554 Washington Street was listed as Best Cleaners and Dryers (2552 Washington Street) in 1926 and Gigantic Cleaners and Laundry (2554 Washington Street) in 1946.
- 1959 Park Avenue was listed as Navy Gas and Supply Co in 1936 and City-Elite Laundry and Dry Cleaning in 1956.
- 739 East 26th Avenue was listed as Arcada Cleaners and Dryers in 1946 and 1956 and as Bell Cleaners and Tailors in 1966.
- 704 East 26th Avenue was listed as Fabulous Cleaners in 1956 and Best Fine Cleaners in 1966.
- 2701 Welton Street was listed as Four Season Cleaners in 1976 and 1986.
- 617 27th Street was listed as Four Season Cleaners in 1976 and 1986.
- 2712 Welton Street was listed as Five Point Cleaners in 1926.
- 2717 Welton Street was listed as Forty Minute Cleaners in 1966.

## Soil Sampling

On February 20 through February 23, 2017, February 27, 2017, and February 28, 2017, Pinyon provided a field geologist to oversee geotechnical drilling and visually evaluate the potential for chemical impacts. Pinyon collected a total of 16 soil samples from 16 soil boring locations at the Site (Figure 2). The soil boring locations were selected by the geotechnical consultant, Kumar and Associates, Inc. (Kumar), of Denver, Colorado. The soil borings were placed approximately 500 feet apart from one another on 27$^{th}$ Street and Washington Street with four soil borings placed in the intersection of 27$^{th}$ Street and Welton Street (Figure 2).

Rock Edge Drilling, of Northglenn, Colorado, and Elite Drilling Services, LLC., of Denver, Colorado, completed the drilling using hollow-stem auger drilling methods. Pinyon screened approximately 18 inches of soil for every five-foot interval. Each of the samples screened was observed for staining, odors, and other evidence of

impacts. In addition, samples were field screened for non-specific VOCs using a photoionization detector (PID) and the headspace technique. In the headspace technique, a portion of the soil sample is placed in a "zip-lock" bag, which is sealed and placed in a warm area to promote volatilization. After a period of time, the PID is inserted into the headspace of the bag, and a reading is obtained.

One soil sample from each boring was selected for laboratory analysis based on the interval with the highest headspace reading and/or notable visual or olfactory impacts. If impacts were not observed, composite soil samples were collected from each of the soil borings. Composite sampling was selected, as during construction activities, significant "mixing" of soils is anticipated during excavation, thus mimicking the composition of samples. The composite samples were collected from the soil just below the asphalt pavement (~ one foot) to either 24 feet below the ground surface (bgs) or 29 feet bgs, depending on the total depth of the soil boring.

Soil Samples were submitted, on ice, under chain of custody controls, to Origins Laboratory, Inc. (Origins), of Denver, Colorado (attached). The samples were collected to support a waste profile at the Denver Arapahoe Disposal Site (DADS) per CCD and Waste Management requirements. The soil samples were analyzed for the following:

- VOCs by United States Environmental Protection Agency (U.S. EPA) Method 8260
- Polycyclic Aromatic Hydrocarbons (PAHs) by U.S. EPA Method 8270 SIM
- The eight Resource Conservation and Recovery Act (RCRA 8) Metals by U.S. EPA Method 9010 and 7471
- Toxicity Characteristic Leaching Procedure (TCLP) for lead by U.S. EPA Method 1311/6010
- Polychlorinated Biphenyls (PCBs) by U.S. EPA Method 8082

Soil analytical results were compared to the U.S. EPA Regional Screening Levels for residential and composite worker protection (RRSL and CWRSL) and the Colorado Department of Public Health and Environment (CDPHE) Groundwater Protection Values . Due to high levels of naturally occurring arsenic in Colorado, soil analytical results for arsenic were compared to the CDPHE risk-based screening level for arsenic of 11 milligrams per kilogram (mg/kg) (Table 1).

***Metals Results***

In each of the soil samples, various metals were detected at concentrations above the laboratory detection limit, but below the EPA RRSL, CWRSL, and CDPHE risk-based screening level for arsenic.

***Organics Results***

Some black soil staining was observed in soil boring B-1 at depths from six feet to eight feet bgs. PID readings measured above 20 parts per million (ppm) were observed in soil boring B-2 at depths from seven feet to nine feet bgs with a reading of 40.7 ppm and at depths from 12 feet to 14 feet bgs with a reading of 21.3 ppm.

*Volatile Organic Compounds*

VOCs were not detected above the laboratory method detection limit in the soil samples collected.

*Polycyclic Aromatic Hydrocarbon*

The PAH benzo(a) pyrene was detected in soil samples B-1 and B-14 at concentrations above the U.S. EPA RRSL, but below the CWRSL. Many other PAH constituents were detected above the laboratory detection limit, but below the U.S. EPA RRSLs, CWRSLs, and CDPHE Groundwater Protection Values in soil samples B-1, B-4, B-5, B-6, B-7, B-9, and B-14.

***Polychlorinated Biphenyl Results***

PCBs were not detected above the laboratory method detection limit.

**Other Observations**

No urban fill material was detected from the soil borings; therefore, there doesn't appear to be a potential that ACM may be found during construction at the ROW.

***Soil Results Discussion***

The purpose of laboratory analysis was to collect information necessary to develop a site-specific waste profile for the Denver-Arapahoe Disposal Site (DADS), so that excavated material may be disposed properly during construction at the Site. An exceedance of benzo(a) pyrene was identified from soil samples B-1 and B-14; however, this constituent does not affect worker safety and should be acceptable at DADS as the material is not characteristically hazardous.

## Groundwater Sampling

Soil borings B-1, B-9, and B-11 were converted into temporary groundwater monitoring wells. On April 18, 2017, groundwater sampling was conducted at the groundwater monitoring wells (Figure 2). Groundwater monitoring wells B-9 and B-11 were dry; the wells were constructed at a total depth of 30 feet bgs. Groundwater was measured at a depth of 14.80 feet below top of well casing in groundwater monitoring well B-1. A slug test was performed at groundwater monitoring well B-1 in anticipation to prepare for a construction dewatering permit. Hydraulic conductivity was calculated at 8.866 feet per day and transmissivity was calculated at 35.91 square feet per day.

The groundwater sample collected from groundwater monitoring well B-1 was submitted for analysis of parameters that are required by the CDPHE-Water Quality Control Division (WQCD) when applying for a Remediation Discharge Permit. The groundwater samples were analyzed for the following:

- VOCs by U.S. EPA Method 8260B
- Semi-Volatile Organic Compounds (SVOCs) by U.S. EPA Method 8270D
- Total recoverable, dissolved, and potentially dissolved metals by U.S. EPA Methods 200.8 and 7196A:
    - Aluminum
    - Antimony
    - Arsenic
    - Barium
    - Beryllium
    - Cadmium
    - Chromium (III and VI)
    - Copper
    - Iron
    - Lead
    - Manganese
    - Molybdenum
    - Nickel
    - Selenium
    - Silver
    - Thallium
    - Uranium
    - Zinc

The sample results were compared to potential permit limits that were derived from the CDPHE-Water Quality Control Commission (WQCC) Regulations 31 and 38 (Table 2). Regulation 31 was used to derive potential permit limits for groundwater dewatering operations that contain VOCs and SVOCs that discharge to surface water bodies. Regulation 38 was used to derive potential permit limits for metals-laden groundwater that is discharged to surface water. Many of the potential limits from Regulation 38 are based on table value standards (TVS), which are formulas based on river hardness values. An assumed hardness value of 200 milligrams per liter (mg/L) was used for the TVS calculations for stream Segment 14 of the Upper South Platte River. These suggested limits are solely potential permit limits that may or may not match actual permit limits defined by the CDPHE (Table 2). In the event of discrepancies between the regulatory values listed in this Site Characterization Memo and the values set by the CDPHE-WQCD, the values set by the CDPHE-WQCD will take precedence. Constituents exceeding the potential permit limits will require monitoring and will likely require treatment prior to discharge.

***Metals Results***

The groundwater sample was analyzed for total recoverable metals, dissolved metals, and potentially dissolved metals as prescribed by the CDPHE-WQCD when applying for a Remediation Discharge Permit. The results of the metals analysis were compared to the presumptive CDPHE surface-water standards derived from Regulation 38, detailed above. Various metals in total recoverable, dissolved, and potentially dissolved states were observed at concentrations exceeding the potential discharge limits.

***Organics Results***

Chloroform and tetrachloroethene were detected at concentrations above the laboratory method detection limits; however, concentrations did not exceed the potential discharge limits.

***Groundwater Results Discussion***

The results indicate that groundwater at groundwater monitoring well B-1 contains concentrations of several metals that exceed the potential CDPHE-WQCD surface water discharge limits. Groundwater monitoring well B-1 was constructed at a total depth of 19 feet bgs and water was measured at a depth of 14.80 feet bgs. Construction around the location of groundwater monitoring well B-1 is anticipated to occur up to 15 feet bgs; therefore, dewatering during construction is likely. **The future Contractor must understand that the CDPHE will likely require treatment of this water prior to discharging into a waters of the State.**

## Limitations

This report was prepared by Pinyon Environmental, Inc., at the request of and for the sole benefit of Merrick and Company (Marrick) and the City and County of Denver (CCD), or any entity controlling, controlled by, or under common control with Merrick or CCD. The information offered in this report are based on the data obtained from a limited number of samples. Soil and groundwater conditions typically vary even over short distances. Thus, the nature and extent of variations outside the subsurface investigation may not become evident except through further investigation.

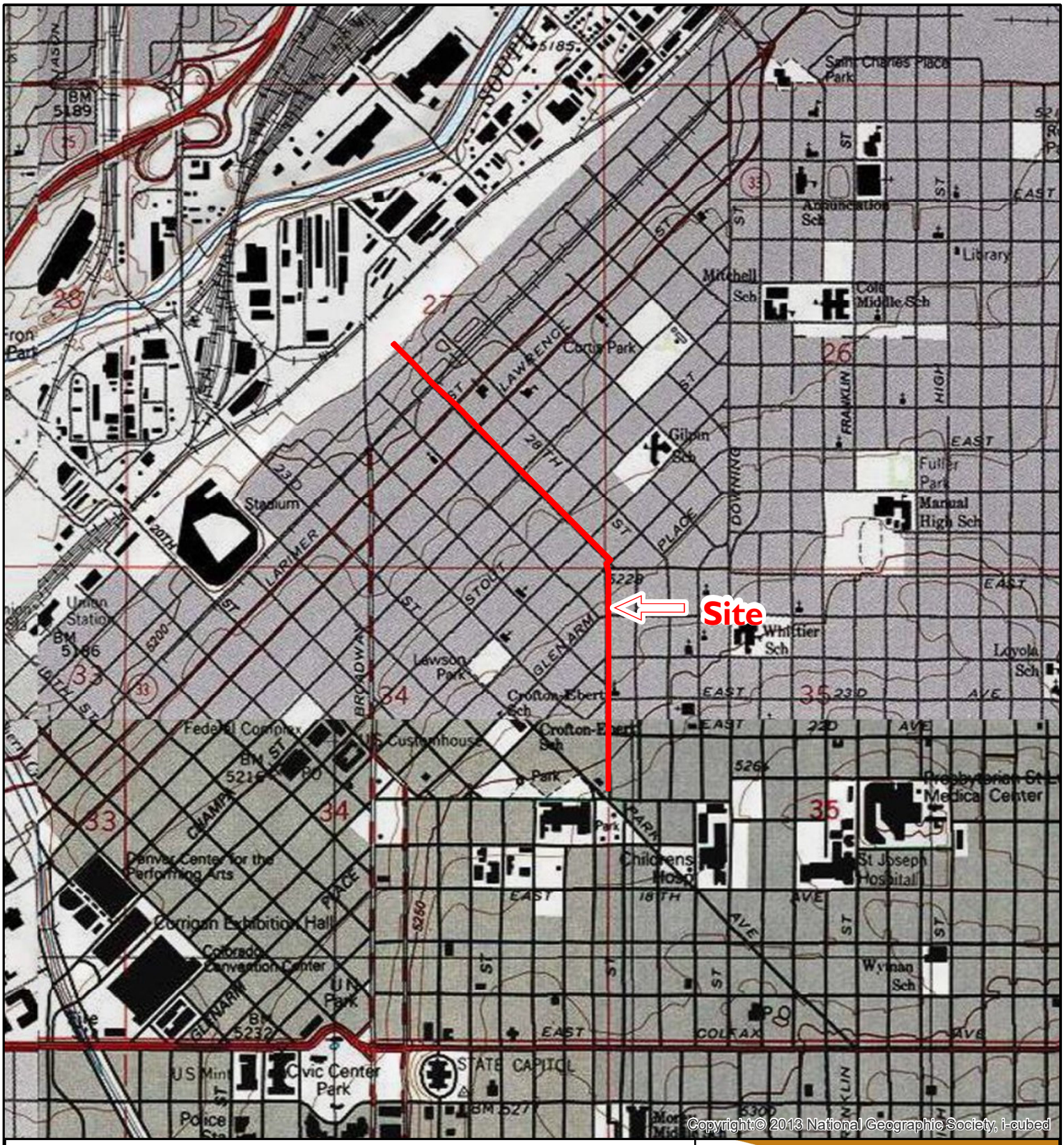
This report is the exclusive and present use of Merrick and CCD, or any entity controlling, controlled by, or under common control with Merrick or CCD. Laboratory analysis has been performed for specific constituents during the course of this investigation, as described in the text. This study makes no attempt to assess constituents not searched for in the laboratory analysis.

***Attachments:***

Site Location and Site Plan Map Figures

Tables for Detected Soil and Groundwater Analytical Results

Analytical Reports for Soil and Groundwater

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## Legend

Site Boundary

USGS 7.5' Topographic Map
Commerce City, Colorado 1965 (Revised 1994)

0 1,000 2,000 Feet

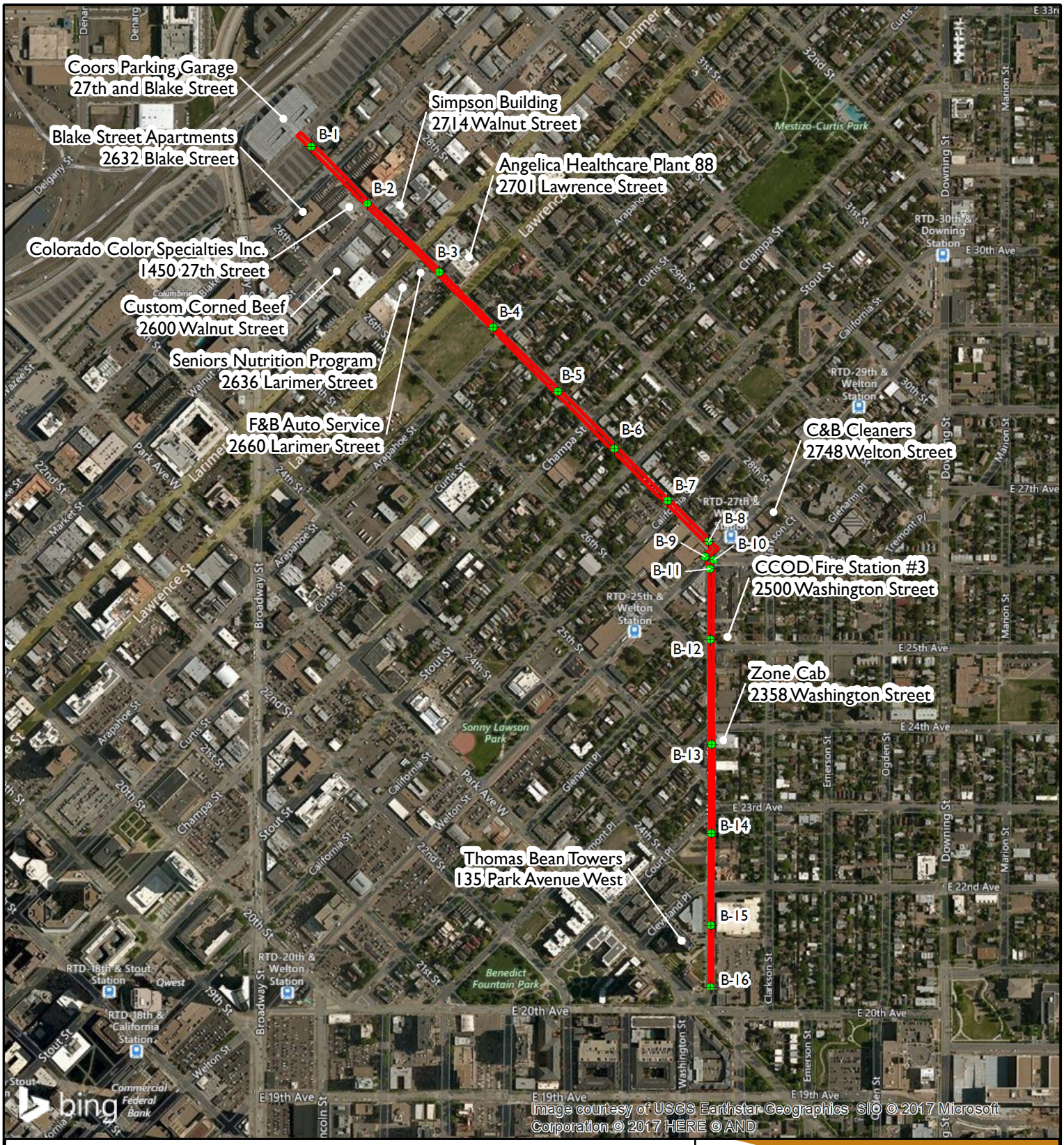
Pinyon Environmental, Inc.

### SITE LOCATION

*27th Street Storm Drain Interceptor*
*27th Street and Washington Street*
*Denver, Colorado*

| | | |
|---|---|---|
| Site Location: Section 27, 26, 35 T 3S, R 68W, 6th Principal Meridian | Drawn By: SJA | Figure: 1 |
| Pinyon Project Number: 1/17-803-01.2100 | Reviewed By: DRH | Date: 5/2/2017 |

Document Path: Z:\PROJECTS\2017\11780301 27th Street Storm Drain Interceptor\Figures\ArcMap\MXDs\LS101_SL.mxd




N **Legend**

Site Boundary

Soil Boring

0 500 1,000 Feet

Pinyon Environmental, Inc.

***SITE PLAN***

*27th Street Storm Drain Interceptor*
*27th Street and Washington Street*
*Denver, Colorado*

| | | |
|---|---|---|
| Site Location: Section 27, 26, 35 T 3S, R 68W, 6th Principal Meridian | Drawn By: SJA | Figure: 2 |
| Pinyon Project Number: 1/17-803-01.2100 | Reviewed By: DRH | Date: 5/9/2017 |

Document Path: Z:\PROJECTS\2017\11780301 27th Street Storm Drain Interceptor\Figures\ArcMap\MXDs\LS102_SP.mxd

*Table 1 - Detected Soil Analytical Results*

| | | | | Sample ID | B-1 | B-2 | B-3 | B-4 | B-5 | B-6 | B-7 | B-8 | B-9 | B-10 | B-11 | B-12 | B-13 | B-14 | B-15 | B-16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample Date | 2/28/2017 | 2/20/2017 | 2/20/2017 | 2/21/2017 | 2/20/2017 | 2/21/2017 | 2/21/2017 | 2/27/2017 | 2/23/2017 | 2/27/2017 | 2/27/2017 | 2/22/2017 | 2/21/2017 | 2/22/2017 | 2/22/2017 | 2/22/2017 |
| | | | | Matrix | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil |
| **Chem Name** | **Units** | **CDPHE Groundwater Protection** | **EPA RSLs Composite Worker Soil THQ=1** | **EPA RSLs Residential Soil THQ=0.1** | | | | | | | | | | | | | | | | |
| **Total Metals by 6010C** | | | | | | | | | | | | | | | | | | | | |
| Arsenic | mg/kg | **NV** | 11* | 11* | 4.36 | <0.494U | 1.11J | 1.11J | 4.54 | 5.83 | 3.83 | <0.489U | 0.934J | 2.94 | <0.563U | 2.8J | 3.49 | 5.55 | 1.14J | 1.62J |
| Barium | mg/kg | **NV** | 22000 | 1500 | 85.8 | 15.7 | 31.1 | 27.2 | 21.2 | 164 | 115 | 19.2 | 11.8 | 117 | 41.3 | 42.8 | 102 | 124 | 25.7 | 32.5 |
| Cadmium | mg/kg | **NV** | 980 | 7.1 | 0.357J | <0.0988U | <0.103U | <0.102U | <0.101U | 0.412J | 0.208J | <0.0978U | <0.102U | 0.232J | <0.113U | <0.101U | 0.176J | 0.258J | <0.0995U | <0.0956U |
| Chromium (III+VI) | mg/kg | **NV** | NV | NV | 4.89 | 3.01 | 36.4 | 8.25 | 2.69 | 16.1 | 15.9 | 2.42 | 2.59 | 11.3 | 4.25 | 5.93 | 9.1 | 7.56 | 3.07 | 2 |
| Lead | mg/kg | **NV** | 800 | 400 | 139 | 3.98 | 3.84 | 4.76 | 2.78 | 14.3 | 16.8 | 1.94 | 1.73 | 8.47 | 3.77 | 4.62 | 7.36 | 63.4 | 1.9 | 2.53 |
| Selenium | mg/kg | **NV** | 5,800 | 39 | <0.525U | <0.494U | <0.515U | <0.508U | <0.507U | <0.609U | <0.621U | <0.489U | <0.509U | <0.478U | 0.638J | <0.506U | <0.572U | <0.52U | <0.498U | <0.478U |
| Silver | mg/kg | **NV** | 5,800 | 39 | 0.86 | <0.0988U | <0.103U | <0.102U | <0.101U | <0.122U | <0.124U | <0.0978U | <0.102U | <0.0956U | <0.113U | <0.101U | <0.114U | <0.104U | <0.0995U | <0.0956U |
| **Total Metals by 7471A** | | | | | | | | | | | | | | | | | | | | |
| Mercury | mg/kg | **NV** | 46 | 1.1 | 0.128 | 0.0247 | 0.0491 | <0.00396U | 0.0474 | <0.00491U | 0.0148J | <0.00395U | 0.00613J | 0.00778J | <0.00447U | 0.0133 | 0.00766J | 0.0753 | 0.0103J | 0.0189 |
| **PAH by 8270D SIM** | | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | mg/kg | **5** | 45,000 | 360 | <0.00179U | <0.00167U | <0.00171U | <0.00171U | <0.00173U | <0.00205U | <0.00211U | <0.00173U | <0.00172U | <0.00172U | <0.0019U | <0.00178U | <0.0019U | 0.00286J | <0.00174U | <0.00171U |
| Anthracene | mg/kg | **5** | 250,000 | 1800 | 0.00358 | <0.00167U | <0.00171U | <0.00171U | <0.00173U | <0.00205U | <0.00211U | <0.00173U | <0.00172U | <0.00172U | <0.0019U | <0.00178U | <0.0019U | 0.00966 | <0.00174U | <0.00171U |
| Benz(a)anthracene | mg/kg | **5** | 21 | 0.16 | 0.0193 | <0.00167U | <0.00171U | <0.00171U | <0.00173U | 0.00205J | <0.00211U | <0.00173U | <0.00172U | <0.00172U | <0.0019U | <0.00178U | <0.0019U | 0.054 | <0.00174U | <0.00171U |
| Benzo(a) pyrene | mg/kg | **5** | 2 | 0.016 | 0.0179 | <0.00167U | <0.00171U | <0.00171U | <0.00173U | <0.00205U | <0.00211U | <0.00173U | <0.00172U | <0.00172U | <0.0019U | <0.00178U | <0.0019U | 0.0659 | <0.00174U | <0.00171U |
| Benzo(b)fluoranthene | mg/kg | **5** | 21 | 0.16 | 0.0318 | <0.00167U | <0.00171U | <0.00171U | 0.00207J | 0.00205J | <0.00211U | <0.00173U | <0.00172U | <0.00172U | <0.0019U | <0.00178U | <0.0019U | 0.0863 | <0.00174U | <0.00171U |
| Benzo(g,h,i)perylene | mg/kg | **NV** | NV | NV | 0.015 | <0.00167U | <0.00171U | <0.00171U | <0.00173U | <0.00205U | <0.00211U | <0.00173U | <0.00172U | <0.00172U | <0.0019U | <0.00178U | <0.0019U | 0.0462 | <0.00174U | <0.00171U |
| Benzo(k)fluoranthene | mg/kg | **5** | 210 | 1.6 | 0.0118 | <0.00167U | <0.00171U | <0.00171U | <0.00173U | <0.00205U | <0.00211U | <0.00173U | <0.00172U | <0.00172U | <0.0019U | <0.00178U | <0.0019U | 0.0286 | <0.00174U | <0.00171U |
| Chrysene | mg/kg | **5** | 2,100 | 16 | 0.0272 | <0.00167U | <0.00171U | <0.00171U | <0.00173U | 0.00205J | <0.00211U | <0.00173U | <0.00172U | <0.00172U | <0.0019U | <0.00178U | <0.0019U | 0.0551 | <0.00174U | <0.00171U |
| Dibenz(a,h)anthracene | mg/kg | **5** | 2 | 0.016 | 0.00465 | <0.00167U | <0.00171U | <0.00171U | <0.00173U | 0.00205J | <0.00211U | <0.00173U | <0.00172U | <0.00172U | <0.0019U | <0.00178U | <0.0019U | 0.0122 | <0.00174U | <0.00171U |
| Fluoranthene | mg/kg | **5** | 30,000 | 240 | 0.0379 | <0.00167U | <0.00171U | <0.00171U | 0.00173J | 0.00205J | <0.00211U | <0.00173U | <0.00172U | <0.00172U | <0.0019U | <0.00178U | <0.0019U | 0.088 | <0.00174U | <0.00171U |
| Fluorene | mg/kg | **5** | 30,000 | 240 | <0.00179U | <0.00167U | <0.00171U | <0.00171U | <0.00173U | <0.00205U | <0.00211U | <0.00173U | <0.00172U | <0.00172U | <0.0019U | <0.00178U | <0.0019U | 0.00286J | <0.00174U | <0.00171U |
| Indeno(1,2,3-c,d)pyrene | mg/kg | **5** | 21 | 0.16 | 0.015 | <0.00167U | <0.00171U | <0.00171U | <0.00173U | 0.00205J | <0.00211U | <0.00173U | <0.00172U | <0.00172U | <0.0019U | <0.00178U | <0.0019U | 0.0569 | <0.00174U | <0.00171U |
| Naphthalene | mg/kg | **NV** | 17 | 3.8 | 0.00573 | <0.001U | <0.00102U | <0.00103U | <0.00104U | <0.00123U | <0.00127U | <0.00104U | <0.00103U | <0.00103U | <0.00114U | <0.00107U | <0.00114U | 0.00251J | <0.00104U | <0.00103U |

| | | | | Sample ID | B-1 | B-2 | B-3 | B-4 | B-5 | B-6 | B-7 | B-8 | B-9 | B-10 | B-11 | B-12 | B-13 | B-14 | B-15 | B-16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample Date | 2/28/2017 | 2/20/2017 | 2/20/2017 | 2/21/2017 | 2/20/2017 | 2/21/2017 | 2/21/2017 | 2/27/2017 | 2/23/2017 | 2/27/2017 | 2/27/2017 | 2/22/2017 | 2/21/2017 | 2/22/2017 | 2/22/2017 | 2/22/2017 |
| | | | | Matrix | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil |
| **Chem Name** | **Units** | **CDPHE Groundwater Protection** | **EPA RSLs Composite Worker Soil THQ=1** | **EPA RSLs Residential Soil THQ=0.1** | | | | | | | | | | | | | | | | |
| **PAH by 8270D SIM** | | | | | | | | | | | | | | | | | | | | |
| Phenanthrene | mg/kg | **NV** | NV | NV | 0.0318 | <0.00167U | <0.00171U | 0.00206J | 0.00276J | 0.00287J | 0.00211J | <0.00173U | 0.00206J | <0.00172U | <0.0019U | <0.00178U | <0.0019U | 0.0444B | <0.00174U | <0.00171U |
| Pyrene | mg/kg | **5** | 23,000 | 180 | 0.0386 | <0.00167U | <0.00171U | <0.00171U | 0.00173J | 0.00205J | <0.00211U | <0.00173U | <0.00172U | <0.00172U | <0.0019U | <0.00178U | <0.0019U | 0.121 | <0.00174U | <0.00171U |

*PCB – Polychlorinated Biphenyls*
*PAH – Polycyclic Aromatic Hydrocarbon*
*mg/kg – milligrams per kilogram*
*mg/L - milligrams per liter*
*< - Less than laboratory detection limit*
*Ua – Sample is Non-Detect*
*U – Result not detected above the detection limit*
*J – Greater than the detection limit but less than the reporting limit*
*B- Blank contamination*
*BJ - Blank contamination. Greater than the detection limit but less than the reporting limit*
** - Colorado has a state specific CDPHE screening value for arsenic, 11 mg/kg*
*Region 3,6,9 Composite Worker THQ=1- U.S. EPA Regional Screening Levels with a Total Hazard Quotient of 1 for Composite Worker Soils (EPA, 2017)*
*Region 3,6,9 Residential THQ=0.1- U.S. EPA Regional Screening Levels with a Total Hazard Quotient of 0.1 for Residential Soils (EPA, 2017)*
***Bold –** Value exceeds CDPHE Groundwater Protection Value*
*Orange highlight for concentrations above EPA RSLs for composite worker soils*
*Green highlight for concentrations above EPA RSLs for residential soils*

*Table 2 - Detected Groundwater Analytical Results*

| | | | Sample ID | B-1 |
|---|---|---|---|---|
| | | | Sample Date | 4/18/2017 |
| **Chem Name** | **Units** | **Potential Permit Limit - 30 Day Average (COSPUS14)** | **Potential Permit Limit - Daily Max (COSPUS14)** | |
| **Dissolved Metals by 200.8** | | | | |
| Manganese (Filtered) | µg/L | 190 | 3761 | 6.62 |
| **Potentially Dissolved Metals by 200.8** | | | | |
| Arsenic (Filtered) | µg/L | 10 | 340 | 3.6 |
| Copper (Filtered) | µg/L | 20.8 | 31.5 | 20.5 |
| Lead (Filtered) | µg/L | 5.3 | 136 | 18 |
| Manganese (Filtered) | µg/L | 190 | 3761 | 121 |
| Nickel (Filtered) | µg/L | 93 | 841 | 2.14 |
| Selenium (Filtered) | µg/L | 4.6 | 18.4 | 24.1 |
| Thallium (Filtered) | µg/L | 0.5 | | <0.4 |
| Uranium (Filtered) | µg/L | 30 | | 21.5 |
| Zinc (Filtered) | µg/L | 227 | 300 | 21.7 |
| **Total Metals by 200.8** | | | | |
| Aluminium | µg/L | 1261 | 8838 | 13,900 |
| Arsenic | µg/L | 3 | | 8.7 |
| Barium | µg/L | | | 513 |
| Beryllium | µg/L | | | 1.32 |
| Chromium (III+VI) | µg/L | | | 13.4 |
| Copper | µg/L | | | 33.8 |
| Iron | µg/L | 1000 | | 24,400 |
| Lead | µg/L | | 50 | 26.8 |
| Molybdenum | µg/L | 150 | | 1.28 |
| Nickel | µg/L | 100 | | 7.2 |
| Selenium | µg/L | | | 36.9 |
| Uranium | µg/L | | | 23.6 |
| Zinc | µg/L | | | 104 |
| **VOC by EPA 624** | | | | |
| Chloroform | µg/L | 3.4 | 28900 | 0.73J |
| Tetrachloroethene | µg/L | 5 | 5280 | 0.89J |

*Notes:*

*U - Result not detected above the detection limit*

*µg/L – micrograms per liter*

*mg/L - milligrams per liter*

*VOCs – Volatile Organic Compounds*

*SVOC - Semi-Volatile Organic Compounds*

*J – Greater than the detection limit but less than the reporting limit*

*COSPUS14 - Colorado South Platte Basin Upper South Platte River Basin Surface Water Standards*

*Green highlight for concentrations that exceed COSPUS14 30 day average*

*Blue highlight for concentrations that exceed COSPUS14 daily max*

ORIGINS LABORATORY, INC

February 27, 2017

Pinyon

Julie Linn

9100 West Jewell Avenue, Suite 200

Lakewood CO 80232

**Project Name - 27th St. Storm Drain** **Project Number - 11780301.2100**

Attached are your analytical results for 27th St. Storm Drain received by Origins Laboratory, Inc. February 20, 2017. This project is associated with Origins project number X702338-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com

THE NELAC INSTITUTE

ACCREDITED
TESTING CERT # 3494.01

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## CROSS REFERENCE REPORT

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| B-2 | X702338-01 | Soil | February 20, 2017 10:00 | 02/20/2017 14:50 |
| B-3 | X702338-02 | Soil | February 20, 2017 12:00 | 02/20/2017 14:50 |
| B-5 | X702338-03 | Soil | February 20, 2017 14:20 | 02/20/2017 14:50 |

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

ORIGINS LABORATORY, INC
www.originslaboratory.com
page 1 of 1

X702338

Client: Pinyon
Address:
Telephone Number: 720-394-7766
Email Address: hosler@pinyon-ew.com, linn@pinyon-ew.com

Project Manager: Julie Linn
Project Name: 27th St Storm Drain
Project Number: 11780301.2100
Samples Collected By: Dan Hosler

| Sample ID Description | Date Sampled | Time Sampled | # of Containers | Preservative: Unpreserved | HCl | $HNO_3$ | Other | Matrix: Groundwater | Soil | Air Summa Canister # | Other | Analysis: VOC 8260 | PAH 8270SIM | Metals RCRA-8 | TCLP Pb | Dil/Ign PLA | PLA 8021 | Sample Instructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-1 | 2/20/17 | 1000 | 4 | | | | | | X | | | X | X | X | X | X | X | RSL Detection |
| B-3 | | 1200 | 4 | | | | | | X | | | | | | | | | Limits needed per |
| B-5 | | 1400 | 4 | | | | | | X | | | | | | | | | the prove call w/ |
| | | | | | | | | | | | | | | | | | | Dan Hosler on |
| | | | | | | | | | | | | | | | | | | 2/20/17. |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

Relinquished By: [signature] Date: 2/20/17 Time: 1450 Received By: [signature] Date: 2-20-17 Time: 1450
Relinquished By: Date: Time: Received By: Date: Time:

Turnaround Time: Same Day ☐ 24 Hr ☐ 48 Hr ☐ 72 Hr ☐ Standard ☑

Temp Received: 23.9 Date Results Needed

1725 Elk Place | Denver, CO 80211 | Phone: 303.433.1322 | Fax: 303.265.9645

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

Origins Laboratory

F-012207-01-R1
Effective Date: 01/09/12

**Sample Receipt Checklist**

Origins Work Order: X702338

Client: Pinyon

Client Project ID: 27th St. Storm Drain

Checklist Completed by: Dan Lu

Shipped Via: UPS
(UPS, FedEx, Hand Delivered, Pick-up, etc.)

Date/time completed: 2-20-17

Airbill #: N/A

Matrix(s) Received: (Check all that apply): ✓ Soil/Solid ____ Water ____ Other: ____ (Describe)

Cooler Number/Temperature: 1 / 23.9 °C ____ / ____ °C ____ / ____ °C ____ / ____ °C

Thermometer ID: T003

| Requirement Description | Yes | No | N/A | Comments (if any) |
|---|---|---|---|---|
| If samples require cooling, was the temperature between 0°C to ≤ 6°C[1]? | | ✓ | | Sampled Same Day |
| Is there ice present (document if blue ice is used) | | ✓ | | |
| Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact) | | ✓ | | |
| Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact) | | ✓ | | |
| Were all samples received intact[1]? | ✓ | | | |
| Was adequate sample volume provided[1]? | ✓ | | | |
| Are short holding time analytes or samples with HTs due within 48 hours present[1]? | | ✓ | | |
| Is a chain-of-custody (COC) present and filled out completely[1]? | ✓ | | | |
| Does the COC agree with the number and type of sample bottles received[1]? | ✓ | | | |
| Do the sample IDs on the bottle labels match the COC[1]? | ✗ | ✓ | | no. COC lists B2, B3, B5 yet are labeled B1, B2, B5 |
| Is the COC properly relinquished by the client with date and time recorded[1]? | ✓ | | | |
| For volatiles in water – is there headspace (> ¼ inch bubble) present? **If yes, contact client and note in narrative.** | | | ✓ | |
| Are samples preserved that require preservation and was it checked [1]? *(note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)/(pH <2 for samples preserved with HNO3, HCL, H2SO4) / ( pH >10 for samples preserved with NaAsO2+NaOH, ZnAc+NaOH)* | | ✓ | | |

Additional Comments (if any): Issue resolved with communication with Pinyon. Dan confirmed by phone that the ID's on the COC were the correct IDs. gp

[1] If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.

Reviewed By (Project Manager) — Date/Time Reviewed: 2/21/17

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-2**
**2/20/2017 10:00:00AM**

## GEL Laboratories, LLC
**X702338-01 (Soil)**

### PAH by 8270D SIM

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | 0.00167 | 0.00335 | mg/kg | 1 | 1641382 | 02/22/2017 | 02/23/2017 | U |
| Acenaphthylene | ND | 0.00167 | 0.00335 | " | " | " | " | " | U |
| Anthracene | ND | 0.00167 | 0.00335 | " | " | " | " | " | U |
| Benzo(a)anthracene | ND | 0.00167 | 0.00335 | " | " | " | " | " | U |
| Benzo(a)pyrene | ND | 0.00167 | 0.00335 | " | " | " | " | " | U |
| Benzo(b)fluoranthene | ND | 0.00167 | 0.00335 | " | " | " | " | " | U |
| Benzo(ghi)perylene | ND | 0.00167 | 0.00335 | " | " | " | " | " | U |
| Benzo(k)fluoranthene | ND | 0.00167 | 0.00335 | " | " | " | " | " | U |
| Chrysene | ND | 0.00167 | 0.00335 | " | " | " | " | " | U |
| Dibenzo(a,h)anthracene | ND | 0.00167 | 0.00335 | " | " | " | " | " | U |
| Fluoranthene | ND | 0.00167 | 0.00335 | " | " | " | " | " | U |
| Fluorene | ND | 0.00167 | 0.00335 | " | " | " | " | " | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.00167 | 0.00335 | " | " | " | " | " | U |
| Naphthalene | ND | 0.001 | 0.00335 | " | " | " | " | " | U |
| Phenanthrene | ND | 0.00167 | 0.00335 | " | " | " | " | " | U |
| Pyrene | ND | 0.00167 | 0.00335 | " | " | " | " | " | U |
| *Surrogate: 5-alpha-Androstane* | *56 %* | | *30-118* | | | " | " | " | |

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Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-2**
**2/20/2017 10:00:00AM**

## GEL Laboratories, LLC
**X702338-01 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **PCB by 8082A** | | | | | | | | | |
| Aroclor-1016 | ND | 0.00112 | 0.00336 | mg/kg | 1 | 1641389 | 02/22/2017 | 02/23/2017 | U |
| Aroclor-1221 | ND | 0.00112 | 0.00336 | " | " | " | " | " | U |
| Aroclor-1232 | ND | 0.00112 | 0.00336 | " | " | " | " | " | U |
| Aroclor-1242 | ND | 0.00112 | 0.00336 | " | " | " | " | " | U |
| Aroclor-1248 | ND | 0.00112 | 0.00336 | " | " | " | " | " | U |
| Aroclor-1254 | ND | 0.00112 | 0.00336 | " | " | " | " | " | U |
| Aroclor-1260 | ND | 0.00112 | 0.00336 | " | " | " | " | " | U |
| Aroclor-Total | ND | 0.00112 | 0.00336 | " | " | " | " | " | U |
| *Surrogate: 4cmx* | *65 %* | | *30-120* | | | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | *71 %* | | *32-139* | | | " | " | " | |
| **TCLP Metals by 1311/6010C** | | | | | | | | | |
| Lead | ND | 0.033 | 0.100 | mg/L | 1 | 1641470 | " | 02/23/2017 | U |
| **Total Metals by 6010C** | | | | | | | | | |
| Arsenic | ND | 0.494 | 2.96 | mg/kg | 1 | 1641195 | 02/21/2017 | 02/22/2017 | U |
| Barium | **15.7** | **0.0988** | 0.494 | " | " | " | " | " | |
| Cadmium | ND | 0.0988 | 0.494 | " | " | " | " | " | U |

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## GEL Laboratories, LLC
**X702338-01 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Total Metals by 6010C** | | | | | | | | | |
| Chromium | **3.01** | **0.148** | 0.494 | mg/kg | 1 | 1641195 | 02/21/2017 | 02/22/2017 | |
| Lead | **3.98** | **0.326** | 0.988 | " | " | " | " | " | |
| Selenium | ND | 0.494 | 2.96 | " | " | " | " | " | U |
| Silver | ND | 0.0988 | 0.494 | " | " | " | " | " | U |
| **Total Metals by 7471A** | | | | | | | | | |
| Mercury | **0.0247** | **0.00384** | 0.0115 | mg/kg | 1 | 1641206 | " | 02/22/2017 | |
| **VOC by EPA 8260C** | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | | 0.00200 | mg/kg | 1 | B7B2302 | 02/23/2017 | 02/23/2017 | Ua |
| 1,1,1-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2,2-Tetrachloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2,3-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,3-Trichloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |

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**B-2**
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## Origins Laboratory, Inc.
**X702338-01 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dibromo-3-chloropropane | ND | | 0.00500 | mg/kg | 1 | B7B2302 | 02/23/2017 | 02/23/2017 | Ua |
| 1,2-Dibromoethane (EDB) | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3,5-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,4-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Butanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 2-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Hexanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 4-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Isopropyltoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Methyl-2-pentanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| Acetone | ND | | 0.0200 | " | " | " | " | " | Ua |
| Benzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |

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**2/20/2017 10:00:00AM**

## Origins Laboratory, Inc.
**X702338-01 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Bromodichloromethane | ND | | 0.00200 | mg/kg | 1 | B7B2302 | 02/23/2017 | 02/23/2017 | Ua |
| Bromoform | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Carbon disulfide | ND | | 0.00500 | " | " | " | " | " | Ua |
| Carbon tetrachloride | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloroethane | ND | | 0.00500 | " | " | " | " | " | Ua |
| Chloroform | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Ethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Hexachlorobutadiene | ND | | 0.00500 | " | " | " | " | " | Ua |
| Iodomethane | ND | | 0.0150 | " | " | " | " | " | Ua |
| Isopropylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| m,p-Xylene | ND | | 0.00400 | " | " | " | " | " | Ua |
| Methyl tert-Butyl Ether | ND | | 0.00200 | " | " | " | " | " | Ua |
| Methylene Chloride | ND | | 0.0200 | " | " | " | " | " | Ua |

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**B-2**
**2/20/2017 10:00:00AM**

## Origins Laboratory, Inc.
**X702338-01 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Naphthalene | ND | | 0.0100 | mg/kg | 1 | B7B2302 | 02/23/2017 | 02/23/2017 | Ua |
| n-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| n-Propylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| o-Xylene | ND | | 0.00200 | " | " | " | " | " | Ua |
| sec-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Styrene | ND | | 0.00200 | " | " | " | " | " | Ua |
| tert-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Tetrachloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Toluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichlorofluoromethane | ND | | 0.00300 | " | " | " | " | " | Ua |
| Vinyl chloride | ND | | 0.00200 | " | " | " | " | " | Ua |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 1,2-Dichloroethane-d4* | *101 %* | *70-130* | " | " | " |
| *Surrogate: Toluene-d8* | *96.3 %* | *70-130* | " | " | " |
| *Surrogate: 4-Bromofluorobenzene* | *98.0 %* | *70-130* | " | " | " |

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**B-3**
**2/20/2017 12:00:00PM**

## GEL Laboratories, LLC
**X702338-02 (Soil)**

### PAH by 8270D SIM

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | 0.00171 | 0.00341 | mg/kg | 1 | 1641382 | 02/22/2017 | 02/23/2017 | U |
| Acenaphthylene | ND | 0.00171 | 0.00341 | " | " | " | " | " | U |
| Anthracene | ND | 0.00171 | 0.00341 | " | " | " | " | " | U |
| Benzo(a)anthracene | ND | 0.00171 | 0.00341 | " | " | " | " | " | U |
| Benzo(a)pyrene | ND | 0.00171 | 0.00341 | " | " | " | " | " | U |
| Benzo(b)fluoranthene | ND | 0.00171 | 0.00341 | " | " | " | " | " | U |
| Benzo(ghi)perylene | ND | 0.00171 | 0.00341 | " | " | " | " | " | U |
| Benzo(k)fluoranthene | ND | 0.00171 | 0.00341 | " | " | " | " | " | U |
| Chrysene | ND | 0.00171 | 0.00341 | " | " | " | " | " | U |
| Dibenzo(a,h)anthracene | ND | 0.00171 | 0.00341 | " | " | " | " | " | U |
| Fluoranthene | ND | 0.00171 | 0.00341 | " | " | " | " | " | U |
| Fluorene | ND | 0.00171 | 0.00341 | " | " | " | " | " | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.00171 | 0.00341 | " | " | " | " | " | U |
| Naphthalene | ND | 0.00102 | 0.00341 | " | " | " | " | " | U |
| Phenanthrene | ND | 0.00171 | 0.00341 | " | " | " | " | " | U |
| Pyrene | ND | 0.00171 | 0.00341 | " | " | " | " | " | U |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 5-alpha-Androstane* | *83 %* | *30-118* | " | " | " |

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**B-3**
**2/20/2017 12:00:00PM**

## GEL Laboratories, LLC
**X702338-02 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **PCB by 8082A** | | | | | | | | | |
| Aroclor-1016 | ND | 0.00115 | 0.00344 | mg/kg | 1 | 1641389 | 02/22/2017 | 02/23/2017 | U |
| Aroclor-1221 | ND | 0.00115 | 0.00344 | " | " | " | " | " | U |
| Aroclor-1232 | ND | 0.00115 | 0.00344 | " | " | " | " | " | U |
| Aroclor-1242 | ND | 0.00115 | 0.00344 | " | " | " | " | " | U |
| Aroclor-1248 | ND | 0.00115 | 0.00344 | " | " | " | " | " | U |
| Aroclor-1254 | ND | 0.00115 | 0.00344 | " | " | " | " | " | U |
| Aroclor-1260 | ND | 0.00115 | 0.00344 | " | " | " | " | " | U |
| Aroclor-Total | ND | 0.00115 | 0.00344 | " | " | " | " | " | U |
| *Surrogate: 4cmx* | *75 %* | | *30-120* | | | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | *82 %* | | *32-139* | | | " | " | " | |
| **TCLP Metals by 1311/6010C** | | | | | | | | | |
| Lead | **0.0381** | **0.033** | 0.100 | mg/L | 1 | 1641470 | " | 02/23/2017 | J |
| **Total Metals by 6010C** | | | | | | | | | |
| Arsenic | **1.11** | **0.515** | 3.09 | mg/kg | 1 | 1641195 | 02/21/2017 | 02/22/2017 | J |
| Barium | **31.1** | **0.103** | 0.515 | " | " | " | " | " | |
| Cadmium | ND | 0.103 | 0.515 | " | " | " | " | " | U |
| Chromium | **36.4** | **0.155** | 0.515 | " | " | " | " | " | |

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**B-3**
**2/20/2017 12:00:00PM**

## GEL Laboratories, LLC
**X702338-02 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Total Metals by 6010C** | | | | | | | | | |
| Lead | **3.84** | **0.340** | 1.03 | mg/kg | 1 | 1641195 | 02/21/2017 | 02/22/2017 | |
| Selenium | ND | 0.515 | 3.09 | " | " | " | " | " | U |
| Silver | ND | 0.103 | 0.515 | " | " | " | " | " | U |
| **Total Metals by 7471A** | | | | | | | | | |
| Mercury | **0.0491** | **0.00374** | 0.0112 | mg/kg | 1 | 1641206 | " | 02/22/2017 | |
| **VOC by EPA 8260C** | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | | 0.00200 | mg/kg | 1 | B7B2302 | 02/23/2017 | 02/23/2017 | Ua |
| 1,1,1-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2,2-Tetrachloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2,3-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,3-Trichloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dibromo-3-chloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |

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**B-3**
**2/20/2017 12:00:00PM**

## Origins Laboratory, Inc.
**X702338-02 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dibromoethane (EDB) | ND | | 0.00200 | mg/kg | 1 | B7B2302 | 02/23/2017 | 02/23/2017 | Ua |
| 1,2-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3,5-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,4-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Butanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 2-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Hexanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 4-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Isopropyltoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Methyl-2-pentanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| Acetone | ND | | 0.0200 | " | " | " | " | " | Ua |
| Benzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromodichloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |

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**B-3**
**2/20/2017 12:00:00PM**

## Origins Laboratory, Inc.
**X702338-02 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Bromoform | ND | | 0.00200 | mg/kg | 1 | B7B2302 | 02/23/2017 | 02/23/2017 | Ua |
| Bromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Carbon disulfide | ND | | 0.00500 | " | " | " | " | " | Ua |
| Carbon tetrachloride | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloroethane | ND | | 0.00500 | " | " | " | " | " | Ua |
| Chloroform | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Ethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Hexachlorobutadiene | ND | | 0.00500 | " | " | " | " | " | Ua |
| Iodomethane | ND | | 0.0150 | " | " | " | " | " | Ua |
| Isopropylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| m,p-Xylene | ND | | 0.00400 | " | " | " | " | " | Ua |
| Methyl tert-Butyl Ether | ND | | 0.00200 | " | " | " | " | " | Ua |
| Methylene Chloride | ND | | 0.0200 | " | " | " | " | " | Ua |
| Naphthalene | ND | | 0.0100 | " | " | " | " | " | Ua |

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Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-3**
**2/20/2017 12:00:00PM**

## Origins Laboratory, Inc.
**X702338-02 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| n-Butylbenzene | ND | | 0.00200 | mg/kg | 1 | B7B2302 | 02/23/2017 | 02/23/2017 | Ua |
| n-Propylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| o-Xylene | ND | | 0.00200 | " | " | " | " | " | Ua |
| sec-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Styrene | ND | | 0.00200 | " | " | " | " | " | Ua |
| tert-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Tetrachloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Toluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichlorofluoromethane | ND | | 0.00300 | " | " | " | " | " | Ua |
| Vinyl chloride | ND | | 0.00200 | " | " | " | " | " | Ua |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 1,2-Dichloroethane-d4* | *99.3 %* | *70-130* | " | " | " |
| *Surrogate: Toluene-d8* | *99.1 %* | *70-130* | " | " | " |
| *Surrogate: 4-Bromofluorobenzene* | *99.1 %* | *70-130* | " | " | " |

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Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-5**
**2/20/2017 2:20:00PM**

## GEL Laboratories, LLC
**X702338-03 (Soil)**

### PAH by 8270D SIM

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | 0.00173 | 0.00345 | mg/kg | 1 | 1641382 | 02/22/2017 | 02/23/2017 | U |
| Acenaphthylene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Anthracene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Benzo(a)anthracene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Benzo(a)pyrene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Benzo(b)fluoranthene | **0.00207** | **0.00173** | 0.00345 | " | " | " | " | " | J |
| Benzo(ghi)perylene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Benzo(k)fluoranthene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Chrysene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Dibenzo(a,h)anthracene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Fluoranthene | **0.00173** | **0.00173** | 0.00345 | " | " | " | " | " | J |
| Fluorene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Naphthalene | ND | 0.00104 | 0.00345 | " | " | " | " | " | U |
| Phenanthrene | **0.00276** | **0.00173** | 0.00345 | " | " | " | " | " | J |
| Pyrene | **0.00173** | **0.00173** | 0.00345 | " | " | " | " | " | J |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Surrogate: 5-alpha-Androstane* | *86 %* | *30-118* | " | " | " |

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Julie Linn
Project Number: 11780301.2100
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**B-5**
**2/20/2017 2:20:00PM**

## GEL Laboratories, LLC
**X702338-03 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **PCB by 8082A** | | | | | | | | | |
| Aroclor-1016 | ND | 0.00116 | 0.00348 | mg/kg | 1 | 1641389 | 02/22/2017 | 02/23/2017 | U |
| Aroclor-1221 | ND | 0.00116 | 0.00348 | " | " | " | " | " | U |
| Aroclor-1232 | ND | 0.00116 | 0.00348 | " | " | " | " | " | U |
| Aroclor-1242 | ND | 0.00116 | 0.00348 | " | " | " | " | " | U |
| Aroclor-1248 | ND | 0.00116 | 0.00348 | " | " | " | " | " | U |
| Aroclor-1254 | ND | 0.00116 | 0.00348 | " | " | " | " | " | U |
| Aroclor-1260 | ND | 0.00116 | 0.00348 | " | " | " | " | " | U |
| Aroclor-Total | ND | 0.00116 | 0.00348 | " | " | " | " | " | U |
| *Surrogate: 4cmx* | *77 %* | | *30-120* | | | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | *77 %* | | *32-139* | | | " | " | " | |
| **TCLP Metals by 1311/6010C** | | | | | | | | | |
| Lead | ND | 0.033 | 0.100 | mg/L | 1 | 1641470 | " | 02/23/2017 | U |
| **Total Metals by 6010C** | | | | | | | | | |
| Arsenic | **4.54** | **0.507** | 3.04 | mg/kg | 1 | 1641195 | 02/21/2017 | 02/22/2017 | |
| Barium | **21.2** | **0.101** | 0.507 | " | " | " | " | " | |
| Cadmium | ND | 0.101 | 0.507 | " | " | " | " | " | U |
| Chromium | **2.69** | **0.152** | 0.507 | " | " | " | " | " | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-5**
**2/20/2017 2:20:00PM**

## GEL Laboratories, LLC
**X702338-03 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Total Metals by 6010C** | | | | | | | | | |
| Lead | **2.78** | **0.335** | 1.01 | mg/kg | 1 | 1641195 | 02/21/2017 | 02/22/2017 | |
| Selenium | ND | 0.507 | 3.04 | " | " | " | " | " | U |
| Silver | ND | 0.101 | 0.507 | " | " | " | " | " | U |
| **Total Metals by 7471A** | | | | | | | | | |
| Mercury | **0.0474** | **0.00418** | 0.0125 | mg/kg | 1 | 1641206 | " | 02/22/2017 | |
| **VOC by EPA 8260C** | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | | 0.00200 | mg/kg | 1 | B7B2302 | 02/23/2017 | 02/23/2017 | Ua |
| 1,1,1-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2,2-Tetrachloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2,3-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,3-Trichloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dibromo-3-chloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |

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Pinyon
9100 West Jewell Avenue, Suite 200
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Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-5**
**2/20/2017 2:20:00PM**

## Origins Laboratory, Inc.
**X702338-03 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dibromoethane (EDB) | ND | | 0.00200 | mg/kg | 1 | B7B2302 | 02/23/2017 | 02/23/2017 | Ua |
| 1,2-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3,5-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,4-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Butanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 2-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Hexanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 4-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Isopropyltoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Methyl-2-pentanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| Acetone | ND | | 0.0200 | " | " | " | " | " | Ua |
| Benzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromodichloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |

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Project Number: 11780301.2100
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**B-5**
**2/20/2017 2:20:00PM**

## Origins Laboratory, Inc.
**X702338-03 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Bromoform | ND | | 0.00200 | mg/kg | 1 | B7B2302 | 02/23/2017 | 02/23/2017 | Ua |
| Bromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Carbon disulfide | ND | | 0.00500 | " | " | " | " | " | Ua |
| Carbon tetrachloride | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloroethane | ND | | 0.00500 | " | " | " | " | " | Ua |
| Chloroform | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Ethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Hexachlorobutadiene | ND | | 0.00500 | " | " | " | " | " | Ua |
| Iodomethane | ND | | 0.0150 | " | " | " | " | " | Ua |
| Isopropylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| m,p-Xylene | ND | | 0.00400 | " | " | " | " | " | Ua |
| Methyl tert-Butyl Ether | ND | | 0.00200 | " | " | " | " | " | Ua |
| Methylene Chloride | ND | | 0.0200 | " | " | " | " | " | Ua |
| Naphthalene | ND | | 0.0100 | " | " | " | " | " | Ua |

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Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-5**
**2/20/2017 2:20:00PM**

## Origins Laboratory, Inc.
**X702338-03 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| n-Butylbenzene | ND | | 0.00200 | mg/kg | 1 | B7B2302 | 02/23/2017 | 02/23/2017 | Ua |
| n-Propylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| o-Xylene | ND | | 0.00200 | " | " | " | " | " | Ua |
| sec-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Styrene | ND | | 0.00200 | " | " | " | " | " | Ua |
| tert-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Tetrachloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Toluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichlorofluoromethane | ND | | 0.00300 | " | " | " | " | " | Ua |
| Vinyl chloride | ND | | 0.00200 | " | " | " | " | " | Ua |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 1,2-Dichloroethane-d4* | *99.8 %* | *70-130* | " | " | " |
| *Surrogate: Toluene-d8* | *98.4 %* | *70-130* | " | " | " |
| *Surrogate: 4-Bromofluorobenzene* | *97.6 %* | *70-130* | " | " | " |

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Jen Pellegrini

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2302 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2302-BLK1)** | | | | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | 0.00200 | mg/kg | | | | | | | Ua |
| 1,1,1-Trichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1,2,2-Tetrachloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1,2-Trichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2,3-Trichlorobenzene | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,3-Trichloropropane | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,4-Trichlorobenzene | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,4-Trimethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dibromo-3-chloropropane | ND | 0.00500 | " | | | | | | | Ua |
| 1,2-Dibromoethane (EDB) | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 1,3,5-Trimethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,3-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,3-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 1,4-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 2,2-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 2-Butanone | ND | 0.0100 | " | | | | | | | Ua |
| 2-Chlorotoluene | ND | 0.00200 | " | | | | | | | Ua |
| 2-Hexanone | ND | 0.0100 | " | | | | | | | Ua |
| 4-Chlorotoluene | ND | 0.00200 | " | | | | | | | Ua |
| 4-Isopropyltoluene | ND | 0.00200 | " | | | | | | | Ua |

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Jen Pellegrini

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2302 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2302-BLK1)** | | | | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | |
| 4-Methyl-2-pentanone | ND | 0.0100 | mg/kg | | | | | | | Ua |
| Acetone | ND | 0.0200 | " | | | | | | | Ua |
| Benzene | ND | 0.00200 | " | | | | | | | Ua |
| Bromobenzene | ND | 0.00200 | " | | | | | | | Ua |
| Bromochloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Bromodichloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Bromoform | ND | 0.00200 | " | | | | | | | Ua |
| Bromomethane | ND | 0.00200 | " | | | | | | | Ua |
| Carbon disulfide | ND | 0.00500 | " | | | | | | | Ua |
| Carbon tetrachloride | ND | 0.00200 | " | | | | | | | Ua |
| Chlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| Chloroethane | ND | 0.00500 | " | | | | | | | Ua |
| Chloroform | ND | 0.00200 | " | | | | | | | Ua |
| Chloromethane | ND | 0.00200 | " | | | | | | | Ua |
| cis-1,2-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| cis-1,3-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| Dibromochloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Dibromomethane | ND | 0.00200 | " | | | | | | | Ua |
| Ethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Hexachlorobutadiene | ND | 0.00500 | " | | | | | | | Ua |
| Iodomethane | ND | 0.0150 | " | | | | | | | Ua |
| Isopropylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| m,p-Xylene | ND | 0.00400 | " | | | | | | | Ua |
| Methyl tert-Butyl Ether | ND | 0.00200 | " | | | | | | | Ua |
| Methylene Chloride | ND | 0.0200 | " | | | | | | | Ua |
| Naphthalene | ND | 0.0100 | " | | | | | | | Ua |

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2302 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2302-BLK1)** | | | | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | |
| n-Butylbenzene | ND | 0.00200 | mg/kg | | | | | | | Ua |
| n-Propylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| o-Xylene | ND | 0.00200 | " | | | | | | | Ua |
| sec-Butylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Styrene | ND | 0.00200 | " | | | | | | | Ua |
| tert-Butylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Tetrachloroethene | ND | 0.00200 | " | | | | | | | Ua |
| Toluene | ND | 0.00200 | " | | | | | | | Ua |
| trans-1,2-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| trans-1,3-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| Trichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| Trichlorofluoromethane | ND | 0.00300 | " | | | | | | | Ua |
| Vinyl chloride | ND | 0.00200 | " | | | | | | | Ua |
| *Surrogate: 1,2-Dichloroethane-d4* | *63* | | *ug/L* | *62.5* | | *101* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *61* | | *"* | *62.5* | | *97.1* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *61* | | *"* | *62.5* | | *97.3* | *70-130* | | | |

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## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2302 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2302-BS1)** | | | | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.102 | 0.00200 | mg/kg | 0.100 | | 102 | 70-130 | | | |
| 1,1,1-Trichloroethane | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 0.106 | 0.00200 | " | 0.100 | | 106 | 70-130 | | | |
| 1,1,2-Trichloroethane | 0.104 | 0.00200 | " | 0.100 | | 104 | 70-130 | | | |
| 1,1-Dichloroethane | 0.106 | 0.00200 | " | 0.100 | | 106 | 70-130 | | | |
| 1,1-Dichloroethene | 0.109 | 0.00200 | " | 0.100 | | 109 | 70-130 | | | |
| 1,1-Dichloropropene | 0.106 | 0.00200 | " | 0.100 | | 106 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 0.0984 | 0.00500 | " | 0.100 | | 98.4 | 70-130 | | | |
| 1,2,3-Trichloropropane | 0.108 | 0.00500 | " | 0.100 | | 108 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 0.0972 | 0.00500 | " | 0.100 | | 97.2 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 0.101 | 0.00200 | " | 0.100 | | 101 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 0.0970 | 0.00500 | " | 0.100 | | 97.0 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| 1,2-Dichlorobenzene | 0.101 | 0.00200 | " | 0.100 | | 101 | 70-130 | | | |
| 1,2-Dichloroethane | 0.115 | 0.00200 | " | 0.100 | | 115 | 70-130 | | | |
| 1,2-Dichloropropane | 0.110 | 0.00200 | " | 0.100 | | 110 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 0.100 | 0.00200 | " | 0.100 | | 100 | 70-130 | | | |
| 1,3-Dichlorobenzene | 0.0990 | 0.00200 | " | 0.100 | | 99.0 | 70-130 | | | |
| 1,3-Dichloropropane | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| 1,4-Dichlorobenzene | 0.100 | 0.00200 | " | 0.100 | | 100 | 70-130 | | | |
| 2,2-Dichloropropane | 0.102 | 0.00200 | " | 0.100 | | 102 | 70-130 | | | |
| 2-Butanone | 0.588 | 0.0100 | " | 0.500 | | 118 | 70-130 | | | |
| 2-Chlorotoluene | 0.101 | 0.00200 | " | 0.100 | | 101 | 70-130 | | | |
| 2-Hexanone | 0.569 | 0.0100 | " | 0.500 | | 114 | 70-130 | | | |
| 4-Chlorotoluene | 0.0997 | 0.00200 | " | 0.100 | | 99.7 | 70-130 | | | |
| 4-Isopropyltoluene | 0.101 | 0.00200 | " | 0.100 | | 101 | 70-130 | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2302 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2302-BS1)** | | | | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | |
| 4-Methyl-2-pentanone | 0.564 | 0.0100 | mg/kg | 0.500 | | 113 | 70-130 | | | |
| Acetone | 0.520 | 0.0200 | " | 0.500 | | 104 | 70-130 | | | |
| Benzene | 0.104 | 0.00200 | " | 0.100 | | 104 | 70-130 | | | |
| Bromobenzene | 0.103 | 0.00200 | " | 0.100 | | 103 | 70-130 | | | |
| Bromochloromethane | 0.106 | 0.00200 | " | 0.100 | | 106 | 70-130 | | | |
| Bromodichloromethane | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| Bromoform | 0.0969 | 0.00200 | " | 0.100 | | 96.9 | 70-130 | | | |
| Bromomethane | 0.103 | 0.00200 | " | 0.100 | | 103 | 70-130 | | | |
| Carbon disulfide | 0.102 | 0.00500 | " | 0.100 | | 102 | 70-130 | | | |
| Carbon tetrachloride | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| Chlorobenzene | 0.100 | 0.00200 | " | 0.100 | | 100 | 70-130 | | | |
| Chloroethane | 0.101 | 0.00500 | " | 0.100 | | 101 | 70-130 | | | |
| Chloroform | 0.0915 | 0.00200 | " | 0.100 | | 91.5 | 70-130 | | | |
| Chloromethane | 0.101 | 0.00200 | " | 0.100 | | 101 | 70-130 | | | |
| cis-1,2-Dichloroethene | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| cis-1,3-Dichloropropene | 0.105 | 0.00200 | " | 0.100 | | 105 | 70-130 | | | |
| Dibromochloromethane | 0.106 | 0.00200 | " | 0.100 | | 106 | 70-130 | | | |
| Dibromomethane | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| Ethylbenzene | 0.0984 | 0.00200 | " | 0.100 | | 98.4 | 70-130 | | | |
| Hexachlorobutadiene | 0.0976 | 0.00500 | " | 0.100 | | 97.6 | 70-130 | | | |
| Iodomethane | 0.107 | 0.0150 | " | 0.100 | | 107 | 70-130 | | | |
| Isopropylbenzene | 0.101 | 0.00200 | " | 0.100 | | 101 | 70-130 | | | |
| m,p-Xylene | 0.202 | 0.00400 | " | 0.200 | | 101 | 70-130 | | | |
| Methyl tert-Butyl Ether | 0.114 | 0.00200 | " | 0.100 | | 114 | 70-130 | | | |
| Methylene Chloride | 0.0944 | 0.0200 | " | 0.100 | | 94.4 | 70-130 | | | |
| Naphthalene | 0.106 | 0.0100 | " | 0.100 | | 106 | 70-130 | | | |

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Julie Linn
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## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2302 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2302-BS1)** | | | | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | |
| n-Butylbenzene | 0.0983 | 0.00200 | mg/kg | 0.100 | | 98.3 | 70-130 | | | |
| n-Propylbenzene | 0.0968 | 0.00200 | " | 0.100 | | 96.8 | 70-130 | | | |
| o-Xylene | 0.101 | 0.00200 | " | 0.100 | | 101 | 70-130 | | | |
| sec-Butylbenzene | 0.0994 | 0.00200 | " | 0.100 | | 99.4 | 70-130 | | | |
| Styrene | 0.100 | 0.00200 | " | 0.100 | | 100 | 70-130 | | | |
| tert-Butylbenzene | 0.101 | 0.00200 | " | 0.100 | | 101 | 70-130 | | | |
| Tetrachloroethene | 0.0984 | 0.00200 | " | 0.100 | | 98.4 | 70-130 | | | |
| Toluene | 0.100 | 0.00200 | " | 0.100 | | 100 | 70-130 | | | |
| trans-1,2-Dichloroethene | 0.110 | 0.00200 | " | 0.100 | | 110 | 70-130 | | | |
| trans-1,3-Dichloropropene | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| Trichloroethene | 0.105 | 0.00200 | " | 0.100 | | 105 | 70-130 | | | |
| Trichlorofluoromethane | 0.105 | 0.00300 | " | 0.100 | | 105 | 70-130 | | | |
| Vinyl chloride | 0.0974 | 0.00200 | " | 0.100 | | 97.4 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *68* | | *ug/L* | *62.5* | | *109* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *61* | | *"* | *62.5* | | *98.2* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *61* | | *"* | *62.5* | | *97.3* | *70-130* | | | |

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## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2302 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2302-MS1)** | | **Source: X702337-01** | | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.102 | 0.00200 | mg/kg | 0.100 | ND | 102 | 70-130 | | | |
| 1,1,1-Trichloroethane | 0.111 | 0.00200 | " | 0.100 | ND | 111 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | | | |
| 1,1,2-Trichloroethane | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| 1,1-Dichloroethane | 0.108 | 0.00200 | " | 0.100 | ND | 108 | 70-130 | | | |
| 1,1-Dichloroethene | 0.114 | 0.00200 | " | 0.100 | ND | 114 | 70-130 | | | |
| 1,1-Dichloropropene | 0.111 | 0.00200 | " | 0.100 | ND | 111 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 0.0993 | 0.00500 | " | 0.100 | 0.00258 | 96.7 | 70-130 | | | |
| 1,2,3-Trichloropropane | 0.108 | 0.00500 | " | 0.100 | ND | 108 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 0.102 | 0.00500 | " | 0.100 | 0.00154 | 100 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 0.0907 | 0.00500 | " | 0.100 | ND | 90.7 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | | | |
| 1,2-Dichlorobenzene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| 1,2-Dichloroethane | 0.111 | 0.00200 | " | 0.100 | ND | 111 | 70-130 | | | |
| 1,2-Dichloropropane | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | | | |
| 1,3-Dichlorobenzene | 0.104 | 0.00200 | " | 0.100 | 0.000280 | 104 | 70-130 | | | |
| 1,3-Dichloropropane | 0.108 | 0.00200 | " | 0.100 | ND | 108 | 70-130 | | | |
| 1,4-Dichlorobenzene | 0.0991 | 0.00200 | " | 0.100 | 0.000420 | 98.7 | 70-130 | | | |
| 2,2-Dichloropropane | 0.114 | 0.00200 | " | 0.100 | ND | 114 | 70-130 | | | |
| 2-Butanone | 0.560 | 0.0100 | " | 0.500 | ND | 112 | 70-130 | | | |
| 2-Chlorotoluene | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | | | |
| 2-Hexanone | 0.548 | 0.0100 | " | 0.500 | ND | 110 | 70-130 | | | |
| 4-Chlorotoluene | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | | | |
| 4-Isopropyltoluene | 0.104 | 0.00200 | " | 0.100 | 0.000300 | 104 | 70-130 | | | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2302 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2302-MS1)** | | **Source: X702337-01** | | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | |
| 4-Methyl-2-pentanone | 0.542 | 0.0100 | mg/kg | 0.500 | ND | 108 | 70-130 | | | |
| Acetone | 0.501 | 0.0200 | " | 0.500 | 0.00986 | 98.3 | 70-130 | | | |
| Benzene | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | | | |
| Bromobenzene | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | | | |
| Bromochloromethane | 0.108 | 0.00200 | " | 0.100 | ND | 108 | 70-130 | | | |
| Bromodichloromethane | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | | | |
| Bromoform | 0.0907 | 0.00200 | " | 0.100 | ND | 90.7 | 70-130 | | | |
| Bromomethane | 0.0952 | 0.00200 | " | 0.100 | ND | 95.2 | 70-130 | | | |
| Carbon disulfide | 0.109 | 0.00500 | " | 0.100 | ND | 109 | 70-130 | | | |
| Carbon tetrachloride | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | | | |
| Chlorobenzene | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | | | |
| Chloroethane | 0.100 | 0.00500 | " | 0.100 | ND | 100 | 70-130 | | | |
| Chloroform | 0.0910 | 0.00200 | " | 0.100 | 0.000960 | 90.0 | 70-130 | | | |
| Chloromethane | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| cis-1,2-Dichloroethene | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | | | |
| cis-1,3-Dichloropropene | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | | | |
| Dibromochloromethane | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| Dibromomethane | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | | | |
| Ethylbenzene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| Hexachlorobutadiene | 0.0865 | 0.00500 | " | 0.100 | 0.00102 | 85.4 | 70-130 | | | |
| Iodomethane | 0.115 | 0.0150 | " | 0.100 | ND | 115 | 70-130 | | | |
| Isopropylbenzene | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | | | |
| m,p-Xylene | 0.211 | 0.00400 | " | 0.200 | ND | 106 | 70-130 | | | |
| Methyl tert-Butyl Ether | 0.112 | 0.00200 | " | 0.100 | ND | 112 | 70-130 | | | |
| Methylene Chloride | 0.107 | 0.0200 | " | 0.100 | ND | 107 | 70-130 | | | |
| Naphthalene | 0.106 | 0.0100 | " | 0.100 | 0.00122 | 105 | 70-130 | | | |

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## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2302 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2302-MS1)** | | **Source: X702337-01** | | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | |
| n-Butylbenzene | 0.102 | 0.00200 | mg/kg | 0.100 | 0.000700 | 102 | 70-130 | | | |
| n-Propylbenzene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| o-Xylene | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | | | |
| sec-Butylbenzene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| Styrene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| tert-Butylbenzene | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | | | |
| Tetrachloroethene | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | | | |
| Toluene | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | | | |
| trans-1,2-Dichloroethene | 0.114 | 0.00200 | " | 0.100 | ND | 114 | 70-130 | | | |
| trans-1,3-Dichloropropene | 0.111 | 0.00200 | " | 0.100 | ND | 111 | 70-130 | | | |
| Trichloroethene | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | | | |
| Trichlorofluoromethane | 0.0993 | 0.00300 | " | 0.100 | ND | 99.3 | 70-130 | | | |
| Vinyl chloride | 0.0996 | 0.00200 | " | 0.100 | ND | 99.6 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *61* | | *ug/L* | *62.5* | | *98.2* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *61* | | *"* | *62.5* | | *98.4* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *62* | | *"* | *62.5* | | *99.9* | *70-130* | | | |

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## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2302 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2302-MSD1)** | | **Source: X702337-01** | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.0978 | 0.00200 | mg/kg | 0.100 | ND | 97.8 | 70-130 | 4.38 | 20 | |
| 1,1,1-Trichloroethane | 0.108 | 0.00200 | " | 0.100 | ND | 108 | 70-130 | 2.99 | 20 | |
| 1,1,2,2-Tetrachloroethane | 0.0995 | 0.00200 | " | 0.100 | ND | 99.5 | 70-130 | 5.19 | 20 | |
| 1,1,2-Trichloroethane | 0.0979 | 0.00200 | " | 0.100 | ND | 97.9 | 70-130 | 3.96 | 20 | |
| 1,1-Dichloroethane | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | 4.34 | 20 | |
| 1,1-Dichloroethene | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | 3.09 | 20 | |
| 1,1-Dichloropropene | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | 4.31 | 20 | |
| 1,2,3-Trichlorobenzene | 0.0935 | 0.00500 | " | 0.100 | 0.00258 | 90.9 | 70-130 | 5.95 | 20 | |
| 1,2,3-Trichloropropane | 0.102 | 0.00500 | " | 0.100 | ND | 102 | 70-130 | 6.06 | 20 | |
| 1,2,4-Trichlorobenzene | 0.0919 | 0.00500 | " | 0.100 | 0.00154 | 90.3 | 70-130 | 10.0 | 20 | |
| 1,2,4-Trimethylbenzene | 0.0983 | 0.00200 | " | 0.100 | ND | 98.3 | 70-130 | 6.80 | 20 | |
| 1,2-Dibromo-3-chloropropane | 0.0866 | 0.00500 | " | 0.100 | ND | 86.6 | 70-130 | 4.60 | 20 | |
| 1,2-Dibromoethane (EDB) | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | 5.29 | 20 | |
| 1,2-Dichlorobenzene | 0.0965 | 0.00200 | " | 0.100 | ND | 96.5 | 70-130 | 5.36 | 20 | |
| 1,2-Dichloroethane | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | 3.58 | 20 | |
| 1,2-Dichloropropane | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | 4.96 | 20 | |
| 1,3,5-Trimethylbenzene | 0.0971 | 0.00200 | " | 0.100 | ND | 97.1 | 70-130 | 5.97 | 20 | |
| 1,3-Dichlorobenzene | 0.0965 | 0.00200 | " | 0.100 | 0.000280 | 96.2 | 70-130 | 7.75 | 20 | |
| 1,3-Dichloropropane | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | 4.62 | 20 | |
| 1,4-Dichlorobenzene | 0.0974 | 0.00200 | " | 0.100 | 0.000420 | 97.0 | 70-130 | 1.75 | 20 | |
| 2,2-Dichloropropane | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | 3.95 | 20 | |
| 2-Butanone | 0.547 | 0.0100 | " | 0.500 | ND | 109 | 70-130 | 2.45 | 20 | |
| 2-Chlorotoluene | 0.0981 | 0.00200 | " | 0.100 | ND | 98.1 | 70-130 | 6.32 | 20 | |
| 2-Hexanone | 0.534 | 0.0100 | " | 0.500 | ND | 107 | 70-130 | 2.60 | 20 | |
| 4-Chlorotoluene | 0.0958 | 0.00200 | " | 0.100 | ND | 95.8 | 70-130 | 7.30 | 20 | |
| 4-Isopropyltoluene | 0.0987 | 0.00200 | " | 0.100 | 0.000300 | 98.4 | 70-130 | 5.65 | 20 | |

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Jen Pellegrini

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2302 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2302-MSD1)** | | **Source: X702337-01** | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | | |
| 4-Methyl-2-pentanone | 0.527 | 0.0100 | mg/kg | 0.500 | ND | 105 | 70-130 | 2.83 | 20 | |
| Acetone | 0.489 | 0.0200 | " | 0.500 | 0.00986 | 95.9 | 70-130 | 2.38 | 20 | |
| Benzene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | 4.08 | 20 | |
| Bromobenzene | 0.0984 | 0.00200 | " | 0.100 | ND | 98.4 | 70-130 | 5.57 | 20 | |
| Bromochloromethane | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | 3.51 | 20 | |
| Bromodichloromethane | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | 3.00 | 20 | |
| Bromoform | 0.0873 | 0.00200 | " | 0.100 | ND | 87.3 | 70-130 | 3.84 | 20 | |
| Bromomethane | 0.0999 | 0.00200 | " | 0.100 | ND | 99.9 | 70-130 | 4.86 | 20 | |
| Carbon disulfide | 0.0655 | 0.00500 | " | 0.100 | ND | 65.5 | 70-130 | 49.5 | 20 | QM-07 |
| Carbon tetrachloride | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | 3.78 | 20 | |
| Chlorobenzene | 0.0983 | 0.00200 | " | 0.100 | ND | 98.3 | 70-130 | 5.31 | 20 | |
| Chloroethane | 0.0981 | 0.00500 | " | 0.100 | ND | 98.1 | 70-130 | 2.02 | 20 | |
| Chloroform | 0.0867 | 0.00200 | " | 0.100 | 0.000960 | 85.7 | 70-130 | 4.84 | 20 | |
| Chloromethane | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | 0.00 | 20 | |
| cis-1,2-Dichloroethene | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | 3.64 | 20 | |
| cis-1,3-Dichloropropene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | 5.67 | 20 | |
| Dibromochloromethane | 0.0972 | 0.00200 | " | 0.100 | ND | 97.2 | 70-130 | 3.42 | 20 | |
| Dibromomethane | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | 1.93 | 20 | |
| Ethylbenzene | 0.0953 | 0.00200 | " | 0.100 | ND | 95.3 | 70-130 | 6.22 | 20 | |
| Hexachlorobutadiene | 0.0847 | 0.00500 | " | 0.100 | 0.00102 | 83.7 | 70-130 | 2.06 | 20 | |
| Iodomethane | 0.109 | 0.0150 | " | 0.100 | ND | 109 | 70-130 | 5.29 | 20 | |
| Isopropylbenzene | 0.0987 | 0.00200 | " | 0.100 | ND | 98.7 | 70-130 | 5.98 | 20 | |
| m,p-Xylene | 0.199 | 0.00400 | " | 0.200 | ND | 99.6 | 70-130 | 6.03 | 20 | |
| Methyl tert-Butyl Ether | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | 1.51 | 20 | |
| Methylene Chloride | 0.0957 | 0.0200 | " | 0.100 | ND | 95.7 | 70-130 | 11.1 | 20 | |
| Naphthalene | 0.100 | 0.0100 | " | 0.100 | 0.00122 | 98.9 | 70-130 | 5.71 | 20 | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2302 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2302-MSD1)** | | **Source: X702337-01** | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | | |
| n-Butylbenzene | 0.0966 | 0.00200 | mg/kg | 0.100 | 0.000700 | 95.9 | 70-130 | 5.67 | 20 | |
| n-Propylbenzene | 0.0955 | 0.00200 | " | 0.100 | ND | 95.5 | 70-130 | 5.84 | 20 | |
| o-Xylene | 0.0991 | 0.00200 | " | 0.100 | ND | 99.1 | 70-130 | 5.59 | 20 | |
| sec-Butylbenzene | 0.0954 | 0.00200 | " | 0.100 | ND | 95.4 | 70-130 | 6.84 | 20 | |
| Styrene | 0.0934 | 0.00200 | " | 0.100 | ND | 93.4 | 70-130 | 7.34 | 20 | |
| tert-Butylbenzene | 0.0968 | 0.00200 | " | 0.100 | ND | 96.8 | 70-130 | 6.42 | 20 | |
| Tetrachloroethene | 0.0982 | 0.00200 | " | 0.100 | ND | 98.2 | 70-130 | 5.50 | 20 | |
| Toluene | 0.0968 | 0.00200 | " | 0.100 | ND | 96.8 | 70-130 | 5.94 | 20 | |
| trans-1,2-Dichloroethene | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 4.77 | 20 | |
| trans-1,3-Dichloropropene | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | 4.15 | 20 | |
| Trichloroethene | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | 5.40 | 20 | |
| Trichlorofluoromethane | 0.101 | 0.00300 | " | 0.100 | ND | 101 | 70-130 | 1.48 | 20 | |
| Vinyl chloride | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | 0.919 | 20 | |
| *Surrogate: 1,2-Dichloroethane-d4* | *61* | | *ug/L* | *62.5* | | *97.9* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *61* | | *"* | *62.5* | | *97.0* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *61* | | *"* | *62.5* | | *98.3* | *70-130* | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|

## PAH by 8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641382 - SW846 3541** | | | | | | | | | | |
| **BLANK (1203733188-BLK)** | | | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |
| Naphthalene | ND | 0.00333 | mg/kg | | | | - | | | U |
| Chrysene | ND | 0.00333 | " | | | | - | | | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.00333 | " | | | | - | | | U |
| Phenanthrene | ND | 0.00333 | " | | | | - | | | U |
| Pyrene | ND | 0.00333 | " | | | | - | | | U |
| Fluoranthene | ND | 0.00333 | " | | | | - | | | U |
| Dibenzo(a,h)anthracene | ND | 0.00333 | " | | | | - | | | U |
| Acenaphthene | ND | 0.00333 | " | | | | - | | | U |
| Acenaphthylene | ND | 0.00333 | " | | | | - | | | U |
| Anthracene | ND | 0.00333 | " | | | | - | | | U |
| Fluorene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(k)fluoranthene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(a)pyrene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(b)fluoranthene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(ghi)perylene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(a)anthracene | ND | 0.00333 | " | | | | - | | | U |
| *Surrogate: 5-alpha-Androstane* | *0.127* | | *"* | *0.167* | | *76* | *30-118* | | | |
| **LCS (1203733189-BKS)** | | | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |
| Naphthalene | 0.239 | 0.00333 | mg/kg | 0.333 | | 72 | 57-98 | | | |
| Phenanthrene | 0.257 | 0.00333 | " | 0.333 | | 77 | 53-97 | | | |

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Jen Pellegrini For Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PAH by 8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641382 - SW846 3541** | | | | | | | | | | |
| **LCS (1203733189-BKS)** | | | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |
| Pyrene | 0.259 | 0.00333 | mg/kg | 0.333 | | 78 | 41-114 | | | |
| Acenaphthene | 0.244 | 0.00333 | " | 0.333 | | 73 | 55-99 | | | |
| Acenaphthylene | 0.264 | 0.00333 | " | 0.333 | | 79 | 48-107 | | | |
| Fluoranthene | 0.314 | 0.00333 | " | 0.333 | | 94 | 39-108 | | | |
| Benzo(a)anthracene | 0.307 | 0.00333 | " | 0.333 | | 92 | 51-108 | | | |
| Benzo(a)pyrene | 0.345 | 0.00333 | " | 0.333 | | 104 | 35-121 | | | |
| Benzo(b)fluoranthene | 0.358 | 0.00333 | " | 0.333 | | 107 | 36-120 | | | |
| Benzo(ghi)perylene | 0.298 | 0.00333 | " | 0.333 | | 89 | 39-119 | | | |
| Benzo(k)fluoranthene | 0.314 | 0.00333 | " | 0.333 | | 94 | 26-121 | | | |
| Chrysene | 0.288 | 0.00333 | " | 0.333 | | 86 | 54-103 | | | |
| Dibenzo(a,h)anthracene | 0.389 | 0.00333 | " | 0.333 | | 117 | 35-142 | | | |
| Indeno(1,2,3-cd)pyrene | 0.394 | 0.00333 | " | 0.333 | | 118 | 41-130 | | | |
| Fluorene | 0.288 | 0.00333 | " | 0.333 | | 87 | 47-106 | | | |
| Anthracene | 0.292 | 0.00333 | " | 0.333 | | 88 | 52-102 | | | |
| *Surrogate: 5-alpha-Androstane* | *0.129* | | *"* | *0.167* | | *78* | *30-118* | | | |
| **MS (1203733190 S)** | | **Source: X702338-01** | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |
| Fluoranthene | 0.260 | 0.00336 | mg/kg | 0.336 | <0.00168 | 78 | 28-116 | | | |
| Dibenzo(a,h)anthracene | 0.319 | 0.00336 | " | 0.336 | <0.00168 | 95 | 18-146 | | | |
| Pyrene | 0.263 | 0.00336 | " | 0.336 | <0.00168 | 78 | 30-131 | | | |
| Phenanthrene | 0.236 | 0.00336 | " | 0.336 | <0.00168 | 70 | 35-119 | | | |
| Naphthalene | 0.215 | 0.00336 | " | 0.336 | <0.00101 | 64 | 33-117 | | | |
| Chrysene | 0.252 | 0.00336 | " | 0.336 | <0.00168 | 75 | 42-113 | | | |
| Fluorene | 0.265 | 0.00336 | " | 0.336 | <0.00168 | 79 | 33-123 | | | |
| Benzo(k)fluoranthene | 0.273 | 0.00336 | " | 0.336 | <0.00168 | 82 | 24-122 | | | |
| Benzo(ghi)perylene | 0.249 | 0.00336 | " | 0.336 | <0.00168 | 74 | 17-118 | | | |
| Benzo(b)fluoranthene | 0.307 | 0.00336 | " | 0.336 | <0.00168 | 91 | 28-126 | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PAH by 8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641382 - SW846 3541** | | | | | | | | | | |
| **MS (1203733190 S)** | | **Source: X702338-01** | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |
| Benzo(a)pyrene | 0.299 | 0.00336 | mg/kg | 0.336 | <0.00168 | 89 | 27-126 | | | |
| Benzo(a)anthracene | 0.274 | 0.00336 | " | 0.336 | <0.00168 | 82 | 41-118 | | | |
| Anthracene | 0.271 | 0.00336 | " | 0.336 | <0.00168 | 81 | 36-120 | | | |
| Acenaphthylene | 0.244 | 0.00336 | " | 0.336 | <0.00168 | 73 | 39-116 | | | |
| Acenaphthene | 0.227 | 0.00336 | " | 0.336 | <0.00168 | 68 | 38-117 | | | |
| Indeno(1,2,3-cd)pyrene | 0.323 | 0.00336 | " | 0.336 | <0.00168 | 96 | 17-133 | | | |
| *Surrogate: 5-alpha-Androstane* | *0.121* | | *"* | *0.168* | *0.0934* | *72* | *30-118* | | | |
| **MSD (1203733191 SD)** | | **Source: X702338-01** | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |
| Benzo(a)anthracene | 0.284 | 0.00334 | mg/kg | 0.334 | <0.00167 | 85 | 41-118 | 4 | 30 | |
| Anthracene | 0.276 | 0.00334 | " | 0.334 | <0.00167 | 83 | 36-120 | 2 | 30 | |
| Acenaphthene | 0.237 | 0.00334 | " | 0.334 | <0.00167 | 71 | 38-117 | 4 | 30 | |
| Acenaphthylene | 0.254 | 0.00334 | " | 0.334 | <0.00167 | 76 | 39-116 | 4 | 30 | |
| Dibenzo(a,h)anthracene | 0.362 | 0.00334 | " | 0.334 | <0.00167 | 108 | 18-146 | 13 | 30 | |
| Phenanthrene | 0.245 | 0.00334 | " | 0.334 | <0.00167 | 73 | 35-119 | 4 | 30 | |
| Pyrene | 0.251 | 0.00334 | " | 0.334 | <0.00167 | 75 | 30-131 | 5 | 30 | |
| Benzo(ghi)perylene | 0.289 | 0.00334 | " | 0.334 | <0.00167 | 87 | 17-118 | 15 | 30 | |
| Benzo(b)fluoranthene | 0.302 | 0.00334 | " | 0.334 | <0.00167 | 90 | 28-126 | 2 | 30 | |
| Indeno(1,2,3-cd)pyrene | 0.372 | 0.00334 | " | 0.334 | <0.00167 | 111 | 17-133 | 14 | 30 | |
| Chrysene | 0.263 | 0.00334 | " | 0.334 | <0.00167 | 79 | 42-113 | 4 | 30 | |
| Fluoranthene | 0.268 | 0.00334 | " | 0.334 | <0.00167 | 80 | 28-116 | 3 | 30 | |
| Benzo(k)fluoranthene | 0.269 | 0.00334 | " | 0.334 | <0.00167 | 80 | 24-122 | 2 | 30 | |
| Fluorene | 0.273 | 0.00334 | " | 0.334 | <0.00167 | 82 | 33-123 | 3 | 30 | |
| Naphthalene | 0.225 | 0.00334 | " | 0.334 | <0.001 | 67 | 33-117 | 4 | 30 | |
| Benzo(a)pyrene | 0.304 | 0.00334 | " | 0.334 | <0.00167 | 91 | 27-126 | 2 | 30 | |
| *Surrogate: 5-alpha-Androstane* | *0.131* | | *"* | *0.167* | *0.0934* | *79* | *30-118* | | | |

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Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PCB by 8082A - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641389 - SW846 3541** | | | | | | | | | | |
| **BLANK (1203733212-BLK)** | | | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |
| Aroclor-1254 | ND | 0.00333 | mg/kg | | | | - | | | U |
| Aroclor-1260 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1248 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1242 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1232 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1221 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1016 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-Total | ND | 0.00333 | " | | | | - | | | U |
| *Surrogate: Decachlorobiphenyl* | *0.00593* | | " | *0.00666* | | *89* | *32-139* | | | |
| *Surrogate: 4cmx* | *0.00462* | | " | *0.00666* | | *69* | *30-120* | | | |
| **LCS (1203733213-BKS)** | | | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |
| Aroclor-1260 | 0.0243 | 0.00333 | mg/kg | 0.0333 | | 73 | 58-117 | | | |
| Aroclor-1016 | 0.025 | 0.00333 | " | 0.0333 | | 75 | 48-93 | | | |
| *Surrogate: Decachlorobiphenyl* | *0.00616* | | " | *0.00666* | | *92* | *32-139* | | | |
| *Surrogate: 4cmx* | *0.00501* | | " | *0.00666* | | *75* | *30-120* | | | |
| **MS (1203733214 S)** | | **Source: 416696001** | | | Prepared: 02/22/2017 Analyzed: 02/24/2017 | | | | | |
| Aroclor-1260 | 0.0862 | 0.020 | mg/kg | 0.0998 | <0.00665 | 86 | 35-135 | | | |
| Aroclor-1016 | 0.0946 | 0.020 | " | 0.0998 | <0.00665 | 95 | 23-121 | | | |
| *Surrogate: Decachlorobiphenyl* | *0.00551* | | " | *0.020* | *0.00552* | *28* | *32-139* | | | |
| *Surrogate: 4cmx* | *0.0119* | | " | *0.020* | *0.0118* | *60* | *30-120* | | | |
| **MSD (1203733215 SD)** | | **Source: 416696001** | | | Prepared: 02/22/2017 Analyzed: 02/24/2017 | | | | | |
| Aroclor-1016 | 0.073 | 0.020 | mg/kg | 0.100 | <0.00666 | 73 | 23-121 | 26 | 29 | |
| Aroclor-1260 | 0.0584 | 0.020 | " | 0.100 | <0.00666 | 58 | 35-135 | 38 | 33 | |
| *Surrogate: 4cmx* | *0.0111* | | " | *0.020* | *0.0118* | *55* | *30-120* | | | |
| *Surrogate: Decachlorobiphenyl* | *0.00504* | | " | *0.020* | *0.00552* | *25* | *32-139* | | | |

Origins Laboratory, Inc.

Jen Pellegrini

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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PCB by 8082A - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641389 - SW846 3541** | | | | | | | | | | |

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## TCLP Metals by 1311/6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641470 - SW846 3010A** | | | | | | | | | | |
| **MS (1203732806 S)** | | **Source: X702338-01** | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |
| Lead | 4.79 | 0.100 | mg/L | 5.00 | <0.033 | 95.4 | 75-125 | | | |
| **TB (1203732807-BLK)** | | | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |
| Lead | ND | 0.100 | mg/L | | | | - | | | U |
| **BLANK (1203733396-BLK)** | | | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |
| Lead | ND | 0.100 | mg/L | | | | - | | | U |
| **LCS (1203733397-BKS)** | | | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |
| Lead | 4.85 | 0.100 | mg/L | 5.00 | | 96.9 | 80-120 | | | |
| **DUP (1203733398 D)** | | **Source: X702338-01** | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |
| Lead | ND | 0.100 | mg/L | | <0.033 | | 0-20 | 14.6 | 20 | U |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Total Metals by 6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641195 - SW846 3050B** | | | | | | | | | | |
| **BLANK (1203732821-BLK)** | | | | | Prepared: 02/21/2017 Analyzed: 02/22/2017 | | | | | |
| Cadmium | ND | 0.469 | mg/kg | | | | - | | | U |
| Chromium | ND | 0.469 | " | | | | - | | | U |
| Lead | ND | 0.938 | " | | | | - | | | U |
| Selenium | ND | 2.81 | " | | | | - | | | U |
| Barium | ND | 0.469 | " | | | | - | | | U |
| Arsenic | ND | 2.81 | " | | | | - | | | U |
| Silver | ND | 0.469 | " | | | | - | | | U |
| **LCS (1203732822-BKS)** | | | | | Prepared: 02/21/2017 Analyzed: 02/22/2017 | | | | | |
| Silver | 50.2 | 0.483 | mg/kg | 48.3 | | 104 | 80-120 | | | |
| Arsenic | 48.5 | 2.90 | " | 48.3 | | 101 | 80-120 | | | |
| Barium | 48.9 | 0.483 | " | 48.3 | | 101 | 80-120 | | | |
| Cadmium | 48.8 | 0.483 | " | 48.3 | | 101 | 80-120 | | | |
| Chromium | 48.9 | 0.483 | " | 48.3 | | 101 | 80-120 | | | |
| Lead | 49.7 | 0.965 | " | 48.3 | | 103 | 80-120 | | | |
| Selenium | 51.9 | 2.90 | " | 48.3 | | 108 | 80-120 | | | |
| **DUP (1203732823 D)** | | **Source: X702338-01** | | | Prepared: 02/21/2017 Analyzed: 02/22/2017 | | | | | |
| Silver | ND | 0.496 | mg/kg | | <0.0992 | | 0-20 | 22.7 | 20 | U |
| Barium | 17.1 | 0.496 | " | | 15.7 | | 0-20 | 8.61 | 20 | |
| Cadmium | ND | 0.496 | " | | <0.0992 | | 0-20 | 30.6 | 20 | U |
| Chromium | 4.14 | 0.496 | " | | 3.01 | | 0-20 | 31.6 | 20 | |
| Lead | 2.57 | 0.992 | " | | 3.98 | | 0-20 | 43 | 20 | |
| Selenium | ND | 2.98 | " | | <0.496 | | 0-20 | 124 | 20 | U |
| Arsenic | 0.883 | 2.98 | " | | <0.496 | | 0-20 | 71.1 | 20 | J |
| **MS (1203732824 S)** | | **Source: X702338-01** | | | Prepared: 02/21/2017 Analyzed: 02/22/2017 | | | | | |

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Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Total Metals by 6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641195 - SW846 3050B** | | | | | | | | | | |
| **MS (1203732824 S)** | | **Source: X702338-01** | | | Prepared: 02/21/2017 Analyzed: 02/22/2017 | | | | | |
| Silver | 51.5 | 0.467 | mg/kg | 46.7 | <0.0933 | 110 | 75-125 | | | |
| Selenium | 47.0 | 2.80 | " | 46.7 | <0.467 | 101 | 75-125 | | | |
| Lead | 47.7 | 0.933 | " | 46.7 | 3.98 | 93.7 | 75-125 | | | |
| Chromium | 49.3 | 0.467 | " | 46.7 | 3.01 | 99.3 | 75-125 | | | |
| Cadmium | 44.9 | 0.467 | " | 46.7 | <0.0933 | 96.3 | 75-125 | | | |
| Arsenic | 46.4 | 2.80 | " | 46.7 | <0.467 | 98.6 | 75-125 | | | |
| Barium | 62.0 | 0.467 | " | 46.7 | 15.7 | 99.1 | 75-125 | | | |

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Pinyon
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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Total Metals by 7471A - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641206 - SW846 7471A Prep** | | | | | | | | | | |
| **BLANK (1203732859-BLK)** | | | | | Prepared: 02/21/2017 Analyzed: 02/22/2017 | | | | | |
| Mercury | ND | 0.0114 | mg/kg | | | | - | | | U |
| **LCS (1203732860-BKS)** | | | | | Prepared: 02/21/2017 Analyzed: 02/22/2017 | | | | | |
| Mercury | 0.118 | 0.0115 | mg/kg | 0.115 | | 102 | 80-120 | | | |
| **DUP (1203732861 D)** | | **Source: 416696001** | | | Prepared: 02/21/2017 Analyzed: 02/22/2017 | | | | | |
| Mercury | 0.00398 | 0.0103 | mg/kg | | <0.00346 | | 0-20 | 25.7 | 20 | J |
| **MS (1203732862 S)** | | **Source: 416696001** | | | Prepared: 02/21/2017 Analyzed: 02/22/2017 | | | | | |
| Mercury | 0.117 | 0.0111 | mg/kg | 0.111 | <0.00372 | 103 | 80-120 | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Notes and Definitions

| | |
|---|---|
| Ua | Sample is Non-Detect. |
| U | Result not detected above the detection limit |
| QM-07 | The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery. |
| J | Greater than the detection limit but less than the reporting limit |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| RPD | Relative Percent Difference |

All soil results are reported on a wet weight basis.

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

February 28, 2017

**Pinyon**

**Julie Linn**

**9100 West Jewell Avenue, Suite 200**

**Lakewood CO 80232**

**Project Name - 27th St. Storm Drain** **Project Number - 11780301.2100**

Attached are your analytical results for 27th St. Storm Drain received by Origins Laboratory, Inc. February 21, 2017. This project is associated with Origins project number X702346-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com

THE NELAC INSTITUTE

ACCREDITED
TESTING CERT # 3494.01

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## CROSS REFERENCE REPORT

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| B-4 | X702346-01 | Soil | February 21, 2017 10:00 | 02/21/2017 15:30 |
| B-6 | X702346-02 | Soil | February 21, 2017 11:40 | 02/21/2017 15:30 |
| B-7 | X702346-03 | Soil | February 21, 2017 12:50 | 02/21/2017 15:30 |
| B-13 | X702346-04 | Soil | February 21, 2017 15:00 | 02/21/2017 15:30 |

Sample depths removed per the email from Dan Hosler.

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
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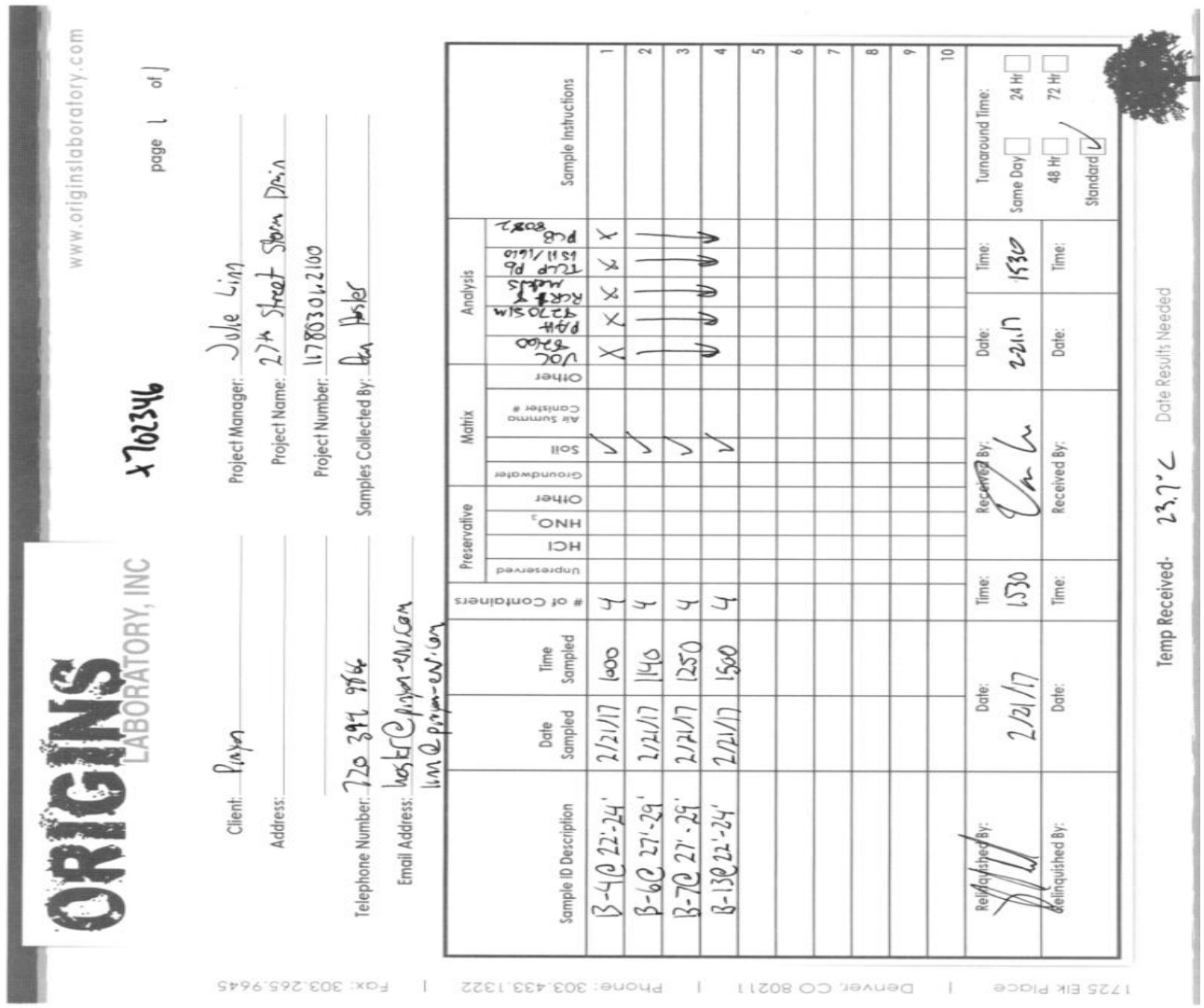
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain



ORIGINS LABORATORY, INC

www.originslaboratory.com

x702346

page 1 of 1

Client: Pinyon
Address:
Telephone Number: 720 399 9866
Email Address: hosler@pinyon-env.com lin@pinyon-env.com

Project Manager: Julie Linn
Project Name: 27th Street Storm Drain
Project Number: 11780301.2100
Samples Collected By: Dan Hosler

| Sample ID Description | Date Sampled | Time Sampled | # of Containers | Preservative: Unpreserved | Preservative: HCl | Preservative: $HNO_3$ | Preservative: Other | Matrix: Groundwater | Matrix: Soil | Matrix: Air Summa Canister # | Matrix: Other | Analysis: VOC 8260 | Analysis: PAH 8270 SIM | Analysis: RCRA 8 Metals | Analysis: TCLP Pb 1311/1610 | Analysis: PCB 8082 | Sample Instructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-4@ 22'-24' | 2/21/17 | 1000 | 4 | | | | | | ✓ | | | X | X | X | X | X | 1 |
| B-6@ 27'-29' | 2/21/17 | 1140 | 4 | | | | | | ✓ | | | | | | | | 2 |
| B-7@ 27'-29' | 2/21/17 | 1250 | 4 | | | | | | ✓ | | | | | | | | 3 |
| B-13@ 22'-24' | 2/21/17 | 1500 | 4 | | | | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | 4 |
| | | | | | | | | | | | | | | | | | 5 |
| | | | | | | | | | | | | | | | | | 6 |
| | | | | | | | | | | | | | | | | | 7 |
| | | | | | | | | | | | | | | | | | 8 |
| | | | | | | | | | | | | | | | | | 9 |
| | | | | | | | | | | | | | | | | | 10 |

| Relinquished By: | Date: | Time: | Received By: | Date: | Time: |
|---|---|---|---|---|---|
| [signature] | 2/21/17 | 1530 | [signature] | 2.21.17 | 1530 |
| Relinquished By: | Date: | Time: | Received By: | Date: | Time: |

Turnaround Time: Same Day ☐ 24 Hr ☐ 48 Hr ☐ 72 Hr ☐ Standard ☑

Temp Received- 23.7°C Date Results Needed

1725 Elk Place | Denver, CO 80211 | Phone: 303.433.1322 | Fax: 303.265.9645

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

Origins Laboratory

F-012207-01-R1
Effective Date: 01/09/12

**Sample Receipt Checklist**

Origins Work Order: K702346

Client: Pinyon
Client Project ID: 27th St. Storm Drain

Checklist Completed by: Dan W
Date/time completed: 2/21/17 1552

Shipped Via: HD (UPS, FedEx, Hand Delivered, Pick-up, etc.)
Airbill #: NA

Matrix(s) Received: (Check all that apply): ✓ Soil/Solid ___ Water ___ Other: ___ (Describe)

Cooler Number/Temperature: 1 / 23.1 °C ___ / ___ °C ___ / ___ °C ___ / ___ °C

Thermometer ID: TW3

| Requirement Description | Yes | No | N/A | Comments (if any) |
|---|---|---|---|---|
| If samples require cooling, was the temperature between 0°C to ≤ 6°C[1]? | | ✓ | | sampled same Day |
| Is there ice present (document if blue ice is used) | | ✓ | | |
| Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact) | | ✓ | | |
| Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact) | | ✓ | | |
| Were all samples received intact[1]? | ✓ | | | |
| Was adequate sample volume provided[1]? | ✓ | | | |
| Are short holding time analytes or samples with HTs due within 48 hours present[1]? | | ✓ | | |
| Is a chain-of-custody (COC) present and filled out completely[1]? | ✓ | | | |
| Does the COC agree with the number and type of sample bottles received[1]? | ✓ | | | |
| Do the sample IDs on the bottle labels match the COC[1]? | ✓ | | | |
| Is the COC properly relinquished by the client with date and time recorded[1]? | ✓ | | | |
| For volatiles in water – is there headspace (> ¼ inch bubble) present? **If yes, contact client and note in narrative.** | | | ✓ | |
| Are samples preserved that require preservation and was it checked[1]? *(note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)/(pH <2 for samples preserved with HNO3, HCL, H2SO4) / ( pH >10 for samples preserved with NaAsO2+NaOH, ZnAc+NaOH)* | | ✓ | | |
| Additional Comments (if any): | | | | |

*[1]If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.*

Reviewed by (Project Manager) — Date/Time Reviewed: 2/22/17

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-4**
**2/21/2017 10:00:00AM**

## GEL Laboratories, LLC
**X702346-01 (Soil)**

### PAH by 8270D SIM

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | 0.00171 | 0.00343 | mg/kg | 1 | 1641584 | 02/23/2017 | 02/23/2017 | U |
| Acenaphthylene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Anthracene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Benzo(a)anthracene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Benzo(a)pyrene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Benzo(b)fluoranthene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Benzo(ghi)perylene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Benzo(k)fluoranthene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Chrysene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Dibenzo(a,h)anthracene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Fluoranthene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Fluorene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Naphthalene | ND | 0.00103 | 0.00343 | " | " | " | " | " | U |
| Phenanthrene | **0.00206** | **0.00171** | 0.00343 | " | " | " | " | " | J |
| Pyrene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 5-alpha-Androstane* | *84 %* | *30-118* | " | " | " |

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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-4**
**2/21/2017 10:00:00AM**

## GEL Laboratories, LLC
**X702346-01 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **PCB by 8082A** | | | | | | | | | |
| Aroclor-1016 | ND | 0.00113 | 0.0034 | mg/kg | 1 | 1642102 | 02/24/2017 | 02/27/2017 | U |
| Aroclor-1221 | ND | 0.00113 | 0.0034 | " | " | " | " | " | U |
| Aroclor-1232 | ND | 0.00113 | 0.0034 | " | " | " | " | " | U |
| Aroclor-1242 | ND | 0.00113 | 0.0034 | " | " | " | " | " | U |
| Aroclor-1248 | ND | 0.00113 | 0.0034 | " | " | " | " | " | U |
| Aroclor-1254 | ND | 0.00113 | 0.0034 | " | " | " | " | " | U |
| Aroclor-1260 | ND | 0.00113 | 0.0034 | " | " | " | " | " | U |
| Aroclor-Total | ND | 0.00113 | 0.0034 | " | " | " | " | " | U |
| *Surrogate: 4cmx* | *67 %* | | *30-120* | | | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | *65 %* | | *32-139* | | | " | " | " | |
| **TCLP Metals by 1311/6010C** | | | | | | | | | |
| Lead | ND | 0.033 | 0.100 | mg/L | 1 | 1641827 | 02/23/2017 | 02/23/2017 | U |
| **Total Metals by 6010C** | | | | | | | | | |
| Arsenic | **1.11** | **0.508** | 3.05 | mg/kg | 1 | 1641481 | 02/22/2017 | 02/23/2017 | J |
| Barium | **27.2** | **0.102** | 0.508 | " | " | " | " | " | |
| Cadmium | ND | 0.102 | 0.508 | " | " | " | " | " | U |
| Chromium | **8.25** | **0.152** | 0.508 | " | " | " | " | " | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-4**
**2/21/2017 10:00:00AM**

## GEL Laboratories, LLC
**X702346-01 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Total Metals by 6010C** | | | | | | | | | |
| Lead | **4.76** | **0.335** | 1.02 | mg/kg | 1 | 1641481 | 02/22/2017 | 02/23/2017 | |
| Selenium | ND | 0.508 | 3.05 | " | " | " | " | " | U |
| Silver | ND | 0.102 | 0.508 | " | " | " | " | " | U |
| **Total Metals by 7471A** | | | | | | | | | |
| Mercury | ND | 0.00396 | 0.0118 | mg/kg | 1 | 1641836 | 02/23/2017 | 02/24/2017 | U |
| **VOC by EPA 8260C** | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | | 0.00200 | mg/kg | 1 | B7B2401 | 02/24/2017 | 02/27/2017 | Ua |
| 1,1,1-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2,2-Tetrachloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2,3-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,3-Trichloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dibromo-3-chloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-4**
**2/21/2017 10:00:00AM**

## Origins Laboratory, Inc.
**X702346-01 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dibromoethane (EDB) | ND | | 0.00200 | mg/kg | 1 | B7B2401 | 02/24/2017 | 02/27/2017 | Ua |
| 1,2-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3,5-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,4-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Butanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 2-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Hexanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 4-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Isopropyltoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Methyl-2-pentanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| Acetone | ND | | 0.0200 | " | " | " | " | " | Ua |
| Benzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromodichloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-4**
**2/21/2017 10:00:00AM**

## Origins Laboratory, Inc.
**X702346-01 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Bromoform | ND | | 0.00200 | mg/kg | 1 | B7B2401 | 02/24/2017 | 02/27/2017 | Ua |
| Bromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Carbon disulfide | ND | | 0.00500 | " | " | " | " | " | Ua |
| Carbon tetrachloride | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloroethane | ND | | 0.00500 | " | " | " | " | " | Ua |
| Chloroform | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Ethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Hexachlorobutadiene | ND | | 0.00500 | " | " | " | " | " | Ua |
| Iodomethane | ND | | 0.0150 | " | " | " | " | " | Ua |
| Isopropylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| m,p-Xylene | ND | | 0.00400 | " | " | " | " | " | Ua |
| Methyl tert-Butyl Ether | ND | | 0.00200 | " | " | " | " | " | Ua |
| Methylene Chloride | ND | | 0.0200 | " | " | " | " | " | Ua |
| Naphthalene | ND | | 0.0100 | " | " | " | " | " | Ua |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-4**
**2/21/2017 10:00:00AM**

## Origins Laboratory, Inc.
**X702346-01 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| n-Butylbenzene | ND | | 0.00200 | mg/kg | 1 | B7B2401 | 02/24/2017 | 02/27/2017 | Ua |
| n-Propylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| o-Xylene | ND | | 0.00200 | " | " | " | " | " | Ua |
| sec-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Styrene | ND | | 0.00200 | " | " | " | " | " | Ua |
| tert-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Tetrachloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Toluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichlorofluoromethane | ND | | 0.00300 | " | " | " | " | " | Ua |
| Vinyl chloride | ND | | 0.00200 | " | " | " | " | " | Ua |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 1,2-Dichloroethane-d4* | *104 %* | *70-130* | " | " | " |
| *Surrogate: Toluene-d8* | *96.6 %* | *70-130* | " | " | " |
| *Surrogate: 4-Bromofluorobenzene* | *98.1 %* | *70-130* | " | " | " |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-6**
**2/21/2017 11:40:00AM**

## GEL Laboratories, LLC
**X702346-02 (Soil)**

### PAH by 8270D SIM

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | 0.00205 | 0.0041 | mg/kg | 1 | 1641584 | 02/23/2017 | 02/24/2017 | U |
| Acenaphthylene | ND | 0.00205 | 0.0041 | " | " | " | " | " | U |
| Anthracene | ND | 0.00205 | 0.0041 | " | " | " | " | " | U |
| Benzo(a)anthracene | **0.00205** | **0.00205** | 0.0041 | " | " | " | " | " | J |
| Benzo(a)pyrene | ND | 0.00205 | 0.0041 | " | " | " | " | " | U |
| Benzo(b)fluoranthene | **0.00205** | **0.00205** | 0.0041 | " | " | " | " | " | J |
| Benzo(ghi)perylene | ND | 0.00205 | 0.0041 | " | " | " | " | " | U |
| Benzo(k)fluoranthene | ND | 0.00205 | 0.0041 | " | " | " | " | " | U |
| Chrysene | **0.00205** | **0.00205** | 0.0041 | " | " | " | " | " | J |
| Dibenzo(a,h)anthracene | **0.00205** | **0.00205** | 0.0041 | " | " | " | " | " | J |
| Fluoranthene | **0.00205** | **0.00205** | 0.0041 | " | " | " | " | " | J |
| Fluorene | ND | 0.00205 | 0.0041 | " | " | " | " | " | U |
| Indeno(1,2,3-cd)pyrene | **0.00205** | **0.00205** | 0.0041 | " | " | " | " | " | J |
| Naphthalene | ND | 0.00123 | 0.0041 | " | " | " | " | " | U |
| Phenanthrene | **0.00287** | **0.00205** | 0.0041 | " | " | " | " | " | J |
| Pyrene | **0.00205** | **0.00205** | 0.0041 | " | " | " | " | " | J |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 5-alpha-Androstane* | *71 %* | *30-118* | *"* | *"* | *"* |

### PCB by 8082A

Origins Laboratory, Inc.

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-6**
**2/21/2017 11:40:00AM**

## GEL Laboratories, LLC
**X702346-02 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **PCB by 8082A** | | | | | | | | | |
| Aroclor-1016 | ND | 0.00137 | 0.00412 | mg/kg | 1 | 1642102 | 02/24/2017 | 02/27/2017 | U |
| Aroclor-1221 | ND | 0.00137 | 0.00412 | " | " | " | " | " | U |
| Aroclor-1232 | ND | 0.00137 | 0.00412 | " | " | " | " | " | U |
| Aroclor-1242 | ND | 0.00137 | 0.00412 | " | " | " | " | " | U |
| Aroclor-1248 | ND | 0.00137 | 0.00412 | " | " | " | " | " | U |
| Aroclor-1254 | ND | 0.00137 | 0.00412 | " | " | " | " | " | U |
| Aroclor-1260 | ND | 0.00137 | 0.00412 | " | " | " | " | " | U |
| Aroclor-Total | ND | 0.00137 | 0.00412 | " | " | " | " | " | U |
| *Surrogate: 4cmx* | *61 %* | | *30-120* | | | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | *65 %* | | *32-139* | | | " | " | " | |
| **TCLP Metals by 1311/6010C** | | | | | | | | | |
| Lead | **0.047** | **0.033** | 0.100 | mg/L | 1 | 1641827 | 02/23/2017 | 02/23/2017 | J |
| **Total Metals by 6010C** | | | | | | | | | |
| Arsenic | **5.83** | **0.609** | 3.65 | mg/kg | 1 | 1641481 | 02/22/2017 | 02/23/2017 | |
| Barium | **164** | **0.122** | 0.609 | " | " | " | " | " | |
| Cadmium | **0.412** | **0.122** | 0.609 | " | " | " | " | " | J |
| Chromium | **16.1** | **0.183** | 0.609 | " | " | " | " | " | |

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**B-6**
**2/21/2017 11:40:00AM**

## GEL Laboratories, LLC
**X702346-02 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Total Metals by 6010C** | | | | | | | | | |
| Lead | **14.3** | **0.402** | 1.22 | mg/kg | 1 | 1641481 | 02/22/2017 | 02/23/2017 | |
| Selenium | ND | 0.609 | 3.65 | " | " | " | " | " | U |
| Silver | ND | 0.122 | 0.609 | " | " | " | " | " | U |
| **Total Metals by 7471A** | | | | | | | | | |
| Mercury | ND | 0.00491 | 0.0146 | mg/kg | 1 | 1641836 | 02/23/2017 | 02/24/2017 | U |
| **VOC by EPA 8260C** | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | | 0.00200 | mg/kg | 1 | B7B2401 | 02/24/2017 | 02/27/2017 | Ua |
| 1,1,1-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2,2-Tetrachloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2,3-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,3-Trichloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dibromo-3-chloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |

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**B-6**
**2/21/2017 11:40:00AM**

## Origins Laboratory, Inc.
**X702346-02 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dibromoethane (EDB) | ND | | 0.00200 | mg/kg | 1 | B7B2401 | 02/24/2017 | 02/27/2017 | Ua |
| 1,2-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3,5-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,4-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Butanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 2-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Hexanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 4-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Isopropyltoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Methyl-2-pentanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| Acetone | ND | | 0.0200 | " | " | " | " | " | Ua |
| Benzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromodichloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |

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**B-6**
**2/21/2017 11:40:00AM**

## Origins Laboratory, Inc.
**X702346-02 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Bromoform | ND | | 0.00200 | mg/kg | 1 | B7B2401 | 02/24/2017 | 02/27/2017 | Ua |
| Bromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Carbon disulfide | ND | | 0.00500 | " | " | " | " | " | Ua |
| Carbon tetrachloride | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloroethane | ND | | 0.00500 | " | " | " | " | " | Ua |
| Chloroform | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Ethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Hexachlorobutadiene | ND | | 0.00500 | " | " | " | " | " | Ua |
| Iodomethane | ND | | 0.0150 | " | " | " | " | " | Ua |
| Isopropylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| m,p-Xylene | ND | | 0.00400 | " | " | " | " | " | Ua |
| Methyl tert-Butyl Ether | ND | | 0.00200 | " | " | " | " | " | Ua |
| Methylene Chloride | ND | | 0.0200 | " | " | " | " | " | Ua |
| Naphthalene | ND | | 0.0100 | " | " | " | " | " | Ua |

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Pinyon
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Julie Linn
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**B-6**
**2/21/2017 11:40:00AM**

## Origins Laboratory, Inc.
**X702346-02 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| n-Butylbenzene | ND | | 0.00200 | mg/kg | 1 | B7B2401 | 02/24/2017 | 02/27/2017 | Ua |
| n-Propylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| o-Xylene | ND | | 0.00200 | " | " | " | " | " | Ua |
| sec-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Styrene | ND | | 0.00200 | " | " | " | " | " | Ua |
| tert-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Tetrachloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Toluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichlorofluoromethane | ND | | 0.00300 | " | " | " | " | " | Ua |
| Vinyl chloride | ND | | 0.00200 | " | " | " | " | " | Ua |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 1,2-Dichloroethane-d4* | *104 %* | *70-130* | " | " | " |
| *Surrogate: Toluene-d8* | *95.9 %* | *70-130* | " | " | " |
| *Surrogate: 4-Bromofluorobenzene* | *97.3 %* | *70-130* | " | " | " |

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-7**
**2/21/2017 12:50:00PM**

## GEL Laboratories, LLC
**X702346-03 (Soil)**

### PAH by 8270D SIM

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | 0.00211 | 0.00422 | mg/kg | 1 | 1641584 | 02/23/2017 | 02/24/2017 | U |
| Acenaphthylene | ND | 0.00211 | 0.00422 | " | " | " | " | " | U |
| Anthracene | ND | 0.00211 | 0.00422 | " | " | " | " | " | U |
| Benzo(a)anthracene | ND | 0.00211 | 0.00422 | " | " | " | " | " | U |
| Benzo(a)pyrene | ND | 0.00211 | 0.00422 | " | " | " | " | " | U |
| Benzo(b)fluoranthene | ND | 0.00211 | 0.00422 | " | " | " | " | " | U |
| Benzo(ghi)perylene | ND | 0.00211 | 0.00422 | " | " | " | " | " | U |
| Benzo(k)fluoranthene | ND | 0.00211 | 0.00422 | " | " | " | " | " | U |
| Chrysene | ND | 0.00211 | 0.00422 | " | " | " | " | " | U |
| Dibenzo(a,h)anthracene | ND | 0.00211 | 0.00422 | " | " | " | " | " | U |
| Fluoranthene | ND | 0.00211 | 0.00422 | " | " | " | " | " | U |
| Fluorene | ND | 0.00211 | 0.00422 | " | " | " | " | " | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.00211 | 0.00422 | " | " | " | " | " | U |
| Naphthalene | ND | 0.00127 | 0.00422 | " | " | " | " | " | U |
| Phenanthrene | **0.00211** | **0.00211** | 0.00422 | " | " | " | " | " | J |
| Pyrene | ND | 0.00211 | 0.00422 | " | " | " | " | " | U |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 5-alpha-Androstane* | *77 %* | *30-118* | " | " | " |

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-7**
**2/21/2017 12:50:00PM**

## GEL Laboratories, LLC
**X702346-03 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **PCB by 8082A** | | | | | | | | | |
| Aroclor-1016 | ND | 0.00142 | 0.00426 | mg/kg | 1 | 1642102 | 02/24/2017 | 02/27/2017 | U |
| Aroclor-1221 | ND | 0.00142 | 0.00426 | " | " | " | " | " | U |
| Aroclor-1232 | ND | 0.00142 | 0.00426 | " | " | " | " | " | U |
| Aroclor-1242 | ND | 0.00142 | 0.00426 | " | " | " | " | " | U |
| Aroclor-1248 | ND | 0.00142 | 0.00426 | " | " | " | " | " | U |
| Aroclor-1254 | ND | 0.00142 | 0.00426 | " | " | " | " | " | U |
| Aroclor-1260 | ND | 0.00142 | 0.00426 | " | " | " | " | " | U |
| Aroclor-Total | ND | 0.00142 | 0.00426 | " | " | " | " | " | U |
| *Surrogate: 4cmx* | *69 %* | | *30-120* | | | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | *51 %* | | *32-139* | | | " | " | " | |
| **TCLP Metals by 1311/6010C** | | | | | | | | | |
| Lead | ND | 0.033 | 0.100 | mg/L | 1 | 1641827 | 02/23/2017 | 02/23/2017 | U |
| **Total Metals by 6010C** | | | | | | | | | |
| Arsenic | **3.83** | **0.621** | 3.73 | mg/kg | 1 | 1641481 | 02/22/2017 | 02/23/2017 | |
| Barium | **115** | **0.124** | 0.621 | " | " | " | " | " | |
| Cadmium | **0.208** | **0.124** | 0.621 | " | " | " | " | " | J |
| Chromium | **15.9** | **0.186** | 0.621 | " | " | " | " | " | |

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**B-7**
**2/21/2017 12:50:00PM**

## GEL Laboratories, LLC
**X702346-03 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Total Metals by 6010C** | | | | | | | | | |
| Lead | **16.8** | **0.410** | 1.24 | mg/kg | 1 | 1641481 | 02/22/2017 | 02/23/2017 | |
| Selenium | ND | 0.621 | 3.73 | " | " | " | " | " | U |
| Silver | ND | 0.124 | 0.621 | " | " | " | " | " | U |
| **Total Metals by 7471A** | | | | | | | | | |
| Mercury | **0.0148** | **0.00515** | 0.0154 | mg/kg | 1 | 1641836 | 02/23/2017 | 02/24/2017 | J |
| **VOC by EPA 8260C** | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | | 0.00200 | mg/kg | 1 | B7B2401 | 02/24/2017 | 02/27/2017 | Ua |
| 1,1,1-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2,2-Tetrachloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2,3-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,3-Trichloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dibromo-3-chloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |

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**B-7**
**2/21/2017 12:50:00PM**

## Origins Laboratory, Inc.
**X702346-03 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dibromoethane (EDB) | ND | | 0.00200 | mg/kg | 1 | B7B2401 | 02/24/2017 | 02/27/2017 | Ua |
| 1,2-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3,5-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,4-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Butanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 2-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Hexanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 4-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Isopropyltoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Methyl-2-pentanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| Acetone | ND | | 0.0200 | " | " | " | " | " | Ua |
| Benzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromodichloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |

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**B-7**
**2/21/2017 12:50:00PM**

## Origins Laboratory, Inc.
**X702346-03 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Bromoform | ND | | 0.00200 | mg/kg | 1 | B7B2401 | 02/24/2017 | 02/27/2017 | Ua |
| Bromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Carbon disulfide | ND | | 0.00500 | " | " | " | " | " | Ua |
| Carbon tetrachloride | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloroethane | ND | | 0.00500 | " | " | " | " | " | Ua |
| Chloroform | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Ethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Hexachlorobutadiene | ND | | 0.00500 | " | " | " | " | " | Ua |
| Iodomethane | ND | | 0.0150 | " | " | " | " | " | Ua |
| Isopropylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| m,p-Xylene | ND | | 0.00400 | " | " | " | " | " | Ua |
| Methyl tert-Butyl Ether | ND | | 0.00200 | " | " | " | " | " | Ua |
| Methylene Chloride | ND | | 0.0200 | " | " | " | " | " | Ua |
| Naphthalene | ND | | 0.0100 | " | " | " | " | " | Ua |

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**B-7**
**2/21/2017 12:50:00PM**

## Origins Laboratory, Inc.
**X702346-03 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| n-Butylbenzene | ND | | 0.00200 | mg/kg | 1 | B7B2401 | 02/24/2017 | 02/27/2017 | Ua |
| n-Propylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| o-Xylene | ND | | 0.00200 | " | " | " | " | " | Ua |
| sec-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Styrene | ND | | 0.00200 | " | " | " | " | " | Ua |
| tert-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Tetrachloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Toluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichlorofluoromethane | ND | | 0.00300 | " | " | " | " | " | Ua |
| Vinyl chloride | ND | | 0.00200 | " | " | " | " | " | Ua |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 1,2-Dichloroethane-d4* | *103 %* | *70-130* | " | " | " |
| *Surrogate: Toluene-d8* | *95.3 %* | *70-130* | " | " | " |
| *Surrogate: 4-Bromofluorobenzene* | *96.7 %* | *70-130* | " | " | " |

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Julie Linn
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Project: 27th St. Storm Drain

**B-13**
**2/21/2017 3:00:00PM**

## GEL Laboratories, LLC
**X702346-04 (Soil)**

### PAH by 8270D SIM

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | 0.0019 | 0.00379 | mg/kg | 1 | 1641584 | 02/23/2017 | 02/24/2017 | U |
| Acenaphthylene | ND | 0.0019 | 0.00379 | " | " | " | " | " | U |
| Anthracene | ND | 0.0019 | 0.00379 | " | " | " | " | " | U |
| Benzo(a)anthracene | ND | 0.0019 | 0.00379 | " | " | " | " | " | U |
| Benzo(a)pyrene | ND | 0.0019 | 0.00379 | " | " | " | " | " | U |
| Benzo(b)fluoranthene | ND | 0.0019 | 0.00379 | " | " | " | " | " | U |
| Benzo(ghi)perylene | ND | 0.0019 | 0.00379 | " | " | " | " | " | U |
| Benzo(k)fluoranthene | ND | 0.0019 | 0.00379 | " | " | " | " | " | U |
| Chrysene | ND | 0.0019 | 0.00379 | " | " | " | " | " | U |
| Dibenzo(a,h)anthracene | ND | 0.0019 | 0.00379 | " | " | " | " | " | U |
| Fluoranthene | ND | 0.0019 | 0.00379 | " | " | " | " | " | U |
| Fluorene | ND | 0.0019 | 0.00379 | " | " | " | " | " | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.0019 | 0.00379 | " | " | " | " | " | U |
| Naphthalene | ND | 0.00114 | 0.00379 | " | " | " | " | " | U |
| Phenanthrene | ND | 0.0019 | 0.00379 | " | " | " | " | " | U |
| Pyrene | ND | 0.0019 | 0.00379 | " | " | " | " | " | U |
| *Surrogate: 5-alpha-Androstane* | *62 %* | | *30-118* | | | *"* | *"* | *"* | |

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**B-13**
**2/21/2017 3:00:00PM**

## GEL Laboratories, LLC
**X702346-04 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **PCB by 8082A** | | | | | | | | | |
| Aroclor-1016 | ND | 0.00127 | 0.00382 | mg/kg | 1 | 1642102 | 02/24/2017 | 02/27/2017 | U |
| Aroclor-1221 | ND | 0.00127 | 0.00382 | " | " | " | " | " | U |
| Aroclor-1232 | ND | 0.00127 | 0.00382 | " | " | " | " | " | U |
| Aroclor-1242 | ND | 0.00127 | 0.00382 | " | " | " | " | " | U |
| Aroclor-1248 | ND | 0.00127 | 0.00382 | " | " | " | " | " | U |
| Aroclor-1254 | ND | 0.00127 | 0.00382 | " | " | " | " | " | U |
| Aroclor-1260 | ND | 0.00127 | 0.00382 | " | " | " | " | " | U |
| Aroclor-Total | ND | 0.00127 | 0.00382 | " | " | " | " | " | U |
| *Surrogate: 4cmx* | *77 %* | | *30-120* | | | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | *85 %* | | *32-139* | | | " | " | " | |
| **TCLP Metals by 1311/6010C** | | | | | | | | | |
| Lead | ND | 0.033 | 0.100 | mg/L | 1 | 1641827 | 02/23/2017 | 02/23/2017 | U |
| **Total Metals by 6010C** | | | | | | | | | |
| Arsenic | **3.49** | **0.572** | 3.43 | mg/kg | 1 | 1641481 | 02/22/2017 | 02/23/2017 | |
| Barium | **102** | **0.114** | 0.572 | " | " | " | " | " | |
| Cadmium | **0.176** | **0.114** | 0.572 | " | " | " | " | " | J |
| Chromium | **9.10** | **0.172** | 0.572 | " | " | " | " | " | |

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## GEL Laboratories, LLC
**X702346-04 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Total Metals by 6010C** | | | | | | | | | |
| Lead | **7.36** | **0.378** | 1.14 | mg/kg | 1 | 1641481 | 02/22/2017 | 02/23/2017 | |
| Selenium | ND | 0.572 | 3.43 | " | " | " | " | " | U |
| Silver | ND | 0.114 | 0.572 | " | " | " | " | " | U |
| **Total Metals by 7471A** | | | | | | | | | |
| Mercury | **0.00766** | **0.00458** | 0.0137 | mg/kg | 1 | 1641836 | 02/23/2017 | 02/24/2017 | J |
| **VOC by EPA 8260C** | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | | 0.00200 | mg/kg | 1 | B7B2401 | 02/24/2017 | 02/27/2017 | Ua |
| 1,1,1-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2,2-Tetrachloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2,3-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,3-Trichloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dibromo-3-chloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |

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**2/21/2017 3:00:00PM**

## Origins Laboratory, Inc.
**X702346-04 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dibromoethane (EDB) | ND | | 0.00200 | mg/kg | 1 | B7B2401 | 02/24/2017 | 02/27/2017 | Ua |
| 1,2-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3,5-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,4-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Butanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 2-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Hexanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 4-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Isopropyltoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Methyl-2-pentanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| Acetone | ND | | 0.0200 | " | " | " | " | " | Ua |
| Benzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromodichloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |

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**B-13**
**2/21/2017 3:00:00PM**

## Origins Laboratory, Inc.
**X702346-04 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Bromoform | ND | | 0.00200 | mg/kg | 1 | B7B2401 | 02/24/2017 | 02/27/2017 | Ua |
| Bromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Carbon disulfide | ND | | 0.00500 | " | " | " | " | " | Ua |
| Carbon tetrachloride | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloroethane | ND | | 0.00500 | " | " | " | " | " | Ua |
| Chloroform | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Ethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Hexachlorobutadiene | ND | | 0.00500 | " | " | " | " | " | Ua |
| Iodomethane | ND | | 0.0150 | " | " | " | " | " | Ua |
| Isopropylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| m,p-Xylene | ND | | 0.00400 | " | " | " | " | " | Ua |
| Methyl tert-Butyl Ether | ND | | 0.00200 | " | " | " | " | " | Ua |
| Methylene Chloride | ND | | 0.0200 | " | " | " | " | " | Ua |
| Naphthalene | ND | | 0.0100 | " | " | " | " | " | Ua |

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-13**
**2/21/2017 3:00:00PM**

## Origins Laboratory, Inc.
**X702346-04 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| n-Butylbenzene | ND | | 0.00200 | mg/kg | 1 | B7B2401 | 02/24/2017 | 02/27/2017 | Ua |
| n-Propylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| o-Xylene | ND | | 0.00200 | " | " | " | " | " | Ua |
| sec-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Styrene | ND | | 0.00200 | " | " | " | " | " | Ua |
| tert-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Tetrachloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Toluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichlorofluoromethane | ND | | 0.00300 | " | " | " | " | " | Ua |
| Vinyl chloride | ND | | 0.00200 | " | " | " | " | " | Ua |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 1,2-Dichloroethane-d4* | *100 %* | *70-130* | " | " | " |
| *Surrogate: Toluene-d8* | *96.9 %* | *70-130* | " | " | " |
| *Surrogate: 4-Bromofluorobenzene* | *98.1 %* | *70-130* | " | " | " |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2401-BLK1)** | | | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | 0.00200 | mg/kg | | | | | | | Ua |
| 1,1,1-Trichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1,2,2-Tetrachloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1,2-Trichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2,3-Trichlorobenzene | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,3-Trichloropropane | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,4-Trichlorobenzene | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,4-Trimethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dibromo-3-chloropropane | ND | 0.00500 | " | | | | | | | Ua |
| 1,2-Dibromoethane (EDB) | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 1,3,5-Trimethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,3-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,3-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 1,4-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 2,2-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 2-Butanone | ND | 0.0100 | " | | | | | | | Ua |
| 2-Chlorotoluene | ND | 0.00200 | " | | | | | | | Ua |
| 2-Hexanone | ND | 0.0100 | " | | | | | | | Ua |
| 4-Chlorotoluene | ND | 0.00200 | " | | | | | | | Ua |
| 4-Isopropyltoluene | ND | 0.00200 | " | | | | | | | Ua |

Origins Laboratory, Inc.

Jen Pellegrini

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2401-BLK1)** | | | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| 4-Methyl-2-pentanone | ND | 0.0100 | mg/kg | | | | | | | Ua |
| Acetone | ND | 0.0200 | " | | | | | | | Ua |
| Benzene | ND | 0.00200 | " | | | | | | | Ua |
| Bromobenzene | ND | 0.00200 | " | | | | | | | Ua |
| Bromochloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Bromodichloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Bromoform | ND | 0.00200 | " | | | | | | | Ua |
| Bromomethane | ND | 0.00200 | " | | | | | | | Ua |
| Carbon disulfide | ND | 0.00500 | " | | | | | | | Ua |
| Carbon tetrachloride | ND | 0.00200 | " | | | | | | | Ua |
| Chlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| Chloroethane | ND | 0.00500 | " | | | | | | | Ua |
| Chloroform | ND | 0.00200 | " | | | | | | | Ua |
| Chloromethane | ND | 0.00200 | " | | | | | | | Ua |
| cis-1,2-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| cis-1,3-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| Dibromochloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Dibromomethane | ND | 0.00200 | " | | | | | | | Ua |
| Ethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Hexachlorobutadiene | ND | 0.00500 | " | | | | | | | Ua |
| Iodomethane | ND | 0.0150 | " | | | | | | | Ua |
| Isopropylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| m,p-Xylene | ND | 0.00400 | " | | | | | | | Ua |
| Methyl tert-Butyl Ether | ND | 0.00200 | " | | | | | | | Ua |
| Methylene Chloride | ND | 0.0200 | " | | | | | | | Ua |
| Naphthalene | ND | 0.0100 | " | | | | | | | Ua |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2401-BLK1)** | | | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| n-Butylbenzene | ND | 0.00200 | mg/kg | | | | | | | Ua |
| n-Propylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| o-Xylene | ND | 0.00200 | " | | | | | | | Ua |
| sec-Butylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Styrene | ND | 0.00200 | " | | | | | | | Ua |
| tert-Butylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Tetrachloroethene | ND | 0.00200 | " | | | | | | | Ua |
| Toluene | ND | 0.00200 | " | | | | | | | Ua |
| trans-1,2-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| trans-1,3-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| Trichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| Trichlorofluoromethane | ND | 0.00300 | " | | | | | | | Ua |
| Vinyl chloride | ND | 0.00200 | " | | | | | | | Ua |
| *Surrogate: 1,2-Dichloroethane-d4* | *64* | | *ug/L* | *62.5* | | *103* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *62* | | *"* | *62.5* | | *98.5* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *60* | | *"* | *62.5* | | *96.4* | *70-130* | | | |

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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2401-BLK2)** | | | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | 0.00200 | mg/kg | | | | | | | Ua |
| 1,1,1-Trichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1,2,2-Tetrachloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1,2-Trichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2,3-Trichlorobenzene | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,3-Trichloropropane | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,4-Trichlorobenzene | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,4-Trimethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dibromo-3-chloropropane | ND | 0.00500 | " | | | | | | | Ua |
| 1,2-Dibromoethane (EDB) | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 1,3,5-Trimethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,3-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,3-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 1,4-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 2,2-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 2-Butanone | ND | 0.0100 | " | | | | | | | Ua |
| 2-Chlorotoluene | ND | 0.00200 | " | | | | | | | Ua |
| 2-Hexanone | ND | 0.0100 | " | | | | | | | Ua |
| 4-Chlorotoluene | ND | 0.00200 | " | | | | | | | Ua |
| 4-Isopropyltoluene | ND | 0.00200 | " | | | | | | | Ua |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2401-BLK2)** | | | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| 4-Methyl-2-pentanone | ND | 0.0100 | mg/kg | | | | | | | Ua |
| Acetone | ND | 0.0200 | " | | | | | | | Ua |
| Benzene | ND | 0.00200 | " | | | | | | | Ua |
| Bromobenzene | ND | 0.00200 | " | | | | | | | Ua |
| Bromochloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Bromodichloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Bromoform | ND | 0.00200 | " | | | | | | | Ua |
| Bromomethane | ND | 0.00200 | " | | | | | | | Ua |
| Carbon disulfide | ND | 0.00500 | " | | | | | | | Ua |
| Carbon tetrachloride | ND | 0.00200 | " | | | | | | | Ua |
| Chlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| Chloroethane | ND | 0.00500 | " | | | | | | | Ua |
| Chloroform | ND | 0.00200 | " | | | | | | | Ua |
| Chloromethane | ND | 0.00200 | " | | | | | | | Ua |
| cis-1,2-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| cis-1,3-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| Dibromochloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Dibromomethane | ND | 0.00200 | " | | | | | | | Ua |
| Ethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Hexachlorobutadiene | ND | 0.00500 | " | | | | | | | Ua |
| Iodomethane | ND | 0.0150 | " | | | | | | | Ua |
| Isopropylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| m,p-Xylene | ND | 0.00400 | " | | | | | | | Ua |
| Methyl tert-Butyl Ether | ND | 0.00200 | " | | | | | | | Ua |
| Methylene Chloride | ND | 0.0200 | " | | | | | | | Ua |
| Naphthalene | ND | 0.0100 | " | | | | | | | Ua |

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Pinyon
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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2401-BLK2)** | | | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| n-Butylbenzene | ND | 0.00200 | mg/kg | | | | | | | Ua |
| n-Propylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| o-Xylene | ND | 0.00200 | " | | | | | | | Ua |
| sec-Butylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Styrene | ND | 0.00200 | " | | | | | | | Ua |
| tert-Butylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Tetrachloroethene | ND | 0.00200 | " | | | | | | | Ua |
| Toluene | ND | 0.00200 | " | | | | | | | Ua |
| trans-1,2-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| trans-1,3-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| Trichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| Trichlorofluoromethane | ND | 0.00300 | " | | | | | | | Ua |
| Vinyl chloride | ND | 0.00200 | " | | | | | | | Ua |
| *Surrogate: 1,2-Dichloroethane-d4* | *63* | | *ug/L* | *62.5* | | *101* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *62* | | *"* | *62.5* | | *99.5* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *61* | | *"* | *62.5* | | *98.1* | *70-130* | | | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2401-BS1)** | | | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.103 | 0.00200 | mg/kg | 0.100 | | 103 | 70-130 | | | |
| 1,1,1-Trichloroethane | 0.109 | 0.00200 | " | 0.100 | | 109 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| 1,1,2-Trichloroethane | 0.106 | 0.00200 | " | 0.100 | | 106 | 70-130 | | | |
| 1,1-Dichloroethane | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| 1,1-Dichloroethene | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| 1,1-Dichloropropene | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 0.103 | 0.00500 | " | 0.100 | | 103 | 70-130 | | | |
| 1,2,3-Trichloropropane | 0.110 | 0.00500 | " | 0.100 | | 110 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 0.0993 | 0.00500 | " | 0.100 | | 99.3 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 0.103 | 0.00200 | " | 0.100 | | 103 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 0.0993 | 0.00500 | " | 0.100 | | 99.3 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| 1,2-Dichlorobenzene | 0.103 | 0.00200 | " | 0.100 | | 103 | 70-130 | | | |
| 1,2-Dichloroethane | 0.114 | 0.00200 | " | 0.100 | | 114 | 70-130 | | | |
| 1,2-Dichloropropane | 0.110 | 0.00200 | " | 0.100 | | 110 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 0.102 | 0.00200 | " | 0.100 | | 102 | 70-130 | | | |
| 1,3-Dichlorobenzene | 0.101 | 0.00200 | " | 0.100 | | 101 | 70-130 | | | |
| 1,3-Dichloropropane | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| 1,4-Dichlorobenzene | 0.0999 | 0.00200 | " | 0.100 | | 99.9 | 70-130 | | | |
| 2,2-Dichloropropane | 0.103 | 0.00200 | " | 0.100 | | 103 | 70-130 | | | |
| 2-Butanone | 0.598 | 0.0100 | " | 0.500 | | 120 | 70-130 | | | |
| 2-Chlorotoluene | 0.101 | 0.00200 | " | 0.100 | | 101 | 70-130 | | | |
| 2-Hexanone | 0.588 | 0.0100 | " | 0.500 | | 118 | 70-130 | | | |
| 4-Chlorotoluene | 0.100 | 0.00200 | " | 0.100 | | 100 | 70-130 | | | |
| 4-Isopropyltoluene | 0.103 | 0.00200 | " | 0.100 | | 103 | 70-130 | | | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2401-BS1)** | | | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| 4-Methyl-2-pentanone | 0.612 | 0.0100 | mg/kg | 0.500 | | 122 | 70-130 | | | |
| Acetone | 0.524 | 0.0200 | " | 0.500 | | 105 | 70-130 | | | |
| Benzene | 0.106 | 0.00200 | " | 0.100 | | 106 | 70-130 | | | |
| Bromobenzene | 0.103 | 0.00200 | " | 0.100 | | 103 | 70-130 | | | |
| Bromochloromethane | 0.110 | 0.00200 | " | 0.100 | | 110 | 70-130 | | | |
| Bromodichloromethane | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| Bromoform | 0.0959 | 0.00200 | " | 0.100 | | 95.9 | 70-130 | | | |
| Bromomethane | 0.110 | 0.00200 | " | 0.100 | | 110 | 70-130 | | | |
| Carbon disulfide | 0.104 | 0.00500 | " | 0.100 | | 104 | 70-130 | | | |
| Carbon tetrachloride | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| Chlorobenzene | 0.103 | 0.00200 | " | 0.100 | | 103 | 70-130 | | | |
| Chloroethane | 0.104 | 0.00500 | " | 0.100 | | 104 | 70-130 | | | |
| Chloroform | 0.0921 | 0.00200 | " | 0.100 | | 92.1 | 70-130 | | | |
| Chloromethane | 0.106 | 0.00200 | " | 0.100 | | 106 | 70-130 | | | |
| cis-1,2-Dichloroethene | 0.109 | 0.00200 | " | 0.100 | | 109 | 70-130 | | | |
| cis-1,3-Dichloropropene | 0.105 | 0.00200 | " | 0.100 | | 105 | 70-130 | | | |
| Dibromochloromethane | 0.105 | 0.00200 | " | 0.100 | | 105 | 70-130 | | | |
| Dibromomethane | 0.110 | 0.00200 | " | 0.100 | | 110 | 70-130 | | | |
| Ethylbenzene | 0.0979 | 0.00200 | " | 0.100 | | 97.9 | 70-130 | | | |
| Hexachlorobutadiene | 0.100 | 0.00500 | " | 0.100 | | 100 | 70-130 | | | |
| Iodomethane | 0.110 | 0.0150 | " | 0.100 | | 110 | 70-130 | | | |
| Isopropylbenzene | 0.102 | 0.00200 | " | 0.100 | | 102 | 70-130 | | | |
| m,p-Xylene | 0.204 | 0.00400 | " | 0.200 | | 102 | 70-130 | | | |
| Methyl tert-Butyl Ether | 0.117 | 0.00200 | " | 0.100 | | 117 | 70-130 | | | |
| Methylene Chloride | 0.0986 | 0.0200 | " | 0.100 | | 98.6 | 70-130 | | | |
| Naphthalene | 0.112 | 0.0100 | " | 0.100 | | 112 | 70-130 | | | |

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Jen Pellegrini

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2401-BS1)** | | | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| n-Butylbenzene | 0.0984 | 0.00200 | mg/kg | 0.100 | | 98.4 | 70-130 | | | |
| n-Propylbenzene | 0.0968 | 0.00200 | " | 0.100 | | 96.8 | 70-130 | | | |
| o-Xylene | 0.102 | 0.00200 | " | 0.100 | | 102 | 70-130 | | | |
| sec-Butylbenzene | 0.101 | 0.00200 | " | 0.100 | | 101 | 70-130 | | | |
| Styrene | 0.102 | 0.00200 | " | 0.100 | | 102 | 70-130 | | | |
| tert-Butylbenzene | 0.102 | 0.00200 | " | 0.100 | | 102 | 70-130 | | | |
| Tetrachloroethene | 0.101 | 0.00200 | " | 0.100 | | 101 | 70-130 | | | |
| Toluene | 0.102 | 0.00200 | " | 0.100 | | 102 | 70-130 | | | |
| trans-1,2-Dichloroethene | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| trans-1,3-Dichloropropene | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| Trichloroethene | 0.106 | 0.00200 | " | 0.100 | | 106 | 70-130 | | | |
| Trichlorofluoromethane | 0.107 | 0.00300 | " | 0.100 | | 107 | 70-130 | | | |
| Vinyl chloride | 0.104 | 0.00200 | " | 0.100 | | 104 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *59* | | *ug/L* | *62.5* | | *95.0* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *62* | | *"* | *62.5* | | *98.7* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *61* | | *"* | *62.5* | | *97.8* | *70-130* | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2401-BS2)** | | | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.105 | 0.00200 | mg/kg | 0.100 | | 105 | 70-130 | | | |
| 1,1,1-Trichloroethane | 0.118 | 0.00200 | " | 0.100 | | 118 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 0.106 | 0.00200 | " | 0.100 | | 106 | 70-130 | | | |
| 1,1,2-Trichloroethane | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| 1,1-Dichloroethane | 0.113 | 0.00200 | " | 0.100 | | 113 | 70-130 | | | |
| 1,1-Dichloroethene | 0.123 | 0.00200 | " | 0.100 | | 123 | 70-130 | | | |
| 1,1-Dichloropropene | 0.118 | 0.00200 | " | 0.100 | | 118 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 0.106 | 0.00500 | " | 0.100 | | 106 | 70-130 | | | |
| 1,2,3-Trichloropropane | 0.108 | 0.00500 | " | 0.100 | | 108 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 0.106 | 0.00500 | " | 0.100 | | 106 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 0.109 | 0.00200 | " | 0.100 | | 109 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 0.0918 | 0.00500 | " | 0.100 | | 91.8 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 0.113 | 0.00200 | " | 0.100 | | 113 | 70-130 | | | |
| 1,2-Dichlorobenzene | 0.105 | 0.00200 | " | 0.100 | | 105 | 70-130 | | | |
| 1,2-Dichloroethane | 0.117 | 0.00200 | " | 0.100 | | 117 | 70-130 | | | |
| 1,2-Dichloropropane | 0.116 | 0.00200 | " | 0.100 | | 116 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 0.109 | 0.00200 | " | 0.100 | | 109 | 70-130 | | | |
| 1,3-Dichlorobenzene | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| 1,3-Dichloropropane | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| 1,4-Dichlorobenzene | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| 2,2-Dichloropropane | 0.120 | 0.00200 | " | 0.100 | | 120 | 70-130 | | | |
| 2-Butanone | 0.582 | 0.0100 | " | 0.500 | | 116 | 70-130 | | | |
| 2-Chlorotoluene | 0.109 | 0.00200 | " | 0.100 | | 109 | 70-130 | | | |
| 2-Hexanone | 0.564 | 0.0100 | " | 0.500 | | 113 | 70-130 | | | |
| 4-Chlorotoluene | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| 4-Isopropyltoluene | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2401-BS2)** | | | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| 4-Methyl-2-pentanone | 0.553 | 0.0100 | mg/kg | 0.500 | | 111 | 70-130 | | | |
| Acetone | 0.510 | 0.0200 | " | 0.500 | | 102 | 70-130 | | | |
| Benzene | 0.113 | 0.00200 | " | 0.100 | | 113 | 70-130 | | | |
| Bromobenzene | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| Bromochloromethane | 0.115 | 0.00200 | " | 0.100 | | 115 | 70-130 | | | |
| Bromodichloromethane | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| Bromoform | 0.0925 | 0.00200 | " | 0.100 | | 92.5 | 70-130 | | | |
| Bromomethane | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| Carbon disulfide | 0.115 | 0.00500 | " | 0.100 | | 115 | 70-130 | | | |
| Carbon tetrachloride | 0.118 | 0.00200 | " | 0.100 | | 118 | 70-130 | | | |
| Chlorobenzene | 0.109 | 0.00200 | " | 0.100 | | 109 | 70-130 | | | |
| Chloroethane | 0.108 | 0.00500 | " | 0.100 | | 108 | 70-130 | | | |
| Chloroform | 0.104 | 0.00200 | " | 0.100 | | 104 | 70-130 | | | |
| Chloromethane | 0.104 | 0.00200 | " | 0.100 | | 104 | 70-130 | | | |
| cis-1,2-Dichloroethene | 0.116 | 0.00200 | " | 0.100 | | 116 | 70-130 | | | |
| cis-1,3-Dichloropropene | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| Dibromochloromethane | 0.106 | 0.00200 | " | 0.100 | | 106 | 70-130 | | | |
| Dibromomethane | 0.113 | 0.00200 | " | 0.100 | | 113 | 70-130 | | | |
| Ethylbenzene | 0.106 | 0.00200 | " | 0.100 | | 106 | 70-130 | | | |
| Hexachlorobutadiene | 0.104 | 0.00500 | " | 0.100 | | 104 | 70-130 | | | |
| Iodomethane | 0.116 | 0.0150 | " | 0.100 | | 116 | 70-130 | | | |
| Isopropylbenzene | 0.109 | 0.00200 | " | 0.100 | | 109 | 70-130 | | | |
| m,p-Xylene | 0.220 | 0.00400 | " | 0.200 | | 110 | 70-130 | | | |
| Methyl tert-Butyl Ether | 0.116 | 0.00200 | " | 0.100 | | 116 | 70-130 | | | |
| Methylene Chloride | 0.103 | 0.0200 | " | 0.100 | | 103 | 70-130 | | | |
| Naphthalene | 0.111 | 0.0100 | " | 0.100 | | 111 | 70-130 | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2401-BS2)** | | | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| n-Butylbenzene | 0.110 | 0.00200 | mg/kg | 0.100 | | 110 | 70-130 | | | |
| n-Propylbenzene | 0.105 | 0.00200 | " | 0.100 | | 105 | 70-130 | | | |
| o-Xylene | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| sec-Butylbenzene | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| Styrene | 0.105 | 0.00200 | " | 0.100 | | 105 | 70-130 | | | |
| tert-Butylbenzene | 0.109 | 0.00200 | " | 0.100 | | 109 | 70-130 | | | |
| Tetrachloroethene | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| Toluene | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| trans-1,2-Dichloroethene | 0.121 | 0.00200 | " | 0.100 | | 121 | 70-130 | | | |
| trans-1,3-Dichloropropene | 0.115 | 0.00200 | " | 0.100 | | 115 | 70-130 | | | |
| Trichloroethene | 0.114 | 0.00200 | " | 0.100 | | 114 | 70-130 | | | |
| Trichlorofluoromethane | 0.110 | 0.00300 | " | 0.100 | | 110 | 70-130 | | | |
| Vinyl chloride | 0.106 | 0.00200 | " | 0.100 | | 106 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *61* | | *ug/L* | *62.5* | | *97.6* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *63* | | *"* | *62.5* | | *100* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *60* | | *"* | *62.5* | | *96.3* | *70-130* | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2401-MS1)** | | **Source: X702339-01** | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.101 | 0.00200 | mg/kg | 0.100 | ND | 101 | 70-130 | | | |
| 1,1,1-Trichloroethane | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | | | |
| 1,1,2-Trichloroethane | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | | | |
| 1,1-Dichloroethane | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | | | |
| 1,1-Dichloroethene | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | | | |
| 1,1-Dichloropropene | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 0.0966 | 0.00500 | " | 0.100 | ND | 96.6 | 70-130 | | | |
| 1,2,3-Trichloropropane | 0.107 | 0.00500 | " | 0.100 | ND | 107 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 0.0977 | 0.00500 | " | 0.100 | ND | 97.7 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 0.0923 | 0.00500 | " | 0.100 | ND | 92.3 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | | | |
| 1,2-Dichlorobenzene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| 1,2-Dichloroethane | 0.116 | 0.00200 | " | 0.100 | ND | 116 | 70-130 | | | |
| 1,2-Dichloropropane | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| 1,3-Dichlorobenzene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| 1,3-Dichloropropane | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | | | |
| 1,4-Dichlorobenzene | 0.0999 | 0.00200 | " | 0.100 | ND | 99.9 | 70-130 | | | |
| 2,2-Dichloropropane | 0.112 | 0.00200 | " | 0.100 | ND | 112 | 70-130 | | | |
| 2-Butanone | 0.578 | 0.0100 | " | 0.500 | ND | 116 | 70-130 | | | |
| 2-Chlorotoluene | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | | | |
| 2-Hexanone | 0.559 | 0.0100 | " | 0.500 | ND | 112 | 70-130 | | | |
| 4-Chlorotoluene | 0.0997 | 0.00200 | " | 0.100 | ND | 99.7 | 70-130 | | | |
| 4-Isopropyltoluene | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2401-MS1)** | | **Source: X702339-01** | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| 4-Methyl-2-pentanone | 0.554 | 0.0100 | mg/kg | 0.500 | ND | 111 | 70-130 | | | |
| Acetone | 0.512 | 0.0200 | " | 0.500 | ND | 102 | 70-130 | | | |
| Benzene | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | | | |
| Bromobenzene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| Bromochloromethane | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | | | |
| Bromodichloromethane | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | | | |
| Bromoform | 0.0937 | 0.00200 | " | 0.100 | ND | 93.7 | 70-130 | | | |
| Bromomethane | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | | | |
| Carbon disulfide | 0.0645 | 0.00500 | " | 0.100 | ND | 64.5 | 70-130 | | | QM-07 |
| Carbon tetrachloride | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | | | |
| Chlorobenzene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| Chloroethane | 0.103 | 0.00500 | " | 0.100 | ND | 103 | 70-130 | | | |
| Chloroform | 0.0915 | 0.00200 | " | 0.100 | ND | 91.5 | 70-130 | | | |
| Chloromethane | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| cis-1,2-Dichloroethene | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | | | |
| cis-1,3-Dichloropropene | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | | | |
| Dibromochloromethane | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | | | |
| Dibromomethane | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | | | |
| Ethylbenzene | 0.0981 | 0.00200 | " | 0.100 | ND | 98.1 | 70-130 | | | |
| Hexachlorobutadiene | 0.0931 | 0.00500 | " | 0.100 | ND | 93.1 | 70-130 | | | |
| Iodomethane | 0.109 | 0.0150 | " | 0.100 | ND | 109 | 70-130 | | | |
| Isopropylbenzene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| m,p-Xylene | 0.204 | 0.00400 | " | 0.200 | ND | 102 | 70-130 | | | |
| Methyl tert-Butyl Ether | 0.115 | 0.00200 | " | 0.100 | ND | 115 | 70-130 | | | |
| Methylene Chloride | 0.101 | 0.0200 | " | 0.100 | ND | 101 | 70-130 | | | |
| Naphthalene | 0.104 | 0.0100 | " | 0.100 | ND | 104 | 70-130 | | | |

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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2401-MS1)** | | **Source: X702339-01** | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| n-Butylbenzene | 0.102 | 0.00200 | mg/kg | 0.100 | ND | 102 | 70-130 | | | |
| n-Propylbenzene | 0.0986 | 0.00200 | " | 0.100 | ND | 98.6 | 70-130 | | | |
| o-Xylene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| sec-Butylbenzene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| Styrene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| tert-Butylbenzene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| Tetrachloroethene | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | | | |
| Toluene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| trans-1,2-Dichloroethene | 0.112 | 0.00200 | " | 0.100 | ND | 112 | 70-130 | | | |
| trans-1,3-Dichloropropene | 0.113 | 0.00200 | " | 0.100 | ND | 113 | 70-130 | | | |
| Trichloroethene | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | | | |
| Trichlorofluoromethane | 0.104 | 0.00300 | " | 0.100 | ND | 104 | 70-130 | | | |
| Vinyl chloride | 0.0985 | 0.00200 | " | 0.100 | ND | 98.5 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *61* | | *ug/L* | *62.5* | | *98.2* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *61* | | *"* | *62.5* | | *97.9* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *62* | | *"* | *62.5* | | *99.2* | *70-130* | | | |

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2401-MS2)** | | **Source: X702339-06** | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.0892 | 0.00200 | mg/kg | 0.100 | ND | 89.2 | 70-130 | | | |
| 1,1,1-Trichloroethane | 0.0878 | 0.00200 | " | 0.100 | ND | 87.8 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 0.0966 | 0.00200 | " | 0.100 | ND | 96.6 | 70-130 | | | |
| 1,1,2-Trichloroethane | 0.0913 | 0.00200 | " | 0.100 | ND | 91.3 | 70-130 | | | |
| 1,1-Dichloroethane | 0.0898 | 0.00200 | " | 0.100 | ND | 89.8 | 70-130 | | | |
| 1,1-Dichloroethene | 0.0889 | 0.00200 | " | 0.100 | ND | 88.9 | 70-130 | | | |
| 1,1-Dichloropropene | 0.0878 | 0.00200 | " | 0.100 | ND | 87.8 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 0.0901 | 0.00500 | " | 0.100 | ND | 90.1 | 70-130 | | | |
| 1,2,3-Trichloropropane | 0.0972 | 0.00500 | " | 0.100 | ND | 97.2 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 0.0873 | 0.00500 | " | 0.100 | ND | 87.3 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 0.0845 | 0.00200 | " | 0.100 | ND | 84.5 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 0.0904 | 0.00500 | " | 0.100 | ND | 90.4 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 0.0956 | 0.00200 | " | 0.100 | ND | 95.6 | 70-130 | | | |
| 1,2-Dichlorobenzene | 0.0914 | 0.00200 | " | 0.100 | ND | 91.4 | 70-130 | | | |
| 1,2-Dichloroethane | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| 1,2-Dichloropropane | 0.0964 | 0.00200 | " | 0.100 | ND | 96.4 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 0.0886 | 0.00200 | " | 0.100 | ND | 88.6 | 70-130 | | | |
| 1,3-Dichlorobenzene | 0.0884 | 0.00200 | " | 0.100 | ND | 88.4 | 70-130 | | | |
| 1,3-Dichloropropane | 0.0945 | 0.00200 | " | 0.100 | ND | 94.5 | 70-130 | | | |
| 1,4-Dichlorobenzene | 0.0890 | 0.00200 | " | 0.100 | ND | 89.0 | 70-130 | | | |
| 2,2-Dichloropropane | 0.0873 | 0.00200 | " | 0.100 | ND | 87.3 | 70-130 | | | |
| 2-Butanone | 0.553 | 0.0100 | " | 0.500 | ND | 111 | 70-130 | | | |
| 2-Chlorotoluene | 0.0871 | 0.00200 | " | 0.100 | ND | 87.1 | 70-130 | | | |
| 2-Hexanone | 0.523 | 0.0100 | " | 0.500 | ND | 105 | 70-130 | | | |
| 4-Chlorotoluene | 0.0847 | 0.00200 | " | 0.100 | ND | 84.7 | 70-130 | | | |
| 4-Isopropyltoluene | 0.0877 | 0.00200 | " | 0.100 | ND | 87.7 | 70-130 | | | |

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2401-MS2)** | | **Source: X702339-06** | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| 4-Methyl-2-pentanone | 0.493 | 0.0100 | mg/kg | 0.500 | ND | 98.6 | 70-130 | | | |
| Acetone | 0.484 | 0.0200 | " | 0.500 | ND | 96.8 | 70-130 | | | |
| Benzene | 0.0884 | 0.00200 | " | 0.100 | ND | 88.4 | 70-130 | | | |
| Bromobenzene | 0.0889 | 0.00200 | " | 0.100 | ND | 88.9 | 70-130 | | | |
| Bromochloromethane | 0.0976 | 0.00200 | " | 0.100 | ND | 97.6 | 70-130 | | | |
| Bromodichloromethane | 0.0937 | 0.00200 | " | 0.100 | ND | 93.7 | 70-130 | | | |
| Bromoform | 0.0848 | 0.00200 | " | 0.100 | ND | 84.8 | 70-130 | | | |
| Bromomethane | 0.0962 | 0.00200 | " | 0.100 | ND | 96.2 | 70-130 | | | |
| Carbon disulfide | 0.0812 | 0.00500 | " | 0.100 | ND | 81.2 | 70-130 | | | |
| Carbon tetrachloride | 0.0871 | 0.00200 | " | 0.100 | ND | 87.1 | 70-130 | | | |
| Chlorobenzene | 0.0845 | 0.00200 | " | 0.100 | ND | 84.5 | 70-130 | | | |
| Chloroethane | 0.0985 | 0.00500 | " | 0.100 | ND | 98.5 | 70-130 | | | |
| Chloroform | 0.0788 | 0.00200 | " | 0.100 | ND | 78.8 | 70-130 | | | |
| Chloromethane | 0.0959 | 0.00200 | " | 0.100 | ND | 95.9 | 70-130 | | | |
| cis-1,2-Dichloroethene | 0.0923 | 0.00200 | " | 0.100 | ND | 92.3 | 70-130 | | | |
| cis-1,3-Dichloropropene | 0.0875 | 0.00200 | " | 0.100 | ND | 87.5 | 70-130 | | | |
| Dibromochloromethane | 0.0881 | 0.00200 | " | 0.100 | ND | 88.1 | 70-130 | | | |
| Dibromomethane | 0.0987 | 0.00200 | " | 0.100 | ND | 98.7 | 70-130 | | | |
| Ethylbenzene | 0.0834 | 0.00200 | " | 0.100 | ND | 83.4 | 70-130 | | | |
| Hexachlorobutadiene | 0.0784 | 0.00500 | " | 0.100 | ND | 78.4 | 70-130 | | | |
| Iodomethane | 0.0889 | 0.0150 | " | 0.100 | ND | 88.9 | 70-130 | | | |
| Isopropylbenzene | 0.0858 | 0.00200 | " | 0.100 | ND | 85.8 | 70-130 | | | |
| m,p-Xylene | 0.169 | 0.00400 | " | 0.200 | ND | 84.6 | 70-130 | | | |
| Methyl tert-Butyl Ether | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | | | |
| Methylene Chloride | 0.0871 | 0.0200 | " | 0.100 | ND | 87.1 | 70-130 | | | |
| Naphthalene | 0.100 | 0.0100 | " | 0.100 | ND | 100 | 70-130 | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2401-MS2)** | | **Source: X702339-06** | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| n-Butylbenzene | 0.0822 | 0.00200 | mg/kg | 0.100 | ND | 82.2 | 70-130 | | | |
| n-Propylbenzene | 0.0812 | 0.00200 | " | 0.100 | ND | 81.2 | 70-130 | | | |
| o-Xylene | 0.0874 | 0.00200 | " | 0.100 | ND | 87.4 | 70-130 | | | |
| sec-Butylbenzene | 0.0823 | 0.00200 | " | 0.100 | ND | 82.3 | 70-130 | | | |
| Styrene | 0.0835 | 0.00200 | " | 0.100 | ND | 83.5 | 70-130 | | | |
| tert-Butylbenzene | 0.0835 | 0.00200 | " | 0.100 | ND | 83.5 | 70-130 | | | |
| Tetrachloroethene | 0.0808 | 0.00200 | " | 0.100 | ND | 80.8 | 70-130 | | | |
| Toluene | 0.0814 | 0.00200 | " | 0.100 | ND | 81.4 | 70-130 | | | |
| trans-1,2-Dichloroethene | 0.0904 | 0.00200 | " | 0.100 | ND | 90.4 | 70-130 | | | |
| trans-1,3-Dichloropropene | 0.0972 | 0.00200 | " | 0.100 | ND | 97.2 | 70-130 | | | |
| Trichloroethene | 0.0889 | 0.00200 | " | 0.100 | ND | 88.9 | 70-130 | | | |
| Trichlorofluoromethane | 0.101 | 0.00300 | " | 0.100 | ND | 101 | 70-130 | | | |
| Vinyl chloride | 0.0956 | 0.00200 | " | 0.100 | ND | 95.6 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *64* | | *ug/L* | *62.5* | | *103* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *60* | | *"* | *62.5* | | *95.8* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *62* | | *"* | *62.5* | | *98.8* | *70-130* | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2401-MSD1)** | | **Source: X702339-01** | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.100 | 0.00200 | mg/kg | 0.100 | ND | 100 | 70-130 | 1.19 | 20 | |
| 1,1,1-Trichloroethane | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | 6.11 | 20 | |
| 1,1,2,2-Tetrachloroethane | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | 1.20 | 20 | |
| 1,1,2-Trichloroethane | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | 3.31 | 20 | |
| 1,1-Dichloroethane | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | 4.46 | 20 | |
| 1,1-Dichloroethene | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | 4.43 | 20 | |
| 1,1-Dichloropropene | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | 6.41 | 20 | |
| 1,2,3-Trichlorobenzene | 0.0905 | 0.00500 | " | 0.100 | ND | 90.5 | 70-130 | 6.54 | 20 | |
| 1,2,3-Trichloropropane | 0.105 | 0.00500 | " | 0.100 | ND | 105 | 70-130 | 2.51 | 20 | |
| 1,2,4-Trichlorobenzene | 0.0936 | 0.00500 | " | 0.100 | ND | 93.6 | 70-130 | 4.31 | 20 | |
| 1,2,4-Trimethylbenzene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | 2.50 | 20 | |
| 1,2-Dibromo-3-chloropropane | 0.0908 | 0.00500 | " | 0.100 | ND | 90.8 | 70-130 | 1.64 | 20 | |
| 1,2-Dibromoethane (EDB) | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | 4.73 | 20 | |
| 1,2-Dichlorobenzene | 0.0987 | 0.00200 | " | 0.100 | ND | 98.7 | 70-130 | 2.28 | 20 | |
| 1,2-Dichloroethane | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 6.29 | 20 | |
| 1,2-Dichloropropane | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | 4.38 | 20 | |
| 1,3,5-Trimethylbenzene | 0.0983 | 0.00200 | " | 0.100 | ND | 98.3 | 70-130 | 3.26 | 20 | |
| 1,3-Dichlorobenzene | 0.0990 | 0.00200 | " | 0.100 | ND | 99.0 | 70-130 | 3.10 | 20 | |
| 1,3-Dichloropropane | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | 1.75 | 20 | |
| 1,4-Dichlorobenzene | 0.0993 | 0.00200 | " | 0.100 | ND | 99.3 | 70-130 | 0.603 | 20 | |
| 2,2-Dichloropropane | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | 6.86 | 20 | |
| 2-Butanone | 0.572 | 0.0100 | " | 0.500 | ND | 114 | 70-130 | 1.14 | 20 | |
| 2-Chlorotoluene | 0.0991 | 0.00200 | " | 0.100 | ND | 99.1 | 70-130 | 3.72 | 20 | |
| 2-Hexanone | 0.550 | 0.0100 | " | 0.500 | ND | 110 | 70-130 | 1.71 | 20 | |
| 4-Chlorotoluene | 0.0961 | 0.00200 | " | 0.100 | ND | 96.1 | 70-130 | 3.66 | 20 | |
| 4-Isopropyltoluene | 0.0995 | 0.00200 | " | 0.100 | ND | 99.5 | 70-130 | 4.69 | 20 | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2401-MSD1)** | | **Source: X702339-01** | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | | |
| 4-Methyl-2-pentanone | 0.542 | 0.0100 | mg/kg | 0.500 | ND | 108 | 70-130 | 2.10 | 20 | |
| Acetone | 0.501 | 0.0200 | " | 0.500 | ND | 100 | 70-130 | 2.03 | 20 | |
| Benzene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | 4.12 | 20 | |
| Bromobenzene | 0.0984 | 0.00200 | " | 0.100 | ND | 98.4 | 70-130 | 3.38 | 20 | |
| Bromochloromethane | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | 3.78 | 20 | |
| Bromodichloromethane | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | 3.90 | 20 | |
| Bromoform | 0.0923 | 0.00200 | " | 0.100 | ND | 92.3 | 70-130 | 1.59 | 20 | |
| Bromomethane | 0.0973 | 0.00200 | " | 0.100 | ND | 97.3 | 70-130 | 11.5 | 20 | |
| Carbon disulfide | 0.0978 | 0.00500 | " | 0.100 | ND | 97.8 | 70-130 | 41.1 | 20 | QR-03 |
| Carbon tetrachloride | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | 5.99 | 20 | |
| Chlorobenzene | 0.0980 | 0.00200 | " | 0.100 | ND | 98.0 | 70-130 | 3.94 | 20 | |
| Chloroethane | 0.0989 | 0.00500 | " | 0.100 | ND | 98.9 | 70-130 | 4.37 | 20 | |
| Chloroform | 0.0874 | 0.00200 | " | 0.100 | ND | 87.4 | 70-130 | 4.67 | 20 | |
| Chloromethane | 0.0940 | 0.00200 | " | 0.100 | ND | 94.0 | 70-130 | 6.88 | 20 | |
| cis-1,2-Dichloroethene | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | 4.52 | 20 | |
| cis-1,3-Dichloropropene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | 3.90 | 20 | |
| Dibromochloromethane | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | 3.86 | 20 | |
| Dibromomethane | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | 3.11 | 20 | |
| Ethylbenzene | 0.0941 | 0.00200 | " | 0.100 | ND | 94.1 | 70-130 | 4.16 | 20 | |
| Hexachlorobutadiene | 0.0875 | 0.00500 | " | 0.100 | ND | 87.5 | 70-130 | 6.20 | 20 | |
| Iodomethane | 0.103 | 0.0150 | " | 0.100 | ND | 103 | 70-130 | 5.93 | 20 | |
| Isopropylbenzene | 0.0987 | 0.00200 | " | 0.100 | ND | 98.7 | 70-130 | 2.92 | 20 | |
| m,p-Xylene | 0.197 | 0.00400 | " | 0.200 | ND | 98.6 | 70-130 | 3.26 | 20 | |
| Methyl tert-Butyl Ether | 0.112 | 0.00200 | " | 0.100 | ND | 112 | 70-130 | 3.17 | 20 | |
| Methylene Chloride | 0.0984 | 0.0200 | " | 0.100 | ND | 98.4 | 70-130 | 2.94 | 20 | |
| Naphthalene | 0.100 | 0.0100 | " | 0.100 | ND | 100 | 70-130 | 4.01 | 20 | |

Origins Laboratory, Inc.

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Julie Linn
Project Number: 11780301.2100
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## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2401-MSD1)** | | **Source: X702339-01** | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| n-Butylbenzene | 0.0974 | 0.00200 | mg/kg | 0.100 | ND | 97.4 | 70-130 | 4.85 | 20 | |
| n-Propylbenzene | 0.0947 | 0.00200 | " | 0.100 | ND | 94.7 | 70-130 | 4.04 | 20 | |
| o-Xylene | 0.0984 | 0.00200 | " | 0.100 | ND | 98.4 | 70-130 | 2.45 | 20 | |
| sec-Butylbenzene | 0.0965 | 0.00200 | " | 0.100 | ND | 96.5 | 70-130 | 4.12 | 20 | |
| Styrene | 0.0952 | 0.00200 | " | 0.100 | ND | 95.2 | 70-130 | 5.20 | 20 | |
| tert-Butylbenzene | 0.0966 | 0.00200 | " | 0.100 | ND | 96.6 | 70-130 | 4.73 | 20 | |
| Tetrachloroethene | 0.0963 | 0.00200 | " | 0.100 | ND | 96.3 | 70-130 | 6.29 | 20 | |
| Toluene | 0.0959 | 0.00200 | " | 0.100 | ND | 95.9 | 70-130 | 4.46 | 20 | |
| trans-1,2-Dichloroethene | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | 6.32 | 20 | |
| trans-1,3-Dichloropropene | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 4.42 | 20 | |
| Trichloroethene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | 4.78 | 20 | |
| Trichlorofluoromethane | 0.0984 | 0.00300 | " | 0.100 | ND | 98.4 | 70-130 | 5.34 | 20 | |
| Vinyl chloride | 0.0933 | 0.00200 | " | 0.100 | ND | 93.3 | 70-130 | 5.40 | 20 | |
| *Surrogate: 1,2-Dichloroethane-d4* | *61* | | *ug/L* | *62.5* | | *97.0* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *61* | | *"* | *62.5* | | *98.2* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *62* | | *"* | *62.5* | | *99.0* | *70-130* | | | |

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Julie Linn
Project Number: 11780301.2100
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## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2401-MSD2)** | | **Source: X702339-06** | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.0909 | 0.00200 | mg/kg | 0.100 | ND | 90.9 | 70-130 | 1.87 | 20 | |
| 1,1,1-Trichloroethane | 0.0895 | 0.00200 | " | 0.100 | ND | 89.5 | 70-130 | 1.99 | 20 | |
| 1,1,2,2-Tetrachloroethane | 0.0940 | 0.00200 | " | 0.100 | ND | 94.0 | 70-130 | 2.71 | 20 | |
| 1,1,2-Trichloroethane | 0.0908 | 0.00200 | " | 0.100 | ND | 90.8 | 70-130 | 0.527 | 20 | |
| 1,1-Dichloroethane | 0.0911 | 0.00200 | " | 0.100 | ND | 91.1 | 70-130 | 1.44 | 20 | |
| 1,1-Dichloroethene | 0.0913 | 0.00200 | " | 0.100 | ND | 91.3 | 70-130 | 2.69 | 20 | |
| 1,1-Dichloropropene | 0.0892 | 0.00200 | " | 0.100 | ND | 89.2 | 70-130 | 1.58 | 20 | |
| 1,2,3-Trichlorobenzene | 0.0776 | 0.00500 | " | 0.100 | ND | 77.6 | 70-130 | 14.8 | 20 | |
| 1,2,3-Trichloropropane | 0.0959 | 0.00500 | " | 0.100 | ND | 95.9 | 70-130 | 1.37 | 20 | |
| 1,2,4-Trichlorobenzene | 0.0788 | 0.00500 | " | 0.100 | ND | 78.8 | 70-130 | 10.3 | 20 | |
| 1,2,4-Trimethylbenzene | 0.0829 | 0.00200 | " | 0.100 | ND | 82.9 | 70-130 | 1.91 | 20 | |
| 1,2-Dibromo-3-chloropropane | 0.0878 | 0.00500 | " | 0.100 | ND | 87.8 | 70-130 | 2.90 | 20 | |
| 1,2-Dibromoethane (EDB) | 0.0947 | 0.00200 | " | 0.100 | ND | 94.7 | 70-130 | 0.883 | 20 | |
| 1,2-Dichlorobenzene | 0.0891 | 0.00200 | " | 0.100 | ND | 89.1 | 70-130 | 2.53 | 20 | |
| 1,2-Dichloroethane | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | 1.12 | 20 | |
| 1,2-Dichloropropane | 0.0960 | 0.00200 | " | 0.100 | ND | 96.0 | 70-130 | 0.478 | 20 | |
| 1,3,5-Trimethylbenzene | 0.0878 | 0.00200 | " | 0.100 | ND | 87.8 | 70-130 | 0.884 | 20 | |
| 1,3-Dichlorobenzene | 0.0871 | 0.00200 | " | 0.100 | ND | 87.1 | 70-130 | 1.46 | 20 | |
| 1,3-Dichloropropane | 0.0939 | 0.00200 | " | 0.100 | ND | 93.9 | 70-130 | 0.616 | 20 | |
| 1,4-Dichlorobenzene | 0.0844 | 0.00200 | " | 0.100 | ND | 84.4 | 70-130 | 5.24 | 20 | |
| 2,2-Dichloropropane | 0.0901 | 0.00200 | " | 0.100 | ND | 90.1 | 70-130 | 3.13 | 20 | |
| 2-Butanone | 0.532 | 0.0100 | " | 0.500 | ND | 106 | 70-130 | 3.89 | 20 | |
| 2-Chlorotoluene | 0.0864 | 0.00200 | " | 0.100 | ND | 86.4 | 70-130 | 0.784 | 20 | |
| 2-Hexanone | 0.505 | 0.0100 | " | 0.500 | ND | 101 | 70-130 | 3.57 | 20 | |
| 4-Chlorotoluene | 0.0846 | 0.00200 | " | 0.100 | ND | 84.6 | 70-130 | 0.0945 | 20 | |
| 4-Isopropyltoluene | 0.0844 | 0.00200 | " | 0.100 | ND | 84.4 | 70-130 | 3.77 | 20 | |

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Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2401-MSD2)** | | **Source: X702339-06** | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | | |
| 4-Methyl-2-pentanone | 0.492 | 0.0100 | mg/kg | 0.500 | ND | 98.4 | 70-130 | 0.150 | 20 | |
| Acetone | 0.476 | 0.0200 | " | 0.500 | ND | 95.3 | 70-130 | 1.64 | 20 | |
| Benzene | 0.0901 | 0.00200 | " | 0.100 | ND | 90.1 | 70-130 | 1.86 | 20 | |
| Bromobenzene | 0.0888 | 0.00200 | " | 0.100 | ND | 88.8 | 70-130 | 0.0900 | 20 | |
| Bromochloromethane | 0.0969 | 0.00200 | " | 0.100 | ND | 96.9 | 70-130 | 0.720 | 20 | |
| Bromodichloromethane | 0.0960 | 0.00200 | " | 0.100 | ND | 96.0 | 70-130 | 2.38 | 20 | |
| Bromoform | 0.0841 | 0.00200 | " | 0.100 | ND | 84.1 | 70-130 | 0.853 | 20 | |
| Bromomethane | 0.0947 | 0.00200 | " | 0.100 | ND | 94.7 | 70-130 | 1.61 | 20 | |
| Carbon disulfide | 0.0823 | 0.00500 | " | 0.100 | ND | 82.3 | 70-130 | 1.37 | 20 | |
| Carbon tetrachloride | 0.0393 | 0.00200 | " | 0.100 | ND | 39.3 | 70-130 | 75.8 | 20 | QM-07 |
| Chlorobenzene | 0.0862 | 0.00200 | " | 0.100 | ND | 86.2 | 70-130 | 2.04 | 20 | |
| Chloroethane | 0.0945 | 0.00500 | " | 0.100 | ND | 94.5 | 70-130 | 4.19 | 20 | |
| Chloroform | 0.0793 | 0.00200 | " | 0.100 | ND | 79.3 | 70-130 | 0.633 | 20 | |
| Chloromethane | 0.0923 | 0.00200 | " | 0.100 | ND | 92.3 | 70-130 | 3.76 | 20 | |
| cis-1,2-Dichloroethene | 0.0930 | 0.00200 | " | 0.100 | ND | 93.0 | 70-130 | 0.756 | 20 | |
| cis-1,3-Dichloropropene | 0.0894 | 0.00200 | " | 0.100 | ND | 89.4 | 70-130 | 2.12 | 20 | |
| Dibromochloromethane | 0.0896 | 0.00200 | " | 0.100 | ND | 89.6 | 70-130 | 1.64 | 20 | |
| Dibromomethane | 0.0967 | 0.00200 | " | 0.100 | ND | 96.7 | 70-130 | 1.97 | 20 | |
| Ethylbenzene | 0.0839 | 0.00200 | " | 0.100 | ND | 83.9 | 70-130 | 0.574 | 20 | |
| Hexachlorobutadiene | 0.0640 | 0.00500 | " | 0.100 | ND | 64.0 | 70-130 | 20.2 | 20 | QM-07 |
| Iodomethane | 0.0905 | 0.0150 | " | 0.100 | ND | 90.5 | 70-130 | 1.69 | 20 | |
| Isopropylbenzene | 0.0858 | 0.00200 | " | 0.100 | ND | 85.8 | 70-130 | 0.0466 | 20 | |
| m,p-Xylene | 0.170 | 0.00400 | " | 0.200 | ND | 84.9 | 70-130 | 0.448 | 20 | |
| Methyl tert-Butyl Ether | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | 1.89 | 20 | |
| Methylene Chloride | 0.0870 | 0.0200 | " | 0.100 | ND | 87.0 | 70-130 | 0.138 | 20 | |
| Naphthalene | 0.0918 | 0.0100 | " | 0.100 | ND | 91.8 | 70-130 | 8.95 | 20 | |

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Jen Pellegrini

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2401 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2401-MSD2)** | | **Source: X702339-06** | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| n-Butylbenzene | 0.0784 | 0.00200 | mg/kg | 0.100 | ND | 78.4 | 70-130 | 4.66 | 20 | |
| n-Propylbenzene | 0.0817 | 0.00200 | " | 0.100 | ND | 81.7 | 70-130 | 0.565 | 20 | |
| o-Xylene | 0.0882 | 0.00200 | " | 0.100 | ND | 88.2 | 70-130 | 0.843 | 20 | |
| sec-Butylbenzene | 0.0798 | 0.00200 | " | 0.100 | ND | 79.8 | 70-130 | 3.08 | 20 | |
| Styrene | 0.0849 | 0.00200 | " | 0.100 | ND | 84.9 | 70-130 | 1.59 | 20 | |
| tert-Butylbenzene | 0.0818 | 0.00200 | " | 0.100 | ND | 81.8 | 70-130 | 2.06 | 20 | |
| Tetrachloroethene | 0.0818 | 0.00200 | " | 0.100 | ND | 81.8 | 70-130 | 1.23 | 20 | |
| Toluene | 0.0834 | 0.00200 | " | 0.100 | ND | 83.4 | 70-130 | 2.43 | 20 | |
| trans-1,2-Dichloroethene | 0.0923 | 0.00200 | " | 0.100 | ND | 92.3 | 70-130 | 2.06 | 20 | |
| trans-1,3-Dichloropropene | 0.0965 | 0.00200 | " | 0.100 | ND | 96.5 | 70-130 | 0.785 | 20 | |
| Trichloroethene | 0.0888 | 0.00200 | " | 0.100 | ND | 88.8 | 70-130 | 0.0675 | 20 | |
| Trichlorofluoromethane | 0.0962 | 0.00300 | " | 0.100 | ND | 96.2 | 70-130 | 4.79 | 20 | |
| Vinyl chloride | 0.0919 | 0.00200 | " | 0.100 | ND | 91.9 | 70-130 | 3.90 | 20 | |
| *Surrogate: 1,2-Dichloroethane-d4* | *61* | | *ug/L* | *62.5* | | *96.8* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *59* | | *"* | *62.5* | | *94.8* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *61* | | *"* | *62.5* | | *97.5* | *70-130* | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|

## PAH by 8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641584 - SW846 3541** | | | | | | | | | | |
| **BLANK (1203733632-BLK)** | | | | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | |
| Pyrene | ND | 0.00331 | mg/kg | | | | - | | | U |
| Chrysene | ND | 0.00331 | " | | | | - | | | U |
| Fluorene | ND | 0.00331 | " | | | | - | | | U |
| Fluoranthene | ND | 0.00331 | " | | | | - | | | U |
| Acenaphthene | ND | 0.00331 | " | | | | - | | | U |
| Naphthalene | ND | 0.00331 | " | | | | - | | | U |
| Acenaphthylene | ND | 0.00331 | " | | | | - | | | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.00331 | " | | | | - | | | U |
| Anthracene | ND | 0.00331 | " | | | | - | | | U |
| Benzo(a)anthracene | ND | 0.00331 | " | | | | - | | | U |
| Benzo(a)pyrene | ND | 0.00331 | " | | | | - | | | U |
| Benzo(b)fluoranthene | ND | 0.00331 | " | | | | - | | | U |
| Benzo(ghi)perylene | ND | 0.00331 | " | | | | - | | | U |
| Benzo(k)fluoranthene | ND | 0.00331 | " | | | | - | | | U |
| Phenanthrene | ND | 0.00331 | " | | | | - | | | U |
| Dibenzo(a,h)anthracene | ND | 0.00331 | " | | | | - | | | U |
| *Surrogate: 5-alpha-Androstane* | *0.128* | | *"* | *0.166* | | *78* | *30-118* | | | |
| **LCS (1203733633-BKS)** | | | | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | |
| Pyrene | 0.281 | 0.00333 | mg/kg | 0.333 | | 84 | 41-114 | | | |
| Acenaphthene | 0.243 | 0.00333 | " | 0.333 | | 73 | 55-99 | | | |

Origins Laboratory, Inc.

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PAH by 8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641584 - SW846 3541** | | | | | | | | | | |
| **LCS (1203733633-BKS)** | | | | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | |
| Acenaphthylene | 0.264 | 0.00333 | mg/kg | 0.333 | | 79 | 48-107 | | | |
| Anthracene | 0.284 | 0.00333 | " | 0.333 | | 85 | 52-102 | | | |
| Benzo(a)anthracene | 0.302 | 0.00333 | " | 0.333 | | 91 | 51-108 | | | |
| Benzo(a)pyrene | 0.334 | 0.00333 | " | 0.333 | | 100 | 35-121 | | | |
| Benzo(b)fluoranthene | 0.337 | 0.00333 | " | 0.333 | | 101 | 36-120 | | | |
| Benzo(k)fluoranthene | 0.294 | 0.00333 | " | 0.333 | | 88 | 26-121 | | | |
| Dibenzo(a,h)anthracene | 0.405 | 0.00333 | " | 0.333 | | 122 | 35-142 | | | |
| Fluoranthene | 0.273 | 0.00333 | " | 0.333 | | 82 | 39-108 | | | |
| Fluorene | 0.281 | 0.00333 | " | 0.333 | | 84 | 47-106 | | | |
| Indeno(1,2,3-cd)pyrene | 0.401 | 0.00333 | " | 0.333 | | 120 | 41-130 | | | |
| Phenanthrene | 0.252 | 0.00333 | " | 0.333 | | 76 | 53-97 | | | |
| Benzo(ghi)perylene | 0.347 | 0.00333 | " | 0.333 | | 104 | 39-119 | | | |
| Naphthalene | 0.239 | 0.00333 | " | 0.333 | | 72 | 57-98 | | | |
| Chrysene | 0.277 | 0.00333 | " | 0.333 | | 83 | 54-103 | | | |
| *Surrogate: 5-alpha-Androstane* | *0.138* | | *"* | *0.166* | | *83* | *30-118* | | | |
| **MS (1203733634 S)** | | **Source: X702346-01** | | | Prepared: 02/23/2017 Analyzed: 02/24/2017 | | | | | |
| Naphthalene | 0.160 | 0.00343 | mg/kg | 0.343 | <0.00103 | 47 | 33-117 | | | |
| Indeno(1,2,3-cd)pyrene | 0.357 | 0.00343 | " | 0.343 | <0.00172 | 104 | 17-133 | | | |
| Fluorene | 0.215 | 0.00343 | " | 0.343 | <0.00172 | 63 | 33-123 | | | |
| Fluoranthene | 0.259 | 0.00343 | " | 0.343 | <0.00172 | 75 | 28-116 | | | |
| Acenaphthene | 0.175 | 0.00343 | " | 0.343 | <0.00172 | 51 | 38-117 | | | |
| Dibenzo(a,h)anthracene | 0.358 | 0.00343 | " | 0.343 | <0.00172 | 104 | 18-146 | | | |
| Anthracene | 0.244 | 0.00343 | " | 0.343 | <0.00172 | 71 | 36-120 | | | |
| Pyrene | 0.279 | 0.00343 | " | 0.343 | <0.00172 | 81 | 30-131 | | | |
| Benzo(a)anthracene | 0.295 | 0.00343 | " | 0.343 | <0.00172 | 86 | 41-118 | | | |
| Benzo(a)pyrene | 0.321 | 0.00343 | " | 0.343 | <0.00172 | 94 | 27-126 | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PAH by 8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641584 - SW846 3541** | | | | | | | | | | |
| **MS (1203733634 S)** | | **Source: X702346-01** | | | Prepared: 02/23/2017 Analyzed: 02/24/2017 | | | | | |
| Benzo(b)fluoranthene | 0.325 | 0.00343 | mg/kg | 0.343 | <0.00172 | 95 | 28-126 | | | |
| Benzo(ghi)perylene | 0.272 | 0.00343 | " | 0.343 | <0.00172 | 79 | 17-118 | | | |
| Benzo(k)fluoranthene | 0.288 | 0.00343 | " | 0.343 | <0.00172 | 84 | 24-122 | | | |
| Chrysene | 0.271 | 0.00343 | " | 0.343 | <0.00172 | 79 | 42-113 | | | |
| Acenaphthylene | 0.188 | 0.00343 | " | 0.343 | <0.00172 | 55 | 39-116 | | | |
| Phenanthrene | 0.214 | 0.00343 | " | 0.343 | 0.00206 | 62 | 35-119 | | | |
| *Surrogate: 5-alpha-Androstane* | *0.123* | | *"* | *0.172* | *0.143* | *72* | *30-118* | | | |
| **MSD (1203733635 SD)** | | **Source: X702346-01** | | | Prepared: 02/23/2017 Analyzed: 02/24/2017 | | | | | |
| Benzo(ghi)perylene | 0.259 | 0.00343 | mg/kg | 0.343 | <0.00172 | 76 | 17-118 | 5 | 30 | |
| Pyrene | 0.269 | 0.00343 | " | 0.343 | <0.00172 | 78 | 30-131 | 3 | 30 | |
| Phenanthrene | 0.257 | 0.00343 | " | 0.343 | 0.00206 | 74 | 35-119 | 18 | 30 | |
| Naphthalene | 0.232 | 0.00343 | " | 0.343 | <0.00103 | 68 | 33-117 | 37 | 30 | |
| Indeno(1,2,3-cd)pyrene | 0.353 | 0.00343 | " | 0.343 | <0.00172 | 103 | 17-133 | 1 | 30 | |
| Fluorene | 0.285 | 0.00343 | " | 0.343 | <0.00172 | 83 | 33-123 | 28 | 30 | |
| Fluoranthene | 0.288 | 0.00343 | " | 0.343 | <0.00172 | 83 | 28-116 | 11 | 30 | |
| Chrysene | 0.282 | 0.00343 | " | 0.343 | <0.00172 | 82 | 42-113 | 4 | 30 | |
| Benzo(a)pyrene | 0.335 | 0.00343 | " | 0.343 | <0.00172 | 98 | 27-126 | 4 | 30 | |
| Benzo(a)anthracene | 0.306 | 0.00343 | " | 0.343 | <0.00172 | 89 | 41-118 | 4 | 30 | |
| Anthracene | 0.286 | 0.00343 | " | 0.343 | <0.00172 | 83 | 36-120 | 16 | 30 | |
| Acenaphthylene | 0.260 | 0.00343 | " | 0.343 | <0.00172 | 76 | 39-116 | 32 | 30 | |
| Acenaphthene | 0.241 | 0.00343 | " | 0.343 | <0.00172 | 70 | 38-117 | 32 | 30 | |
| Benzo(b)fluoranthene | 0.348 | 0.00343 | " | 0.343 | <0.00172 | 101 | 28-126 | 7 | 30 | |
| Dibenzo(a,h)anthracene | 0.358 | 0.00343 | " | 0.343 | <0.00172 | 104 | 18-146 | 0 | 30 | |
| Benzo(k)fluoranthene | 0.308 | 0.00343 | " | 0.343 | <0.00172 | 90 | 24-122 | 7 | 30 | |
| *Surrogate: 5-alpha-Androstane* | *0.133* | | *"* | *0.172* | *0.143* | *78* | *30-118* | | | |

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PCB by 8082A - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1642102 - SW846 3541** | | | | | | | | | | |
| **BLANK (1203734672-BLK)** | | | | | Prepared: 02/24/2017 Analyzed: 02/27/2017 | | | | | |
| Aroclor-Total | ND | 0.00333 | mg/kg | | | | - | | | U |
| Aroclor-1260 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1254 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1248 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1242 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1232 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1221 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1016 | ND | 0.00333 | " | | | | - | | | U |
| *Surrogate: 4cmx* | *0.00437* | | " | *0.00666* | | *66* | *30-120* | | | |
| *Surrogate: Decachlorobiphenyl* | *0.00489* | | " | *0.00666* | | *73* | *32-139* | | | |
| **LCS (1203734673-BKS)** | | | | | Prepared: 02/24/2017 Analyzed: 02/27/2017 | | | | | |
| Aroclor-1016 | 0.0226 | 0.00333 | mg/kg | 0.0333 | | 68 | 48-93 | | | |
| Aroclor-1260 | 0.0194 | 0.00333 | " | 0.0333 | | 58 | 58-117 | | | |
| *Surrogate: 4cmx* | *0.00459* | | " | *0.00666* | | *69* | *30-120* | | | |
| *Surrogate: Decachlorobiphenyl* | *0.00457* | | " | *0.00666* | | *69* | *32-139* | | | |
| **MS (1203734674 S)** | | **Source: 417238005** | | | Prepared: 02/24/2017 Analyzed: 02/27/2017 | | | | | |
| Aroclor-1016 | 0.110 | 0.0472 | mg/kg | 0.0944 | <0.0157 | 117 | 23-121 | | | J |
| Aroclor-1260 | 0.639 | 0.0472 | " | 0.0944 | <0.0157 | 677 | 35-135 | | | J |
| *Surrogate: 4cmx* | *0.011* | | " | *0.0189* | *0.0105* | *58* | *30-120* | | | |
| *Surrogate: Decachlorobiphenyl* | *0.0116* | | " | *0.0189* | *0.0114* | *61* | *32-139* | | | |
| **MSD (1203734675 SD)** | | **Source: 417238005** | | | Prepared: 02/24/2017 Analyzed: 02/27/2017 | | | | | |
| Aroclor-1260 | 0.205 | 0.0496 | mg/kg | 0.0992 | <0.0165 | 206 | 35-135 | 103 | 33 | J |
| Aroclor-1016 | 0.110 | 0.0496 | " | 0.0992 | <0.0165 | 111 | 23-121 | 0 | 29 | J |
| *Surrogate: Decachlorobiphenyl* | *0.0194* | | " | *0.0198* | *0.0114* | *98* | *32-139* | | | |
| *Surrogate: 4cmx* | *0.012* | | " | *0.0198* | *0.0105* | *60* | *30-120* | | | |

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PCB by 8082A - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1642102 - SW846 3541** | | | | | | | | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## TCLP Metals by 1311/6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641827 - SW846 3010A** | | | | | | | | | | |
| **MS (1203733415 S)** | | **Source: X702346-01** | | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | |
| Lead | 4.65 | 0.100 | mg/L | 5.00 | <0.033 | 92.8 | 75-125 | | | |
| **TB (1203733416-BLK)** | | | | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | |
| Lead | 0.0605 | 0.100 | mg/L | | | | - | | | J |
| **BLANK (1203734080-BLK)** | | | | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | |
| Lead | 0.036 | 0.100 | mg/L | | | | - | | | J |
| **LCS (1203734081-BKS)** | | | | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | |
| Lead | 4.67 | 0.100 | mg/L | 5.00 | | 93.5 | 80-120 | | | |
| **DUP (1203734082 D)** | | **Source: X702346-01** | | | Prepared: 02/23/2017 Analyzed: 02/23/2017 | | | | | |
| Lead | ND | 0.100 | mg/L | | <0.033 | | 0-20 | 99.9 | 20 | U |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Total Metals by 6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641481 - SW846 3050B** | | | | | | | | | | |
| **BLANK (1203733417-BLK)** | | | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |
| Silver | ND | 0.490 | mg/kg | | | | - | | | U |
| Selenium | ND | 2.94 | " | | | | - | | | U |
| Lead | ND | 0.980 | " | | | | - | | | U |
| Chromium | ND | 0.490 | " | | | | - | | | U |
| Cadmium | ND | 0.490 | " | | | | - | | | U |
| Barium | ND | 0.490 | " | | | | - | | | U |
| Arsenic | ND | 2.94 | " | | | | - | | | U |
| **LCS (1203733418-BKS)** | | | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |
| Arsenic | 47.0 | 2.82 | mg/kg | 47.1 | | 99.9 | 80-120 | | | |
| Lead | 47.1 | 0.942 | " | 47.1 | | 100 | 80-120 | | | |
| Chromium | 46.1 | 0.471 | " | 47.1 | | 97.9 | 80-120 | | | |
| Selenium | 49.2 | 2.82 | " | 47.1 | | 104 | 80-120 | | | |
| Silver | 47.8 | 0.471 | " | 47.1 | | 102 | 80-120 | | | |
| Barium | 45.7 | 0.471 | " | 47.1 | | 97.1 | 80-120 | | | |
| Cadmium | 45.9 | 0.471 | " | 47.1 | | 97.4 | 80-120 | | | |
| **DUP (1203733419 D)** | | **Source: X702346-01** | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |
| Cadmium | ND | 0.495 | mg/kg | | <0.099 | | 0-20 | 13.1 | 20 | U |
| Arsenic | 1.16 | 2.97 | " | | 1.11 | | 0-20 | 3.99 | 20 | J |
| Barium | 23.5 | 0.495 | " | | 27.2 | | 0-20 | 14.6 | 20 | |
| Chromium | 10.1 | 0.495 | " | | 8.25 | | 0-20 | 20.3 | 20 | |
| Lead | 4.14 | 0.990 | " | | 4.76 | | 0-20 | 14 | 20 | |
| Selenium | ND | 2.97 | " | | <0.495 | | 0-20 | 29.2 | 20 | U |
| Silver | ND | 0.495 | " | | <0.099 | | 0-20 | 0.343 | 20 | U |
| **MS (1203733420 S)** | | **Source: X702346-01** | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |

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Jen Pellegrini For Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Total Metals by 6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641481 - SW846 3050B** | | | | | | | | | | |
| **MS (1203733420 S)** | | **Source: X702346-01** | | | Prepared: 02/22/2017 Analyzed: 02/23/2017 | | | | | |
| Selenium | 52.3 | 3.06 | mg/kg | 51.1 | <0.511 | 102 | 75-125 | | | |
| Silver | 52.5 | 0.511 | " | 51.1 | <0.102 | 103 | 75-125 | | | |
| Arsenic | 51.1 | 3.06 | " | 51.1 | 1.11 | 97.8 | 75-125 | | | |
| Barium | 71.8 | 0.511 | " | 51.1 | 27.2 | 87.3 | 75-125 | | | |
| Cadmium | 48.7 | 0.511 | " | 51.1 | <0.102 | 95.3 | 75-125 | | | |
| Chromium | 54.5 | 0.511 | " | 51.1 | 8.25 | 90.6 | 75-125 | | | |
| Lead | 53.1 | 1.02 | " | 51.1 | 4.76 | 94.7 | 75-125 | | | |

Origins Laboratory, Inc.

Jen Pellegrini

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Total Metals by 7471A - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641836 - SW846 7471A Prep** | | | | | | | | | | |
| **BLANK (1203734114-BLK)** | | | | | Prepared: 02/23/2017 Analyzed: 02/24/2017 | | | | | |
| Mercury | ND | 0.0117 | mg/kg | | | | - | | | U |
| **LCS (1203734115-BKS)** | | | | | Prepared: 02/23/2017 Analyzed: 02/24/2017 | | | | | |
| Mercury | 0.112 | 0.0118 | mg/kg | 0.118 | | 95.1 | 80-120 | | | |
| **DUP (1203734116 D)** | | **Source: 416893019** | | | Prepared: 02/23/2017 Analyzed: 02/24/2017 | | | | | |
| Mercury | 0.0422 | 0.0133 | mg/kg | | 0.027 | | 0-20 | 43.8 | 20 | |
| **MS (1203734117 S)** | | **Source: 416893019** | | | Prepared: 02/23/2017 Analyzed: 02/24/2017 | | | | | |
| Mercury | 0.171 | 0.0131 | mg/kg | 0.131 | 0.027 | 110 | 80-120 | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Notes and Definitions

| | |
|---|---|
| Ua | Sample is Non-Detect. |
| U | Result not detected above the detection limit |
| QR-03 | The RPD value for the sample duplicate or MS/MSD was outside of QC acceptance limits due to matrix interference. QC batch accepted based on LCS and/or LCSD recovery and/or RPD values. |
| QM-07 | The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery. |
| J | Greater than the detection limit but less than the reporting limit |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| RPD | Relative Percent Difference |

All soil results are reported on a wet weight basis.

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

February 28, 2017

Pinyon

Julie Linn

9100 West Jewell Avenue, Suite 200

Lakewood CO 80232

**Project Name - 27th St. Storm Drain** **Project Number - 11780301.2100**

Attached are your analytical results for 27th St. Storm Drain received by Origins Laboratory, Inc. February 22, 2017. This project is associated with Origins project number X702367-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com

THE NELAC INSTITUTE

ACCREDITED
TESTING CERT # 3494.01

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## CROSS REFERENCE REPORT

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| B-12 | X702367-01 | Soil | February 22, 2017 9:30 | 02/22/2017 14:20 |
| B-14 | X702367-02 | Soil | February 22, 2017 10:40 | 02/22/2017 14:20 |
| B-15 | X702367-03 | Soil | February 22, 2017 11:30 | 02/22/2017 14:20 |
| B-16 | X702367-04 | Soil | February 22, 2017 13:00 | 02/22/2017 14:20 |

Origins Laboratory, Inc.

Jen Pellegrini

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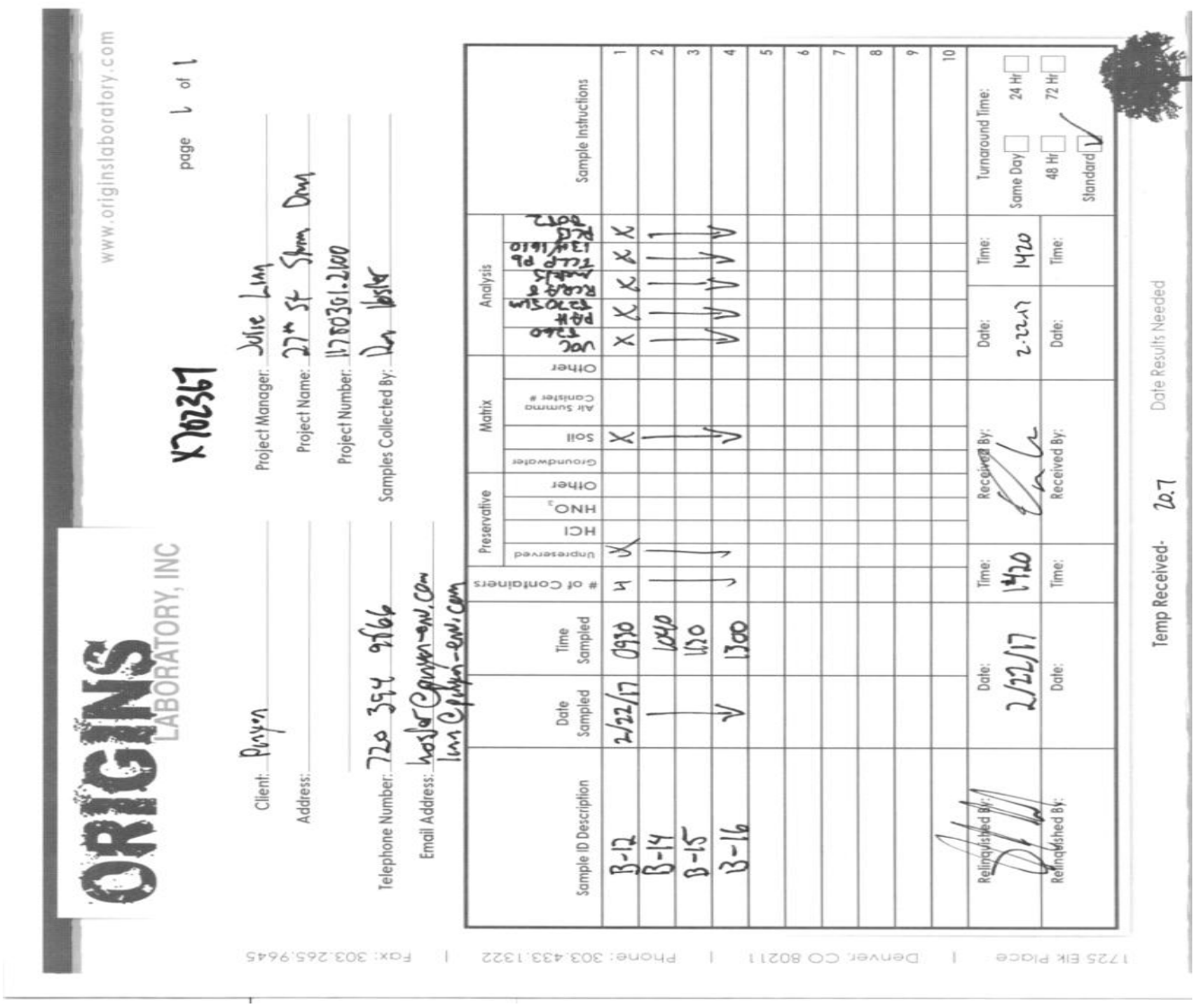
ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain



ORIGINS LABORATORY, INC

www.originslaboratory.com

page 1 of 1

X702367

Client: Pinyon
Address:
Telephone Number: 720 394 9766
Email Address: hosler@pinyon-env.com lnn@pinyon-env.com

Project Manager: Julie Linn
Project Name: 27th St Storm Drain
Project Number: 11780301.2100
Samples Collected By: Dan Hosler

| Sample ID Description | Date Sampled | Time Sampled | # of Containers | Preservative: Unpreserved | Preservative: HCl | Preservative: $HNO_3$ | Preservative: Other | Matrix: Groundwater | Matrix: Soil | Matrix: Air Summa Canister # | Matrix: Other | Analysis: VOC 8260 | Analysis: PAH 8270 SIM | Analysis: RCRA 8 Metals | Analysis: TCLP Pb 13H/1610 | Analysis: RCI 8082 | Sample Instructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-12 | 2/22/17 | 0930 | 4 | X | | | | | X | | | X | X | X | X | X | 1 |
| B-14 | | 1040 | | | | | | | | | | | | | | | 2 |
| B-15 | | 1120 | | | | | | | | | | | | | | | 3 |
| B-16 | | 1300 | | | | | | | | | | | | | | | 4 |
| | | | | | | | | | | | | | | | | | 5 |
| | | | | | | | | | | | | | | | | | 6 |
| | | | | | | | | | | | | | | | | | 7 |
| | | | | | | | | | | | | | | | | | 8 |
| | | | | | | | | | | | | | | | | | 9 |
| | | | | | | | | | | | | | | | | | 10 |

| Relinquished By: | Date: | Time: | Received By: | Date: | Time: |
|---|---|---|---|---|---|
| | 2/22/17 | 1420 | | 2.22.17 | 1420 |
| Relinquished By: | Date: | Time: | Received By: | Date: | Time: |

Turnaround Time: Same Day ☐ 24 Hr ☐ 48 Hr ☐ 72 Hr ☐ Standard ☑

Temp Received- 20.7

Date Results Needed

1725 Elk Place | Denver, CO 80211 | Phone: 303.433.1322 | Fax: 303.265.9645

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

Origins Laboratory

F-012207-01-R1
Effective Date: 01/09/12

**Sample Receipt Checklist**

Origins Work Order: X702367

Client: Pinyon

Client Project ID: 27th St Storm Drain

Checklist Completed by: Dan Lee

Date/time completed: 2-22-17 1509

Shipped Via: _____ (UPS, FedEx, Hand Delivered, Pick-up, etc.)

Airbill #: _____

Matrix(s) Received: (Check all that apply): / Soil/Solid ____ Water ____ Other: _____ (Describe)

Cooler Number/Temperature: 1 / 20.7 °C ____/____ °C ____/____ °C ____/____ °C

Thermometer ID: T003

| Requirement Description | Yes | No | N/A | Comments (if any) |
|---|---|---|---|---|
| If samples require cooling, was the temperature between 0°C to ≤ 6°C[1]? | | / | | Sampled Same Day |
| Is there ice present (document if blue ice is used) | | / | | |
| Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact) | | / | | |
| Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact) | | / | | |
| Were all samples received intact[1]? | / | | | |
| Was adequate sample volume provided[1]? | / | | | |
| Are short holding time analytes or samples with HTs due within 48 hours present[1]? | | / | | |
| Is a chain-of-custody (COC) present and filled out completely[1]? | / | | | |
| Does the COC agree with the number and type of sample bottles received[1]? | / | | | |
| Do the sample IDs on the bottle labels match the COC[1]? | / | | | |
| Is the COC properly relinquished by the client with date and time recorded[1]? | / | | | |
| For volatiles in water – is there headspace (> ¼ inch bubble) present? **If yes, contact client and note in narrative.** | | | / | |
| Are samples preserved that require preservation and was it checked[1]? *(note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)/(pH <2 for samples preserved with HNO3, HCL, H2SO4) / ( pH >10 for samples preserved with NaAsO2+NaOH, ZnAc+NaOH)* | | / | | |
| Additional Comments (if any): | | | | |

[1] *If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.*

Reviewed by (Project Manager) [signature] Date/Time Reviewed 2/23/17

Origins Laboratory, Inc.

Jen Pellegrini

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-12**
**2/22/2017 9:30:00AM**

## GEL Laboratories, LLC
**X702367-01 (Soil)**

### PAH by 8270D SIM

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | 0.00178 | 0.00356 | mg/kg | 1 | 1642119 | 02/24/2017 | 02/27/2017 | U |
| Acenaphthylene | ND | 0.00178 | 0.00356 | " | " | " | " | " | U |
| Anthracene | ND | 0.00178 | 0.00356 | " | " | " | " | " | U |
| Benzo(a)anthracene | ND | 0.00178 | 0.00356 | " | " | " | " | " | U |
| Benzo(a)pyrene | ND | 0.00178 | 0.00356 | " | " | " | " | " | U |
| Benzo(b)fluoranthene | ND | 0.00178 | 0.00356 | " | " | " | " | " | U |
| Benzo(ghi)perylene | ND | 0.00178 | 0.00356 | " | " | " | " | " | U |
| Benzo(k)fluoranthene | ND | 0.00178 | 0.00356 | " | " | " | " | " | U |
| Chrysene | ND | 0.00178 | 0.00356 | " | " | " | " | " | U |
| Dibenzo(a,h)anthracene | ND | 0.00178 | 0.00356 | " | " | " | " | " | U |
| Fluoranthene | ND | 0.00178 | 0.00356 | " | " | " | " | " | U |
| Fluorene | ND | 0.00178 | 0.00356 | " | " | " | " | " | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.00178 | 0.00356 | " | " | " | " | " | U |
| Naphthalene | ND | 0.00107 | 0.00356 | " | " | " | " | " | U |
| Phenanthrene | ND | 0.00178 | 0.00356 | " | " | " | " | " | U |
| Pyrene | ND | 0.00178 | 0.00356 | " | " | " | " | " | U |
| *Surrogate: 5-alpha-Androstane* | *89 %* | | *30-118* | | | " | " | " | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-12**
**2/22/2017 9:30:00AM**

## GEL Laboratories, LLC
**X702367-01 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **PCB by 8082A** | | | | | | | | | |
| Aroclor-1016 | ND | 0.00119 | 0.00356 | mg/kg | 1 | 1642102 | 02/24/2017 | 02/27/2017 | U |
| Aroclor-1221 | ND | 0.00119 | 0.00356 | " | " | " | " | " | U |
| Aroclor-1232 | ND | 0.00119 | 0.00356 | " | " | " | " | " | U |
| Aroclor-1242 | ND | 0.00119 | 0.00356 | " | " | " | " | " | U |
| Aroclor-1248 | ND | 0.00119 | 0.00356 | " | " | " | " | " | U |
| Aroclor-1254 | ND | 0.00119 | 0.00356 | " | " | " | " | " | U |
| Aroclor-1260 | ND | 0.00119 | 0.00356 | " | " | " | " | " | U |
| Aroclor-Total | ND | 0.00119 | 0.00356 | " | " | " | " | " | U |
| *Surrogate: 4cmx* | *57 %* | | *30-120* | | | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | *66 %* | | *32-139* | | | " | " | " | |
| **TCLP Metals by 1311/6010C** | | | | | | | | | |
| Lead | ND | 0.033 | 0.100 | mg/L | 1 | 1642341 | " | 02/27/2017 | U |
| **Total Metals by 6010C** | | | | | | | | | |
| Arsenic | **2.80** | **0.506** | 3.04 | mg/kg | 1 | 1641878 | 02/23/2017 | 02/24/2017 | J |
| Barium | **42.8** | **0.101** | 0.506 | " | " | " | " | " | |
| Cadmium | ND | 0.101 | 0.506 | " | " | " | " | " | U |
| Chromium | **5.93** | **0.152** | 0.506 | " | " | " | " | " | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-12**
**2/22/2017 9:30:00AM**

## GEL Laboratories, LLC
**X702367-01 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Total Metals by 6010C** | | | | | | | | | |
| Lead | **4.62** | **0.334** | 1.01 | mg/kg | 1 | 1641878 | 02/23/2017 | 02/24/2017 | |
| Selenium | ND | 0.506 | 3.04 | " | " | " | " | " | U |
| Silver | ND | 0.101 | 0.506 | " | " | " | " | " | U |
| **Total Metals by 7471A** | | | | | | | | | |
| Mercury | **0.0133** | **0.00413** | 0.0123 | mg/kg | 1 | 1642214 | 02/24/2017 | 02/28/2017 | |
| **VOC by EPA 8260C** | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| 1,1,1-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2,2-Tetrachloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2,3-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,3-Trichloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dibromo-3-chloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |

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Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-12**
**2/22/2017 9:30:00AM**

**Origins Laboratory, Inc.**
**X702367-01 (Soil)**

## VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dibromoethane (EDB) | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| 1,2-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3,5-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,4-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Butanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 2-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Hexanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 4-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Isopropyltoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Methyl-2-pentanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| Acetone | ND | | 0.0200 | " | " | " | " | " | Ua |
| Benzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromodichloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |

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Jen Pellegrini For Noelle Doyle Mathis, President

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-12**
**2/22/2017 9:30:00AM**

**Origins Laboratory, Inc.**
**X702367-01 (Soil)**

## VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Bromoform | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| Bromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Carbon disulfide | ND | | 0.00500 | " | " | " | " | " | Ua |
| Carbon tetrachloride | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloroethane | ND | | 0.00500 | " | " | " | " | " | Ua |
| Chloroform | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Ethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Hexachlorobutadiene | ND | | 0.00500 | " | " | " | " | " | Ua |
| Iodomethane | ND | | 0.0150 | " | " | " | " | " | Ua |
| Isopropylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| m,p-Xylene | ND | | 0.00400 | " | " | " | " | " | Ua |
| Methyl tert-Butyl Ether | ND | | 0.00200 | " | " | " | " | " | Ua |
| Methylene Chloride | ND | | 0.0200 | " | " | " | " | " | Ua |
| Naphthalene | ND | | 0.0100 | " | " | " | " | " | Ua |

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-12**
**2/22/2017 9:30:00AM**

## Origins Laboratory, Inc.
**X702367-01 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| n-Butylbenzene | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| n-Propylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| o-Xylene | ND | | 0.00200 | " | " | " | " | " | Ua |
| sec-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Styrene | ND | | 0.00200 | " | " | " | " | " | Ua |
| tert-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Tetrachloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Toluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichlorofluoromethane | ND | | 0.00300 | " | " | " | " | " | Ua |
| Vinyl chloride | ND | | 0.00200 | " | " | " | " | " | Ua |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 1,2-Dichloroethane-d4* | *100 %* | *70-130* | " | " | " |
| *Surrogate: Toluene-d8* | *96.4 %* | *70-130* | " | " | " |
| *Surrogate: 4-Bromofluorobenzene* | *98.0 %* | *70-130* | " | " | " |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-14**
**2/22/2017 10:40:00AM**

## GEL Laboratories, LLC
**X702367-02 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **PAH by 8270D SIM** | | | | | | | | | |
| Acenaphthene | **0.00286** | **0.00179** | 0.00358 | mg/kg | 1 | 1642119 | 02/24/2017 | 02/24/2017 | J |
| Acenaphthylene | ND | 0.00179 | 0.00358 | " | " | " | " | " | U |
| Anthracene | **0.00966** | **0.00179** | 0.00358 | " | " | " | " | " | |
| Benzo(a)anthracene | **0.054** | **0.00179** | 0.00358 | " | " | " | " | " | |
| Benzo(a)pyrene | **0.0659** | **0.00179** | 0.00358 | " | " | " | " | " | |
| Benzo(b)fluoranthene | **0.0863** | **0.00179** | 0.00358 | " | " | " | " | " | |
| Benzo(ghi)perylene | **0.0462** | **0.00179** | 0.00358 | " | " | " | " | " | |
| Benzo(k)fluoranthene | **0.0286** | **0.00179** | 0.00358 | " | " | " | " | " | |
| Chrysene | **0.0551** | **0.00179** | 0.00358 | " | " | " | " | " | |
| Dibenzo(a,h)anthracene | **0.0122** | **0.00179** | 0.00358 | " | " | " | " | " | |
| Fluoranthene | **0.088** | **0.00179** | 0.00358 | " | " | " | " | " | |
| Fluorene | **0.00286** | **0.00179** | 0.00358 | " | " | " | " | " | J |
| Indeno(1,2,3-cd)pyrene | **0.0569** | **0.00179** | 0.00358 | " | " | " | " | " | |
| Naphthalene | **0.00251** | **0.00107** | 0.00358 | " | " | " | " | " | J |
| Phenanthrene | **0.0444** | **0.00179** | 0.00358 | " | " | " | " | " | B |
| Pyrene | **0.121** | **0.00179** | 0.00358 | " | " | " | " | " | |
| *Surrogate: 5-alpha-Androstane* | *72 %* | | *30-118* | | | " | " | " | |
| **PCB by 8082A** | | | | | | | | | |
| Aroclor-1016 | ND | 0.00119 | 0.00357 | mg/kg | 1 | 1642102 | " | 02/27/2017 | U |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-14**
**2/22/2017 10:40:00AM**

## GEL Laboratories, LLC
**X702367-02 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **PCB by 8082A** | | | | | | | | | |
| Aroclor-1221 | ND | 0.00119 | 0.00357 | mg/kg | 1 | 1642102 | 02/24/2017 | 02/27/2017 | U |
| Aroclor-1232 | ND | 0.00119 | 0.00357 | " | " | " | " | " | U |
| Aroclor-1242 | ND | 0.00119 | 0.00357 | " | " | " | " | " | U |
| Aroclor-1248 | ND | 0.00119 | 0.00357 | " | " | " | " | " | U |
| Aroclor-1254 | ND | 0.00119 | 0.00357 | " | " | " | " | " | U |
| Aroclor-1260 | ND | 0.00119 | 0.00357 | " | " | " | " | " | U |
| Aroclor-Total | ND | 0.00119 | 0.00357 | " | " | " | " | " | U |
| *Surrogate: 4cmx* | *55 %* | | *30-120* | | | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | *37 %* | | *32-139* | | | " | " | " | |
| **TCLP Metals by 1311/6010C** | | | | | | | | | |
| Lead | **0.0541** | **0.033** | 0.100 | mg/L | 1 | 1642341 | " | 02/27/2017 | J |
| **Total Metals by 6010C** | | | | | | | | | |
| Arsenic | **5.55** | **0.520** | 3.12 | mg/kg | 1 | 1641878 | 02/23/2017 | 02/24/2017 | |
| Barium | **124** | **0.104** | 0.520 | " | " | " | " | " | |
| Cadmium | **0.258** | **0.104** | 0.520 | " | " | " | " | " | J |
| Chromium | **7.56** | **0.156** | 0.520 | " | " | " | " | " | |
| Lead | **63.4** | **0.343** | 1.04 | " | " | " | " | " | |

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**B-14**
**2/22/2017 10:40:00AM**

## GEL Laboratories, LLC
**X702367-02 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Total Metals by 6010C** | | | | | | | | | |
| Selenium | ND | 0.520 | 3.12 | mg/kg | 1 | 1641878 | 02/23/2017 | 02/24/2017 | U |
| Silver | ND | 0.104 | 0.520 | " | " | " | " | " | U |
| **Total Metals by 7471A** | | | | | | | | | |
| Mercury | **0.0753** | **0.0043** | 0.0128 | mg/kg | 1 | 1642214 | 02/24/2017 | 02/28/2017 | |
| **VOC by EPA 8260C** | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| 1,1,1-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2,2-Tetrachloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2,3-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,3-Trichloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dibromo-3-chloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2-Dibromoethane (EDB) | ND | | 0.00200 | " | " | " | " | " | Ua |

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## Origins Laboratory, Inc.
**X702367-02 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dichlorobenzene | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| 1,2-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3,5-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,4-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Butanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 2-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Hexanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 4-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Isopropyltoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Methyl-2-pentanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| Acetone | ND | | 0.0200 | " | " | " | " | " | Ua |
| Benzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromodichloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromoform | ND | | 0.00200 | " | " | " | " | " | Ua |

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**Origins Laboratory, Inc.**
**X702367-02 (Soil)**

## VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Bromomethane | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| Carbon disulfide | ND | | 0.00500 | " | " | " | " | " | Ua |
| Carbon tetrachloride | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloroethane | ND | | 0.00500 | " | " | " | " | " | Ua |
| Chloroform | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Ethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Hexachlorobutadiene | ND | | 0.00500 | " | " | " | " | " | Ua |
| Iodomethane | ND | | 0.0150 | " | " | " | " | " | Ua |
| Isopropylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| m,p-Xylene | ND | | 0.00400 | " | " | " | " | " | Ua |
| Methyl tert-Butyl Ether | ND | | 0.00200 | " | " | " | " | " | Ua |
| Methylene Chloride | ND | | 0.0200 | " | " | " | " | " | Ua |
| Naphthalene | ND | | 0.0100 | " | " | " | " | " | Ua |
| n-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |

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**B-14**
**2/22/2017 10:40:00AM**

## Origins Laboratory, Inc.
**X702367-02 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| n-Propylbenzene | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| o-Xylene | ND | | 0.00200 | " | " | " | " | " | Ua |
| sec-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Styrene | ND | | 0.00200 | " | " | " | " | " | Ua |
| tert-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Tetrachloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Toluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichlorofluoromethane | ND | | 0.00300 | " | " | " | " | " | Ua |
| Vinyl chloride | ND | | 0.00200 | " | " | " | " | " | Ua |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 1,2-Dichloroethane-d4* | *106 %* | *70-130* | " | " | " |
| *Surrogate: Toluene-d8* | *94.8 %* | *70-130* | " | " | " |
| *Surrogate: 4-Bromofluorobenzene* | *98.5 %* | *70-130* | " | " | " |

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Jen Pellegrini

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Pinyon
9100 West Jewell Avenue, Suite 200
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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-15**
**2/22/2017 11:30:00AM**

## GEL Laboratories, LLC
**X702367-03 (Soil)**

### PAH by 8270D SIM

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | 0.00174 | 0.00348 | mg/kg | 1 | 1642119 | 02/24/2017 | 02/27/2017 | U |
| Acenaphthylene | ND | 0.00174 | 0.00348 | " | " | " | " | " | U |
| Anthracene | ND | 0.00174 | 0.00348 | " | " | " | " | " | U |
| Benzo(a)anthracene | ND | 0.00174 | 0.00348 | " | " | " | " | " | U |
| Benzo(a)pyrene | ND | 0.00174 | 0.00348 | " | " | " | " | " | U |
| Benzo(b)fluoranthene | ND | 0.00174 | 0.00348 | " | " | " | " | " | U |
| Benzo(ghi)perylene | ND | 0.00174 | 0.00348 | " | " | " | " | " | U |
| Benzo(k)fluoranthene | ND | 0.00174 | 0.00348 | " | " | " | " | " | U |
| Chrysene | ND | 0.00174 | 0.00348 | " | " | " | " | " | U |
| Dibenzo(a,h)anthracene | ND | 0.00174 | 0.00348 | " | " | " | " | " | U |
| Fluoranthene | ND | 0.00174 | 0.00348 | " | " | " | " | " | U |
| Fluorene | ND | 0.00174 | 0.00348 | " | " | " | " | " | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.00174 | 0.00348 | " | " | " | " | " | U |
| Naphthalene | ND | 0.00104 | 0.00348 | " | " | " | " | " | U |
| Phenanthrene | ND | 0.00174 | 0.00348 | " | " | " | " | " | U |
| Pyrene | ND | 0.00174 | 0.00348 | " | " | " | " | " | U |
| *Surrogate: 5-alpha-Androstane* | *66 %* | | *30-118* | | | " | " | " | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-15**
**2/22/2017 11:30:00AM**

## GEL Laboratories, LLC
**X702367-03 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **PCB by 8082A** | | | | | | | | | |
| Aroclor-1016 | ND | 0.00116 | 0.00348 | mg/kg | 1 | 1642102 | 02/24/2017 | 02/27/2017 | U |
| Aroclor-1221 | ND | 0.00116 | 0.00348 | " | " | " | " | " | U |
| Aroclor-1232 | ND | 0.00116 | 0.00348 | " | " | " | " | " | U |
| Aroclor-1242 | ND | 0.00116 | 0.00348 | " | " | " | " | " | U |
| Aroclor-1248 | ND | 0.00116 | 0.00348 | " | " | " | " | " | U |
| Aroclor-1254 | ND | 0.00116 | 0.00348 | " | " | " | " | " | U |
| Aroclor-1260 | ND | 0.00116 | 0.00348 | " | " | " | " | " | U |
| Aroclor-Total | ND | 0.00116 | 0.00348 | " | " | " | " | " | U |
| *Surrogate: 4cmx* | *65 %* | | *30-120* | | | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | *63 %* | | *32-139* | | | " | " | " | |
| **TCLP Metals by 1311/6010C** | | | | | | | | | |
| Lead | **0.0334** | **0.033** | 0.100 | mg/L | 1 | 1642341 | " | 02/27/2017 | J |
| **Total Metals by 6010C** | | | | | | | | | |
| Arsenic | **1.14** | **0.498** | 2.99 | mg/kg | 1 | 1641878 | 02/23/2017 | 02/24/2017 | J |
| Barium | **25.7** | **0.0995** | 0.498 | " | " | " | " | " | |
| Cadmium | ND | 0.0995 | 0.498 | " | " | " | " | " | U |
| Chromium | **3.07** | **0.149** | 0.498 | " | " | " | " | " | |

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**B-15**
**2/22/2017 11:30:00AM**

## GEL Laboratories, LLC
**X702367-03 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Total Metals by 6010C** | | | | | | | | | |
| Lead | **1.90** | **0.328** | 0.995 | mg/kg | 1 | 1641878 | 02/23/2017 | 02/24/2017 | |
| Selenium | ND | 0.498 | 2.99 | " | " | " | " | " | U |
| Silver | ND | 0.0995 | 0.498 | " | " | " | " | " | U |
| **Total Metals by 7471A** | | | | | | | | | |
| Mercury | **0.0103** | **0.00414** | 0.0123 | mg/kg | 1 | 1642214 | 02/24/2017 | 02/28/2017 | J |
| **VOC by EPA 8260C** | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| 1,1,1-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2,2-Tetrachloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2,3-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,3-Trichloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dibromo-3-chloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |

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**B-15**
**2/22/2017 11:30:00AM**

## Origins Laboratory, Inc.
**X702367-03 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dibromoethane (EDB) | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| 1,2-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3,5-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,4-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Butanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 2-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Hexanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 4-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Isopropyltoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Methyl-2-pentanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| Acetone | ND | | 0.0200 | " | " | " | " | " | Ua |
| Benzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromodichloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |

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**B-15**
**2/22/2017 11:30:00AM**

## Origins Laboratory, Inc.
**X702367-03 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Bromoform | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| Bromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Carbon disulfide | ND | | 0.00500 | " | " | " | " | " | Ua |
| Carbon tetrachloride | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloroethane | ND | | 0.00500 | " | " | " | " | " | Ua |
| Chloroform | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Ethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Hexachlorobutadiene | ND | | 0.00500 | " | " | " | " | " | Ua |
| Iodomethane | ND | | 0.0150 | " | " | " | " | " | Ua |
| Isopropylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| m,p-Xylene | ND | | 0.00400 | " | " | " | " | " | Ua |
| Methyl tert-Butyl Ether | ND | | 0.00200 | " | " | " | " | " | Ua |
| Methylene Chloride | ND | | 0.0200 | " | " | " | " | " | Ua |
| Naphthalene | ND | | 0.0100 | " | " | " | " | " | Ua |

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**B-15**
**2/22/2017 11:30:00AM**

## Origins Laboratory, Inc.
**X702367-03 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| n-Butylbenzene | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| n-Propylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| o-Xylene | ND | | 0.00200 | " | " | " | " | " | Ua |
| sec-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Styrene | ND | | 0.00200 | " | " | " | " | " | Ua |
| tert-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Tetrachloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Toluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichlorofluoromethane | ND | | 0.00300 | " | " | " | " | " | Ua |
| Vinyl chloride | ND | | 0.00200 | " | " | " | " | " | Ua |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 1,2-Dichloroethane-d4* | *101 %* | *70-130* | " | " | " |
| *Surrogate: Toluene-d8* | *95.7 %* | *70-130* | " | " | " |
| *Surrogate: 4-Bromofluorobenzene* | *97.4 %* | *70-130* | " | " | " |

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**B-16**
**2/22/2017 1:00:00PM**

## GEL Laboratories, LLC
**X702367-04 (Soil)**

### PAH by 8270D SIM

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | 0.00171 | 0.00343 | mg/kg | 1 | 1642119 | 02/24/2017 | 02/24/2017 | U |
| Acenaphthylene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Anthracene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Benzo(a)anthracene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Benzo(a)pyrene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Benzo(b)fluoranthene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Benzo(ghi)perylene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Benzo(k)fluoranthene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Chrysene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Dibenzo(a,h)anthracene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Fluoranthene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Fluorene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Naphthalene | ND | 0.00103 | 0.00343 | " | " | " | " | " | U |
| Phenanthrene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |
| Pyrene | ND | 0.00171 | 0.00343 | " | " | " | " | " | U |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 5-alpha-Androstane* | *65 %* | *30-118* | " | " | " |

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**B-16**
**2/22/2017 1:00:00PM**

## GEL Laboratories, LLC
**X702367-04 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **PCB by 8082A** | | | | | | | | | |
| Aroclor-1016 | ND | 0.00115 | 0.00345 | mg/kg | 1 | 1642102 | 02/24/2017 | 02/27/2017 | U |
| Aroclor-1221 | ND | 0.00115 | 0.00345 | " | " | " | " | " | U |
| Aroclor-1232 | ND | 0.00115 | 0.00345 | " | " | " | " | " | U |
| Aroclor-1242 | ND | 0.00115 | 0.00345 | " | " | " | " | " | U |
| Aroclor-1248 | ND | 0.00115 | 0.00345 | " | " | " | " | " | U |
| Aroclor-1254 | ND | 0.00115 | 0.00345 | " | " | " | " | " | U |
| Aroclor-1260 | ND | 0.00115 | 0.00345 | " | " | " | " | " | U |
| Aroclor-Total | ND | 0.00115 | 0.00345 | " | " | " | " | " | U |
| *Surrogate: 4cmx* | *73 %* | | *30-120* | | | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | *82 %* | | *32-139* | | | " | " | " | |
| **TCLP Metals by 1311/6010C** | | | | | | | | | |
| Lead | ND | 0.033 | 0.100 | mg/L | 1 | 1642341 | " | 02/27/2017 | U |
| **Total Metals by 6010C** | | | | | | | | | |
| Arsenic | **1.62** | **0.478** | 2.87 | mg/kg | 1 | 1641878 | 02/23/2017 | 02/24/2017 | J |
| Barium | **32.5** | **0.0956** | 0.478 | " | " | " | " | " | |
| Cadmium | ND | 0.0956 | 0.478 | " | " | " | " | " | U |
| Chromium | **2.00** | **0.143** | 0.478 | " | " | " | " | " | |

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**B-16**
**2/22/2017 1:00:00PM**

## GEL Laboratories, LLC
**X702367-04 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Total Metals by 6010C** | | | | | | | | | |
| Lead | **2.53** | **0.315** | 0.956 | mg/kg | 1 | 1641878 | 02/23/2017 | 02/24/2017 | |
| Selenium | ND | 0.478 | 2.87 | " | " | " | " | " | U |
| Silver | ND | 0.0956 | 0.478 | " | " | " | " | " | U |
| **Total Metals by 7471A** | | | | | | | | | |
| Mercury | **0.0189** | **0.00389** | 0.0116 | mg/kg | 1 | 1642214 | 02/24/2017 | 02/28/2017 | |
| **VOC by EPA 8260C** | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| 1,1,1-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2,2-Tetrachloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2,3-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,3-Trichloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dibromo-3-chloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |

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**B-16**
**2/22/2017 1:00:00PM**

## Origins Laboratory, Inc.
**X702367-04 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dibromoethane (EDB) | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| 1,2-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3,5-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,4-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Butanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 2-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Hexanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 4-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Isopropyltoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Methyl-2-pentanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| Acetone | ND | | 0.0200 | " | " | " | " | " | Ua |
| Benzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromodichloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-16**
**2/22/2017 1:00:00PM**

## Origins Laboratory, Inc.
**X702367-04 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Bromoform | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| Bromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Carbon disulfide | ND | | 0.00500 | " | " | " | " | " | Ua |
| Carbon tetrachloride | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloroethane | ND | | 0.00500 | " | " | " | " | " | Ua |
| Chloroform | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Ethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Hexachlorobutadiene | ND | | 0.00500 | " | " | " | " | " | Ua |
| Iodomethane | ND | | 0.0150 | " | " | " | " | " | Ua |
| Isopropylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| m,p-Xylene | ND | | 0.00400 | " | " | " | " | " | Ua |
| Methyl tert-Butyl Ether | ND | | 0.00200 | " | " | " | " | " | Ua |
| Methylene Chloride | ND | | 0.0200 | " | " | " | " | " | Ua |
| Naphthalene | ND | | 0.0100 | " | " | " | " | " | Ua |

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9100 West Jewell Avenue, Suite 200
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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-16**
**2/22/2017 1:00:00PM**

## Origins Laboratory, Inc.
**X702367-04 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| n-Butylbenzene | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| n-Propylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| o-Xylene | ND | | 0.00200 | " | " | " | " | " | Ua |
| sec-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Styrene | ND | | 0.00200 | " | " | " | " | " | Ua |
| tert-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Tetrachloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Toluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichlorofluoromethane | ND | | 0.00300 | " | " | " | " | " | Ua |
| Vinyl chloride | ND | | 0.00200 | " | " | " | " | " | Ua |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 1,2-Dichloroethane-d4* | *100 %* | *70-130* | " | " | " |
| *Surrogate: Toluene-d8* | *94.7 %* | *70-130* | " | " | " |
| *Surrogate: 4-Bromofluorobenzene* | *96.4 %* | *70-130* | " | " | " |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2701-BLK1)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | 0.00200 | mg/kg | | | | | | | Ua |
| 1,1,1-Trichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1,2,2-Tetrachloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1,2-Trichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2,3-Trichlorobenzene | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,3-Trichloropropane | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,4-Trichlorobenzene | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,4-Trimethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dibromo-3-chloropropane | ND | 0.00500 | " | | | | | | | Ua |
| 1,2-Dibromoethane (EDB) | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 1,3,5-Trimethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,3-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,3-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 1,4-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 2,2-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 2-Butanone | ND | 0.0100 | " | | | | | | | Ua |
| 2-Chlorotoluene | ND | 0.00200 | " | | | | | | | Ua |
| 2-Hexanone | ND | 0.0100 | " | | | | | | | Ua |
| 4-Chlorotoluene | ND | 0.00200 | " | | | | | | | Ua |
| 4-Isopropyltoluene | ND | 0.00200 | " | | | | | | | Ua |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2701-BLK1)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 4-Methyl-2-pentanone | ND | 0.0100 | mg/kg | | | | | | | Ua |
| Acetone | ND | 0.0200 | " | | | | | | | Ua |
| Benzene | ND | 0.00200 | " | | | | | | | Ua |
| Bromobenzene | ND | 0.00200 | " | | | | | | | Ua |
| Bromochloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Bromodichloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Bromoform | ND | 0.00200 | " | | | | | | | Ua |
| Bromomethane | ND | 0.00200 | " | | | | | | | Ua |
| Carbon disulfide | ND | 0.00500 | " | | | | | | | Ua |
| Carbon tetrachloride | ND | 0.00200 | " | | | | | | | Ua |
| Chlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| Chloroethane | ND | 0.00500 | " | | | | | | | Ua |
| Chloroform | ND | 0.00200 | " | | | | | | | Ua |
| Chloromethane | ND | 0.00200 | " | | | | | | | Ua |
| cis-1,2-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| cis-1,3-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| Dibromochloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Dibromomethane | ND | 0.00200 | " | | | | | | | Ua |
| Ethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Hexachlorobutadiene | ND | 0.00500 | " | | | | | | | Ua |
| Iodomethane | ND | 0.0150 | " | | | | | | | Ua |
| Isopropylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| m,p-Xylene | ND | 0.00400 | " | | | | | | | Ua |
| Methyl tert-Butyl Ether | ND | 0.00200 | " | | | | | | | Ua |
| Methylene Chloride | ND | 0.0200 | " | | | | | | | Ua |
| Naphthalene | ND | 0.0100 | " | | | | | | | Ua |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2701-BLK1)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| n-Butylbenzene | ND | 0.00200 | mg/kg | | | | | | | Ua |
| n-Propylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| o-Xylene | ND | 0.00200 | " | | | | | | | Ua |
| sec-Butylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Styrene | ND | 0.00200 | " | | | | | | | Ua |
| tert-Butylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Tetrachloroethene | ND | 0.00200 | " | | | | | | | Ua |
| Toluene | ND | 0.00200 | " | | | | | | | Ua |
| trans-1,2-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| trans-1,3-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| Trichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| Trichlorofluoromethane | ND | 0.00300 | " | | | | | | | Ua |
| Vinyl chloride | ND | 0.00200 | " | | | | | | | Ua |
| *Surrogate: 1,2-Dichloroethane-d4* | *63* | | *ug/L* | *62.5* | | *101* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *61* | | *"* | *62.5* | | *97.2* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *58* | | *"* | *62.5* | | *93.4* | *70-130* | | | |

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Julie Linn
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## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2701-BLK2)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | 0.00200 | mg/kg | | | | | | | Ua |
| 1,1,1-Trichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1,2,2-Tetrachloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1,2-Trichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2,3-Trichlorobenzene | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,3-Trichloropropane | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,4-Trichlorobenzene | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,4-Trimethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dibromo-3-chloropropane | ND | 0.00500 | " | | | | | | | Ua |
| 1,2-Dibromoethane (EDB) | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 1,3,5-Trimethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,3-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,3-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 1,4-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 2,2-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 2-Butanone | ND | 0.0100 | " | | | | | | | Ua |
| 2-Chlorotoluene | ND | 0.00200 | " | | | | | | | Ua |
| 2-Hexanone | ND | 0.0100 | " | | | | | | | Ua |
| 4-Chlorotoluene | ND | 0.00200 | " | | | | | | | Ua |
| 4-Isopropyltoluene | ND | 0.00200 | " | | | | | | | Ua |

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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2701-BLK2)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 4-Methyl-2-pentanone | ND | 0.0100 | mg/kg | | | | | | | Ua |
| Acetone | ND | 0.0200 | " | | | | | | | Ua |
| Benzene | ND | 0.00200 | " | | | | | | | Ua |
| Bromobenzene | ND | 0.00200 | " | | | | | | | Ua |
| Bromochloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Bromodichloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Bromoform | ND | 0.00200 | " | | | | | | | Ua |
| Bromomethane | ND | 0.00200 | " | | | | | | | Ua |
| Carbon disulfide | ND | 0.00500 | " | | | | | | | Ua |
| Carbon tetrachloride | ND | 0.00200 | " | | | | | | | Ua |
| Chlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| Chloroethane | ND | 0.00500 | " | | | | | | | Ua |
| Chloroform | ND | 0.00200 | " | | | | | | | Ua |
| Chloromethane | ND | 0.00200 | " | | | | | | | Ua |
| cis-1,2-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| cis-1,3-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| Dibromochloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Dibromomethane | ND | 0.00200 | " | | | | | | | Ua |
| Ethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Hexachlorobutadiene | ND | 0.00500 | " | | | | | | | Ua |
| Iodomethane | ND | 0.0150 | " | | | | | | | Ua |
| Isopropylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| m,p-Xylene | ND | 0.00400 | " | | | | | | | Ua |
| Methyl tert-Butyl Ether | ND | 0.00200 | " | | | | | | | Ua |
| Methylene Chloride | ND | 0.0200 | " | | | | | | | Ua |
| Naphthalene | ND | 0.0100 | " | | | | | | | Ua |

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2701-BLK2)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| n-Butylbenzene | ND | 0.00200 | mg/kg | | | | | | | Ua |
| n-Propylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| o-Xylene | ND | 0.00200 | " | | | | | | | Ua |
| sec-Butylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Styrene | ND | 0.00200 | " | | | | | | | Ua |
| tert-Butylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Tetrachloroethene | ND | 0.00200 | " | | | | | | | Ua |
| Toluene | ND | 0.00200 | " | | | | | | | Ua |
| trans-1,2-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| trans-1,3-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| Trichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| Trichlorofluoromethane | ND | 0.00300 | " | | | | | | | Ua |
| Vinyl chloride | ND | 0.00200 | " | | | | | | | Ua |
| *Surrogate: 1,2-Dichloroethane-d4* | *61* | | *ug/L* | *62.5* | | *97.5* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *60* | | *"* | *62.5* | | *96.5* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *60* | | *"* | *62.5* | | *95.6* | *70-130* | | | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2701-BS1)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.101 | 0.00200 | mg/kg | 0.100 | | 101 | 70-130 | | | |
| 1,1,1-Trichloroethane | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 0.100 | 0.00200 | " | 0.100 | | 100 | 70-130 | | | |
| 1,1,2-Trichloroethane | 0.102 | 0.00200 | " | 0.100 | | 102 | 70-130 | | | |
| 1,1-Dichloroethane | 0.105 | 0.00200 | " | 0.100 | | 105 | 70-130 | | | |
| 1,1-Dichloroethene | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| 1,1-Dichloropropene | 0.109 | 0.00200 | " | 0.100 | | 109 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 0.107 | 0.00500 | " | 0.100 | | 107 | 70-130 | | | |
| 1,2,3-Trichloropropane | 0.102 | 0.00500 | " | 0.100 | | 102 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 0.105 | 0.00500 | " | 0.100 | | 105 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 0.100 | 0.00200 | " | 0.100 | | 100 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 0.0949 | 0.00500 | " | 0.100 | | 94.9 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| 1,2-Dichlorobenzene | 0.101 | 0.00200 | " | 0.100 | | 101 | 70-130 | | | |
| 1,2-Dichloroethane | 0.110 | 0.00200 | " | 0.100 | | 110 | 70-130 | | | |
| 1,2-Dichloropropane | 0.106 | 0.00200 | " | 0.100 | | 106 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 0.0989 | 0.00200 | " | 0.100 | | 98.9 | 70-130 | | | |
| 1,3-Dichlorobenzene | 0.101 | 0.00200 | " | 0.100 | | 101 | 70-130 | | | |
| 1,3-Dichloropropane | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| 1,4-Dichlorobenzene | 0.0997 | 0.00200 | " | 0.100 | | 99.7 | 70-130 | | | |
| 2,2-Dichloropropane | 0.113 | 0.00200 | " | 0.100 | | 113 | 70-130 | | | |
| 2-Butanone | 0.555 | 0.0100 | " | 0.500 | | 111 | 70-130 | | | |
| 2-Chlorotoluene | 0.0980 | 0.00200 | " | 0.100 | | 98.0 | 70-130 | | | |
| 2-Hexanone | 0.551 | 0.0100 | " | 0.500 | | 110 | 70-130 | | | |
| 4-Chlorotoluene | 0.0969 | 0.00200 | " | 0.100 | | 96.9 | 70-130 | | | |
| 4-Isopropyltoluene | 0.102 | 0.00200 | " | 0.100 | | 102 | 70-130 | | | |

Origins Laboratory, Inc.

Jen Pellegrini

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2701-BS1)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 4-Methyl-2-pentanone | 0.537 | 0.0100 | mg/kg | 0.500 | | 107 | 70-130 | | | |
| Acetone | 0.491 | 0.0200 | " | 0.500 | | 98.2 | 70-130 | | | |
| Benzene | 0.104 | 0.00200 | " | 0.100 | | 104 | 70-130 | | | |
| Bromobenzene | 0.0971 | 0.00200 | " | 0.100 | | 97.1 | 70-130 | | | |
| Bromochloromethane | 0.109 | 0.00200 | " | 0.100 | | 109 | 70-130 | | | |
| Bromodichloromethane | 0.106 | 0.00200 | " | 0.100 | | 106 | 70-130 | | | |
| Bromoform | 0.0947 | 0.00200 | " | 0.100 | | 94.7 | 70-130 | | | |
| Bromomethane | 0.104 | 0.00200 | " | 0.100 | | 104 | 70-130 | | | |
| Carbon disulfide | 0.103 | 0.00500 | " | 0.100 | | 103 | 70-130 | | | |
| Carbon tetrachloride | 0.113 | 0.00200 | " | 0.100 | | 113 | 70-130 | | | |
| Chlorobenzene | 0.102 | 0.00200 | " | 0.100 | | 102 | 70-130 | | | |
| Chloroethane | 0.0969 | 0.00500 | " | 0.100 | | 96.9 | 70-130 | | | |
| Chloroform | 0.0896 | 0.00200 | " | 0.100 | | 89.6 | 70-130 | | | |
| Chloromethane | 0.0913 | 0.00200 | " | 0.100 | | 91.3 | 70-130 | | | |
| cis-1,2-Dichloroethene | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| cis-1,3-Dichloropropene | 0.103 | 0.00200 | " | 0.100 | | 103 | 70-130 | | | |
| Dibromochloromethane | 0.105 | 0.00200 | " | 0.100 | | 105 | 70-130 | | | |
| Dibromomethane | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| Ethylbenzene | 0.0950 | 0.00200 | " | 0.100 | | 95.0 | 70-130 | | | |
| Hexachlorobutadiene | 0.103 | 0.00500 | " | 0.100 | | 103 | 70-130 | | | |
| Iodomethane | 0.109 | 0.0150 | " | 0.100 | | 109 | 70-130 | | | |
| Isopropylbenzene | 0.0991 | 0.00200 | " | 0.100 | | 99.1 | 70-130 | | | |
| m,p-Xylene | 0.197 | 0.00400 | " | 0.200 | | 98.5 | 70-130 | | | |
| Methyl tert-Butyl Ether | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| Methylene Chloride | 0.0966 | 0.0200 | " | 0.100 | | 96.6 | 70-130 | | | |
| Naphthalene | 0.112 | 0.0100 | " | 0.100 | | 112 | 70-130 | | | |

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Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2701-BS1)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| n-Butylbenzene | 0.101 | 0.00200 | mg/kg | 0.100 | | 101 | 70-130 | | | |
| n-Propylbenzene | 0.0952 | 0.00200 | " | 0.100 | | 95.2 | 70-130 | | | |
| o-Xylene | 0.0990 | 0.00200 | " | 0.100 | | 99.0 | 70-130 | | | |
| sec-Butylbenzene | 0.0987 | 0.00200 | " | 0.100 | | 98.7 | 70-130 | | | |
| Styrene | 0.0916 | 0.00200 | " | 0.100 | | 91.6 | 70-130 | | | |
| tert-Butylbenzene | 0.0988 | 0.00200 | " | 0.100 | | 98.8 | 70-130 | | | |
| Tetrachloroethene | 0.103 | 0.00200 | " | 0.100 | | 103 | 70-130 | | | |
| Toluene | 0.0990 | 0.00200 | " | 0.100 | | 99.0 | 70-130 | | | |
| trans-1,2-Dichloroethene | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| trans-1,3-Dichloropropene | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| Trichloroethene | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| Trichlorofluoromethane | 0.110 | 0.00300 | " | 0.100 | | 110 | 70-130 | | | |
| Vinyl chloride | 0.0959 | 0.00200 | " | 0.100 | | 95.9 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *60* | | *ug/L* | *62.5* | | *96.1* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *61* | | *"* | *62.5* | | *98.1* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *60* | | *"* | *62.5* | | *96.3* | *70-130* | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2701-BS2)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.112 | 0.00200 | mg/kg | 0.100 | | 112 | 70-130 | | | |
| 1,1,1-Trichloroethane | 0.123 | 0.00200 | " | 0.100 | | 123 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| 1,1,2-Trichloroethane | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| 1,1-Dichloroethane | 0.116 | 0.00200 | " | 0.100 | | 116 | 70-130 | | | |
| 1,1-Dichloroethene | 0.122 | 0.00200 | " | 0.100 | | 122 | 70-130 | | | |
| 1,1-Dichloropropene | 0.120 | 0.00200 | " | 0.100 | | 120 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 0.113 | 0.00500 | " | 0.100 | | 113 | 70-130 | | | |
| 1,2,3-Trichloropropane | 0.112 | 0.00500 | " | 0.100 | | 112 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 0.111 | 0.00500 | " | 0.100 | | 111 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 0.0963 | 0.00500 | " | 0.100 | | 96.3 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| 1,2-Dichlorobenzene | 0.110 | 0.00200 | " | 0.100 | | 110 | 70-130 | | | |
| 1,2-Dichloroethane | 0.121 | 0.00200 | " | 0.100 | | 121 | 70-130 | | | |
| 1,2-Dichloropropane | 0.118 | 0.00200 | " | 0.100 | | 118 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 0.113 | 0.00200 | " | 0.100 | | 113 | 70-130 | | | |
| 1,3-Dichlorobenzene | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| 1,3-Dichloropropane | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| 1,4-Dichlorobenzene | 0.109 | 0.00200 | " | 0.100 | | 109 | 70-130 | | | |
| 2,2-Dichloropropane | 0.120 | 0.00200 | " | 0.100 | | 120 | 70-130 | | | |
| 2-Butanone | 0.582 | 0.0100 | " | 0.500 | | 116 | 70-130 | | | |
| 2-Chlorotoluene | 0.114 | 0.00200 | " | 0.100 | | 114 | 70-130 | | | |
| 2-Hexanone | 0.576 | 0.0100 | " | 0.500 | | 115 | 70-130 | | | |
| 4-Chlorotoluene | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| 4-Isopropyltoluene | 0.114 | 0.00200 | " | 0.100 | | 114 | 70-130 | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2701-BS2)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 4-Methyl-2-pentanone | 0.567 | 0.0100 | mg/kg | 0.500 | | 113 | 70-130 | | | |
| Acetone | 0.516 | 0.0200 | " | 0.500 | | 103 | 70-130 | | | |
| Benzene | 0.113 | 0.00200 | " | 0.100 | | 113 | 70-130 | | | |
| Bromobenzene | 0.110 | 0.00200 | " | 0.100 | | 110 | 70-130 | | | |
| Bromochloromethane | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| Bromodichloromethane | 0.117 | 0.00200 | " | 0.100 | | 117 | 70-130 | | | |
| Bromoform | 0.103 | 0.00200 | " | 0.100 | | 103 | 70-130 | | | |
| Bromomethane | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| Carbon disulfide | 0.110 | 0.00500 | " | 0.100 | | 110 | 70-130 | | | |
| Carbon tetrachloride | 0.122 | 0.00200 | " | 0.100 | | 122 | 70-130 | | | |
| Chlorobenzene | 0.110 | 0.00200 | " | 0.100 | | 110 | 70-130 | | | |
| Chloroethane | 0.100 | 0.00500 | " | 0.100 | | 100 | 70-130 | | | |
| Chloroform | 0.0997 | 0.00200 | " | 0.100 | | 99.7 | 70-130 | | | |
| Chloromethane | 0.0993 | 0.00200 | " | 0.100 | | 99.3 | 70-130 | | | |
| cis-1,2-Dichloroethene | 0.119 | 0.00200 | " | 0.100 | | 119 | 70-130 | | | |
| cis-1,3-Dichloropropene | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| Dibromochloromethane | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| Dibromomethane | 0.114 | 0.00200 | " | 0.100 | | 114 | 70-130 | | | |
| Ethylbenzene | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| Hexachlorobutadiene | 0.114 | 0.00500 | " | 0.100 | | 114 | 70-130 | | | |
| Iodomethane | 0.115 | 0.0150 | " | 0.100 | | 115 | 70-130 | | | |
| Isopropylbenzene | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| m,p-Xylene | 0.229 | 0.00400 | " | 0.200 | | 114 | 70-130 | | | |
| Methyl tert-Butyl Ether | 0.114 | 0.00200 | " | 0.100 | | 114 | 70-130 | | | |
| Methylene Chloride | 0.112 | 0.0200 | " | 0.100 | | 112 | 70-130 | | | |
| Naphthalene | 0.115 | 0.0100 | " | 0.100 | | 115 | 70-130 | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2701-BS2)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| n-Butylbenzene | 0.113 | 0.00200 | mg/kg | 0.100 | | 113 | 70-130 | | | |
| n-Propylbenzene | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| o-Xylene | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| sec-Butylbenzene | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| Styrene | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| tert-Butylbenzene | 0.113 | 0.00200 | " | 0.100 | | 113 | 70-130 | | | |
| Tetrachloroethene | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| Toluene | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| trans-1,2-Dichloroethene | 0.124 | 0.00200 | " | 0.100 | | 124 | 70-130 | | | |
| trans-1,3-Dichloropropene | 0.117 | 0.00200 | " | 0.100 | | 117 | 70-130 | | | |
| Trichloroethene | 0.118 | 0.00200 | " | 0.100 | | 118 | 70-130 | | | |
| Trichlorofluoromethane | 0.115 | 0.00300 | " | 0.100 | | 115 | 70-130 | | | |
| Vinyl chloride | 0.104 | 0.00200 | " | 0.100 | | 104 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *60* | | *ug/L* | *62.5* | | *95.9* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *61* | | *"* | *62.5* | | *98.3* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *60* | | *"* | *62.5* | | *96.1* | *70-130* | | | |

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Julie Linn
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Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2701-MS1)** | | **Source: X702406-03** | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.0992 | 0.00200 | mg/kg | 0.100 | ND | 99.2 | 70-130 | | | |
| 1,1,1-Trichloroethane | 0.112 | 0.00200 | " | 0.100 | ND | 112 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| 1,1,2-Trichloroethane | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| 1,1-Dichloroethane | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | | | |
| 1,1-Dichloroethene | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | | | |
| 1,1-Dichloropropene | 0.111 | 0.00200 | " | 0.100 | ND | 111 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 0.104 | 0.00500 | " | 0.100 | ND | 104 | 70-130 | | | |
| 1,2,3-Trichloropropane | 0.104 | 0.00500 | " | 0.100 | ND | 104 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 0.103 | 0.00500 | " | 0.100 | ND | 103 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 0.111 | 0.00200 | " | 0.100 | 0.0131 | 97.4 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 0.0991 | 0.00500 | " | 0.100 | ND | 99.1 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | | | |
| 1,2-Dichlorobenzene | 0.0997 | 0.00200 | " | 0.100 | ND | 99.7 | 70-130 | | | |
| 1,2-Dichloroethane | 0.115 | 0.00200 | " | 0.100 | ND | 115 | 70-130 | | | |
| 1,2-Dichloropropane | 0.108 | 0.00200 | " | 0.100 | ND | 108 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 0.103 | 0.00200 | " | 0.100 | 0.00368 | 98.9 | 70-130 | | | |
| 1,3-Dichlorobenzene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| 1,3-Dichloropropane | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | | | |
| 1,4-Dichlorobenzene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| 2,2-Dichloropropane | 0.115 | 0.00200 | " | 0.100 | ND | 115 | 70-130 | | | |
| 2-Butanone | 0.603 | 0.0100 | " | 0.500 | ND | 121 | 70-130 | | | |
| 2-Chlorotoluene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| 2-Hexanone | 0.567 | 0.0100 | " | 0.500 | ND | 113 | 70-130 | | | |
| 4-Chlorotoluene | 0.0980 | 0.00200 | " | 0.100 | ND | 98.0 | 70-130 | | | |
| 4-Isopropyltoluene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2701-MS1)** | | **Source: X702406-03** | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 4-Methyl-2-pentanone | 0.547 | 0.0100 | mg/kg | 0.500 | ND | 109 | 70-130 | | | |
| Acetone | 0.546 | 0.0200 | " | 0.500 | 0.0114 | 107 | 70-130 | | | |
| Benzene | 0.119 | 0.00200 | " | 0.100 | 0.0221 | 97.0 | 70-130 | | | |
| Bromobenzene | 0.0995 | 0.00200 | " | 0.100 | ND | 99.5 | 70-130 | | | |
| Bromochloromethane | 0.111 | 0.00200 | " | 0.100 | ND | 111 | 70-130 | | | |
| Bromodichloromethane | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | | | |
| Bromoform | 0.0958 | 0.00200 | " | 0.100 | ND | 95.8 | 70-130 | | | |
| Bromomethane | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| Carbon disulfide | 0.100 | 0.00500 | " | 0.100 | ND | 100 | 70-130 | | | |
| Carbon tetrachloride | 0.113 | 0.00200 | " | 0.100 | ND | 113 | 70-130 | | | |
| Chlorobenzene | 0.0994 | 0.00200 | " | 0.100 | ND | 99.4 | 70-130 | | | |
| Chloroethane | 0.0969 | 0.00500 | " | 0.100 | ND | 96.9 | 70-130 | | | |
| Chloroform | 0.0922 | 0.00200 | " | 0.100 | ND | 92.2 | 70-130 | | | |
| Chloromethane | 0.0903 | 0.00200 | " | 0.100 | ND | 90.3 | 70-130 | | | |
| cis-1,2-Dichloroethene | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | | | |
| cis-1,3-Dichloropropene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| Dibromochloromethane | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | | | |
| Dibromomethane | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | | | |
| Ethylbenzene | 0.0972 | 0.00200 | " | 0.100 | 0.00220 | 95.0 | 70-130 | | | |
| Hexachlorobutadiene | 0.0976 | 0.00500 | " | 0.100 | ND | 97.6 | 70-130 | | | |
| Iodomethane | 0.106 | 0.0150 | " | 0.100 | ND | 106 | 70-130 | | | |
| Isopropylbenzene | 0.0990 | 0.00200 | " | 0.100 | ND | 99.0 | 70-130 | | | |
| m,p-Xylene | 0.209 | 0.00400 | " | 0.200 | 0.00784 | 101 | 70-130 | | | |
| Methyl tert-Butyl Ether | 0.246 | 0.00200 | " | 0.100 | 0.166 | 79.7 | 70-130 | | | |
| Methylene Chloride | 0.124 | 0.0200 | " | 0.100 | ND | 124 | 70-130 | | | |
| Naphthalene | 0.115 | 0.0100 | " | 0.100 | 0.00418 | 111 | 70-130 | | | |

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2701-MS1)** | | **Source: X702406-03** | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| n-Butylbenzene | 0.101 | 0.00200 | mg/kg | 0.100 | ND | 101 | 70-130 | | | |
| n-Propylbenzene | 0.0966 | 0.00200 | " | 0.100 | ND | 96.6 | 70-130 | | | |
| o-Xylene | 0.0987 | 0.00200 | " | 0.100 | 0.000520 | 98.2 | 70-130 | | | |
| sec-Butylbenzene | 0.0972 | 0.00200 | " | 0.100 | ND | 97.2 | 70-130 | | | |
| Styrene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| tert-Butylbenzene | 0.0986 | 0.00200 | " | 0.100 | ND | 98.6 | 70-130 | | | |
| Tetrachloroethene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| Toluene | 0.0972 | 0.00200 | " | 0.100 | 0.000640 | 96.6 | 70-130 | | | |
| trans-1,2-Dichloroethene | 0.112 | 0.00200 | " | 0.100 | ND | 112 | 70-130 | | | |
| trans-1,3-Dichloropropene | 0.111 | 0.00200 | " | 0.100 | ND | 111 | 70-130 | | | |
| Trichloroethene | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | | | |
| Trichlorofluoromethane | 0.104 | 0.00300 | " | 0.100 | ND | 104 | 70-130 | | | |
| Vinyl chloride | 0.0956 | 0.00200 | " | 0.100 | ND | 95.6 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *61* | | *ug/L* | *62.5* | | *98.1* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *60* | | *"* | *62.5* | | *95.8* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *60* | | *"* | *62.5* | | *96.7* | *70-130* | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2701-MS2)** | | **Source: X702406-02** | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.0984 | 0.00200 | mg/kg | 0.100 | ND | 98.4 | 70-130 | | | |
| 1,1,1-Trichloroethane | 0.118 | 0.00200 | " | 0.100 | ND | 118 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 0.0988 | 0.00200 | " | 0.100 | ND | 98.8 | 70-130 | | | |
| 1,1,2-Trichloroethane | 0.0979 | 0.00200 | " | 0.100 | ND | 97.9 | 70-130 | | | |
| 1,1-Dichloroethane | 0.112 | 0.00200 | " | 0.100 | ND | 112 | 70-130 | | | |
| 1,1-Dichloroethene | 0.122 | 0.00200 | " | 0.100 | ND | 122 | 70-130 | | | |
| 1,1-Dichloropropene | 0.113 | 0.00200 | " | 0.100 | ND | 113 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 0.109 | 0.00500 | " | 0.100 | ND | 109 | 70-130 | | | |
| 1,2,3-Trichloropropane | 0.105 | 0.00500 | " | 0.100 | ND | 105 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 0.107 | 0.00500 | " | 0.100 | ND | 107 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 0.103 | 0.00200 | " | 0.100 | 0.000640 | 102 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 0.101 | 0.00500 | " | 0.100 | ND | 101 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 0.113 | 0.00200 | " | 0.100 | ND | 113 | 70-130 | | | |
| 1,2-Dichlorobenzene | 0.0996 | 0.00200 | " | 0.100 | ND | 99.6 | 70-130 | | | |
| 1,2-Dichloroethane | 0.116 | 0.00200 | " | 0.100 | ND | 116 | 70-130 | | | |
| 1,2-Dichloropropane | 0.114 | 0.00200 | " | 0.100 | ND | 114 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| 1,3-Dichlorobenzene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| 1,3-Dichloropropane | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | | | |
| 1,4-Dichlorobenzene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| 2,2-Dichloropropane | 0.119 | 0.00200 | " | 0.100 | ND | 119 | 70-130 | | | |
| 2-Butanone | 0.607 | 0.0100 | " | 0.500 | ND | 121 | 70-130 | | | |
| 2-Chlorotoluene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| 2-Hexanone | 0.564 | 0.0100 | " | 0.500 | ND | 113 | 70-130 | | | |
| 4-Chlorotoluene | 0.0974 | 0.00200 | " | 0.100 | ND | 97.4 | 70-130 | | | |
| 4-Isopropyltoluene | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | | | |

Origins Laboratory, Inc.

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2701-MS2)** | | **Source: X702406-02** | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 4-Methyl-2-pentanone | 0.557 | 0.0100 | mg/kg | 0.500 | ND | 111 | 70-130 | | | |
| Acetone | 0.560 | 0.0200 | " | 0.500 | 0.0153 | 109 | 70-130 | | | |
| Benzene | 0.111 | 0.00200 | " | 0.100 | ND | 111 | 70-130 | | | |
| Bromobenzene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| Bromochloromethane | 0.113 | 0.00200 | " | 0.100 | ND | 113 | 70-130 | | | |
| Bromodichloromethane | 0.111 | 0.00200 | " | 0.100 | ND | 111 | 70-130 | | | |
| Bromoform | 0.0971 | 0.00200 | " | 0.100 | ND | 97.1 | 70-130 | | | |
| Bromomethane | 0.108 | 0.00200 | " | 0.100 | ND | 108 | 70-130 | | | |
| Carbon disulfide | 0.111 | 0.00500 | " | 0.100 | ND | 111 | 70-130 | | | |
| Carbon tetrachloride | 0.118 | 0.00200 | " | 0.100 | ND | 118 | 70-130 | | | |
| Chlorobenzene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| Chloroethane | 0.0974 | 0.00500 | " | 0.100 | ND | 97.4 | 70-130 | | | |
| Chloroform | 0.0954 | 0.00200 | " | 0.100 | ND | 95.4 | 70-130 | | | |
| Chloromethane | 0.0929 | 0.00200 | " | 0.100 | ND | 92.9 | 70-130 | | | |
| cis-1,2-Dichloroethene | 0.120 | 0.00200 | " | 0.100 | ND | 120 | 70-130 | | | |
| cis-1,3-Dichloropropene | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | | | |
| Dibromochloromethane | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | | | |
| Dibromomethane | 0.115 | 0.00200 | " | 0.100 | ND | 115 | 70-130 | | | |
| Ethylbenzene | 0.0986 | 0.00200 | " | 0.100 | ND | 98.6 | 70-130 | | | |
| Hexachlorobutadiene | 0.0995 | 0.00500 | " | 0.100 | ND | 99.5 | 70-130 | | | |
| Iodomethane | 0.111 | 0.0150 | " | 0.100 | ND | 111 | 70-130 | | | |
| Isopropylbenzene | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | | | |
| m,p-Xylene | 0.209 | 0.00400 | " | 0.200 | ND | 104 | 70-130 | | | |
| Methyl tert-Butyl Ether | 0.157 | 0.00200 | " | 0.100 | 0.0264 | 131 | 70-130 | | | QM-07 |
| Methylene Chloride | 0.138 | 0.0200 | " | 0.100 | ND | 138 | 70-130 | | | QM-07 |
| Naphthalene | 0.109 | 0.0100 | " | 0.100 | 0.00188 | 108 | 70-130 | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2701-MS2)** | | **Source: X702406-02** | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| n-Butylbenzene | 0.104 | 0.00200 | mg/kg | 0.100 | ND | 104 | 70-130 | | | |
| n-Propylbenzene | 0.0992 | 0.00200 | " | 0.100 | ND | 99.2 | 70-130 | | | |
| o-Xylene | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | | | |
| sec-Butylbenzene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| Styrene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| tert-Butylbenzene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| Tetrachloroethene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| Toluene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| trans-1,2-Dichloroethene | 0.122 | 0.00200 | " | 0.100 | ND | 122 | 70-130 | | | |
| trans-1,3-Dichloropropene | 0.112 | 0.00200 | " | 0.100 | ND | 112 | 70-130 | | | |
| Trichloroethene | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | | | |
| Trichlorofluoromethane | 0.109 | 0.00300 | " | 0.100 | ND | 109 | 70-130 | | | |
| Vinyl chloride | 0.0986 | 0.00200 | " | 0.100 | ND | 98.6 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *62* | | *ug/L* | *62.5* | | *98.5* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *60* | | *"* | *62.5* | | *95.5* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *60* | | *"* | *62.5* | | *96.6* | *70-130* | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2701-MSD1)** | | **Source: X702406-03** | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.0948 | 0.00200 | mg/kg | 0.100 | ND | 94.8 | 70-130 | 4.47 | 20 | |
| 1,1,1-Trichloroethane | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | 6.32 | 20 | |
| 1,1,2,2-Tetrachloroethane | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | 0.531 | 20 | |
| 1,1,2-Trichloroethane | 0.0967 | 0.00200 | " | 0.100 | ND | 96.7 | 70-130 | 3.68 | 20 | |
| 1,1-Dichloroethane | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | 3.88 | 20 | |
| 1,1-Dichloroethene | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | 2.18 | 20 | |
| 1,1-Dichloropropene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | 10.1 | 20 | |
| 1,2,3-Trichlorobenzene | 0.106 | 0.00500 | " | 0.100 | ND | 106 | 70-130 | 2.65 | 20 | |
| 1,2,3-Trichloropropane | 0.105 | 0.00500 | " | 0.100 | ND | 105 | 70-130 | 1.53 | 20 | |
| 1,2,4-Trichlorobenzene | 0.101 | 0.00500 | " | 0.100 | ND | 101 | 70-130 | 1.88 | 20 | |
| 1,2,4-Trimethylbenzene | 0.104 | 0.00200 | " | 0.100 | 0.0131 | 91.3 | 70-130 | 5.62 | 20 | |
| 1,2-Dibromo-3-chloropropane | 0.103 | 0.00500 | " | 0.100 | ND | 103 | 70-130 | 3.80 | 20 | |
| 1,2-Dibromoethane (EDB) | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | 4.08 | 20 | |
| 1,2-Dichlorobenzene | 0.0955 | 0.00200 | " | 0.100 | ND | 95.5 | 70-130 | 4.32 | 20 | |
| 1,2-Dichloroethane | 0.113 | 0.00200 | " | 0.100 | ND | 113 | 70-130 | 2.05 | 20 | |
| 1,2-Dichloropropane | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | 1.70 | 20 | |
| 1,3,5-Trimethylbenzene | 0.0965 | 0.00200 | " | 0.100 | 0.00368 | 92.8 | 70-130 | 6.13 | 20 | |
| 1,3-Dichlorobenzene | 0.0948 | 0.00200 | " | 0.100 | ND | 94.8 | 70-130 | 5.56 | 20 | |
| 1,3-Dichloropropane | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | 0.381 | 20 | |
| 1,4-Dichlorobenzene | 0.0959 | 0.00200 | " | 0.100 | ND | 95.9 | 70-130 | 4.90 | 20 | |
| 2,2-Dichloropropane | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | 7.37 | 20 | |
| 2-Butanone | 0.631 | 0.0100 | " | 0.500 | ND | 126 | 70-130 | 4.51 | 20 | |
| 2-Chlorotoluene | 0.0951 | 0.00200 | " | 0.100 | ND | 95.1 | 70-130 | 5.16 | 20 | |
| 2-Hexanone | 0.571 | 0.0100 | " | 0.500 | ND | 114 | 70-130 | 0.661 | 20 | |
| 4-Chlorotoluene | 0.0914 | 0.00200 | " | 0.100 | ND | 91.4 | 70-130 | 7.01 | 20 | |
| 4-Isopropyltoluene | 0.0980 | 0.00200 | " | 0.100 | ND | 98.0 | 70-130 | 2.78 | 20 | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2701-MSD1)** | | **Source: X702406-03** | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 4-Methyl-2-pentanone | 0.557 | 0.0100 | mg/kg | 0.500 | ND | 111 | 70-130 | 1.73 | 20 | |
| Acetone | 0.584 | 0.0200 | " | 0.500 | 0.0114 | 114 | 70-130 | 6.67 | 20 | |
| Benzene | 0.115 | 0.00200 | " | 0.100 | 0.0221 | 92.8 | 70-130 | 3.55 | 20 | |
| Bromobenzene | 0.0962 | 0.00200 | " | 0.100 | ND | 96.2 | 70-130 | 3.41 | 20 | |
| Bromochloromethane | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | 3.25 | 20 | |
| Bromodichloromethane | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | 4.49 | 20 | |
| Bromoform | 0.0994 | 0.00200 | " | 0.100 | ND | 99.4 | 70-130 | 3.69 | 20 | |
| Bromomethane | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | 3.26 | 20 | |
| Carbon disulfide | 0.0961 | 0.00500 | " | 0.100 | ND | 96.1 | 70-130 | 4.22 | 20 | |
| Carbon tetrachloride | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | 8.90 | 20 | |
| Chlorobenzene | 0.0925 | 0.00200 | " | 0.100 | ND | 92.5 | 70-130 | 7.15 | 20 | |
| Chloroethane | 0.0984 | 0.00500 | " | 0.100 | ND | 98.4 | 70-130 | 1.62 | 20 | |
| Chloroform | 0.0890 | 0.00200 | " | 0.100 | ND | 89.0 | 70-130 | 3.55 | 20 | |
| Chloromethane | 0.0939 | 0.00200 | " | 0.100 | ND | 93.9 | 70-130 | 3.84 | 20 | |
| cis-1,2-Dichloroethene | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 1.08 | 20 | |
| cis-1,3-Dichloropropene | 0.0995 | 0.00200 | " | 0.100 | ND | 99.5 | 70-130 | 2.48 | 20 | |
| Dibromochloromethane | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | 2.63 | 20 | |
| Dibromomethane | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 0.729 | 20 | |
| Ethylbenzene | 0.0942 | 0.00200 | " | 0.100 | 0.00220 | 92.0 | 70-130 | 3.16 | 20 | |
| Hexachlorobutadiene | 0.0917 | 0.00500 | " | 0.100 | ND | 91.7 | 70-130 | 6.19 | 20 | |
| Iodomethane | 0.0999 | 0.0150 | " | 0.100 | ND | 99.9 | 70-130 | 6.38 | 20 | |
| Isopropylbenzene | 0.0950 | 0.00200 | " | 0.100 | ND | 95.0 | 70-130 | 4.08 | 20 | |
| m,p-Xylene | 0.204 | 0.00400 | " | 0.200 | 0.00784 | 98.1 | 70-130 | 2.56 | 20 | |
| Methyl tert-Butyl Ether | 0.254 | 0.00200 | " | 0.100 | 0.166 | 87.4 | 70-130 | 3.09 | 20 | |
| Methylene Chloride | 0.137 | 0.0200 | " | 0.100 | ND | 137 | 70-130 | 9.68 | 20 | QM-07 |
| Naphthalene | 0.114 | 0.0100 | " | 0.100 | 0.00418 | 110 | 70-130 | 0.489 | 20 | |

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9100 West Jewell Avenue, Suite 200
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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2701-MSD1)** | | **Source: X702406-03** | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | | |
| n-Butylbenzene | 0.0951 | 0.00200 | mg/kg | 0.100 | ND | 95.1 | 70-130 | 5.58 | 20 | |
| n-Propylbenzene | 0.0924 | 0.00200 | " | 0.100 | ND | 92.4 | 70-130 | 4.40 | 20 | |
| o-Xylene | 0.0965 | 0.00200 | " | 0.100 | 0.000520 | 96.0 | 70-130 | 2.23 | 20 | |
| sec-Butylbenzene | 0.0924 | 0.00200 | " | 0.100 | ND | 92.4 | 70-130 | 5.08 | 20 | |
| Styrene | 0.0977 | 0.00200 | " | 0.100 | ND | 97.7 | 70-130 | 2.99 | 20 | |
| tert-Butylbenzene | 0.0940 | 0.00200 | " | 0.100 | ND | 94.0 | 70-130 | 4.76 | 20 | |
| Tetrachloroethene | 0.0918 | 0.00200 | " | 0.100 | ND | 91.8 | 70-130 | 8.59 | 20 | |
| Toluene | 0.0921 | 0.00200 | " | 0.100 | 0.000640 | 91.4 | 70-130 | 5.41 | 20 | |
| trans-1,2-Dichloroethene | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 2.31 | 20 | |
| trans-1,3-Dichloropropene | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 2.20 | 20 | |
| Trichloroethene | 0.0997 | 0.00200 | " | 0.100 | ND | 99.7 | 70-130 | 7.49 | 20 | |
| Trichlorofluoromethane | 0.109 | 0.00300 | " | 0.100 | ND | 109 | 70-130 | 4.77 | 20 | |
| Vinyl chloride | 0.0990 | 0.00200 | " | 0.100 | ND | 99.0 | 70-130 | 3.47 | 20 | |
| *Surrogate: 1,2-Dichloroethane-d4* | *70* | | *ug/L* | *62.5* | | *112* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *60* | | *"* | *62.5* | | *96.0* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *62* | | *"* | *62.5* | | *99.6* | *70-130* | | | |

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2701-MSD2)** | | **Source: X702406-02** | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.0967 | 0.00200 | mg/kg | 0.100 | ND | 96.7 | 70-130 | 1.78 | 20 | |
| 1,1,1-Trichloroethane | 0.114 | 0.00200 | " | 0.100 | ND | 114 | 70-130 | 2.97 | 20 | |
| 1,1,2,2-Tetrachloroethane | 0.0953 | 0.00200 | " | 0.100 | ND | 95.3 | 70-130 | 3.56 | 20 | |
| 1,1,2-Trichloroethane | 0.0958 | 0.00200 | " | 0.100 | ND | 95.8 | 70-130 | 2.23 | 20 | |
| 1,1-Dichloroethane | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 2.96 | 20 | |
| 1,1-Dichloroethene | 0.117 | 0.00200 | " | 0.100 | ND | 117 | 70-130 | 4.24 | 20 | |
| 1,1-Dichloropropene | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 3.76 | 20 | |
| 1,2,3-Trichlorobenzene | 0.107 | 0.00500 | " | 0.100 | ND | 107 | 70-130 | 2.63 | 20 | |
| 1,2,3-Trichloropropane | 0.102 | 0.00500 | " | 0.100 | ND | 102 | 70-130 | 2.59 | 20 | |
| 1,2,4-Trichlorobenzene | 0.106 | 0.00500 | " | 0.100 | ND | 106 | 70-130 | 0.677 | 20 | |
| 1,2,4-Trimethylbenzene | 0.101 | 0.00200 | " | 0.100 | 0.000640 | 100 | 70-130 | 1.93 | 20 | |
| 1,2-Dibromo-3-chloropropane | 0.0983 | 0.00500 | " | 0.100 | ND | 98.3 | 70-130 | 2.87 | 20 | |
| 1,2-Dibromoethane (EDB) | 0.108 | 0.00200 | " | 0.100 | ND | 108 | 70-130 | 3.77 | 20 | |
| 1,2-Dichlorobenzene | 0.0978 | 0.00200 | " | 0.100 | ND | 97.8 | 70-130 | 1.84 | 20 | |
| 1,2-Dichloroethane | 0.111 | 0.00200 | " | 0.100 | ND | 111 | 70-130 | 4.67 | 20 | |
| 1,2-Dichloropropane | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | 3.40 | 20 | |
| 1,3,5-Trimethylbenzene | 0.0994 | 0.00200 | " | 0.100 | ND | 99.4 | 70-130 | 2.48 | 20 | |
| 1,3-Dichlorobenzene | 0.0969 | 0.00200 | " | 0.100 | ND | 96.9 | 70-130 | 3.29 | 20 | |
| 1,3-Dichloropropane | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | 3.02 | 20 | |
| 1,4-Dichlorobenzene | 0.0982 | 0.00200 | " | 0.100 | ND | 98.2 | 70-130 | 2.42 | 20 | |
| 2,2-Dichloropropane | 0.115 | 0.00200 | " | 0.100 | ND | 115 | 70-130 | 3.63 | 20 | |
| 2-Butanone | 0.587 | 0.0100 | " | 0.500 | ND | 117 | 70-130 | 3.34 | 20 | |
| 2-Chlorotoluene | 0.0984 | 0.00200 | " | 0.100 | ND | 98.4 | 70-130 | 3.91 | 20 | |
| 2-Hexanone | 0.551 | 0.0100 | " | 0.500 | ND | 110 | 70-130 | 2.24 | 20 | |
| 4-Chlorotoluene | 0.0945 | 0.00200 | " | 0.100 | ND | 94.5 | 70-130 | 3.00 | 20 | |
| 4-Isopropyltoluene | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | 1.43 | 20 | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2701-MSD2)** | | **Source: X702406-02** | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | | |
| 4-Methyl-2-pentanone | 0.536 | 0.0100 | mg/kg | 0.500 | ND | 107 | 70-130 | 3.86 | 20 | |
| Acetone | 0.544 | 0.0200 | " | 0.500 | 0.0153 | 106 | 70-130 | 2.94 | 20 | |
| Benzene | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | 3.72 | 20 | |
| Bromobenzene | 0.0989 | 0.00200 | " | 0.100 | ND | 98.9 | 70-130 | 2.04 | 20 | |
| Bromochloromethane | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 3.02 | 20 | |
| Bromodichloromethane | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | 3.05 | 20 | |
| Bromoform | 0.0957 | 0.00200 | " | 0.100 | ND | 95.7 | 70-130 | 1.43 | 20 | |
| Bromomethane | 0.0835 | 0.00200 | " | 0.100 | ND | 83.5 | 70-130 | 26.0 | 20 | QR-02 |
| Carbon disulfide | 0.106 | 0.00500 | " | 0.100 | ND | 106 | 70-130 | 4.00 | 20 | |
| Carbon tetrachloride | 0.114 | 0.00200 | " | 0.100 | ND | 114 | 70-130 | 3.78 | 20 | |
| Chlorobenzene | 0.0963 | 0.00200 | " | 0.100 | ND | 96.3 | 70-130 | 3.81 | 20 | |
| Chloroethane | 0.0841 | 0.00500 | " | 0.100 | ND | 84.1 | 70-130 | 14.6 | 20 | |
| Chloroform | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | 9.15 | 20 | |
| Chloromethane | 0.0803 | 0.00200 | " | 0.100 | ND | 80.3 | 70-130 | 14.6 | 20 | |
| cis-1,2-Dichloroethene | 0.116 | 0.00200 | " | 0.100 | ND | 116 | 70-130 | 3.19 | 20 | |
| cis-1,3-Dichloropropene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | 2.56 | 20 | |
| Dibromochloromethane | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | 2.78 | 20 | |
| Dibromomethane | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 4.88 | 20 | |
| Ethylbenzene | 0.0967 | 0.00200 | " | 0.100 | ND | 96.7 | 70-130 | 1.95 | 20 | |
| Hexachlorobutadiene | 0.0969 | 0.00500 | " | 0.100 | ND | 96.9 | 70-130 | 2.69 | 20 | |
| Iodomethane | 0.108 | 0.0150 | " | 0.100 | ND | 108 | 70-130 | 2.80 | 20 | |
| Isopropylbenzene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | 2.05 | 20 | |
| m,p-Xylene | 0.202 | 0.00400 | " | 0.200 | ND | 101 | 70-130 | 3.00 | 20 | |
| Methyl tert-Butyl Ether | 0.150 | 0.00200 | " | 0.100 | 0.0264 | 123 | 70-130 | 5.08 | 20 | |
| Methylene Chloride | 0.131 | 0.0200 | " | 0.100 | ND | 131 | 70-130 | 5.17 | 20 | QM-07 |
| Naphthalene | 0.108 | 0.0100 | " | 0.100 | 0.00188 | 106 | 70-130 | 1.21 | 20 | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2701-MSD2)** | | **Source: X702406-02** | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | | |
| n-Butylbenzene | 0.101 | 0.00200 | mg/kg | 0.100 | ND | 101 | 70-130 | 3.36 | 20 | |
| n-Propylbenzene | 0.0978 | 0.00200 | " | 0.100 | ND | 97.8 | 70-130 | 1.36 | 20 | |
| o-Xylene | 0.0988 | 0.00200 | " | 0.100 | ND | 98.8 | 70-130 | 4.02 | 20 | |
| sec-Butylbenzene | 0.0987 | 0.00200 | " | 0.100 | ND | 98.7 | 70-130 | 1.61 | 20 | |
| Styrene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | 0.512 | 20 | |
| tert-Butylbenzene | 0.0997 | 0.00200 | " | 0.100 | ND | 99.7 | 70-130 | 2.26 | 20 | |
| Tetrachloroethene | 0.0999 | 0.00200 | " | 0.100 | ND | 99.9 | 70-130 | 2.59 | 20 | |
| Toluene | 0.0977 | 0.00200 | " | 0.100 | ND | 97.7 | 70-130 | 2.57 | 20 | |
| trans-1,2-Dichloroethene | 0.118 | 0.00200 | " | 0.100 | ND | 118 | 70-130 | 3.06 | 20 | |
| trans-1,3-Dichloropropene | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 3.23 | 20 | |
| Trichloroethene | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | 4.24 | 20 | |
| Trichlorofluoromethane | 0.0922 | 0.00300 | " | 0.100 | ND | 92.2 | 70-130 | 16.4 | 20 | |
| Vinyl chloride | 0.0860 | 0.00200 | " | 0.100 | ND | 86.0 | 70-130 | 13.7 | 20 | |
| *Surrogate: 1,2-Dichloroethane-d4* | *61* | | *ug/L* | *62.5* | | *97.1* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *59* | | *"* | *62.5* | | *95.1* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *60* | | *"* | *62.5* | | *96.4* | *70-130* | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|

## PAH by 8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1642119 - SW846 3541** | | | | | | | | | | |
| **BLANK (1203734709-BLK)** | | | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| Fluorene | ND | 0.00333 | mg/kg | | | | - | | | U |
| Acenaphthene | ND | 0.00333 | " | | | | - | | | U |
| Acenaphthylene | ND | 0.00333 | " | | | | - | | | U |
| Anthracene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(a)anthracene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(a)pyrene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(b)fluoranthene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(ghi)perylene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(k)fluoranthene | ND | 0.00333 | " | | | | - | | | U |
| Chrysene | ND | 0.00333 | " | | | | - | | | U |
| Phenanthrene | 0.00167 | 0.00333 | " | | | | - | | | J |
| Fluoranthene | ND | 0.00333 | " | | | | - | | | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.00333 | " | | | | - | | | U |
| Naphthalene | ND | 0.00333 | " | | | | - | | | U |
| Dibenzo(a,h)anthracene | ND | 0.00333 | " | | | | - | | | U |
| Pyrene | ND | 0.00333 | " | | | | - | | | U |
| *Surrogate: 5-alpha-Androstane* | *0.153* | | *"* | *0.167* | | *92* | *30-118* | | | |
| **LCS (1203734710-BKS)** | | | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| Benzo(ghi)perylene | 0.277 | 0.00333 | mg/kg | 0.333 | | 83 | 39-119 | | | |
| Naphthalene | 0.254 | 0.00333 | " | 0.333 | | 76 | 57-98 | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PAH by 8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1642119 - SW846 3541** | | | | | | | | | | |
| **LCS (1203734710-BKS)** | | | | | Prepared: 02/24/2017 Analyzed: 02/24/2017 | | | | | |
| Indeno(1,2,3-cd)pyrene | 0.262 | 0.00333 | mg/kg | 0.333 | | 79 | 41-130 | | | |
| Fluorene | 0.207 | 0.00333 | " | 0.333 | | 62 | 47-106 | | | |
| Fluoranthene | 0.269 | 0.00333 | " | 0.333 | | 81 | 39-108 | | | |
| Dibenzo(a,h)anthracene | 0.294 | 0.00333 | " | 0.333 | | 88 | 35-142 | | | |
| Benzo(k)fluoranthene | 0.262 | 0.00333 | " | 0.333 | | 79 | 26-121 | | | |
| Pyrene | 0.227 | 0.00333 | " | 0.333 | | 68 | 41-114 | | | |
| Benzo(b)fluoranthene | 0.257 | 0.00333 | " | 0.333 | | 77 | 36-120 | | | |
| Benzo(a)pyrene | 0.277 | 0.00333 | " | 0.333 | | 83 | 35-121 | | | |
| Benzo(a)anthracene | 0.273 | 0.00333 | " | 0.333 | | 82 | 51-108 | | | |
| Anthracene | 0.262 | 0.00333 | " | 0.333 | | 79 | 52-102 | | | |
| Acenaphthylene | 0.231 | 0.00333 | " | 0.333 | | 69 | 48-107 | | | |
| Acenaphthene | 0.254 | 0.00333 | " | 0.333 | | 76 | 55-99 | | | |
| Chrysene | 0.281 | 0.00333 | " | 0.333 | | 84 | 54-103 | | | |
| Phenanthrene | 0.257 | 0.00333 | " | 0.333 | | 77 | 53-97 | | | B |
| *Surrogate: 5-alpha-Androstane* | *0.138* | | *"* | *0.167* | | *83* | *30-118* | | | |
| **MS (1203734711 S)** | | **Source: 417175006** | | | Prepared: 02/24/2017 Analyzed: 02/25/2017 | | | | | |
| Benzo(k)fluoranthene | ND | 0.449 | mg/kg | 0.333 | <0.225 | 0 | 24-122 | | | U |
| Pyrene | 0.315 | 0.449 | " | 0.333 | <0.225 | 94 | 30-131 | | | J |
| Phenanthrene | 0.270 | 0.449 | " | 0.333 | <0.225 | 81 | 35-119 | | | BJ |
| Naphthalene | ND | 0.449 | " | 0.333 | <0.135 | 0 | 33-117 | | | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.449 | " | 0.333 | <0.225 | 0 | 17-133 | | | U |
| Fluorene | ND | 0.449 | " | 0.333 | <0.225 | 0 | 33-123 | | | U |
| Fluoranthene | 0.270 | 0.449 | " | 0.333 | <0.225 | 81 | 28-116 | | | J |
| Chrysene | 0.404 | 0.449 | " | 0.333 | <0.225 | 122 | 42-113 | | | J |
| Benzo(b)fluoranthene | 0.315 | 0.449 | " | 0.333 | <0.225 | 94 | 28-126 | | | J |
| Benzo(a)anthracene | 0.225 | 0.449 | " | 0.333 | <0.225 | 67 | 41-118 | | | J |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PAH by 8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1642119 - SW846 3541** | | | | | | | | | | |
| **MS (1203734711 S)** | | **Source: 417175006** | | | Prepared: 02/24/2017 Analyzed: 02/25/2017 | | | | | |
| Anthracene | ND | 0.449 | mg/kg | 0.333 | <0.225 | 0 | 36-120 | | | U |
| Acenaphthylene | ND | 0.449 | " | 0.333 | <0.225 | 0 | 39-116 | | | U |
| Acenaphthene | ND | 0.449 | " | 0.333 | <0.225 | 0 | 38-117 | | | U |
| Benzo(a)pyrene | 0.225 | 0.449 | " | 0.333 | <0.225 | 67 | 27-126 | | | J |
| Dibenzo(a,h)anthracene | ND | 0.449 | " | 0.333 | <0.225 | 0 | 18-146 | | | U |
| Benzo(ghi)perylene | ND | 0.449 | " | 0.333 | <0.225 | 0 | 17-118 | | | U |
| *Surrogate: 5-alpha-Androstane* | *0.0899* | | " | *0.166* | *0.0797* | *54* | *30-118* | | | |
| **MSD (1203734712 SD)** | | **Source: 417175006** | | | Prepared: 02/24/2017 Analyzed: 02/25/2017 | | | | | |
| Dibenzo(a,h)anthracene | ND | 0.416 | mg/kg | 0.333 | <0.208 | 0 | 18-146 | 0 | 30 | U |
| Acenaphthene | ND | 0.416 | " | 0.333 | <0.208 | 0 | 38-117 | 0 | 30 | U |
| Acenaphthylene | ND | 0.416 | " | 0.333 | <0.208 | 0 | 39-116 | 0 | 30 | U |
| Anthracene | ND | 0.416 | " | 0.333 | <0.208 | 0 | 36-120 | 0 | 30 | U |
| Benzo(a)anthracene | 0.250 | 0.416 | " | 0.333 | <0.208 | 75 | 41-118 | 11 | 30 | J |
| Benzo(b)fluoranthene | 0.291 | 0.416 | " | 0.333 | <0.208 | 88 | 28-126 | 8 | 30 | J |
| Chrysene | 0.416 | 0.416 | " | 0.333 | <0.208 | 125 | 42-113 | 3 | 30 | |
| Benzo(a)pyrene | 0.250 | 0.416 | " | 0.333 | <0.208 | 75 | 27-126 | 11 | 30 | J |
| Fluoranthene | 0.291 | 0.416 | " | 0.333 | <0.208 | 88 | 28-116 | 8 | 30 | J |
| Fluorene | ND | 0.416 | " | 0.333 | <0.208 | 0 | 33-123 | 0 | 30 | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.416 | " | 0.333 | <0.208 | 0 | 17-133 | 0 | 30 | U |
| Naphthalene | ND | 0.416 | " | 0.333 | <0.125 | 0 | 33-117 | 0 | 30 | U |
| Phenanthrene | 0.250 | 0.416 | " | 0.333 | <0.208 | 75 | 35-119 | 8 | 30 | BJ |
| Pyrene | 0.333 | 0.416 | " | 0.333 | <0.208 | 100 | 30-131 | 6 | 30 | J |
| Benzo(k)fluoranthene | ND | 0.416 | " | 0.333 | <0.208 | 0 | 24-122 | 0 | 30 | U |
| Benzo(ghi)perylene | 0.250 | 0.416 | " | 0.333 | <0.208 | 75 | 17-118 | 200 | 30 | J |
| *Surrogate: 5-alpha-Androstane* | *0.0833* | | " | *0.167* | *0.0797* | *50* | *30-118* | | | |

Origins Laboratory, Inc.

Jen Pellegrini

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PCB by 8082A - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1642102 - SW846 3541** | | | | | | | | | | |
| **BLANK (1203734672-BLK)** | | | | | Prepared: 02/24/2017 Analyzed: 02/27/2017 | | | | | |
| Aroclor-Total | ND | 0.00333 | mg/kg | | | | - | | | U |
| Aroclor-1016 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1221 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1232 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1242 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1260 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1254 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1248 | ND | 0.00333 | " | | | | - | | | U |
| *Surrogate: 4cmx* | *0.00437* | | " | *0.00666* | | *66* | *30-120* | | | |
| *Surrogate: Decachlorobiphenyl* | *0.00489* | | " | *0.00666* | | *73* | *32-139* | | | |
| **LCS (1203734673-BKS)** | | | | | Prepared: 02/24/2017 Analyzed: 02/27/2017 | | | | | |
| Aroclor-1260 | 0.0194 | 0.00333 | mg/kg | 0.0333 | | 58 | 58-117 | | | |
| Aroclor-1016 | 0.0226 | 0.00333 | " | 0.0333 | | 68 | 48-93 | | | |
| *Surrogate: 4cmx* | *0.00459* | | " | *0.00666* | | *69* | *30-120* | | | |
| *Surrogate: Decachlorobiphenyl* | *0.00457* | | " | *0.00666* | | *69* | *32-139* | | | |
| **MS (1203734674 S)** | | **Source: 417238005** | | | Prepared: 02/24/2017 Analyzed: 02/27/2017 | | | | | |
| Aroclor-1260 | 0.639 | 0.0472 | mg/kg | 0.0944 | <0.0157 | 677 | 35-135 | | | J |
| Aroclor-1016 | 0.110 | 0.0472 | " | 0.0944 | <0.0157 | 117 | 23-121 | | | J |
| *Surrogate: Decachlorobiphenyl* | *0.0116* | | " | *0.0189* | *0.0114* | *61* | *32-139* | | | |
| *Surrogate: 4cmx* | *0.011* | | " | *0.0189* | *0.0105* | *58* | *30-120* | | | |
| **MSD (1203734675 SD)** | | **Source: 417238005** | | | Prepared: 02/24/2017 Analyzed: 02/27/2017 | | | | | |
| Aroclor-1016 | 0.110 | 0.0496 | mg/kg | 0.0992 | <0.0165 | 111 | 23-121 | 0 | 29 | J |
| Aroclor-1260 | 0.205 | 0.0496 | " | 0.0992 | <0.0165 | 206 | 35-135 | 103 | 33 | J |
| *Surrogate: Decachlorobiphenyl* | *0.0194* | | " | *0.0198* | *0.0114* | *98* | *32-139* | | | |
| *Surrogate: 4cmx* | *0.012* | | " | *0.0198* | *0.0105* | *60* | *30-120* | | | |

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PCB by 8082A - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1642102 - SW846 3541** | | | | | | | | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## TCLP Metals by 1311/6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1642341 - SW846 3010A** | | | | | | | | | | |
| **MS (1203734370 S)** | | **Source: X702367-01** | | | Prepared: 02/24/2017 Analyzed: 02/27/2017 | | | | | |
| Lead | 4.83 | 0.100 | mg/L | 5.00 | <0.033 | 96.3 | 75-125 | | | |
| **TB (1203734371-BLK)** | | | | | Prepared: 02/24/2017 Analyzed: 02/27/2017 | | | | | |
| Lead | 0.038 | 0.100 | mg/L | | | | - | | | J |
| **BLANK (1203735218-BLK)** | | | | | Prepared: 02/24/2017 Analyzed: 02/27/2017 | | | | | |
| Lead | ND | 0.100 | mg/L | | | | - | | | U |
| **LCS (1203735219-BKS)** | | | | | Prepared: 02/24/2017 Analyzed: 02/27/2017 | | | | | |
| Lead | 5.09 | 0.100 | mg/L | 5.00 | | 102 | 80-120 | | | |
| **DUP (1203735220 D)** | | **Source: X702367-01** | | | Prepared: 02/24/2017 Analyzed: 02/27/2017 | | | | | |
| Lead | 0.037 | 0.100 | mg/L | | <0.033 | | 0-20 | 70.5 | 20 | J |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Total Metals by 6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641878 - SW846 3050B** | | | | | | | | | | |
| **BLANK (1203734218-BLK)** | | | | | Prepared: 02/23/2017 Analyzed: 02/24/2017 | | | | | |
| Silver | ND | 0.473 | mg/kg | | | | - | | | U |
| Selenium | ND | 2.84 | " | | | | - | | | U |
| Arsenic | ND | 2.84 | " | | | | - | | | U |
| Chromium | ND | 0.473 | " | | | | - | | | U |
| Barium | 0.101 | 0.473 | " | | | | - | | | J |
| Lead | ND | 0.947 | " | | | | - | | | U |
| Cadmium | ND | 0.473 | " | | | | - | | | U |
| **LCS (1203734219-BKS)** | | | | | Prepared: 02/23/2017 Analyzed: 02/24/2017 | | | | | |
| Lead | 48.5 | 0.982 | mg/kg | 49.1 | | 98.8 | 80-120 | | | |
| Arsenic | 48.9 | 2.95 | " | 49.1 | | 99.6 | 80-120 | | | |
| Barium | 48.5 | 0.491 | " | 49.1 | | 98.8 | 80-120 | | | |
| Cadmium | 48.5 | 0.491 | " | 49.1 | | 98.8 | 80-120 | | | |
| Chromium | 48.3 | 0.491 | " | 49.1 | | 98.3 | 80-120 | | | |
| Selenium | 49.6 | 2.95 | " | 49.1 | | 101 | 80-120 | | | |
| Silver | 46.5 | 0.491 | " | 49.1 | | 94.7 | 80-120 | | | |
| **DUP (1203734220 D)** | | **Source: X702367-01** | | | Prepared: 02/23/2017 Analyzed: 02/24/2017 | | | | | |
| Arsenic | 3.16 | 3.07 | mg/kg | | 2.80 | | 0-20 | 11.9 | 20 | |
| Barium | 45.0 | 0.512 | " | | 42.8 | | 0-20 | 4.92 | 20 | |
| Cadmium | 0.106 | 0.512 | " | | <0.102 | | 0-20 | 27.3 | 20 | J |
| Chromium | 6.73 | 0.512 | " | | 5.93 | | 0-20 | 12.7 | 20 | |
| Lead | 5.42 | 1.02 | " | | 4.62 | | 0-20 | 16 | 20 | |
| Silver | ND | 0.512 | " | | <0.102 | | 0-20 | 41 | 20 | U |
| Selenium | ND | 3.07 | " | | <0.512 | | 0-20 | 69.4 | 20 | U |
| **MS (1203734221 S)** | | **Source: X702367-01** | | | Prepared: 02/23/2017 Analyzed: 02/24/2017 | | | | | |

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Total Metals by 6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1641878 - SW846 3050B** | | | | | | | | | | |
| **MS (1203734221 S)** | | **Source: X702367-01** | | | Prepared: 02/23/2017 Analyzed: 02/24/2017 | | | | | |
| Cadmium | 45.5 | 0.487 | mg/kg | 48.7 | <0.0975 | 93.2 | 75-125 | | | |
| Barium | 173 | 0.487 | " | 48.7 | 42.8 | 267 | 75-125 | | | |
| Chromium | 54.4 | 0.487 | " | 48.7 | 5.93 | 99.5 | 75-125 | | | |
| Lead | 52.3 | 0.975 | " | 48.7 | 4.62 | 97.8 | 75-125 | | | |
| Selenium | 48.0 | 2.92 | " | 48.7 | <0.487 | 98.4 | 75-125 | | | |
| Silver | 45.7 | 0.487 | " | 48.7 | <0.0975 | 93.7 | 75-125 | | | |
| Arsenic | 51.2 | 2.92 | " | 48.7 | 2.80 | 99.2 | 75-125 | | | |
| **PS (1203735384 S)** | | **Source: X702367-01** | | | Prepared: 02/23/2017 Analyzed: 02/24/2017 | | | | | |
| Barium | 0.963 | 0.00535 | mg/kg | 0.500 | | 95.2 | 80-120 | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Total Metals by 7471A - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1642214 - SW846 7471A Prep** | | | | | | | | | | |
| **BLANK (1203734907-BLK)** | | | | | Prepared: 02/24/2017 Analyzed: 02/28/2017 | | | | | |
| Mercury | ND | 0.0119 | mg/kg | | | | - | | | U |
| **LCS (1203734908-BKS)** | | | | | Prepared: 02/24/2017 Analyzed: 02/28/2017 | | | | | |
| Mercury | 0.126 | 0.0117 | mg/kg | 0.117 | | 108 | 80-120 | | | |
| **DUP (1203734909 D)** | | **Source: 417001001** | | | Prepared: 02/24/2017 Analyzed: 02/28/2017 | | | | | |
| Mercury | 12.0 | 1.17 | mg/kg | | 10.6 | | 0-20 | 11.9 | 20 | |
| **MS (1203734910 S)** | | **Source: 417001001** | | | Prepared: 02/24/2017 Analyzed: 02/28/2017 | | | | | |
| Mercury | 16.8 | 1.20 | mg/kg | 0.120 | 10.6 | NR | 80-120 | | | |

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Notes and Definitions

| | |
|---|---|
| Ua | Sample is Non-Detect. |
| U | Result not detected above the detection limit |
| QR-02 | The RPD result exceeded the QC control limits; however, both percent recoveries were acceptable. Sample results for the QC batch were accepted based on percent recoveries and completeness of QC data. |
| QM-07 | The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery. |
| J | Greater than the detection limit but less than the reporting limit |
| BJ | Blank contamination. Greater than the detection limit but less than the reporting limit |
| B | Blank contamination |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| RPD | Relative Percent Difference |

All soil results are reported on a wet weight basis.

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

March 01, 2017

Pinyon

Julie Linn

9100 West Jewell Avenue, Suite 200

Lakewood CO 80232

**Project Name - 27th St. Storm Drain** **Project Number - 11780301.2100**

Attached are your analytical results for 27th St. Storm Drain received by Origins Laboratory, Inc. February 23, 2017. This project is associated with Origins project number X702386-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com

THE NELAC INSTITUTE

ACCREDITED
TESTING CERT # 3494.01

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## CROSS REFERENCE REPORT

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| B-9 | X702386-01 | Soil | February 23, 2017 10:00 | 02/23/2017 11:05 |

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

ORIGINS LABORATORY, INC

www.originslaboratory.com

page 1 of 1

X702386

Client: Pinyon
Address:
Telephone Number: 720 374 9586
Email Address: hester@pinyon-env.com, linn@pinyon-env.com

Project Manager: Julie Linn
Project Name: 27th St Storm Drain
Project Number: 11780301.2100
Samples Collected By: Dan Hester

| Sample ID Description | Date Sampled | Time Sampled | # of Containers | Preservative: Unpreserved | HCl | $HNO_3$ | Other | Matrix: Groundwater | Soil | Air Summa Canister # | Other | Analysis: VOC 8260 | PAH 8270 SIM | Metals RCRA 8 | TCLP PB 1311/1340 | RCRA Corr | Sample Instructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 B-9 | 2/23/17 | 1000 | 4 | ✓ | | | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 2 | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | |

Relinquished By: Date: 2/23/17 Time: 1100 Received By: Date: 2-23-17 Time: 1105
Relinquished By: Date: Time: Received By: Date: Time:

Turnaround Time: Same Day ☐ 24 Hr ☐ 48 Hr ☐ 72 Hr ☐ Standard ☑

Temp Received- 4.1°C Date Results Needed

1725 Elk Place | Denver, CO 80211 | Phone: 303.433.1322 | Fax: 303.265.9645

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

Origins Laboratory

F-012207-01-R1
Effective Date: 01/09/12

**Sample Receipt Checklist**

Origins Work Order: X702386

Client: Pinyon
Client Project ID: 27th St Storm Drain

Checklist Completed by: Dan Lee
Date/time completed: 2-23-17 1235

Shipped Via: Pick-up (UPS, FedEx, Hand Delivered, Pick-up, etc.)
Airbill #: NA

Matrix(s) Received: (Check all that apply): ✓ Soil/Solid ____ Water ____ Other: ____ (Describe)

Cooler Number/Temperature: 1 / 4.1 °C ____ / ____ °C ____ / ____ °C ____ / ____ °C

Thermometer ID: T003

| Requirement Description | Yes | No | N/A | Comments (if any) |
|---|---|---|---|---|
| If samples require cooling, was the temperature between 0°C to ≤ 6°C[1]? | ✓ | | | |
| Is there ice present (document if blue ice is used) | ✓ | | | |
| Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact) | | ✓ | | |
| Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact) | | ✓ | | |
| Were all samples received intact[1]? | ✓ | | | |
| Was adequate sample volume provided[1]? | ✓ | | | |
| Are short holding time analytes or samples with HTs due within 48 hours present[1]? | | ✓ | | |
| Is a chain-of-custody (COC) present and filled out completely[1]? | ✓ | | | |
| Does the COC agree with the number and type of sample bottles received[1]? | ✓ | | | |
| Do the sample IDs on the bottle labels match the COC[1]? | ✓ | | | |
| Is the COC properly relinquished by the client with date and time recorded[1]? | ✓ | | | |
| For volatiles in water – is there headspace (> ¼ inch bubble) present? **If yes, contact client and note in narrative.** | | | ✓ | |
| Are samples preserved that require preservation and was it checked[1]? *(note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)/(pH <2 for samples preserved with HNO3, HCL, H2SO4) / ( pH >10 for samples preserved with NaAsO2+NaOH, ZnAc+NaOH)* | | ✓ | | |
| Additional Comments (if any): | | | | |

*[1]If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.*

Reviewed by (Project Manager) — Date/Time Reviewed: 2/24/17

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-9**
**2/23/2017 10:00:00AM**

## GEL Laboratories, LLC
**X702386-01 (Soil)**

### PAH by 8270D SIM

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | 0.00172 | 0.00344 | mg/kg | 1 | 1642685 | 02/27/2017 | 02/28/2017 | U |
| Acenaphthylene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Anthracene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Benzo(a)anthracene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Benzo(a)pyrene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Benzo(b)fluoranthene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Benzo(ghi)perylene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Benzo(k)fluoranthene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Chrysene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Dibenzo(a,h)anthracene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Fluoranthene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Fluorene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Naphthalene | ND | 0.00103 | 0.00344 | " | " | " | " | " | U |
| Phenanthrene | **0.00206** | **0.00172** | 0.00344 | " | " | " | " | " | J |
| Pyrene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 5-alpha-Androstane* | *94 %* | *30-118* | " | " | " |

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Jen Pellegrini

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-9**
**2/23/2017 10:00:00AM**

## GEL Laboratories, LLC
**X702386-01 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **PCB by 8082A** | | | | | | | | | |
| Aroclor-1016 | ND | 0.00115 | 0.00344 | mg/kg | 1 | 1642672 | 02/27/2017 | 02/28/2017 | U |
| Aroclor-1221 | ND | 0.00115 | 0.00344 | " | " | " | " | " | U |
| Aroclor-1232 | ND | 0.00115 | 0.00344 | " | " | " | " | " | U |
| Aroclor-1242 | ND | 0.00115 | 0.00344 | " | " | " | " | " | U |
| Aroclor-1248 | ND | 0.00115 | 0.00344 | " | " | " | " | " | U |
| Aroclor-1254 | ND | 0.00115 | 0.00344 | " | " | " | " | " | U |
| Aroclor-1260 | ND | 0.00115 | 0.00344 | " | " | " | " | " | U |
| Aroclor-Total | ND | 0.00115 | 0.00344 | " | " | " | " | " | U |
| *Surrogate: 4cmx* | *70 %* | | *30-120* | | | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | *115 %* | | *32-139* | | | " | " | " | |
| **TCLP Metals by 1311/6010C** | | | | | | | | | |
| Lead | ND | 0.033 | 0.100 | mg/L | 1 | 1643200 | 02/28/2017 | 02/28/2017 | U |
| **Total Metals by 6010C** | | | | | | | | | |
| Arsenic | **0.934** | **0.509** | 3.06 | mg/kg | 1 | 1642384 | 02/25/2017 | 02/27/2017 | J |
| Barium | **11.8** | **0.102** | 0.509 | " | " | " | " | " | |
| Cadmium | ND | 0.102 | 0.509 | " | " | " | " | " | U |
| Chromium | **2.59** | **0.153** | 0.509 | " | " | " | " | " | |

Origins Laboratory, Inc.

Jen Pellegrini

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-9**
**2/23/2017 10:00:00AM**

## GEL Laboratories, LLC
**X702386-01 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Total Metals by 6010C** | | | | | | | | | |
| Lead | **1.73** | **0.336** | 1.02 | mg/kg | 1 | 1642384 | 02/25/2017 | 02/27/2017 | |
| Selenium | ND | 0.509 | 3.06 | " | " | " | " | " | U |
| Silver | ND | 0.102 | 0.509 | " | " | " | " | " | U |
| **Total Metals by 7471A** | | | | | | | | | |
| Mercury | **0.00613** | **0.00407** | 0.0121 | mg/kg | 1 | 1642214 | 02/24/2017 | 02/28/2017 | J |
| **VOC by EPA 8260C** | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| 1,1,1-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2,2-Tetrachloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1,2-Trichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,1-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2,3-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,3-Trichloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trichlorobenzene | ND | | 0.00500 | " | " | " | " | " | Ua |
| 1,2,4-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dibromo-3-chloropropane | ND | | 0.00500 | " | " | " | " | " | Ua |

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Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-9**
**2/23/2017 10:00:00AM**

## Origins Laboratory, Inc.
**X702386-01 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dibromoethane (EDB) | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| 1,2-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloroethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3,5-Trimethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,3-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 1,4-Dichlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2,2-Dichloropropane | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Butanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 2-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 2-Hexanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| 4-Chlorotoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Isopropyltoluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| 4-Methyl-2-pentanone | ND | | 0.0100 | " | " | " | " | " | Ua |
| Acetone | ND | | 0.0200 | " | " | " | " | " | Ua |
| Benzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Bromodichloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |

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Jen Pellegrini For Noelle Doyle Mathis, President

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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-9**
**2/23/2017 10:00:00AM**

## Origins Laboratory, Inc.
**X702386-01 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Bromoform | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| Bromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Carbon disulfide | ND | | 0.00500 | " | " | " | " | " | Ua |
| Carbon tetrachloride | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chlorobenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloroethane | ND | | 0.00500 | " | " | " | " | " | Ua |
| Chloroform | ND | | 0.00200 | " | " | " | " | " | Ua |
| Chloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| cis-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromochloromethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Dibromomethane | ND | | 0.00200 | " | " | " | " | " | Ua |
| Ethylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Hexachlorobutadiene | ND | | 0.00500 | " | " | " | " | " | Ua |
| Iodomethane | ND | | 0.0150 | " | " | " | " | " | Ua |
| Isopropylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| m,p-Xylene | ND | | 0.00400 | " | " | " | " | " | Ua |
| Methyl tert-Butyl Ether | ND | | 0.00200 | " | " | " | " | " | Ua |
| Methylene Chloride | ND | | 0.0200 | " | " | " | " | " | Ua |
| Naphthalene | ND | | 0.0100 | " | " | " | " | " | Ua |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-9**
**2/23/2017 10:00:00AM**

## Origins Laboratory, Inc.
**X702386-01 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| n-Butylbenzene | ND | | 0.00200 | mg/kg | 1 | B7B2701 | 02/27/2017 | 02/27/2017 | Ua |
| n-Propylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| o-Xylene | ND | | 0.00200 | " | " | " | " | " | Ua |
| sec-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Styrene | ND | | 0.00200 | " | " | " | " | " | Ua |
| tert-Butylbenzene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Tetrachloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Toluene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,2-Dichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| trans-1,3-Dichloropropene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichloroethene | ND | | 0.00200 | " | " | " | " | " | Ua |
| Trichlorofluoromethane | ND | | 0.00300 | " | " | " | " | " | Ua |
| Vinyl chloride | ND | | 0.00200 | " | " | " | " | " | Ua |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 1,2-Dichloroethane-d4* | *102 %* | *70-130* | " | " | " |
| *Surrogate: Toluene-d8* | *95.3 %* | *70-130* | " | " | " |
| *Surrogate: 4-Bromofluorobenzene* | *96.7 %* | *70-130* | " | " | " |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2701-BLK1)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | 0.00200 | mg/kg | | | | | | | Ua |
| 1,1,1-Trichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1,2,2-Tetrachloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1,2-Trichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2,3-Trichlorobenzene | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,3-Trichloropropane | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,4-Trichlorobenzene | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,4-Trimethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dibromo-3-chloropropane | ND | 0.00500 | " | | | | | | | Ua |
| 1,2-Dibromoethane (EDB) | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 1,3,5-Trimethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,3-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,3-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 1,4-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 2,2-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 2-Butanone | ND | 0.0100 | " | | | | | | | Ua |
| 2-Chlorotoluene | ND | 0.00200 | " | | | | | | | Ua |
| 2-Hexanone | ND | 0.0100 | " | | | | | | | Ua |
| 4-Chlorotoluene | ND | 0.00200 | " | | | | | | | Ua |
| 4-Isopropyltoluene | ND | 0.00200 | " | | | | | | | Ua |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2701-BLK1)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 4-Methyl-2-pentanone | ND | 0.0100 | mg/kg | | | | | | | Ua |
| Acetone | ND | 0.0200 | " | | | | | | | Ua |
| Benzene | ND | 0.00200 | " | | | | | | | Ua |
| Bromobenzene | ND | 0.00200 | " | | | | | | | Ua |
| Bromochloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Bromodichloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Bromoform | ND | 0.00200 | " | | | | | | | Ua |
| Bromomethane | ND | 0.00200 | " | | | | | | | Ua |
| Carbon disulfide | ND | 0.00500 | " | | | | | | | Ua |
| Carbon tetrachloride | ND | 0.00200 | " | | | | | | | Ua |
| Chlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| Chloroethane | ND | 0.00500 | " | | | | | | | Ua |
| Chloroform | ND | 0.00200 | " | | | | | | | Ua |
| Chloromethane | ND | 0.00200 | " | | | | | | | Ua |
| cis-1,2-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| cis-1,3-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| Dibromochloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Dibromomethane | ND | 0.00200 | " | | | | | | | Ua |
| Ethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Hexachlorobutadiene | ND | 0.00500 | " | | | | | | | Ua |
| Iodomethane | ND | 0.0150 | " | | | | | | | Ua |
| Isopropylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| m,p-Xylene | ND | 0.00400 | " | | | | | | | Ua |
| Methyl tert-Butyl Ether | ND | 0.00200 | " | | | | | | | Ua |
| Methylene Chloride | ND | 0.0200 | " | | | | | | | Ua |
| Naphthalene | ND | 0.0100 | " | | | | | | | Ua |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2701-BLK1)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| n-Butylbenzene | ND | 0.00200 | mg/kg | | | | | | | Ua |
| n-Propylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| o-Xylene | ND | 0.00200 | " | | | | | | | Ua |
| sec-Butylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Styrene | ND | 0.00200 | " | | | | | | | Ua |
| tert-Butylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Tetrachloroethene | ND | 0.00200 | " | | | | | | | Ua |
| Toluene | ND | 0.00200 | " | | | | | | | Ua |
| trans-1,2-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| trans-1,3-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| Trichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| Trichlorofluoromethane | ND | 0.00300 | " | | | | | | | Ua |
| Vinyl chloride | ND | 0.00200 | " | | | | | | | Ua |
| *Surrogate: 1,2-Dichloroethane-d4* | *63* | | *ug/L* | *62.5* | | *101* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *61* | | *"* | *62.5* | | *97.2* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *58* | | *"* | *62.5* | | *93.4* | *70-130* | | | |

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Julie Linn
Project Number: 11780301.2100
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## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2701-BLK2)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | 0.00200 | mg/kg | | | | | | | Ua |
| 1,1,1-Trichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1,2,2-Tetrachloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1,2-Trichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| 1,1-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2,3-Trichlorobenzene | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,3-Trichloropropane | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,4-Trichlorobenzene | ND | 0.00500 | " | | | | | | | Ua |
| 1,2,4-Trimethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dibromo-3-chloropropane | ND | 0.00500 | " | | | | | | | Ua |
| 1,2-Dibromoethane (EDB) | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichloroethane | ND | 0.00200 | " | | | | | | | Ua |
| 1,2-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 1,3,5-Trimethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,3-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 1,3-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 1,4-Dichlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| 2,2-Dichloropropane | ND | 0.00200 | " | | | | | | | Ua |
| 2-Butanone | ND | 0.0100 | " | | | | | | | Ua |
| 2-Chlorotoluene | ND | 0.00200 | " | | | | | | | Ua |
| 2-Hexanone | ND | 0.0100 | " | | | | | | | Ua |
| 4-Chlorotoluene | ND | 0.00200 | " | | | | | | | Ua |
| 4-Isopropyltoluene | ND | 0.00200 | " | | | | | | | Ua |

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9100 West Jewell Avenue, Suite 200
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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2701-BLK2)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 4-Methyl-2-pentanone | ND | 0.0100 | mg/kg | | | | | | | Ua |
| Acetone | ND | 0.0200 | " | | | | | | | Ua |
| Benzene | ND | 0.00200 | " | | | | | | | Ua |
| Bromobenzene | ND | 0.00200 | " | | | | | | | Ua |
| Bromochloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Bromodichloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Bromoform | ND | 0.00200 | " | | | | | | | Ua |
| Bromomethane | ND | 0.00200 | " | | | | | | | Ua |
| Carbon disulfide | ND | 0.00500 | " | | | | | | | Ua |
| Carbon tetrachloride | ND | 0.00200 | " | | | | | | | Ua |
| Chlorobenzene | ND | 0.00200 | " | | | | | | | Ua |
| Chloroethane | ND | 0.00500 | " | | | | | | | Ua |
| Chloroform | ND | 0.00200 | " | | | | | | | Ua |
| Chloromethane | ND | 0.00200 | " | | | | | | | Ua |
| cis-1,2-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| cis-1,3-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| Dibromochloromethane | ND | 0.00200 | " | | | | | | | Ua |
| Dibromomethane | ND | 0.00200 | " | | | | | | | Ua |
| Ethylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Hexachlorobutadiene | ND | 0.00500 | " | | | | | | | Ua |
| Iodomethane | ND | 0.0150 | " | | | | | | | Ua |
| Isopropylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| m,p-Xylene | ND | 0.00400 | " | | | | | | | Ua |
| Methyl tert-Butyl Ether | ND | 0.00200 | " | | | | | | | Ua |
| Methylene Chloride | ND | 0.0200 | " | | | | | | | Ua |
| Naphthalene | ND | 0.0100 | " | | | | | | | Ua |

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Julie Linn
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## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2701-BLK2)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| n-Butylbenzene | ND | 0.00200 | mg/kg | | | | | | | Ua |
| n-Propylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| o-Xylene | ND | 0.00200 | " | | | | | | | Ua |
| sec-Butylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Styrene | ND | 0.00200 | " | | | | | | | Ua |
| tert-Butylbenzene | ND | 0.00200 | " | | | | | | | Ua |
| Tetrachloroethene | ND | 0.00200 | " | | | | | | | Ua |
| Toluene | ND | 0.00200 | " | | | | | | | Ua |
| trans-1,2-Dichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| trans-1,3-Dichloropropene | ND | 0.00200 | " | | | | | | | Ua |
| Trichloroethene | ND | 0.00200 | " | | | | | | | Ua |
| Trichlorofluoromethane | ND | 0.00300 | " | | | | | | | Ua |
| Vinyl chloride | ND | 0.00200 | " | | | | | | | Ua |
| *Surrogate: 1,2-Dichloroethane-d4* | *61* | | *ug/L* | *62.5* | | *97.5* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *60* | | *"* | *62.5* | | *96.5* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *60* | | *"* | *62.5* | | *95.6* | *70-130* | | | |

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2701-BS1)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.101 | 0.00200 | mg/kg | 0.100 | | 101 | 70-130 | | | |
| 1,1,1-Trichloroethane | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 0.100 | 0.00200 | " | 0.100 | | 100 | 70-130 | | | |
| 1,1,2-Trichloroethane | 0.102 | 0.00200 | " | 0.100 | | 102 | 70-130 | | | |
| 1,1-Dichloroethane | 0.105 | 0.00200 | " | 0.100 | | 105 | 70-130 | | | |
| 1,1-Dichloroethene | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| 1,1-Dichloropropene | 0.109 | 0.00200 | " | 0.100 | | 109 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 0.107 | 0.00500 | " | 0.100 | | 107 | 70-130 | | | |
| 1,2,3-Trichloropropane | 0.102 | 0.00500 | " | 0.100 | | 102 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 0.105 | 0.00500 | " | 0.100 | | 105 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 0.100 | 0.00200 | " | 0.100 | | 100 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 0.0949 | 0.00500 | " | 0.100 | | 94.9 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| 1,2-Dichlorobenzene | 0.101 | 0.00200 | " | 0.100 | | 101 | 70-130 | | | |
| 1,2-Dichloroethane | 0.110 | 0.00200 | " | 0.100 | | 110 | 70-130 | | | |
| 1,2-Dichloropropane | 0.106 | 0.00200 | " | 0.100 | | 106 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 0.0989 | 0.00200 | " | 0.100 | | 98.9 | 70-130 | | | |
| 1,3-Dichlorobenzene | 0.101 | 0.00200 | " | 0.100 | | 101 | 70-130 | | | |
| 1,3-Dichloropropane | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| 1,4-Dichlorobenzene | 0.0997 | 0.00200 | " | 0.100 | | 99.7 | 70-130 | | | |
| 2,2-Dichloropropane | 0.113 | 0.00200 | " | 0.100 | | 113 | 70-130 | | | |
| 2-Butanone | 0.555 | 0.0100 | " | 0.500 | | 111 | 70-130 | | | |
| 2-Chlorotoluene | 0.0980 | 0.00200 | " | 0.100 | | 98.0 | 70-130 | | | |
| 2-Hexanone | 0.551 | 0.0100 | " | 0.500 | | 110 | 70-130 | | | |
| 4-Chlorotoluene | 0.0969 | 0.00200 | " | 0.100 | | 96.9 | 70-130 | | | |
| 4-Isopropyltoluene | 0.102 | 0.00200 | " | 0.100 | | 102 | 70-130 | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2701-BS1)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 4-Methyl-2-pentanone | 0.537 | 0.0100 | mg/kg | 0.500 | | 107 | 70-130 | | | |
| Acetone | 0.491 | 0.0200 | " | 0.500 | | 98.2 | 70-130 | | | |
| Benzene | 0.104 | 0.00200 | " | 0.100 | | 104 | 70-130 | | | |
| Bromobenzene | 0.0971 | 0.00200 | " | 0.100 | | 97.1 | 70-130 | | | |
| Bromochloromethane | 0.109 | 0.00200 | " | 0.100 | | 109 | 70-130 | | | |
| Bromodichloromethane | 0.106 | 0.00200 | " | 0.100 | | 106 | 70-130 | | | |
| Bromoform | 0.0947 | 0.00200 | " | 0.100 | | 94.7 | 70-130 | | | |
| Bromomethane | 0.104 | 0.00200 | " | 0.100 | | 104 | 70-130 | | | |
| Carbon disulfide | 0.103 | 0.00500 | " | 0.100 | | 103 | 70-130 | | | |
| Carbon tetrachloride | 0.113 | 0.00200 | " | 0.100 | | 113 | 70-130 | | | |
| Chlorobenzene | 0.102 | 0.00200 | " | 0.100 | | 102 | 70-130 | | | |
| Chloroethane | 0.0969 | 0.00500 | " | 0.100 | | 96.9 | 70-130 | | | |
| Chloroform | 0.0896 | 0.00200 | " | 0.100 | | 89.6 | 70-130 | | | |
| Chloromethane | 0.0913 | 0.00200 | " | 0.100 | | 91.3 | 70-130 | | | |
| cis-1,2-Dichloroethene | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| cis-1,3-Dichloropropene | 0.103 | 0.00200 | " | 0.100 | | 103 | 70-130 | | | |
| Dibromochloromethane | 0.105 | 0.00200 | " | 0.100 | | 105 | 70-130 | | | |
| Dibromomethane | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| Ethylbenzene | 0.0950 | 0.00200 | " | 0.100 | | 95.0 | 70-130 | | | |
| Hexachlorobutadiene | 0.103 | 0.00500 | " | 0.100 | | 103 | 70-130 | | | |
| Iodomethane | 0.109 | 0.0150 | " | 0.100 | | 109 | 70-130 | | | |
| Isopropylbenzene | 0.0991 | 0.00200 | " | 0.100 | | 99.1 | 70-130 | | | |
| m,p-Xylene | 0.197 | 0.00400 | " | 0.200 | | 98.5 | 70-130 | | | |
| Methyl tert-Butyl Ether | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| Methylene Chloride | 0.0966 | 0.0200 | " | 0.100 | | 96.6 | 70-130 | | | |
| Naphthalene | 0.112 | 0.0100 | " | 0.100 | | 112 | 70-130 | | | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2701-BS1)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| n-Butylbenzene | 0.101 | 0.00200 | mg/kg | 0.100 | | 101 | 70-130 | | | |
| n-Propylbenzene | 0.0952 | 0.00200 | " | 0.100 | | 95.2 | 70-130 | | | |
| o-Xylene | 0.0990 | 0.00200 | " | 0.100 | | 99.0 | 70-130 | | | |
| sec-Butylbenzene | 0.0987 | 0.00200 | " | 0.100 | | 98.7 | 70-130 | | | |
| Styrene | 0.0916 | 0.00200 | " | 0.100 | | 91.6 | 70-130 | | | |
| tert-Butylbenzene | 0.0988 | 0.00200 | " | 0.100 | | 98.8 | 70-130 | | | |
| Tetrachloroethene | 0.103 | 0.00200 | " | 0.100 | | 103 | 70-130 | | | |
| Toluene | 0.0990 | 0.00200 | " | 0.100 | | 99.0 | 70-130 | | | |
| trans-1,2-Dichloroethene | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| trans-1,3-Dichloropropene | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| Trichloroethene | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| Trichlorofluoromethane | 0.110 | 0.00300 | " | 0.100 | | 110 | 70-130 | | | |
| Vinyl chloride | 0.0959 | 0.00200 | " | 0.100 | | 95.9 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *60* | | *ug/L* | *62.5* | | *96.1* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *61* | | *"* | *62.5* | | *98.1* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *60* | | *"* | *62.5* | | *96.3* | *70-130* | | | |

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## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2701-BS2)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.112 | 0.00200 | mg/kg | 0.100 | | 112 | 70-130 | | | |
| 1,1,1-Trichloroethane | 0.123 | 0.00200 | " | 0.100 | | 123 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| 1,1,2-Trichloroethane | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| 1,1-Dichloroethane | 0.116 | 0.00200 | " | 0.100 | | 116 | 70-130 | | | |
| 1,1-Dichloroethene | 0.122 | 0.00200 | " | 0.100 | | 122 | 70-130 | | | |
| 1,1-Dichloropropene | 0.120 | 0.00200 | " | 0.100 | | 120 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 0.113 | 0.00500 | " | 0.100 | | 113 | 70-130 | | | |
| 1,2,3-Trichloropropane | 0.112 | 0.00500 | " | 0.100 | | 112 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 0.111 | 0.00500 | " | 0.100 | | 111 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 0.0963 | 0.00500 | " | 0.100 | | 96.3 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| 1,2-Dichlorobenzene | 0.110 | 0.00200 | " | 0.100 | | 110 | 70-130 | | | |
| 1,2-Dichloroethane | 0.121 | 0.00200 | " | 0.100 | | 121 | 70-130 | | | |
| 1,2-Dichloropropane | 0.118 | 0.00200 | " | 0.100 | | 118 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 0.113 | 0.00200 | " | 0.100 | | 113 | 70-130 | | | |
| 1,3-Dichlorobenzene | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| 1,3-Dichloropropane | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| 1,4-Dichlorobenzene | 0.109 | 0.00200 | " | 0.100 | | 109 | 70-130 | | | |
| 2,2-Dichloropropane | 0.120 | 0.00200 | " | 0.100 | | 120 | 70-130 | | | |
| 2-Butanone | 0.582 | 0.0100 | " | 0.500 | | 116 | 70-130 | | | |
| 2-Chlorotoluene | 0.114 | 0.00200 | " | 0.100 | | 114 | 70-130 | | | |
| 2-Hexanone | 0.576 | 0.0100 | " | 0.500 | | 115 | 70-130 | | | |
| 4-Chlorotoluene | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| 4-Isopropyltoluene | 0.114 | 0.00200 | " | 0.100 | | 114 | 70-130 | | | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2701-BS2)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 4-Methyl-2-pentanone | 0.567 | 0.0100 | mg/kg | 0.500 | | 113 | 70-130 | | | |
| Acetone | 0.516 | 0.0200 | " | 0.500 | | 103 | 70-130 | | | |
| Benzene | 0.113 | 0.00200 | " | 0.100 | | 113 | 70-130 | | | |
| Bromobenzene | 0.110 | 0.00200 | " | 0.100 | | 110 | 70-130 | | | |
| Bromochloromethane | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| Bromodichloromethane | 0.117 | 0.00200 | " | 0.100 | | 117 | 70-130 | | | |
| Bromoform | 0.103 | 0.00200 | " | 0.100 | | 103 | 70-130 | | | |
| Bromomethane | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| Carbon disulfide | 0.110 | 0.00500 | " | 0.100 | | 110 | 70-130 | | | |
| Carbon tetrachloride | 0.122 | 0.00200 | " | 0.100 | | 122 | 70-130 | | | |
| Chlorobenzene | 0.110 | 0.00200 | " | 0.100 | | 110 | 70-130 | | | |
| Chloroethane | 0.100 | 0.00500 | " | 0.100 | | 100 | 70-130 | | | |
| Chloroform | 0.0997 | 0.00200 | " | 0.100 | | 99.7 | 70-130 | | | |
| Chloromethane | 0.0993 | 0.00200 | " | 0.100 | | 99.3 | 70-130 | | | |
| cis-1,2-Dichloroethene | 0.119 | 0.00200 | " | 0.100 | | 119 | 70-130 | | | |
| cis-1,3-Dichloropropene | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| Dibromochloromethane | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| Dibromomethane | 0.114 | 0.00200 | " | 0.100 | | 114 | 70-130 | | | |
| Ethylbenzene | 0.107 | 0.00200 | " | 0.100 | | 107 | 70-130 | | | |
| Hexachlorobutadiene | 0.114 | 0.00500 | " | 0.100 | | 114 | 70-130 | | | |
| Iodomethane | 0.115 | 0.0150 | " | 0.100 | | 115 | 70-130 | | | |
| Isopropylbenzene | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| m,p-Xylene | 0.229 | 0.00400 | " | 0.200 | | 114 | 70-130 | | | |
| Methyl tert-Butyl Ether | 0.114 | 0.00200 | " | 0.100 | | 114 | 70-130 | | | |
| Methylene Chloride | 0.112 | 0.0200 | " | 0.100 | | 112 | 70-130 | | | |
| Naphthalene | 0.115 | 0.0100 | " | 0.100 | | 115 | 70-130 | | | |

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Julie Linn
Project Number: 11780301.2100
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## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2701-BS2)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| n-Butylbenzene | 0.113 | 0.00200 | mg/kg | 0.100 | | 113 | 70-130 | | | |
| n-Propylbenzene | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| o-Xylene | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| sec-Butylbenzene | 0.111 | 0.00200 | " | 0.100 | | 111 | 70-130 | | | |
| Styrene | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| tert-Butylbenzene | 0.113 | 0.00200 | " | 0.100 | | 113 | 70-130 | | | |
| Tetrachloroethene | 0.112 | 0.00200 | " | 0.100 | | 112 | 70-130 | | | |
| Toluene | 0.108 | 0.00200 | " | 0.100 | | 108 | 70-130 | | | |
| trans-1,2-Dichloroethene | 0.124 | 0.00200 | " | 0.100 | | 124 | 70-130 | | | |
| trans-1,3-Dichloropropene | 0.117 | 0.00200 | " | 0.100 | | 117 | 70-130 | | | |
| Trichloroethene | 0.118 | 0.00200 | " | 0.100 | | 118 | 70-130 | | | |
| Trichlorofluoromethane | 0.115 | 0.00300 | " | 0.100 | | 115 | 70-130 | | | |
| Vinyl chloride | 0.104 | 0.00200 | " | 0.100 | | 104 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *60* | | *ug/L* | *62.5* | | *95.9* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *61* | | *"* | *62.5* | | *98.3* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *60* | | *"* | *62.5* | | *96.1* | *70-130* | | | |

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## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2701-MS1)** | | **Source: X702406-03** | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.0992 | 0.00200 | mg/kg | 0.100 | ND | 99.2 | 70-130 | | | |
| 1,1,1-Trichloroethane | 0.112 | 0.00200 | " | 0.100 | ND | 112 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| 1,1,2-Trichloroethane | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| 1,1-Dichloroethane | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | | | |
| 1,1-Dichloroethene | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | | | |
| 1,1-Dichloropropene | 0.111 | 0.00200 | " | 0.100 | ND | 111 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 0.104 | 0.00500 | " | 0.100 | ND | 104 | 70-130 | | | |
| 1,2,3-Trichloropropane | 0.104 | 0.00500 | " | 0.100 | ND | 104 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 0.103 | 0.00500 | " | 0.100 | ND | 103 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 0.111 | 0.00200 | " | 0.100 | 0.0131 | 97.4 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 0.0991 | 0.00500 | " | 0.100 | ND | 99.1 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | | | |
| 1,2-Dichlorobenzene | 0.0997 | 0.00200 | " | 0.100 | ND | 99.7 | 70-130 | | | |
| 1,2-Dichloroethane | 0.115 | 0.00200 | " | 0.100 | ND | 115 | 70-130 | | | |
| 1,2-Dichloropropane | 0.108 | 0.00200 | " | 0.100 | ND | 108 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 0.103 | 0.00200 | " | 0.100 | 0.00368 | 98.9 | 70-130 | | | |
| 1,3-Dichlorobenzene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| 1,3-Dichloropropane | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | | | |
| 1,4-Dichlorobenzene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| 2,2-Dichloropropane | 0.115 | 0.00200 | " | 0.100 | ND | 115 | 70-130 | | | |
| 2-Butanone | 0.603 | 0.0100 | " | 0.500 | ND | 121 | 70-130 | | | |
| 2-Chlorotoluene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| 2-Hexanone | 0.567 | 0.0100 | " | 0.500 | ND | 113 | 70-130 | | | |
| 4-Chlorotoluene | 0.0980 | 0.00200 | " | 0.100 | ND | 98.0 | 70-130 | | | |
| 4-Isopropyltoluene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2701-MS1)** | | **Source: X702406-03** | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 4-Methyl-2-pentanone | 0.547 | 0.0100 | mg/kg | 0.500 | ND | 109 | 70-130 | | | |
| Acetone | 0.546 | 0.0200 | " | 0.500 | 0.0114 | 107 | 70-130 | | | |
| Benzene | 0.119 | 0.00200 | " | 0.100 | 0.0221 | 97.0 | 70-130 | | | |
| Bromobenzene | 0.0995 | 0.00200 | " | 0.100 | ND | 99.5 | 70-130 | | | |
| Bromochloromethane | 0.111 | 0.00200 | " | 0.100 | ND | 111 | 70-130 | | | |
| Bromodichloromethane | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | | | |
| Bromoform | 0.0958 | 0.00200 | " | 0.100 | ND | 95.8 | 70-130 | | | |
| Bromomethane | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| Carbon disulfide | 0.100 | 0.00500 | " | 0.100 | ND | 100 | 70-130 | | | |
| Carbon tetrachloride | 0.113 | 0.00200 | " | 0.100 | ND | 113 | 70-130 | | | |
| Chlorobenzene | 0.0994 | 0.00200 | " | 0.100 | ND | 99.4 | 70-130 | | | |
| Chloroethane | 0.0969 | 0.00500 | " | 0.100 | ND | 96.9 | 70-130 | | | |
| Chloroform | 0.0922 | 0.00200 | " | 0.100 | ND | 92.2 | 70-130 | | | |
| Chloromethane | 0.0903 | 0.00200 | " | 0.100 | ND | 90.3 | 70-130 | | | |
| cis-1,2-Dichloroethene | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | | | |
| cis-1,3-Dichloropropene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| Dibromochloromethane | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | | | |
| Dibromomethane | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | | | |
| Ethylbenzene | 0.0972 | 0.00200 | " | 0.100 | 0.00220 | 95.0 | 70-130 | | | |
| Hexachlorobutadiene | 0.0976 | 0.00500 | " | 0.100 | ND | 97.6 | 70-130 | | | |
| Iodomethane | 0.106 | 0.0150 | " | 0.100 | ND | 106 | 70-130 | | | |
| Isopropylbenzene | 0.0990 | 0.00200 | " | 0.100 | ND | 99.0 | 70-130 | | | |
| m,p-Xylene | 0.209 | 0.00400 | " | 0.200 | 0.00784 | 101 | 70-130 | | | |
| Methyl tert-Butyl Ether | 0.246 | 0.00200 | " | 0.100 | 0.166 | 79.7 | 70-130 | | | |
| Methylene Chloride | 0.124 | 0.0200 | " | 0.100 | ND | 124 | 70-130 | | | |
| Naphthalene | 0.115 | 0.0100 | " | 0.100 | 0.00418 | 111 | 70-130 | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2701-MS1)** | | **Source: X702406-03** | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| n-Butylbenzene | 0.101 | 0.00200 | mg/kg | 0.100 | ND | 101 | 70-130 | | | |
| n-Propylbenzene | 0.0966 | 0.00200 | " | 0.100 | ND | 96.6 | 70-130 | | | |
| o-Xylene | 0.0987 | 0.00200 | " | 0.100 | 0.000520 | 98.2 | 70-130 | | | |
| sec-Butylbenzene | 0.0972 | 0.00200 | " | 0.100 | ND | 97.2 | 70-130 | | | |
| Styrene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| tert-Butylbenzene | 0.0986 | 0.00200 | " | 0.100 | ND | 98.6 | 70-130 | | | |
| Tetrachloroethene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| Toluene | 0.0972 | 0.00200 | " | 0.100 | 0.000640 | 96.6 | 70-130 | | | |
| trans-1,2-Dichloroethene | 0.112 | 0.00200 | " | 0.100 | ND | 112 | 70-130 | | | |
| trans-1,3-Dichloropropene | 0.111 | 0.00200 | " | 0.100 | ND | 111 | 70-130 | | | |
| Trichloroethene | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | | | |
| Trichlorofluoromethane | 0.104 | 0.00300 | " | 0.100 | ND | 104 | 70-130 | | | |
| Vinyl chloride | 0.0956 | 0.00200 | " | 0.100 | ND | 95.6 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *61* | | *ug/L* | *62.5* | | *98.1* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *60* | | *"* | *62.5* | | *95.8* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *60* | | *"* | *62.5* | | *96.7* | *70-130* | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2701-MS2)** | | **Source: X702406-02** | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.0984 | 0.00200 | mg/kg | 0.100 | ND | 98.4 | 70-130 | | | |
| 1,1,1-Trichloroethane | 0.118 | 0.00200 | " | 0.100 | ND | 118 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 0.0988 | 0.00200 | " | 0.100 | ND | 98.8 | 70-130 | | | |
| 1,1,2-Trichloroethane | 0.0979 | 0.00200 | " | 0.100 | ND | 97.9 | 70-130 | | | |
| 1,1-Dichloroethane | 0.112 | 0.00200 | " | 0.100 | ND | 112 | 70-130 | | | |
| 1,1-Dichloroethene | 0.122 | 0.00200 | " | 0.100 | ND | 122 | 70-130 | | | |
| 1,1-Dichloropropene | 0.113 | 0.00200 | " | 0.100 | ND | 113 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 0.109 | 0.00500 | " | 0.100 | ND | 109 | 70-130 | | | |
| 1,2,3-Trichloropropane | 0.105 | 0.00500 | " | 0.100 | ND | 105 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 0.107 | 0.00500 | " | 0.100 | ND | 107 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 0.103 | 0.00200 | " | 0.100 | 0.000640 | 102 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 0.101 | 0.00500 | " | 0.100 | ND | 101 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 0.113 | 0.00200 | " | 0.100 | ND | 113 | 70-130 | | | |
| 1,2-Dichlorobenzene | 0.0996 | 0.00200 | " | 0.100 | ND | 99.6 | 70-130 | | | |
| 1,2-Dichloroethane | 0.116 | 0.00200 | " | 0.100 | ND | 116 | 70-130 | | | |
| 1,2-Dichloropropane | 0.114 | 0.00200 | " | 0.100 | ND | 114 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| 1,3-Dichlorobenzene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| 1,3-Dichloropropane | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | | | |
| 1,4-Dichlorobenzene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| 2,2-Dichloropropane | 0.119 | 0.00200 | " | 0.100 | ND | 119 | 70-130 | | | |
| 2-Butanone | 0.607 | 0.0100 | " | 0.500 | ND | 121 | 70-130 | | | |
| 2-Chlorotoluene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| 2-Hexanone | 0.564 | 0.0100 | " | 0.500 | ND | 113 | 70-130 | | | |
| 4-Chlorotoluene | 0.0974 | 0.00200 | " | 0.100 | ND | 97.4 | 70-130 | | | |
| 4-Isopropyltoluene | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2701-MS2)** | | **Source: X702406-02** | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| 4-Methyl-2-pentanone | 0.557 | 0.0100 | mg/kg | 0.500 | ND | 111 | 70-130 | | | |
| Acetone | 0.560 | 0.0200 | " | 0.500 | 0.0153 | 109 | 70-130 | | | |
| Benzene | 0.111 | 0.00200 | " | 0.100 | ND | 111 | 70-130 | | | |
| Bromobenzene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | | | |
| Bromochloromethane | 0.113 | 0.00200 | " | 0.100 | ND | 113 | 70-130 | | | |
| Bromodichloromethane | 0.111 | 0.00200 | " | 0.100 | ND | 111 | 70-130 | | | |
| Bromoform | 0.0971 | 0.00200 | " | 0.100 | ND | 97.1 | 70-130 | | | |
| Bromomethane | 0.108 | 0.00200 | " | 0.100 | ND | 108 | 70-130 | | | |
| Carbon disulfide | 0.111 | 0.00500 | " | 0.100 | ND | 111 | 70-130 | | | |
| Carbon tetrachloride | 0.118 | 0.00200 | " | 0.100 | ND | 118 | 70-130 | | | |
| Chlorobenzene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| Chloroethane | 0.0974 | 0.00500 | " | 0.100 | ND | 97.4 | 70-130 | | | |
| Chloroform | 0.0954 | 0.00200 | " | 0.100 | ND | 95.4 | 70-130 | | | |
| Chloromethane | 0.0929 | 0.00200 | " | 0.100 | ND | 92.9 | 70-130 | | | |
| cis-1,2-Dichloroethene | 0.120 | 0.00200 | " | 0.100 | ND | 120 | 70-130 | | | |
| cis-1,3-Dichloropropene | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | | | |
| Dibromochloromethane | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | | | |
| Dibromomethane | 0.115 | 0.00200 | " | 0.100 | ND | 115 | 70-130 | | | |
| Ethylbenzene | 0.0986 | 0.00200 | " | 0.100 | ND | 98.6 | 70-130 | | | |
| Hexachlorobutadiene | 0.0995 | 0.00500 | " | 0.100 | ND | 99.5 | 70-130 | | | |
| Iodomethane | 0.111 | 0.0150 | " | 0.100 | ND | 111 | 70-130 | | | |
| Isopropylbenzene | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | | | |
| m,p-Xylene | 0.209 | 0.00400 | " | 0.200 | ND | 104 | 70-130 | | | |
| Methyl tert-Butyl Ether | 0.157 | 0.00200 | " | 0.100 | 0.0264 | 131 | 70-130 | | | QM-07 |
| Methylene Chloride | 0.138 | 0.0200 | " | 0.100 | ND | 138 | 70-130 | | | QM-07 |
| Naphthalene | 0.109 | 0.0100 | " | 0.100 | 0.00188 | 108 | 70-130 | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2701-MS2)** | | **Source: X702406-02** | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| n-Butylbenzene | 0.104 | 0.00200 | mg/kg | 0.100 | ND | 104 | 70-130 | | | |
| n-Propylbenzene | 0.0992 | 0.00200 | " | 0.100 | ND | 99.2 | 70-130 | | | |
| o-Xylene | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | | | |
| sec-Butylbenzene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| Styrene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| tert-Butylbenzene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| Tetrachloroethene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | | | |
| Toluene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | | | |
| trans-1,2-Dichloroethene | 0.122 | 0.00200 | " | 0.100 | ND | 122 | 70-130 | | | |
| trans-1,3-Dichloropropene | 0.112 | 0.00200 | " | 0.100 | ND | 112 | 70-130 | | | |
| Trichloroethene | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | | | |
| Trichlorofluoromethane | 0.109 | 0.00300 | " | 0.100 | ND | 109 | 70-130 | | | |
| Vinyl chloride | 0.0986 | 0.00200 | " | 0.100 | ND | 98.6 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *62* | | *ug/L* | *62.5* | | *98.5* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *60* | | *"* | *62.5* | | *95.5* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *60* | | *"* | *62.5* | | *96.6* | *70-130* | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2701-MSD1)** | | **Source: X702406-03** | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.0948 | 0.00200 | mg/kg | 0.100 | ND | 94.8 | 70-130 | 4.47 | 20 | |
| 1,1,1-Trichloroethane | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | 6.32 | 20 | |
| 1,1,2,2-Tetrachloroethane | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | 0.531 | 20 | |
| 1,1,2-Trichloroethane | 0.0967 | 0.00200 | " | 0.100 | ND | 96.7 | 70-130 | 3.68 | 20 | |
| 1,1-Dichloroethane | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | 3.88 | 20 | |
| 1,1-Dichloroethene | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | 2.18 | 20 | |
| 1,1-Dichloropropene | 0.100 | 0.00200 | " | 0.100 | ND | 100 | 70-130 | 10.1 | 20 | |
| 1,2,3-Trichlorobenzene | 0.106 | 0.00500 | " | 0.100 | ND | 106 | 70-130 | 2.65 | 20 | |
| 1,2,3-Trichloropropane | 0.105 | 0.00500 | " | 0.100 | ND | 105 | 70-130 | 1.53 | 20 | |
| 1,2,4-Trichlorobenzene | 0.101 | 0.00500 | " | 0.100 | ND | 101 | 70-130 | 1.88 | 20 | |
| 1,2,4-Trimethylbenzene | 0.104 | 0.00200 | " | 0.100 | 0.0131 | 91.3 | 70-130 | 5.62 | 20 | |
| 1,2-Dibromo-3-chloropropane | 0.103 | 0.00500 | " | 0.100 | ND | 103 | 70-130 | 3.80 | 20 | |
| 1,2-Dibromoethane (EDB) | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | 4.08 | 20 | |
| 1,2-Dichlorobenzene | 0.0955 | 0.00200 | " | 0.100 | ND | 95.5 | 70-130 | 4.32 | 20 | |
| 1,2-Dichloroethane | 0.113 | 0.00200 | " | 0.100 | ND | 113 | 70-130 | 2.05 | 20 | |
| 1,2-Dichloropropane | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | 1.70 | 20 | |
| 1,3,5-Trimethylbenzene | 0.0965 | 0.00200 | " | 0.100 | 0.00368 | 92.8 | 70-130 | 6.13 | 20 | |
| 1,3-Dichlorobenzene | 0.0948 | 0.00200 | " | 0.100 | ND | 94.8 | 70-130 | 5.56 | 20 | |
| 1,3-Dichloropropane | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | 0.381 | 20 | |
| 1,4-Dichlorobenzene | 0.0959 | 0.00200 | " | 0.100 | ND | 95.9 | 70-130 | 4.90 | 20 | |
| 2,2-Dichloropropane | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | 7.37 | 20 | |
| 2-Butanone | 0.631 | 0.0100 | " | 0.500 | ND | 126 | 70-130 | 4.51 | 20 | |
| 2-Chlorotoluene | 0.0951 | 0.00200 | " | 0.100 | ND | 95.1 | 70-130 | 5.16 | 20 | |
| 2-Hexanone | 0.571 | 0.0100 | " | 0.500 | ND | 114 | 70-130 | 0.661 | 20 | |
| 4-Chlorotoluene | 0.0914 | 0.00200 | " | 0.100 | ND | 91.4 | 70-130 | 7.01 | 20 | |
| 4-Isopropyltoluene | 0.0980 | 0.00200 | " | 0.100 | ND | 98.0 | 70-130 | 2.78 | 20 | |

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Pinyon
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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2701-MSD1)** | | **Source: X702406-03** | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | | |
| 4-Methyl-2-pentanone | 0.557 | 0.0100 | mg/kg | 0.500 | ND | 111 | 70-130 | 1.73 | 20 | |
| Acetone | 0.584 | 0.0200 | " | 0.500 | 0.0114 | 114 | 70-130 | 6.67 | 20 | |
| Benzene | 0.115 | 0.00200 | " | 0.100 | 0.0221 | 92.8 | 70-130 | 3.55 | 20 | |
| Bromobenzene | 0.0962 | 0.00200 | " | 0.100 | ND | 96.2 | 70-130 | 3.41 | 20 | |
| Bromochloromethane | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | 3.25 | 20 | |
| Bromodichloromethane | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | 4.49 | 20 | |
| Bromoform | 0.0994 | 0.00200 | " | 0.100 | ND | 99.4 | 70-130 | 3.69 | 20 | |
| Bromomethane | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | 3.26 | 20 | |
| Carbon disulfide | 0.0961 | 0.00500 | " | 0.100 | ND | 96.1 | 70-130 | 4.22 | 20 | |
| Carbon tetrachloride | 0.103 | 0.00200 | " | 0.100 | ND | 103 | 70-130 | 8.90 | 20 | |
| Chlorobenzene | 0.0925 | 0.00200 | " | 0.100 | ND | 92.5 | 70-130 | 7.15 | 20 | |
| Chloroethane | 0.0984 | 0.00500 | " | 0.100 | ND | 98.4 | 70-130 | 1.62 | 20 | |
| Chloroform | 0.0890 | 0.00200 | " | 0.100 | ND | 89.0 | 70-130 | 3.55 | 20 | |
| Chloromethane | 0.0939 | 0.00200 | " | 0.100 | ND | 93.9 | 70-130 | 3.84 | 20 | |
| cis-1,2-Dichloroethene | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 1.08 | 20 | |
| cis-1,3-Dichloropropene | 0.0995 | 0.00200 | " | 0.100 | ND | 99.5 | 70-130 | 2.48 | 20 | |
| Dibromochloromethane | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | 2.63 | 20 | |
| Dibromomethane | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 0.729 | 20 | |
| Ethylbenzene | 0.0942 | 0.00200 | " | 0.100 | 0.00220 | 92.0 | 70-130 | 3.16 | 20 | |
| Hexachlorobutadiene | 0.0917 | 0.00500 | " | 0.100 | ND | 91.7 | 70-130 | 6.19 | 20 | |
| Iodomethane | 0.0999 | 0.0150 | " | 0.100 | ND | 99.9 | 70-130 | 6.38 | 20 | |
| Isopropylbenzene | 0.0950 | 0.00200 | " | 0.100 | ND | 95.0 | 70-130 | 4.08 | 20 | |
| m,p-Xylene | 0.204 | 0.00400 | " | 0.200 | 0.00784 | 98.1 | 70-130 | 2.56 | 20 | |
| Methyl tert-Butyl Ether | 0.254 | 0.00200 | " | 0.100 | 0.166 | 87.4 | 70-130 | 3.09 | 20 | |
| Methylene Chloride | 0.137 | 0.0200 | " | 0.100 | ND | 137 | 70-130 | 9.68 | 20 | QM-07 |
| Naphthalene | 0.114 | 0.0100 | " | 0.100 | 0.00418 | 110 | 70-130 | 0.489 | 20 | |

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2701-MSD1)** | | **Source: X702406-03** | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | | |
| n-Butylbenzene | 0.0951 | 0.00200 | mg/kg | 0.100 | ND | 95.1 | 70-130 | 5.58 | 20 | |
| n-Propylbenzene | 0.0924 | 0.00200 | " | 0.100 | ND | 92.4 | 70-130 | 4.40 | 20 | |
| o-Xylene | 0.0965 | 0.00200 | " | 0.100 | 0.000520 | 96.0 | 70-130 | 2.23 | 20 | |
| sec-Butylbenzene | 0.0924 | 0.00200 | " | 0.100 | ND | 92.4 | 70-130 | 5.08 | 20 | |
| Styrene | 0.0977 | 0.00200 | " | 0.100 | ND | 97.7 | 70-130 | 2.99 | 20 | |
| tert-Butylbenzene | 0.0940 | 0.00200 | " | 0.100 | ND | 94.0 | 70-130 | 4.76 | 20 | |
| Tetrachloroethene | 0.0918 | 0.00200 | " | 0.100 | ND | 91.8 | 70-130 | 8.59 | 20 | |
| Toluene | 0.0921 | 0.00200 | " | 0.100 | 0.000640 | 91.4 | 70-130 | 5.41 | 20 | |
| trans-1,2-Dichloroethene | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 2.31 | 20 | |
| trans-1,3-Dichloropropene | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 2.20 | 20 | |
| Trichloroethene | 0.0997 | 0.00200 | " | 0.100 | ND | 99.7 | 70-130 | 7.49 | 20 | |
| Trichlorofluoromethane | 0.109 | 0.00300 | " | 0.100 | ND | 109 | 70-130 | 4.77 | 20 | |
| Vinyl chloride | 0.0990 | 0.00200 | " | 0.100 | ND | 99.0 | 70-130 | 3.47 | 20 | |
| *Surrogate: 1,2-Dichloroethane-d4* | *70* | | *ug/L* | *62.5* | | *112* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *60* | | *"* | *62.5* | | *96.0* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *62* | | *"* | *62.5* | | *99.6* | *70-130* | | | |

Origins Laboratory, Inc.

Jen Pellegrini

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2701-MSD2)** | | **Source: X702406-02** | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | | |
| 1,1,1,2-Tetrachloroethane | 0.0967 | 0.00200 | mg/kg | 0.100 | ND | 96.7 | 70-130 | 1.78 | 20 | |
| 1,1,1-Trichloroethane | 0.114 | 0.00200 | " | 0.100 | ND | 114 | 70-130 | 2.97 | 20 | |
| 1,1,2,2-Tetrachloroethane | 0.0953 | 0.00200 | " | 0.100 | ND | 95.3 | 70-130 | 3.56 | 20 | |
| 1,1,2-Trichloroethane | 0.0958 | 0.00200 | " | 0.100 | ND | 95.8 | 70-130 | 2.23 | 20 | |
| 1,1-Dichloroethane | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 2.96 | 20 | |
| 1,1-Dichloroethene | 0.117 | 0.00200 | " | 0.100 | ND | 117 | 70-130 | 4.24 | 20 | |
| 1,1-Dichloropropene | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 3.76 | 20 | |
| 1,2,3-Trichlorobenzene | 0.107 | 0.00500 | " | 0.100 | ND | 107 | 70-130 | 2.63 | 20 | |
| 1,2,3-Trichloropropane | 0.102 | 0.00500 | " | 0.100 | ND | 102 | 70-130 | 2.59 | 20 | |
| 1,2,4-Trichlorobenzene | 0.106 | 0.00500 | " | 0.100 | ND | 106 | 70-130 | 0.677 | 20 | |
| 1,2,4-Trimethylbenzene | 0.101 | 0.00200 | " | 0.100 | 0.000640 | 100 | 70-130 | 1.93 | 20 | |
| 1,2-Dibromo-3-chloropropane | 0.0983 | 0.00500 | " | 0.100 | ND | 98.3 | 70-130 | 2.87 | 20 | |
| 1,2-Dibromoethane (EDB) | 0.108 | 0.00200 | " | 0.100 | ND | 108 | 70-130 | 3.77 | 20 | |
| 1,2-Dichlorobenzene | 0.0978 | 0.00200 | " | 0.100 | ND | 97.8 | 70-130 | 1.84 | 20 | |
| 1,2-Dichloroethane | 0.111 | 0.00200 | " | 0.100 | ND | 111 | 70-130 | 4.67 | 20 | |
| 1,2-Dichloropropane | 0.110 | 0.00200 | " | 0.100 | ND | 110 | 70-130 | 3.40 | 20 | |
| 1,3,5-Trimethylbenzene | 0.0994 | 0.00200 | " | 0.100 | ND | 99.4 | 70-130 | 2.48 | 20 | |
| 1,3-Dichlorobenzene | 0.0969 | 0.00200 | " | 0.100 | ND | 96.9 | 70-130 | 3.29 | 20 | |
| 1,3-Dichloropropane | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | 3.02 | 20 | |
| 1,4-Dichlorobenzene | 0.0982 | 0.00200 | " | 0.100 | ND | 98.2 | 70-130 | 2.42 | 20 | |
| 2,2-Dichloropropane | 0.115 | 0.00200 | " | 0.100 | ND | 115 | 70-130 | 3.63 | 20 | |
| 2-Butanone | 0.587 | 0.0100 | " | 0.500 | ND | 117 | 70-130 | 3.34 | 20 | |
| 2-Chlorotoluene | 0.0984 | 0.00200 | " | 0.100 | ND | 98.4 | 70-130 | 3.91 | 20 | |
| 2-Hexanone | 0.551 | 0.0100 | " | 0.500 | ND | 110 | 70-130 | 2.24 | 20 | |
| 4-Chlorotoluene | 0.0945 | 0.00200 | " | 0.100 | ND | 94.5 | 70-130 | 3.00 | 20 | |
| 4-Isopropyltoluene | 0.105 | 0.00200 | " | 0.100 | ND | 105 | 70-130 | 1.43 | 20 | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2701-MSD2)** | | **Source: X702406-02** | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | | |
| 4-Methyl-2-pentanone | 0.536 | 0.0100 | mg/kg | 0.500 | ND | 107 | 70-130 | 3.86 | 20 | |
| Acetone | 0.544 | 0.0200 | " | 0.500 | 0.0153 | 106 | 70-130 | 2.94 | 20 | |
| Benzene | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | 3.72 | 20 | |
| Bromobenzene | 0.0989 | 0.00200 | " | 0.100 | ND | 98.9 | 70-130 | 2.04 | 20 | |
| Bromochloromethane | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 3.02 | 20 | |
| Bromodichloromethane | 0.107 | 0.00200 | " | 0.100 | ND | 107 | 70-130 | 3.05 | 20 | |
| Bromoform | 0.0957 | 0.00200 | " | 0.100 | ND | 95.7 | 70-130 | 1.43 | 20 | |
| Bromomethane | 0.0835 | 0.00200 | " | 0.100 | ND | 83.5 | 70-130 | 26.0 | 20 | QR-02 |
| Carbon disulfide | 0.106 | 0.00500 | " | 0.100 | ND | 106 | 70-130 | 4.00 | 20 | |
| Carbon tetrachloride | 0.114 | 0.00200 | " | 0.100 | ND | 114 | 70-130 | 3.78 | 20 | |
| Chlorobenzene | 0.0963 | 0.00200 | " | 0.100 | ND | 96.3 | 70-130 | 3.81 | 20 | |
| Chloroethane | 0.0841 | 0.00500 | " | 0.100 | ND | 84.1 | 70-130 | 14.6 | 20 | |
| Chloroform | 0.104 | 0.00200 | " | 0.100 | ND | 104 | 70-130 | 9.15 | 20 | |
| Chloromethane | 0.0803 | 0.00200 | " | 0.100 | ND | 80.3 | 70-130 | 14.6 | 20 | |
| cis-1,2-Dichloroethene | 0.116 | 0.00200 | " | 0.100 | ND | 116 | 70-130 | 3.19 | 20 | |
| cis-1,3-Dichloropropene | 0.102 | 0.00200 | " | 0.100 | ND | 102 | 70-130 | 2.56 | 20 | |
| Dibromochloromethane | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | 2.78 | 20 | |
| Dibromomethane | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 4.88 | 20 | |
| Ethylbenzene | 0.0967 | 0.00200 | " | 0.100 | ND | 96.7 | 70-130 | 1.95 | 20 | |
| Hexachlorobutadiene | 0.0969 | 0.00500 | " | 0.100 | ND | 96.9 | 70-130 | 2.69 | 20 | |
| Iodomethane | 0.108 | 0.0150 | " | 0.100 | ND | 108 | 70-130 | 2.80 | 20 | |
| Isopropylbenzene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | 2.05 | 20 | |
| m,p-Xylene | 0.202 | 0.00400 | " | 0.200 | ND | 101 | 70-130 | 3.00 | 20 | |
| Methyl tert-Butyl Ether | 0.150 | 0.00200 | " | 0.100 | 0.0264 | 123 | 70-130 | 5.08 | 20 | |
| Methylene Chloride | 0.131 | 0.0200 | " | 0.100 | ND | 131 | 70-130 | 5.17 | 20 | QM-07 |
| Naphthalene | 0.108 | 0.0100 | " | 0.100 | 0.00188 | 106 | 70-130 | 1.21 | 20 | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2701 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2701-MSD2)** | | **Source: X702406-02** | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | | |
| n-Butylbenzene | 0.101 | 0.00200 | mg/kg | 0.100 | ND | 101 | 70-130 | 3.36 | 20 | |
| n-Propylbenzene | 0.0978 | 0.00200 | " | 0.100 | ND | 97.8 | 70-130 | 1.36 | 20 | |
| o-Xylene | 0.0988 | 0.00200 | " | 0.100 | ND | 98.8 | 70-130 | 4.02 | 20 | |
| sec-Butylbenzene | 0.0987 | 0.00200 | " | 0.100 | ND | 98.7 | 70-130 | 1.61 | 20 | |
| Styrene | 0.101 | 0.00200 | " | 0.100 | ND | 101 | 70-130 | 0.512 | 20 | |
| tert-Butylbenzene | 0.0997 | 0.00200 | " | 0.100 | ND | 99.7 | 70-130 | 2.26 | 20 | |
| Tetrachloroethene | 0.0999 | 0.00200 | " | 0.100 | ND | 99.9 | 70-130 | 2.59 | 20 | |
| Toluene | 0.0977 | 0.00200 | " | 0.100 | ND | 97.7 | 70-130 | 2.57 | 20 | |
| trans-1,2-Dichloroethene | 0.118 | 0.00200 | " | 0.100 | ND | 118 | 70-130 | 3.06 | 20 | |
| trans-1,3-Dichloropropene | 0.109 | 0.00200 | " | 0.100 | ND | 109 | 70-130 | 3.23 | 20 | |
| Trichloroethene | 0.106 | 0.00200 | " | 0.100 | ND | 106 | 70-130 | 4.24 | 20 | |
| Trichlorofluoromethane | 0.0922 | 0.00300 | " | 0.100 | ND | 92.2 | 70-130 | 16.4 | 20 | |
| Vinyl chloride | 0.0860 | 0.00200 | " | 0.100 | ND | 86.0 | 70-130 | 13.7 | 20 | |
| *Surrogate: 1,2-Dichloroethane-d4* | *61* | | *ug/L* | *62.5* | | *97.1* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *59* | | *"* | *62.5* | | *95.1* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *60* | | *"* | *62.5* | | *96.4* | *70-130* | | | |

Origins Laboratory, Inc.

Jen Pellegrini

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|

## PAH by 8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1642685 - SW846 3541** | | | | | | | | | | |
| **BLANK (1203736108-BLK)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| Acenaphthene | ND | 0.00333 | mg/kg | | | | - | | | U |
| Benzo(k)fluoranthene | ND | 0.00333 | " | | | | - | | | U |
| Anthracene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(a)pyrene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(b)fluoranthene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(ghi)perylene | ND | 0.00333 | " | | | | - | | | U |
| Chrysene | ND | 0.00333 | " | | | | - | | | U |
| Dibenzo(a,h)anthracene | ND | 0.00333 | " | | | | - | | | U |
| Fluoranthene | ND | 0.00333 | " | | | | - | | | U |
| Fluorene | ND | 0.00333 | " | | | | - | | | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.00333 | " | | | | - | | | U |
| Naphthalene | ND | 0.00333 | " | | | | - | | | U |
| Pyrene | ND | 0.00333 | " | | | | - | | | U |
| Acenaphthylene | ND | 0.00333 | " | | | | - | | | U |
| Phenanthrene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(a)anthracene | ND | 0.00333 | " | | | | - | | | U |
| *Surrogate: 5-alpha-Androstane* | *0.175* | | *"* | *0.166* | | *105* | *30-118* | | | |
| **LCS (1203736109-BKS)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| Dibenzo(a,h)anthracene | 0.416 | 0.00333 | mg/kg | 0.333 | | 125 | 35-142 | | | |
| Acenaphthene | 0.305 | 0.00333 | " | 0.333 | | 91 | 55-99 | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PAH by 8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1642685 - SW846 3541** | | | | | | | | | | |
| **LCS (1203736109-BKS)** | | | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| Acenaphthylene | 0.337 | 0.00333 | mg/kg | 0.333 | | 101 | 48-107 | | | |
| Anthracene | 0.326 | 0.00333 | " | 0.333 | | 98 | 52-102 | | | |
| Benzo(a)anthracene | 0.341 | 0.00333 | " | 0.333 | | 102 | 51-108 | | | |
| Benzo(a)pyrene | 0.367 | 0.00333 | " | 0.333 | | 110 | 35-121 | | | |
| Benzo(b)fluoranthene | 0.332 | 0.00333 | " | 0.333 | | 100 | 36-120 | | | |
| Benzo(k)fluoranthene | 0.321 | 0.00333 | " | 0.333 | | 96 | 26-121 | | | |
| Chrysene | 0.321 | 0.00333 | " | 0.333 | | 96 | 54-103 | | | |
| Fluorene | 0.333 | 0.00333 | " | 0.333 | | 100 | 47-106 | | | |
| Indeno(1,2,3-cd)pyrene | 0.431 | 0.00333 | " | 0.333 | | 129 | 41-130 | | | |
| Naphthalene | 0.313 | 0.00333 | " | 0.333 | | 94 | 57-98 | | | |
| Phenanthrene | 0.301 | 0.00333 | " | 0.333 | | 90 | 53-97 | | | |
| Pyrene | 0.233 | 0.00333 | " | 0.333 | | 70 | 41-114 | | | |
| Benzo(ghi)perylene | 0.385 | 0.00333 | " | 0.333 | | 116 | 39-119 | | | |
| Fluoranthene | 0.341 | 0.00333 | " | 0.333 | | 102 | 39-108 | | | |
| *Surrogate: 5-alpha-Androstane* | *0.156* | | *"* | *0.167* | | *94* | *30-118* | | | |
| **MS (1203736110 S)** | | **Source: 417266001** | | | Prepared: 02/27/2017 Analyzed: 02/28/2017 | | | | | |
| Dibenzo(a,h)anthracene | 0.771 | 0.0104 | mg/kg | 1.04 | <0.0052 | 74 | 18-146 | | | |
| Acenaphthylene | 0.565 | 0.0104 | " | 1.04 | <0.0052 | 54 | 39-116 | | | |
| Benzo(a)anthracene | 0.751 | 0.0104 | " | 1.04 | <0.0052 | 72 | 41-118 | | | |
| Benzo(a)pyrene | 0.774 | 0.0104 | " | 1.04 | <0.0052 | 74 | 27-126 | | | |
| Benzo(b)fluoranthene | 0.705 | 0.0104 | " | 1.04 | <0.0052 | 68 | 28-126 | | | |
| Benzo(ghi)perylene | 0.607 | 0.0104 | " | 1.04 | <0.0052 | 58 | 17-118 | | | |
| Chrysene | 0.639 | 0.0104 | " | 1.04 | <0.0052 | 61 | 42-113 | | | |
| Acenaphthene | 0.493 | 0.0104 | " | 1.04 | <0.0052 | 47 | 38-117 | | | |
| Fluoranthene | 0.658 | 0.0104 | " | 1.04 | 0.00624 | 63 | 28-116 | | | |
| Fluorene | 0.554 | 0.0104 | " | 1.04 | <0.0052 | 53 | 33-123 | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PAH by 8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1642685 - SW846 3541** | | | | | | | | | | |
| **MS (1203736110 S)** | | **Source: 417266001** | | | Prepared: 02/27/2017 Analyzed: 02/28/2017 | | | | | |
| Indeno(1,2,3-cd)pyrene | 0.730 | 0.0104 | mg/kg | 1.04 | <0.0052 | 70 | 17-133 | | | |
| Naphthalene | 0.493 | 0.0104 | " | 1.04 | <0.00312 | 47 | 33-117 | | | |
| Phenanthrene | 0.528 | 0.0104 | " | 1.04 | <0.0052 | 51 | 35-119 | | | |
| Pyrene | 0.592 | 0.0104 | " | 1.04 | <0.0052 | 57 | 30-131 | | | |
| Benzo(k)fluoranthene | 0.687 | 0.0104 | " | 1.04 | <0.0052 | 66 | 24-122 | | | |
| Anthracene | 0.606 | 0.0104 | " | 1.04 | <0.0052 | 58 | 36-120 | | | |
| *Surrogate: 5-alpha-Androstane* | *0.242* | | *"* | *0.520* | *0.461* | *47* | *30-118* | | | |
| **MSD (1203736111 SD)** | | **Source: 417266001** | | | Prepared: 02/27/2017 Analyzed: 02/27/2017 | | | | | |
| Benzo(a)pyrene | 0.993 | 0.0104 | mg/kg | 1.04 | <0.0052 | 95 | 27-126 | 25 | 30 | |
| Benzo(a)anthracene | 0.986 | 0.0104 | " | 1.04 | <0.0052 | 95 | 41-118 | 27 | 30 | |
| Anthracene | 0.775 | 0.0104 | " | 1.04 | <0.0052 | 74 | 36-120 | 24 | 30 | |
| Acenaphthylene | 0.696 | 0.0104 | " | 1.04 | <0.0052 | 67 | 39-116 | 21 | 30 | |
| Acenaphthene | 0.610 | 0.0104 | " | 1.04 | <0.0052 | 59 | 38-117 | 21 | 30 | |
| Benzo(b)fluoranthene | 0.841 | 0.0104 | " | 1.04 | <0.0052 | 81 | 28-126 | 18 | 30 | |
| Benzo(k)fluoranthene | 0.788 | 0.0104 | " | 1.04 | <0.0052 | 76 | 24-122 | 14 | 30 | |
| Chrysene | 0.823 | 0.0104 | " | 1.04 | <0.0052 | 79 | 42-113 | 25 | 30 | |
| Dibenzo(a,h)anthracene | 1.03 | 0.0104 | " | 1.04 | <0.0052 | 99 | 18-146 | 29 | 30 | |
| Fluoranthene | 0.869 | 0.0104 | " | 1.04 | 0.00624 | 83 | 28-116 | 28 | 30 | |
| Fluorene | 0.726 | 0.0104 | " | 1.04 | <0.0052 | 70 | 33-123 | 27 | 30 | |
| Indeno(1,2,3-cd)pyrene | 1.06 | 0.0104 | " | 1.04 | <0.0052 | 102 | 17-133 | 37 | 30 | |
| Naphthalene | 0.563 | 0.0104 | " | 1.04 | <0.00312 | 54 | 33-117 | 13 | 30 | |
| Phenanthrene | 0.706 | 0.0104 | " | 1.04 | <0.0052 | 68 | 35-119 | 29 | 30 | |
| Pyrene | 0.634 | 0.0104 | " | 1.04 | <0.0052 | 61 | 30-131 | 7 | 30 | |
| Benzo(ghi)perylene | 0.909 | 0.0104 | " | 1.04 | <0.0052 | 87 | 17-118 | 40 | 30 | |
| *Surrogate: 5-alpha-Androstane* | *0.339* | | *"* | *0.520* | *0.461* | *65* | *30-118* | | | |

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PCB by 8082A - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1642672 - SW846 3541** | | | | | | | | | | |
| **BLANK (1203736081-BLK)** | | | | | Prepared: 02/27/2017 Analyzed: 02/28/2017 | | | | | |
| Aroclor-1242 | ND | 0.00333 | mg/kg | | | | - | | | U |
| Aroclor-1016 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1232 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1248 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1254 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1260 | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-Total | ND | 0.00333 | " | | | | - | | | U |
| Aroclor-1221 | ND | 0.00333 | " | | | | - | | | U |
| *Surrogate: 4cmx* | *0.00411* | | *"* | *0.00666* | | *62* | *30-120* | | | |
| *Surrogate: Decachlorobiphenyl* | *0.00606* | | *"* | *0.00666* | | *91* | *32-139* | | | |
| **LCS (1203736082-BKS)** | | | | | Prepared: 02/27/2017 Analyzed: 02/28/2017 | | | | | |
| Aroclor-1016 | 0.0214 | 0.00333 | mg/kg | 0.0333 | | 64 | 48-93 | | | |
| Aroclor-1260 | 0.026 | 0.00333 | " | 0.0333 | | 78 | 58-117 | | | |
| *Surrogate: 4cmx* | *0.00455* | | *"* | *0.00666* | | *68* | *30-120* | | | |
| *Surrogate: Decachlorobiphenyl* | *0.00637* | | *"* | *0.00666* | | *96* | *32-139* | | | |
| **MS (1203736083 S)** | | **Source: 417274002** | | | Prepared: 02/27/2017 Analyzed: 02/28/2017 | | | | | |
| Aroclor-1016 | 0.0261 | 0.0196 | mg/kg | 0.0392 | <0.00652 | 67 | 23-121 | | | |
| Aroclor-1260 | 0.0275 | 0.0196 | " | 0.0392 | <0.00652 | 70 | 35-135 | | | |
| *Surrogate: 4cmx* | *0.00511* | | *"* | *0.00783* | *0.00546* | *65* | *30-120* | | | |
| *Surrogate: Decachlorobiphenyl* | *0.00603* | | *"* | *0.00783* | *0.00635* | *77* | *32-139* | | | |
| **MSD (1203736084 SD)** | | **Source: 417274002** | | | Prepared: 02/27/2017 Analyzed: 02/28/2017 | | | | | |
| Aroclor-1016 | 0.0257 | 0.0196 | mg/kg | 0.0392 | <0.00652 | 66 | 23-121 | 2 | 29 | |
| Aroclor-1260 | 0.0264 | 0.0196 | " | 0.0392 | <0.00652 | 67 | 35-135 | 4 | 33 | |
| *Surrogate: Decachlorobiphenyl* | *0.00611* | | *"* | *0.00784* | *0.00635* | *78* | *32-139* | | | |
| *Surrogate: 4cmx* | *0.00476* | | *"* | *0.00784* | *0.00546* | *61* | *30-120* | | | |

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PCB by 8082A - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1642672 - SW846 3541** | | | | | | | | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## TCLP Metals by 1311/6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1643200 - SW846 3010A** | | | | | | | | | | |
| **MS (1203735075 S)** | | **Source: X702386-01** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| Lead | 4.67 | 0.100 | mg/L | 5.00 | <0.033 | 93.2 | 75-125 | | | |
| **TB (1203735076-BLK)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| Lead | ND | 0.100 | mg/L | | | | - | | | U |
| **BLANK (1203737218-BLK)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| Lead | ND | 0.100 | mg/L | | | | - | | | U |
| **LCS (1203737219-BKS)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| Lead | 4.95 | 0.100 | mg/L | 5.00 | | 99 | 80-120 | | | |
| **DUP (1203737220 D)** | | **Source: X702386-01** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| Lead | ND | 0.100 | mg/L | | <0.033 | | 0-20 | 132 | 20 | U |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Total Metals by 6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1642384 - SW846 3050B** | | | | | | | | | | |
| **BLANK (1203735304-BLK)** | | | | | Prepared: 02/25/2017 Analyzed: 02/27/2017 | | | | | |
| Lead | ND | 0.958 | mg/kg | | | | - | | | U |
| Selenium | ND | 2.87 | " | | | | - | | | U |
| Chromium | ND | 0.479 | " | | | | - | | | U |
| Cadmium | ND | 0.479 | " | | | | - | | | U |
| Barium | ND | 0.479 | " | | | | - | | | U |
| Arsenic | ND | 2.87 | " | | | | - | | | U |
| Silver | ND | 0.479 | " | | | | - | | | U |
| **LCS (1203735305-BKS)** | | | | | Prepared: 02/25/2017 Analyzed: 02/27/2017 | | | | | |
| Chromium | 49.2 | 0.489 | mg/kg | 48.9 | | 100 | 80-120 | | | |
| Cadmium | 49.4 | 0.489 | " | 48.9 | | 101 | 80-120 | | | |
| Silver | 50.3 | 0.489 | " | 48.9 | | 103 | 80-120 | | | |
| Selenium | 51.5 | 2.94 | " | 48.9 | | 105 | 80-120 | | | |
| Barium | 48.9 | 0.489 | " | 48.9 | | 99.9 | 80-120 | | | |
| Arsenic | 48.9 | 2.94 | " | 48.9 | | 99.9 | 80-120 | | | |
| Lead | 50.2 | 0.978 | " | 48.9 | | 103 | 80-120 | | | |
| **DUP (1203735306 D)** | | **Source: 417299001** | | | Prepared: 02/25/2017 Analyzed: 02/27/2017 | | | | | |
| Barium | 95.2 | 0.512 | mg/kg | | 77.9 | | 0-20 | 20 | 20 | |
| Selenium | ND | 3.07 | " | | <0.512 | | 0-20 | 73.5 | 20 | U |
| Lead | 14.5 | 1.02 | " | | 11.8 | | 0-20 | 20.6 | 20 | |
| Arsenic | 3.55 | 3.07 | " | | 3.69 | | 0-20 | 3.85 | 20 | |
| Chromium | 11.6 | 0.512 | " | | 10.7 | | 0-20 | 8.29 | 20 | |
| Cadmium | 0.305 | 0.512 | " | | 0.283 | | 0-20 | 7.41 | 20 | J |
| Silver | ND | 0.512 | " | | <0.102 | | 0-20 | NR | 20 | U |
| **MS (1203735307 S)** | | **Source: 417299001** | | | Prepared: 02/25/2017 Analyzed: 02/27/2017 | | | | | |

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Total Metals by 6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1642384 - SW846 3050B** | | | | | | | | | | |
| **MS (1203735307 S)** | | **Source: 417299001** | | | Prepared: 02/25/2017 Analyzed: 02/27/2017 | | | | | |
| Cadmium | 46.3 | 0.490 | mg/kg | 49.0 | 0.283 | 93.8 | 75-125 | | | |
| Chromium | 56.4 | 0.490 | " | 49.0 | 10.7 | 93.3 | 75-125 | | | |
| Arsenic | 51.1 | 2.94 | " | 49.0 | 3.69 | 96.8 | 75-125 | | | |
| Lead | 55.8 | 0.980 | " | 49.0 | 11.8 | 89.7 | 75-125 | | | |
| Selenium | 48.2 | 2.94 | " | 49.0 | <0.490 | 98.4 | 75-125 | | | |
| Silver | 47.2 | 0.490 | " | 49.0 | <0.098 | 96.4 | 75-125 | | | |
| Barium | 125 | 0.490 | " | 49.0 | 77.9 | 95.8 | 75-125 | | | |

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Total Metals by 7471A - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1642214 - SW846 7471A Prep** | | | | | | | | | | |
| **BLANK (1203734907-BLK)** | | | | | Prepared: 02/24/2017 Analyzed: 02/28/2017 | | | | | |
| Mercury | ND | 0.0119 | mg/kg | | | | - | | | U |
| **LCS (1203734908-BKS)** | | | | | Prepared: 02/24/2017 Analyzed: 02/28/2017 | | | | | |
| Mercury | 0.126 | 0.0117 | mg/kg | 0.117 | | 108 | 80-120 | | | |
| **DUP (1203734909 D)** | | **Source: 417001001** | | | Prepared: 02/24/2017 Analyzed: 02/28/2017 | | | | | |
| Mercury | 12.0 | 1.17 | mg/kg | | 10.6 | | 0-20 | 11.9 | 20 | |
| **MS (1203734910 S)** | | **Source: 417001001** | | | Prepared: 02/24/2017 Analyzed: 02/28/2017 | | | | | |
| Mercury | 16.8 | 1.20 | mg/kg | 0.120 | 10.6 | NR | 80-120 | | | |

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Notes and Definitions

| | |
|---|---|
| Ua | Sample is Non-Detect. |
| U | Result not detected above the detection limit |
| QR-02 | The RPD result exceeded the QC control limits; however, both percent recoveries were acceptable. Sample results for the QC batch were accepted based on percent recoveries and completeness of QC data. |
| QM-07 | The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery. |
| J | Greater than the detection limit but less than the reporting limit |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| RPD | Relative Percent Difference |

All soil results are reported on a wet weight basis.

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

March 06, 2017

Pinyon

Julie Linn

9100 West Jewell Avenue, Suite 200

Lakewood CO 80232

**Project Name -** 27th St. Storm Drain **Project Number -** 11780301.2100

Attached are your analytical results for 27th St. Storm Drain received by Origins Laboratory, Inc. February 27, 2017. This project is associated with Origins project number Y702026-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com

THE NELAC INSTITUTE

ACCREDITED
TESTING CERT # 3494.01

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## CROSS REFERENCE REPORT

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| B-8 | Y702026-01 | Soil | February 27, 2017 12:20 | 02/27/2017 14:24 |
| B-10 | Y702026-02 | Soil | February 27, 2017 14:00 | 02/27/2017 14:24 |
| B-11 | Y702026-03 | Soil | February 27, 2017 10:30 | 02/27/2017 14:24 |

Origins Laboratory, Inc.

Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon

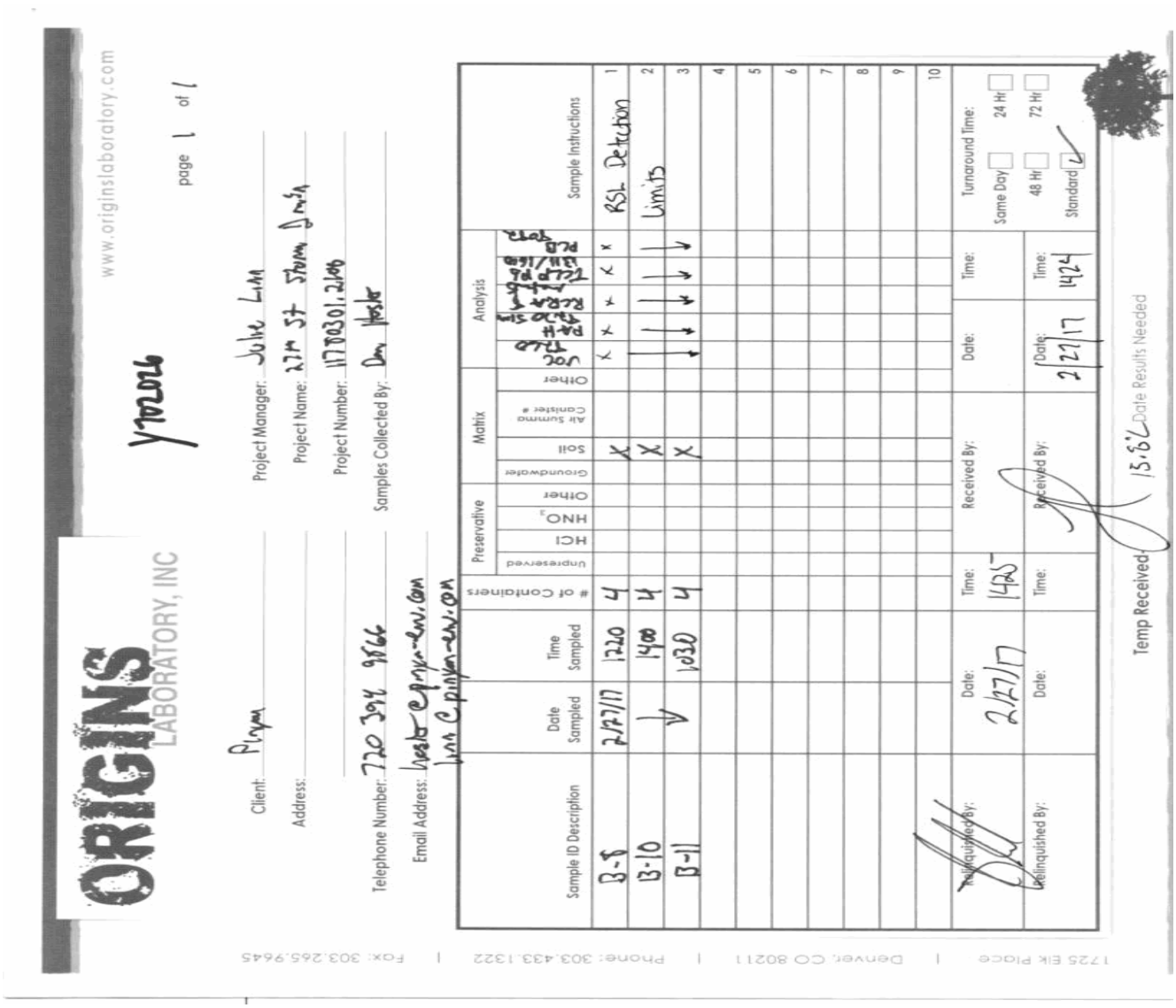
9100 West Jewell Avenue, Suite 200

Lakewood CO 80232

Julie Linn

Project Number: 11780301.2100

Project: 27th St. Storm Drain



ORIGINS LABORATORY, INC

www.originslaboratory.com

page 1 of 1

Y702026

Client: Pinyon

Address:

Telephone Number: 720 394 9866

Email Address: hester@pinyon-env.com
linn@pinyon-env.com

Project Manager: Julie Linn

Project Name: 27th St Storm Drain

Project Number: 11780301.2100

Samples Collected By: Dan Hester

| Sample ID Description | Date Sampled | Time Sampled | # of Containers | Preservative: Unpreserved | Preservative: HCl | Preservative: $HNO_3$ | Preservative: Other | Matrix: Groundwater | Matrix: Soil | Matrix: Air Summa Canister # | Matrix: Other | Analysis: VOC TCLP | Analysis: PAH TCLP SIM | Analysis: RCRA 8 Metals | Analysis: TCLP PB | Analysis: PCB 1311/1680 | Analysis: PCB TOTA | Sample Instructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-8 | 2/27/17 | 1220 | 4 | | | | | | X | | | X | X | X | X | X | X | RSL Detection |
| B-10 | ↓ | 1400 | 4 | | | | | | X | | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | Limits |
| B-11 | ↓ | 1030 | 4 | | | | | | X | | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | |
| | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | | |

Relinquished By: Date: 2/27/17 Time: 1425 Received By: Date: Time:

Relinquished By: Date: Time: Received By: Date: 2/27/17 Time: 1424

Turnaround Time: Same Day ☐ 24 Hr ☐ 48 Hr ☐ 72 Hr ☐ Standard ☑

Temp Received 15.8°C Date Results Needed

1725 Elk Place | Denver, CO 80211 | Phone: 303.433.1322 | Fax: 303.265.9645

Origins Laboratory, Inc.

Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

Origins Laboratory

F-012207-01-R1
Effective Date: 01/09/12

**Sample Receipt Checklist**

Origins Work Order: Y702026

Client: Pinyon
Client Project ID: 27th St Storm Drain

Checklist Completed by: Dan Ler

Shipped Via: HD (UPS, FedEx, Hand Delivered, Pick-up, etc.)

Date/time completed: 7-27-12 1442

Airbill #: NA

Matrix(s) Received: (Check all that apply): ✓ Soil/Solid ____ Water ____ Other: ____ (Describe)

Cooler Number/Temperature: 1 / 15.8 °C ____/____ °C ____/____ °C ____/____ °C

Thermometer ID: T003

| Requirement Description | Yes | No | N/A | Comments (if any) |
|---|---|---|---|---|
| If samples require cooling, was the temperature between 0°C to ≤ 6°C[1]? | | ✓ | | Sampled Same Day |
| Is there ice present (document if blue ice is used) | ✓ | | | |
| Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact) | | ✓ | | |
| Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact) | | ✓ | | |
| Were all samples received intact[1]? | ✓ | | | |
| Was adequate sample volume provided[1]? | ✓ | | | |
| Are short holding time analytes or samples with HTs due within 48 hours present[1]? | | ✓ | | |
| Is a chain-of-custody (COC) present and filled out completely[1]? | ✓ | | | |
| Does the COC agree with the number and type of sample bottles received[1]? | ✓ | | | |
| Do the sample IDs on the bottle labels match the COC[1]? | ✓ | | | |
| Is the COC properly relinquished by the client with date and time recorded[1]? | ✓ | | | |
| For volatiles in water – is there headspace (> ¼ inch bubble) present? **If yes, contact client and note in narrative.** | | | | |
| Are samples preserved that require preservation and was it checked[1]? *(note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)/(pH <2 for samples preserved with HNO3, HCL, H2SO4) / ( pH >10 for samples preserved with NaAsO2+NaOH, ZnAc+NaOH)* | | ✓ | | |
| Additional Comments (if any): | | | | |

*[1]If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.*

Reviewed by (Project Manager) 2/28/17 Date/Time Reviewed

Origins Laboratory, Inc.

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Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-8**

**2/27/2017 12:20:00PM**

## GEL Laboratories, LLC

**Y702026-01 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Metals by SW846 3050B/6010C** | | | | | | | | | |
| Arsenic | ND | 0.489 | 2.93 | mg/kg dry | 1 | 1643435 | 02/28/2017 | 03/02/2017 | U |
| Barium | **19.2** | **0.0978** | 0.489 | " | " | " | " | " | |
| Cadmium | ND | 0.0978 | 0.489 | " | " | " | " | " | U |
| Chromium | **2.42** | **0.147** | 0.489 | " | " | " | " | " | |
| Lead | **1.94** | **0.323** | 0.978 | " | " | " | " | " | |
| Selenium | ND | 0.489 | 2.93 | " | " | " | " | " | U |
| Silver | ND | 0.0978 | 0.489 | " | " | " | " | " | U |
| **Metals by SW846 7471A** | | | | | | | | | |
| Mercury | ND | 0.00395 | 0.0118 | mg/kg dry | 1 | 1643501 | 03/01/2017 | 03/02/2017 | U |
| **PAHs by SW846 3541/8270D SIM** | | | | | | | | | |
| Acenaphthene | ND | 0.00173 | 0.00345 | mg/kg dry | 1 | 1643449 | " | 03/01/2017 | U |
| Acenaphthylene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Anthracene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Benzo(a)anthracene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Benzo(a)pyrene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Benzo(b)fluoranthene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Benzo(ghi)perylene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Benzo(k)fluoranthene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-8**

**2/27/2017 12:20:00PM**

## GEL Laboratories, LLC

**Y702026-01 (Soil)**

### PAHs by SW846 3541/8270D SIM

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Chrysene | ND | 0.00173 | 0.00345 | mg/kg dry | 1 | 1643449 | 03/01/2017 | 03/01/2017 | U |
| Dibenzo(a,h)anthracene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Fluoranthene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Fluorene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Naphthalene | ND | 0.00104 | 0.00345 | " | " | " | " | " | U |
| Phenanthrene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| Pyrene | ND | 0.00173 | 0.00345 | " | " | " | " | " | U |
| *Surrogate: 5-alpha-Androstane* | *69 %* | | *30-118* | | | " | " | " | |

### SW846 3541/8082A PCB Solid Automated Soxhlet

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Aroclor-1016 | ND | 0.00115 | 0.00345 | mg/kg dry | 1 | 1644161 | 03/03/2017 | 03/04/2017 | U |
| Aroclor-1221 | ND | 0.00115 | 0.00345 | " | " | " | " | " | U |
| Aroclor-1232 | ND | 0.00115 | 0.00345 | " | " | " | " | " | U |
| Aroclor-1242 | ND | 0.00115 | 0.00345 | " | " | " | " | " | U |
| Aroclor-1248 | ND | 0.00115 | 0.00345 | " | " | " | " | " | U |
| Aroclor-1254 | ND | 0.00115 | 0.00345 | " | " | " | " | " | U |
| Aroclor-1260 | ND | 0.00115 | 0.00345 | " | " | " | " | " | U |

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**B-8**

**2/27/2017 12:20:00PM**

**GEL Laboratories, LLC**

**Y702026-01 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **SW846 3541/8082A PCB Solid Automated Soxhlet** | | | | | | | | | |
| Aroclor-Total | ND | 0.00115 | 0.00345 | mg/kg dry | 1 | 1644161 | 03/03/2017 | 03/04/2017 | U |
| *Surrogate: 4cmx* | *83 %* | | *30-120* | | | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | *95 %* | | *32-139* | | | " | " | " | |
| **TCLP Metals by SW846 3010A/6010C** | | | | | | | | | |
| Lead | ND | 0.033 | 0.100 | mg/L | 1 | 1643819 | 03/02/2017 | 03/02/2017 | U |
| **VOC by EPA 8260C** | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | | 2.00 | ug/kg | 1 | B7B2807 | 02/28/2017 | 03/01/2017 | Ua |
| 1,1,1-Trichloroethane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,1,2,2-Tetrachloroethane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,1,2-Trichloroethane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,1-Dichloroethane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,1-Dichloroethene | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,1-Dichloropropene | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,2,3-Trichlorobenzene | ND | | 5.00 | " | " | " | " | " | Ua |
| 1,2,3-Trichloropropane | ND | | 5.00 | " | " | " | " | " | Ua |
| 1,2,4-Trichlorobenzene | ND | | 5.00 | " | " | " | " | " | Ua |

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**B-8**

**2/27/2017 12:20:00PM**

## Origins Laboratory, Inc.

**Y702026-01 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | ND | | 2.00 | ug/kg | 1 | B7B2807 | 02/28/2017 | 03/01/2017 | Ua |
| 1,2-Dibromo-3-chloropropane | ND | | 5.00 | " | " | " | " | " | Ua |
| 1,2-Dibromoethane (EDB) | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,2-Dichlorobenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,2-Dichloroethane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,2-Dichloropropane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,3,5-Trimethylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,3-Dichlorobenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,3-Dichloropropane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,4-Dichlorobenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| 2,2-Dichloropropane | ND | | 2.00 | " | " | " | " | " | Ua |
| 2-Butanone | ND | | 10.0 | " | " | " | " | " | Ua |
| 2-Chlorotoluene | ND | | 2.00 | " | " | " | " | " | Ua |
| 2-Hexanone | ND | | 10.0 | " | " | " | " | " | Ua |
| 4-Chlorotoluene | ND | | 2.00 | " | " | " | " | " | Ua |
| 4-Isopropyltoluene | ND | | 2.00 | " | " | " | " | " | Ua |
| 4-Methyl-2-pentanone | ND | | 10.0 | " | " | " | " | " | Ua |
| Acetone | ND | | 20.0 | " | " | " | " | " | Ua |
| Benzene | ND | | 2.00 | " | " | " | " | " | Ua |
| Bromobenzene | ND | | 2.00 | " | " | " | " | " | Ua |

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**2/27/2017 12:20:00PM**

## Origins Laboratory, Inc.

**Y702026-01 (Soil)**

### VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Bromochloromethane | ND | | 2.00 | ug/kg | 1 | B7B2807 | 02/28/2017 | 03/01/2017 | Ua |
| Bromodichloromethane | ND | | 2.00 | " | " | " | " | " | Ua |
| Bromoform | ND | | 2.00 | " | " | " | " | " | Ua |
| Bromomethane | ND | | 2.00 | " | " | " | " | " | Ua |
| Carbon disulfide | ND | | 5.00 | " | " | " | " | " | Ua |
| Carbon tetrachloride | ND | | 2.00 | " | " | " | " | " | Ua |
| Chlorobenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| Chloroethane | ND | | 5.00 | " | " | " | " | " | Ua |
| Chloroform | ND | | 2.00 | " | " | " | " | " | Ua |
| Chloromethane | ND | | 2.00 | " | " | " | " | " | Ua |
| cis-1,2-Dichloroethene | ND | | 2.00 | " | " | " | " | " | Ua |
| cis-1,3-Dichloropropene | ND | | 2.00 | " | " | " | " | " | Ua |
| Dibromochloromethane | ND | | 2.00 | " | " | " | " | " | Ua |
| Dibromomethane | ND | | 2.00 | " | " | " | " | " | Ua |
| Ethylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| Hexachlorobutadiene | ND | | 5.00 | " | " | " | " | " | Ua |
| Iodomethane | ND | | 15.0 | " | " | " | " | " | Ua |
| Isopropylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| m,p-Xylene | ND | | 4.00 | " | " | " | " | " | Ua |
| Methyl tert-Butyl Ether | ND | | 2.00 | " | " | " | " | " | Ua |

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**B-8**

**2/27/2017 12:20:00PM**

**Origins Laboratory, Inc.**

**Y702026-01 (Soil)**

## VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Methylene Chloride | ND | | 20.0 | ug/kg | 1 | B7B2807 | 02/28/2017 | 03/01/2017 | Ua |
| Naphthalene | ND | | 10.0 | " | " | " | " | " | Ua |
| n-Butylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| n-Propylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| o-Xylene | ND | | 2.00 | " | " | " | " | " | Ua |
| sec-Butylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| Styrene | ND | | 2.00 | " | " | " | " | " | Ua |
| tert-Butylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| Tetrachloroethene | ND | | 2.00 | " | " | " | " | " | Ua |
| Toluene | ND | | 2.00 | " | " | " | " | " | Ua |
| trans-1,2-Dichloroethene | ND | | 2.00 | " | " | " | " | " | Ua |
| trans-1,3-Dichloropropene | ND | | 2.00 | " | " | " | " | " | Ua |
| Trichloroethene | ND | | 2.00 | " | " | " | " | " | Ua |
| Trichlorofluoromethane | ND | | 3.00 | " | " | " | " | " | Ua |
| Vinyl chloride | ND | | 2.00 | " | " | " | " | " | Ua |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 1,2-Dichloroethane-d4* | *103 %* | *70-130* | " | " | " |
| *Surrogate: Toluene-d8* | *96.2 %* | *70-130* | " | " | " |
| *Surrogate: 4-Bromofluorobenzene* | *96.8 %* | *70-130* | " | " | " |

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**B-10**

**2/27/2017 2:00:00PM**

**GEL Laboratories, LLC**

**Y702026-02 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Metals by SW846 3050B/6010C** | | | | | | | | | |
| Arsenic | **2.94** | **0.478** | 2.87 | mg/kg dry | 1 | 1643435 | 02/28/2017 | 03/02/2017 | |
| Barium | **117** | **0.0956** | 0.478 | " | " | " | " | " | |
| Cadmium | **0.232** | **0.0956** | 0.478 | " | " | " | " | " | J |
| Chromium | **11.3** | **0.143** | 0.478 | " | " | " | " | " | |
| Lead | **8.47** | **0.315** | 0.956 | " | " | " | " | " | |
| Selenium | ND | 0.478 | 2.87 | " | " | " | " | " | U |
| Silver | ND | 0.0956 | 0.478 | " | " | " | " | " | U |
| **Metals by SW846 7471A** | | | | | | | | | |
| Mercury | **0.00778** | **0.00386** | 0.0115 | mg/kg dry | 1 | 1643501 | 03/01/2017 | 03/02/2017 | J |
| **PAHs by SW846 3541/8270D SIM** | | | | | | | | | |
| Acenaphthene | ND | 0.00172 | 0.00344 | mg/kg dry | 1 | 1643449 | " | 03/01/2017 | U |
| Acenaphthylene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Anthracene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Benzo(a)anthracene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Benzo(a)pyrene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Benzo(b)fluoranthene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Benzo(ghi)perylene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Benzo(k)fluoranthene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |

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**B-10**

**2/27/2017 2:00:00PM**

## GEL Laboratories, LLC

**Y702026-02 (Soil)**

### PAHs by SW846 3541/8270D SIM

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Chrysene | ND | 0.00172 | 0.00344 | mg/kg dry | 1 | 1643449 | 03/01/2017 | 03/01/2017 | U |
| Dibenzo(a,h)anthracene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Fluoranthene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Fluorene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Naphthalene | ND | 0.00103 | 0.00344 | " | " | " | " | " | U |
| Phenanthrene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| Pyrene | ND | 0.00172 | 0.00344 | " | " | " | " | " | U |
| *Surrogate: 5-alpha-Androstane* | *65 %* | | *30-118* | | | " | " | " | |

### SW846 3541/8082A PCB Solid Automated Soxhlet

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Aroclor-1016 | ND | 0.00114 | 0.00344 | mg/kg dry | 1 | 1644161 | 03/03/2017 | 03/04/2017 | U |
| Aroclor-1221 | ND | 0.00114 | 0.00344 | " | " | " | " | " | U |
| Aroclor-1232 | ND | 0.00114 | 0.00344 | " | " | " | " | " | U |
| Aroclor-1242 | ND | 0.00114 | 0.00344 | " | " | " | " | " | U |
| Aroclor-1248 | ND | 0.00114 | 0.00344 | " | " | " | " | " | U |
| Aroclor-1254 | ND | 0.00114 | 0.00344 | " | " | " | " | " | U |
| Aroclor-1260 | ND | 0.00114 | 0.00344 | " | " | " | " | " | U |

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**2/27/2017 2:00:00PM**

**GEL Laboratories, LLC**

**Y702026-02 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **SW846 3541/8082A PCB Solid Automated Soxhlet** | | | | | | | | | |
| Aroclor-Total | ND | 0.00114 | 0.00344 | mg/kg dry | 1 | 1644161 | 03/03/2017 | 03/04/2017 | U |
| *Surrogate: 4cmx* | *98 %* | | *30-120* | | | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | *101 %* | | *32-139* | | | " | " | " | |
| **TCLP Metals by SW846 3010A/6010C** | | | | | | | | | |
| Lead | ND | 0.033 | 0.100 | mg/L | 1 | 1643819 | 03/02/2017 | 03/02/2017 | U |
| **VOC by EPA 8260C** | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | | 2.00 | ug/kg | 1 | B7B2807 | 02/28/2017 | 03/01/2017 | Ua |
| 1,1,1-Trichloroethane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,1,2,2-Tetrachloroethane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,1,2-Trichloroethane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,1-Dichloroethane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,1-Dichloroethene | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,1-Dichloropropene | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,2,3-Trichlorobenzene | ND | | 5.00 | " | " | " | " | " | Ua |
| 1,2,3-Trichloropropane | ND | | 5.00 | " | " | " | " | " | Ua |
| 1,2,4-Trichlorobenzene | ND | | 5.00 | " | " | " | " | " | Ua |

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**2/27/2017 2:00:00PM**

**Origins Laboratory, Inc.**

**Y702026-02 (Soil)**

## VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | ND | | 2.00 | ug/kg | 1 | B7B2807 | 02/28/2017 | 03/01/2017 | Ua |
| 1,2-Dibromo-3-chloropropane | ND | | 5.00 | " | " | " | " | " | Ua |
| 1,2-Dibromoethane (EDB) | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,2-Dichlorobenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,2-Dichloroethane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,2-Dichloropropane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,3,5-Trimethylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,3-Dichlorobenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,3-Dichloropropane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,4-Dichlorobenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| 2,2-Dichloropropane | ND | | 2.00 | " | " | " | " | " | Ua |
| 2-Butanone | ND | | 10.0 | " | " | " | " | " | Ua |
| 2-Chlorotoluene | ND | | 2.00 | " | " | " | " | " | Ua |
| 2-Hexanone | ND | | 10.0 | " | " | " | " | " | Ua |
| 4-Chlorotoluene | ND | | 2.00 | " | " | " | " | " | Ua |
| 4-Isopropyltoluene | ND | | 2.00 | " | " | " | " | " | Ua |
| 4-Methyl-2-pentanone | ND | | 10.0 | " | " | " | " | " | Ua |
| Acetone | ND | | 20.0 | " | " | " | " | " | Ua |
| Benzene | ND | | 2.00 | " | " | " | " | " | Ua |
| Bromobenzene | ND | | 2.00 | " | " | " | " | " | Ua |

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Project: 27th St. Storm Drain

**B-10**

**2/27/2017 2:00:00PM**

**Origins Laboratory, Inc.**

**Y702026-02 (Soil)**

## VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Bromochloromethane | ND | | 2.00 | ug/kg | 1 | B7B2807 | 02/28/2017 | 03/01/2017 | Ua |
| Bromodichloromethane | ND | | 2.00 | " | " | " | " | " | Ua |
| Bromoform | ND | | 2.00 | " | " | " | " | " | Ua |
| Bromomethane | ND | | 2.00 | " | " | " | " | " | Ua |
| Carbon disulfide | ND | | 5.00 | " | " | " | " | " | Ua |
| Carbon tetrachloride | ND | | 2.00 | " | " | " | " | " | Ua |
| Chlorobenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| Chloroethane | ND | | 5.00 | " | " | " | " | " | Ua |
| Chloroform | ND | | 2.00 | " | " | " | " | " | Ua |
| Chloromethane | ND | | 2.00 | " | " | " | " | " | Ua |
| cis-1,2-Dichloroethene | ND | | 2.00 | " | " | " | " | " | Ua |
| cis-1,3-Dichloropropene | ND | | 2.00 | " | " | " | " | " | Ua |
| Dibromochloromethane | ND | | 2.00 | " | " | " | " | " | Ua |
| Dibromomethane | ND | | 2.00 | " | " | " | " | " | Ua |
| Ethylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| Hexachlorobutadiene | ND | | 5.00 | " | " | " | " | " | Ua |
| Iodomethane | ND | | 15.0 | " | " | " | " | " | Ua |
| Isopropylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| m,p-Xylene | ND | | 4.00 | " | " | " | " | " | Ua |
| Methyl tert-Butyl Ether | ND | | 2.00 | " | " | " | " | " | Ua |

Origins Laboratory, Inc.

Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-10**

**2/27/2017 2:00:00PM**

**Origins Laboratory, Inc.**

**Y702026-02 (Soil)**

## VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Methylene Chloride | ND | | 20.0 | ug/kg | 1 | B7B2807 | 02/28/2017 | 03/01/2017 | Ua |
| Naphthalene | ND | | 10.0 | " | " | " | " | " | Ua |
| n-Butylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| n-Propylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| o-Xylene | ND | | 2.00 | " | " | " | " | " | Ua |
| sec-Butylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| Styrene | ND | | 2.00 | " | " | " | " | " | Ua |
| tert-Butylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| Tetrachloroethene | ND | | 2.00 | " | " | " | " | " | Ua |
| Toluene | ND | | 2.00 | " | " | " | " | " | Ua |
| trans-1,2-Dichloroethene | ND | | 2.00 | " | " | " | " | " | Ua |
| trans-1,3-Dichloropropene | ND | | 2.00 | " | " | " | " | " | Ua |
| Trichloroethene | ND | | 2.00 | " | " | " | " | " | Ua |
| Trichlorofluoromethane | ND | | 3.00 | " | " | " | " | " | Ua |
| Vinyl chloride | ND | | 2.00 | " | " | " | " | " | Ua |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 1,2-Dichloroethane-d4* | *104 %* | *70-130* | " | " | " |
| *Surrogate: Toluene-d8* | *94.9 %* | *70-130* | " | " | " |
| *Surrogate: 4-Bromofluorobenzene* | *97.5 %* | *70-130* | " | " | " |

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Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-11**

**2/27/2017 10:30:00AM**

## GEL Laboratories, LLC

**Y702026-03 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Metals by SW846 3050B/6010C** | | | | | | | | | |
| Arsenic | ND | 0.563 | 3.38 | mg/kg dry | 1 | 1643435 | 02/28/2017 | 03/02/2017 | U |
| Barium | **41.3** | **0.113** | 0.563 | " | " | " | " | " | |
| Cadmium | ND | 0.113 | 0.563 | " | " | " | " | " | U |
| Chromium | **4.25** | **0.169** | 0.563 | " | " | " | " | " | |
| Lead | **3.77** | **0.372** | 1.13 | " | " | " | " | " | |
| Selenium | **0.638** | **0.563** | 3.38 | " | " | " | " | " | J |
| Silver | ND | 0.113 | 0.563 | " | " | " | " | " | U |
| **Metals by SW846 7471A** | | | | | | | | | |
| Mercury | ND | 0.00447 | 0.0134 | mg/kg dry | 1 | 1643501 | 03/01/2017 | 03/02/2017 | U |
| **PAHs by SW846 3541/8270D SIM** | | | | | | | | | |
| Acenaphthene | ND | 0.0019 | 0.00381 | mg/kg dry | 1 | 1643449 | " | 03/01/2017 | U |
| Acenaphthylene | ND | 0.0019 | 0.00381 | " | " | " | " | " | U |
| Anthracene | ND | 0.0019 | 0.00381 | " | " | " | " | " | U |
| Benzo(a)anthracene | ND | 0.0019 | 0.00381 | " | " | " | " | " | U |
| Benzo(a)pyrene | ND | 0.0019 | 0.00381 | " | " | " | " | " | U |
| Benzo(b)fluoranthene | ND | 0.0019 | 0.00381 | " | " | " | " | " | U |
| Benzo(ghi)perylene | ND | 0.0019 | 0.00381 | " | " | " | " | " | U |
| Benzo(k)fluoranthene | ND | 0.0019 | 0.00381 | " | " | " | " | " | U |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-11**

**2/27/2017 10:30:00AM**

## GEL Laboratories, LLC

**Y702026-03 (Soil)**

### PAHs by SW846 3541/8270D SIM

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Chrysene | ND | 0.0019 | 0.00381 | mg/kg dry | 1 | 1643449 | 03/01/2017 | 03/01/2017 | U |
| Dibenzo(a,h)anthracene | ND | 0.0019 | 0.00381 | " | " | " | " | " | U |
| Fluoranthene | ND | 0.0019 | 0.00381 | " | " | " | " | " | U |
| Fluorene | ND | 0.0019 | 0.00381 | " | " | " | " | " | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.0019 | 0.00381 | " | " | " | " | " | U |
| Naphthalene | ND | 0.00114 | 0.00381 | " | " | " | " | " | U |
| Phenanthrene | ND | 0.0019 | 0.00381 | " | " | " | " | " | U |
| Pyrene | ND | 0.0019 | 0.00381 | " | " | " | " | " | U |
| *Surrogate: 5-alpha-Androstane* | *68 %* | | *30-118* | | | " | " | " | |

### SW846 3541/8082A PCB Solid Automated Soxhlet

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Aroclor-1016 | ND | 0.00127 | 0.00381 | mg/kg dry | 1 | 1644161 | 03/03/2017 | 03/04/2017 | U |
| Aroclor-1221 | ND | 0.00127 | 0.00381 | " | " | " | " | " | U |
| Aroclor-1232 | ND | 0.00127 | 0.00381 | " | " | " | " | " | U |
| Aroclor-1242 | ND | 0.00127 | 0.00381 | " | " | " | " | " | U |
| Aroclor-1248 | ND | 0.00127 | 0.00381 | " | " | " | " | " | U |
| Aroclor-1254 | ND | 0.00127 | 0.00381 | " | " | " | " | " | U |
| Aroclor-1260 | ND | 0.00127 | 0.00381 | " | " | " | " | " | U |

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9100 West Jewell Avenue, Suite 200
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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-11**

**2/27/2017 10:30:00AM**

**GEL Laboratories, LLC**

**Y702026-03 (Soil)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **SW846 3541/8082A PCB Solid Automated Soxhlet** | | | | | | | | | |
| Aroclor-Total | ND | 0.00127 | 0.00381 | mg/kg dry | 1 | 1644161 | 03/03/2017 | 03/04/2017 | U |
| *Surrogate: 4cmx* | *113 %* | | *30-120* | | | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | *118 %* | | *32-139* | | | " | " | " | |
| **TCLP Metals by SW846 3010A/6010C** | | | | | | | | | |
| Lead | ND | 0.033 | 0.100 | mg/L | 1 | 1643819 | 03/02/2017 | 03/02/2017 | U |
| **VOC by EPA 8260C** | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | | 2.00 | ug/kg | 1 | B7B2807 | 02/28/2017 | 03/01/2017 | Ua |
| 1,1,1-Trichloroethane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,1,2,2-Tetrachloroethane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,1,2-Trichloroethane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,1-Dichloroethane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,1-Dichloroethene | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,1-Dichloropropene | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,2,3-Trichlorobenzene | ND | | 5.00 | " | " | " | " | " | Ua |
| 1,2,3-Trichloropropane | ND | | 5.00 | " | " | " | " | " | Ua |
| 1,2,4-Trichlorobenzene | ND | | 5.00 | " | " | " | " | " | Ua |

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9100 West Jewell Avenue, Suite 200
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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-11**

**2/27/2017 10:30:00AM**

**Origins Laboratory, Inc.**

**Y702026-03 (Soil)**

## VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | ND | | 2.00 | ug/kg | 1 | B7B2807 | 02/28/2017 | 03/01/2017 | Ua |
| 1,2-Dibromo-3-chloropropane | ND | | 5.00 | " | " | " | " | " | Ua |
| 1,2-Dibromoethane (EDB) | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,2-Dichlorobenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,2-Dichloroethane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,2-Dichloropropane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,3,5-Trimethylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,3-Dichlorobenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,3-Dichloropropane | ND | | 2.00 | " | " | " | " | " | Ua |
| 1,4-Dichlorobenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| 2,2-Dichloropropane | ND | | 2.00 | " | " | " | " | " | Ua |
| 2-Butanone | ND | | 10.0 | " | " | " | " | " | Ua |
| 2-Chlorotoluene | ND | | 2.00 | " | " | " | " | " | Ua |
| 2-Hexanone | ND | | 10.0 | " | " | " | " | " | Ua |
| 4-Chlorotoluene | ND | | 2.00 | " | " | " | " | " | Ua |
| 4-Isopropyltoluene | ND | | 2.00 | " | " | " | " | " | Ua |
| 4-Methyl-2-pentanone | ND | | 10.0 | " | " | " | " | " | Ua |
| Acetone | ND | | 20.0 | " | " | " | " | " | Ua |
| Benzene | ND | | 2.00 | " | " | " | " | " | Ua |
| Bromobenzene | ND | | 2.00 | " | " | " | " | " | Ua |

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**2/27/2017 10:30:00AM**

**Origins Laboratory, Inc.**

**Y702026-03 (Soil)**

## VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Bromochloromethane | ND | | 2.00 | ug/kg | 1 | B7B2807 | 02/28/2017 | 03/01/2017 | Ua |
| Bromodichloromethane | ND | | 2.00 | " | " | " | " | " | Ua |
| Bromoform | ND | | 2.00 | " | " | " | " | " | Ua |
| Bromomethane | ND | | 2.00 | " | " | " | " | " | Ua |
| Carbon disulfide | ND | | 5.00 | " | " | " | " | " | Ua |
| Carbon tetrachloride | ND | | 2.00 | " | " | " | " | " | Ua |
| Chlorobenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| Chloroethane | ND | | 5.00 | " | " | " | " | " | Ua |
| Chloroform | ND | | 2.00 | " | " | " | " | " | Ua |
| Chloromethane | ND | | 2.00 | " | " | " | " | " | Ua |
| cis-1,2-Dichloroethene | ND | | 2.00 | " | " | " | " | " | Ua |
| cis-1,3-Dichloropropene | ND | | 2.00 | " | " | " | " | " | Ua |
| Dibromochloromethane | ND | | 2.00 | " | " | " | " | " | Ua |
| Dibromomethane | ND | | 2.00 | " | " | " | " | " | Ua |
| Ethylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| Hexachlorobutadiene | ND | | 5.00 | " | " | " | " | " | Ua |
| Iodomethane | ND | | 15.0 | " | " | " | " | " | Ua |
| Isopropylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| m,p-Xylene | ND | | 4.00 | " | " | " | " | " | Ua |
| Methyl tert-Butyl Ether | ND | | 2.00 | " | " | " | " | " | Ua |

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9100 West Jewell Avenue, Suite 200
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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-11**

**2/27/2017 10:30:00AM**

**Origins Laboratory, Inc.**

**Y702026-03 (Soil)**

## VOC by EPA 8260C

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Methylene Chloride | ND | | 20.0 | ug/kg | 1 | B7B2807 | 02/28/2017 | 03/01/2017 | Ua |
| Naphthalene | ND | | 10.0 | " | " | " | " | " | Ua |
| n-Butylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| n-Propylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| o-Xylene | ND | | 2.00 | " | " | " | " | " | Ua |
| sec-Butylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| Styrene | ND | | 2.00 | " | " | " | " | " | Ua |
| tert-Butylbenzene | ND | | 2.00 | " | " | " | " | " | Ua |
| Tetrachloroethene | ND | | 2.00 | " | " | " | " | " | Ua |
| Toluene | ND | | 2.00 | " | " | " | " | " | Ua |
| trans-1,2-Dichloroethene | ND | | 2.00 | " | " | " | " | " | Ua |
| trans-1,3-Dichloropropene | ND | | 2.00 | " | " | " | " | " | Ua |
| Trichloroethene | ND | | 2.00 | " | " | " | " | " | Ua |
| Trichlorofluoromethane | ND | | 3.00 | " | " | " | " | " | Ua |
| Vinyl chloride | ND | | 2.00 | " | " | " | " | " | Ua |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 1,2-Dichloroethane-d4* | *99.4 %* | *70-130* | " | " | " |
| *Surrogate: Toluene-d8* | *95.2 %* | *70-130* | " | " | " |
| *Surrogate: 4-Bromofluorobenzene* | *95.2 %* | *70-130* | " | " | " |

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Noelle Doyle Mathis, President

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2807-BLK1)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | 2.00 | ug/kg | | | | | | | Ua |
| 1,1,1-Trichloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,1,2,2-Tetrachloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,1,2-Trichloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,1-Dichloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,1-Dichloroethene | ND | 2.00 | " | | | | | | | Ua |
| 1,1-Dichloropropene | ND | 2.00 | " | | | | | | | Ua |
| 1,2,3-Trichlorobenzene | ND | 5.00 | " | | | | | | | Ua |
| 1,2,3-Trichloropropane | ND | 5.00 | " | | | | | | | Ua |
| 1,2,4-Trichlorobenzene | ND | 5.00 | " | | | | | | | Ua |
| 1,2,4-Trimethylbenzene | ND | 2.00 | " | | | | | | | Ua |
| 1,2-Dibromo-3-chloropropane | ND | 5.00 | " | | | | | | | Ua |
| 1,2-Dibromoethane (EDB) | ND | 2.00 | " | | | | | | | Ua |
| 1,2-Dichlorobenzene | ND | 2.00 | " | | | | | | | Ua |
| 1,2-Dichloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,2-Dichloropropane | ND | 2.00 | " | | | | | | | Ua |
| 1,3,5-Trimethylbenzene | ND | 2.00 | " | | | | | | | Ua |
| 1,3-Dichlorobenzene | ND | 2.00 | " | | | | | | | Ua |
| 1,3-Dichloropropane | ND | 2.00 | " | | | | | | | Ua |
| 1,4-Dichlorobenzene | ND | 2.00 | " | | | | | | | Ua |
| 2,2-Dichloropropane | ND | 2.00 | " | | | | | | | Ua |
| 2-Butanone | ND | 10.0 | " | | | | | | | Ua |
| 2-Chlorotoluene | ND | 2.00 | " | | | | | | | Ua |
| 2-Hexanone | ND | 10.0 | " | | | | | | | Ua |
| 4-Chlorotoluene | ND | 2.00 | " | | | | | | | Ua |
| 4-Isopropyltoluene | ND | 2.00 | " | | | | | | | Ua |

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Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2807-BLK1)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 4-Methyl-2-pentanone | ND | 10.0 | ug/kg | | | | | | | Ua |
| Acetone | ND | 20.0 | " | | | | | | | Ua |
| Benzene | ND | 2.00 | " | | | | | | | Ua |
| Bromobenzene | ND | 2.00 | " | | | | | | | Ua |
| Bromochloromethane | ND | 2.00 | " | | | | | | | Ua |
| Bromodichloromethane | ND | 2.00 | " | | | | | | | Ua |
| Bromoform | ND | 2.00 | " | | | | | | | Ua |
| Bromomethane | ND | 2.00 | " | | | | | | | Ua |
| Carbon disulfide | ND | 5.00 | " | | | | | | | Ua |
| Carbon tetrachloride | ND | 2.00 | " | | | | | | | Ua |
| Chlorobenzene | ND | 2.00 | " | | | | | | | Ua |
| Chloroethane | ND | 5.00 | " | | | | | | | Ua |
| Chloroform | ND | 2.00 | " | | | | | | | Ua |
| Chloromethane | ND | 2.00 | " | | | | | | | Ua |
| cis-1,2-Dichloroethene | ND | 2.00 | " | | | | | | | Ua |
| cis-1,3-Dichloropropene | ND | 2.00 | " | | | | | | | Ua |
| Dibromochloromethane | ND | 2.00 | " | | | | | | | Ua |
| Dibromomethane | ND | 2.00 | " | | | | | | | Ua |
| Ethylbenzene | ND | 2.00 | " | | | | | | | Ua |
| Hexachlorobutadiene | ND | 5.00 | " | | | | | | | Ua |
| Iodomethane | ND | 15.0 | " | | | | | | | Ua |
| Isopropylbenzene | ND | 2.00 | " | | | | | | | Ua |
| m,p-Xylene | ND | 4.00 | " | | | | | | | Ua |
| Methyl tert-Butyl Ether | ND | 2.00 | " | | | | | | | Ua |
| Methylene Chloride | ND | 20.0 | " | | | | | | | Ua |
| Naphthalene | ND | 10.0 | " | | | | | | | Ua |

Origins Laboratory, Inc.

Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2807-BLK1)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| n-Butylbenzene | ND | 2.00 | ug/kg | | | | | | | Ua |
| n-Propylbenzene | ND | 2.00 | " | | | | | | | Ua |
| o-Xylene | ND | 2.00 | " | | | | | | | Ua |
| sec-Butylbenzene | ND | 2.00 | " | | | | | | | Ua |
| Styrene | ND | 2.00 | " | | | | | | | Ua |
| tert-Butylbenzene | ND | 2.00 | " | | | | | | | Ua |
| Tetrachloroethene | ND | 2.00 | " | | | | | | | Ua |
| Toluene | ND | 2.00 | " | | | | | | | Ua |
| trans-1,2-Dichloroethene | ND | 2.00 | " | | | | | | | Ua |
| trans-1,3-Dichloropropene | ND | 2.00 | " | | | | | | | Ua |
| Trichloroethene | ND | 2.00 | " | | | | | | | Ua |
| Trichlorofluoromethane | ND | 3.00 | " | | | | | | | Ua |
| Vinyl chloride | ND | 2.00 | " | | | | | | | Ua |
| *Surrogate: 1,2-Dichloroethane-d4* | *62* | | *ug/L* | *62.5* | | *99.5* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *61* | | *"* | *62.5* | | *97.6* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *60* | | *"* | *62.5* | | *96.0* | *70-130* | | | |

Origins Laboratory, Inc.

Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2807-BLK2)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | 2.00 | ug/kg | | | | | | | Ua |
| 1,1,1-Trichloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,1,2,2-Tetrachloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,1,2-Trichloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,1-Dichloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,1-Dichloroethene | ND | 2.00 | " | | | | | | | Ua |
| 1,1-Dichloropropene | ND | 2.00 | " | | | | | | | Ua |
| 1,2,3-Trichlorobenzene | ND | 5.00 | " | | | | | | | Ua |
| 1,2,3-Trichloropropane | ND | 5.00 | " | | | | | | | Ua |
| 1,2,4-Trichlorobenzene | ND | 5.00 | " | | | | | | | Ua |
| 1,2,4-Trimethylbenzene | ND | 2.00 | " | | | | | | | Ua |
| 1,2-Dibromo-3-chloropropane | ND | 5.00 | " | | | | | | | Ua |
| 1,2-Dibromoethane (EDB) | ND | 2.00 | " | | | | | | | Ua |
| 1,2-Dichlorobenzene | ND | 2.00 | " | | | | | | | Ua |
| 1,2-Dichloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,2-Dichloropropane | ND | 2.00 | " | | | | | | | Ua |
| 1,3,5-Trimethylbenzene | ND | 2.00 | " | | | | | | | Ua |
| 1,3-Dichlorobenzene | ND | 2.00 | " | | | | | | | Ua |
| 1,3-Dichloropropane | ND | 2.00 | " | | | | | | | Ua |
| 1,4-Dichlorobenzene | ND | 2.00 | " | | | | | | | Ua |
| 2,2-Dichloropropane | ND | 2.00 | " | | | | | | | Ua |
| 2-Butanone | ND | 10.0 | " | | | | | | | Ua |
| 2-Chlorotoluene | ND | 2.00 | " | | | | | | | Ua |
| 2-Hexanone | ND | 10.0 | " | | | | | | | Ua |
| 4-Chlorotoluene | ND | 2.00 | " | | | | | | | Ua |
| 4-Isopropyltoluene | ND | 2.00 | " | | | | | | | Ua |

Origins Laboratory, Inc.

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Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2807-BLK2)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 4-Methyl-2-pentanone | ND | 10.0 | ug/kg | | | | | | | Ua |
| Acetone | ND | 20.0 | " | | | | | | | Ua |
| Benzene | ND | 2.00 | " | | | | | | | Ua |
| Bromobenzene | ND | 2.00 | " | | | | | | | Ua |
| Bromochloromethane | ND | 2.00 | " | | | | | | | Ua |
| Bromodichloromethane | ND | 2.00 | " | | | | | | | Ua |
| Bromoform | ND | 2.00 | " | | | | | | | Ua |
| Bromomethane | ND | 2.00 | " | | | | | | | Ua |
| Carbon disulfide | ND | 5.00 | " | | | | | | | Ua |
| Carbon tetrachloride | ND | 2.00 | " | | | | | | | Ua |
| Chlorobenzene | ND | 2.00 | " | | | | | | | Ua |
| Chloroethane | ND | 5.00 | " | | | | | | | Ua |
| Chloroform | ND | 2.00 | " | | | | | | | Ua |
| Chloromethane | ND | 2.00 | " | | | | | | | Ua |
| cis-1,2-Dichloroethene | ND | 2.00 | " | | | | | | | Ua |
| cis-1,3-Dichloropropene | ND | 2.00 | " | | | | | | | Ua |
| Dibromochloromethane | ND | 2.00 | " | | | | | | | Ua |
| Dibromomethane | ND | 2.00 | " | | | | | | | Ua |
| Ethylbenzene | ND | 2.00 | " | | | | | | | Ua |
| Hexachlorobutadiene | ND | 5.00 | " | | | | | | | Ua |
| Iodomethane | ND | 15.0 | " | | | | | | | Ua |
| Isopropylbenzene | ND | 2.00 | " | | | | | | | Ua |
| m,p-Xylene | ND | 4.00 | " | | | | | | | Ua |
| Methyl tert-Butyl Ether | ND | 2.00 | " | | | | | | | Ua |
| Methylene Chloride | ND | 20.0 | " | | | | | | | Ua |
| Naphthalene | ND | 10.0 | " | | | | | | | Ua |

Origins Laboratory, Inc.

Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2807-BLK2)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| n-Butylbenzene | ND | 2.00 | ug/kg | | | | | | | Ua |
| n-Propylbenzene | ND | 2.00 | " | | | | | | | Ua |
| o-Xylene | ND | 2.00 | " | | | | | | | Ua |
| sec-Butylbenzene | ND | 2.00 | " | | | | | | | Ua |
| Styrene | ND | 2.00 | " | | | | | | | Ua |
| tert-Butylbenzene | ND | 2.00 | " | | | | | | | Ua |
| Tetrachloroethene | ND | 2.00 | " | | | | | | | Ua |
| Toluene | ND | 2.00 | " | | | | | | | Ua |
| trans-1,2-Dichloroethene | ND | 2.00 | " | | | | | | | Ua |
| trans-1,3-Dichloropropene | ND | 2.00 | " | | | | | | | Ua |
| Trichloroethene | ND | 2.00 | " | | | | | | | Ua |
| Trichlorofluoromethane | ND | 3.00 | " | | | | | | | Ua |
| Vinyl chloride | ND | 2.00 | " | | | | | | | Ua |
| *Surrogate: 1,2-Dichloroethane-d4* | *59* | | *ug/L* | *62.5* | | *94.0* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *61* | | *"* | *62.5* | | *97.3* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *61* | | *"* | *62.5* | | *97.2* | *70-130* | | | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2807-BS1)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 102 | 2.00 | ug/kg | 100 | | 102 | 70-130 | | | |
| 1,1,1-Trichloroethane | 119 | 2.00 | " | 100 | | 119 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 101 | 2.00 | " | 100 | | 101 | 70-130 | | | |
| 1,1,2-Trichloroethane | 99.8 | 2.00 | " | 100 | | 99.8 | 70-130 | | | |
| 1,1-Dichloroethane | 110 | 2.00 | " | 100 | | 110 | 70-130 | | | |
| 1,1-Dichloroethene | 114 | 2.00 | " | 100 | | 114 | 70-130 | | | |
| 1,1-Dichloropropene | 110 | 2.00 | " | 100 | | 110 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 111 | 5.00 | " | 100 | | 111 | 70-130 | | | |
| 1,2,3-Trichloropropane | 105 | 5.00 | " | 100 | | 105 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 109 | 5.00 | " | 100 | | 109 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 106 | 2.00 | " | 100 | | 106 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 100 | 5.00 | " | 100 | | 100 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 112 | 2.00 | " | 100 | | 112 | 70-130 | | | |
| 1,2-Dichlorobenzene | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| 1,2-Dichloroethane | 111 | 2.00 | " | 100 | | 111 | 70-130 | | | |
| 1,2-Dichloropropane | 112 | 2.00 | " | 100 | | 112 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 107 | 2.00 | " | 100 | | 107 | 70-130 | | | |
| 1,3-Dichlorobenzene | 104 | 2.00 | " | 100 | | 104 | 70-130 | | | |
| 1,3-Dichloropropane | 107 | 2.00 | " | 100 | | 107 | 70-130 | | | |
| 1,4-Dichlorobenzene | 104 | 2.00 | " | 100 | | 104 | 70-130 | | | |
| 2,2-Dichloropropane | 117 | 2.00 | " | 100 | | 117 | 70-130 | | | |
| 2-Butanone | 565 | 10.0 | " | 500 | | 113 | 70-130 | | | |
| 2-Chlorotoluene | 105 | 2.00 | " | 100 | | 105 | 70-130 | | | |
| 2-Hexanone | 555 | 10.0 | " | 500 | | 111 | 70-130 | | | |
| 4-Chlorotoluene | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| 4-Isopropyltoluene | 112 | 2.00 | " | 100 | | 112 | 70-130 | | | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2807-BS1)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 4-Methyl-2-pentanone | 534 | 10.0 | ug/kg | 500 | | 107 | 70-130 | | | |
| Acetone | 504 | 20.0 | " | 500 | | 101 | 70-130 | | | |
| Benzene | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |
| Bromobenzene | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| Bromochloromethane | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |
| Bromodichloromethane | 108 | 2.00 | " | 100 | | 108 | 70-130 | | | |
| Bromoform | 95.5 | 2.00 | " | 100 | | 95.5 | 70-130 | | | |
| Bromomethane | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |
| Carbon disulfide | 109 | 5.00 | " | 100 | | 109 | 70-130 | | | |
| Carbon tetrachloride | 114 | 2.00 | " | 100 | | 114 | 70-130 | | | |
| Chlorobenzene | 103 | 2.00 | " | 100 | | 103 | 70-130 | | | |
| Chloroethane | 105 | 5.00 | " | 100 | | 105 | 70-130 | | | |
| Chloroform | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| Chloromethane | 96.0 | 2.00 | " | 100 | | 96.0 | 70-130 | | | |
| cis-1,2-Dichloroethene | 118 | 2.00 | " | 100 | | 118 | 70-130 | | | |
| cis-1,3-Dichloropropene | 105 | 2.00 | " | 100 | | 105 | 70-130 | | | |
| Dibromochloromethane | 106 | 2.00 | " | 100 | | 106 | 70-130 | | | |
| Dibromomethane | 110 | 2.00 | " | 100 | | 110 | 70-130 | | | |
| Ethylbenzene | 103 | 2.00 | " | 100 | | 103 | 70-130 | | | |
| Hexachlorobutadiene | 106 | 5.00 | " | 100 | | 106 | 70-130 | | | |
| Iodomethane | 108 | 15.0 | " | 100 | | 108 | 70-130 | | | |
| Isopropylbenzene | 107 | 2.00 | " | 100 | | 107 | 70-130 | | | |
| m,p-Xylene | 216 | 4.00 | " | 200 | | 108 | 70-130 | | | |
| Methyl tert-Butyl Ether | 121 | 2.00 | " | 100 | | 121 | 70-130 | | | |
| Methylene Chloride | 100 | 20.0 | " | 100 | | 100 | 70-130 | | | |
| Naphthalene | 110 | 10.0 | " | 100 | | 110 | 70-130 | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2807-BS1)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| n-Butylbenzene | 108 | 2.00 | ug/kg | 100 | | 108 | 70-130 | | | |
| n-Propylbenzene | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| o-Xylene | 106 | 2.00 | " | 100 | | 106 | 70-130 | | | |
| sec-Butylbenzene | 105 | 2.00 | " | 100 | | 105 | 70-130 | | | |
| Styrene | 112 | 2.00 | " | 100 | | 112 | 70-130 | | | |
| tert-Butylbenzene | 107 | 2.00 | " | 100 | | 107 | 70-130 | | | |
| Tetrachloroethene | 106 | 2.00 | " | 100 | | 106 | 70-130 | | | |
| Toluene | 104 | 2.00 | " | 100 | | 104 | 70-130 | | | |
| trans-1,2-Dichloroethene | 120 | 2.00 | " | 100 | | 120 | 70-130 | | | |
| trans-1,3-Dichloropropene | 112 | 2.00 | " | 100 | | 112 | 70-130 | | | |
| Trichloroethene | 110 | 2.00 | " | 100 | | 110 | 70-130 | | | |
| Trichlorofluoromethane | 111 | 3.00 | " | 100 | | 111 | 70-130 | | | |
| Vinyl chloride | 105 | 2.00 | " | 100 | | 105 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *59* | | *ug/L* | *62.5* | | *93.7* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *62* | | *"* | *62.5* | | *98.6* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *61* | | *"* | *62.5* | | *97.8* | *70-130* | | | |

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## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2807-BS2)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 99.0 | 2.00 | ug/kg | 100 | | 99.0 | 70-130 | | | |
| 1,1,1-Trichloroethane | 117 | 2.00 | " | 100 | | 117 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 97.8 | 2.00 | " | 100 | | 97.8 | 70-130 | | | |
| 1,1,2-Trichloroethane | 98.3 | 2.00 | " | 100 | | 98.3 | 70-130 | | | |
| 1,1-Dichloroethane | 110 | 2.00 | " | 100 | | 110 | 70-130 | | | |
| 1,1-Dichloroethene | 111 | 2.00 | " | 100 | | 111 | 70-130 | | | |
| 1,1-Dichloropropene | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 111 | 5.00 | " | 100 | | 111 | 70-130 | | | |
| 1,2,3-Trichloropropane | 101 | 5.00 | " | 100 | | 101 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 107 | 5.00 | " | 100 | | 107 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 103 | 2.00 | " | 100 | | 103 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 97.0 | 5.00 | " | 100 | | 97.0 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 110 | 2.00 | " | 100 | | 110 | 70-130 | | | |
| 1,2-Dichlorobenzene | 97.9 | 2.00 | " | 100 | | 97.9 | 70-130 | | | |
| 1,2-Dichloroethane | 111 | 2.00 | " | 100 | | 111 | 70-130 | | | |
| 1,2-Dichloropropane | 112 | 2.00 | " | 100 | | 112 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| 1,3-Dichlorobenzene | 101 | 2.00 | " | 100 | | 101 | 70-130 | | | |
| 1,3-Dichloropropane | 104 | 2.00 | " | 100 | | 104 | 70-130 | | | |
| 1,4-Dichlorobenzene | 100 | 2.00 | " | 100 | | 100 | 70-130 | | | |
| 2,2-Dichloropropane | 114 | 2.00 | " | 100 | | 114 | 70-130 | | | |
| 2-Butanone | 562 | 10.0 | " | 500 | | 112 | 70-130 | | | |
| 2-Chlorotoluene | 101 | 2.00 | " | 100 | | 101 | 70-130 | | | |
| 2-Hexanone | 546 | 10.0 | " | 500 | | 109 | 70-130 | | | |
| 4-Chlorotoluene | 98.1 | 2.00 | " | 100 | | 98.1 | 70-130 | | | |
| 4-Isopropyltoluene | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2807-BS2)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 4-Methyl-2-pentanone | 531 | 10.0 | ug/kg | 500 | | 106 | 70-130 | | | |
| Acetone | 505 | 20.0 | " | 500 | | 101 | 70-130 | | | |
| Benzene | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |
| Bromobenzene | 101 | 2.00 | " | 100 | | 101 | 70-130 | | | |
| Bromochloromethane | 110 | 2.00 | " | 100 | | 110 | 70-130 | | | |
| Bromodichloromethane | 108 | 2.00 | " | 100 | | 108 | 70-130 | | | |
| Bromoform | 93.3 | 2.00 | " | 100 | | 93.3 | 70-130 | | | |
| Bromomethane | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |
| Carbon disulfide | 106 | 5.00 | " | 100 | | 106 | 70-130 | | | |
| Carbon tetrachloride | 113 | 2.00 | " | 100 | | 113 | 70-130 | | | |
| Chlorobenzene | 101 | 2.00 | " | 100 | | 101 | 70-130 | | | |
| Chloroethane | 107 | 5.00 | " | 100 | | 107 | 70-130 | | | |
| Chloroform | 94.4 | 2.00 | " | 100 | | 94.4 | 70-130 | | | |
| Chloromethane | 98.3 | 2.00 | " | 100 | | 98.3 | 70-130 | | | |
| cis-1,2-Dichloroethene | 116 | 2.00 | " | 100 | | 116 | 70-130 | | | |
| cis-1,3-Dichloropropene | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| Dibromochloromethane | 103 | 2.00 | " | 100 | | 103 | 70-130 | | | |
| Dibromomethane | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |
| Ethylbenzene | 99.3 | 2.00 | " | 100 | | 99.3 | 70-130 | | | |
| Hexachlorobutadiene | 103 | 5.00 | " | 100 | | 103 | 70-130 | | | |
| Iodomethane | 107 | 15.0 | " | 100 | | 107 | 70-130 | | | |
| Isopropylbenzene | 104 | 2.00 | " | 100 | | 104 | 70-130 | | | |
| m,p-Xylene | 208 | 4.00 | " | 200 | | 104 | 70-130 | | | |
| Methyl tert-Butyl Ether | 120 | 2.00 | " | 100 | | 120 | 70-130 | | | |
| Methylene Chloride | 99.0 | 20.0 | " | 100 | | 99.0 | 70-130 | | | |
| Naphthalene | 109 | 10.0 | " | 100 | | 109 | 70-130 | | | |

Origins Laboratory, Inc.

Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2807-BS2)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| n-Butylbenzene | 105 | 2.00 | ug/kg | 100 | | 105 | 70-130 | | | |
| n-Propylbenzene | 99.4 | 2.00 | " | 100 | | 99.4 | 70-130 | | | |
| o-Xylene | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| sec-Butylbenzene | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| Styrene | 108 | 2.00 | " | 100 | | 108 | 70-130 | | | |
| tert-Butylbenzene | 104 | 2.00 | " | 100 | | 104 | 70-130 | | | |
| Tetrachloroethene | 103 | 2.00 | " | 100 | | 103 | 70-130 | | | |
| Toluene | 101 | 2.00 | " | 100 | | 101 | 70-130 | | | |
| trans-1,2-Dichloroethene | 119 | 2.00 | " | 100 | | 119 | 70-130 | | | |
| trans-1,3-Dichloropropene | 108 | 2.00 | " | 100 | | 108 | 70-130 | | | |
| Trichloroethene | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |
| Trichlorofluoromethane | 113 | 3.00 | " | 100 | | 113 | 70-130 | | | |
| Vinyl chloride | 106 | 2.00 | " | 100 | | 106 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *59* | | *ug/L* | *62.5* | | *94.2* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *60* | | *"* | *62.5* | | *96.8* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *59* | | *"* | *62.5* | | *95.0* | *70-130* | | | |

Origins Laboratory, Inc.

Noelle Doyle Mathis, President

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2807-MS1)** | | **Source: Y702054-01** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 95.3 | 2.00 | ug/kg | 100 | ND | 95.3 | 70-130 | | | |
| 1,1,1-Trichloroethane | 108 | 2.00 | " | 100 | ND | 108 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 96.1 | 2.00 | " | 100 | ND | 96.1 | 70-130 | | | |
| 1,1,2-Trichloroethane | 91.6 | 2.00 | " | 100 | ND | 91.6 | 70-130 | | | |
| 1,1-Dichloroethane | 100 | 2.00 | " | 100 | ND | 100 | 70-130 | | | |
| 1,1-Dichloroethene | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | | | |
| 1,1-Dichloropropene | 99.2 | 2.00 | " | 100 | ND | 99.2 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 101 | 5.00 | " | 100 | ND | 101 | 70-130 | | | |
| 1,2,3-Trichloropropane | 101 | 5.00 | " | 100 | ND | 101 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 97.1 | 5.00 | " | 100 | ND | 97.1 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 98.9 | 2.00 | " | 100 | ND | 98.9 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 100 | 5.00 | " | 100 | ND | 100 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | | | |
| 1,2-Dichlorobenzene | 94.0 | 2.00 | " | 100 | ND | 94.0 | 70-130 | | | |
| 1,2-Dichloroethane | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | | | |
| 1,2-Dichloropropane | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 95.0 | 2.00 | " | 100 | ND | 95.0 | 70-130 | | | |
| 1,3-Dichlorobenzene | 93.9 | 2.00 | " | 100 | ND | 93.9 | 70-130 | | | |
| 1,3-Dichloropropane | 98.5 | 2.00 | " | 100 | ND | 98.5 | 70-130 | | | |
| 1,4-Dichlorobenzene | 94.0 | 2.00 | " | 100 | ND | 94.0 | 70-130 | | | |
| 2,2-Dichloropropane | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | | | |
| 2-Butanone | 553 | 10.0 | " | 500 | ND | 111 | 70-130 | | | |
| 2-Chlorotoluene | 93.6 | 2.00 | " | 100 | ND | 93.6 | 70-130 | | | |
| 2-Hexanone | 526 | 10.0 | " | 500 | ND | 105 | 70-130 | | | |
| 4-Chlorotoluene | 90.5 | 2.00 | " | 100 | ND | 90.5 | 70-130 | | | |
| 4-Isopropyltoluene | 98.3 | 2.00 | " | 100 | ND | 98.3 | 70-130 | | | |

Origins Laboratory, Inc.

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Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2807-MS1)** | | **Source: Y702054-01** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 4-Methyl-2-pentanone | 489 | 10.0 | ug/kg | 500 | ND | 97.8 | 70-130 | | | |
| Acetone | 491 | 20.0 | " | 500 | ND | 98.3 | 70-130 | | | |
| Benzene | 100 | 2.00 | " | 100 | ND | 100 | 70-130 | | | |
| Bromobenzene | 94.6 | 2.00 | " | 100 | ND | 94.6 | 70-130 | | | |
| Bromochloromethane | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | | | |
| Bromodichloromethane | 101 | 2.00 | " | 100 | ND | 101 | 70-130 | | | |
| Bromoform | 90.9 | 2.00 | " | 100 | ND | 90.9 | 70-130 | | | |
| Bromomethane | 98.3 | 2.00 | " | 100 | ND | 98.3 | 70-130 | | | |
| Carbon disulfide | 96.6 | 5.00 | " | 100 | ND | 96.6 | 70-130 | | | |
| Carbon tetrachloride | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | | | |
| Chlorobenzene | 92.2 | 2.00 | " | 100 | ND | 92.2 | 70-130 | | | |
| Chloroethane | 95.8 | 5.00 | " | 100 | ND | 95.8 | 70-130 | | | |
| Chloroform | 87.7 | 2.00 | " | 100 | ND | 87.7 | 70-130 | | | |
| Chloromethane | 87.0 | 2.00 | " | 100 | ND | 87.0 | 70-130 | | | |
| cis-1,2-Dichloroethene | 108 | 2.00 | " | 100 | ND | 108 | 70-130 | | | |
| cis-1,3-Dichloropropene | 94.9 | 2.00 | " | 100 | ND | 94.9 | 70-130 | | | |
| Dibromochloromethane | 96.1 | 2.00 | " | 100 | ND | 96.1 | 70-130 | | | |
| Dibromomethane | 106 | 2.00 | " | 100 | ND | 106 | 70-130 | | | |
| Ethylbenzene | 92.7 | 2.00 | " | 100 | ND | 92.7 | 70-130 | | | |
| Hexachlorobutadiene | 82.3 | 5.00 | " | 100 | ND | 82.3 | 70-130 | | | |
| Iodomethane | 98.9 | 15.0 | " | 100 | ND | 98.9 | 70-130 | | | |
| Isopropylbenzene | 97.1 | 2.00 | " | 100 | ND | 97.1 | 70-130 | | | |
| m,p-Xylene | 196 | 4.00 | " | 200 | ND | 98.1 | 70-130 | | | |
| Methyl tert-Butyl Ether | 117 | 2.00 | " | 100 | ND | 117 | 70-130 | | | |
| Methylene Chloride | 98.4 | 20.0 | " | 100 | ND | 98.4 | 70-130 | | | |
| Naphthalene | 107 | 10.0 | " | 100 | ND | 107 | 70-130 | | | |

Origins Laboratory, Inc.

Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2807-MS1)** | | **Source: Y702054-01** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| n-Butylbenzene | 92.9 | 2.00 | ug/kg | 100 | ND | 92.9 | 70-130 | | | |
| n-Propylbenzene | 92.4 | 2.00 | " | 100 | ND | 92.4 | 70-130 | | | |
| o-Xylene | 97.2 | 2.00 | " | 100 | ND | 97.2 | 70-130 | | | |
| sec-Butylbenzene | 92.4 | 2.00 | " | 100 | ND | 92.4 | 70-130 | | | |
| Styrene | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | | | |
| tert-Butylbenzene | 93.7 | 2.00 | " | 100 | ND | 93.7 | 70-130 | | | |
| Tetrachloroethene | 92.9 | 2.00 | " | 100 | ND | 92.9 | 70-130 | | | |
| Toluene | 92.1 | 2.00 | " | 100 | ND | 92.1 | 70-130 | | | |
| trans-1,2-Dichloroethene | 107 | 2.00 | " | 100 | ND | 107 | 70-130 | | | |
| trans-1,3-Dichloropropene | 101 | 2.00 | " | 100 | ND | 101 | 70-130 | | | |
| Trichloroethene | 99.1 | 2.00 | " | 100 | ND | 99.1 | 70-130 | | | |
| Trichlorofluoromethane | 102 | 3.00 | " | 100 | ND | 102 | 70-130 | | | |
| Vinyl chloride | 94.0 | 2.00 | " | 100 | ND | 94.0 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *61* | | *ug/L* | *62.5* | | *97.2* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *59* | | *"* | *62.5* | | *94.5* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *62* | | *"* | *62.5* | | *99.4* | *70-130* | | | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2807-MS2)** | | **Source: Y702054-02** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 94.2 | 2.00 | ug/kg | 100 | ND | 94.2 | 70-130 | | | |
| 1,1,1-Trichloroethane | 110 | 2.00 | " | 100 | ND | 110 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 97.1 | 2.00 | " | 100 | ND | 97.1 | 70-130 | | | |
| 1,1,2-Trichloroethane | 95.3 | 2.00 | " | 100 | ND | 95.3 | 70-130 | | | |
| 1,1-Dichloroethane | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | | | |
| 1,1-Dichloroethene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | | | |
| 1,1-Dichloropropene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 95.3 | 5.00 | " | 100 | ND | 95.3 | 70-130 | | | |
| 1,2,3-Trichloropropane | 99.9 | 5.00 | " | 100 | ND | 99.9 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 91.0 | 5.00 | " | 100 | ND | 91.0 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 94.1 | 2.00 | " | 100 | ND | 94.1 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 98.7 | 5.00 | " | 100 | ND | 98.7 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 108 | 2.00 | " | 100 | ND | 108 | 70-130 | | | |
| 1,2-Dichlorobenzene | 92.7 | 2.00 | " | 100 | ND | 92.7 | 70-130 | | | |
| 1,2-Dichloroethane | 109 | 2.00 | " | 100 | ND | 109 | 70-130 | | | |
| 1,2-Dichloropropane | 108 | 2.00 | " | 100 | ND | 108 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 92.6 | 2.00 | " | 100 | ND | 92.6 | 70-130 | | | |
| 1,3-Dichlorobenzene | 90.9 | 2.00 | " | 100 | ND | 90.9 | 70-130 | | | |
| 1,3-Dichloropropane | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | | | |
| 1,4-Dichlorobenzene | 91.8 | 2.00 | " | 100 | ND | 91.8 | 70-130 | | | |
| 2,2-Dichloropropane | 107 | 2.00 | " | 100 | ND | 107 | 70-130 | | | |
| 2-Butanone | 592 | 10.0 | " | 500 | ND | 118 | 70-130 | | | |
| 2-Chlorotoluene | 91.4 | 2.00 | " | 100 | ND | 91.4 | 70-130 | | | |
| 2-Hexanone | 545 | 10.0 | " | 500 | ND | 109 | 70-130 | | | |
| 4-Chlorotoluene | 89.3 | 2.00 | " | 100 | ND | 89.3 | 70-130 | | | |
| 4-Isopropyltoluene | 96.3 | 2.00 | " | 100 | ND | 96.3 | 70-130 | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2807-MS2)** | | **Source: Y702054-02** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 4-Methyl-2-pentanone | 531 | 10.0 | ug/kg | 500 | ND | 106 | 70-130 | | | |
| Acetone | 518 | 20.0 | " | 500 | ND | 104 | 70-130 | | | |
| Benzene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | | | |
| Bromobenzene | 93.8 | 2.00 | " | 100 | ND | 93.8 | 70-130 | | | |
| Bromochloromethane | 108 | 2.00 | " | 100 | ND | 108 | 70-130 | | | |
| Bromodichloromethane | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | | | |
| Bromoform | 90.8 | 2.00 | " | 100 | ND | 90.8 | 70-130 | | | |
| Bromomethane | 93.5 | 2.00 | " | 100 | ND | 93.5 | 70-130 | | | |
| Carbon disulfide | 98.4 | 5.00 | " | 100 | ND | 98.4 | 70-130 | | | |
| Carbon tetrachloride | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | | | |
| Chlorobenzene | 93.5 | 2.00 | " | 100 | ND | 93.5 | 70-130 | | | |
| Chloroethane | 90.3 | 5.00 | " | 100 | ND | 90.3 | 70-130 | | | |
| Chloroform | 100 | 2.00 | " | 100 | ND | 100 | 70-130 | | | |
| Chloromethane | 83.0 | 2.00 | " | 100 | ND | 83.0 | 70-130 | | | |
| cis-1,2-Dichloroethene | 111 | 2.00 | " | 100 | ND | 111 | 70-130 | | | |
| cis-1,3-Dichloropropene | 96.6 | 2.00 | " | 100 | ND | 96.6 | 70-130 | | | |
| Dibromochloromethane | 99.7 | 2.00 | " | 100 | ND | 99.7 | 70-130 | | | |
| Dibromomethane | 109 | 2.00 | " | 100 | ND | 109 | 70-130 | | | |
| Ethylbenzene | 91.2 | 2.00 | " | 100 | ND | 91.2 | 70-130 | | | |
| Hexachlorobutadiene | 75.9 | 5.00 | " | 100 | ND | 75.9 | 70-130 | | | |
| Iodomethane | 101 | 15.0 | " | 100 | ND | 101 | 70-130 | | | |
| Isopropylbenzene | 94.4 | 2.00 | " | 100 | ND | 94.4 | 70-130 | | | |
| m,p-Xylene | 191 | 4.00 | " | 200 | ND | 95.4 | 70-130 | | | |
| Methyl tert-Butyl Ether | 121 | 2.00 | " | 100 | ND | 121 | 70-130 | | | |
| Methylene Chloride | 103 | 20.0 | " | 100 | ND | 103 | 70-130 | | | |
| Naphthalene | 103 | 10.0 | " | 100 | ND | 103 | 70-130 | | | |

Origins Laboratory, Inc.

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2807-MS2)** | | **Source: Y702054-02** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| n-Butylbenzene | 88.7 | 2.00 | ug/kg | 100 | ND | 88.7 | 70-130 | | | |
| n-Propylbenzene | 90.4 | 2.00 | " | 100 | ND | 90.4 | 70-130 | | | |
| o-Xylene | 95.8 | 2.00 | " | 100 | ND | 95.8 | 70-130 | | | |
| sec-Butylbenzene | 90.4 | 2.00 | " | 100 | ND | 90.4 | 70-130 | | | |
| Styrene | 99.8 | 2.00 | " | 100 | ND | 99.8 | 70-130 | | | |
| tert-Butylbenzene | 92.8 | 2.00 | " | 100 | ND | 92.8 | 70-130 | | | |
| Tetrachloroethene | 93.7 | 2.00 | " | 100 | ND | 93.7 | 70-130 | | | |
| Toluene | 93.6 | 2.00 | " | 100 | ND | 93.6 | 70-130 | | | |
| trans-1,2-Dichloroethene | 111 | 2.00 | " | 100 | ND | 111 | 70-130 | | | |
| trans-1,3-Dichloropropene | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | | | |
| Trichloroethene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | | | |
| Trichlorofluoromethane | 96.0 | 3.00 | " | 100 | ND | 96.0 | 70-130 | | | |
| Vinyl chloride | 88.6 | 2.00 | " | 100 | ND | 88.6 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *63* | | *ug/L* | *62.5* | | *101* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *60* | | *"* | *62.5* | | *95.5* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *61* | | *"* | *62.5* | | *98.3* | *70-130* | | | |

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Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2807-MSD1)** | | **Source: Y702054-01** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 103 | 2.00 | ug/kg | 100 | ND | 103 | 70-130 | 7.77 | 20 | |
| 1,1,1-Trichloroethane | 118 | 2.00 | " | 100 | ND | 118 | 70-130 | 9.16 | 20 | |
| 1,1,2,2-Tetrachloroethane | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | 7.43 | 20 | |
| 1,1,2-Trichloroethane | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 10.4 | 20 | |
| 1,1-Dichloroethane | 111 | 2.00 | " | 100 | ND | 111 | 70-130 | 9.73 | 20 | |
| 1,1-Dichloroethene | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 8.08 | 20 | |
| 1,1-Dichloropropene | 111 | 2.00 | " | 100 | ND | 111 | 70-130 | 11.6 | 20 | |
| 1,2,3-Trichlorobenzene | 113 | 5.00 | " | 100 | ND | 113 | 70-130 | 11.6 | 20 | |
| 1,2,3-Trichloropropane | 107 | 5.00 | " | 100 | ND | 107 | 70-130 | 6.15 | 20 | |
| 1,2,4-Trichlorobenzene | 109 | 5.00 | " | 100 | ND | 109 | 70-130 | 11.5 | 20 | |
| 1,2,4-Trimethylbenzene | 106 | 2.00 | " | 100 | ND | 106 | 70-130 | 6.86 | 20 | |
| 1,2-Dibromo-3-chloropropane | 106 | 5.00 | " | 100 | ND | 106 | 70-130 | 5.97 | 20 | |
| 1,2-Dibromoethane (EDB) | 116 | 2.00 | " | 100 | ND | 116 | 70-130 | 10.7 | 20 | |
| 1,2-Dichlorobenzene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 8.06 | 20 | |
| 1,2-Dichloroethane | 114 | 2.00 | " | 100 | ND | 114 | 70-130 | 8.86 | 20 | |
| 1,2-Dichloropropane | 116 | 2.00 | " | 100 | ND | 116 | 70-130 | 9.91 | 20 | |
| 1,3,5-Trimethylbenzene | 106 | 2.00 | " | 100 | ND | 106 | 70-130 | 10.6 | 20 | |
| 1,3-Dichlorobenzene | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | 9.37 | 20 | |
| 1,3-Dichloropropane | 110 | 2.00 | " | 100 | ND | 110 | 70-130 | 11.2 | 20 | |
| 1,4-Dichlorobenzene | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | 9.25 | 20 | |
| 2,2-Dichloropropane | 114 | 2.00 | " | 100 | ND | 114 | 70-130 | 7.95 | 20 | |
| 2-Butanone | 609 | 10.0 | " | 500 | ND | 122 | 70-130 | 9.61 | 20 | |
| 2-Chlorotoluene | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | 11.0 | 20 | |
| 2-Hexanone | 574 | 10.0 | " | 500 | ND | 115 | 70-130 | 8.77 | 20 | |
| 4-Chlorotoluene | 100 | 2.00 | " | 100 | ND | 100 | 70-130 | 10.1 | 20 | |
| 4-Isopropyltoluene | 110 | 2.00 | " | 100 | ND | 110 | 70-130 | 11.6 | 20 | |

Origins Laboratory, Inc.

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Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2807-MSD1)** | | **Source: Y702054-01** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 4-Methyl-2-pentanone | 561 | 10.0 | ug/kg | 500 | ND | 112 | 70-130 | 13.7 | 20 | |
| Acetone | 536 | 20.0 | " | 500 | ND | 107 | 70-130 | 8.59 | 20 | |
| Benzene | 111 | 2.00 | " | 100 | ND | 111 | 70-130 | 9.67 | 20 | |
| Bromobenzene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | 10.3 | 20 | |
| Bromochloromethane | 114 | 2.00 | " | 100 | ND | 114 | 70-130 | 8.82 | 20 | |
| Bromodichloromethane | 111 | 2.00 | " | 100 | ND | 111 | 70-130 | 9.09 | 20 | |
| Bromoform | 98.6 | 2.00 | " | 100 | ND | 98.6 | 70-130 | 8.10 | 20 | |
| Bromomethane | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | 4.75 | 20 | |
| Carbon disulfide | 105 | 5.00 | " | 100 | ND | 105 | 70-130 | 8.18 | 20 | |
| Carbon tetrachloride | 113 | 2.00 | " | 100 | ND | 113 | 70-130 | 9.22 | 20 | |
| Chlorobenzene | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | 11.4 | 20 | |
| Chloroethane | 101 | 5.00 | " | 100 | ND | 101 | 70-130 | 5.27 | 20 | |
| Chloroform | 96.5 | 2.00 | " | 100 | ND | 96.5 | 70-130 | 9.58 | 20 | |
| Chloromethane | 92.1 | 2.00 | " | 100 | ND | 92.1 | 70-130 | 5.67 | 20 | |
| cis-1,2-Dichloroethene | 118 | 2.00 | " | 100 | ND | 118 | 70-130 | 9.22 | 20 | |
| cis-1,3-Dichloropropene | 106 | 2.00 | " | 100 | ND | 106 | 70-130 | 11.0 | 20 | |
| Dibromochloromethane | 107 | 2.00 | " | 100 | ND | 107 | 70-130 | 10.4 | 20 | |
| Dibromomethane | 114 | 2.00 | " | 100 | ND | 114 | 70-130 | 7.60 | 20 | |
| Ethylbenzene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 9.32 | 20 | |
| Hexachlorobutadiene | 98.9 | 5.00 | " | 100 | ND | 98.9 | 70-130 | 18.4 | 20 | |
| Iodomethane | 107 | 15.0 | " | 100 | ND | 107 | 70-130 | 8.19 | 20 | |
| Isopropylbenzene | 106 | 2.00 | " | 100 | ND | 106 | 70-130 | 8.57 | 20 | |
| m,p-Xylene | 216 | 4.00 | " | 200 | ND | 108 | 70-130 | 9.48 | 20 | |
| Methyl tert-Butyl Ether | 126 | 2.00 | " | 100 | ND | 126 | 70-130 | 7.77 | 20 | |
| Methylene Chloride | 108 | 20.0 | " | 100 | ND | 108 | 70-130 | 9.70 | 20 | |
| Naphthalene | 115 | 10.0 | " | 100 | ND | 115 | 70-130 | 6.85 | 20 | |

Origins Laboratory, Inc.

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Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2807-MSD1)** | | **Source: Y702054-01** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| n-Butylbenzene | 105 | 2.00 | ug/kg | 100 | ND | 105 | 70-130 | 11.9 | 20 | |
| n-Propylbenzene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 9.67 | 20 | |
| o-Xylene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | 8.13 | 20 | |
| sec-Butylbenzene | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | 11.5 | 20 | |
| Styrene | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 8.54 | 20 | |
| tert-Butylbenzene | 106 | 2.00 | " | 100 | ND | 106 | 70-130 | 12.5 | 20 | |
| Tetrachloroethene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | 11.8 | 20 | |
| Toluene | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | 11.8 | 20 | |
| trans-1,2-Dichloroethene | 120 | 2.00 | " | 100 | ND | 120 | 70-130 | 11.0 | 20 | |
| trans-1,3-Dichloropropene | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 10.3 | 20 | |
| Trichloroethene | 110 | 2.00 | " | 100 | ND | 110 | 70-130 | 10.4 | 20 | |
| Trichlorofluoromethane | 107 | 3.00 | " | 100 | ND | 107 | 70-130 | 4.54 | 20 | |
| Vinyl chloride | 99.4 | 2.00 | " | 100 | ND | 99.4 | 70-130 | 5.54 | 20 | |
| *Surrogate: 1,2-Dichloroethane-d4* | *60* | | *ug/L* | *62.5* | | *96.8* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *60* | | *"* | *62.5* | | *96.4* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *61* | | *"* | *62.5* | | *97.1* | *70-130* | | | |

Origins Laboratory, Inc.

Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2807-MSD2)** | | **Source: Y702054-02** | | | Prepared: 02/28/2017 Analyzed: 03/01/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 101 | 2.00 | ug/kg | 100 | ND | 101 | 70-130 | 6.53 | 20 | |
| 1,1,1-Trichloroethane | 122 | 2.00 | " | 100 | ND | 122 | 70-130 | 10.4 | 20 | |
| 1,1,2,2-Tetrachloroethane | 101 | 2.00 | " | 100 | ND | 101 | 70-130 | 3.58 | 20 | |
| 1,1,2-Trichloroethane | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 6.89 | 20 | |
| 1,1-Dichloroethane | 110 | 2.00 | " | 100 | ND | 110 | 70-130 | 6.74 | 20 | |
| 1,1-Dichloroethene | 116 | 2.00 | " | 100 | ND | 116 | 70-130 | 9.39 | 20 | |
| 1,1-Dichloropropene | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 9.67 | 20 | |
| 1,2,3-Trichlorobenzene | 112 | 5.00 | " | 100 | ND | 112 | 70-130 | 15.9 | 20 | |
| 1,2,3-Trichloropropane | 105 | 5.00 | " | 100 | ND | 105 | 70-130 | 4.71 | 20 | |
| 1,2,4-Trichlorobenzene | 111 | 5.00 | " | 100 | ND | 111 | 70-130 | 20.1 | 20 | QM-07, QR-03 |
| 1,2,4-Trimethylbenzene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | 10.7 | 20 | |
| 1,2-Dibromo-3-chloropropane | 101 | 5.00 | " | 100 | ND | 101 | 70-130 | 2.70 | 20 | |
| 1,2-Dibromoethane (EDB) | 115 | 2.00 | " | 100 | ND | 115 | 70-130 | 6.81 | 20 | |
| 1,2-Dichlorobenzene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 9.42 | 20 | |
| 1,2-Dichloroethane | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 2.14 | 20 | |
| 1,2-Dichloropropane | 113 | 2.00 | " | 100 | ND | 113 | 70-130 | 5.10 | 20 | |
| 1,3,5-Trimethylbenzene | 107 | 2.00 | " | 100 | ND | 107 | 70-130 | 14.1 | 20 | |
| 1,3-Dichlorobenzene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | 14.4 | 20 | |
| 1,3-Dichloropropane | 108 | 2.00 | " | 100 | ND | 108 | 70-130 | 5.97 | 20 | |
| 1,4-Dichlorobenzene | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | 11.9 | 20 | |
| 2,2-Dichloropropane | 120 | 2.00 | " | 100 | ND | 120 | 70-130 | 11.3 | 20 | |
| 2-Butanone | 590 | 10.0 | " | 500 | ND | 118 | 70-130 | 0.430 | 20 | |
| 2-Chlorotoluene | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | 12.7 | 20 | |
| 2-Hexanone | 578 | 10.0 | " | 500 | ND | 116 | 70-130 | 5.72 | 20 | |
| 4-Chlorotoluene | 101 | 2.00 | " | 100 | ND | 101 | 70-130 | 12.1 | 20 | |
| 4-Isopropyltoluene | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 15.1 | 20 | |

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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2807-MSD2)** | | **Source: Y702054-02** | | | Prepared: 02/28/2017 Analyzed: 03/01/2017 | | | | | |
| 4-Methyl-2-pentanone | 594 | 10.0 | ug/kg | 500 | ND | 119 | 70-130 | 11.1 | 20 | |
| Acetone | 511 | 20.0 | " | 500 | ND | 102 | 70-130 | 1.41 | 20 | |
| Benzene | 110 | 2.00 | " | 100 | ND | 110 | 70-130 | 7.43 | 20 | |
| Bromobenzene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 8.30 | 20 | |
| Bromochloromethane | 113 | 2.00 | " | 100 | ND | 113 | 70-130 | 4.91 | 20 | |
| Bromodichloromethane | 109 | 2.00 | " | 100 | ND | 109 | 70-130 | 3.18 | 20 | |
| Bromoform | 94.6 | 2.00 | " | 100 | ND | 94.6 | 70-130 | 4.08 | 20 | |
| Bromomethane | 108 | 2.00 | " | 100 | ND | 108 | 70-130 | 14.5 | 20 | |
| Carbon disulfide | 108 | 5.00 | " | 100 | ND | 108 | 70-130 | 9.51 | 20 | |
| Carbon tetrachloride | 118 | 2.00 | " | 100 | ND | 118 | 70-130 | 12.1 | 20 | |
| Chlorobenzene | 106 | 2.00 | " | 100 | ND | 106 | 70-130 | 12.4 | 20 | |
| Chloroethane | 99.9 | 5.00 | " | 100 | ND | 99.9 | 70-130 | 10.1 | 20 | |
| Chloroform | 95.5 | 2.00 | " | 100 | ND | 95.5 | 70-130 | 4.76 | 20 | |
| Chloromethane | 93.7 | 2.00 | " | 100 | ND | 93.7 | 70-130 | 12.1 | 20 | |
| cis-1,2-Dichloroethene | 118 | 2.00 | " | 100 | ND | 118 | 70-130 | 6.16 | 20 | |
| cis-1,3-Dichloropropene | 106 | 2.00 | " | 100 | ND | 106 | 70-130 | 9.39 | 20 | |
| Dibromochloromethane | 107 | 2.00 | " | 100 | ND | 107 | 70-130 | 7.45 | 20 | |
| Dibromomethane | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 2.47 | 20 | |
| Ethylbenzene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 10.8 | 20 | |
| Hexachlorobutadiene | 106 | 5.00 | " | 100 | ND | 106 | 70-130 | 32.9 | 20 | QM-07 |
| Iodomethane | 111 | 15.0 | " | 100 | ND | 111 | 70-130 | 9.12 | 20 | |
| Isopropylbenzene | 107 | 2.00 | " | 100 | ND | 107 | 70-130 | 12.7 | 20 | |
| m,p-Xylene | 215 | 4.00 | " | 200 | ND | 108 | 70-130 | 12.0 | 20 | |
| Methyl tert-Butyl Ether | 122 | 2.00 | " | 100 | ND | 122 | 70-130 | 0.675 | 20 | |
| Methylene Chloride | 96.2 | 20.0 | " | 100 | ND | 96.2 | 70-130 | 7.25 | 20 | |
| Naphthalene | 111 | 10.0 | " | 100 | ND | 111 | 70-130 | 7.63 | 20 | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2807-MSD2)** | | **Source: Y702054-02** | | | Prepared: 02/28/2017 Analyzed: 03/01/2017 | | | | | |
| n-Butylbenzene | 108 | 2.00 | ug/kg | 100 | ND | 108 | 70-130 | 19.4 | 20 | |
| n-Propylbenzene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 12.2 | 20 | |
| o-Xylene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | 9.33 | 20 | |
| sec-Butylbenzene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | 14.6 | 20 | |
| Styrene | 111 | 2.00 | " | 100 | ND | 111 | 70-130 | 10.2 | 20 | |
| tert-Butylbenzene | 107 | 2.00 | " | 100 | ND | 107 | 70-130 | 13.8 | 20 | |
| Tetrachloroethene | 109 | 2.00 | " | 100 | ND | 109 | 70-130 | 14.9 | 20 | |
| Toluene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | 11.1 | 20 | |
| trans-1,2-Dichloroethene | 121 | 2.00 | " | 100 | ND | 121 | 70-130 | 8.62 | 20 | |
| trans-1,3-Dichloropropene | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 7.95 | 20 | |
| Trichloroethene | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 9.82 | 20 | |
| Trichlorofluoromethane | 110 | 3.00 | " | 100 | ND | 110 | 70-130 | 13.4 | 20 | |
| Vinyl chloride | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | 15.0 | 20 | |
| *Surrogate: 1,2-Dichloroethane-d4* | *59* | | *ug/L* | *62.5* | | *94.8* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *62* | | *"* | *62.5* | | *98.9* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *61* | | *"* | *62.5* | | *97.1* | *70-130* | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|

## Metals by SW846 3050B/6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1643435 - SW846 3050B** | | | | | | | | | | |
| **BLANK (1203737825-BLK)** | | | | | Prepared: 02/28/2017 Analyzed: 03/02/2017 | | | | | |
| Lead | ND | 0.978 | mg/kg | | | | - | | | U |
| Barium | ND | 0.489 | " | | | | - | | | U |
| Silver | ND | 0.489 | " | | | | - | | | U |
| Selenium | ND | 2.94 | " | | | | - | | | U |
| Cadmium | ND | 0.489 | " | | | | - | | | U |
| Arsenic | ND | 2.94 | " | | | | - | | | U |
| Chromium | ND | 0.489 | " | | | | - | | | U |
| **LCS (1203737826-BKS)** | | | | | Prepared: 02/28/2017 Analyzed: 03/02/2017 | | | | | |
| Silver | 49.1 | 0.499 | mg/kg | 49.9 | | 98.4 | 80-120 | | | |
| Arsenic | 51.3 | 2.99 | " | 49.9 | | 103 | 80-120 | | | |
| Barium | 51.1 | 0.499 | " | 49.9 | | 102 | 80-120 | | | |
| Cadmium | 51.6 | 0.499 | " | 49.9 | | 103 | 80-120 | | | |
| Chromium | 50.5 | 0.499 | " | 49.9 | | 101 | 80-120 | | | |
| Lead | 51.8 | 0.998 | " | 49.9 | | 104 | 80-120 | | | |
| Selenium | 53.3 | 2.99 | " | 49.9 | | 107 | 80-120 | | | |
| **DUP (1203737827 D)** | | **Source: Y702026-01** | | | Prepared: 02/28/2017 Analyzed: 03/02/2017 | | | | | |
| Selenium | 1.35 | 3.00 | mg/kg dry | | <0.500 | | 0-20 | 102 | 20 | J |
| Lead | 1.80 | 0.999 | " | | 1.94 | | 0-20 | 7.7 | 20 | |
| Chromium | 2.33 | 0.500 | " | | 2.42 | | 0-20 | 3.71 | 20 | |
| Cadmium | ND | 0.500 | " | | <0.0999 | | 0-20 | 68 | 20 | U |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Metals by SW846 3050B/6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1643435 - SW846 3050B** | | | | | | | | | | |
| **DUP (1203737827 D)** | | **Source: Y702026-01** | | | Prepared: 02/28/2017 Analyzed: 03/02/2017 | | | | | |
| Arsenic | 1.69 | 3.00 | mg/kg dry | | <0.500 | | 0-20 | 160 | 20 | J |
| Silver | ND | 0.500 | " | | <0.0999 | | 0-20 | 45.7 | 20 | U |
| Barium | 19.1 | 0.500 | " | | 19.2 | | 0-20 | 0.458 | 20 | |
| **MS (1203737828 S)** | | **Source: Y702026-01** | | | Prepared: 02/28/2017 Analyzed: 03/02/2017 | | | | | |
| Lead | 50.9 | 0.993 | mg/kg dry | 49.7 | 1.94 | 98.6 | 75-125 | | | |
| Silver | 48.2 | 0.497 | " | 49.7 | <0.0993 | 97 | 75-125 | | | |
| Selenium | 51.3 | 2.98 | " | 49.7 | <0.497 | 102 | 75-125 | | | |
| Chromium | 51.1 | 0.497 | " | 49.7 | 2.42 | 97.9 | 75-125 | | | |
| Cadmium | 49.9 | 0.497 | " | 49.7 | <0.0993 | 100 | 75-125 | | | |
| Arsenic | 50.2 | 2.98 | " | 49.7 | <0.497 | 101 | 75-125 | | | |
| Barium | 69.5 | 0.497 | " | 49.7 | 19.2 | 101 | 75-125 | | | |

Origins Laboratory, Inc.

Noelle Doyle Mathis, President

*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Metals by SW846 7471A - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1643501 - SW846 7471A Prep** | | | | | | | | | | |
| **BLANK (1203737987-BLK)** | | | | | Prepared: 03/01/2017 Analyzed: 03/02/2017 | | | | | |
| Mercury | ND | 0.0115 | mg/kg | | | | - | | | U |
| **LCS (1203737988-BKS)** | | | | | Prepared: 03/01/2017 Analyzed: 03/02/2017 | | | | | |
| Mercury | 0.115 | 0.0118 | mg/kg | 0.118 | | 97.6 | 80-120 | | | |

Origins Laboratory, Inc.

Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PAHs by SW846 3541/8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1643449 - SW846 3541** | | | | | | | | | | |
| **BLANK (1203737862-BLK)** | | | | | Prepared: 03/01/2017 Analyzed: 03/01/2017 | | | | | |
| Dibenzo(a,h)anthracene | ND | 0.00333 | mg/kg | | | | - | | | U |
| Pyrene | ND | 0.00333 | " | | | | - | | | U |
| Phenanthrene | ND | 0.00333 | " | | | | - | | | U |
| Naphthalene | ND | 0.00333 | " | | | | - | | | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(a)pyrene | ND | 0.00333 | " | | | | - | | | U |
| Fluorene | ND | 0.00333 | " | | | | - | | | U |
| Fluoranthene | ND | 0.00333 | " | | | | - | | | U |
| Chrysene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(ghi)perylene | ND | 0.00333 | " | | | | - | | | U |
| Acenaphthene | ND | 0.00333 | " | | | | - | | | U |
| Acenaphthylene | ND | 0.00333 | " | | | | - | | | U |
| Anthracene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(a)anthracene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(b)fluoranthene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(k)fluoranthene | ND | 0.00333 | " | | | | - | | | U |
| *Surrogate: 5-alpha-Androstane* | *0.150* | | *"* | *0.167* | | *90* | *30-118* | | | |
| **LCS (1203737863-BKS)** | | | | | Prepared: 03/01/2017 Analyzed: 03/01/2017 | | | | | |
| Chrysene | 0.244 | 0.00333 | mg/kg | 0.333 | | 73 | 54-103 | | | |
| Dibenzo(a,h)anthracene | 0.316 | 0.00333 | " | 0.333 | | 95 | 35-142 | | | |
| Phenanthrene | 0.231 | 0.00333 | " | 0.333 | | 69 | 53-97 | | | |
| Naphthalene | 0.212 | 0.00333 | " | 0.333 | | 64 | 57-98 | | | |
| Indeno(1,2,3-cd)pyrene | 0.311 | 0.00333 | " | 0.333 | | 93 | 41-130 | | | |
| Fluorene | 0.251 | 0.00333 | " | 0.333 | | 75 | 47-106 | | | |
| Pyrene | 0.203 | 0.00333 | " | 0.333 | | 61 | 41-114 | | | |
| Acenaphthene | 0.216 | 0.00333 | " | 0.333 | | 65 | 55-99 | | | |

Origins Laboratory, Inc.

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Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PAHs by SW846 3541/8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1643449 - SW846 3541** | | | | | | | | | | |
| **LCS (1203737863-BKS)** | | | | | Prepared: 03/01/2017 Analyzed: 03/01/2017 | | | | | |
| Benzo(k)fluoranthene | 0.269 | 0.00333 | mg/kg | 0.333 | | 81 | 26-121 | | | |
| Benzo(ghi)perylene | 0.268 | 0.00333 | " | 0.333 | | 81 | 39-119 | | | |
| Benzo(b)fluoranthene | 0.279 | 0.00333 | " | 0.333 | | 84 | 36-120 | | | |
| Benzo(a)pyrene | 0.321 | 0.00333 | " | 0.333 | | 96 | 35-121 | | | |
| Benzo(a)anthracene | 0.293 | 0.00333 | " | 0.333 | | 88 | 51-108 | | | |
| Anthracene | 0.258 | 0.00333 | " | 0.333 | | 77 | 52-102 | | | |
| Acenaphthylene | 0.242 | 0.00333 | " | 0.333 | | 73 | 48-107 | | | |
| Fluoranthene | 0.276 | 0.00333 | " | 0.333 | | 83 | 39-108 | | | |
| *Surrogate: 5-alpha-Androstane* | *0.127* | | *"* | *0.166* | | *76* | *30-118* | | | |
| **MS (1203737864 S)** | | **Source: 417445001** | | | Prepared: 03/01/2017 Analyzed: 03/01/2017 | | | | | |
| Dibenzo(a,h)anthracene | 0.447 | 0.00443 | mg/kg dry | 0.443 | <0.00221 | 101 | 18-146 | | | |
| Fluoranthene | 0.413 | 0.00443 | " | 0.443 | 0.0124 | 91 | 28-116 | | | |
| Fluorene | 0.396 | 0.00443 | " | 0.443 | 0.00531 | 88 | 33-123 | | | |
| Indeno(1,2,3-cd)pyrene | 0.457 | 0.00443 | " | 0.443 | 0.00575 | 102 | 17-133 | | | |
| Naphthalene | 0.543 | 0.00443 | " | 0.443 | <0.00133 | 123 | 33-117 | | | |
| Pyrene | 0.292 | 0.00443 | " | 0.443 | 0.00752 | 64 | 30-131 | | | |
| Benzo(ghi)perylene | 0.395 | 0.00443 | " | 0.443 | 0.00575 | 88 | 17-118 | | | |
| Phenanthrene | 0.356 | 0.00443 | " | 0.443 | 0.0168 | 77 | 35-119 | | | |
| Benzo(b)fluoranthene | 0.426 | 0.00443 | " | 0.443 | 0.00664 | 95 | 28-126 | | | |
| Benzo(a)pyrene | 0.440 | 0.00443 | " | 0.443 | 0.00487 | 98 | 27-126 | | | |
| Benzo(a)anthracene | 0.420 | 0.00443 | " | 0.443 | 0.00354 | 94 | 41-118 | | | |
| Anthracene | 0.387 | 0.00443 | " | 0.443 | <0.00221 | 87 | 36-120 | | | |
| Acenaphthylene | 0.374 | 0.00443 | " | 0.443 | <0.00221 | 85 | 39-116 | | | |
| Acenaphthene | 0.347 | 0.00443 | " | 0.443 | 0.00531 | 77 | 38-117 | | | |
| Benzo(k)fluoranthene | 0.401 | 0.00443 | " | 0.443 | 0.00266 | 90 | 24-122 | | | |
| Chrysene | 0.366 | 0.00443 | " | 0.443 | 0.00398 | 82 | 42-113 | | | |

Origins Laboratory, Inc.

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Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PAHs by SW846 3541/8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1643449 - SW846 3541** | | | | | | | | | | |
| **MS (1203737864 S)** | | **Source: 417445001** | | | Prepared: 03/01/2017 Analyzed: 03/01/2017 | | | | | |
| *Surrogate: 5-alpha-Androstane* | *0.173* | | *mg/kg dry* | *0.221* | *0.186* | *78* | *30-118* | | | |
| **MSD (1203737865 SD)** | | **Source: 417445001** | | | Prepared: 03/01/2017 Analyzed: 03/01/2017 | | | | | |
| Dibenzo(a,h)anthracene | 0.444 | 0.00442 | mg/kg dry | 0.442 | <0.00221 | 100 | 18-146 | 1 | 30 | |
| Fluoranthene | 0.429 | 0.00442 | " | 0.442 | 0.0124 | 94 | 28-116 | 4 | 30 | |
| Fluorene | 0.402 | 0.00442 | " | 0.442 | 0.00531 | 90 | 33-123 | 2 | 30 | |
| Indeno(1,2,3-cd)pyrene | 0.458 | 0.00442 | " | 0.442 | 0.00575 | 102 | 17-133 | 0 | 30 | |
| Naphthalene | 0.473 | 0.00442 | " | 0.442 | <0.00133 | 107 | 33-117 | 14 | 30 | |
| Pyrene | 0.295 | 0.00442 | " | 0.442 | 0.00752 | 65 | 30-131 | 1 | 30 | |
| Benzo(ghi)perylene | 0.398 | 0.00442 | " | 0.442 | 0.00575 | 89 | 17-118 | 1 | 30 | |
| Phenanthrene | 0.363 | 0.00442 | " | 0.442 | 0.0168 | 78 | 35-119 | 2 | 30 | |
| Benzo(k)fluoranthene | 0.418 | 0.00442 | " | 0.442 | 0.00266 | 94 | 24-122 | 4 | 30 | |
| Benzo(b)fluoranthene | 0.446 | 0.00442 | " | 0.442 | 0.00664 | 99 | 28-126 | 5 | 30 | |
| Benzo(a)pyrene | 0.452 | 0.00442 | " | 0.442 | 0.00487 | 101 | 27-126 | 3 | 30 | |
| Benzo(a)anthracene | 0.432 | 0.00442 | " | 0.442 | 0.00354 | 97 | 41-118 | 3 | 30 | |
| Anthracene | 0.396 | 0.00442 | " | 0.442 | <0.00221 | 90 | 36-120 | 2 | 30 | |
| Acenaphthylene | 0.383 | 0.00442 | " | 0.442 | <0.00221 | 87 | 39-116 | 2 | 30 | |
| Acenaphthene | 0.353 | 0.00442 | " | 0.442 | 0.00531 | 78 | 38-117 | 2 | 30 | |
| Chrysene | 0.376 | 0.00442 | " | 0.442 | 0.00398 | 84 | 42-113 | 3 | 30 | |
| *Surrogate: 5-alpha-Androstane* | *0.180* | | *"* | *0.221* | *0.186* | *82* | *30-118* | | | |

Origins Laboratory, Inc.

Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## TCLP Metals by SW846 3010A/6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1643819 - SW846 3010A** | | | | | | | | | | |
| **MS (1203737906 S)** | | **Source: Y702026-01** | | | Prepared: 03/02/2017 Analyzed: 03/02/2017 | | | | | |
| Lead | 4.28 | 0.100 | mg/L | 5.00 | <0.033 | 85.6 | 75-125 | | | |
| **TB (1203737907-BLK)** | | | | | Prepared: 03/02/2017 Analyzed: 03/02/2017 | | | | | |
| Lead | ND | 0.100 | mg/L | | | | - | | | U |
| **BLANK (1203738798-BLK)** | | | | | Prepared: 03/02/2017 Analyzed: 03/02/2017 | | | | | |
| Lead | ND | 0.100 | mg/L | | | | - | | | U |
| **LCS (1203738799-BKS)** | | | | | Prepared: 03/02/2017 Analyzed: 03/02/2017 | | | | | |
| Lead | 4.57 | 0.100 | mg/L | 5.00 | | 91.4 | 80-120 | | | |
| **DUP (1203738800 D)** | | **Source: Y702026-01** | | | Prepared: 03/02/2017 Analyzed: 03/02/2017 | | | | | |
| Lead | ND | 0.100 | mg/L | | <0.033 | | 0-20 | 6.9 | 20 | U |

Origins Laboratory, Inc.

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Noelle Doyle Mathis, President

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Notes and Definitions

| | |
|---|---|
| Ua | Sample is Non-Detect. |
| U | Result not detected above the detection limit |
| QR-03 | The RPD value for the sample duplicate or MS/MSD was outside of QC acceptance limits due to matrix interference. QC batch accepted based on LCS and/or LCSD recovery and/or RPD values. |
| QM-07 | The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery. |
| J | Greater than the detection limit but less than the reporting limit |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| RPD | Relative Percent Difference |

All soil results are reported on a wet weight basis.

Origins Laboratory, Inc.

Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

March 06, 2017

Pinyon

Julie Linn

9100 West Jewell Avenue, Suite 200

Lakewood CO 80232

**Project Name -** 27th St. Storm Drain **Project Number -** 11780301.2100

Attached are your analytical results for 27th St. Storm Drain received by Origins Laboratory, Inc. February 28, 2017. This project is associated with Origins project number Y702047-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com

THE NELAC INSTITUTE

ACCREDITED
TESTING CERT # 3494.01

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## CROSS REFERENCE REPORT

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| B-1 | Y702047-01 | Soil | February 28, 2017 10:20 | 02/28/2017 11:30 |

Origins Laboratory, Inc.

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Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon

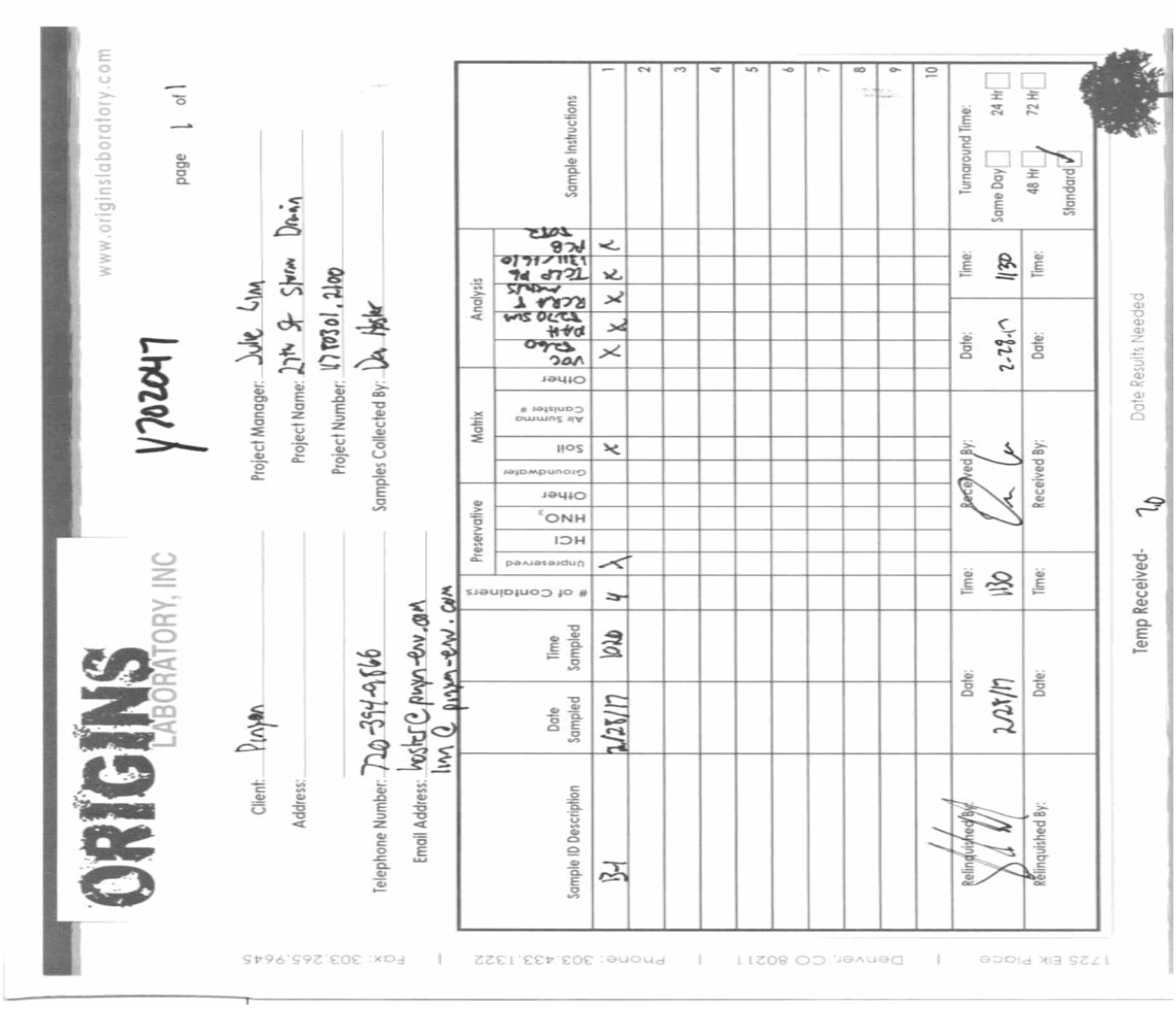
9100 West Jewell Avenue, Suite 200

Lakewood CO 80232

Julie Linn

Project Number: 11780301.2100

Project: 27th St. Storm Drain



ORIGINS LABORATORY, INC

www.originslaboratory.com

page 1 of 1

Y702047

Client: Pinyon

Address:

Telephone Number: 720-394-9566

Email Address: hester@pinyon-env.com linn@pinyon-env.com

Project Manager: Julie Linn

Project Name: 27th St Storm Drain

Project Number: 11780301.2100

Samples Collected By: Da Hester

| Sample ID Description | Date Sampled | Time Sampled | # of Containers | Preservative: Unpreserved | Preservative: HCl | Preservative: $HNO_3$ | Preservative: Other | Matrix: Groundwater | Matrix: Soil | Matrix: Air Summa Canister # | Matrix: Other | Analysis: VOC 8260 | Analysis: PAH 8270 SIM | Analysis: RCRA 8 Metals | Analysis: TCLP Pb 1311/1610 | Analysis: PCB 8082 | Sample Instructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B4 | 2/28/17 | 1020 | 4 | X | | | | | X | | | X | X | X | X | X | |
| | | | | | | | | | | | | | | | | | |
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Relinquished By: Date: 2/28/17 Time: 1130 Received By: Date: 2-28-17 Time: 1130

Relinquished By: Date: Time: Received By: Date: Time:

Turnaround Time: Same Day ☐ 24 Hr ☐ 48 Hr ☐ 72 Hr ☐ Standard ☑

Temp Received- 20

Date Results Needed

1725 Elk Place | Denver, CO 80211 | Phone: 303.433.1322 | Fax: 303.265.9645

Origins Laboratory, Inc.

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Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

Origins Laboratory

F-012207-01-R1
Effective Date: 01/09/12

**Sample Receipt Checklist**

Origins Work Order: Y702047

Client: Pinyon
Client Project ID: 27th St. Storm Drain

Checklist Completed by: Dan Lee
Date/time completed: 2-28-17 1305

Shipped Via: HD (UPS, FedEx, Hand Delivered, Pick-up, etc.)
Airbill #: NA

Matrix(s) Received: (Check all that apply): ✓ Soil/Solid ____ Water ____ Other: ____ (Describe)

Cooler Number/Temperature: ✓ / 7.0 °C ____ / ____ °C ____ / ____ °C ____ / ____ °C

Thermometer ID: T003

| Requirement Description | Yes | No | N/A | Comments (if any) |
|---|---|---|---|---|
| If samples require cooling, was the temperature between 0°C to ≤ 6°C[1]? | | ✓ | | Sampled Same Day |
| Is there ice present (document if blue ice is used) | ✓ | | | |
| Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact) | | ✓ | | |
| Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact) | | ✓ | | |
| Were all samples received intact[1]? | ✓ | | | |
| Was adequate sample volume provided[1]? | ✓ | | | |
| Are short holding time analytes or samples with HTs due within 48 hours present[1]? | | ✓ | | |
| Is a chain-of-custody (COC) present and filled out completely[1]? | ✓ | | | |
| Does the COC agree with the number and type of sample bottles received[1]? | ✓ | | | |
| Do the sample IDs on the bottle labels match the COC[1]? | ✓ | | | |
| Is the COC properly relinquished by the client with date and time recorded[1]? | ✓ | | | |
| For volatiles in water – is there headspace (> ¼ inch bubble) present? **If yes, contact client and note in narrative.** | | | ✓ | |
| Are samples preserved that require preservation and was it checked[1]? *(note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)/(pH <2 for samples preserved with HNO3, HCL, H2SO4) / ( pH >10 for samples preserved with NaAsO2+NaOH, ZnAc+NaOH)* | | ✓ | | |

Additional Comments (if any):

[1] *If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.*

Reviewed by (Project Manager) ____ Date/Time Reviewed 3/1/17

Origins Laboratory, Inc.

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Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-1**

**2/28/2017 10:20:00AM**

## GEL Laboratories, LLC

**Y702047-01 (Soil)**

| Analyte | Result | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|
| **Metals by SW846 3050B/6010C** | | | | | | | | |
| Arsenic | **4.36** | 3.15 | mg/kg dry | 1 | 1643537 | 03/01/2017 | 03/06/2017 | |
| Barium | **85.8** | 0.525 | " | " | " | " | " | |
| Cadmium | **0.357** | 0.525 | " | " | " | " | " | J |
| Chromium | **4.89** | 0.525 | " | " | " | " | " | |
| Lead | **139** | 1.05 | " | " | " | " | " | |
| Selenium | ND | 3.15 | " | " | " | " | " | U |
| Silver | **0.860** | 0.525 | " | " | " | " | " | |
| **Metals by SW846 7471A** | | | | | | | | |
| Mercury | **0.128** | 0.0122 | mg/kg dry | 1 | 1643501 | " | 03/02/2017 | |
| **PAHs by SW846 3541/8270D SIM** | | | | | | | | |
| Acenaphthene | ND | 0.00358 | mg/kg dry | 1 | 1644035 | 03/03/2017 | 03/03/2017 | U |
| Acenaphthylene | ND | 0.00358 | " | " | " | " | " | U |
| Anthracene | **0.00358** | 0.00358 | " | " | " | " | " | |
| Benzo(a)anthracene | **0.0193** | 0.00358 | " | " | " | " | " | |
| Benzo(a)pyrene | **0.0179** | 0.00358 | " | " | " | " | " | |
| Benzo(b)fluoranthene | **0.0318** | 0.00358 | " | " | " | " | " | |
| Benzo(ghi)perylene | **0.015** | 0.00358 | " | " | " | " | " | |
| Benzo(k)fluoranthene | **0.0118** | 0.00358 | " | " | " | " | " | |
| Chrysene | **0.0272** | 0.00358 | " | " | " | " | " | |
| Dibenzo(a,h)anthracene | **0.00465** | 0.00358 | " | " | " | " | " | |

Origins Laboratory, Inc.

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Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-1**

**2/28/2017 10:20:00AM**

## GEL Laboratories, LLC

**Y702047-01 (Soil)**

| Analyte | Result | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|
| **PAHs by SW846 3541/8270D SIM** | | | | | | | | |
| Fluoranthene | **0.0379** | 0.00358 | mg/kg dry | 1 | 1644035 | 03/03/2017 | 03/03/2017 | |
| Fluorene | ND | 0.00358 | " | " | " | " | " | U |
| Indeno(1,2,3-cd)pyrene | **0.015** | 0.00358 | " | " | " | " | " | |
| Naphthalene | **0.00573** | 0.00358 | " | " | " | " | " | |
| Phenanthrene | **0.0318** | 0.00358 | " | " | " | " | " | |
| Pyrene | **0.0386** | 0.00358 | " | " | " | " | " | |
| *Surrogate: 5-alpha-Androstane* | *78 %* | *30-118* | | | " | " | " | |
| **PCBs by SW846 3541/8082A** | | | | | | | | |
| Aroclor-1016 | ND | 0.00358 | mg/kg dry | 1 | 1644161 | " | 03/04/2017 | U |
| Aroclor-1221 | ND | 0.00358 | " | " | " | " | " | U |
| Aroclor-1232 | ND | 0.00358 | " | " | " | " | " | U |
| Aroclor-1242 | ND | 0.00358 | " | " | " | " | " | U |
| Aroclor-1248 | ND | 0.00358 | " | " | " | " | " | U |
| Aroclor-1254 | ND | 0.00358 | " | " | " | " | " | U |
| Aroclor-1260 | ND | 0.00358 | " | " | " | " | " | U |
| Aroclor-Total | ND | 0.00358 | " | " | " | " | " | U |
| *Surrogate: 4cmx* | *93 %* | *30-120* | | | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | *78 %* | *32-139* | | | " | " | " | |

Origins Laboratory, Inc.

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Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-1**

**2/28/2017 10:20:00AM**

## GEL Laboratories, LLC

**Y702047-01 (Soil)**

| Analyte | Result | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|
| **TCLP Metals by 1311/3010A/6010C** | | | | | | | | |
| Lead | ND | 0.100 | mg/L | 1 | 1643819 | 03/02/2017 | 03/02/2017 | U |
| **VOC by EPA 8260C** | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | 2.00 | ug/kg | 1 | B7B2807 | 02/28/2017 | 03/02/2017 | Ua |
| 1,1,1-Trichloroethane | ND | 2.00 | " | " | " | " | " | Ua |
| 1,1,2,2-Tetrachloroethane | ND | 2.00 | " | " | " | " | " | Ua |
| 1,1,2-Trichloroethane | ND | 2.00 | " | " | " | " | " | Ua |
| 1,1-Dichloroethane | ND | 2.00 | " | " | " | " | " | Ua |
| 1,1-Dichloroethene | ND | 2.00 | " | " | " | " | " | Ua |
| 1,1-Dichloropropene | ND | 2.00 | " | " | " | " | " | Ua |
| 1,2,3-Trichlorobenzene | ND | 5.00 | " | " | " | " | " | Ua |
| 1,2,3-Trichloropropane | ND | 5.00 | " | " | " | " | " | Ua |
| 1,2,4-Trichlorobenzene | ND | 5.00 | " | " | " | " | " | Ua |
| 1,2,4-Trimethylbenzene | ND | 2.00 | " | " | " | " | " | Ua |
| 1,2-Dibromo-3-chloropropane | ND | 5.00 | " | " | " | " | " | Ua |
| 1,2-Dibromoethane (EDB) | ND | 2.00 | " | " | " | " | " | Ua |
| 1,2-Dichlorobenzene | ND | 2.00 | " | " | " | " | " | Ua |
| 1,2-Dichloroethane | ND | 2.00 | " | " | " | " | " | Ua |
| 1,2-Dichloropropane | ND | 2.00 | " | " | " | " | " | Ua |

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Pinyon
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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-1**

**2/28/2017 10:20:00AM**

**Origins Laboratory, Inc.**

**Y702047-01 (Soil)**

## VOC by EPA 8260C

| Analyte | Result | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|
| 1,3,5-Trimethylbenzene | ND | 2.00 | ug/kg | 1 | B7B2807 | 02/28/2017 | 03/02/2017 | Ua |
| 1,3-Dichlorobenzene | ND | 2.00 | " | " | " | " | " | Ua |
| 1,3-Dichloropropane | ND | 2.00 | " | " | " | " | " | Ua |
| 1,4-Dichlorobenzene | ND | 2.00 | " | " | " | " | " | Ua |
| 2,2-Dichloropropane | ND | 2.00 | " | " | " | " | " | Ua |
| 2-Butanone | ND | 10.0 | " | " | " | " | " | Ua |
| 2-Chlorotoluene | ND | 2.00 | " | " | " | " | " | Ua |
| 2-Hexanone | ND | 10.0 | " | " | " | " | " | Ua |
| 4-Chlorotoluene | ND | 2.00 | " | " | " | " | " | Ua |
| 4-Isopropyltoluene | ND | 2.00 | " | " | " | " | " | Ua |
| 4-Methyl-2-pentanone | ND | 10.0 | " | " | " | " | " | Ua |
| Acetone | ND | 20.0 | " | " | " | " | " | Ua |
| Benzene | ND | 2.00 | " | " | " | " | " | Ua |
| Bromobenzene | ND | 2.00 | " | " | " | " | " | Ua |
| Bromochloromethane | ND | 2.00 | " | " | " | " | " | Ua |
| Bromodichloromethane | ND | 2.00 | " | " | " | " | " | Ua |
| Bromoform | ND | 2.00 | " | " | " | " | " | Ua |
| Bromomethane | ND | 2.00 | " | " | " | " | " | Ua |
| Carbon disulfide | ND | 5.00 | " | " | " | " | " | Ua |

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Pinyon
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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-1**

**2/28/2017 10:20:00AM**

**Origins Laboratory, Inc.**

**Y702047-01 (Soil)**

## VOC by EPA 8260C

| Analyte | Result | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|
| Carbon tetrachloride | ND | 2.00 | ug/kg | 1 | B7B2807 | 02/28/2017 | 03/02/2017 | Ua |
| Chlorobenzene | ND | 2.00 | " | " | " | " | " | Ua |
| Chloroethane | ND | 5.00 | " | " | " | " | " | Ua |
| Chloroform | ND | 2.00 | " | " | " | " | " | Ua |
| Chloromethane | ND | 2.00 | " | " | " | " | " | Ua |
| cis-1,2-Dichloroethene | ND | 2.00 | " | " | " | " | " | Ua |
| cis-1,3-Dichloropropene | ND | 2.00 | " | " | " | " | " | Ua |
| Dibromochloromethane | ND | 2.00 | " | " | " | " | " | Ua |
| Dibromomethane | ND | 2.00 | " | " | " | " | " | Ua |
| Ethylbenzene | ND | 2.00 | " | " | " | " | " | Ua |
| Hexachlorobutadiene | ND | 5.00 | " | " | " | " | " | Ua |
| Iodomethane | ND | 15.0 | " | " | " | " | " | Ua |
| Isopropylbenzene | ND | 2.00 | " | " | " | " | " | Ua |
| m,p-Xylene | ND | 4.00 | " | " | " | " | " | Ua |
| Methyl tert-Butyl Ether | ND | 2.00 | " | " | " | " | " | Ua |
| Methylene Chloride | ND | 20.0 | " | " | " | " | " | Ua |
| Naphthalene | ND | 10.0 | " | " | " | " | " | Ua |
| n-Butylbenzene | ND | 2.00 | " | " | " | " | " | Ua |
| n-Propylbenzene | ND | 2.00 | " | " | " | " | " | Ua |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-1**

**2/28/2017 10:20:00AM**

**Origins Laboratory, Inc.**

**Y702047-01 (Soil)**

## VOC by EPA 8260C

| Analyte | Result | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|
| o-Xylene | ND | 2.00 | ug/kg | 1 | B7B2807 | 02/28/2017 | 03/02/2017 | Ua |
| sec-Butylbenzene | ND | 2.00 | " | " | " | " | " | Ua |
| Styrene | ND | 2.00 | " | " | " | " | " | Ua |
| tert-Butylbenzene | ND | 2.00 | " | " | " | " | " | Ua |
| Tetrachloroethene | ND | 2.00 | " | " | " | " | " | Ua |
| Toluene | ND | 2.00 | " | " | " | " | " | Ua |
| trans-1,2-Dichloroethene | ND | 2.00 | " | " | " | " | " | Ua |
| trans-1,3-Dichloropropene | ND | 2.00 | " | " | " | " | " | Ua |
| Trichloroethene | ND | 2.00 | " | " | " | " | " | Ua |
| Trichlorofluoromethane | ND | 3.00 | " | " | " | " | " | Ua |
| Vinyl chloride | ND | 2.00 | " | " | " | " | " | Ua |
| *Surrogate: 1,2-Dichloroethane-d4* | *106 %* | *70-130* | | | " | " | " | |
| *Surrogate: Toluene-d8* | *96.1 %* | *70-130* | | | " | " | " | |
| *Surrogate: 4-Bromofluorobenzene* | *97.3 %* | *70-130* | | | " | " | " | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2807-BLK1)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | 2.00 | ug/kg | | | | | | | Ua |
| 1,1,1-Trichloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,1,2,2-Tetrachloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,1,2-Trichloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,1-Dichloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,1-Dichloroethene | ND | 2.00 | " | | | | | | | Ua |
| 1,1-Dichloropropene | ND | 2.00 | " | | | | | | | Ua |
| 1,2,3-Trichlorobenzene | ND | 5.00 | " | | | | | | | Ua |
| 1,2,3-Trichloropropane | ND | 5.00 | " | | | | | | | Ua |
| 1,2,4-Trichlorobenzene | ND | 5.00 | " | | | | | | | Ua |
| 1,2,4-Trimethylbenzene | ND | 2.00 | " | | | | | | | Ua |
| 1,2-Dibromo-3-chloropropane | ND | 5.00 | " | | | | | | | Ua |
| 1,2-Dibromoethane (EDB) | ND | 2.00 | " | | | | | | | Ua |
| 1,2-Dichlorobenzene | ND | 2.00 | " | | | | | | | Ua |
| 1,2-Dichloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,2-Dichloropropane | ND | 2.00 | " | | | | | | | Ua |
| 1,3,5-Trimethylbenzene | ND | 2.00 | " | | | | | | | Ua |
| 1,3-Dichlorobenzene | ND | 2.00 | " | | | | | | | Ua |
| 1,3-Dichloropropane | ND | 2.00 | " | | | | | | | Ua |
| 1,4-Dichlorobenzene | ND | 2.00 | " | | | | | | | Ua |
| 2,2-Dichloropropane | ND | 2.00 | " | | | | | | | Ua |
| 2-Butanone | ND | 10.0 | " | | | | | | | Ua |
| 2-Chlorotoluene | ND | 2.00 | " | | | | | | | Ua |
| 2-Hexanone | ND | 10.0 | " | | | | | | | Ua |
| 4-Chlorotoluene | ND | 2.00 | " | | | | | | | Ua |
| 4-Isopropyltoluene | ND | 2.00 | " | | | | | | | Ua |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2807-BLK1)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 4-Methyl-2-pentanone | ND | 10.0 | ug/kg | | | | | | | Ua |
| Acetone | ND | 20.0 | " | | | | | | | Ua |
| Benzene | ND | 2.00 | " | | | | | | | Ua |
| Bromobenzene | ND | 2.00 | " | | | | | | | Ua |
| Bromochloromethane | ND | 2.00 | " | | | | | | | Ua |
| Bromodichloromethane | ND | 2.00 | " | | | | | | | Ua |
| Bromoform | ND | 2.00 | " | | | | | | | Ua |
| Bromomethane | ND | 2.00 | " | | | | | | | Ua |
| Carbon disulfide | ND | 5.00 | " | | | | | | | Ua |
| Carbon tetrachloride | ND | 2.00 | " | | | | | | | Ua |
| Chlorobenzene | ND | 2.00 | " | | | | | | | Ua |
| Chloroethane | ND | 5.00 | " | | | | | | | Ua |
| Chloroform | ND | 2.00 | " | | | | | | | Ua |
| Chloromethane | ND | 2.00 | " | | | | | | | Ua |
| cis-1,2-Dichloroethene | ND | 2.00 | " | | | | | | | Ua |
| cis-1,3-Dichloropropene | ND | 2.00 | " | | | | | | | Ua |
| Dibromochloromethane | ND | 2.00 | " | | | | | | | Ua |
| Dibromomethane | ND | 2.00 | " | | | | | | | Ua |
| Ethylbenzene | ND | 2.00 | " | | | | | | | Ua |
| Hexachlorobutadiene | ND | 5.00 | " | | | | | | | Ua |
| Iodomethane | ND | 15.0 | " | | | | | | | Ua |
| Isopropylbenzene | ND | 2.00 | " | | | | | | | Ua |
| m,p-Xylene | ND | 4.00 | " | | | | | | | Ua |
| Methyl tert-Butyl Ether | ND | 2.00 | " | | | | | | | Ua |
| Methylene Chloride | ND | 20.0 | " | | | | | | | Ua |
| Naphthalene | ND | 10.0 | " | | | | | | | Ua |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2807-BLK1)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| n-Butylbenzene | ND | 2.00 | ug/kg | | | | | | | Ua |
| n-Propylbenzene | ND | 2.00 | " | | | | | | | Ua |
| o-Xylene | ND | 2.00 | " | | | | | | | Ua |
| sec-Butylbenzene | ND | 2.00 | " | | | | | | | Ua |
| Styrene | ND | 2.00 | " | | | | | | | Ua |
| tert-Butylbenzene | ND | 2.00 | " | | | | | | | Ua |
| Tetrachloroethene | ND | 2.00 | " | | | | | | | Ua |
| Toluene | ND | 2.00 | " | | | | | | | Ua |
| trans-1,2-Dichloroethene | ND | 2.00 | " | | | | | | | Ua |
| trans-1,3-Dichloropropene | ND | 2.00 | " | | | | | | | Ua |
| Trichloroethene | ND | 2.00 | " | | | | | | | Ua |
| Trichlorofluoromethane | ND | 3.00 | " | | | | | | | Ua |
| Vinyl chloride | ND | 2.00 | " | | | | | | | Ua |
| *Surrogate: 1,2-Dichloroethane-d4* | *62* | | *ug/L* | *62.5* | | *99.5* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *61* | | *"* | *62.5* | | *97.6* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *60* | | *"* | *62.5* | | *96.0* | *70-130* | | | |

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Pinyon
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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2807-BLK2)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | ND | 2.00 | ug/kg | | | | | | | Ua |
| 1,1,1-Trichloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,1,2,2-Tetrachloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,1,2-Trichloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,1-Dichloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,1-Dichloroethene | ND | 2.00 | " | | | | | | | Ua |
| 1,1-Dichloropropene | ND | 2.00 | " | | | | | | | Ua |
| 1,2,3-Trichlorobenzene | ND | 5.00 | " | | | | | | | Ua |
| 1,2,3-Trichloropropane | ND | 5.00 | " | | | | | | | Ua |
| 1,2,4-Trichlorobenzene | ND | 5.00 | " | | | | | | | Ua |
| 1,2,4-Trimethylbenzene | ND | 2.00 | " | | | | | | | Ua |
| 1,2-Dibromo-3-chloropropane | ND | 5.00 | " | | | | | | | Ua |
| 1,2-Dibromoethane (EDB) | ND | 2.00 | " | | | | | | | Ua |
| 1,2-Dichlorobenzene | ND | 2.00 | " | | | | | | | Ua |
| 1,2-Dichloroethane | ND | 2.00 | " | | | | | | | Ua |
| 1,2-Dichloropropane | ND | 2.00 | " | | | | | | | Ua |
| 1,3,5-Trimethylbenzene | ND | 2.00 | " | | | | | | | Ua |
| 1,3-Dichlorobenzene | ND | 2.00 | " | | | | | | | Ua |
| 1,3-Dichloropropane | ND | 2.00 | " | | | | | | | Ua |
| 1,4-Dichlorobenzene | ND | 2.00 | " | | | | | | | Ua |
| 2,2-Dichloropropane | ND | 2.00 | " | | | | | | | Ua |
| 2-Butanone | ND | 10.0 | " | | | | | | | Ua |
| 2-Chlorotoluene | ND | 2.00 | " | | | | | | | Ua |
| 2-Hexanone | ND | 10.0 | " | | | | | | | Ua |
| 4-Chlorotoluene | ND | 2.00 | " | | | | | | | Ua |
| 4-Isopropyltoluene | ND | 2.00 | " | | | | | | | Ua |

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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2807-BLK2)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 4-Methyl-2-pentanone | ND | 10.0 | ug/kg | | | | | | | Ua |
| Acetone | ND | 20.0 | " | | | | | | | Ua |
| Benzene | ND | 2.00 | " | | | | | | | Ua |
| Bromobenzene | ND | 2.00 | " | | | | | | | Ua |
| Bromochloromethane | ND | 2.00 | " | | | | | | | Ua |
| Bromodichloromethane | ND | 2.00 | " | | | | | | | Ua |
| Bromoform | ND | 2.00 | " | | | | | | | Ua |
| Bromomethane | ND | 2.00 | " | | | | | | | Ua |
| Carbon disulfide | ND | 5.00 | " | | | | | | | Ua |
| Carbon tetrachloride | ND | 2.00 | " | | | | | | | Ua |
| Chlorobenzene | ND | 2.00 | " | | | | | | | Ua |
| Chloroethane | ND | 5.00 | " | | | | | | | Ua |
| Chloroform | ND | 2.00 | " | | | | | | | Ua |
| Chloromethane | ND | 2.00 | " | | | | | | | Ua |
| cis-1,2-Dichloroethene | ND | 2.00 | " | | | | | | | Ua |
| cis-1,3-Dichloropropene | ND | 2.00 | " | | | | | | | Ua |
| Dibromochloromethane | ND | 2.00 | " | | | | | | | Ua |
| Dibromomethane | ND | 2.00 | " | | | | | | | Ua |
| Ethylbenzene | ND | 2.00 | " | | | | | | | Ua |
| Hexachlorobutadiene | ND | 5.00 | " | | | | | | | Ua |
| Iodomethane | ND | 15.0 | " | | | | | | | Ua |
| Isopropylbenzene | ND | 2.00 | " | | | | | | | Ua |
| m,p-Xylene | ND | 4.00 | " | | | | | | | Ua |
| Methyl tert-Butyl Ether | ND | 2.00 | " | | | | | | | Ua |
| Methylene Chloride | ND | 20.0 | " | | | | | | | Ua |
| Naphthalene | ND | 10.0 | " | | | | | | | Ua |

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Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Blank (B7B2807-BLK2)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| n-Butylbenzene | ND | 2.00 | ug/kg | | | | | | | Ua |
| n-Propylbenzene | ND | 2.00 | " | | | | | | | Ua |
| o-Xylene | ND | 2.00 | " | | | | | | | Ua |
| sec-Butylbenzene | ND | 2.00 | " | | | | | | | Ua |
| Styrene | ND | 2.00 | " | | | | | | | Ua |
| tert-Butylbenzene | ND | 2.00 | " | | | | | | | Ua |
| Tetrachloroethene | ND | 2.00 | " | | | | | | | Ua |
| Toluene | ND | 2.00 | " | | | | | | | Ua |
| trans-1,2-Dichloroethene | ND | 2.00 | " | | | | | | | Ua |
| trans-1,3-Dichloropropene | ND | 2.00 | " | | | | | | | Ua |
| Trichloroethene | ND | 2.00 | " | | | | | | | Ua |
| Trichlorofluoromethane | ND | 3.00 | " | | | | | | | Ua |
| Vinyl chloride | ND | 2.00 | " | | | | | | | Ua |
| *Surrogate: 1,2-Dichloroethane-d4* | *59* | | *ug/L* | *62.5* | | *94.0* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *61* | | *"* | *62.5* | | *97.3* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *61* | | *"* | *62.5* | | *97.2* | *70-130* | | | |

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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2807-BS1)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 102 | 2.00 | ug/kg | 100 | | 102 | 70-130 | | | |
| 1,1,1-Trichloroethane | 119 | 2.00 | " | 100 | | 119 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 101 | 2.00 | " | 100 | | 101 | 70-130 | | | |
| 1,1,2-Trichloroethane | 99.8 | 2.00 | " | 100 | | 99.8 | 70-130 | | | |
| 1,1-Dichloroethane | 110 | 2.00 | " | 100 | | 110 | 70-130 | | | |
| 1,1-Dichloroethene | 114 | 2.00 | " | 100 | | 114 | 70-130 | | | |
| 1,1-Dichloropropene | 110 | 2.00 | " | 100 | | 110 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 111 | 5.00 | " | 100 | | 111 | 70-130 | | | |
| 1,2,3-Trichloropropane | 105 | 5.00 | " | 100 | | 105 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 109 | 5.00 | " | 100 | | 109 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 106 | 2.00 | " | 100 | | 106 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 100 | 5.00 | " | 100 | | 100 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 112 | 2.00 | " | 100 | | 112 | 70-130 | | | |
| 1,2-Dichlorobenzene | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| 1,2-Dichloroethane | 111 | 2.00 | " | 100 | | 111 | 70-130 | | | |
| 1,2-Dichloropropane | 112 | 2.00 | " | 100 | | 112 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 107 | 2.00 | " | 100 | | 107 | 70-130 | | | |
| 1,3-Dichlorobenzene | 104 | 2.00 | " | 100 | | 104 | 70-130 | | | |
| 1,3-Dichloropropane | 107 | 2.00 | " | 100 | | 107 | 70-130 | | | |
| 1,4-Dichlorobenzene | 104 | 2.00 | " | 100 | | 104 | 70-130 | | | |
| 2,2-Dichloropropane | 117 | 2.00 | " | 100 | | 117 | 70-130 | | | |
| 2-Butanone | 565 | 10.0 | " | 500 | | 113 | 70-130 | | | |
| 2-Chlorotoluene | 105 | 2.00 | " | 100 | | 105 | 70-130 | | | |
| 2-Hexanone | 555 | 10.0 | " | 500 | | 111 | 70-130 | | | |
| 4-Chlorotoluene | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| 4-Isopropyltoluene | 112 | 2.00 | " | 100 | | 112 | 70-130 | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2807-BS1)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 4-Methyl-2-pentanone | 534 | 10.0 | ug/kg | 500 | | 107 | 70-130 | | | |
| Acetone | 504 | 20.0 | " | 500 | | 101 | 70-130 | | | |
| Benzene | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |
| Bromobenzene | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| Bromochloromethane | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |
| Bromodichloromethane | 108 | 2.00 | " | 100 | | 108 | 70-130 | | | |
| Bromoform | 95.5 | 2.00 | " | 100 | | 95.5 | 70-130 | | | |
| Bromomethane | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |
| Carbon disulfide | 109 | 5.00 | " | 100 | | 109 | 70-130 | | | |
| Carbon tetrachloride | 114 | 2.00 | " | 100 | | 114 | 70-130 | | | |
| Chlorobenzene | 103 | 2.00 | " | 100 | | 103 | 70-130 | | | |
| Chloroethane | 105 | 5.00 | " | 100 | | 105 | 70-130 | | | |
| Chloroform | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| Chloromethane | 96.0 | 2.00 | " | 100 | | 96.0 | 70-130 | | | |
| cis-1,2-Dichloroethene | 118 | 2.00 | " | 100 | | 118 | 70-130 | | | |
| cis-1,3-Dichloropropene | 105 | 2.00 | " | 100 | | 105 | 70-130 | | | |
| Dibromochloromethane | 106 | 2.00 | " | 100 | | 106 | 70-130 | | | |
| Dibromomethane | 110 | 2.00 | " | 100 | | 110 | 70-130 | | | |
| Ethylbenzene | 103 | 2.00 | " | 100 | | 103 | 70-130 | | | |
| Hexachlorobutadiene | 106 | 5.00 | " | 100 | | 106 | 70-130 | | | |
| Iodomethane | 108 | 15.0 | " | 100 | | 108 | 70-130 | | | |
| Isopropylbenzene | 107 | 2.00 | " | 100 | | 107 | 70-130 | | | |
| m,p-Xylene | 216 | 4.00 | " | 200 | | 108 | 70-130 | | | |
| Methyl tert-Butyl Ether | 121 | 2.00 | " | 100 | | 121 | 70-130 | | | |
| Methylene Chloride | 100 | 20.0 | " | 100 | | 100 | 70-130 | | | |
| Naphthalene | 110 | 10.0 | " | 100 | | 110 | 70-130 | | | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2807-BS1)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| n-Butylbenzene | 108 | 2.00 | ug/kg | 100 | | 108 | 70-130 | | | |
| n-Propylbenzene | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| o-Xylene | 106 | 2.00 | " | 100 | | 106 | 70-130 | | | |
| sec-Butylbenzene | 105 | 2.00 | " | 100 | | 105 | 70-130 | | | |
| Styrene | 112 | 2.00 | " | 100 | | 112 | 70-130 | | | |
| tert-Butylbenzene | 107 | 2.00 | " | 100 | | 107 | 70-130 | | | |
| Tetrachloroethene | 106 | 2.00 | " | 100 | | 106 | 70-130 | | | |
| Toluene | 104 | 2.00 | " | 100 | | 104 | 70-130 | | | |
| trans-1,2-Dichloroethene | 120 | 2.00 | " | 100 | | 120 | 70-130 | | | |
| trans-1,3-Dichloropropene | 112 | 2.00 | " | 100 | | 112 | 70-130 | | | |
| Trichloroethene | 110 | 2.00 | " | 100 | | 110 | 70-130 | | | |
| Trichlorofluoromethane | 111 | 3.00 | " | 100 | | 111 | 70-130 | | | |
| Vinyl chloride | 105 | 2.00 | " | 100 | | 105 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *59* | | *ug/L* | *62.5* | | *93.7* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *62* | | *"* | *62.5* | | *98.6* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *61* | | *"* | *62.5* | | *97.8* | *70-130* | | | |

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Julie Linn
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Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2807-BS2)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 99.0 | 2.00 | ug/kg | 100 | | 99.0 | 70-130 | | | |
| 1,1,1-Trichloroethane | 117 | 2.00 | " | 100 | | 117 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 97.8 | 2.00 | " | 100 | | 97.8 | 70-130 | | | |
| 1,1,2-Trichloroethane | 98.3 | 2.00 | " | 100 | | 98.3 | 70-130 | | | |
| 1,1-Dichloroethane | 110 | 2.00 | " | 100 | | 110 | 70-130 | | | |
| 1,1-Dichloroethene | 111 | 2.00 | " | 100 | | 111 | 70-130 | | | |
| 1,1-Dichloropropene | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 111 | 5.00 | " | 100 | | 111 | 70-130 | | | |
| 1,2,3-Trichloropropane | 101 | 5.00 | " | 100 | | 101 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 107 | 5.00 | " | 100 | | 107 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 103 | 2.00 | " | 100 | | 103 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 97.0 | 5.00 | " | 100 | | 97.0 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 110 | 2.00 | " | 100 | | 110 | 70-130 | | | |
| 1,2-Dichlorobenzene | 97.9 | 2.00 | " | 100 | | 97.9 | 70-130 | | | |
| 1,2-Dichloroethane | 111 | 2.00 | " | 100 | | 111 | 70-130 | | | |
| 1,2-Dichloropropane | 112 | 2.00 | " | 100 | | 112 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| 1,3-Dichlorobenzene | 101 | 2.00 | " | 100 | | 101 | 70-130 | | | |
| 1,3-Dichloropropane | 104 | 2.00 | " | 100 | | 104 | 70-130 | | | |
| 1,4-Dichlorobenzene | 100 | 2.00 | " | 100 | | 100 | 70-130 | | | |
| 2,2-Dichloropropane | 114 | 2.00 | " | 100 | | 114 | 70-130 | | | |
| 2-Butanone | 562 | 10.0 | " | 500 | | 112 | 70-130 | | | |
| 2-Chlorotoluene | 101 | 2.00 | " | 100 | | 101 | 70-130 | | | |
| 2-Hexanone | 546 | 10.0 | " | 500 | | 109 | 70-130 | | | |
| 4-Chlorotoluene | 98.1 | 2.00 | " | 100 | | 98.1 | 70-130 | | | |
| 4-Isopropyltoluene | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2807-BS2)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 4-Methyl-2-pentanone | 531 | 10.0 | ug/kg | 500 | | 106 | 70-130 | | | |
| Acetone | 505 | 20.0 | " | 500 | | 101 | 70-130 | | | |
| Benzene | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |
| Bromobenzene | 101 | 2.00 | " | 100 | | 101 | 70-130 | | | |
| Bromochloromethane | 110 | 2.00 | " | 100 | | 110 | 70-130 | | | |
| Bromodichloromethane | 108 | 2.00 | " | 100 | | 108 | 70-130 | | | |
| Bromoform | 93.3 | 2.00 | " | 100 | | 93.3 | 70-130 | | | |
| Bromomethane | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |
| Carbon disulfide | 106 | 5.00 | " | 100 | | 106 | 70-130 | | | |
| Carbon tetrachloride | 113 | 2.00 | " | 100 | | 113 | 70-130 | | | |
| Chlorobenzene | 101 | 2.00 | " | 100 | | 101 | 70-130 | | | |
| Chloroethane | 107 | 5.00 | " | 100 | | 107 | 70-130 | | | |
| Chloroform | 94.4 | 2.00 | " | 100 | | 94.4 | 70-130 | | | |
| Chloromethane | 98.3 | 2.00 | " | 100 | | 98.3 | 70-130 | | | |
| cis-1,2-Dichloroethene | 116 | 2.00 | " | 100 | | 116 | 70-130 | | | |
| cis-1,3-Dichloropropene | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| Dibromochloromethane | 103 | 2.00 | " | 100 | | 103 | 70-130 | | | |
| Dibromomethane | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |
| Ethylbenzene | 99.3 | 2.00 | " | 100 | | 99.3 | 70-130 | | | |
| Hexachlorobutadiene | 103 | 5.00 | " | 100 | | 103 | 70-130 | | | |
| Iodomethane | 107 | 15.0 | " | 100 | | 107 | 70-130 | | | |
| Isopropylbenzene | 104 | 2.00 | " | 100 | | 104 | 70-130 | | | |
| m,p-Xylene | 208 | 4.00 | " | 200 | | 104 | 70-130 | | | |
| Methyl tert-Butyl Ether | 120 | 2.00 | " | 100 | | 120 | 70-130 | | | |
| Methylene Chloride | 99.0 | 20.0 | " | 100 | | 99.0 | 70-130 | | | |
| Naphthalene | 109 | 10.0 | " | 100 | | 109 | 70-130 | | | |

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Pinyon
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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **LCS (B7B2807-BS2)** | | | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| n-Butylbenzene | 105 | 2.00 | ug/kg | 100 | | 105 | 70-130 | | | |
| n-Propylbenzene | 99.4 | 2.00 | " | 100 | | 99.4 | 70-130 | | | |
| o-Xylene | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| sec-Butylbenzene | 102 | 2.00 | " | 100 | | 102 | 70-130 | | | |
| Styrene | 108 | 2.00 | " | 100 | | 108 | 70-130 | | | |
| tert-Butylbenzene | 104 | 2.00 | " | 100 | | 104 | 70-130 | | | |
| Tetrachloroethene | 103 | 2.00 | " | 100 | | 103 | 70-130 | | | |
| Toluene | 101 | 2.00 | " | 100 | | 101 | 70-130 | | | |
| trans-1,2-Dichloroethene | 119 | 2.00 | " | 100 | | 119 | 70-130 | | | |
| trans-1,3-Dichloropropene | 108 | 2.00 | " | 100 | | 108 | 70-130 | | | |
| Trichloroethene | 109 | 2.00 | " | 100 | | 109 | 70-130 | | | |
| Trichlorofluoromethane | 113 | 3.00 | " | 100 | | 113 | 70-130 | | | |
| Vinyl chloride | 106 | 2.00 | " | 100 | | 106 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *59* | | *ug/L* | *62.5* | | *94.2* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *60* | | *"* | *62.5* | | *96.8* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *59* | | *"* | *62.5* | | *95.0* | *70-130* | | | |

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## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2807-MS1)** | | **Source: Y702054-01** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 95.3 | 2.00 | ug/kg | 100 | ND | 95.3 | 70-130 | | | |
| 1,1,1-Trichloroethane | 108 | 2.00 | " | 100 | ND | 108 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 96.1 | 2.00 | " | 100 | ND | 96.1 | 70-130 | | | |
| 1,1,2-Trichloroethane | 91.6 | 2.00 | " | 100 | ND | 91.6 | 70-130 | | | |
| 1,1-Dichloroethane | 100 | 2.00 | " | 100 | ND | 100 | 70-130 | | | |
| 1,1-Dichloroethene | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | | | |
| 1,1-Dichloropropene | 99.2 | 2.00 | " | 100 | ND | 99.2 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 101 | 5.00 | " | 100 | ND | 101 | 70-130 | | | |
| 1,2,3-Trichloropropane | 101 | 5.00 | " | 100 | ND | 101 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 97.1 | 5.00 | " | 100 | ND | 97.1 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 98.9 | 2.00 | " | 100 | ND | 98.9 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 100 | 5.00 | " | 100 | ND | 100 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | | | |
| 1,2-Dichlorobenzene | 94.0 | 2.00 | " | 100 | ND | 94.0 | 70-130 | | | |
| 1,2-Dichloroethane | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | | | |
| 1,2-Dichloropropane | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 95.0 | 2.00 | " | 100 | ND | 95.0 | 70-130 | | | |
| 1,3-Dichlorobenzene | 93.9 | 2.00 | " | 100 | ND | 93.9 | 70-130 | | | |
| 1,3-Dichloropropane | 98.5 | 2.00 | " | 100 | ND | 98.5 | 70-130 | | | |
| 1,4-Dichlorobenzene | 94.0 | 2.00 | " | 100 | ND | 94.0 | 70-130 | | | |
| 2,2-Dichloropropane | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | | | |
| 2-Butanone | 553 | 10.0 | " | 500 | ND | 111 | 70-130 | | | |
| 2-Chlorotoluene | 93.6 | 2.00 | " | 100 | ND | 93.6 | 70-130 | | | |
| 2-Hexanone | 526 | 10.0 | " | 500 | ND | 105 | 70-130 | | | |
| 4-Chlorotoluene | 90.5 | 2.00 | " | 100 | ND | 90.5 | 70-130 | | | |
| 4-Isopropyltoluene | 98.3 | 2.00 | " | 100 | ND | 98.3 | 70-130 | | | |

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9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2807-MS1)** | | **Source: Y702054-01** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 4-Methyl-2-pentanone | 489 | 10.0 | ug/kg | 500 | ND | 97.8 | 70-130 | | | |
| Acetone | 491 | 20.0 | " | 500 | ND | 98.3 | 70-130 | | | |
| Benzene | 100 | 2.00 | " | 100 | ND | 100 | 70-130 | | | |
| Bromobenzene | 94.6 | 2.00 | " | 100 | ND | 94.6 | 70-130 | | | |
| Bromochloromethane | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | | | |
| Bromodichloromethane | 101 | 2.00 | " | 100 | ND | 101 | 70-130 | | | |
| Bromoform | 90.9 | 2.00 | " | 100 | ND | 90.9 | 70-130 | | | |
| Bromomethane | 98.3 | 2.00 | " | 100 | ND | 98.3 | 70-130 | | | |
| Carbon disulfide | 96.6 | 5.00 | " | 100 | ND | 96.6 | 70-130 | | | |
| Carbon tetrachloride | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | | | |
| Chlorobenzene | 92.2 | 2.00 | " | 100 | ND | 92.2 | 70-130 | | | |
| Chloroethane | 95.8 | 5.00 | " | 100 | ND | 95.8 | 70-130 | | | |
| Chloroform | 87.7 | 2.00 | " | 100 | ND | 87.7 | 70-130 | | | |
| Chloromethane | 87.0 | 2.00 | " | 100 | ND | 87.0 | 70-130 | | | |
| cis-1,2-Dichloroethene | 108 | 2.00 | " | 100 | ND | 108 | 70-130 | | | |
| cis-1,3-Dichloropropene | 94.9 | 2.00 | " | 100 | ND | 94.9 | 70-130 | | | |
| Dibromochloromethane | 96.1 | 2.00 | " | 100 | ND | 96.1 | 70-130 | | | |
| Dibromomethane | 106 | 2.00 | " | 100 | ND | 106 | 70-130 | | | |
| Ethylbenzene | 92.7 | 2.00 | " | 100 | ND | 92.7 | 70-130 | | | |
| Hexachlorobutadiene | 82.3 | 5.00 | " | 100 | ND | 82.3 | 70-130 | | | |
| Iodomethane | 98.9 | 15.0 | " | 100 | ND | 98.9 | 70-130 | | | |
| Isopropylbenzene | 97.1 | 2.00 | " | 100 | ND | 97.1 | 70-130 | | | |
| m,p-Xylene | 196 | 4.00 | " | 200 | ND | 98.1 | 70-130 | | | |
| Methyl tert-Butyl Ether | 117 | 2.00 | " | 100 | ND | 117 | 70-130 | | | |
| Methylene Chloride | 98.4 | 20.0 | " | 100 | ND | 98.4 | 70-130 | | | |
| Naphthalene | 107 | 10.0 | " | 100 | ND | 107 | 70-130 | | | |

Origins Laboratory, Inc.

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Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2807-MS1)** | | **Source: Y702054-01** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| n-Butylbenzene | 92.9 | 2.00 | ug/kg | 100 | ND | 92.9 | 70-130 | | | |
| n-Propylbenzene | 92.4 | 2.00 | " | 100 | ND | 92.4 | 70-130 | | | |
| o-Xylene | 97.2 | 2.00 | " | 100 | ND | 97.2 | 70-130 | | | |
| sec-Butylbenzene | 92.4 | 2.00 | " | 100 | ND | 92.4 | 70-130 | | | |
| Styrene | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | | | |
| tert-Butylbenzene | 93.7 | 2.00 | " | 100 | ND | 93.7 | 70-130 | | | |
| Tetrachloroethene | 92.9 | 2.00 | " | 100 | ND | 92.9 | 70-130 | | | |
| Toluene | 92.1 | 2.00 | " | 100 | ND | 92.1 | 70-130 | | | |
| trans-1,2-Dichloroethene | 107 | 2.00 | " | 100 | ND | 107 | 70-130 | | | |
| trans-1,3-Dichloropropene | 101 | 2.00 | " | 100 | ND | 101 | 70-130 | | | |
| Trichloroethene | 99.1 | 2.00 | " | 100 | ND | 99.1 | 70-130 | | | |
| Trichlorofluoromethane | 102 | 3.00 | " | 100 | ND | 102 | 70-130 | | | |
| Vinyl chloride | 94.0 | 2.00 | " | 100 | ND | 94.0 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *61* | | *ug/L* | *62.5* | | *97.2* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *59* | | *"* | *62.5* | | *94.5* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *62* | | *"* | *62.5* | | *99.4* | *70-130* | | | |

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Pinyon
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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2807-MS2)** | | **Source: Y702054-02** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 94.2 | 2.00 | ug/kg | 100 | ND | 94.2 | 70-130 | | | |
| 1,1,1-Trichloroethane | 110 | 2.00 | " | 100 | ND | 110 | 70-130 | | | |
| 1,1,2,2-Tetrachloroethane | 97.1 | 2.00 | " | 100 | ND | 97.1 | 70-130 | | | |
| 1,1,2-Trichloroethane | 95.3 | 2.00 | " | 100 | ND | 95.3 | 70-130 | | | |
| 1,1-Dichloroethane | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | | | |
| 1,1-Dichloroethene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | | | |
| 1,1-Dichloropropene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | | | |
| 1,2,3-Trichlorobenzene | 95.3 | 5.00 | " | 100 | ND | 95.3 | 70-130 | | | |
| 1,2,3-Trichloropropane | 99.9 | 5.00 | " | 100 | ND | 99.9 | 70-130 | | | |
| 1,2,4-Trichlorobenzene | 91.0 | 5.00 | " | 100 | ND | 91.0 | 70-130 | | | |
| 1,2,4-Trimethylbenzene | 94.1 | 2.00 | " | 100 | ND | 94.1 | 70-130 | | | |
| 1,2-Dibromo-3-chloropropane | 98.7 | 5.00 | " | 100 | ND | 98.7 | 70-130 | | | |
| 1,2-Dibromoethane (EDB) | 108 | 2.00 | " | 100 | ND | 108 | 70-130 | | | |
| 1,2-Dichlorobenzene | 92.7 | 2.00 | " | 100 | ND | 92.7 | 70-130 | | | |
| 1,2-Dichloroethane | 109 | 2.00 | " | 100 | ND | 109 | 70-130 | | | |
| 1,2-Dichloropropane | 108 | 2.00 | " | 100 | ND | 108 | 70-130 | | | |
| 1,3,5-Trimethylbenzene | 92.6 | 2.00 | " | 100 | ND | 92.6 | 70-130 | | | |
| 1,3-Dichlorobenzene | 90.9 | 2.00 | " | 100 | ND | 90.9 | 70-130 | | | |
| 1,3-Dichloropropane | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | | | |
| 1,4-Dichlorobenzene | 91.8 | 2.00 | " | 100 | ND | 91.8 | 70-130 | | | |
| 2,2-Dichloropropane | 107 | 2.00 | " | 100 | ND | 107 | 70-130 | | | |
| 2-Butanone | 592 | 10.0 | " | 500 | ND | 118 | 70-130 | | | |
| 2-Chlorotoluene | 91.4 | 2.00 | " | 100 | ND | 91.4 | 70-130 | | | |
| 2-Hexanone | 545 | 10.0 | " | 500 | ND | 109 | 70-130 | | | |
| 4-Chlorotoluene | 89.3 | 2.00 | " | 100 | ND | 89.3 | 70-130 | | | |
| 4-Isopropyltoluene | 96.3 | 2.00 | " | 100 | ND | 96.3 | 70-130 | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2807-MS2)** | | **Source: Y702054-02** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 4-Methyl-2-pentanone | 531 | 10.0 | ug/kg | 500 | ND | 106 | 70-130 | | | |
| Acetone | 518 | 20.0 | " | 500 | ND | 104 | 70-130 | | | |
| Benzene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | | | |
| Bromobenzene | 93.8 | 2.00 | " | 100 | ND | 93.8 | 70-130 | | | |
| Bromochloromethane | 108 | 2.00 | " | 100 | ND | 108 | 70-130 | | | |
| Bromodichloromethane | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | | | |
| Bromoform | 90.8 | 2.00 | " | 100 | ND | 90.8 | 70-130 | | | |
| Bromomethane | 93.5 | 2.00 | " | 100 | ND | 93.5 | 70-130 | | | |
| Carbon disulfide | 98.4 | 5.00 | " | 100 | ND | 98.4 | 70-130 | | | |
| Carbon tetrachloride | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | | | |
| Chlorobenzene | 93.5 | 2.00 | " | 100 | ND | 93.5 | 70-130 | | | |
| Chloroethane | 90.3 | 5.00 | " | 100 | ND | 90.3 | 70-130 | | | |
| Chloroform | 100 | 2.00 | " | 100 | ND | 100 | 70-130 | | | |
| Chloromethane | 83.0 | 2.00 | " | 100 | ND | 83.0 | 70-130 | | | |
| cis-1,2-Dichloroethene | 111 | 2.00 | " | 100 | ND | 111 | 70-130 | | | |
| cis-1,3-Dichloropropene | 96.6 | 2.00 | " | 100 | ND | 96.6 | 70-130 | | | |
| Dibromochloromethane | 99.7 | 2.00 | " | 100 | ND | 99.7 | 70-130 | | | |
| Dibromomethane | 109 | 2.00 | " | 100 | ND | 109 | 70-130 | | | |
| Ethylbenzene | 91.2 | 2.00 | " | 100 | ND | 91.2 | 70-130 | | | |
| Hexachlorobutadiene | 75.9 | 5.00 | " | 100 | ND | 75.9 | 70-130 | | | |
| Iodomethane | 101 | 15.0 | " | 100 | ND | 101 | 70-130 | | | |
| Isopropylbenzene | 94.4 | 2.00 | " | 100 | ND | 94.4 | 70-130 | | | |
| m,p-Xylene | 191 | 4.00 | " | 200 | ND | 95.4 | 70-130 | | | |
| Methyl tert-Butyl Ether | 121 | 2.00 | " | 100 | ND | 121 | 70-130 | | | |
| Methylene Chloride | 103 | 20.0 | " | 100 | ND | 103 | 70-130 | | | |
| Naphthalene | 103 | 10.0 | " | 100 | ND | 103 | 70-130 | | | |

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Pinyon
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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike (B7B2807-MS2)** | | **Source: Y702054-02** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| n-Butylbenzene | 88.7 | 2.00 | ug/kg | 100 | ND | 88.7 | 70-130 | | | |
| n-Propylbenzene | 90.4 | 2.00 | " | 100 | ND | 90.4 | 70-130 | | | |
| o-Xylene | 95.8 | 2.00 | " | 100 | ND | 95.8 | 70-130 | | | |
| sec-Butylbenzene | 90.4 | 2.00 | " | 100 | ND | 90.4 | 70-130 | | | |
| Styrene | 99.8 | 2.00 | " | 100 | ND | 99.8 | 70-130 | | | |
| tert-Butylbenzene | 92.8 | 2.00 | " | 100 | ND | 92.8 | 70-130 | | | |
| Tetrachloroethene | 93.7 | 2.00 | " | 100 | ND | 93.7 | 70-130 | | | |
| Toluene | 93.6 | 2.00 | " | 100 | ND | 93.6 | 70-130 | | | |
| trans-1,2-Dichloroethene | 111 | 2.00 | " | 100 | ND | 111 | 70-130 | | | |
| trans-1,3-Dichloropropene | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | | | |
| Trichloroethene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | | | |
| Trichlorofluoromethane | 96.0 | 3.00 | " | 100 | ND | 96.0 | 70-130 | | | |
| Vinyl chloride | 88.6 | 2.00 | " | 100 | ND | 88.6 | 70-130 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *63* | | *ug/L* | *62.5* | | *101* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *60* | | *"* | *62.5* | | *95.5* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *61* | | *"* | *62.5* | | *98.3* | *70-130* | | | |

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## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2807-MSD1)** | | **Source: Y702054-01** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 103 | 2.00 | ug/kg | 100 | ND | 103 | 70-130 | 7.77 | 20 | |
| 1,1,1-Trichloroethane | 118 | 2.00 | " | 100 | ND | 118 | 70-130 | 9.16 | 20 | |
| 1,1,2,2-Tetrachloroethane | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | 7.43 | 20 | |
| 1,1,2-Trichloroethane | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 10.4 | 20 | |
| 1,1-Dichloroethane | 111 | 2.00 | " | 100 | ND | 111 | 70-130 | 9.73 | 20 | |
| 1,1-Dichloroethene | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 8.08 | 20 | |
| 1,1-Dichloropropene | 111 | 2.00 | " | 100 | ND | 111 | 70-130 | 11.6 | 20 | |
| 1,2,3-Trichlorobenzene | 113 | 5.00 | " | 100 | ND | 113 | 70-130 | 11.6 | 20 | |
| 1,2,3-Trichloropropane | 107 | 5.00 | " | 100 | ND | 107 | 70-130 | 6.15 | 20 | |
| 1,2,4-Trichlorobenzene | 109 | 5.00 | " | 100 | ND | 109 | 70-130 | 11.5 | 20 | |
| 1,2,4-Trimethylbenzene | 106 | 2.00 | " | 100 | ND | 106 | 70-130 | 6.86 | 20 | |
| 1,2-Dibromo-3-chloropropane | 106 | 5.00 | " | 100 | ND | 106 | 70-130 | 5.97 | 20 | |
| 1,2-Dibromoethane (EDB) | 116 | 2.00 | " | 100 | ND | 116 | 70-130 | 10.7 | 20 | |
| 1,2-Dichlorobenzene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 8.06 | 20 | |
| 1,2-Dichloroethane | 114 | 2.00 | " | 100 | ND | 114 | 70-130 | 8.86 | 20 | |
| 1,2-Dichloropropane | 116 | 2.00 | " | 100 | ND | 116 | 70-130 | 9.91 | 20 | |
| 1,3,5-Trimethylbenzene | 106 | 2.00 | " | 100 | ND | 106 | 70-130 | 10.6 | 20 | |
| 1,3-Dichlorobenzene | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | 9.37 | 20 | |
| 1,3-Dichloropropane | 110 | 2.00 | " | 100 | ND | 110 | 70-130 | 11.2 | 20 | |
| 1,4-Dichlorobenzene | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | 9.25 | 20 | |
| 2,2-Dichloropropane | 114 | 2.00 | " | 100 | ND | 114 | 70-130 | 7.95 | 20 | |
| 2-Butanone | 609 | 10.0 | " | 500 | ND | 122 | 70-130 | 9.61 | 20 | |
| 2-Chlorotoluene | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | 11.0 | 20 | |
| 2-Hexanone | 574 | 10.0 | " | 500 | ND | 115 | 70-130 | 8.77 | 20 | |
| 4-Chlorotoluene | 100 | 2.00 | " | 100 | ND | 100 | 70-130 | 10.1 | 20 | |
| 4-Isopropyltoluene | 110 | 2.00 | " | 100 | ND | 110 | 70-130 | 11.6 | 20 | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2807-MSD1)** | | **Source: Y702054-01** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| 4-Methyl-2-pentanone | 561 | 10.0 | ug/kg | 500 | ND | 112 | 70-130 | 13.7 | 20 | |
| Acetone | 536 | 20.0 | " | 500 | ND | 107 | 70-130 | 8.59 | 20 | |
| Benzene | 111 | 2.00 | " | 100 | ND | 111 | 70-130 | 9.67 | 20 | |
| Bromobenzene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | 10.3 | 20 | |
| Bromochloromethane | 114 | 2.00 | " | 100 | ND | 114 | 70-130 | 8.82 | 20 | |
| Bromodichloromethane | 111 | 2.00 | " | 100 | ND | 111 | 70-130 | 9.09 | 20 | |
| Bromoform | 98.6 | 2.00 | " | 100 | ND | 98.6 | 70-130 | 8.10 | 20 | |
| Bromomethane | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | 4.75 | 20 | |
| Carbon disulfide | 105 | 5.00 | " | 100 | ND | 105 | 70-130 | 8.18 | 20 | |
| Carbon tetrachloride | 113 | 2.00 | " | 100 | ND | 113 | 70-130 | 9.22 | 20 | |
| Chlorobenzene | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | 11.4 | 20 | |
| Chloroethane | 101 | 5.00 | " | 100 | ND | 101 | 70-130 | 5.27 | 20 | |
| Chloroform | 96.5 | 2.00 | " | 100 | ND | 96.5 | 70-130 | 9.58 | 20 | |
| Chloromethane | 92.1 | 2.00 | " | 100 | ND | 92.1 | 70-130 | 5.67 | 20 | |
| cis-1,2-Dichloroethene | 118 | 2.00 | " | 100 | ND | 118 | 70-130 | 9.22 | 20 | |
| cis-1,3-Dichloropropene | 106 | 2.00 | " | 100 | ND | 106 | 70-130 | 11.0 | 20 | |
| Dibromochloromethane | 107 | 2.00 | " | 100 | ND | 107 | 70-130 | 10.4 | 20 | |
| Dibromomethane | 114 | 2.00 | " | 100 | ND | 114 | 70-130 | 7.60 | 20 | |
| Ethylbenzene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 9.32 | 20 | |
| Hexachlorobutadiene | 98.9 | 5.00 | " | 100 | ND | 98.9 | 70-130 | 18.4 | 20 | |
| Iodomethane | 107 | 15.0 | " | 100 | ND | 107 | 70-130 | 8.19 | 20 | |
| Isopropylbenzene | 106 | 2.00 | " | 100 | ND | 106 | 70-130 | 8.57 | 20 | |
| m,p-Xylene | 216 | 4.00 | " | 200 | ND | 108 | 70-130 | 9.48 | 20 | |
| Methyl tert-Butyl Ether | 126 | 2.00 | " | 100 | ND | 126 | 70-130 | 7.77 | 20 | |
| Methylene Chloride | 108 | 20.0 | " | 100 | ND | 108 | 70-130 | 9.70 | 20 | |
| Naphthalene | 115 | 10.0 | " | 100 | ND | 115 | 70-130 | 6.85 | 20 | |

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Julie Linn
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## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2807-MSD1)** | | **Source: Y702054-01** | | | Prepared: 02/28/2017 Analyzed: 02/28/2017 | | | | | |
| n-Butylbenzene | 105 | 2.00 | ug/kg | 100 | ND | 105 | 70-130 | 11.9 | 20 | |
| n-Propylbenzene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 9.67 | 20 | |
| o-Xylene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | 8.13 | 20 | |
| sec-Butylbenzene | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | 11.5 | 20 | |
| Styrene | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 8.54 | 20 | |
| tert-Butylbenzene | 106 | 2.00 | " | 100 | ND | 106 | 70-130 | 12.5 | 20 | |
| Tetrachloroethene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | 11.8 | 20 | |
| Toluene | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | 11.8 | 20 | |
| trans-1,2-Dichloroethene | 120 | 2.00 | " | 100 | ND | 120 | 70-130 | 11.0 | 20 | |
| trans-1,3-Dichloropropene | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 10.3 | 20 | |
| Trichloroethene | 110 | 2.00 | " | 100 | ND | 110 | 70-130 | 10.4 | 20 | |
| Trichlorofluoromethane | 107 | 3.00 | " | 100 | ND | 107 | 70-130 | 4.54 | 20 | |
| Vinyl chloride | 99.4 | 2.00 | " | 100 | ND | 99.4 | 70-130 | 5.54 | 20 | |
| *Surrogate: 1,2-Dichloroethane-d4* | *60* | | *ug/L* | *62.5* | | *96.8* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *60* | | *"* | *62.5* | | *96.4* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *61* | | *"* | *62.5* | | *97.1* | *70-130* | | | |

Origins Laboratory, Inc.

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Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2807-MSD2)** | | **Source: Y702054-02** | | | Prepared: 02/28/2017 Analyzed: 03/01/2017 | | | | | |
| 1,1,1,2-Tetrachloroethane | 101 | 2.00 | ug/kg | 100 | ND | 101 | 70-130 | 6.53 | 20 | |
| 1,1,1-Trichloroethane | 122 | 2.00 | " | 100 | ND | 122 | 70-130 | 10.4 | 20 | |
| 1,1,2,2-Tetrachloroethane | 101 | 2.00 | " | 100 | ND | 101 | 70-130 | 3.58 | 20 | |
| 1,1,2-Trichloroethane | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 6.89 | 20 | |
| 1,1-Dichloroethane | 110 | 2.00 | " | 100 | ND | 110 | 70-130 | 6.74 | 20 | |
| 1,1-Dichloroethene | 116 | 2.00 | " | 100 | ND | 116 | 70-130 | 9.39 | 20 | |
| 1,1-Dichloropropene | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 9.67 | 20 | |
| 1,2,3-Trichlorobenzene | 112 | 5.00 | " | 100 | ND | 112 | 70-130 | 15.9 | 20 | |
| 1,2,3-Trichloropropane | 105 | 5.00 | " | 100 | ND | 105 | 70-130 | 4.71 | 20 | |
| 1,2,4-Trichlorobenzene | 111 | 5.00 | " | 100 | ND | 111 | 70-130 | 20.1 | 20 | QM-07, QR-03 |
| 1,2,4-Trimethylbenzene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | 10.7 | 20 | |
| 1,2-Dibromo-3-chloropropane | 101 | 5.00 | " | 100 | ND | 101 | 70-130 | 2.70 | 20 | |
| 1,2-Dibromoethane (EDB) | 115 | 2.00 | " | 100 | ND | 115 | 70-130 | 6.81 | 20 | |
| 1,2-Dichlorobenzene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 9.42 | 20 | |
| 1,2-Dichloroethane | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 2.14 | 20 | |
| 1,2-Dichloropropane | 113 | 2.00 | " | 100 | ND | 113 | 70-130 | 5.10 | 20 | |
| 1,3,5-Trimethylbenzene | 107 | 2.00 | " | 100 | ND | 107 | 70-130 | 14.1 | 20 | |
| 1,3-Dichlorobenzene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | 14.4 | 20 | |
| 1,3-Dichloropropane | 108 | 2.00 | " | 100 | ND | 108 | 70-130 | 5.97 | 20 | |
| 1,4-Dichlorobenzene | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | 11.9 | 20 | |
| 2,2-Dichloropropane | 120 | 2.00 | " | 100 | ND | 120 | 70-130 | 11.3 | 20 | |
| 2-Butanone | 590 | 10.0 | " | 500 | ND | 118 | 70-130 | 0.430 | 20 | |
| 2-Chlorotoluene | 104 | 2.00 | " | 100 | ND | 104 | 70-130 | 12.7 | 20 | |
| 2-Hexanone | 578 | 10.0 | " | 500 | ND | 116 | 70-130 | 5.72 | 20 | |
| 4-Chlorotoluene | 101 | 2.00 | " | 100 | ND | 101 | 70-130 | 12.1 | 20 | |
| 4-Isopropyltoluene | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 15.1 | 20 | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2807-MSD2)** | | **Source: Y702054-02** | | | Prepared: 02/28/2017 Analyzed: 03/01/2017 | | | | | |
| 4-Methyl-2-pentanone | 594 | 10.0 | ug/kg | 500 | ND | 119 | 70-130 | 11.1 | 20 | |
| Acetone | 511 | 20.0 | " | 500 | ND | 102 | 70-130 | 1.41 | 20 | |
| Benzene | 110 | 2.00 | " | 100 | ND | 110 | 70-130 | 7.43 | 20 | |
| Bromobenzene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 8.30 | 20 | |
| Bromochloromethane | 113 | 2.00 | " | 100 | ND | 113 | 70-130 | 4.91 | 20 | |
| Bromodichloromethane | 109 | 2.00 | " | 100 | ND | 109 | 70-130 | 3.18 | 20 | |
| Bromoform | 94.6 | 2.00 | " | 100 | ND | 94.6 | 70-130 | 4.08 | 20 | |
| Bromomethane | 108 | 2.00 | " | 100 | ND | 108 | 70-130 | 14.5 | 20 | |
| Carbon disulfide | 108 | 5.00 | " | 100 | ND | 108 | 70-130 | 9.51 | 20 | |
| Carbon tetrachloride | 118 | 2.00 | " | 100 | ND | 118 | 70-130 | 12.1 | 20 | |
| Chlorobenzene | 106 | 2.00 | " | 100 | ND | 106 | 70-130 | 12.4 | 20 | |
| Chloroethane | 99.9 | 5.00 | " | 100 | ND | 99.9 | 70-130 | 10.1 | 20 | |
| Chloroform | 95.5 | 2.00 | " | 100 | ND | 95.5 | 70-130 | 4.76 | 20 | |
| Chloromethane | 93.7 | 2.00 | " | 100 | ND | 93.7 | 70-130 | 12.1 | 20 | |
| cis-1,2-Dichloroethene | 118 | 2.00 | " | 100 | ND | 118 | 70-130 | 6.16 | 20 | |
| cis-1,3-Dichloropropene | 106 | 2.00 | " | 100 | ND | 106 | 70-130 | 9.39 | 20 | |
| Dibromochloromethane | 107 | 2.00 | " | 100 | ND | 107 | 70-130 | 7.45 | 20 | |
| Dibromomethane | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 2.47 | 20 | |
| Ethylbenzene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 10.8 | 20 | |
| Hexachlorobutadiene | 106 | 5.00 | " | 100 | ND | 106 | 70-130 | 32.9 | 20 | QM-07 |
| Iodomethane | 111 | 15.0 | " | 100 | ND | 111 | 70-130 | 9.12 | 20 | |
| Isopropylbenzene | 107 | 2.00 | " | 100 | ND | 107 | 70-130 | 12.7 | 20 | |
| m,p-Xylene | 215 | 4.00 | " | 200 | ND | 108 | 70-130 | 12.0 | 20 | |
| Methyl tert-Butyl Ether | 122 | 2.00 | " | 100 | ND | 122 | 70-130 | 0.675 | 20 | |
| Methylene Chloride | 96.2 | 20.0 | " | 100 | ND | 96.2 | 70-130 | 7.25 | 20 | |
| Naphthalene | 111 | 10.0 | " | 100 | ND | 111 | 70-130 | 7.63 | 20 | |

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Pinyon
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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch B7B2807 - EPA 5030 (soil)** | | | | | | | | | | |
| **Matrix Spike Dup (B7B2807-MSD2)** | | **Source: Y702054-02** | | | Prepared: 02/28/2017 Analyzed: 03/01/2017 | | | | | |
| n-Butylbenzene | 108 | 2.00 | ug/kg | 100 | ND | 108 | 70-130 | 19.4 | 20 | |
| n-Propylbenzene | 102 | 2.00 | " | 100 | ND | 102 | 70-130 | 12.2 | 20 | |
| o-Xylene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | 9.33 | 20 | |
| sec-Butylbenzene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | 14.6 | 20 | |
| Styrene | 111 | 2.00 | " | 100 | ND | 111 | 70-130 | 10.2 | 20 | |
| tert-Butylbenzene | 107 | 2.00 | " | 100 | ND | 107 | 70-130 | 13.8 | 20 | |
| Tetrachloroethene | 109 | 2.00 | " | 100 | ND | 109 | 70-130 | 14.9 | 20 | |
| Toluene | 105 | 2.00 | " | 100 | ND | 105 | 70-130 | 11.1 | 20 | |
| trans-1,2-Dichloroethene | 121 | 2.00 | " | 100 | ND | 121 | 70-130 | 8.62 | 20 | |
| trans-1,3-Dichloropropene | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 7.95 | 20 | |
| Trichloroethene | 112 | 2.00 | " | 100 | ND | 112 | 70-130 | 9.82 | 20 | |
| Trichlorofluoromethane | 110 | 3.00 | " | 100 | ND | 110 | 70-130 | 13.4 | 20 | |
| Vinyl chloride | 103 | 2.00 | " | 100 | ND | 103 | 70-130 | 15.0 | 20 | |
| *Surrogate: 1,2-Dichloroethane-d4* | *59* | | *ug/L* | *62.5* | | *94.8* | *70-130* | | | |
| *Surrogate: Toluene-d8* | *62* | | *"* | *62.5* | | *98.9* | *70-130* | | | |
| *Surrogate: 4-Bromofluorobenzene* | *61* | | *"* | *62.5* | | *97.1* | *70-130* | | | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
## Origins Laboratory, Inc.

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|

## Metals by SW846 3050B/6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1643537 - SW846 3050B** | | | | | | | | | | |
| **BLANK (1203738108-BLK)** | | | | | Prepared: 03/01/2017 Analyzed: 03/06/2017 | | | | | |
| Selenium | ND | 2.80 | mg/kg | | | | - | | | U |
| Lead | ND | 0.933 | " | | | | - | | | U |
| Chromium | ND | 0.466 | " | | | | - | | | U |
| Cadmium | ND | 0.466 | " | | | | - | | | U |
| Silver | ND | 0.466 | " | | | | - | | | U |
| Barium | ND | 0.466 | " | | | | - | | | U |
| Arsenic | ND | 2.80 | " | | | | - | | | U |
| **LCS (1203738109-BKS)** | | | | | Prepared: 03/01/2017 Analyzed: 03/06/2017 | | | | | |
| Chromium | 44.7 | 0.470 | mg/kg | 47.0 | | 95.1 | 80-120 | | | |
| Silver | 44.0 | 0.470 | " | 47.0 | | 93.6 | 80-120 | | | |
| Lead | 44.8 | 0.940 | " | 47.0 | | 95.4 | 80-120 | | | |
| Cadmium | 44.8 | 0.470 | " | 47.0 | | 95.4 | 80-120 | | | |
| Barium | 45.0 | 0.470 | " | 47.0 | | 95.8 | 80-120 | | | |
| Arsenic | 46.0 | 2.82 | " | 47.0 | | 97.8 | 80-120 | | | |
| Selenium | 45.5 | 2.82 | " | 47.0 | | 96.8 | 80-120 | | | |
| **DUP (1203738110 D)** | | **Source: Y702047-01** | | | Prepared: 03/01/2017 Analyzed: 03/06/2017 | | | | | |
| Arsenic | 3.64 | 3.14 | mg/kg dry | | 4.36 | | 0-20 | 17.9 | 20 | |
| Barium | 70.2 | 0.524 | " | | 85.8 | | 0-20 | 19.9 | 20 | |
| Cadmium | 0.271 | 0.524 | " | | 0.357 | | 0-20 | 27.3 | 20 | J |
| Chromium | 4.08 | 0.524 | " | | 4.89 | | 0-20 | 18 | 20 | |

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ORIGINS LABORATORY, INC

Pinyon
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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Metals by SW846 3050B/6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1643537 - SW846 3050B** | | | | | | | | | | |
| **DUP (1203738110 D)** | | **Source: Y702047-01** | | | Prepared: 03/01/2017 Analyzed: 03/06/2017 | | | | | |
| Lead | 115 | 1.05 | mg/kg dry | | 139 | | 0-20 | 18.9 | 20 | |
| Selenium | ND | 3.14 | " | | <0.524 | | 0-20 | 48.7 | 20 | U |
| Silver | 0.669 | 0.524 | " | | 0.860 | | 0-20 | 25 | 20 | |
| **MS (1203738111 S)** | | **Source: Y702047-01** | | | Prepared: 03/01/2017 Analyzed: 03/06/2017 | | | | | |
| Cadmium | 49.1 | 0.526 | mg/kg dry | 52.6 | 0.357 | 92.8 | 75-125 | | | |
| Barium | 146 | 0.526 | " | 52.6 | 85.8 | 114 | 75-125 | | | |
| Silver | 50.1 | 0.526 | " | 52.6 | 0.860 | 93.7 | 75-125 | | | |
| Selenium | 50.6 | 3.15 | " | 52.6 | <0.526 | 96 | 75-125 | | | |
| Chromium | 54.6 | 0.526 | " | 52.6 | 4.89 | 94.5 | 75-125 | | | |
| Lead | 200 | 1.05 | " | 52.6 | 139 | 117 | 75-125 | | | |
| Arsenic | 55.1 | 3.15 | " | 52.6 | 4.36 | 96.6 | 75-125 | | | |

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ORIGINS LABORATORY, INC

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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Metals by SW846 7471A - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1643501 - SW846 7471A Prep** | | | | | | | | | | |
| **BLANK (1203737987-BLK)** | | | | | Prepared: 03/01/2017 Analyzed: 03/02/2017 | | | | | |
| Mercury | ND | 0.0115 | mg/kg | | | | - | | | U |
| **LCS (1203737988-BKS)** | | | | | Prepared: 03/01/2017 Analyzed: 03/02/2017 | | | | | |
| Mercury | 0.115 | 0.0118 | mg/kg | 0.118 | | 97.6 | 80-120 | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PAHs by SW846 3541/8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1644035 - SW846 3541** | | | | | | | | | | |
| **BLANK (1203739273-BLK)** | | | | | Prepared: 03/03/2017 Analyzed: 03/03/2017 | | | | | |
| Benzo(b)fluoranthene | ND | 0.00333 | mg/kg | | | | - | | | U |
| Pyrene | ND | 0.00333 | " | | | | - | | | U |
| Phenanthrene | ND | 0.00333 | " | | | | - | | | U |
| Naphthalene | ND | 0.00333 | " | | | | - | | | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.00333 | " | | | | - | | | U |
| Fluorene | ND | 0.00333 | " | | | | - | | | U |
| Fluoranthene | ND | 0.00333 | " | | | | - | | | U |
| Dibenzo(a,h)anthracene | ND | 0.00333 | " | | | | - | | | U |
| Chrysene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(ghi)perylene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(a)anthracene | ND | 0.00333 | " | | | | - | | | U |
| Anthracene | ND | 0.00333 | " | | | | - | | | U |
| Acenaphthylene | ND | 0.00333 | " | | | | - | | | U |
| Acenaphthene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(a)pyrene | ND | 0.00333 | " | | | | - | | | U |
| Benzo(k)fluoranthene | ND | 0.00333 | " | | | | - | | | U |
| *Surrogate: 5-alpha-Androstane* | *0.135* | | *"* | *0.166* | | *81* | *30-118* | | | |
| **LCS (1203739274-BKS)** | | | | | Prepared: 03/03/2017 Analyzed: 03/03/2017 | | | | | |
| Benzo(b)fluoranthene | 0.281 | 0.00333 | mg/kg | 0.333 | | 84 | 36-120 | | | |
| Pyrene | 0.283 | 0.00333 | " | 0.333 | | 85 | 41-114 | | | |
| Benzo(k)fluoranthene | 0.291 | 0.00333 | " | 0.333 | | 87 | 26-121 | | | |
| Chrysene | 0.278 | 0.00333 | " | 0.333 | | 83 | 54-103 | | | |
| Dibenzo(a,h)anthracene | 0.291 | 0.00333 | " | 0.333 | | 87 | 35-142 | | | |
| Phenanthrene | 0.248 | 0.00333 | " | 0.333 | | 75 | 53-97 | | | |
| Indeno(1,2,3-cd)pyrene | 0.257 | 0.00333 | " | 0.333 | | 77 | 41-130 | | | |
| Fluorene | 0.238 | 0.00333 | " | 0.333 | | 71 | 47-106 | | | |

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Pinyon
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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PAHs by SW846 3541/8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1644035 - SW846 3541** | | | | | | | | | | |
| **LCS (1203739274-BKS)** | | | | | Prepared: 03/03/2017 Analyzed: 03/03/2017 | | | | | |
| Fluoranthene | 0.247 | 0.00333 | mg/kg | 0.333 | | 74 | 39-108 | | | |
| Benzo(a)pyrene | 0.283 | 0.00333 | " | 0.333 | | 85 | 35-121 | | | |
| Naphthalene | 0.260 | 0.00333 | " | 0.333 | | 78 | 57-98 | | | |
| Anthracene | 0.254 | 0.00333 | " | 0.333 | | 76 | 52-102 | | | |
| Acenaphthylene | 0.236 | 0.00333 | " | 0.333 | | 71 | 48-107 | | | |
| Acenaphthene | 0.265 | 0.00333 | " | 0.333 | | 80 | 55-99 | | | |
| Benzo(a)anthracene | 0.273 | 0.00333 | " | 0.333 | | 82 | 51-108 | | | |
| Benzo(ghi)perylene | 0.256 | 0.00333 | " | 0.333 | | 77 | 39-119 | | | |
| *Surrogate: 5-alpha-Androstane* | *0.118* | | *"* | *0.167* | | *71* | *30-118* | | | |
| **MS (1203739275 S)** | | **Source: Y702047-01** | | | Prepared: 03/03/2017 Analyzed: 03/03/2017 | | | | | |
| Naphthalene | 0.303 | 0.00353 | mg/kg dry | 0.353 | 0.00573 | 84 | 33-117 | | | |
| Benzo(ghi)perylene | 0.270 | 0.00353 | " | 0.353 | 0.015 | 72 | 17-118 | | | |
| Benzo(k)fluoranthene | 0.342 | 0.00353 | " | 0.353 | 0.0118 | 94 | 24-122 | | | |
| Chrysene | 0.351 | 0.00353 | " | 0.353 | 0.0272 | 92 | 42-113 | | | |
| Dibenzo(a,h)anthracene | 0.309 | 0.00353 | " | 0.353 | 0.00465 | 86 | 18-146 | | | |
| Fluoranthene | 0.329 | 0.00353 | " | 0.353 | 0.0379 | 83 | 28-116 | | | |
| Indeno(1,2,3-cd)pyrene | 0.282 | 0.00353 | " | 0.353 | 0.015 | 76 | 17-133 | | | |
| Benzo(a)anthracene | 0.342 | 0.00353 | " | 0.353 | 0.0193 | 91 | 41-118 | | | |
| Phenanthrene | 0.316 | 0.00353 | " | 0.353 | 0.0318 | 80 | 35-119 | | | |
| Pyrene | 0.361 | 0.00353 | " | 0.353 | 0.0386 | 91 | 30-131 | | | |
| Fluorene | 0.276 | 0.00353 | " | 0.353 | <0.00176 | 78 | 33-123 | | | |
| Benzo(a)pyrene | 0.343 | 0.00353 | " | 0.353 | 0.0179 | 92 | 27-126 | | | |
| Anthracene | 0.306 | 0.00353 | " | 0.353 | 0.00358 | 86 | 36-120 | | | |
| Acenaphthylene | 0.271 | 0.00353 | " | 0.353 | <0.00176 | 77 | 39-116 | | | |
| Acenaphthene | 0.306 | 0.00353 | " | 0.353 | <0.00176 | 87 | 38-117 | | | |
| Benzo(b)fluoranthene | 0.344 | 0.00353 | " | 0.353 | 0.0318 | 89 | 28-126 | | | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## PAHs by SW846 3541/8270D SIM - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1644035 - SW846 3541** | | | | | | | | | | |
| **MS (1203739275 S)** | | **Source: Y702047-01** | | | Prepared: 03/03/2017 Analyzed: 03/03/2017 | | | | | |
| *Surrogate: 5-alpha-Androstane* | *0.126* | | *mg/kg dry* | *0.176* | *0.139* | *71* | *30-118* | | | |
| **MSD (1203739276 SD)** | | **Source: Y702047-01** | | | Prepared: 03/03/2017 Analyzed: 03/03/2017 | | | | | |
| Benzo(a)pyrene | 0.315 | 0.00356 | mg/kg dry | 0.356 | 0.0179 | 83 | 27-126 | 8 | 30 | |
| Fluoranthene | 0.306 | 0.00356 | " | 0.356 | 0.0379 | 75 | 28-116 | 7 | 30 | |
| Fluorene | 0.292 | 0.00356 | " | 0.356 | <0.00178 | 82 | 33-123 | 6 | 30 | |
| Dibenzo(a,h)anthracene | 0.282 | 0.00356 | " | 0.356 | 0.00465 | 78 | 18-146 | 9 | 30 | |
| Chrysene | 0.323 | 0.00356 | " | 0.356 | 0.0272 | 83 | 42-113 | 8 | 30 | |
| Indeno(1,2,3-cd)pyrene | 0.246 | 0.00356 | " | 0.356 | 0.015 | 65 | 17-133 | 14 | 30 | |
| Benzo(k)fluoranthene | 0.319 | 0.00356 | " | 0.356 | 0.0118 | 86 | 24-122 | 7 | 30 | |
| Benzo(ghi)perylene | 0.238 | 0.00356 | " | 0.356 | 0.015 | 63 | 17-118 | 13 | 30 | |
| Benzo(b)fluoranthene | 0.316 | 0.00356 | " | 0.356 | 0.0318 | 80 | 28-126 | 9 | 30 | |
| Benzo(a)anthracene | 0.313 | 0.00356 | " | 0.356 | 0.0193 | 82 | 41-118 | 9 | 30 | |
| Anthracene | 0.297 | 0.00356 | " | 0.356 | 0.00358 | 82 | 36-120 | 3 | 30 | |
| Acenaphthylene | 0.284 | 0.00356 | " | 0.356 | <0.00178 | 80 | 39-116 | 5 | 30 | |
| Acenaphthene | 0.321 | 0.00356 | " | 0.356 | <0.00178 | 90 | 38-117 | 5 | 30 | |
| Naphthalene | 0.309 | 0.00356 | " | 0.356 | 0.00573 | 85 | 33-117 | 2 | 30 | |
| Phenanthrene | 0.301 | 0.00356 | " | 0.356 | 0.0318 | 76 | 35-119 | 5 | 30 | |
| Pyrene | 0.325 | 0.00356 | " | 0.356 | 0.0386 | 81 | 30-131 | 10 | 30 | |
| *Surrogate: 5-alpha-Androstane* | *0.0986* | | *"* | *0.178* | *0.139* | *55* | *30-118* | | | |

Origins Laboratory, Inc.

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Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## TCLP Metals by 1311/3010A/6010C - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1643819 - SW846 3010A** | | | | | | | | | | |
| **MS (1203737906 S)** | | **Source: 417512001** | | | Prepared: 03/02/2017 Analyzed: 03/02/2017 | | | | | |
| Lead | 4.28 | 0.100 | mg/L | 5.00 | <0.033 | 85.6 | 75-125 | | | |
| **TB (1203737907-BLK)** | | | | | Prepared: 03/02/2017 Analyzed: 03/02/2017 | | | | | |
| Lead | ND | 0.100 | mg/L | | | | - | | | U |
| **BLANK (1203738798-BLK)** | | | | | Prepared: 03/02/2017 Analyzed: 03/02/2017 | | | | | |
| Lead | ND | 0.100 | mg/L | | | | - | | | U |
| **LCS (1203738799-BKS)** | | | | | Prepared: 03/02/2017 Analyzed: 03/02/2017 | | | | | |
| Lead | 4.57 | 0.100 | mg/L | 5.00 | | 91.4 | 80-120 | | | |
| **DUP (1203738800 D)** | | **Source: 417512001** | | | Prepared: 03/02/2017 Analyzed: 03/02/2017 | | | | | |
| Lead | ND | 0.100 | mg/L | | <0.033 | | 0-20 | 6.9 | 20 | U |

Origins Laboratory, Inc.

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Notes and Definitions

| | |
|---|---|
| Ua | Sample is Non-Detect. |
| U | Result not detected above the detection limit |
| QR-03 | The RPD value for the sample duplicate or MS/MSD was outside of QC acceptance limits due to matrix interference. QC batch accepted based on LCS and/or LCSD recovery and/or RPD values. |
| QM-07 | The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery. |
| J | Greater than the detection limit but less than the reporting limit |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| RPD | Relative Percent Difference |

All soil results are reported at a wet weight basis.

Origins Laboratory, Inc.

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Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

April 28, 2017

Pinyon

Julie Linn

9100 West Jewell Avenue, Suite 200

Lakewood CO 80232

**Project Name - 27th St. Storm Drain** **Project Number - 11780301.2100**

Attached are your analytical results for 27th St. Storm Drain received by Origins Laboratory, Inc. April 18, 2017. This project is associated with Origins project number Y704217-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com

THE NELAC INSTITUTE

ACCREDITED
TESTING CERT # 3494.01

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## CROSS REFERENCE REPORT

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| B-1 | Y704217-01 | Water | April 18, 2017 11:30 | 04/18/2017 15:15 |

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

ORIGINS LABORATORY, INC

www.originslaboratory.com

page 1 of 1

Client: Pinyon
Address:
Telephone Number: 720 394 9566
Email Address: hosler@pinyon-env.com, Curtis@pinyon-env.com

Project Manager: Travis Gwin
Project Name: 27th St ~~[illegible]~~ Storm Drain
Project Number: 11780301
Samples Collected By: Dan Hosler

| Sample ID Description | Date Sampled | Time Sampled | # of Containers | Preservative: Unpreserved | HCl | $HNO_3$ | Other | Matrix: Groundwater | Soil | Air Summa Canister # | Other | Analysis: Constituents Detected (Alkalinity, Hardness, Total Dissolved Solids) | Resistivity | Sent-Date | Sample Instructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-1 | 4/18/17 | 1130 | 11 | | | | | ✓ | | | | X | X | X | Phone White Field Filtered |
| 2 | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | |

Relinquished By: Date: 4/18/17 Time: 1575 Received By: Date: 4-18-17 Time: 1515
Relinquished By: Date: Time: Received By: Date: Time:

Temp Received- 17.2 Date Results Needed

Turnaround Time: Same Day ☐ 24 Hr ☐ 48 Hr ☐ 72 Hr ☐ Standard ✓

1725 Elk Place | Denver, CO 80211 | Phone: 303.433.1322 | Fax: 303.265.9645

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

Origins Laboratory

F-012207-01-R1
Effective Date: 01/09/12

**Sample Receipt Checklist**

Origins Work Order: Y704217

Client: Pinyon
Client Project ID: 27th St Storm Drain

Checklist Completed by: DW

Shipped Via: HD
(UPS, FedEx, Hand Delivered, Pick-up, etc.)

Date/time completed: 4-18-17 1659

Airbill #: na

Matrix(s) Received: (Check all that apply): ____Soil/Solid ✓ Water ____Other: ____ (Describe)

Cooler Number/Temperature: 1 / 19.2 °C ____/____ °C ____/____ °C ____/____ °C

Thermometer ID: T003

| Requirement Description | Yes | No | N/A | Comments (if any) |
|---|---|---|---|---|
| If samples require cooling, was the temperature between 0°C to ≤ 6°C[1]? | | ✓ | | Sampled Same Day |
| Is there ice present (document if blue ice is used) | | ✓ | | |
| Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact) | | ✓ | | |
| Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact) | | ✓ | | |
| Were all samples received intact[1]? | ✓ | | | |
| Was adequate sample volume provided[1]? | ✓ | | | |
| Are short holding time analytes or samples with HTs due within 48 hours present[1]? | ✓ | | | Hexavalent Cr Trivalent Cr |
| Is a chain-of-custody (COC) present and filled out completely[1]? | ✓ | | | |
| Does the COC agree with the number and type of sample bottles received[1]? | ✓ | | | |
| Do the sample IDs on the bottle labels match the COC[1]? | ✓ | | | |
| Is the COC properly relinquished by the client with date and time recorded[1]? | ✓ | | | |
| For volatiles in water – is there headspace (> ¼ inch bubble) present? **If yes, contact client and note in narrative.** | | ✓ | | |
| Are samples preserved that require preservation and was it checked [1]? *(note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)/(pH <2 for samples preserved with HNO3, HCL, H2SO4) / ( pH >10 for samples preserved with NaAsO2+NaOH, ZnAc+NaOH)* | | ✓ | | |
| Additional Comments (if any): | | | | |

*[1]If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.*

Reviewed by (Project Manager) 4/19/17 Date/Time Reviewed

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-1**
**4/18/2017 11:30:00AM**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Accutest Laboratories** | | | | | | | | | |
| **Y704217-01 (Water)** | | | | | | | | | |
| **Dissolved Metals by 200.8** | | | | | | | | | |
| Iron, Dissolved | ND | 20 | 20 | mg/L | 2 | '[none]' | 04/26/2017 | 04/27/2017 | |
| Manganese-Dissolved | **6.62** | **1.00** | 5.00 | ug/L | 1 | 1657613 | 04/20/2017 | 04/21/2017 | |
| **Dissolved Metals by 7196A** | | | | | | | | | |
| Chromium, Hexavalent, Dissolved | ND | 0.010 | 0.010 | mg/L | 1 | '[none]' | 04/26/2017 | 04/27/2017 | |
| **Potentially Dissolved Metals by 200.8** | | | | | | | | | |
| Arsenic, Potentially Dissolved | **3.6** | **0.40** | 0.40 | ug/L | 2 | '[none]' | " | 04/27/2017 | |
| Chromium, Potentially Dissolved | ND | 4 | 4 | " | " | " | " | " | |
| Selenium, Potentially Dissolved | **24.1** | **0.80** | 0.80 | " | " | " | " | " | |
| Thallium, Potentially Dissolved | ND | 0.40 | 0.40 | " | " | " | " | " | |
| Cadmium-Potentially Dissolved | ND | 0.300 | 1.00 | " | 1 | 1657614 | 04/20/2017 | 04/21/2017 | U |
| Copper-Potentially Dissolved | **20.5** | **0.300** | 1.00 | " | " | " | " | " | |
| Lead-Potentially Dissolved | **18.0** | **0.500** | 2.00 | " | " | " | " | " | |
| Manganese-Potentially Dissolved | **121** | **1.00** | 5.00 | " | " | " | " | " | |
| Nickel-Potentially Dissolved | **2.14** | **0.600** | 2.00 | " | " | " | " | " | |
| Silver-Potentially Dissolved | ND | 0.300 | 1.00 | " | " | " | " | " | U |
| Uranium-Potentially Dissolved | **21.5** | **0.067** | 0.200 | " | " | " | " | " | |
| Zinc-Potentially Dissolved | **21.7** | **3.30** | 10.0 | " | " | " | " | " | |

Origins Laboratory, Inc.

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-1**
**4/18/2017 11:30:00AM**

## GEL Laboratories, LLC
**Y704217-01 (Water)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Potentially Dissolved Metals by 200.8/7196A** | | | | | | | | | |
| Chromium, Trivalent, Potentially Dissolved | ND | 0.014 | 0.014 | mg/L | 1 | '[none]' | 04/26/2017 | 04/27/2017 | |
| **Potentially Dissolved Metals by 7196A** | | | | | | | | | |
| Chromium, Hexavalent, Potentially Dissolved | ND | 0.010 | 0.010 | mg/L | 1 | '[none]' | " | 04/27/2017 | |
| **SVOC by EPA 625** | | | | | | | | | |
| 1,2,4-Trichlorobenzene | ND | 3.06 | 10.2 | ug/L | 1 | 1657514 | 04/20/2017 | 04/20/2017 | U |
| 1,2-Dichlorobenzene | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| 1,2-Diphenylhydrazine | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| 1,3-Dichlorobenzene | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| 1,4-Dichlorobenzene | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| 1,4-Dioxane | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| 2,4,6-Trichlorophenol | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| 2,4-Dichlorophenol | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| 2,4-Dimethylphenol | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| 2,4-Dinitrophenol | ND | 5.10 | 20.4 | " | " | " | " | " | U |
| 2,4-Dinitrotoluene | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| 2,6-Dinitrotoluene | ND | 3.06 | 10.2 | " | " | " | " | " | U |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-1**
**4/18/2017 11:30:00AM**

## GEL Laboratories, LLC
**Y704217-01 (Water)**

### SVOC by EPA 625

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 2-Chloronaphthalene | ND | 0.418 | 1.02 | ug/L | 1 | 1657514 | 04/20/2017 | 04/20/2017 | U |
| 2-Chlorophenol | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| 2-Methyl-4,6-dinitrophenol | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| 3,3'-Dichlorobenzidine | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| 4-Nitrophenol | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| Acenaphthene | ND | 0.306 | 1.02 | " | " | " | " | " | U |
| Acenaphthylene | ND | 0.306 | 1.02 | " | " | " | " | " | U |
| Anthracene | ND | 0.306 | 1.02 | " | " | " | " | " | U |
| Benzidine | ND | 3.98 | 10.2 | " | " | " | " | " | U |
| Benzo(a)anthracene | ND | 0.306 | 1.02 | " | " | " | " | " | U |
| Benzo(a)pyrene | ND | 0.306 | 1.02 | " | " | " | " | " | U |
| Benzo(b)fluoranthene | ND | 0.306 | 1.02 | " | " | " | " | " | U |
| Benzo(ghi)perylene | ND | 0.306 | 1.02 | " | " | " | " | " | U |
| Benzo(k)fluoranthene | ND | 0.306 | 1.02 | " | " | " | " | " | U |
| bis(2-Chloro-1-methylethyl)ether | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| bis(2-Chloroethyl) ether | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| bis(2-Ethylhexyl)phthalate | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| Butylbenzylphthalate | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| Chrysene | ND | 0.306 | 1.02 | " | " | " | " | " | U |
| Dibenzo(a,h)anthracene | ND | 0.306 | 1.02 | " | " | " | " | " | U |

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Jen Pellegrini

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-1**
**4/18/2017 11:30:00AM**

## GEL Laboratories, LLC
**Y704217-01 (Water)**

### SVOC by EPA 625

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Diethylphthalate | ND | 3.06 | 10.2 | ug/L | 1 | 1657514 | 04/20/2017 | 04/20/2017 | U |
| Dimethylphthalate | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| Di-n-butylphthalate | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| Diphenylamine | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| Fluoranthene | ND | 0.306 | 1.02 | " | " | " | " | " | U |
| Fluorene | ND | 0.306 | 1.02 | " | " | " | " | " | U |
| Hexachlorobenzene | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| Hexachlorobutadiene | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| Hexachlorocyclopentadiene | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| Hexachloroethane | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| Indeno(1,2,3-cd)pyrene | ND | 0.306 | 1.02 | " | " | " | " | " | U |
| Isophorone | ND | 3.57 | 10.2 | " | " | " | " | " | U |
| Naphthalene | ND | 0.306 | 1.02 | " | " | " | " | " | U |
| Nitrobenzene | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| N-Methyl-N-nitrosomethylamine | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| N-Nitrosodipropylamine | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| Pentachlorophenol | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| Phenol | ND | 3.06 | 10.2 | " | " | " | " | " | U |
| Pyrene | ND | 0.306 | 1.02 | " | " | " | " | " | U |
| *Surrogate: 2,4,6-Tribromophenol* | *54 %* | | *32-124* | | | *"* | *"* | *"* | |

Origins Laboratory, Inc.

Jen Pellegrini

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-1**
**4/18/2017 11:30:00AM**

## GEL Laboratories, LLC
**Y704217-01 (Water)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **SVOC by EPA 625** | | | | | | | | | |
| *Surrogate: 2-Fluorobiphenyl* | *60 %* | | *32-112* | | | *16575 14* | *04/20/2017* | *04/20/2017* | |
| *Surrogate: 2-Fluorophenol* | *26 %* | | *15-88* | | | *"* | *"* | *"* | |
| *Surrogate: Nitrobenzene-d5* | *59 %* | | *36-115* | | | *"* | *"* | *"* | |
| *Surrogate: Phenol-d5* | *17 %* | | *15-91* | | | *"* | *"* | *"* | |
| *Surrogate: p-Terphenyl-d14* | *48 %* | | *36-121* | | | *"* | *"* | *"* | |
| **Total Metals by 200.8** | | | | | | | | | |
| Arsenic, Total | **8.7** | **0.40** | 0.40 | ug/L | 2 | '[none]' | 04/26/2017 | 04/27/2017 | |
| Chromium, Total | **13.4** | **4** | 4 | " | " | " | " | " | |
| Iron, Total | **24400** | **500** | 500 | " | 50 | " | " | " | |
| Selenium, Total | **36.9** | **0.80** | 0.80 | " | 2 | " | " | " | |
| Thallium, Total | ND | 0.40 | 0.40 | " | " | " | " | " | |
| Aluminum | **13900** | **19.3** | 50.0 | " | 1 | 1657612 | 04/20/2017 | 04/21/2017 | |
| Antimony | ND | 1.00 | 3.00 | " | " | " | " | " | U |
| Barium | **513** | **0.670** | 2.00 | " | " | " | " | " | |
| Beryllium | **1.32** | **0.200** | 0.500 | " | " | " | " | " | |
| Cadmium | ND | 0.300 | 1.00 | " | " | " | " | " | U |
| Copper | **33.8** | **0.300** | 1.00 | " | " | " | " | " | |
| Lead | **26.8** | **0.500** | 2.00 | " | " | " | " | " | |
| Molybdenum | **1.28** | **0.200** | 0.500 | " | " | " | " | " | |
| Nickel | **7.20** | **0.600** | 2.00 | " | " | " | " | " | |
| Silver | ND | 0.300 | 1.00 | " | " | " | " | " | U |

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-1**
**4/18/2017 11:30:00AM**

## GEL Laboratories, LLC
**Y704217-01 (Water)**

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Total Metals by 200.8** | | | | | | | | | |
| Uranium | **23.6** | **0.067** | 0.200 | ug/L | 1 | 1657612 | 04/20/2017 | 04/21/2017 | |
| Zinc | **104** | **3.30** | 10.0 | " | " | " | " | " | |
| **Total Metals by 200.8/7196A** | | | | | | | | | |
| Chromium, Trivalent, Total | ND | 0.014 | 0.014 | mg/L | 1 | '[none]' | 04/26/2017 | 04/27/2017 | |
| **Total Metals by 7196A** | | | | | | | | | |
| Chromium, Hexavalent, Total | ND | 0.010 | 0.010 | mg/L | 1 | '[none]' | " | 04/27/2017 | |
| **VOC by EPA 624** | | | | | | | | | |
| 1,1,1-Trichloroethane | ND | 0.333 | 1.00 | ug/L | 1 | 1658698 | | 04/24/2017 | U |
| 1,1,2,2-Tetrachloroethane | ND | 0.333 | 1.00 | " | " | " | " | " | U |
| 1,1,2-Trichloroethane | ND | 0.333 | 1.00 | " | " | " | " | " | U |
| 1,1-Dichloroethylene | ND | 0.333 | 1.00 | " | " | " | " | " | U |
| 1,2-Dichloroethane | ND | 0.333 | 1.00 | " | " | " | " | " | U |
| 1,2-Dichloropropane | ND | 0.333 | 1.00 | " | " | " | " | " | U |
| 1,3-Dichloropropylene | ND | 0.667 | 2.00 | " | " | " | " | " | U |
| 1,4-Dioxane | ND | 16.7 | 50.0 | " | " | " | " | " | U |
| 2-Chloroethylvinyl ether | ND | 1.67 | 5.00 | " | " | " | " | " | U |
| Acrolein | ND | 1.67 | 5.00 | " | " | " | " | " | U |

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Pinyon
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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

**B-1**
**4/18/2017 11:30:00AM**

## GEL Laboratories, LLC
**Y704217-01 (Water)**

### VOC by EPA 624

| Analyte | Result | Min Detection Limit | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Benzene | ND | 0.333 | 1.00 | ug/L | 1 | 1658698 | | 04/24/2017 | U |
| Bromoform | ND | 0.333 | 1.00 | " | " | " | " | " | U |
| Bromomethane | ND | 0.337 | 1.00 | " | " | " | " | " | U |
| Carbon tetrachloride | ND | 0.333 | 1.00 | " | " | " | " | " | U |
| Chlorobenzene | ND | 0.333 | 1.00 | " | " | " | " | " | U |
| Chloroform | **0.730** | **0.333** | 1.00 | " | " | " | " | " | J |
| Chloromethane | ND | 0.333 | 1.00 | " | " | " | " | " | U |
| Dibromochloromethane | ND | 0.333 | 1.00 | " | " | " | " | " | U |
| Ethylbenzene | ND | 0.333 | 1.00 | " | " | " | " | " | U |
| Methylene chloride | ND | 1.67 | 2.00 | " | " | " | " | " | U |
| Tetrachloroethylene | **0.890** | **0.333** | 1.00 | " | " | " | " | " | J |
| Toluene | ND | 0.333 | 1.00 | " | " | " | " | " | U |
| trans-1,2-Dichloroethylene | ND | 0.333 | 1.00 | " | " | " | " | " | U |
| Trichloroethylene | ND | 0.333 | 1.00 | " | " | " | " | " | U |
| Vinyl chloride | ND | 0.333 | 1.00 | " | " | " | " | " | U |
| Xylenes (total) | ND | 1.00 | 3.00 | " | " | " | " | " | U |

| | | | | | |
|---|---|---|---|---|---|
| *Surrogate: 1,2-Dichloroethane-d4* | *92 %* | *78-125* | " | " | " |
| *Surrogate: Bromofluorobenzene* | *101 %* | *80-120* | " | " | " |
| *Surrogate: Toluene-d8* | *93 %* | *80-120* | " | " | " |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## SVOC by EPA 625 - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1657514 - EPA 625** | | | | | | | | | | |
| **BLANK (1203771211-BLK)** | | | | | Prepared: 04/20/2017 Analyzed: 04/20/2017 | | | | | |
| Hexachlorocyclopentadiene | ND | 10.0 | ug/L | | | | - | | | U |
| Benzo(k)fluoranthene | ND | 1.00 | " | | | | - | | | U |
| bis(2-Chloro-1-methylethyl)ether | ND | 10.0 | " | | | | - | | | U |
| bis(2-Chloroethyl) ether | ND | 10.0 | " | | | | - | | | U |
| bis(2-Ethylhexyl)phthalate | ND | 10.0 | " | | | | - | | | U |
| Butylbenzylphthalate | ND | 10.0 | " | | | | - | | | U |
| Chrysene | ND | 1.00 | " | | | | - | | | U |
| Di-n-butylphthalate | ND | 10.0 | " | | | | - | | | U |
| Dibenzo(a,h)anthracene | ND | 1.00 | " | | | | - | | | U |
| Diethylphthalate | ND | 10.0 | " | | | | - | | | U |
| Dimethylphthalate | ND | 10.0 | " | | | | - | | | U |
| Diphenylamine | ND | 10.0 | " | | | | - | | | U |
| Benzo(ghi)perylene | ND | 1.00 | " | | | | - | | | U |
| Hexachlorobenzene | ND | 10.0 | " | | | | - | | | U |
| Fluorene | ND | 1.00 | " | | | | - | | | U |
| Hexachloroethane | ND | 10.0 | " | | | | - | | | U |
| Indeno(1,2,3-cd)pyrene | ND | 1.00 | " | | | | - | | | U |
| Isophorone | ND | 10.0 | " | | | | - | | | U |
| N-Methyl-N-nitrosomethylamine | ND | 10.0 | " | | | | - | | | U |
| N-Nitrosodipropylamine | ND | 10.0 | " | | | | - | | | U |
| Naphthalene | ND | 1.00 | " | | | | - | | | U |
| Nitrobenzene | ND | 10.0 | " | | | | - | | | U |
| Pentachlorophenol | ND | 10.0 | " | | | | - | | | U |
| Phenol | ND | 10.0 | " | | | | - | | | U |
| Fluoranthene | ND | 1.00 | " | | | | - | | | U |
| 1,2-Dichlorobenzene | ND | 10.0 | " | | | | - | | | U |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## SVOC by EPA 625 - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1657514 - EPA 625** | | | | | | | | | | |
| **BLANK (1203771211-BLK)** | | | | | Prepared: 04/20/2017 Analyzed: 04/20/2017 | | | | | |
| Hexachlorobutadiene | ND | 10.0 | ug/L | | | | - | | | U |
| 1,2,4-Trichlorobenzene | ND | 10.0 | " | | | | - | | | U |
| Benzo(b)fluoranthene | ND | 1.00 | " | | | | - | | | U |
| 1,2-Diphenylhydrazine | ND | 10.0 | " | | | | - | | | U |
| 1,3-Dichlorobenzene | ND | 10.0 | " | | | | - | | | U |
| 1,4-Dichlorobenzene | ND | 10.0 | " | | | | - | | | U |
| 1,4-Dioxane | ND | 10.0 | " | | | | - | | | U |
| 2,4,6-Trichlorophenol | ND | 10.0 | " | | | | - | | | U |
| 2,4-Dichlorophenol | ND | 10.0 | " | | | | - | | | U |
| 2,4-Dimethylphenol | ND | 10.0 | " | | | | - | | | U |
| 2,4-Dinitrophenol | ND | 20.0 | " | | | | - | | | U |
| 2,4-Dinitrotoluene | ND | 10.0 | " | | | | - | | | U |
| 2,6-Dinitrotoluene | ND | 10.0 | " | | | | - | | | U |
| Benzidine | ND | 10.0 | " | | | | - | | | U |
| Benzo(a)anthracene | ND | 1.00 | " | | | | - | | | U |
| Anthracene | ND | 1.00 | " | | | | - | | | U |
| Acenaphthylene | ND | 1.00 | " | | | | - | | | U |
| Acenaphthene | ND | 1.00 | " | | | | - | | | U |
| 4-Nitrophenol | ND | 10.0 | " | | | | - | | | U |
| 3,3'-Dichlorobenzidine | ND | 10.0 | " | | | | - | | | U |
| 2-Chlorophenol | ND | 10.0 | " | | | | - | | | U |
| 2-Chloronaphthalene | ND | 1.00 | " | | | | - | | | U |
| 2-Methyl-4,6-dinitrophenol | ND | 10.0 | " | | | | - | | | U |
| Benzo(a)pyrene | ND | 1.00 | " | | | | - | | | U |
| *Surrogate: Nitrobenzene-d5* | *46.4* | | " | *50.0* | | *93* | *36-115* | | | |
| *Surrogate: p-Terphenyl-d14* | *38.1* | | " | *50.0* | | *76* | *36-121* | | | |
| *Surrogate: Phenol-d5* | *31.9* | | " | *100* | | *32* | *15-91* | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## SVOC by EPA 625 - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1657514 - EPA 625** | | | | | | | | | | |
| **BLANK (1203771211-BLK)** | | | | | Prepared: 04/20/2017 Analyzed: 04/20/2017 | | | | | |
| *Surrogate: 2,4,6-Tribromophenol* | *84.6* | | *"* | *100* | | *85* | *32-124* | | | |
| *Surrogate: 2-Fluorophenol* | *48.6* | | *"* | *100* | | *49* | *15-88* | | | |
| *Surrogate: 2-Fluorobiphenyl* | *47.6* | | *"* | *50.0* | | *95* | *32-112* | | | |
| **LCS (1203771212-BKS)** | | | | | Prepared: 04/20/2017 Analyzed: 04/20/2017 | | | | | |
| bis(2-Chloroethyl) ether | 38.4 | 10.0 | ug/L | 50.0 | | 77 | 51-111 | | | |
| Fluorene | 44.2 | 1.00 | " | 50.0 | | 88 | 52-114 | | | |
| Diphenylamine | 39.2 | 10.0 | " | 50.0 | | 78 | 55-113 | | | |
| Dimethylphthalate | 41.2 | 10.0 | " | 50.0 | | 82 | 60-122 | | | |
| Diethylphthalate | 43.5 | 10.0 | " | 50.0 | | 87 | 57-122 | | | |
| Dibenzo(a,h)anthracene | 39.1 | 1.00 | " | 50.0 | | 78 | 38-129 | | | |
| Di-n-butylphthalate | 41.0 | 10.0 | " | 50.0 | | 82 | 57-123 | | | |
| Chrysene | 39.0 | 1.00 | " | 50.0 | | 78 | 58-117 | | | |
| bis(2-Ethylhexyl)phthalate | 41.4 | 10.0 | " | 50.0 | | 83 | 52-125 | | | |
| bis(2-Chloro-1-methylethyl)ether | 41.8 | 10.0 | " | 50.0 | | 84 | 44-123 | | | |
| Hexachlorobutadiene | 33.1 | 10.0 | " | 50.0 | | 66 | 35-98 | | | |
| Nitrobenzene | 40.7 | 10.0 | " | 50.0 | | 81 | 53-115 | | | |
| Benzo(k)fluoranthene | 44.0 | 1.00 | " | 50.0 | | 88 | 42-121 | | | |
| Butylbenzylphthalate | 38.7 | 10.0 | " | 50.0 | | 77 | 52-125 | | | |
| Hexachlorocyclopentadiene | 26.8 | 10.0 | " | 50.0 | | 54 | 34-89 | | | |
| Hexachloroethane | 30.0 | 10.0 | " | 50.0 | | 60 | 36-96 | | | |
| Indeno(1,2,3-cd)pyrene | 37.7 | 1.00 | " | 50.0 | | 75 | 34-125 | | | |
| Isophorone | 41.1 | 10.0 | " | 50.0 | | 82 | 56-117 | | | |
| N-Methyl-N-nitrosomethylamine | 25.5 | 10.0 | " | 50.0 | | 51 | 30-88 | | | |
| Naphthalene | 36.7 | 1.00 | " | 50.0 | | 73 | 44-102 | | | |
| Benzo(ghi)perylene | 38.9 | 1.00 | " | 50.0 | | 78 | 33-131 | | | |
| Pentachlorophenol | 40.2 | 10.0 | " | 50.0 | | 80 | 41-116 | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## SVOC by EPA 625 - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1657514 - EPA 625** | | | | | | | | | | |
| **LCS (1203771212-BKS)** | | | | | Prepared: 04/20/2017 Analyzed: 04/20/2017 | | | | | |
| Phenol | 15.0 | 10.0 | ug/L | 50.0 | | 30 | 16-82 | | | |
| Fluoranthene | 42.3 | 1.00 | " | 50.0 | | 85 | 54-118 | | | |
| N-Nitrosodipropylamine | 42.8 | 10.0 | " | 50.0 | | 86 | 54-115 | | | |
| 1,2-Dichlorobenzene | 32.0 | 10.0 | " | 50.0 | | 64 | 39-97 | | | |
| Benzo(b)fluoranthene | 41.3 | 1.00 | " | 50.0 | | 83 | 41-118 | | | |
| Hexachlorobenzene | 38.3 | 10.0 | " | 50.0 | | 77 | 54-115 | | | |
| 1,2,4-Trichlorobenzene | 33.5 | 10.0 | " | 50.0 | | 67 | 39-99 | | | |
| 1,2-Diphenylhydrazine | 42.2 | 10.0 | " | 50.0 | | 84 | 53-115 | | | |
| 1,3-Dichlorobenzene | 31.1 | 10.0 | " | 50.0 | | 62 | 37-95 | | | |
| 1,4-Dichlorobenzene | 31.5 | 10.0 | " | 50.0 | | 63 | 38-96 | | | |
| 1,4-Dioxane | 29.0 | 10.0 | " | 50.0 | | 58 | 38-78 | | | |
| 2,4,6-Trichlorophenol | 42.3 | 10.0 | " | 50.0 | | 85 | 55-120 | | | |
| 2,4-Dichlorophenol | 36.9 | 10.0 | " | 50.0 | | 74 | 53-109 | | | |
| 2,4-Dimethylphenol | 34.6 | 10.0 | " | 50.0 | | 69 | 51-104 | | | |
| 2,4-Dinitrophenol | 33.4 | 20.0 | " | 50.0 | | 67 | 34-122 | | | |
| 2,4-Dinitrotoluene | 41.5 | 10.0 | " | 50.0 | | 83 | 57-124 | | | |
| 2,6-Dinitrotoluene | 40.8 | 10.0 | " | 50.0 | | 82 | 59-122 | | | |
| Benzidine | 37.5 | 10.0 | " | 100 | | 37 | 20-144 | | | |
| 2-Chloronaphthalene | 37.9 | 1.00 | " | 50.0 | | 76 | 44-107 | | | |
| Benzo(a)anthracene | 38.3 | 1.00 | " | 50.0 | | 77 | 57-112 | | | |
| Anthracene | 38.2 | 1.00 | " | 50.0 | | 76 | 56-112 | | | |
| Acenaphthylene | 44.4 | 1.00 | " | 50.0 | | 89 | 50-113 | | | |
| Acenaphthene | 43.5 | 1.00 | " | 50.0 | | 87 | 49-112 | | | |
| 4-Nitrophenol | 14.4 | 10.0 | " | 50.0 | | 29 | 15-137 | | | |
| 2-Methyl-4,6-dinitrophenol | 35.0 | 10.0 | " | 50.0 | | 70 | 45-124 | | | |
| Benzo(a)pyrene | 41.8 | 1.00 | " | 50.0 | | 84 | 40-118 | | | |

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Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## SVOC by EPA 625 - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1657514 - EPA 625** | | | | | | | | | | |
| **LCS (1203771212-BKS)** | | | | | Prepared: 04/20/2017 Analyzed: 04/20/2017 | | | | | |
| 2-Chlorophenol | 34.4 | 10.0 | ug/L | 50.0 | | 69 | 49-105 | | | |
| 3,3'-Dichlorobenzidine | 38.0 | 10.0 | " | 50.0 | | 76 | 43-127 | | | |
| *Surrogate: Phenol-d5* | *29.3* | | *"* | *100* | | *29* | *15-91* | | | |
| *Surrogate: Nitrobenzene-d5* | *42.0* | | *"* | *50.0* | | *84* | *36-115* | | | |
| *Surrogate: p-Terphenyl-d14* | *37.1* | | *"* | *50.0* | | *74* | *36-121* | | | |
| *Surrogate: 2,4,6-Tribromophenol* | *83.1* | | *"* | *100* | | *83* | *32-124* | | | |
| *Surrogate: 2-Fluorophenol* | *44.0* | | *"* | *100* | | *44* | *15-88* | | | |
| *Surrogate: 2-Fluorobiphenyl* | *42.2* | | *"* | *50.0* | | *84* | *32-112* | | | |
| **MS (1203771213 S)** | | **Source: 420997001** | | | Prepared: 04/20/2017 Analyzed: 04/20/2017 | | | | | |
| bis(2-Ethylhexyl)phthalate | 83.8 | 25.0 | ug/L | 125 | <7.50 | 67 | 38-131 | | | |
| Fluoranthene | 72.6 | 2.50 | " | 125 | <0.750 | 58 | 41-119 | | | |
| Diphenylamine | 9.78 | 25.0 | " | 125 | <7.50 | 8 | 37-118 | | | J |
| Dimethylphthalate | 78.9 | 25.0 | " | 125 | <7.50 | 63 | 45-128 | | | |
| Diethylphthalate | 83.5 | 25.0 | " | 125 | <7.50 | 67 | 43-127 | | | |
| Dibenzo(a,h)anthracene | 74.8 | 2.50 | " | 125 | <0.750 | 60 | 30-125 | | | |
| Benzo(k)fluoranthene | 80.7 | 2.50 | " | 125 | <0.750 | 65 | 33-123 | | | |
| Di-n-butylphthalate | 76.1 | 25.0 | " | 125 | <7.50 | 61 | 41-128 | | | |
| bis(2-Chloro-1-methylethyl)ether | 76.5 | 25.0 | " | 125 | <7.50 | 61 | 32-127 | | | |
| Butylbenzylphthalate | 76.9 | 25.0 | " | 125 | <7.50 | 62 | 40-129 | | | |
| bis(2-Chloroethyl) ether | 69.3 | 25.0 | " | 125 | <7.50 | 55 | 39-114 | | | |
| Fluorene | 82.3 | 2.50 | " | 125 | <0.750 | 66 | 39-117 | | | |
| N-Methyl-N-nitrosomethylamine | 54.3 | 25.0 | " | 125 | <7.50 | 43 | 25-106 | | | |
| Chrysene | 72.1 | 2.50 | " | 125 | <0.750 | 58 | 41-124 | | | |
| Hexachlorobenzene | 73.5 | 25.0 | " | 125 | <7.50 | 59 | 40-118 | | | |
| Hexachlorobutadiene | 61.9 | 25.0 | " | 125 | <7.50 | 50 | 26-98 | | | |
| Hexachlorocyclopentadiene | 51.7 | 25.0 | " | 125 | <7.50 | 41 | 26-79 | | | |

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Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## SVOC by EPA 625 - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1657514 - EPA 625** | | | | | | | | | | |
| **MS (1203771213 S)** | | **Source: 420997001** | | | Prepared: 04/20/2017 Analyzed: 04/20/2017 | | | | | |
| Hexachloroethane | 57.8 | 25.0 | ug/L | 125 | <7.50 | 46 | 29-94 | | | |
| Pentachlorophenol | 56.0 | 25.0 | " | 125 | <7.50 | 45 | 35-121 | | | |
| Isophorone | 73.2 | 25.0 | " | 125 | <8.75 | 59 | 43-120 | | | |
| N-Nitrosodipropylamine | 77.8 | 25.0 | " | 125 | <7.50 | 62 | 42-118 | | | |
| Naphthalene | 66.3 | 2.50 | " | 125 | <0.750 | 53 | 31-108 | | | |
| Nitrobenzene | 72.9 | 25.0 | " | 125 | <7.50 | 58 | 38-123 | | | |
| Benzo(a)pyrene | 75.7 | 2.50 | " | 125 | <0.750 | 61 | 32-118 | | | |
| Phenol | 26.9 | 25.0 | " | 125 | <7.50 | 21 | 23-82 | | | |
| Indeno(1,2,3-cd)pyrene | 73.2 | 2.50 | " | 125 | <0.750 | 59 | 27-121 | | | |
| Benzo(ghi)perylene | 72.4 | 2.50 | " | 125 | <0.750 | 58 | 24-126 | | | |
| Benzo(b)fluoranthene | 75.9 | 2.50 | " | 125 | <0.750 | 61 | 31-122 | | | |
| 1,2,4-Trichlorobenzene | 61.8 | 25.0 | " | 125 | <7.50 | 49 | 26-102 | | | |
| 1,2-Dichlorobenzene | 59.7 | 25.0 | " | 125 | <7.50 | 48 | 28-99 | | | |
| 1,2-Diphenylhydrazine | 82.1 | 25.0 | " | 125 | <7.50 | 66 | 38-120 | | | |
| 1,3-Dichlorobenzene | 58.5 | 25.0 | " | 125 | <7.50 | 47 | 27-97 | | | |
| 1,4-Dioxane | 59.4 | 25.0 | " | 125 | <7.50 | 48 | 24-110 | | | |
| 2,4,6-Trichlorophenol | 55.3 | 25.0 | " | 125 | <7.50 | 44 | 39-124 | | | |
| 2,4-Dichlorophenol | 48.8 | 25.0 | " | 125 | <7.50 | 39 | 40-111 | | | |
| 2,4-Dimethylphenol | 19.5 | 25.0 | " | 125 | <7.50 | 16 | 39-107 | | | J |
| 2,4-Dinitrophenol | 49.3 | 50.0 | " | 125 | <12.5 | 39 | 27-122 | | | J |
| 2,4-Dinitrotoluene | 78.3 | 25.0 | " | 125 | <7.50 | 63 | 45-125 | | | |
| Anthracene | 66.5 | 2.50 | " | 125 | <0.750 | 53 | 38-120 | | | |
| Benzo(a)anthracene | 70.1 | 2.50 | " | 125 | <0.750 | 56 | 39-120 | | | |
| 1,4-Dichlorobenzene | 59.3 | 25.0 | " | 125 | <7.50 | 47 | 28-97 | | | |
| Benzidine | ND | 25.0 | " | 250 | <9.75 | 0 | 15-130 | | | U |
| 2,6-Dinitrotoluene | 77.3 | 25.0 | " | 125 | <7.50 | 62 | 46-124 | | | |

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## SVOC by EPA 625 - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1657514 - EPA 625** | | | | | | | | | | |
| **MS (1203771213 S)** | | **Source: 420997001** | | | Prepared: 04/20/2017 Analyzed: 04/20/2017 | | | | | |
| Acenaphthylene | 83.8 | 2.50 | ug/L | 125 | <0.750 | 67 | 35-120 | | | |
| Acenaphthene | 79.3 | 2.50 | " | 125 | <0.750 | 63 | 35-117 | | | |
| 4-Nitrophenol | 35.4 | 25.0 | " | 125 | <7.50 | 28 | 17-85 | | | |
| 3,3'-Dichlorobenzidine | ND | 25.0 | " | 125 | <7.50 | 0 | 34-124 | | | U |
| 2-Methyl-4,6-dinitrophenol | 51.6 | 25.0 | " | 125 | <7.50 | 41 | 32-126 | | | |
| 2-Chlorophenol | 45.8 | 25.0 | " | 125 | <7.50 | 37 | 37-108 | | | |
| 2-Chloronaphthalene | 73.0 | 2.50 | " | 125 | <1.03 | 58 | 29-113 | | | |
| *Surrogate: Nitrobenzene-d5* | *74.0* | | " | *125* | *25.7* | *59* | *36-115* | | | |
| *Surrogate: p-Terphenyl-d14* | *42.7* | | " | *125* | *14.5* | *34* | *36-121* | | | |
| *Surrogate: Phenol-d5* | *52.9* | | " | *250* | *11.6* | *21* | *15-91* | | | |
| *Surrogate: 2,4,6-Tribromophenol* | *103* | | " | *250* | *41.7* | *41* | *32-124* | | | |
| *Surrogate: 2-Fluorophenol* | *65.8* | | " | *250* | *18.8* | *26* | *15-88* | | | |
| *Surrogate: 2-Fluorobiphenyl* | *79.9* | | " | *125* | *25.4* | *64* | *32-112* | | | |
| **MSD (1203771214 SD)** | | **Source: 420997001** | | | Prepared: 04/20/2017 Analyzed: 04/20/2017 | | | | | |
| Benzo(a)anthracene | 66.6 | 2.50 | ug/L | 125 | <0.750 | 53 | 39-120 | 5 | 30 | |
| 2-Chlorophenol | 52.1 | 25.0 | " | 125 | <7.50 | 42 | 37-108 | 13 | 30 | |
| 2-Methyl-4,6-dinitrophenol | 44.8 | 25.0 | " | 125 | <7.50 | 36 | 32-126 | 14 | 30 | |
| 3,3'-Dichlorobenzidine | ND | 25.0 | " | 125 | <7.50 | 0 | 34-124 | 0 | 30 | U |
| 4-Nitrophenol | 36.4 | 25.0 | " | 125 | <7.50 | 29 | 17-85 | 3 | 30 | |
| Acenaphthene | 77.1 | 2.50 | " | 125 | <0.750 | 62 | 35-117 | 3 | 30 | |
| Benzo(b)fluoranthene | 73.0 | 2.50 | " | 125 | <0.750 | 58 | 31-122 | 4 | 30 | |
| Anthracene | 61.7 | 2.50 | " | 125 | <0.750 | 49 | 38-120 | 7 | 30 | |
| 2-Chloronaphthalene | 71.7 | 2.50 | " | 125 | <1.03 | 57 | 29-113 | 2 | 30 | |
| Benzo(ghi)perylene | 61.8 | 2.50 | " | 125 | <0.750 | 49 | 24-126 | 16 | 30 | |
| Acenaphthylene | 80.9 | 2.50 | " | 125 | <0.750 | 65 | 35-120 | 3 | 30 | |
| 2,6-Dinitrotoluene | 73.6 | 25.0 | " | 125 | <7.50 | 59 | 46-124 | 5 | 30 | |

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Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## SVOC by EPA 625 - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1657514 - EPA 625** | | | | | | | | | | |
| **MSD (1203771214 SD)** | | **Source: 420997001** | | | Prepared: 04/20/2017 Analyzed: 04/20/2017 | | | | | |
| 2,4-Dinitrotoluene | 75.6 | 25.0 | ug/L | 125 | <7.50 | 60 | 45-125 | 4 | 30 | |
| 2,4-Dinitrophenol | 44.2 | 50.0 | " | 125 | <12.5 | 35 | 27-122 | 11 | 30 | J |
| 2,4-Dimethylphenol | 18.6 | 25.0 | " | 125 | <7.50 | 15 | 39-107 | 5 | 30 | J |
| 2,4-Dichlorophenol | 51.6 | 25.0 | " | 125 | <7.50 | 41 | 40-111 | 6 | 30 | |
| 2,4,6-Trichlorophenol | 54.9 | 25.0 | " | 125 | <7.50 | 44 | 39-124 | 1 | 30 | |
| 1,4-Dioxane | 66.6 | 25.0 | " | 125 | <7.50 | 53 | 24-110 | 11 | 30 | |
| 1,4-Dichlorobenzene | 64.5 | 25.0 | " | 125 | <7.50 | 52 | 28-97 | 8 | 30 | |
| 1,3-Dichlorobenzene | 64.6 | 25.0 | " | 125 | <7.50 | 52 | 27-97 | 10 | 30 | |
| 1,2-Diphenylhydrazine | 74.4 | 25.0 | " | 125 | <7.50 | 59 | 38-120 | 10 | 30 | |
| 1,2-Dichlorobenzene | 65.5 | 25.0 | " | 125 | <7.50 | 52 | 28-99 | 9 | 30 | |
| Benzo(a)pyrene | 70.8 | 2.50 | " | 125 | <0.750 | 57 | 32-118 | 7 | 30 | |
| 1,2,4-Trichlorobenzene | 65.2 | 25.0 | " | 125 | <7.50 | 52 | 26-102 | 5 | 30 | |
| Nitrobenzene | 75.6 | 25.0 | " | 125 | <7.50 | 60 | 38-123 | 4 | 30 | |
| Benzidine | ND | 25.0 | " | 250 | <9.75 | 0 | 15-130 | 0 | 30 | U |
| Benzo(k)fluoranthene | 78.7 | 2.50 | " | 125 | <0.750 | 63 | 33-123 | 3 | 30 | |
| Phenol | 29.7 | 25.0 | " | 125 | <7.50 | 24 | 23-82 | 10 | 30 | |
| Pentachlorophenol | 54.4 | 25.0 | " | 125 | <7.50 | 43 | 35-121 | 3 | 30 | |
| Naphthalene | 70.2 | 2.50 | " | 125 | <0.750 | 56 | 31-108 | 6 | 30 | |
| N-Nitrosodipropylamine | 81.9 | 25.0 | " | 125 | <7.50 | 66 | 42-118 | 5 | 30 | |
| N-Methyl-N-nitrosomethylamine | 57.9 | 25.0 | " | 125 | <7.50 | 46 | 25-106 | 6 | 30 | |
| Isophorone | 74.8 | 25.0 | " | 125 | <8.75 | 60 | 43-120 | 2 | 30 | |
| Indeno(1,2,3-cd)pyrene | 64.5 | 2.50 | " | 125 | <0.750 | 52 | 27-121 | 13 | 30 | |
| Hexachloroethane | 63.3 | 25.0 | " | 125 | <7.50 | 51 | 29-94 | 9 | 30 | |
| Hexachlorocyclopentadiene | 52.2 | 25.0 | " | 125 | <7.50 | 42 | 26-79 | 1 | 30 | |
| Hexachlorobutadiene | 65.4 | 25.0 | " | 125 | <7.50 | 52 | 26-98 | 6 | 30 | |
| Di-n-butylphthalate | 72.7 | 25.0 | " | 125 | <7.50 | 58 | 41-128 | 5 | 30 | |

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Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## SVOC by EPA 625 - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1657514 - EPA 625** | | | | | | | | | | |
| **MSD (1203771214 SD)** | | **Source: 420997001** | | | Prepared: 04/20/2017 Analyzed: 04/20/2017 | | | | | |
| Hexachlorobenzene | 66.7 | 25.0 | ug/L | 125 | <7.50 | 53 | 40-118 | 10 | 30 | |
| bis(2-Chloro-1-methylethyl)ether | 82.8 | 25.0 | " | 125 | <7.50 | 66 | 32-127 | 8 | 30 | |
| Butylbenzylphthalate | 73.2 | 25.0 | " | 125 | <7.50 | 59 | 40-129 | 5 | 30 | |
| Chrysene | 68.6 | 2.50 | " | 125 | <0.750 | 55 | 41-124 | 5 | 30 | |
| bis(2-Ethylhexyl)phthalate | 81.5 | 25.0 | " | 125 | <7.50 | 65 | 38-131 | 3 | 30 | |
| Dibenzo(a,h)anthracene | 65.8 | 2.50 | " | 125 | <0.750 | 53 | 30-125 | 13 | 30 | |
| Diethylphthalate | 79.7 | 25.0 | " | 125 | <7.50 | 64 | 43-127 | 5 | 30 | |
| Dimethylphthalate | 75.1 | 25.0 | " | 125 | <7.50 | 60 | 45-128 | 5 | 30 | |
| Diphenylamine | ND | 25.0 | " | 125 | <7.50 | 0 | 37-118 | 200 | 30 | U |
| Fluoranthene | 72.6 | 2.50 | " | 125 | <0.750 | 58 | 41-119 | 0 | 30 | |
| Fluorene | 80.7 | 2.50 | " | 125 | <0.750 | 65 | 39-117 | 2 | 30 | |
| bis(2-Chloroethyl) ether | 74.6 | 25.0 | " | 125 | <7.50 | 60 | 39-114 | 7 | 30 | |
| *Surrogate: 2-Fluorobiphenyl* | *80.6* | | " | *125* | *25.4* | *64* | *32-112* | | | |
| *Surrogate: 2-Fluorophenol* | *77.8* | | " | *250* | *18.8* | *31* | *15-88* | | | |
| *Surrogate: 2,4,6-Tribromophenol* | *109* | | " | *250* | *41.7* | *44* | *32-124* | | | |
| *Surrogate: Phenol-d5* | *59.8* | | " | *250* | *11.6* | *24* | *15-91* | | | |
| *Surrogate: Nitrobenzene-d5* | *79.8* | | " | *125* | *25.7* | *64* | *36-115* | | | |
| *Surrogate: p-Terphenyl-d14* | *40.6* | | " | *125* | *14.5* | *32* | *36-121* | | | |

Origins Laboratory, Inc.

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Total Metals by 200.8 - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1657612 -** | | | | | | | | | | |
| **FLTB (1203770658-BLK)** | | | | | Prepared: 04/20/2017 Analyzed: 04/24/2017 | | | | | |
| Uranium | ND | 0.200 | ug/L | | | | - | | | U |
| Zinc | ND | 10.0 | " | | | | - | | | U |
| Silver | ND | 1.00 | " | | | | - | | | U |
| Copper | ND | 1.00 | " | | | | - | | | U |
| Nickel | ND | 2.00 | " | | | | - | | | U |
| Lead | ND | 2.00 | " | | | | - | | | U |
| Cadmium | ND | 1.00 | " | | | | - | | | U |
| **BLANK (1203771389-BLK)** | | | | | Prepared: 04/20/2017 Analyzed: 04/24/2017 | | | | | |
| Uranium | ND | 0.200 | ug/L | | | | - | | | U |
| Barium | ND | 2.00 | " | | | | - | | | U |
| Zinc | 15.6 | 10.0 | " | | | | - | | | |
| Silver | ND | 1.00 | " | | | | - | | | U |
| Nickel | ND | 2.00 | " | | | | - | | | U |
| Molybdenum | ND | 0.500 | " | | | | - | | | U |
| Lead | ND | 2.00 | " | | | | - | | | U |
| Copper | ND | 1.00 | " | | | | - | | | U |
| Beryllium | ND | 0.500 | " | | | | - | | | U |
| Antimony | ND | 3.00 | " | | | | - | | | U |
| Aluminum | ND | 50.0 | " | | | | - | | | U |
| Cadmium | ND | 1.00 | " | | | | - | | | U |
| **LCS (1203771390-BKS)** | | | | | Prepared: 04/20/2017 Analyzed: 04/24/2017 | | | | | |
| Uranium | 55.6 | 0.200 | ug/L | 50.0 | | 111 | 85-115 | | | |
| Cadmium | 52.4 | 1.00 | " | 50.0 | | 105 | 85-115 | | | |
| Zinc | 50.4 | 10.0 | " | 50.0 | | 101 | 85-115 | | | |
| Nickel | 51.3 | 2.00 | " | 50.0 | | 103 | 85-115 | | | |

Origins Laboratory, Inc.

Jen Pellegrini

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Total Metals by 200.8 - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1657612 - EPA 200.2** | | | | | | | | | | |
| **LCS (1203771390-BKS)** | | | | | Prepared: 04/20/2017 Analyzed: 04/24/2017 | | | | | |
| Molybdenum | 50.7 | 0.500 | ug/L | 50.0 | | 101 | 85-115 | | | |
| Silver | 49.8 | 1.00 | " | 50.0 | | 99.6 | 85-115 | | | |
| Copper | 50.8 | 1.00 | " | 50.0 | | 102 | 85-115 | | | |
| Beryllium | 49.6 | 0.500 | " | 50.0 | | 99.1 | 85-115 | | | |
| Barium | 48.9 | 2.00 | " | 50.0 | | 97.8 | 85-115 | | | |
| Antimony | 49.3 | 3.00 | " | 50.0 | | 98.5 | 85-115 | | | |
| Aluminum | 2010 | 50.0 | " | 2000 | | 100 | 85-115 | | | |
| Lead | 53.3 | 2.00 | " | 50.0 | | 107 | 85-115 | | | |
| **DUP (1203771391 D)** | | **Source: 420997001** | | | Prepared: 04/20/2017 Analyzed: 04/22/2017 | | | | | |
| Nickel | 178 | 2.00 | ug/L | | 167 | | 0-20 | 6.22 | 20 | |
| Zinc | 932 | 10.0 | " | | 875 | | 0-20 | 6.29 | 20 | |
| Silver | 1.75 | 1.00 | " | | 1.64 | | 0-20 | 5.96 | 20 | |
| Molybdenum | 14.2 | 0.500 | " | | 13.4 | | 0-20 | 6.12 | 20 | |
| Lead | 257 | 2.00 | " | | 245 | | 0-20 | 4.6 | 20 | |
| Copper | 264 | 1.00 | " | | 247 | | 0-20 | 6.72 | 20 | |
| Cadmium | 5.53 | 1.00 | " | | 5.26 | | 0-20 | 5.03 | 20 | |
| Beryllium | 17.4 | 0.500 | " | | 17.4 | | 0-20 | 0.242 | 20 | |
| Barium | 5130 | 100 | " | | 4900 | | 0-20 | 4.53 | 20 | |
| Antimony | ND | 3.00 | " | | <1.00 | | 0-20 | 1.59 | 20 | U |
| Aluminum | 227000 | 2500 | " | | 212000 | | 0-20 | 6.8 | 20 | |
| Uranium | 75.9 | 0.200 | " | | 73.6 | | 0-20 | 3.07 | 20 | |
| **MS (1203771392 S)** | | **Source: 420997001** | | | Prepared: 04/20/2017 Analyzed: 04/24/2017 | | | | | |
| Lead | 295 | 2.00 | ug/L | 50.0 | 245 | 99.5 | 75-125 | | | |
| Zinc | 956 | 10.0 | " | 50.0 | 875 | 161 | 75-125 | | | |
| Uranium | 122 | 0.200 | " | 50.0 | 73.6 | 97.2 | 75-125 | | | |

Origins Laboratory, Inc.

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Jen Pellegrini For Noelle Doyle Mathis, President

ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Total Metals by 200.8 - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1657612 - EPA 200.2** | | | | | | | | | | |
| **MS (1203771392 S)** | | **Source: 420997001** | | | Prepared: 04/20/2017 Analyzed: 04/22/2017 | | | | | |
| Antimony | 5.76 | 3.00 | ug/L | 50.0 | <1.00 | 10.7 | 75-125 | | | |
| Molybdenum | 49.7 | 0.500 | " | 50.0 | 13.4 | 72.6 | 75-125 | | | |
| Copper | 306 | 1.00 | " | 50.0 | 247 | 119 | 75-125 | | | |
| Cadmium | 48.2 | 1.00 | " | 50.0 | 5.26 | 85.8 | 75-125 | | | |
| Beryllium | 61.4 | 0.500 | " | 50.0 | 17.4 | 88.1 | 75-125 | | | |
| Barium | 5280 | 100 | " | 50.0 | 4900 | 747 | 75-125 | | | |
| Silver | 42.4 | 1.00 | " | 50.0 | 1.64 | 81.6 | 75-125 | | | |
| Nickel | 220 | 2.00 | " | 50.0 | 167 | 105 | 75-125 | | | |
| Aluminum | 227000 | 2500 | " | 2000 | 212000 | 780 | 75-125 | | | |

Origins Laboratory, Inc.

Jen Pellegrini

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## VOC by EPA 624 - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1658698 -** | | | | | | | | | | |
| **BLANK (1203774169-BLK)** | | | | | Prepared: Analyzed: 04/24/2017 | | | | | |
| Chloromethane | ND | 1.00 | ug/L | | | | - | | | U |
| Dibromochloromethane | ND | 1.00 | " | | | | - | | | U |
| Ethylbenzene | ND | 1.00 | " | | | | - | | | U |
| Methylene chloride | ND | 2.00 | " | | | | - | | | U |
| Tetrachloroethylene | ND | 1.00 | " | | | | - | | | U |
| Vinyl chloride | ND | 1.00 | " | | | | - | | | U |
| Xylenes (total) | ND | 3.00 | " | | | | - | | | U |
| Toluene | ND | 1.00 | " | | | | - | | | U |
| Chloroform | ND | 1.00 | " | | | | - | | | U |
| Trichloroethylene | ND | 1.00 | " | | | | - | | | U |
| Chlorobenzene | ND | 1.00 | " | | | | - | | | U |
| 1,1,1-Trichloroethane | ND | 1.00 | " | | | | - | | | U |
| 1,1,2,2-Tetrachloroethane | ND | 1.00 | " | | | | - | | | U |
| 1,1,2-Trichloroethane | ND | 1.00 | " | | | | - | | | U |
| 1,2-Dichloroethane | ND | 1.00 | " | | | | - | | | U |
| trans-1,2-Dichloroethylene | ND | 1.00 | " | | | | - | | | U |
| 1,2-Dichloropropane | ND | 1.00 | " | | | | - | | | U |
| 1,3-Dichloropropylene | ND | 2.00 | " | | | | - | | | U |
| Bromomethane | ND | 1.00 | " | | | | - | | | U |
| 1,1-Dichloroethylene | ND | 1.00 | " | | | | - | | | U |
| Carbon tetrachloride | ND | 1.00 | " | | | | - | | | U |
| 1,4-Dioxane | ND | 50.0 | " | | | | - | | | U |
| Bromoform | ND | 1.00 | " | | | | - | | | U |
| Benzene | ND | 1.00 | " | | | | - | | | U |
| Acrolein | ND | 5.00 | " | | | | - | | | U |
| 2-Chloroethylvinyl ether | ND | 5.00 | " | | | | - | | | U |

Origins Laboratory, Inc.

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## VOC by EPA 624 - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1658698 -** | | | | | | | | | | |
| **BLANK (1203774169-BLK)** | | | | | Prepared: Analyzed: 04/24/2017 | | | | | |
| *Surrogate: Toluene-d8* | *47.7* | | *ug/L* | *50.0* | | *95* | *80-120* | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *46.7* | | *"* | *50.0* | | *93* | *78-125* | | | |
| *Surrogate: Bromofluorobenzene* | *49.2* | | *"* | *50.0* | | *98* | *80-120* | | | |
| **LCS (1203774170-BKS)** | | | | | Prepared: Analyzed: 04/24/2017 | | | | | |
| Chloromethane | 17.5 | 1.00 | ug/L | 20.0 | | 88 | 1-273 | | | |
| Dibromochloromethane | 17.8 | 1.00 | " | 20.0 | | 89 | 53-149 | | | |
| Vinyl chloride | 16.0 | 1.00 | " | 20.0 | | 80 | 1-251 | | | |
| Trichloroethylene | 19.7 | 1.00 | " | 20.0 | | 99 | 71-157 | | | |
| trans-1,2-Dichloroethylene | 19.6 | 1.00 | " | 20.0 | | 98 | 54-156 | | | |
| Toluene | 19.9 | 1.00 | " | 20.0 | | 100 | 47-150 | | | |
| Tetrachloroethylene | 20.0 | 1.00 | " | 20.0 | | 100 | 64-148 | | | |
| Ethylbenzene | 20.9 | 1.00 | " | 20.0 | | 105 | 37-162 | | | |
| Xylenes (total) | 63.0 | 3.00 | " | 60.0 | | 105 | 79-125 | | | |
| 1,2-Dichloropropane | 19.2 | 1.00 | " | 20.0 | | 96 | 1-210 | | | |
| 1,1,1-Trichloroethane | 19.0 | 1.00 | " | 20.0 | | 95 | 52-162 | | | |
| 1,1,2,2-Tetrachloroethane | 18.4 | 1.00 | " | 20.0 | | 92 | 46-157 | | | |
| 1,1,2-Trichloroethane | 19.3 | 1.00 | " | 20.0 | | 96 | 52-150 | | | |
| 1,1-Dichloroethylene | 17.5 | 1.00 | " | 20.0 | | 88 | 1-234 | | | |
| Methylene chloride | 17.5 | 2.00 | " | 20.0 | | 88 | 1-221 | | | |
| Chloroform | 18.9 | 1.00 | " | 20.0 | | 95 | 51-138 | | | |
| 1,3-Dichloropropylene | 39.7 | 2.00 | " | 40.0 | | 99 | 80-126 | | | |
| Bromomethane | 14.8 | 1.00 | " | 20.0 | | 74 | 1-242 | | | |
| Chlorobenzene | 19.6 | 1.00 | " | 20.0 | | 98 | 37-160 | | | |
| 1,2-Dichloroethane | 18.4 | 1.00 | " | 20.0 | | 92 | 49-155 | | | |
| 2-Chloroethylvinyl ether | 14.4 | 5.00 | " | 20.0 | | 72 | 1-305 | | | |
| Carbon tetrachloride | 20.1 | 1.00 | " | 20.0 | | 100 | 70-140 | | | |

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Jen Pellegrini

Jen Pellegrini For Noelle Doyle Mathis, President

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## VOC by EPA 624 - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1658698 -** | | | | | | | | | | |
| **LCS (1203774170-BKS)** | | | | | Prepared: Analyzed: 04/24/2017 | | | | | |
| Bromoform | 17.0 | 1.00 | ug/L | 20.0 | | 85 | 45-169 | | | |
| Benzene | 19.6 | 1.00 | " | 20.0 | | 98 | 37-151 | | | |
| *Surrogate: Toluene-d8* | *47.5* | | *"* | *50.0* | | *95* | *80-120* | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *45.3* | | *"* | *50.0* | | *91* | *78-125* | | | |
| *Surrogate: Bromofluorobenzene* | *47.7* | | *"* | *50.0* | | *95* | *80-120* | | | |
| **LCS (1203774171-BKS)** | | | | | Prepared: Analyzed: 04/24/2017 | | | | | |
| Acrolein | 52.6 | 5.00 | ug/L | 50.0 | | 105 | 86-120 | | | |
| *Surrogate: Toluene-d8* | *48.0* | | *"* | *50.0* | | *96* | *80-120* | | | |
| *Surrogate: Bromofluorobenzene* | *49.9* | | *"* | *50.0* | | *100* | *80-120* | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *47.4* | | *"* | *50.0* | | *95* | *78-125* | | | |
| **DUP (1203774172 D)** | | **Source: 420997001** | | | Prepared: Analyzed: 04/24/2017 | | | | | |
| Xylenes (total) | ND | 3.00 | ug/L | | <1.00 | | 0-20 | 0 | 20 | U |
| Acrolein | ND | 5.00 | " | | <1.67 | | 0-20 | 0 | 20 | U |
| Ethylbenzene | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |
| Methylene chloride | ND | 2.00 | " | | <1.67 | | 0-20 | 0 | 20 | U |
| Tetrachloroethylene | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |
| Dibromochloromethane | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |
| Toluene | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |
| trans-1,2-Dichloroethylene | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |
| Vinyl chloride | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |
| Chloromethane | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |
| Trichloroethylene | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |
| 1,1,2-Trichloroethane | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |
| Chloroform | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |
| 1,1-Dichloroethylene | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## VOC by EPA 624 - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1658698 -** | | | | | | | | | | |
| **DUP (1203774172 D)** | | **Source: 420997001** | | | Prepared: Analyzed: 04/24/2017 | | | | | |
| 1,1,2,2-Tetrachloroethane | ND | 1.00 | ug/L | | <0.333 | | 0-20 | 0 | 20 | U |
| 1,1,1-Trichloroethane | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |
| 1,2-Dichloropropane | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |
| 1,4-Dioxane | ND | 50.0 | " | | <16.7 | | 0-20 | 0 | 20 | U |
| 2-Chloroethylvinyl ether | ND | 5.00 | " | | <1.67 | | 0-20 | 0 | 20 | U |
| Benzene | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |
| Bromoform | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |
| Bromomethane | ND | 1.00 | " | | <0.337 | | 0-20 | 0 | 20 | U |
| Chlorobenzene | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |
| 1,3-Dichloropropylene | ND | 2.00 | " | | <0.667 | | 0-20 | 0 | 20 | U |
| Carbon tetrachloride | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |
| 1,2-Dichloroethane | ND | 1.00 | " | | <0.333 | | 0-20 | 0 | 20 | U |
| *Surrogate: Toluene-d8* | *47.6* | | " | *50.0* | *48.2* | *95* | *80-120* | | | |
| *Surrogate: Bromofluorobenzene* | *48.8* | | " | *50.0* | *50.3* | *98* | *80-120* | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *46.6* | | " | *50.0* | *48.0* | *93* | *78-125* | | | |
| **PS (1203774173 S)** | | **Source: 420997001** | | | Prepared: Analyzed: 04/24/2017 | | | | | |
| Vinyl chloride | 18.1 | 1.00 | ug/L | 20.0 | | 90 | 1-251 | | | |
| Ethylbenzene | 18.7 | 1.00 | " | 20.0 | | 93 | 37-162 | | | |
| Methylene chloride | 16.0 | 2.00 | " | 20.0 | | 80 | 1-221 | | | |
| Tetrachloroethylene | 17.2 | 1.00 | " | 20.0 | | 86 | 64-148 | | | |
| Toluene | 17.5 | 1.00 | " | 20.0 | | 88 | 47-150 | | | |
| Trichloroethylene | 17.1 | 1.00 | " | 20.0 | | 85 | 71-157 | | | |
| Xylenes (total) | 55.7 | 3.00 | " | 60.0 | | 93 | 70-133 | | | |
| Dibromochloromethane | 16.0 | 1.00 | " | 20.0 | | 80 | 53-149 | | | |
| Bromomethane | 16.1 | 1.00 | " | 20.0 | | 81 | 1-242 | | | |
| trans-1,2-Dichloroethylene | 16.9 | 1.00 | " | 20.0 | | 85 | 54-156 | | | |

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ORIGINS LABORATORY, INC

Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## VOC by EPA 624 - Quality Control
## GEL Laboratories, LLC

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 1658698 -** | | | | | | | | | | |
| **PS (1203774173 S)** | | **Source: 420997001** | | | Prepared: Analyzed: 04/24/2017 | | | | | |
| 1,3-Dichloropropylene | 35.6 | 2.00 | ug/L | 40.0 | | 89 | 56-126 | | | |
| 1,1,2-Trichloroethane | 17.5 | 1.00 | " | 20.0 | | 87 | 52-150 | | | |
| 1,1-Dichloroethylene | 15.2 | 1.00 | " | 20.0 | | 76 | 1-234 | | | |
| 1,2-Dichloroethane | 17.3 | 1.00 | " | 20.0 | | 86 | 49-155 | | | |
| 1,1,1-Trichloroethane | 16.3 | 1.00 | " | 20.0 | | 81 | 52-162 | | | |
| Chlorobenzene | 17.6 | 1.00 | " | 20.0 | | 88 | 37-160 | | | |
| 1,1,2,2-Tetrachloroethane | 16.0 | 1.00 | " | 20.0 | | 80 | 46-157 | | | |
| 1,2-Dichloropropane | 17.5 | 1.00 | " | 20.0 | | 87 | 1-210 | | | |
| 2-Chloroethylvinyl ether | 14.4 | 5.00 | " | 20.0 | | 72 | 1-305 | | | |
| Benzene | 17.2 | 1.00 | " | 20.0 | | 86 | 37-151 | | | |
| Bromoform | 14.4 | 1.00 | " | 20.0 | | 72 | 45-169 | | | |
| Carbon tetrachloride | 17.0 | 1.00 | " | 20.0 | | 85 | 70-140 | | | |
| Chloroform | 17.1 | 1.00 | " | 20.0 | | 86 | 51-138 | | | |
| Chloromethane | 19.8 | 1.00 | " | 20.0 | | 99 | 1-273 | | | |
| *Surrogate: Toluene-d8* | *47.8* | | *"* | *50.0* | | *96* | *80-120* | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *45.8* | | *"* | *50.0* | | *92* | *78-125* | | | |
| *Surrogate: Bromofluorobenzene* | *45.9* | | *"* | *50.0* | | *92* | *80-120* | | | |
| **PS (1203774174 S)** | | **Source: 420997001** | | | Prepared: Analyzed: 04/24/2017 | | | | | |
| Acrolein | 39.8 | 5.00 | ug/L | 50.0 | | 80 | 48-150 | | | |
| *Surrogate: Toluene-d8* | *47.3* | | *"* | *50.0* | | *95* | *80-120* | | | |
| *Surrogate: Bromofluorobenzene* | *49.8* | | *"* | *50.0* | | *100* | *80-120* | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | *46.6* | | *"* | *50.0* | | *93* | *78-125* | | | |

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Pinyon
9100 West Jewell Avenue, Suite 200
Lakewood CO 80232

Julie Linn
Project Number: 11780301.2100
Project: 27th St. Storm Drain

## Notes and Definitions

U Result not detected above the detection limit

J Greater than the detection limit but less than the reporting limit

ND Analyte NOT DETECTED at or above the reporting limit

RPD Relative Percent Difference

All soil results are reported on a wet weight basis.

Origins Laboratory, Inc.

Jen Pellegrini For Noelle Doyle Mathis, President

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# Appendix C Environmental Protection Agency Regional Screening Levels – Composite Worker and Residential; EPA Toxicity Maximum Concentrations of Contaminants; CDPHE-Hazardous Materials, and Waste Management Division Groundwater Protection Values Soil Cleanup Table

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (see FQ #31); H = HEAST; F = See FAQ; W = see user guide Section 2.3.5; E = see user guide Section 2.3.6; L = see user's guide Section 5.2; M = mutagen; S = see user's guide Section 5; V = volatile; R = RBA applied (see user's guide Section 5.10) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (see user's guide Section 5.13); s = concentration may exceed Csat (see user's guide Section 5.12)

| Toxicity and Chemical-specific Information | | | | | | | | | | | | | Contaminant | | Screening Levels | | | | | | | | | | | Protection of Ground Water SSLs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFO (mg/kg-day)$^{-1}$ | key | IUR (ug/m$^3$)$^{-1}$ | key | $RfD_o$ (mg/kg-day) | key | $RfC_i$ (mg/m$^3$) | key | vol | mutagen | GIABS | ABS | $C_{sat}$ (mg/kg) | Analyte | CAS No. | Resident Soil (mg/kg) | key | Industrial Soil (mg/kg) | key | Resident Air (ug/m$^3$) | key | Industrial Air (ug/m$^3$) | key | Tapwater (ug/L) | key | MCL (ug/L) | Risk-based SSL (mg/kg) | key | MCL-based SSL (mg/kg) |
| | | | | 1.2E-03 | O | | | | | 1 | 0.1 | | Acephate | 30560-19-1 | 7.6E+01 | n | 9.8E+02 | n | | | | | 2.4E+01 | n | | 5.3E-03 | n | |
| | | 2.2E-06 | I | | | 9.0E-03 | I | V | | 1 | | 1.07E+05 | Acetaldehyde | 75-07-0 | 1.1E+01 | c** | 4.9E+01 | c** | 1.3E+00 | c** | 5.6E+00 | c** | 2.6E+00 | c** | | 5.2E-04 | c** | |
| | | | | 2.0E-02 | I | | | | | 1 | 0.1 | | Acetochlor | 34256-82-1 | 1.3E+03 | n | 1.6E+04 | n | | | | | 3.5E+02 | n | | 2.8E-01 | n | |
| | | | | 9.0E-01 | I | 3.1E+01 | A | V | | 1 | | 1.14E+05 | Acetone | 67-64-1 | 6.1E+04 | n | 6.7E+05 | nms | 3.2E+04 | n | 1.4E+05 | n | 1.4E+04 | n | | 2.9E+00 | n | |
| | | | | | | 2.0E-03 | X | | | 1 | 0.1 | | Acetone Cyanohydrin | 75-86-5 | 2.8E+06 | nm | 1.2E+07 | nm | 2.1E+00 | n | 8.8E+00 | n | | | | | | |
| | | | | | | 6.0E-02 | I | V | | 1 | | 1.28E+05 | Acetonitrile | 75-05-8 | 8.1E+02 | n | 3.4E+03 | n | 6.3E+01 | n | 2.6E+02 | n | 1.3E+02 | n | | 2.6E-02 | n | |
| | | | | 1.0E-01 | I | | | V | | 1 | | 2.52E+03 | Acetophenone | 98-86-2 | 7.8E+03 | ns | 1.2E+05 | nms | | | | | 1.9E+03 | n | | 5.8E-01 | n | |
| 3.8E+00 | C | 1.3E-03 | C | | | | | | | 1 | 0.1 | | Acetylaminofluorene, 2- | 53-96-3 | 1.4E-01 | c | 6.0E-01 | c | 2.2E-03 | c | 9.4E-03 | c | 1.6E-02 | c | | 7.2E-05 | c | |
| | | | | 5.0E-04 | I | 2.0E-05 | I | V | | 1 | | 2.27E+04 | Acrolein | 107-02-8 | 1.4E-01 | n | 6.0E-01 | n | 2.1E-02 | n | 8.8E-02 | n | 4.2E-02 | n | | 8.4E-06 | n | |
| 5.0E-01 | I | 1.0E-04 | I | 2.0E-03 | I | 6.0E-03 | I | | M | 1 | 0.1 | | Acrylamide | 79-06-1 | 2.4E-01 | c | 4.6E+00 | c | 1.0E-02 | c | 1.2E-01 | c | 5.0E-02 | c | | 1.1E-05 | c | |
| | | | | 5.0E-01 | I | 1.0E-03 | I | V | | 1 | | 1.09E+05 | Acrylic Acid | 79-10-7 | 9.9E+01 | n | 4.2E+02 | n | 1.0E+00 | n | 4.4E+00 | n | 2.1E+00 | n | | 4.2E-04 | n | |
| 5.4E-01 | I | 6.8E-05 | I | 4.0E-02 | A | 2.0E-03 | I | V | | 1 | | 1.13E+04 | Acrylonitrile | 107-13-1 | 2.5E-01 | c* | 1.1E+00 | c* | 4.1E-02 | c* | 1.8E-01 | c* | 5.2E-02 | c* | | 1.1E-05 | c* | |
| | | | | | | 6.0E-03 | P | | | 1 | 0.1 | | Adiponitrile | 111-69-3 | 8.5E+06 | nm | 3.6E+07 | nm | 6.3E+00 | n | 2.6E+01 | n | | | | | | |
| 5.6E-02 | C | | | 1.0E-02 | I | | | | | 1 | 0.1 | | Alachlor | 15972-60-8 | 9.7E+00 | c* | 4.1E+01 | c | | | | | 1.1E+00 | c | 2 | 8.7E-04 | c | 1.6E-03 |
| | | | | 1.0E-03 | I | | | | | 1 | 0.1 | | Aldicarb | 116-06-3 | 6.3E+01 | n | 8.2E+02 | n | | | | | 2.0E+01 | n | 3 | 4.9E-03 | n | 7.5E-04 |
| | | | | 1.0E-03 | I | | | | | 1 | 0.1 | | Aldicarb Sulfone | 1646-88-4 | 6.3E+01 | n | 8.2E+02 | n | | | | | 2.0E+01 | n | 2 | 4.4E-03 | n | 4.4E-04 |
| | | | | | | | | | | 1 | 0.1 | | Aldicarb sulfoxide | 1646-87-3 | | | | | | | | | | | 4 | | | 8.8E-04 |
| 1.7E+01 | I | 4.9E-03 | I | 3.0E-05 | I | | | V | | 1 | | | Aldrin | 309-00-2 | 3.9E-02 | c* | 1.8E-01 | c | 5.7E-04 | c | 2.5E-03 | c | 9.2E-04 | c | | 1.5E-04 | c | |
| | | | | 5.0E-03 | I | 1.0E-04 | X | V | | 1 | | 1.11E+05 | Allyl Alcohol | 107-18-6 | 3.5E+00 | n | 1.5E+01 | n | 1.0E-01 | n | 4.4E-01 | n | 2.1E-01 | n | | 4.2E-05 | n | |
| 2.1E-02 | C | 6.0E-06 | C | | | 1.0E-03 | I | V | | 1 | | 1.42E+03 | Allyl Chloride | 107-05-1 | 7.2E-01 | c** | 3.2E+00 | c** | 4.7E-01 | c** | 2.0E+00 | c** | 7.3E-01 | c** | | 2.3E-04 | c** | |
| | | | | 1.0E+00 | P | 5.0E-03 | P | | | 1 | | | Aluminum | 7429-90-5 | 7.7E+04 | n | 1.1E+06 | nm | 5.2E+00 | n | 2.2E+01 | n | 2.0E+04 | n | | 3.0E+04 | n | |
| | | | | 4.0E-04 | I | | | | | 1 | | | Aluminum Phosphide | 20859-73-8 | 3.1E+01 | n | 4.7E+02 | n | | | | | 8.0E+00 | n | | | | |
| | | | | 9.0E-03 | I | | | | | 1 | 0.1 | | Ametryn | 834-12-8 | 5.7E+02 | n | 7.4E+03 | n | | | | | 1.5E+02 | n | | 1.6E-01 | n | |
| 2.1E+01 | C | 6.0E-03 | C | | | | | | | 1 | 0.1 | | Aminobiphenyl, 4- | 92-67-1 | 2.6E-02 | c | 1.1E-01 | c | 4.7E-04 | c | 2.0E-03 | c | 3.0E-03 | c | | 1.5E-05 | c | |
| | | | | 8.0E-02 | P | | | | | 1 | 0.1 | | Aminophenol, m- | 591-27-5 | 5.1E+03 | n | 6.6E+04 | n | | | | | 1.6E+03 | n | | 6.1E-01 | n | |
| | | | | 4.0E-03 | X | | | | | 1 | 0.1 | | Aminophenol, o- | 95-55-6 | 2.5E+02 | n | 3.3E+03 | n | | | | | 7.9E+01 | n | | 3.0E-02 | n | |
| | | | | 2.0E-02 | P | | | | | 1 | 0.1 | | Aminophenol, p- | 123-30-8 | 1.3E+03 | n | 1.6E+04 | n | | | | | 4.0E+02 | n | | 1.5E-01 | n | |
| | | | | 2.5E-03 | I | | | | | 1 | 0.1 | | Amitraz | 33089-61-1 | 1.6E+02 | n | 2.1E+03 | n | | | | | 8.2E+00 | n | | 4.2E+00 | n | |
| | | | | | | 5.0E-01 | I | V | | 1 | | | Ammonia | 7664-41-7 | | | | | 5.2E+02 | n | 2.2E+03 | n | | | | | | |
| | | | | 2.0E-01 | I | | | | | 1 | | | Ammonium Sulfamate | 7773-06-0 | 1.6E+04 | n | 2.3E+05 | nm | | | | | 4.0E+03 | n | | | | |
| | | | | | | 3.0E-03 | X | V | | 1 | | 1.37E+04 | Amyl Alcohol, tert- | 75-85-4 | 8.2E+01 | n | 3.4E+02 | n | 3.1E+00 | n | 1.3E+01 | n | 6.3E+00 | n | | 1.3E-03 | n | |
| 5.7E-03 | I | 1.6E-06 | C | 7.0E-03 | P | 1.0E-03 | I | | | 1 | 0.1 | | Aniline | 62-53-3 | 9.5E+01 | c** | 4.0E+02 | c* | 1.0E+00 | n | 4.4E+00 | n | 1.3E+01 | c* | | 4.6E-03 | c* | |
| 4.0E-02 | P | | | 2.0E-03 | X | | | | | 1 | 0.1 | | Anthraquinone, 9,10- | 84-65-1 | 1.4E+01 | c** | 5.7E+01 | c* | | | | | 1.4E+00 | c* | | 1.4E-02 | c* | |
| | | | | 4.0E-04 | I | | | | | 0.15 | | | Antimony (metallic) | 7440-36-0 | 3.1E+01 | n | 4.7E+02 | n | | | | | 7.8E+00 | n | 6 | 3.5E-01 | n | 2.7E-01 |
| | | | | 5.0E-04 | H | | | | | 0.15 | | | Antimony Pentoxide | 1314-60-9 | 3.9E+01 | n | 5.8E+02 | n | | | | | 9.7E+00 | n | | | | |
| | | | | 4.0E-04 | H | | | | | 0.15 | | | Antimony Tetroxide | 1332-81-6 | 3.1E+01 | n | 4.7E+02 | n | | | | | 7.8E+00 | n | | | | |
| | | | | | | 2.0E-04 | I | | | 0.15 | | | Antimony Trioxide | 1309-64-4 | 2.8E+05 | nm | 1.2E+06 | nm | 2.1E-01 | n | 8.8E-01 | n | | | | | | |
| 1.5E+00 | I | 4.3E-03 | I | 3.0E-04 | I | 1.5E-05 | C | | | 1 | 0.03 | | Arsenic, Inorganic | 7440-38-2 | 6.8E-01 | c*R | 3.0E+00 | cR | 6.5E-04 | c* | 2.9E-03 | c* | 5.2E-02 | c | 10 | 1.5E-03 | c | 2.9E-01 |
| | | | | 3.5E-06 | C | 5.0E-05 | I | | | 1 | | | Arsine | 7784-42-1 | 2.7E-01 | n | 4.1E+00 | n | 5.2E-02 | n | 2.2E-01 | n | 7.0E-02 | n | | | | |
| | | | | 3.6E-02 | O | | | | | 1 | 0.1 | | Asulam | 3337-71-1 | 2.3E+03 | n | 3.0E+04 | n | | | | | 7.2E+02 | n | | 1.8E-01 | n | |
| 2.3E-01 | C | | | 3.5E-02 | I | | | | | 1 | 0.1 | | Atrazine | 1912-24-9 | 2.4E+00 | c | 1.0E+01 | c | | | | | 3.0E-01 | c | 3 | 2.0E-04 | c | 1.9E-03 |
| 8.8E-01 | C | 2.5E-04 | C | | | | | | | 1 | 0.1 | | Auramine | 492-80-8 | 6.2E-01 | c | 2.6E+00 | c | 1.1E-02 | c | 4.9E-02 | c | 6.7E-02 | c | | 6.1E-04 | c | |
| | | | | 4.0E-04 | I | | | | | 1 | 0.1 | | Avermectin B1 | 65195-55-3 | 2.5E+01 | n | 3.3E+02 | n | | | | | 8.0E+00 | n | | 1.4E+01 | n | |
| | | | | 3.0E-03 | A | 1.0E-02 | A | | | 1 | 0.1 | | Azinphos-methyl | 86-50-0 | 1.9E+02 | n | 2.5E+03 | n | 1.0E+01 | n | 4.4E+01 | n | 5.6E+01 | n | | 1.7E-02 | n | |
| 1.1E-01 | I | 3.1E-05 | I | | | | | V | | 1 | | | Azobenzene | 103-33-3 | 5.6E+00 | c | 2.6E+01 | c | 9.1E-02 | c | 4.0E-01 | c | 1.2E-01 | c | | 9.3E-04 | c | |
| | | | | 1.0E+00 | P | 7.0E-06 | P | | | 1 | 0.1 | | Azodicarbonamide | 123-77-3 | 8.6E+03 | n | 4.0E+04 | n | 7.3E-03 | n | 3.1E-02 | n | 2.0E+04 | n | | 6.8E+00 | n | |
| | | | | 2.0E-01 | I | 5.0E-04 | H | | | 0.07 | | | Barium | 7440-39-3 | 1.5E+04 | n | 2.2E+05 | nm | 5.2E-01 | n | 2.2E+00 | n | 3.8E+03 | n | 2000 | 1.6E+02 | n | 8.2E+01 |
| | | | | 5.0E-03 | O | | | V | | 1 | | | Benfluralin | 1861-40-1 | 3.9E+02 | n | 5.8E+03 | n | | | | | 2.8E+01 | n | | 9.4E-01 | n | |
| | | | | 5.0E-02 | I | | | | | 1 | 0.1 | | Benomyl | 17804-35-2 | 3.2E+03 | n | 4.1E+04 | n | | | | | 9.7E+02 | n | | 8.5E-01 | n | |
| | | | | 2.0E-01 | I | | | | | 1 | 0.1 | | Bensulfuron-methyl | 83055-99-6 | 1.3E+04 | n | 1.6E+05 | nm | | | | | 3.9E+03 | n | | 1.0E+00 | n | |
| | | | | 3.0E-02 | I | | | | | 1 | 0.1 | | Bentazon | 25057-89-0 | 1.9E+03 | n | 2.5E+04 | n | | | | | 5.7E+02 | n | | 1.2E-01 | n | |
| 4.0E-03 | P | | | 1.0E-01 | I | | | V | | 1 | | 1.16E+03 | Benzaldehyde | 100-52-7 | 1.7E+02 | c* | 8.2E+02 | c | | | | | 1.9E+01 | c | | 4.1E-03 | c | |
| 5.5E-02 | I | 7.8E-06 | I | 4.0E-03 | I | 3.0E-02 | I | V | | 1 | | 1.82E+03 | Benzene | 71-43-2 | 1.2E+00 | c* | 5.1E+00 | c* | 3.6E-01 | c* | 1.6E+00 | c* | 4.6E-01 | c* | 5 | 2.3E-04 | c* | 2.6E-03 |
| 1.0E-01 | X | | | 3.0E-04 | X | | | | | 1 | 0.1 | | Benzenediamine-2-methyl sulfate, 1,4- | 6369-59-1 | 5.4E+00 | c** | 2.3E+01 | c* | | | | | 7.8E-01 | c** | | 2.2E-04 | c** | |
| | | | | 1.0E-03 | P | | | V | | 1 | | 1.26E+03 | Benzenethiol | 108-98-5 | 7.8E+01 | n | 1.2E+03 | n | | | | | 1.7E+01 | n | | 1.1E-02 | n | |
| 2.3E+02 | I | 6.7E-02 | I | 3.0E-03 | I | | | | M | 1 | 0.1 | | Benzidine | 92-87-5 | 5.3E-04 | c | 1.0E-02 | c | 1.5E-05 | c | 1.8E-04 | c | 1.1E-04 | c | | 2.8E-07 | c | |
| | | | | 4.0E+00 | I | | | | | 1 | 0.1 | | Benzoic Acid | 65-85-0 | 2.5E+05 | nm | 3.3E+06 | nm | | | | | 7.5E+04 | n | | 1.5E+01 | n | |
| 1.3E+01 | I | | | | | | | V | | 1 | | 3.24E+02 | Benzotrichloride | 98-07-7 | 5.3E-02 | c | 2.5E-01 | c | | | | | 3.0E-03 | c | | 6.6E-06 | c | |
| | | | | 1.0E-01 | P | | | | | 1 | 0.1 | | Benzyl Alcohol | 100-51-6 | 6.3E+03 | n | 8.2E+04 | n | | | | | 2.0E+03 | n | | 4.8E-01 | n | |
| 1.7E-01 | I | 4.9E-05 | C | 2.0E-03 | P | 1.0E-03 | P | V | | 1 | | 1.46E+03 | Benzyl Chloride | 100-44-7 | 1.1E+00 | c* | 4.8E+00 | c* | 5.7E-02 | c* | 2.5E-01 | c* | 8.9E-02 | c* | | 9.8E-05 | c* | |
| | | 2.4E-03 | I | 2.0E-03 | I | 2.0E-05 | I | | | 0.007 | | | Beryllium and compounds | 7440-41-7 | 1.6E+02 | n | 2.3E+03 | n | 1.2E-03 | c* | 5.1E-03 | c* | 2.5E+01 | n | 4 | 1.9E+01 | n | 3.2E+00 |
| | | | | 9.0E-03 | P | | | | | 1 | 0.1 | | Bifenox | 42576-02-3 | 5.7E+02 | n | 7.4E+03 | n | | | | | 1.0E+02 | n | | 7.6E-01 | n | |
| | | | | 1.5E-02 | I | | | | | 1 | 0.1 | | Biphenthrin | 82657-04-3 | 9.5E+02 | n | 1.2E+04 | n | | | | | 3.0E+02 | n | | 1.4E+03 | n | |
| 8.0E-03 | I | | | 5.0E-01 | I | 4.0E-04 | X | V | | 1 | | | Biphenyl, 1,1'- | 92-52-4 | 4.7E+01 | n | 2.0E+02 | n | 4.2E-01 | n | 1.8E+00 | n | 8.3E-01 | n | | 8.7E-03 | n | |
| | | | | 4.0E-02 | I | | | V | | 1 | | 1.02E+03 | Bis(2-chloro-1-methylethyl) ether | 108-60-1 | 3.1E+03 | ns | 4.7E+04 | ns | | | | | 7.1E+02 | n | | 2.6E-01 | n | |
| | | | | 3.0E-03 | P | | | | | 1 | 0.1 | | Bis(2-chloroethoxy)methane | 111-91-1 | 1.9E+02 | n | 2.5E+03 | n | | | | | 5.9E+01 | n | | 1.3E-02 | n | |
| 1.1E+00 | I | 3.3E-04 | I | | | | | V | | 1 | | 5.05E+03 | Bis(2-chloroethyl)ether | 111-44-4 | 2.3E-01 | c | 1.0E+00 | c | 8.5E-03 | c | 3.7E-02 | c | 1.4E-02 | c | | 3.6E-06 | c | |
| 2.2E+02 | I | 6.2E-02 | I | | | | | V | | 1 | | 4.22E+03 | Bis(chloromethyl)ether | 542-88-1 | 8.3E-05 | c | 3.6E-04 | c | 4.5E-05 | c | 2.0E-04 | c | 7.2E-05 | c | | 1.7E-08 | c | |
| | | | | 5.0E-02 | I | | | | | 1 | 0.1 | | Bisphenol A | 80-05-7 | 3.2E+03 | n | 4.1E+04 | n | | | | | 7.7E+02 | n | | 5.8E+01 | n | |
| | | | | 2.0E-01 | I | 2.0E-02 | H | | | 1 | | | Boron And Borates Only | 7440-42-8 | 1.6E+04 | n | 2.3E+05 | nm | 2.1E+01 | n | 8.8E+01 | n | 4.0E+03 | n | | 1.3E+01 | n | |
| | | | | 2.0E+00 | P | 2.0E-02 | P | V | | 1 | | | Boron Trichloride | 10294-34-5 | 1.6E+05 | nm | 2.3E+06 | nm | 2.1E+01 | n | 8.8E+01 | n | 4.2E+01 | n | | | | |

TR=1E-06
THQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (see FQ #31); H = HEAST; F = See FAQ; W = see user guide Section 2.3.5; E = see user guide Section 2.3.6; L = see user's guide Section 5.2; M = mutagen; S = see user's guide Section 5; V = volatile; R = RBA applied (see user's guide Section 5.10) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (see user's guide Section 5.13); s = concentration may exceed Csat (see user's guide Section 5.12)

| Toxicity and Chemical-specific Information | | | | | | | | | | | | Contaminant | | Screening Levels | | | | | | | | | | | Protection of Ground Water SSLs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFO (mg/kg-day)$^{-1}$ | key | IUR (ug/m$^3$)$^{-1}$ | key | $RfD_o$ (mg/kg-day) | key | $RfC_i$ (mg/m$^3$) | key | vol | mutagen | GIABS | ABS | $C_{sat}$ (mg/kg) | Analyte | CAS No. | Resident Soil (mg/kg) | key | Industrial Soil (mg/kg) | key | Resident Air (ug/m$^3$) | key | Industrial Air (ug/m$^3$) | key | Tapwater (ug/L) | key | MCL (ug/L) | Risk-based SSL (mg/kg) | key | MCL-based SSL (mg/kg) |
| | | | | 4.0E-02 | C | 1.3E-02 | C | V | | 1 | | | Boron Trifluoride | 7637-07-2 | 3.1E+03 | n | 4.7E+04 | n | 1.4E+01 | n | 5.7E+01 | n | 2.6E+01 | n | | | | |
| 7.0E-01 | I | | | 4.0E-03 | I | | | | | 1 | | | Bromate | 15541-45-4 | 9.9E-01 | c | 4.7E+00 | c | | | | | 1.1E-01 | c | 10 | 8.5E-04 | c | 7.7E-02 |
| 2.0E+00 | X | 6.0E-04 | X | | | | | V | | 1 | | 2.38E+03 | Bromo-2-chloroethane, 1- | 107-04-0 | 2.6E-02 | c | 1.1E-01 | c | 4.7E-03 | c | 2.0E-02 | c | 7.4E-03 | c | | 2.1E-06 | c | |
| | | | | 3.0E-04 | X | | | V | | 1 | | 8.96E+02 | Bromo-3-fluorobenzene, 1- | 1073-06-9 | 2.3E+01 | n | 3.5E+02 | n | | | | | 4.9E+00 | n | | 4.7E-03 | n | |
| | | | | 3.0E-04 | X | | | V | | 1 | | 3.23E+02 | Bromo-4-fluorobenzene, 1- | 460-00-4 | 2.3E+01 | n | 3.5E+02 | ns | | | | | 4.6E+00 | n | | 4.4E-03 | n | |
| | | | | 8.0E-03 | I | 6.0E-02 | I | V | | 1 | | 6.79E+02 | Bromobenzene | 108-86-1 | 2.9E+02 | n | 1.8E+03 | ns | 6.3E+01 | n | 2.6E+02 | n | 6.2E+01 | n | | 4.2E-02 | n | |
| | | | | | | 4.0E-02 | X | V | | 1 | | 4.04E+03 | Bromochloromethane | 74-97-5 | 1.5E+02 | n | 6.3E+02 | n | 4.2E+01 | n | 1.8E+02 | n | 8.3E+01 | n | | 2.1E-02 | n | |
| 6.2E-02 | I | 3.7E-05 | C | 2.0E-02 | I | | | V | | 1 | | 9.32E+02 | Bromodichloromethane | 75-27-4 | 2.9E-01 | c | 1.3E+00 | c | 7.6E-02 | c | 3.3E-01 | c | 1.3E-01 | c | 80.0(F) | 3.6E-05 | c | 2.2E-02 |
| 7.9E-03 | I | 1.1E-06 | I | 2.0E-02 | I | | | V | | 1 | | 9.15E+02 | Bromoform | 75-25-2 | 1.9E+01 | c* | 8.6E+01 | c | 2.6E+00 | c | 1.1E+01 | c | 3.3E+00 | c | 80.0(F) | 8.7E-04 | c | 2.1E-02 |
| | | | | 1.4E-03 | I | 5.0E-03 | I | V | | 1 | | 3.59E+03 | Bromomethane | 74-83-9 | 6.8E+00 | n | 3.0E+01 | n | 5.2E+00 | n | 2.2E+01 | n | 7.5E+00 | n | | 1.9E-03 | n | |
| | | | | 5.0E-03 | H | | | V | | 1 | | | Bromophos | 2104-96-3 | 3.9E+02 | n | 5.8E+03 | n | | | | | 3.5E+01 | n | | 1.5E-01 | n | |
| | | | | | | 1.0E-01 | A | V | | 1 | | 9.66E+02 | Bromopropane, 1- | 106-94-5 | 2.2E+02 | n | 9.4E+02 | n | 1.0E+02 | n | 4.4E+02 | n | 2.1E+02 | n | | 6.4E-02 | n | |
| 1.0E-01 | O | | | 1.5E-02 | O | | | | | 1 | 0.1 | | Bromoxynil | 1689-84-5 | 5.3E+00 | c | 2.2E+01 | c | | | | | 6.1E-01 | c | | 5.2E-04 | c | |
| 1.0E-01 | O | | | 1.5E-02 | O | | | V | | 1 | | | Bromoxynil Octanoate | 1689-99-2 | 6.7E+00 | c | 3.2E+01 | c | | | | | 2.4E-01 | c | | 2.1E-03 | c | |
| 3.4E+00 | C | 3.0E-05 | I | | | 2.0E-03 | I | V | | 1 | | 6.67E+02 | Butadiene, 1,3- | 106-99-0 | 5.8E-02 | c* | 2.6E-01 | c* | 9.4E-02 | c* | 4.1E-01 | c* | 1.8E-02 | c | | 9.9E-06 | c | |
| | | | | 3.0E-02 | O | | | | | 1 | 0.1 | | Butanoic acid, 4-(2,4-dichlorophenoxy)- | 94-82-6 | 1.9E+03 | n | 2.5E+04 | n | | | | | 4.5E+02 | n | | 4.2E-01 | n | |
| | | | | 1.0E-01 | I | | | V | | 1 | | 7.64E+03 | Butanol, N- | 71-36-3 | 7.8E+03 | ns | 1.2E+05 | nms | | | | | 2.0E+03 | n | | 4.1E-01 | n | |
| | | | | 2.0E+00 | P | 3.0E+01 | P | V | | 1 | | 2.13E+04 | Butyl alcohol, sec- | 78-92-2 | 1.3E+05 | nms | 1.5E+06 | nms | 3.1E+04 | n | 1.3E+05 | n | 2.4E+04 | n | | 5.0E+00 | n | |
| | | | | 5.0E-02 | I | | | V | | 1 | | | Butylate | 2008-41-5 | 3.9E+03 | n | 5.8E+04 | n | | | | | 4.6E+02 | n | | 4.5E-01 | n | |
| 2.0E-04 | C | 5.7E-08 | C | | | | | | | 1 | 0.1 | | Butylated hydroxyanisole | 25013-16-5 | 2.7E+03 | c | 1.1E+04 | c | 4.9E+01 | c | 2.2E+02 | c | 1.5E+02 | c | | 2.9E-01 | c | |
| 3.6E-03 | P | | | 3.0E-01 | P | | | | | 1 | 0.1 | | Butylated hydroxytoluene | 128-37-0 | 1.5E+02 | c | 6.4E+02 | c | | | | | 3.4E+00 | c | | 1.0E-01 | c | |
| | | | | 5.0E-02 | P | | | V | | 1 | | 1.08E+02 | Butylbenzene, n- | 104-51-8 | 3.9E+03 | ns | 5.8E+04 | ns | | | | | 1.0E+03 | n | | 3.2E+00 | n | |
| | | | | 1.0E-01 | X | | | V | | 1 | | 1.45E+02 | Butylbenzene, sec- | 135-98-8 | 7.8E+03 | ns | 1.2E+05 | nms | | | | | 2.0E+03 | n | | 5.9E+00 | n | |
| | | | | 1.0E-01 | X | | | V | | 1 | | 1.83E+02 | Butylbenzene, tert- | 98-06-6 | 7.8E+03 | ns | 1.2E+05 | nms | | | | | 6.9E+02 | n | | 1.6E+00 | n | |
| | | | | 2.0E-02 | A | | | | | 1 | 0.1 | | Cacodylic Acid | 75-60-5 | 1.3E+03 | n | 1.6E+04 | n | | | | | 4.0E+02 | n | | 1.1E-01 | n | |
| | | 1.8E-03 | I | 1.0E-03 | I | 1.0E-05 | A | | | 0.025 | 0.001 | | Cadmium (Diet) | 7440-43-9 | 7.1E+01 | n | 9.8E+02 | n | | | | | | | | | | |
| | | 1.8E-03 | I | 5.0E-04 | I | 1.0E-05 | A | | | 0.05 | 0.001 | | Cadmium (Water) | 7440-43-9 | | | | | 1.6E-03 | c** | 6.8E-03 | c** | 9.2E+00 | n | 5 | 6.9E-01 | n | 3.8E-01 |
| | | | | 5.0E-01 | I | 2.2E-03 | C | | | 1 | 0.1 | | Caprolactam | 105-60-2 | 3.1E+04 | n | 4.0E+05 | nm | 2.3E+00 | n | 9.6E+00 | n | 9.9E+03 | n | | 2.5E+00 | n | |
| 1.5E-01 | C | 4.3E-05 | C | 2.0E-03 | I | | | | | 1 | 0.1 | | Captafol | 2425-06-1 | 3.6E+00 | c* | 1.5E+01 | c | 6.5E-02 | c | 2.9E-01 | c | 4.0E-01 | c* | | 7.1E-04 | c* | |
| 2.3E-03 | C | 6.6E-07 | C | 1.3E-01 | I | | | | | 1 | 0.1 | | Captan | 133-06-2 | 2.4E+02 | c* | 1.0E+03 | c | 4.3E+00 | c | 1.9E+01 | c | 3.1E+01 | c* | | 2.2E-02 | c* | |
| | | | | 1.0E-01 | I | | | | | 1 | 0.1 | | Carbaryl | 63-25-2 | 6.3E+03 | n | 8.2E+04 | n | | | | | 1.8E+03 | n | | 1.7E+00 | n | |
| | | | | 5.0E-03 | I | | | | | 1 | 0.1 | | Carbofuran | 1563-66-2 | 3.2E+02 | n | 4.1E+03 | n | | | | | 9.4E+01 | n | 40 | 3.7E-02 | n | 1.6E-02 |
| | | | | 1.0E-01 | I | 7.0E-01 | I | V | | 1 | | 7.38E+02 | Carbon Disulfide | 75-15-0 | 7.7E+02 | ns | 3.5E+03 | ns | 7.3E+02 | n | 3.1E+03 | n | 8.1E+02 | n | | 2.4E-01 | n | |
| 7.0E-02 | I | 6.0E-06 | I | 4.0E-03 | I | 1.0E-01 | I | V | | 1 | | 4.58E+02 | Carbon Tetrachloride | 56-23-5 | 6.5E-01 | c | 2.9E+00 | c | 4.7E-01 | c | 2.0E+00 | c | 4.6E-01 | c | 5 | 1.8E-04 | c | 1.9E-03 |
| | | | | | | 1.0E-01 | P | V | | 1 | | 5.89E+03 | Carbonyl Sulfide | 463-58-1 | 6.7E+01 | n | 2.8E+02 | n | 1.0E+02 | n | 4.4E+02 | n | 2.1E+02 | n | | 5.1E-01 | n | |
| | | | | 1.0E-02 | I | | | | | 1 | 0.1 | | Carbosulfan | 55285-14-8 | 6.3E+02 | n | 8.2E+03 | n | | | | | 5.1E+01 | n | | 1.2E+00 | n | |
| | | | | 1.0E-01 | I | | | | | 1 | 0.1 | | Carboxin | 5234-68-4 | 6.3E+03 | n | 8.2E+04 | n | | | | | 1.9E+03 | n | | 1.0E+00 | n | |
| | | | | | | 9.0E-04 | I | | | 1 | | | Ceric oxide | 1306-38-3 | 1.3E+06 | nm | 5.4E+06 | nm | 9.4E-01 | n | 3.9E+00 | n | | | | | | |
| | | | | 1.0E-01 | I | | | V | | 1 | | | Chloral Hydrate | 302-17-0 | 7.8E+03 | n | 1.2E+05 | nm | | | | | 2.0E+03 | n | | 4.0E-01 | n | |
| | | | | 1.5E-02 | I | | | | | 1 | 0.1 | | Chloramben | 133-90-4 | 9.5E+02 | n | 1.2E+04 | n | | | | | 2.9E+02 | n | | 7.0E-02 | n | |
| 4.0E-01 | H | | | | | | | | | 1 | 0.1 | | Chloranil | 118-75-2 | 1.3E+00 | c | 5.7E+00 | c | | | | | 1.8E-01 | c | | 1.5E-04 | c | |
| 3.5E-01 | I | 1.0E-04 | I | 5.0E-04 | I | 7.0E-04 | I | V | | 1 | 0.04 | | Chlordane | 12789-03-6 | 1.7E+00 | c* | 7.7E+00 | c* | 2.8E-02 | c* | 1.2E-01 | c* | 2.0E-02 | c* | 2 | 2.7E-03 | c* | 2.7E-01 |
| 1.0E+01 | I | 4.6E-03 | C | 3.0E-04 | I | | | | | 1 | 0.1 | | Chlordecone (Kepone) | 143-50-0 | 5.4E-02 | c | 2.3E-01 | c | 6.1E-04 | c | 2.7E-03 | c | 3.5E-03 | c | | 1.2E-04 | c | |
| | | | | 7.0E-04 | A | | | | | 1 | 0.1 | | Chlorfenvinphos | 470-90-6 | 4.4E+01 | n | 5.7E+02 | n | | | | | 1.1E+01 | n | | 3.1E-02 | n | |
| | | | | 9.0E-02 | O | | | | | 1 | 0.1 | | Chlorimuron, Ethyl- | 90982-32-4 | 5.7E+03 | n | 7.4E+04 | n | | | | | 1.8E+03 | n | | 6.0E-01 | n | |
| | | | | 1.0E-01 | I | 1.5E-04 | A | V | | 1 | | 2.78E+03 | Chlorine | 7782-50-5 | 1.8E-01 | n | 7.8E-01 | n | 1.5E-01 | n | 6.4E-01 | n | 3.0E-01 | n | | 1.4E-04 | n | |
| | | | | 3.0E-02 | I | 2.0E-04 | I | V | | 1 | | | Chlorine Dioxide | 10049-04-4 | 2.3E+03 | n | 3.4E+04 | n | 2.1E-01 | n | 8.8E-01 | n | 4.2E-01 | n | | | | |
| | | | | 3.0E-02 | I | | | | | 1 | | | Chlorite (Sodium Salt) | 7758-19-2 | 2.3E+03 | n | 3.5E+04 | n | | | | | 6.0E+02 | n | 1000 | | | |
| | | | | | | 5.0E+01 | I | V | | 1 | | 1.15E+03 | Chloro-1,1-difluoroethane, 1- | 75-68-3 | 5.4E+04 | ns | 2.3E+05 | nms | 5.2E+04 | n | 2.2E+05 | n | 1.0E+05 | n | | 5.2E+01 | n | |
| | | 3.0E-04 | I | 2.0E-02 | H | 2.0E-02 | I | V | | 1 | | 7.86E+02 | Chloro-1,3-butadiene, 2- | 126-99-8 | 1.0E-02 | c | 4.4E-02 | c | 9.4E-03 | c | 4.1E-02 | c | 1.9E-02 | c | | 9.8E-06 | c | |
| 4.6E-01 | H | | | | | | | | | 1 | 0.1 | | Chloro-2-methylaniline HCl, 4- | 3165-93-3 | 1.2E+00 | c | 5.0E+00 | c | | | | | 1.7E-01 | c | | 1.5E-04 | c | |
| 1.0E-01 | P | 7.7E-05 | C | 3.0E-03 | X | | | | | 1 | 0.1 | | Chloro-2-methylaniline, 4- | 95-69-2 | 5.4E+00 | c* | 2.3E+01 | c | 3.6E-02 | c | 1.6E-01 | c | 7.0E-01 | c* | | 4.0E-04 | c* | |
| 2.7E-01 | X | | | | | | | V | | 1 | | 1.18E+04 | Chloroacetaldehyde, 2- | 107-20-0 | 2.6E+00 | c | 1.2E+01 | c | | | | | 2.9E-01 | c | | 5.8E-05 | c | |
| | | | | | | | | | | 1 | 0.1 | | Chloroacetic Acid | 79-11-8 | | | | | | | | | | | 60 | | | 1.2E-02 |
| | | | | | | 3.0E-05 | I | | | 1 | 0.1 | | Chloroacetophenone, 2- | 532-27-4 | 4.3E+04 | n | 1.8E+05 | nm | 3.1E-02 | n | 1.3E-01 | n | | | | | | |
| 2.0E-01 | P | | | 4.0E-03 | I | | | | | 1 | 0.1 | | Chloroaniline, p- | 106-47-8 | 2.7E+00 | c* | 1.1E+01 | c | | | | | 3.7E-01 | c | | 1.6E-04 | c | |
| | | | | 2.0E-02 | I | 5.0E-02 | P | V | | 1 | | 7.61E+02 | Chlorobenzene | 108-90-7 | 2.8E+02 | n | 1.3E+03 | ns | 5.2E+01 | n | 2.2E+02 | n | 7.8E+01 | n | 100 | 5.3E-02 | n | 6.8E-02 |
| | | | | 1.0E-01 | X | | | | | 1 | 0.1 | | Chlorobenzene sulfonic acid, p- | 98-66-8 | 6.3E+03 | n | 8.2E+04 | n | | | | | 2.0E+03 | n | | 4.7E-01 | n | |
| 1.1E-01 | C | 3.1E-05 | C | 2.0E-02 | I | | | | | 1 | 0.1 | | Chlorobenzilate | 510-15-6 | 4.9E+00 | c | 2.1E+01 | c | 9.1E-02 | c | 4.0E-01 | c | 3.1E-01 | c | | 1.0E-03 | c | |
| | | | | 3.0E-02 | X | | | | | 1 | 0.1 | | Chlorobenzoic Acid, p- | 74-11-3 | 1.9E+03 | n | 2.5E+04 | n | | | | | 5.1E+02 | n | | 1.3E-01 | n | |
| | | | | 3.0E-03 | P | 3.0E-01 | P | V | | 1 | | 2.90E+02 | Chlorobenzotrifluoride, 4- | 98-56-6 | 2.1E+02 | n | 2.5E+03 | ns | 3.1E+02 | n | 1.3E+03 | n | 3.5E+01 | n | | 1.2E-01 | n | |
| | | | | 4.0E-02 | P | | | V | | 1 | | 7.28E+02 | Chlorobutane, 1- | 109-69-3 | 3.1E+03 | ns | 4.7E+04 | ns | | | | | 6.4E+02 | n | | 2.6E-01 | n | |
| | | | | | | 5.0E+01 | I | V | | 1 | | 1.68E+03 | Chlorodifluoromethane | 75-45-6 | 4.9E+04 | ns | 2.1E+05 | nms | 5.2E+04 | n | 2.2E+05 | n | 1.0E+05 | n | | 4.3E+01 | n | |
| | | | | 2.0E-02 | P | | | V | | 1 | | 1.11E+05 | Chloroethanol, 2- | 107-07-3 | 1.6E+03 | n | 2.3E+04 | n | | | | | 4.0E+02 | n | | 8.1E-02 | n | |
| 3.1E-02 | C | 2.3E-05 | I | 1.0E-02 | I | 9.8E-02 | A | V | | 1 | | 2.54E+03 | Chloroform | 67-66-3 | 3.2E-01 | c | 1.4E+00 | c | 1.2E-01 | c | 5.3E-01 | c | 2.2E-01 | c | 80.0(F) | 6.1E-05 | c | 2.2E-02 |
| | | | | | | 9.0E-02 | I | V | | 1 | | 1.32E+03 | Chloromethane | 74-87-3 | 1.1E+02 | n | 4.6E+02 | n | 9.4E+01 | n | 3.9E+02 | n | 1.9E+02 | n | | 4.9E-02 | n | |
| 2.4E+00 | C | 6.9E-04 | C | | | | | V | | 1 | | 9.32E+03 | Chloromethyl Methyl Ether | 107-30-2 | 2.0E-02 | c | 8.9E-02 | c | 4.1E-03 | c | 1.8E-02 | c | 6.5E-03 | c | | 1.4E-06 | c | |
| 3.0E-01 | P | | | 3.0E-03 | P | 1.0E-05 | X | | | 1 | 0.1 | | Chloronitrobenzene, o- | 88-73-3 | 1.8E+00 | c | 7.7E+00 | c | 1.0E-02 | n | 4.4E-02 | n | 2.4E-01 | c | | 2.2E-04 | c | |
| 6.0E-02 | P | | | 7.0E-04 | P | 2.0E-03 | P | | | 1 | 0.1 | | Chloronitrobenzene, p- | 100-00-5 | 9.0E+00 | c** | 3.8E+01 | c* | 2.1E+00 | n | 8.8E+00 | n | 1.2E+00 | c* | | 1.1E-03 | c* | |
| | | | | 5.0E-03 | I | | | V | | 1 | | 2.74E+04 | Chlorophenol, 2- | 95-57-8 | 3.9E+02 | n | 5.8E+03 | n | | | | | 9.1E+01 | n | | 8.9E-02 | n | |
| | | | | | | 4.0E-04 | C | V | | 1 | | 6.17E+02 | Chloropicrin | 76-06-2 | 2.0E+00 | n | 8.2E+00 | n | 4.2E-01 | n | 1.8E+00 | n | 8.3E-01 | n | | 2.5E-04 | n | |

TR=1E-06
HQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (see FQ #31); H = HEAST; F = See FAQ; W = see user guide Section 2.3.5; E = see user guide Section 2.3.6; L = see user's guide Section 5.2; M = mutagen; S = see user's guide Section 5; V = volatile; R = RBA applied (see user's guide Section 5.10) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (see user's guide Section 5.13); s = concentration may exceed Csat (see user's guide Section 5.12)

| Toxicity and Chemical-specific Information | | | | | | | | | | | | | Contaminant | | Screening Levels | | | | | | | | | | | Protection of Ground Water SSLs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFO (mg/kg-day)$^{-1}$ | key | IUR (ug/m$^3$)$^{-1}$ | key | $RfD_o$ (mg/kg-day) | key | $RfC_i$ (mg/m$^3$) | key | vol | mutagen | GIABS | ABS | $C_{sat}$ (mg/kg) | Analyte | CAS No. | Resident Soil (mg/kg) | key | Industrial Soil (mg/kg) | key | Resident Air (ug/m$^3$) | key | Industrial Air (ug/m$^3$) | key | Tapwater (ug/L) | key | MCL (ug/L) | Risk-based SSL (mg/kg) | key | MCL-based SSL (mg/kg) |
| 3.1E-03 | C | 8.9E-07 | C | 1.5E-02 | I | | | | | 1 | 0.1 | | Chlorothalonil | 1897-45-6 | 1.8E+02 | c** | 7.4E+02 | c* | 3.2E+00 | c | 1.4E+01 | c | 2.2E+01 | c* | | 5.0E-02 | c* | |
| | | | | 2.0E-02 | I | | | V | | 1 | | 9.07E+02 | Chlorotoluene, o- | 95-49-8 | 1.6E+03 | ns | 2.3E+04 | ns | | | | | 2.4E+02 | n | | 2.3E-01 | n | |
| | | | | 2.0E-02 | X | | | V | | 1 | | 2.53E+02 | Chlorotoluene, p- | 106-43-4 | 1.6E+03 | ns | 2.3E+04 | ns | | | | | 2.5E+02 | n | | 2.4E-01 | n | |
| 2.4E+02 | C | 6.9E-02 | C | | | | | | | 1 | 0.1 | | Chlorozotocin | 54749-90-5 | 2.3E-03 | c | 9.6E-03 | c | 4.1E-05 | c | 1.8E-04 | c | 3.2E-04 | c | | 7.1E-08 | c | |
| | | | | 5.0E-02 | O | | | | | 1 | 0.1 | | Chlorpropham | 101-21-3 | 3.2E+03 | n | 4.1E+04 | n | | | | | 7.1E+02 | n | | 6.4E-01 | n | |
| | | | | 1.0E-03 | A | | | | | 1 | 0.1 | | Chlorpyrifos | 2921-88-2 | 6.3E+01 | n | 8.2E+02 | n | | | | | 8.4E+00 | n | | 1.2E-01 | n | |
| | | | | 1.0E-02 | H | | | | | 1 | 0.1 | | Chlorpyrifos Methyl | 5598-13-0 | 6.3E+02 | n | 8.2E+03 | n | | | | | 1.2E+02 | n | | 5.4E-01 | n | |
| | | | | 5.0E-02 | O | | | | | 1 | 0.1 | | Chlorsulfuron | 64902-72-3 | 3.2E+03 | n | 4.1E+04 | n | | | | | 9.9E+02 | n | | 8.3E-01 | n | |
| | | | | 1.0E-02 | I | | | | | 1 | 0.1 | | Chlorthal-dimethyl | 1861-32-1 | 6.3E+02 | n | 8.2E+03 | n | | | | | 1.2E+02 | n | | 1.5E-01 | n | |
| | | | | 8.0E-04 | H | | | | | 1 | 0.1 | | Chlorthiophos | 60238-56-4 | 5.1E+01 | n | 6.6E+02 | n | | | | | 2.8E+00 | n | | 7.3E-02 | n | |
| | | | | 1.5E+00 | I | | | | | 0.013 | | | Chromium(III), Insoluble Salts | 16065-83-1 | 1.2E+05 | nm | 1.8E+06 | nm | | | | | 2.2E+04 | n | | 4.0E+07 | n | |
| 5.0E-01 | C | 8.4E-02 | S | 3.0E-03 | I | 1.0E-04 | I | | M | 0.025 | | | Chromium(VI) | 18540-29-9 | 3.0E-01 | c | 6.3E+00 | c | 1.2E-05 | c | 1.5E-04 | c | 3.5E-02 | c | | 6.7E-04 | c | |
| | | | | | | | | | | 0.013 | | | Chromium, Total | 7440-47-3 | | | | | | | | | | | 100 | | | 1.8E+05 |
| | | | | 1.3E-02 | I | | | | | 1 | 0.1 | | Clofentezine | 74115-24-5 | 8.2E+02 | n | 1.1E+04 | n | | | | | 2.3E+02 | n | | 1.4E+01 | n | |
| | | 9.0E-03 | P | 3.0E-04 | P | 6.0E-06 | P | | | 1 | | | Cobalt | 7440-48-4 | 2.3E+01 | n | 3.5E+02 | n | 3.1E-04 | c* | 1.4E-03 | c* | 6.0E+00 | n | | 2.7E-01 | n | |
| | | 6.2E-04 | I | | | | | V | M | 1 | | | Coke Oven Emissions | 8007-45-2 | | | | | 1.6E-03 | c | 2.0E-02 | c | | | | | | |
| | | | | 4.0E-02 | H | | | | | 1 | | | Copper | 7440-50-8 | 3.1E+03 | n | 4.7E+04 | n | | | | | 8.0E+02 | n | 1300 | 2.8E+01 | n | 4.6E+01 |
| | | | | 5.0E-02 | I | 6.0E-01 | C | | | 1 | 0.1 | | Cresol, m- | 108-39-4 | 3.2E+03 | n | 4.1E+04 | n | 6.3E+02 | n | 2.6E+03 | n | 9.3E+02 | n | | 7.4E-01 | n | |
| | | | | 5.0E-02 | I | 6.0E-01 | C | | | 1 | 0.1 | | Cresol, o- | 95-48-7 | 3.2E+03 | n | 4.1E+04 | n | 6.3E+02 | n | 2.6E+03 | n | 9.3E+02 | n | | 7.5E-01 | n | |
| | | | | 1.0E-01 | A | 6.0E-01 | C | | | 1 | 0.1 | | Cresol, p- | 106-44-5 | 6.3E+03 | n | 8.2E+04 | n | 6.3E+02 | n | 2.6E+03 | n | 1.9E+03 | n | | 1.5E+00 | n | |
| | | | | 1.0E-01 | A | | | | | 1 | 0.1 | | Cresol, p-chloro-m- | 59-50-7 | 6.3E+03 | n | 8.2E+04 | n | | | | | 1.4E+03 | n | | 1.7E+00 | n | |
| | | | | 1.0E-01 | A | 6.0E-01 | C | | | 1 | 0.1 | | Cresols | 1319-77-3 | 6.3E+03 | n | 8.2E+04 | n | 6.3E+02 | n | 2.6E+03 | n | 1.5E+03 | n | | 1.3E+00 | n | |
| 1.9E+00 | H | | | 1.0E-03 | P | | | V | | 1 | | 1.66E+04 | Crotonaldehyde, trans- | 123-73-9 | 3.7E-01 | c | 1.7E+00 | c | | | | | 4.0E-02 | c | | 8.2E-06 | c | |
| | | | | 1.0E-01 | I | 4.0E-01 | I | V | | 1 | | 2.68E+02 | Cumene | 98-82-8 | 1.9E+03 | ns | 9.9E+03 | ns | 4.2E+02 | n | 1.8E+03 | n | 4.5E+02 | n | | 7.4E-01 | n | |
| 2.2E-01 | C | 6.3E-05 | C | | | | | | | 1 | 0.1 | | Cupferron | 135-20-6 | 2.5E+00 | c | 1.0E+01 | c | 4.5E-02 | c | 1.9E-01 | c | 3.5E-01 | c | | 6.1E-04 | c | |
| 8.4E-01 | H | | | 2.0E-03 | H | | | | | 1 | 0.1 | | Cyanazine | 21725-46-2 | 6.5E-01 | c | 2.7E+00 | c | | | | | 8.8E-02 | c | | 4.1E-05 | c | |
| | | | | | | | | | | | | | Cyanides | | | | | | | | | | | | | | | |
| | | | | 1.0E-03 | I | | | | | 1 | | | ~Calcium Cyanide | 592-01-8 | 7.8E+01 | n | 1.2E+03 | n | | | | | 2.0E+01 | n | | | | |
| | | | | 5.0E-03 | I | | | | | 1 | | | ~Copper Cyanide | 544-92-3 | 3.9E+02 | n | 5.8E+03 | n | | | | | 1.0E+02 | n | | | | |
| | | | | 6.0E-04 | I | 8.0E-04 | S | V | | 1 | | 9.54E+05 | ~Cyanide (CN-) | 57-12-5 | 2.3E+01 | n | 1.5E+02 | n | 8.3E-01 | n | 3.5E+00 | n | 1.5E+00 | n | 200 | 1.5E-02 | n | 2.0E+00 |
| | | | | 1.0E-03 | I | | | V | | 1 | | | ~Cyanogen | 460-19-5 | 7.8E+01 | n | 1.2E+03 | n | | | | | 2.0E+01 | n | | | | |
| | | | | 9.0E-02 | I | | | V | | 1 | | | ~Cyanogen Bromide | 506-68-3 | 7.0E+03 | n | 1.1E+05 | nm | | | | | 1.8E+03 | n | | | | |
| | | | | 5.0E-02 | I | | | V | | 1 | | | ~Cyanogen Chloride | 506-77-4 | 3.9E+03 | n | 5.8E+04 | n | | | | | 1.0E+03 | n | | | | |
| | | | | 6.0E-04 | I | 8.0E-04 | I | V | | 1 | | 1.00E+07 | ~Hydrogen Cyanide | 74-90-8 | 2.3E+01 | n | 1.5E+02 | n | 8.3E-01 | n | 3.5E+00 | n | 1.5E+00 | n | | 1.5E-02 | n | |
| | | | | 2.0E-03 | I | | | | | 1 | | | ~Potassium Cyanide | 151-50-8 | 1.6E+02 | n | 2.3E+03 | n | | | | | 4.0E+01 | n | | | | |
| | | | | 5.0E-03 | I | | | | | 0.04 | | | ~Potassium Silver Cyanide | 506-61-6 | 3.9E+02 | n | 5.8E+03 | n | | | | | 8.2E+01 | n | | | | |
| | | | | 1.0E-01 | I | | | | | 0.04 | | | ~Silver Cyanide | 506-64-9 | 7.8E+03 | n | 1.2E+05 | nm | | | | | 1.8E+03 | n | | | | |
| | | | | 1.0E-03 | I | | | | | 1 | | | ~Sodium Cyanide | 143-33-9 | 7.8E+01 | n | 1.2E+03 | n | | | | | 2.0E+01 | n | 200 | | | |
| | | | | 2.0E-04 | P | | | | | 1 | | | ~Thiocyanates | E1790664 | 1.6E+01 | n | 2.3E+02 | n | | | | | 4.0E+00 | n | | | | |
| | | | | 2.0E-04 | X | | | V | | 1 | | | ~Thiocyanic Acid | 463-56-9 | 1.6E+01 | n | 2.3E+02 | n | | | | | 4.0E+00 | n | | | | |
| | | | | 5.0E-02 | I | | | | | 1 | | | ~Zinc Cyanide | 557-21-1 | 3.9E+03 | n | 5.8E+04 | n | | | | | 1.0E+03 | n | | | | |
| | | | | | | 6.0E+00 | I | V | | 1 | | 1.17E+02 | Cyclohexane | 110-82-7 | 6.5E+03 | ns | 2.7E+04 | ns | 6.3E+03 | n | 2.6E+04 | n | 1.3E+04 | n | | 1.3E+01 | n | |
| 2.0E-02 | X | | | 2.0E-02 | X | | | | | 1 | 0.1 | | Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro- | 87-84-3 | 2.7E+01 | c* | 1.1E+02 | c | | | | | 2.8E+00 | c | | 1.6E-02 | c | |
| | | | | 5.0E+00 | I | 7.0E-01 | P | V | | 1 | | 5.11E+03 | Cyclohexanone | 108-94-1 | 2.8E+04 | ns | 1.3E+05 | nms | 7.3E+02 | n | 3.1E+03 | n | 1.4E+03 | n | | 3.4E-01 | n | |
| | | | | 5.0E-03 | P | 1.0E+00 | X | V | | 1 | | 2.83E+02 | Cyclohexene | 110-83-8 | 3.1E+02 | ns | 3.1E+03 | ns | 1.0E+03 | n | 4.4E+03 | n | 7.0E+01 | n | | 4.6E-02 | n | |
| | | | | 2.0E-01 | I | | | V | | 1 | | 2.93E+05 | Cyclohexylamine | 108-91-8 | 1.6E+04 | n | 2.3E+05 | nm | | | | | 3.8E+03 | n | | 1.0E+00 | n | |
| | | | | 2.5E-02 | I | | | | | 1 | 0.1 | | Cyfluthrin | 68359-37-5 | 1.6E+03 | n | 2.1E+04 | n | | | | | 1.2E+02 | n | | 3.1E+01 | n | |
| | | | | 1.0E-03 | O | | | | | 1 | 0.1 | | Cyhalothrin | 68085-85-8 | 6.3E+01 | n | 8.2E+02 | n | | | | | 2.0E+01 | n | | 1.4E+01 | n | |
| | | | | 5.0E-01 | O | | | | | 1 | 0.1 | | Cyromazine | 66215-27-8 | 3.2E+04 | n | 4.1E+05 | nm | | | | | 9.9E+03 | n | | 2.5E+00 | n | |
| 2.4E-01 | I | 6.9E-05 | C | 3.0E-05 | X | | | | | 1 | 0.1 | | DDD, p,p'- (DDD) | 72-54-8 | 1.9E+00 | n | 9.6E+00 | c** | 4.1E-02 | c | 1.8E-01 | c | 3.2E-02 | c** | | 7.5E-03 | c** | |
| 3.4E-01 | I | 9.7E-05 | C | 3.0E-04 | X | | | V | | 1 | | | DDE, p,p'- | 72-55-9 | 2.0E+00 | c* | 9.3E+00 | c* | 2.9E-02 | c | 1.3E-01 | c | 4.6E-02 | c | | 1.1E-02 | c | |
| 3.4E-01 | I | 9.7E-05 | I | 5.0E-04 | I | | | | | 1 | 0.03 | | DDT | 50-29-3 | 1.9E+00 | c* | 8.5E+00 | c* | 2.9E-02 | c | 1.3E-01 | c | 2.3E-01 | c* | | 7.7E-02 | c* | |
| | | | | 3.0E-02 | I | | | | | 1 | 0.1 | | Dalapon | 75-99-0 | 1.9E+03 | n | 2.5E+04 | n | | | | | 6.0E+02 | n | 200 | 1.2E-01 | n | 4.1E-02 |
| 1.8E-02 | C | 5.1E-06 | C | 1.5E-01 | I | | | | | 1 | 0.1 | | Daminozide | 1596-84-5 | 3.0E+01 | c | 1.3E+02 | c | 5.5E-01 | c | 2.4E+00 | c | 4.3E+00 | c | | 9.5E-04 | c | |
| 7.0E-04 | I | | | 7.0E-03 | I | | | | | 1 | 0.1 | | Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209) | 1163-19-5 | 4.4E+02 | n | 3.3E+03 | c** | | | | | 1.1E+02 | c** | | 6.2E+01 | c** | |
| | | | | 4.0E-05 | I | | | | | 1 | 0.1 | | Demeton | 8065-48-3 | 2.5E+00 | n | 3.3E+01 | n | | | | | 4.2E-01 | n | | | | |
| 1.2E-03 | I | | | 6.0E-01 | I | | | | | 1 | 0.1 | | Di(2-ethylhexyl)adipate | 103-23-1 | 4.5E+02 | c* | 1.9E+03 | c | | | | | 6.5E+01 | c | 400 | 4.7E+00 | c | 2.9E+01 |
| 6.1E-02 | H | | | | | | | | | 1 | 0.1 | | Diallate | 2303-16-4 | 8.9E+00 | c | 3.8E+01 | c | | | | | 5.4E-01 | c | | 8.0E-04 | c | |
| | | | | 7.0E-04 | A | | | | | 1 | 0.1 | | Diazinon | 333-41-5 | 4.4E+01 | n | 5.7E+02 | n | | | | | 1.0E+01 | n | | 6.5E-02 | n | |
| | | | | 1.0E-02 | X | | | V | | 1 | | | Dibenzothiophene | 132-65-0 | 7.8E+02 | n | 1.2E+04 | n | | | | | 6.5E+01 | n | | 1.2E+00 | n | |
| 8.0E-01 | P | 6.0E-03 | P | 2.0E-04 | P | 2.0E-04 | I | V | M | 1 | | 9.79E+02 | Dibromo-3-chloropropane, 1,2- | 96-12-8 | 5.3E-03 | c | 6.4E-02 | c | 1.7E-04 | c | 2.0E-03 | c | 3.3E-04 | c | 0.2 | 1.4E-07 | c | 8.6E-05 |
| | | | | 4.0E-04 | X | | | V | | 1 | | 1.59E+02 | Dibromobenzene, 1,3- | 108-36-1 | 3.1E+01 | n | 4.7E+02 | ns | | | | | 5.3E+00 | n | | 5.1E-03 | n | |
| | | | | 1.0E-02 | I | | | V | | 1 | | | Dibromobenzene, 1,4- | 106-37-6 | 7.8E+02 | n | 1.2E+04 | n | | | | | 1.3E+02 | n | | 1.2E-01 | n | |
| 8.4E-02 | I | | | 2.0E-02 | I | | | V | | 1 | | 8.02E+02 | Dibromochloromethane | 124-48-1 | 8.3E+00 | c | 3.9E+01 | c | | | | | 8.7E-01 | c | 80.0(F) | 2.3E-04 | c | 2.1E-02 |
| 2.0E+00 | I | 6.0E-04 | I | 9.0E-03 | I | 9.0E-03 | I | V | | 1 | | 1.34E+03 | Dibromoethane, 1,2- | 106-93-4 | 3.6E-02 | c | 1.6E-01 | c | 4.7E-03 | c | 2.0E-02 | c | 7.5E-03 | c | 0.05 | 2.1E-06 | c | 1.4E-05 |
| | | | | | | 4.0E-03 | X | V | | 1 | | 2.82E+03 | Dibromomethane (Methylene Bromide) | 74-95-3 | 2.4E+01 | n | 9.9E+01 | n | 4.2E+00 | n | 1.8E+01 | n | 8.3E+00 | n | | 2.1E-03 | n | |
| | | | | 3.0E-04 | P | | | | | 1 | 0.1 | | Dibutyltin Compounds | E1790660 | 1.9E+01 | n | 2.5E+02 | n | | | | | 6.0E+00 | n | | | | |
| | | | | 3.0E-02 | I | | | | | 1 | 0.1 | | Dicamba | 1918-00-9 | 1.9E+03 | n | 2.5E+04 | n | | | | | 5.7E+02 | n | | 1.5E-01 | n | |
| | | 4.2E-03 | P | | | | | V | | 1 | | 5.54E+02 | Dichloro-2-butene, 1,4- | 764-41-0 | 2.1E-03 | c | 9.4E-03 | c | 6.7E-04 | c | 2.9E-03 | c | 1.3E-03 | c | | 6.6E-07 | c | |
| | | 4.2E-03 | P | | | | | V | | 1 | | 5.19E+02 | Dichloro-2-butene, cis-1,4- | 1476-11-5 | 7.4E-03 | c | 3.2E-02 | c | 6.7E-04 | c | 2.9E-03 | c | 1.3E-03 | c | | 6.2E-07 | c | |
| | | 4.2E-03 | P | | | | | V | | 1 | | 7.60E+02 | Dichloro-2-butene, trans-1,4- | 110-57-6 | 7.4E-03 | c | 3.2E-02 | c | 6.7E-04 | c | 2.9E-03 | c | 1.3E-03 | c | | 6.2E-07 | c | |

TR=1E-06
THQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (see FQ #31); H = HEAST; F = See FAQ; W = see user guide Section 2.3.5; E = see user guide Section 2.3.6; L = see user's guide Section 5.2; M = mutagen; S = see user's guide Section 5; V = volatile; R = RBA applied (see user's guide Section 5.10) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (see user's guide Section 5.13); s = concentration may exceed Csat (see user's guide Section 5.12)

| Toxicity and Chemical-specific Information | | | | | | | | | | | | | Contaminant | | Screening Levels | | | | | | | | | | | | Protection of Ground Water SSLs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFO (mg/kg-day)$^{-1}$ | key | IUR (ug/m$^3$)$^{-1}$ | key | $RfD_o$ (mg/kg-day) | key | $RfC_i$ (mg/m$^3$) | key | vol | muta gen | GIABS | ABS | $C_{sat}$ (mg/kg) | Analyte | CAS No. | Resident Soil (mg/kg) | key | Industrial Soil (mg/kg) | key | Resident Air (ug/m$^3$) | key | Industrial Air (ug/m$^3$) | key | Tapwater (ug/L) | key | MCL (ug/L) | | Risk-based SSL (mg/kg) | key | MCL-based SSL (mg/kg) |
| 5.0E-02 | I | | | 4.0E-03 | I | | | | | 1 | 0.1 | | Dichloroacetic Acid | 79-43-6 | 1.1E+01 | c* | 4.6E+01 | c* | | | | | 1.5E+00 | c* | 60 | | 3.1E-04 | c* | 1.2E-02 |
| | | | | 9.0E-02 | I | 2.0E-01 | H | V | | 1 | | 3.76E+02 | Dichlorobenzene, 1,2- | 95-50-1 | 1.8E+03 | ns | 9.3E+03 | ns | 2.1E+02 | n | 8.8E+02 | n | 3.0E+02 | n | 600 | | 3.0E-01 | n | 5.8E-01 |
| 5.4E-03 | C | 1.1E-05 | C | 7.0E-02 | A | 8.0E-01 | I | V | | 1 | | | Dichlorobenzene, 1,4- | 106-46-7 | 2.6E+00 | c | 1.1E+01 | c | 2.6E-01 | c | 1.1E+00 | c | 4.8E-01 | c | 75 | | 4.6E-04 | c | 7.2E-02 |
| 4.5E-01 | I | 3.4E-04 | C | | | | | | | 1 | 0.1 | | Dichlorobenzidine, 3,3'- | 91-94-1 | 1.2E+00 | c | 5.1E+00 | c | 8.3E-03 | c | 3.6E-02 | c | 1.3E-01 | c | | | 8.2E-04 | c | |
| | | | | 9.0E-03 | X | | | | | 1 | 0.1 | | Dichlorobenzophenone, 4,4'- | 90-98-2 | 5.7E+02 | n | 7.4E+03 | n | | | | | 7.8E+01 | n | | | 4.7E-01 | n | |
| | | | | 2.0E-01 | I | 1.0E-01 | X | V | | 1 | | 8.45E+02 | Dichlorodifluoromethane | 75-71-8 | 8.7E+01 | n | 3.7E+02 | n | 1.0E+02 | n | 4.4E+02 | n | 2.0E+02 | n | | | 3.0E-01 | n | |
| 5.7E-03 | C | 1.6E-06 | C | 2.0E-01 | P | | | V | | 1 | | 1.69E+03 | Dichloroethane, 1,1- | 75-34-3 | 3.6E+00 | c | 1.6E+01 | c | 1.8E+00 | c | 7.7E+00 | c | 2.8E+00 | c | | | 7.8E-04 | c | |
| 9.1E-02 | I | 2.6E-05 | I | 6.0E-03 | X | 7.0E-03 | P | V | | 1 | | 2.98E+03 | Dichloroethane, 1,2- | 107-06-2 | 4.6E-01 | c* | 2.0E+00 | c* | 1.1E-01 | c* | 4.7E-01 | c* | 1.7E-01 | c* | 5 | | 4.8E-05 | c* | 1.4E-03 |
| | | | | 5.0E-02 | I | 2.0E-01 | I | V | | 1 | | 1.19E+03 | Dichloroethylene, 1,1- | 75-35-4 | 2.3E+02 | n | 1.0E+03 | n | 2.1E+02 | n | 8.8E+02 | n | 2.8E+02 | n | 7 | | 1.0E-01 | n | 2.5E-03 |
| | | | | 2.0E-03 | I | | | V | | 1 | | 2.37E+03 | Dichloroethylene, 1,2-cis- | 156-59-2 | 1.6E+02 | n | 2.3E+03 | n | | | | | 3.6E+01 | n | 70 | | 1.1E-02 | n | 2.1E-02 |
| | | | | 2.0E-02 | I | | | V | | 1 | | 1.85E+03 | Dichloroethylene, 1,2-trans- | 156-60-5 | 1.6E+03 | n | 2.3E+04 | ns | | | | | 3.6E+02 | n | 100 | | 1.1E-01 | n | 3.1E-02 |
| | | | | 3.0E-03 | I | | | | | 1 | 0.1 | | Dichlorophenol, 2,4- | 120-83-2 | 1.9E+02 | n | 2.5E+03 | n | | | | | 4.6E+01 | n | | | 2.3E-02 | n | |
| | | | | 1.0E-02 | I | | | | | 1 | 0.05 | | Dichlorophenoxy Acetic Acid, 2,4- | 94-75-7 | 7.0E+02 | n | 9.6E+03 | n | | | | | 1.7E+02 | n | 70 | | 4.5E-02 | n | 1.8E-02 |
| 3.7E-02 | P | 3.7E-06 | P | 4.0E-02 | P | 4.0E-03 | I | V | | 1 | | 1.36E+03 | Dichloropropane, 1,2- | 78-87-5 | 2.5E+00 | c** | 1.1E+01 | c** | 7.6E-01 | c** | 3.3E+00 | c** | 8.5E-01 | c** | 5 | | 2.8E-04 | c** | 1.7E-03 |
| | | | | 2.0E-02 | P | | | V | | 1 | | 1.49E+03 | Dichloropropane, 1,3- | 142-28-9 | 1.6E+03 | ns | 2.3E+04 | ns | | | | | 3.7E+02 | n | | | 1.3E-01 | n | |
| | | | | 3.0E-03 | I | | | | | 1 | 0.1 | | Dichloropropanol, 2,3- | 616-23-9 | 1.9E+02 | n | 2.5E+03 | n | | | | | 5.9E+01 | n | | | 1.3E-02 | n | |
| 1.0E-01 | I | 4.0E-06 | I | 3.0E-02 | I | 2.0E-02 | I | V | | 1 | | 1.57E+03 | Dichloropropene, 1,3- | 542-75-6 | 1.8E+00 | c* | 8.2E+00 | c* | 7.0E-01 | c* | 3.1E+00 | c* | 4.7E-01 | c* | | | 1.7E-04 | c* | |
| 2.9E-01 | I | 8.3E-05 | C | 5.0E-04 | I | 5.0E-04 | I | | | 1 | 0.1 | | Dichlorvos | 62-73-7 | 1.9E+00 | c* | 7.9E+00 | c* | 3.4E-02 | c* | 1.5E-01 | c* | 2.6E-01 | c* | | | 8.1E-05 | c* | |
| | | | | 3.0E-05 | O | | | | | 1 | 0.1 | | Dicrotophos | 141-66-2 | 1.9E+00 | n | 2.5E+01 | n | | | | | 6.0E-01 | n | | | 1.4E-04 | n | |
| | | | | 8.0E-02 | P | 3.0E-04 | X | V | | 1 | | 2.56E+02 | Dicyclopentadiene | 77-73-6 | 1.3E+00 | n | 5.4E+00 | n | 3.1E-01 | n | 1.3E+00 | n | 6.3E-01 | n | | | 2.2E-03 | n | |
| 1.6E+01 | I | 4.6E-03 | I | 5.0E-05 | I | | | | | 1 | 0.1 | | Dieldrin | 60-57-1 | 3.4E-02 | c* | 1.4E-01 | c | 6.1E-04 | c | 2.7E-03 | c | 1.8E-03 | c | | | 7.1E-05 | c | |
| | | 3.0E-04 | C | | | 5.0E-03 | I | | | 1 | 0.1 | | Diesel Engine Exhaust | E17136615 | | | | | 9.4E-03 | c | 4.1E-02 | c | | | | | | | |
| | | | | 2.0E-03 | P | 2.0E-04 | P | | | 1 | 0.1 | | Diethanolamine | 111-42-2 | 1.3E+02 | n | 1.6E+03 | n | 2.1E-01 | n | 8.8E-01 | n | 4.0E+01 | n | | | 8.1E-03 | n | |
| | | | | 3.0E-02 | P | 1.0E-04 | P | | | 1 | 0.1 | | Diethylene Glycol Monobutyl Ether | 112-34-5 | 1.9E+03 | n | 2.4E+04 | n | 1.0E-01 | n | 4.4E-01 | n | 6.0E+02 | n | | | 1.3E-01 | n | |
| | | | | 6.0E-02 | P | 3.0E-04 | P | | | 1 | 0.1 | | Diethylene Glycol Monoethyl Ether | 111-90-0 | 3.8E+03 | n | 4.8E+04 | n | 3.1E-01 | n | 1.3E+00 | n | 1.2E+03 | n | | | 2.4E-01 | n | |
| | | | | 1.0E-03 | P | | | V | | 1 | | 1.12E+05 | Diethylformamide | 617-84-5 | 7.8E+01 | n | 1.2E+03 | n | | | | | 2.0E+01 | n | | | 4.1E-03 | n | |
| 3.5E+02 | C | 1.0E-01 | C | | | | | | | 1 | 0.1 | | Diethylstilbestrol | 56-53-1 | 1.6E-03 | c | 6.6E-03 | c | 2.8E-05 | c | 1.2E-04 | c | 5.1E-05 | c | | | 2.8E-05 | c | |
| | | | | 8.3E-02 | O | | | | | 1 | 0.1 | | Difenzoquat | 43222-48-6 | 5.2E+03 | n | 6.8E+04 | n | | | | | 1.7E+03 | n | | | 2.6E+02 | n | |
| | | | | 2.0E-02 | I | | | | | 1 | 0.1 | | Diflubenzuron | 35367-38-5 | 1.3E+03 | n | 1.6E+04 | n | | | | | 2.9E+02 | n | | | 3.3E-01 | n | |
| | | | | | | 4.0E+01 | I | V | | 1 | | 1.43E+03 | Difluoroethane, 1,1- | 75-37-6 | 4.8E+04 | ns | 2.0E+05 | nms | 4.2E+04 | n | 1.8E+05 | n | 8.3E+04 | n | | | 2.8E+01 | n | |
| | | | | | | 3.0E+01 | X | V | | 1 | | 6.91E+02 | Difluoropropane, 2,2- | 420-45-1 | 2.4E+04 | ns | 1.0E+05 | ns | 3.1E+04 | n | 1.3E+05 | n | 6.3E+04 | n | | | 1.4E+02 | n | |
| 4.4E-02 | C | 1.3E-05 | C | | | | | V | | 1 | | | Dihydrosafrole | 94-58-6 | 9.9E+00 | c | 4.5E+01 | c | 2.2E-01 | c | 9.4E-01 | c | 3.0E-01 | c | | | 1.9E-04 | c | |
| | | | | | | 7.0E-01 | P | V | | 1 | | 2.26E+03 | Diisopropyl Ether | 108-20-3 | 2.2E+03 | n | 9.4E+03 | ns | 7.3E+02 | n | 3.1E+03 | n | 1.5E+03 | n | | | 3.7E-01 | n | |
| | | | | 8.0E-02 | I | | | V | | 1 | | 5.30E+02 | Diisopropyl Methylphosphonate | 1445-75-6 | 6.3E+03 | ns | 9.3E+04 | ns | | | | | 1.6E+03 | n | | | 4.5E-01 | n | |
| | | | | 2.2E-02 | O | | | | | 1 | 0.1 | | Dimethipin | 55290-64-7 | 1.4E+03 | n | 1.8E+04 | n | | | | | 4.4E+02 | n | | | 9.6E-02 | n | |
| | | | | 2.2E-03 | O | | | | | 1 | 0.1 | | Dimethoate | 60-51-5 | 1.4E+02 | n | 1.8E+03 | n | | | | | 4.4E+01 | n | | | 9.9E-03 | n | |
| 1.6E+00 | P | | | | | | | | | 1 | 0.1 | | Dimethoxybenzidine, 3,3'- | 119-90-4 | 3.4E-01 | c | 1.4E+00 | c | | | | | 4.7E-02 | c | | | 5.8E-05 | c | |
| 1.7E-03 | P | | | 6.0E-02 | P | | | | | 1 | 0.1 | | Dimethyl methylphosphonate | 756-79-6 | 3.2E+02 | c* | 1.4E+03 | c* | | | | | 4.6E+01 | c* | | | 9.6E-03 | c* | |
| 4.6E+00 | C | 1.3E-03 | C | | | | | | | 1 | 0.1 | | Dimethylamino azobenzene [p-] | 60-11-7 | 1.2E-01 | c | 5.0E-01 | c | 2.2E-03 | c | 9.4E-03 | c | 5.0E-03 | c | | | 2.1E-05 | c | |
| 5.8E-01 | H | | | | | | | | | 1 | 0.1 | | Dimethylaniline HCl, 2,4- | 21436-96-4 | 9.4E-01 | c | 4.0E+00 | c | | | | | 1.3E-01 | c | | | 1.2E-04 | c | |
| 2.0E-01 | P | | | 2.0E-03 | X | | | | | 1 | 0.1 | | Dimethylaniline, 2,4- | 95-68-1 | 2.7E+00 | c* | 1.1E+01 | c | | | | | 3.7E-01 | c | | | 2.1E-04 | c | |
| 2.7E-02 | P | | | 2.0E-03 | I | | | V | | 1 | | 8.30E+02 | Dimethylaniline, N,N- | 121-69-7 | 2.6E+01 | c** | 1.2E+02 | c* | | | | | 2.5E+00 | c* | | | 9.0E-04 | c* | |
| 1.1E+01 | P | | | | | | | | | 1 | 0.1 | | Dimethylbenzidine, 3,3'- | 119-93-7 | 4.9E-02 | c | 2.1E-01 | c | | | | | 6.5E-03 | c | | | 4.3E-05 | c | |
| | | | | 1.0E-01 | P | 3.0E-02 | I | V | | 1 | | 1.06E+05 | Dimethylformamide | 68-12-2 | 2.6E+03 | n | 1.5E+04 | n | 3.1E+01 | n | 1.3E+02 | n | 6.1E+01 | n | | | 1.2E-02 | n | |
| | | | | 1.0E-04 | X | 2.0E-06 | X | V | | 1 | | 1.72E+05 | Dimethylhydrazine, 1,1- | 57-14-7 | 5.7E-02 | n | 2.4E-01 | n | 2.1E-03 | n | 8.8E-03 | n | 4.2E-03 | n | | | 9.3E-07 | n | |
| 5.5E+02 | C | 1.6E-01 | C | | | | | V | | 1 | | 1.89E+05 | Dimethylhydrazine, 1,2- | 540-73-8 | 8.8E-04 | c | 4.1E-03 | c | 1.8E-05 | c | 7.7E-05 | c | 2.8E-05 | c | | | 6.5E-09 | c | |
| | | | | 2.0E-02 | I | | | | | 1 | 0.1 | | Dimethylphenol, 2,4- | 105-67-9 | 1.3E+03 | n | 1.6E+04 | n | | | | | 3.6E+02 | n | | | 4.2E-01 | n | |
| | | | | 6.0E-04 | I | | | | | 1 | 0.1 | | Dimethylphenol, 2,6- | 576-26-1 | 3.8E+01 | n | 4.9E+02 | n | | | | | 1.1E+01 | n | | | 1.3E-02 | n | |
| | | | | 1.0E-03 | I | | | | | 1 | 0.1 | | Dimethylphenol, 3,4- | 95-65-8 | 6.3E+01 | n | 8.2E+02 | n | | | | | 1.8E+01 | n | | | 2.1E-02 | n | |
| 4.5E-02 | C | 1.3E-05 | C | | | | | V | | 1 | | 4.73E+02 | Dimethylvinylchloride | 513-37-1 | 1.1E+00 | c | 4.8E+00 | c | 2.2E-01 | c | 9.4E-01 | c | 3.3E-01 | c | | | 1.1E-04 | c | |
| | | | | 8.0E-05 | X | | | | | 1 | 0.1 | | Dinitro-o-cresol, 4,6- | 534-52-1 | 5.1E+00 | n | 6.6E+01 | n | | | | | 1.5E+00 | n | | | 2.6E-03 | n | |
| | | | | 2.0E-03 | I | | | | | 1 | 0.1 | | Dinitro-o-cyclohexyl Phenol, 4,6- | 131-89-5 | 1.3E+02 | n | 1.6E+03 | n | | | | | 2.3E+01 | n | | | 7.7E-01 | n | |
| | | | | 1.0E-04 | P | | | | | 1 | 0.1 | | Dinitrobenzene, 1,2- | 528-29-0 | 6.3E+00 | n | 8.2E+01 | n | | | | | 1.9E+00 | n | | | 1.8E-03 | n | |
| | | | | 1.0E-04 | I | | | | | 1 | 0.1 | | Dinitrobenzene, 1,3- | 99-65-0 | 6.3E+00 | n | 8.2E+01 | n | | | | | 2.0E+00 | n | | | 1.8E-03 | n | |
| | | | | 1.0E-04 | P | | | | | 1 | 0.1 | | Dinitrobenzene, 1,4- | 100-25-4 | 6.3E+00 | n | 8.2E+01 | n | | | | | 2.0E+00 | n | | | 1.8E-03 | n | |
| | | | | 2.0E-03 | I | | | | | 1 | 0.1 | | Dinitrophenol, 2,4- | 51-28-5 | 1.3E+02 | n | 1.6E+03 | n | | | | | 3.9E+01 | n | | | 4.4E-02 | n | |
| 6.8E-01 | I | | | | | | | | | 1 | 0.1 | | Dinitrotoluene Mixture, 2,4/2,6- | E1615210 | 8.0E-01 | c | 3.4E+00 | c | | | | | 1.1E-01 | c | | | 1.5E-04 | c | |
| 3.1E-01 | C | 8.9E-05 | C | 2.0E-03 | I | | | | | 1 | 0.102 | | Dinitrotoluene, 2,4- | 121-14-2 | 1.7E+00 | c* | 7.4E+00 | c | 3.2E-02 | c | 1.4E-01 | c | 2.4E-01 | c | | | 3.2E-04 | c | |
| 1.5E+00 | P | | | 3.0E-04 | X | | | | | 1 | 0.099 | | Dinitrotoluene, 2,6- | 606-20-2 | 3.6E-01 | c* | 1.5E+00 | c | | | | | 4.9E-02 | c | | | 6.7E-05 | c | |
| | | | | 2.0E-03 | S | | | | | 1 | 0.006 | | Dinitrotoluene, 2-Amino-4,6- | 35572-78-2 | 1.5E+02 | n | 2.3E+03 | n | | | | | 3.9E+01 | n | | | 3.0E-02 | n | |
| | | | | 2.0E-03 | S | | | | | 1 | 0.009 | | Dinitrotoluene, 4-Amino-2,6- | 19406-51-0 | 1.5E+02 | n | 2.3E+03 | n | | | | | 3.9E+01 | n | | | 3.0E-02 | n | |
| 4.5E-01 | X | | | 9.0E-04 | X | | | | | 1 | 0.1 | | Dinitrotoluene, Technical grade | 25321-14-6 | 1.2E+00 | c* | 5.1E+00 | c | | | | | 1.0E-01 | c | | | 1.4E-04 | c | |
| | | | | 1.0E-03 | I | | | | | 1 | 0.1 | | Dinoseb | 88-85-7 | 6.3E+01 | n | 8.2E+02 | n | | | | | 1.5E+01 | n | 7 | | 1.3E-01 | n | 6.2E-02 |
| 1.0E-01 | I | 5.0E-06 | I | 3.0E-02 | I | 3.0E-02 | I | V | | 1 | | 1.16E+05 | Dioxane, 1,4- | 123-91-1 | 5.3E+00 | c | 2.4E+01 | c | 5.6E-01 | c* | 2.5E+00 | c* | 4.6E-01 | c | | | 9.4E-05 | c | |
| | | | | | | | | | | | | | Dioxins | | | | | | | | | | | | | | | | |
| 6.2E+03 | I | 1.3E+00 | I | | | | | | | 1 | 0.03 | | ~Hexachlorodibenzo-p-dioxin, Mixture | | 1.0E-04 | c | 4.7E-04 | c | 2.2E-06 | c | 9.4E-06 | c | 1.3E-05 | c | | | 1.7E-05 | c | |
| 1.3E+05 | C | 3.8E+01 | C | 7.0E-10 | I | 4.0E-08 | C | V | | 1 | 0.03 | | ~TCDD, 2,3,7,8- | 1746-01-6 | 4.8E-06 | c* | 2.2E-05 | c* | 7.4E-08 | c | 3.2E-07 | c | 1.2E-07 | c | 3.00E-05 | | 5.9E-08 | c | 1.5E-05 |
| | | | | 3.0E-02 | I | | | | | 1 | 0.1 | | Diphenamid | 957-51-7 | 1.9E+03 | n | 2.5E+04 | n | | | | | 5.3E+02 | n | | | 5.2E+00 | n | |
| | | | | | | 4.0E-04 | X | V | | 1 | | | Diphenyl Ether | 101-84-8 | 3.4E+01 | n | 1.4E+02 | n | 4.2E-01 | n | 1.8E+00 | n | 8.3E-01 | n | | | 3.4E-03 | n | |
| | | | | 8.0E-04 | X | | | | | 1 | 0.1 | | Diphenyl Sulfone | 127-63-9 | 5.1E+01 | n | 6.6E+02 | n | | | | | 1.5E+01 | n | | | 3.6E-02 | n | |
| | | | | 1.0E-01 | O | | | | | 1 | 0.1 | | Diphenylamine | 122-39-4 | 6.3E+03 | n | 8.2E+04 | n | | | | | 1.3E+03 | n | | | 2.3E+00 | n | |

TR=1E-06
HQ=1

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (see FQ #31); H = HEAST; F = See FAQ; W = see user guide Section 2.3.5; E = see user guide Section 2.3.6; L = see user's guide Section 5.2; M = mutagen; S = see user's guide Section 5; V = volatile; R = RBA applied (see user's guide Section 5.10) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (see user's guide Section 5.13); s = concentration may exceed Csat (see user's guide Section 5.12)

| Toxicity and Chemical-specific Information | | | | | | | | | | | | | Contaminant | | Screening Levels | | | | | | | | | | | | Protection of Ground Water SSLs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFO (mg/kg-day)$^{-1}$ | key | IUR (ug/m$^3$)$^{-1}$ | key | $RfD_o$ (mg/kg-day) | key | $RfC_i$ (mg/m$^3$) | key | vol | mutagen | GIABS | ABS | $C_{sat}$ (mg/kg) | Analyte | CAS No. | Resident Soil (mg/kg) | key | Industrial Soil (mg/kg) | key | Resident Air (ug/m$^3$) | key | Industrial Air (ug/m$^3$) | key | Tapwater (ug/L) | key | MCL (ug/L) | Risk-based SSL (mg/kg) | key | MCL-based SSL (mg/kg) |
| 8.0E-01 | I | 2.2E-04 | I | | | | | | | 1 | 0.1 | | Diphenylhydrazine, 1,2- | 122-66-7 | 6.8E-01 | c | 2.9E+00 | c | 1.3E-02 | c | 5.6E-02 | c | 7.8E-02 | c | | 2.5E-04 | c | |
| | | | | 2.2E-03 | I | | | | | 1 | 0.1 | | Diquat | 85-00-7 | 1.4E+02 | n | 1.8E+03 | n | | | | | 4.4E+01 | n | 20 | 8.3E-01 | n | 3.7E-01 |
| 7.1E+00 | C | 1.4E-01 | C | | | | | | | 1 | 0.1 | | Direct Black 38 | 1937-37-7 | 7.6E-02 | c | 3.2E-01 | c | 2.0E-05 | c | 8.8E-05 | c | 1.1E-02 | c | | 5.3E+00 | c | |
| 7.4E+00 | C | 1.4E-01 | C | | | | | | | 1 | 0.1 | | Direct Blue 6 | 2602-46-2 | 7.3E-02 | c | 3.1E-01 | c | 2.0E-05 | c | 8.8E-05 | c | 1.1E-02 | c | | 1.7E+01 | c | |
| 6.7E+00 | C | 1.4E-01 | C | | | | | | | 1 | 0.1 | | Direct Brown 95 | 16071-86-6 | 8.1E-02 | c | 3.4E-01 | c | 2.0E-05 | c | 8.8E-05 | c | 1.2E-02 | c | | 1.6E-01 | c | |
| | | | | 4.0E-05 | I | | | | | 1 | 0.1 | | Disulfoton | 298-04-4 | 2.5E+00 | n | 3.3E+01 | n | | | | | 5.0E-01 | n | | 9.4E-04 | n | |
| | | | | 1.0E-02 | I | | | V | | 1 | | | Dithiane, 1,4- | 505-29-3 | 7.8E+02 | n | 1.2E+04 | n | | | | | 2.0E+02 | n | | 9.7E-02 | n | |
| | | | | 2.0E-03 | I | | | | | 1 | 0.1 | | Diuron | 330-54-1 | 1.3E+02 | n | 1.6E+03 | n | | | | | 3.6E+01 | n | | 1.5E-02 | n | |
| | | | | 2.0E-02 | O | | | | | 1 | 0.1 | | Dodine | 2439-10-3 | 1.3E+03 | n | 1.6E+04 | n | | | | | 4.0E+02 | n | | 2.1E+00 | n | |
| | | | | 5.0E-02 | O | | | V | | 1 | | | EPTC | 759-94-4 | 3.9E+03 | n | 5.8E+04 | n | | | | | 7.5E+02 | n | | 4.0E-01 | n | |
| | | | | 6.0E-03 | I | | | V | | 1 | | | Endosulfan | 115-29-7 | 4.7E+02 | n | 7.0E+03 | n | | | | | 1.0E+02 | n | | 1.4E+00 | n | |
| | | | | 2.0E-02 | I | | | | | 1 | 0.1 | | Endothall | 145-73-3 | 1.3E+03 | n | 1.6E+04 | n | | | | | 3.8E+02 | n | 100 | 9.1E-02 | n | 2.4E-02 |
| | | | | 3.0E-04 | I | | | | | 1 | 0.1 | | Endrin | 72-20-8 | 1.9E+01 | n | 2.5E+02 | n | | | | | 2.3E+00 | n | 2 | 9.2E-02 | n | 8.1E-02 |
| 9.9E-03 | I | 1.2E-06 | I | 6.0E-03 | P | 1.0E-03 | I | V | | 1 | | 1.05E+04 | Epichlorohydrin | 106-89-8 | 1.9E+01 | n | 8.2E+01 | n | 1.0E+00 | n | 4.4E+00 | n | 2.0E+00 | n | | 4.5E-04 | n | |
| | | | | | | 2.0E-02 | I | V | | 1 | | 1.53E+04 | Epoxybutane, 1,2- | 106-88-7 | 1.6E+02 | n | 6.7E+02 | n | 2.1E+01 | n | 8.8E+01 | n | 4.2E+01 | n | | 9.2E-03 | n | |
| | | | | 4.0E-02 | P | | | | | 1 | 0.1 | | Ethanol, 2-(2-methoxyethoxy)- | 111-77-3 | 2.5E+03 | n | 3.3E+04 | n | | | | | 8.0E+02 | n | | 1.6E-01 | n | |
| | | | | 5.0E-03 | I | | | | | 1 | 0.1 | | Ethephon | 16672-87-0 | 3.2E+02 | n | 4.1E+03 | n | | | | | 1.0E+02 | n | | 2.1E-02 | n | |
| | | | | 5.0E-04 | I | | | | | 1 | 0.1 | | Ethion | 563-12-2 | 3.2E+01 | n | 4.1E+02 | n | | | | | 4.3E+00 | n | | 8.5E-03 | n | |
| | | | | 1.0E-01 | P | 6.0E-02 | P | V | | 1 | | 2.38E+04 | Ethoxyethanol Acetate, 2- | 111-15-9 | 2.6E+03 | n | 1.4E+04 | n | 6.3E+01 | n | 2.6E+02 | n | 1.2E+02 | n | | 2.5E-02 | n | |
| | | | | 9.0E-02 | P | 2.0E-01 | I | V | | 1 | | 1.06E+05 | Ethoxyethanol, 2- | 110-80-5 | 5.2E+03 | n | 4.7E+04 | n | 2.1E+02 | n | 8.8E+02 | n | 3.4E+02 | n | | 6.8E-02 | n | |
| | | | | 9.0E-01 | I | 7.0E-02 | P | V | | 1 | | 1.08E+04 | Ethyl Acetate | 141-78-6 | 6.2E+02 | n | 2.6E+03 | n | 7.3E+01 | n | 3.1E+02 | n | 1.4E+02 | n | | 3.1E-02 | n | |
| | | | | 5.0E-03 | P | 8.0E-03 | P | V | | 1 | | 2.50E+03 | Ethyl Acrylate | 140-88-5 | 4.7E+01 | n | 2.1E+02 | n | 8.3E+00 | n | 3.5E+01 | n | 1.4E+01 | n | | 3.2E-03 | n | |
| | | | | | | 1.0E+01 | I | V | | 1 | | 2.12E+03 | Ethyl Chloride (Chloroethane) | 75-00-3 | 1.4E+04 | ns | 5.7E+04 | ns | 1.0E+04 | n | 4.4E+04 | n | 2.1E+04 | n | | 5.9E+00 | n | |
| | | | | 2.0E-01 | I | | | V | | 1 | | 1.01E+04 | Ethyl Ether | 60-29-7 | 1.6E+04 | ns | 2.3E+05 | nms | | | | | 3.9E+03 | n | | 8.8E-01 | n | |
| | | | | | | 3.0E-01 | P | V | | 1 | | 1.10E+03 | Ethyl Methacrylate | 97-63-2 | 1.8E+03 | ns | 7.6E+03 | ns | 3.1E+02 | n | 1.3E+03 | n | 6.3E+02 | n | | 1.5E-01 | n | |
| | | | | 1.0E-05 | I | | | | | 1 | 0.1 | | Ethyl-p-nitrophenyl Phosphonate | 2104-64-5 | 6.3E-01 | n | 8.2E+00 | n | | | | | 8.9E-02 | n | | 2.8E-03 | n | |
| 1.1E-02 | C | 2.5E-06 | C | 1.0E-01 | I | 1.0E+00 | I | V | | 1 | | 4.80E+02 | Ethylbenzene | 100-41-4 | 5.8E+00 | c | 2.5E+01 | c | 1.1E+00 | c | 4.9E+00 | c | 1.5E+00 | c | 700 | 1.7E-03 | c | 7.8E-01 |
| | | | | 7.0E-02 | P | | | | | 1 | 0.1 | | Ethylene Cyanohydrin | 109-78-4 | 4.4E+03 | n | 5.7E+04 | n | | | | | 1.4E+03 | n | | 2.8E-01 | n | |
| | | | | 9.0E-02 | P | | | V | | 1 | | 1.89E+05 | Ethylene Diamine | 107-15-3 | 7.0E+03 | n | 1.1E+05 | nm | | | | | 1.8E+03 | n | | 4.1E-01 | n | |
| | | | | 2.0E+00 | I | 4.0E-01 | C | | | 1 | 0.1 | | Ethylene Glycol | 107-21-1 | 1.3E+05 | nm | 1.6E+06 | nm | 4.2E+02 | n | 1.8E+03 | n | 4.0E+04 | n | | 8.1E+00 | n | |
| | | | | 1.0E-01 | I | 1.6E+00 | I | | | 1 | 0.1 | | Ethylene Glycol Monobutyl Ether | 111-76-2 | 6.3E+03 | n | 8.2E+04 | n | 1.7E+03 | n | 7.0E+03 | n | 2.0E+03 | n | | 4.1E-01 | n | |
| 3.1E-01 | C | 3.0E-03 | I | | | 3.0E-02 | C | V | M | 1 | | 1.21E+05 | Ethylene Oxide | 75-21-8 | 2.0E-03 | c | 2.5E-02 | c | 3.4E-04 | c | 4.1E-03 | c | 6.7E-04 | c | | 1.4E-07 | c | |
| 4.5E-02 | C | 1.3E-05 | C | 8.0E-05 | I | | | | | 1 | 0.1 | | Ethylene Thiourea | 96-45-7 | 5.1E+00 | n | 5.1E+01 | c** | 2.2E-01 | c | 9.4E-01 | c | 1.6E+00 | n | | 3.6E-04 | n | |
| 6.5E+01 | C | 1.9E-02 | C | | | | | V | | 1 | | 1.54E+05 | Ethyleneimine | 151-56-4 | 2.7E-03 | c | 1.2E-02 | c | 1.5E-04 | c | 6.5E-04 | c | 2.4E-04 | c | | 5.2E-08 | c | |
| | | | | 3.0E+00 | I | | | | | 1 | 0.1 | | Ethylphthalyl Ethyl Glycolate | 84-72-0 | 1.9E+05 | nm | 2.5E+06 | nm | | | | | 5.8E+04 | n | | 1.3E+02 | n | |
| | | | | 2.5E-04 | I | | | | | 1 | 0.1 | | Fenamiphos | 22224-92-6 | 1.6E+01 | n | 2.1E+02 | n | | | | | 4.4E+00 | n | | 4.3E-03 | n | |
| | | | | 2.5E-02 | I | | | | | 1 | 0.1 | | Fenpropathrin | 39515-41-8 | 1.6E+03 | n | 2.1E+04 | n | | | | | 6.4E+01 | n | | 2.9E+00 | n | |
| | | | | 2.5E-02 | I | | | | | 1 | 0.1 | | Fenvalerate | 51630-58-1 | 1.6E+03 | n | 2.1E+04 | n | | | | | 5.0E+02 | n | | 3.2E+02 | n | |
| | | | | 1.3E-02 | I | | | | | 1 | 0.1 | | Fluometuron | 2164-17-2 | 8.2E+02 | n | 1.1E+04 | n | | | | | 2.4E+02 | n | | 1.9E-01 | n | |
| | | | | 4.0E-02 | C | 1.3E-02 | C | | | 1 | | | Fluoride | 16984-48-8 | 3.1E+03 | n | 4.7E+04 | n | 1.4E+01 | n | 5.7E+01 | n | 8.0E+02 | n | 4000 | 1.2E+02 | n | 6.0E+02 |
| | | | | 6.0E-02 | I | 1.3E-02 | C | | | 1 | | | Fluorine (Soluble Fluoride) | 7782-41-4 | 4.7E+03 | n | 7.0E+04 | n | 1.4E+01 | n | 5.7E+01 | n | 1.2E+03 | n | 4000 | 1.8E+02 | n | 6.0E+02 |
| | | | | 8.0E-02 | I | | | | | 1 | 0.1 | | Fluridone | 59756-60-4 | 5.1E+03 | n | 6.6E+04 | n | | | | | 1.4E+03 | n | | 1.6E+02 | n | |
| | | | | 4.0E-02 | O | | | | | 1 | 0.1 | | Flurprimidol | 56425-91-3 | 2.5E+03 | n | 3.3E+04 | n | | | | | 6.9E+02 | n | | 3.1E+00 | n | |
| | | | | 2.0E-03 | O | | | | | 1 | 0.1 | | Flusilazole | 85509-19-9 | 1.3E+02 | n | 1.6E+03 | n | | | | | 3.1E+01 | n | | 5.1E+00 | n | |
| | | | | 5.0E-01 | O | | | | | 1 | 0.1 | | Flutolanil | 66332-96-5 | 3.2E+04 | n | 4.1E+05 | nm | | | | | 7.9E+03 | n | | 4.2E+01 | n | |
| | | | | 1.0E-02 | I | | | | | 1 | 0.1 | | Fluvalinate | 69409-94-5 | 6.3E+02 | n | 8.2E+03 | n | | | | | 2.0E+02 | n | | 2.9E+02 | n | |
| | | | | 9.0E-02 | O | | | | | 1 | 0.1 | | Folpet | 133-07-3 | 5.7E+03 | n | 7.4E+04 | n | | | | | 1.6E+03 | n | | 3.9E-01 | n | |
| | | | | 2.5E-03 | O | | | | | 1 | 0.1 | | Fomesafen | 72178-02-0 | 1.6E+02 | n | 2.1E+03 | n | | | | | 4.8E+01 | n | | 1.6E-01 | n | |
| | | | | 2.0E-03 | I | | | | | 1 | 0.1 | | Fonofos | 944-22-9 | 1.3E+02 | n | 1.6E+03 | n | | | | | 2.4E+01 | n | | 4.7E-02 | n | |
| | | 1.3E-05 | I | 2.0E-01 | I | 9.8E-03 | A | V | | 1 | | 4.24E+04 | Formaldehyde | 50-00-0 | 1.7E+01 | c* | 7.3E+01 | c* | 2.2E-01 | c* | 9.4E-01 | c* | 4.3E-01 | c* | | 8.7E-05 | c* | |
| | | | | 9.0E-01 | P | 3.0E-04 | X | V | | 1 | | 1.06E+05 | Formic Acid | 64-18-6 | 2.9E+01 | n | 1.2E+02 | n | 3.1E-01 | n | 1.3E+00 | n | 6.3E-01 | n | | 1.3E-04 | n | |
| | | | | 2.5E+00 | O | | | | | 1 | 0.1 | | Fosetyl-AL | 39148-24-8 | 1.6E+05 | nm | 2.1E+06 | nm | | | | | 5.0E+04 | n | | 6.6E+02 | n | |
| | | | | | | | | | | | | | Furans | | | | | | | | | | | | | | | | |
| | | | | 1.0E-03 | X | | | V | | 1 | 0.03 | | ~Dibenzofuran | 132-64-9 | 7.3E+01 | n | 1.0E+03 | n | | | | | 7.9E+00 | n | | 1.5E-01 | n | |
| | | | | 1.0E-03 | I | | | V | | 1 | 0.03 | 6.22E+03 | ~Furan | 110-00-9 | 7.3E+01 | n | 1.0E+03 | n | | | | | 1.9E+01 | n | | 7.3E-03 | n | |
| | | | | 9.0E-01 | I | 2.0E+00 | I | V | | 1 | 0.03 | 1.65E+05 | ~Tetrahydrofuran | 109-99-9 | 1.8E+04 | n | 9.4E+04 | n | 2.1E+03 | n | 8.8E+03 | n | 3.4E+03 | n | | 7.5E-01 | n | |
| 3.8E+00 | H | | | | | | | | | 1 | 0.1 | | Furazolidone | 67-45-8 | 1.4E-01 | c | 6.0E-01 | c | | | | | 2.0E-02 | c | | 3.9E-05 | c | |
| | | | | 3.0E-03 | I | 5.0E-02 | H | V | | 1 | | 1.01E+04 | Furfural | 98-01-1 | 2.1E+02 | n | 2.6E+03 | n | 5.2E+01 | n | 2.2E+02 | n | 3.8E+01 | n | | 8.1E-03 | n | |
| 1.5E+00 | C | 4.3E-04 | C | | | | | | | 1 | 0.1 | | Furium | 531-82-8 | 3.6E-01 | c | 1.5E+00 | c | 6.5E-03 | c | 2.9E-02 | c | 5.1E-02 | c | | 6.8E-05 | c | |
| 3.0E-02 | I | 8.6E-06 | C | | | | | | | 1 | 0.1 | | Furmecyclox | 60568-05-0 | 1.8E+01 | c | 7.7E+01 | c | 3.3E-01 | c | 1.4E+00 | c | 1.1E+00 | c | | 1.2E-03 | c | |
| | | | | 6.0E-03 | O | | | | | 1 | 0.1 | | Glufosinate, Ammonium | 77182-82-2 | 3.8E+02 | n | 4.9E+03 | n | | | | | 1.2E+02 | n | | 2.6E-02 | n | |
| | | | | 1.0E-01 | A | 8.0E-05 | C | | | 1 | 0.1 | | Glutaraldehyde | 111-30-8 | 6.0E+03 | n | 7.0E+04 | n | 8.3E-02 | n | 3.5E-01 | n | 2.0E+03 | n | | 4.0E-01 | n | |
| | | | | 4.0E-04 | I | 1.0E-03 | H | V | | 1 | | 1.06E+05 | Glycidyl | 765-34-4 | 2.3E+01 | n | 2.1E+02 | n | 1.0E+00 | n | 4.4E+00 | n | 1.7E+00 | n | | 3.3E-04 | n | |
| | | | | 1.0E-01 | I | | | | | 1 | 0.1 | | Glyphosate | 1071-83-6 | 6.3E+03 | n | 8.2E+04 | n | | | | | 2.0E+03 | n | 700 | 8.8E+00 | n | 3.1E+00 |
| | | | | 1.0E-02 | X | | | V | | 1 | | | Guanidine | 113-00-8 | 7.8E+02 | n | 1.2E+04 | n | | | | | 2.0E+02 | n | | 4.5E-02 | n | |
| | | | | 2.0E-02 | P | | | | | 1 | 0.1 | | Guanidine Chloride | 50-01-1 | 1.3E+03 | n | 1.6E+04 | n | | | | | 4.0E+02 | n | | | | |
| | | | | 3.0E-02 | X | | | | | 1 | 0.1 | | Guanidine Nitrate | 506-93-4 | 1.9E+03 | n | 2.5E+04 | n | | | | | 6.0E+02 | n | | 1.5E-01 | n | |
| | | | | 5.0E-05 | I | | | | | 1 | 0.1 | | Haloxyfop, Methyl | 69806-40-2 | 3.2E+00 | n | 4.1E+01 | n | | | | | 7.6E-01 | n | | 8.4E-03 | n | |
| 4.5E+00 | I | 1.3E-03 | I | 5.0E-04 | I | | | V | | 1 | | | Heptachlor | 76-44-8 | 1.3E-01 | c | 6.3E-01 | c | 2.2E-03 | c | 9.4E-03 | c | 1.4E-03 | c | 0.4 | 1.2E-04 | c | 3.3E-02 |
| 9.1E+00 | I | 2.6E-03 | I | 1.3E-05 | I | | | V | | 1 | | | Heptachlor Epoxide | 1024-57-3 | 7.0E-02 | c* | 3.3E-01 | c* | 1.1E-03 | c | 4.7E-03 | c | 1.4E-03 | c* | 0.2 | 2.8E-05 | c* | 4.1E-03 |
| | | | | | | 3.0E-03 | X | V | | 1 | | 2.09E+02 | Heptanal, n- | 111-71-7 | 2.4E+01 | n | 1.0E+02 | n | 3.1E+00 | n | 1.3E+01 | n | 6.3E+00 | n | | 1.4E-03 | n | |

TR=1E-06
THQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (see FQ #31); H = HEAST; F = See FAQ; W = see user guide Section 2.3.5; E = see user guide Section 2.3.6; L = see user's guide Section 5.2; M = mutagen; S = see user's guide Section 5; V = volatile; R = RBA applied (see user's guide Section 5.10) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (see user's guide Section 5.13); s = concentration may exceed Csat (see user's guide Section 5.12)

| Toxicity and Chemical-specific Information | | | | | | | | | | | | | Contaminant | | Screening Levels | | | | | | | | | | | Protection of Ground Water SSLs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFO (mg/kg-day)$^{-1}$ | key | IUR (ug/m$^3$)$^{-1}$ | key | $RfD_o$ (mg/kg-day) | key | $RfC_i$ (mg/m$^3$) | key | vol | muta gen | GIABS | ABS | $C_{sat}$ (mg/kg) | Analyte | CAS No. | Resident Soil (mg/kg) | key | Industrial Soil (mg/kg) | key | Resident Air (ug/m$^3$) | key | Industrial Air (ug/m$^3$) | key | Tapwater (ug/L) | key | MCL (ug/L) | Risk-based SSL (mg/kg) | key | MCL-based SSL (mg/kg) |
| | | | | 3.0E-04 | X | 4.0E-01 | P | V | | 1 | | 5.79E+01 | Heptane, N- | 142-82-5 | 2.2E+01 | n | 2.9E+02 | ns | 4.2E+02 | n | 1.8E+03 | n | 6.0E+00 | n | | 4.8E-02 | n | |
| | | | | 2.0E-03 | I | | | V | | 1 | | | Hexabromobenzene | 87-82-1 | 1.6E+02 | n | 2.3E+03 | n | | | | | 4.0E+01 | n | | 2.3E-01 | n | |
| | | | | 2.0E-04 | I | | | | | 1 | 0.1 | | Hexabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-153) | 68631-49-2 | 1.3E+01 | n | 1.6E+02 | n | | | | | 4.0E+00 | n | | | | |
| 1.6E+00 | I | 4.6E-04 | I | 8.0E-04 | I | | | V | | 1 | | | Hexachlorobenzene | 118-74-1 | 2.1E-01 | c | 9.6E-01 | c | 6.1E-03 | c | 2.7E-02 | c | 9.8E-03 | c | 1 | 1.2E-04 | c | 1.3E-02 |
| 7.8E-02 | I | 2.2E-05 | I | 1.0E-03 | P | | | V | | 1 | | 1.68E+01 | Hexachlorobutadiene | 87-68-3 | 1.2E+00 | c* | 5.3E+00 | c | 1.3E-01 | c | 5.6E-01 | c | 1.4E-01 | c* | | 2.7E-04 | c* | |
| 6.3E+00 | I | 1.8E-03 | I | 8.0E-03 | A | | | | | 1 | 0.1 | | Hexachlorocyclohexane, Alpha- | 319-84-6 | 8.6E-02 | c | 3.6E-01 | c | 1.6E-03 | c | 6.8E-03 | c | 7.2E-03 | c | | 4.2E-05 | c | |
| 1.8E+00 | I | 5.3E-04 | I | | | | | | | 1 | 0.1 | | Hexachlorocyclohexane, Beta- | 319-85-7 | 3.0E-01 | c | 1.3E+00 | c | 5.3E-03 | c | 2.3E-02 | c | 2.5E-02 | c | | 1.5E-04 | c | |
| 1.1E+00 | C | 3.1E-04 | C | 3.0E-04 | I | | | | | 1 | 0.04 | | Hexachlorocyclohexane, Gamma- (Lindane) | 58-89-9 | 5.7E-01 | c* | 2.5E+00 | c | 9.1E-03 | c | 4.0E-02 | c | 4.2E-02 | c* | 0.2 | 2.4E-04 | c* | 1.2E-03 |
| 1.8E+00 | I | 5.1E-04 | I | | | | | | | 1 | 0.1 | | Hexachlorocyclohexane, Technical | 608-73-1 | 3.0E-01 | c | 1.3E+00 | c | 5.5E-03 | c | 2.4E-02 | c | 2.5E-02 | c | | 1.5E-04 | c | |
| | | | | 6.0E-03 | I | 2.0E-04 | I | V | | 1 | | 1.57E+01 | Hexachlorocyclopentadiene | 77-47-4 | 1.8E+00 | n | 7.5E+00 | n | 2.1E-01 | n | 8.8E-01 | n | 4.1E-01 | n | 50 | 1.3E-03 | n | 1.6E-01 |
| 4.0E-02 | I | 1.1E-05 | C | 7.0E-04 | I | 3.0E-02 | I | V | | 1 | | | Hexachloroethane | 67-72-1 | 1.8E+00 | c* | 8.0E+00 | c* | 2.6E-01 | c | 1.1E+00 | c | 3.3E-01 | c* | | 2.0E-04 | c* | |
| | | | | 3.0E-04 | I | | | | | 1 | 0.1 | | Hexachlorophene | 70-30-4 | 1.9E+01 | n | 2.5E+02 | n | | | | | 6.0E+00 | n | | 8.0E+00 | n | |
| 8.0E-02 | I | | | 4.0E-03 | I | | | | | 1 | 0.015 | | Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) | 121-82-4 | 8.3E+00 | c* | 3.8E+01 | c | | | | | 9.7E-01 | c* | | 3.7E-04 | c* | |
| | | | | | | 1.0E-05 | I | V | | 1 | | 3.39E+03 | Hexamethylene Diisocyanate, 1,6- | 822-06-0 | 3.1E+00 | n | 1.3E+01 | n | 1.0E-02 | n | 4.4E-02 | n | 2.1E-02 | n | | 2.1E-04 | n | |
| | | | | 4.0E-04 | P | | | | | 1 | 0.1 | | Hexamethylphosphoramide | 680-31-9 | 2.5E+01 | n | 3.3E+02 | n | | | | | 8.0E+00 | n | | 1.8E-03 | n | |
| | | | | | | 7.0E-01 | I | V | | 1 | | 1.41E+02 | Hexane, N- | 110-54-3 | 6.1E+02 | ns | 2.5E+03 | ns | 7.3E+02 | n | 3.1E+03 | n | 1.5E+03 | n | | 1.0E+01 | n | |
| | | | | 2.0E+00 | P | | | | | 1 | 0.1 | | Hexanedioic Acid | 124-04-9 | 1.3E+05 | nm | 1.6E+06 | nm | | | | | 4.0E+04 | n | | 9.9E+00 | n | |
| | | | | 5.0E-03 | I | 3.0E-02 | I | V | | 1 | | 3.28E+03 | Hexanone, 2- | 591-78-6 | 2.0E+02 | n | 1.3E+03 | n | 3.1E+01 | n | 1.3E+02 | n | 3.8E+01 | n | | 8.8E-03 | n | |
| | | | | 3.3E-02 | I | | | | | 1 | 0.1 | | Hexazinone | 51235-04-2 | 2.1E+03 | n | 2.7E+04 | n | | | | | 6.4E+02 | n | | 3.0E-01 | n | |
| | | | | 2.5E-02 | I | | | | | 1 | 0.1 | | Hexythiazox | 78587-05-0 | 1.6E+03 | n | 2.1E+04 | n | | | | | 1.1E+02 | n | | 5.0E-01 | n | |
| | | | | 1.7E-02 | O | | | | | 1 | 0.1 | | Hydramethylnon | 67485-29-4 | 1.1E+03 | n | 1.4E+04 | n | | | | | 3.4E+02 | n | | 1.2E+05 | n | |
| 3.0E+00 | I | 4.9E-03 | I | | | 3.0E-05 | P | V | | 1 | | 1.12E+05 | Hydrazine | 302-01-2 | 3.2E-02 | c* | 1.4E-01 | c* | 5.7E-04 | c* | 2.5E-03 | c* | 1.1E-03 | c* | | 2.2E-07 | c* | |
| 3.0E+00 | I | 4.9E-03 | I | | | | | | | 1 | | | Hydrazine Sulfate | 10034-93-2 | 2.3E-01 | c | 1.1E+00 | c | 5.7E-04 | c | 2.5E-03 | c | 2.6E-02 | c | | | | |
| | | | | | | 2.0E-02 | I | V | | 1 | | | Hydrogen Chloride | 7647-01-0 | 2.8E+07 | nm | 1.2E+08 | nm | 2.1E+01 | n | 8.8E+01 | n | 4.2E+01 | n | | | | |
| | | | | 4.0E-02 | C | 1.4E-02 | C | V | | 1 | | | Hydrogen Fluoride | 7664-39-3 | 3.1E+03 | n | 4.7E+04 | n | 1.5E+01 | n | 6.1E+01 | n | 2.8E+01 | n | | | | |
| | | | | | | 2.0E-03 | I | V | | 1 | | | Hydrogen Sulfide | 7783-06-4 | 2.8E+06 | nm | 1.2E+07 | nm | 2.1E+00 | n | 8.8E+00 | n | 4.2E+00 | n | | | | |
| 6.0E-02 | P | | | 4.0E-02 | P | | | | | 1 | 0.1 | | Hydroquinone | 123-31-9 | 9.0E+00 | c | 3.8E+01 | c | | | | | 1.3E+00 | c | | 8.7E-04 | c | |
| 6.1E-02 | O | | | 2.5E-03 | O | | | | | 1 | 0.1 | | Imazalil | 35554-44-0 | 8.9E+00 | c* | 3.8E+01 | c* | | | | | 9.0E-01 | c* | | 1.5E-02 | c* | |
| | | | | 2.5E-01 | I | | | | | 1 | 0.1 | | Imazaquin | 81335-37-7 | 1.6E+04 | n | 2.1E+05 | nm | | | | | 4.9E+03 | n | | 2.4E+01 | n | |
| | | | | 2.5E+00 | O | | | | | 1 | 0.1 | | Imazethapyr | 81335-77-5 | 1.6E+05 | nm | 2.1E+06 | nm | | | | | 4.7E+04 | n | | 4.1E+01 | n | |
| | | | | 1.0E-02 | A | | | | | 1 | | | Iodine | 7553-56-2 | 7.8E+02 | n | 1.2E+04 | n | | | | | 2.0E+02 | n | | 1.2E+01 | n | |
| | | | | 4.0E-02 | I | | | | | 1 | 0.1 | | Iprodione | 36734-19-7 | 2.5E+03 | n | 3.3E+04 | n | | | | | 7.4E+02 | n | | 2.2E-01 | n | |
| | | | | 7.0E-01 | P | | | | | 1 | | | Iron | 7439-89-6 | 5.5E+04 | n | 8.2E+05 | nm | | | | | 1.4E+04 | n | | 3.5E+02 | n | |
| | | | | 3.0E-01 | I | | | V | | 1 | | 1.00E+04 | Isobutyl Alcohol | 78-83-1 | 2.3E+04 | ns | 3.5E+05 | nms | | | | | 5.9E+03 | n | | 1.2E+00 | n | |
| 9.5E-04 | I | | | 2.0E-01 | I | 2.0E+00 | C | | | 1 | 0.1 | | Isophorone | 78-59-1 | 5.7E+02 | c* | 2.4E+03 | c* | 2.1E+03 | n | 8.8E+03 | n | 7.8E+01 | c* | | 2.6E-02 | c* | |
| | | | | 1.5E-02 | I | | | V | | 1 | | | Isopropalin | 33820-53-0 | 1.2E+03 | n | 1.8E+04 | n | | | | | 4.0E+01 | n | | 9.2E-01 | n | |
| | | | | 2.0E+00 | P | 2.0E-01 | P | V | | 1 | | 1.09E+05 | Isopropanol | 67-63-0 | 5.6E+03 | n | 2.4E+04 | n | 2.1E+02 | n | 8.8E+02 | n | 4.1E+02 | n | | 8.4E-02 | n | |
| | | | | 1.0E-01 | I | | | | | 1 | 0.1 | | Isopropyl Methyl Phosphonic Acid | 1832-54-8 | 6.3E+03 | n | 8.2E+04 | n | | | | | 2.0E+03 | n | | 4.3E-01 | n | |
| | | | | 5.0E-02 | I | | | | | 1 | 0.1 | | Isoxaben | 82558-50-7 | 3.2E+03 | n | 4.1E+04 | n | | | | | 7.3E+02 | n | | 2.0E+00 | n | |
| | | | | | | 3.0E-01 | A | V | | 1 | | | JP-7 | E1737665 | 4.3E+08 | nm | 1.8E+09 | nm | 3.1E+02 | n | 1.3E+03 | n | 6.3E+02 | n | | | | |
| | | | | 8.0E-03 | O | | | | | 1 | 0.1 | | Lactofen | 77501-63-4 | 5.1E+02 | n | 6.6E+03 | n | | | | | 1.0E+02 | n | | 4.6E+00 | n | |
| | | | | 2.0E-04 | X | | | | | 1 | 0.1 | | Lactonitrile | 78-97-7 | 1.3E+01 | n | 1.6E+02 | n | | | | | 4.0E+00 | n | | 8.1E-04 | n | |
| | | | | 5.0E-05 | P | | | | | 1 | | | Lanthanum | 7439-91-0 | 3.9E+00 | n | 5.8E+01 | n | | | | | 1.0E+00 | n | | | | |
| | | | | 2.1E-05 | P | | | | | 1 | 0.1 | | Lanthanum Acetate Hydrate | 100587-90-4 | 1.3E+00 | n | 1.7E+01 | n | | | | | 4.2E-01 | n | | | | |
| | | | | 1.9E-05 | P | | | | | 1 | | | Lanthanum Chloride Heptahydrate | 10025-84-0 | 1.5E+00 | n | 2.2E+01 | n | | | | | 3.7E-01 | n | | | | |
| | | | | 2.8E-05 | P | | | | | 1 | | | Lanthanum Chloride, Anhydrous | 10099-58-8 | 2.2E+00 | n | 3.3E+01 | n | | | | | 5.7E-01 | n | | | | |
| | | | | 1.6E-05 | P | | | | | 1 | | | Lanthanum Nitrate Hexahydrate | 10277-43-7 | 1.3E+00 | n | 1.9E+01 | n | | | | | 3.2E-01 | n | | | | |
| | | | | | | | | | | | | | Lead Compounds | | | | | | | | | | | | | | | |
| 8.5E-03 | C | 1.2E-05 | C | | | | | | | 1 | | | ~Lead Phosphate | 7446-27-7 | 8.2E+01 | c | 3.8E+02 | c | 2.3E-01 | c | 1.0E+00 | c | 9.1E+00 | c | | | | |
| 8.5E-03 | C | 1.2E-05 | C | | | | | | | 1 | 0.1 | | ~Lead acetate | 301-04-2 | 6.4E+01 | c | 2.7E+02 | c | 2.3E-01 | c | 1.0E+00 | c | 9.2E+00 | c | | 1.8E-03 | c | |
| | | | | | | | | | | 1 | | | ~Lead and Compounds | 7439-92-1 | 4.0E+02 | L | 8.0E+02 | n | 1.5E-01 | n | | | 1.5E+01 | n | 15 | | n | 1.4E+01 |
| 8.5E-03 | C | 1.2E-05 | C | | | | | | | 1 | 0.1 | | ~Lead subacetate | 1335-32-6 | 6.4E+01 | c | 2.7E+02 | c | 2.3E-01 | c | 1.0E+00 | c | 9.2E+00 | c | | 2.0E-03 | c | |
| | | | | 1.0E-07 | I | | | V | | 1 | | 2.43E+00 | ~Tetraethyl Lead | 78-00-2 | 7.8E-03 | n | 1.2E-01 | n | | | | | 1.3E-03 | n | | 4.7E-06 | n | |
| | | | | 5.0E-06 | P | | | V | | 1 | | 3.83E+02 | Lewisite | 541-25-3 | 3.9E-01 | n | 5.8E+00 | n | | | | | 9.0E-02 | n | | 3.8E-05 | n | |
| | | | | 7.7E-03 | O | | | | | 1 | 0.1 | | Linuron | 330-55-2 | 4.9E+02 | n | 6.3E+03 | n | | | | | 1.3E+02 | n | | 1.1E-01 | n | |
| | | | | 2.0E-03 | P | | | | | 1 | | | Lithium | 7439-93-2 | 1.6E+02 | n | 2.3E+03 | n | | | | | 4.0E+01 | n | | 1.2E+01 | n | |
| | | | | 5.0E-04 | I | | | | | 1 | 0.1 | | MCPA | 94-74-6 | 3.2E+01 | n | 4.1E+02 | n | | | | | 7.5E+00 | n | | 2.0E-03 | n | |
| | | | | 4.4E-03 | O | | | | | 1 | 0.1 | | MCPB | 94-81-5 | 2.8E+02 | n | 3.6E+03 | n | | | | | 6.5E+01 | n | | 2.6E-02 | n | |
| | | | | 1.0E-03 | I | | | | | 1 | 0.1 | | MCPP | 93-65-2 | 6.3E+01 | n | 8.2E+02 | n | | | | | 1.6E+01 | n | | 4.7E-03 | n | |
| | | | | 2.0E-02 | I | | | | | 1 | 0.1 | | Malathion | 121-75-5 | 1.3E+03 | n | 1.6E+04 | n | | | | | 3.9E+02 | n | | 1.0E-01 | n | |
| | | | | 1.0E-01 | I | 7.0E-04 | C | | | 1 | 0.1 | | Maleic Anhydride | 108-31-6 | 6.3E+03 | n | 8.0E+04 | n | 7.3E-01 | n | 3.1E+00 | n | 1.9E+03 | n | | 3.8E-01 | n | |
| | | | | 5.0E-01 | I | | | | | 1 | 0.1 | | Maleic Hydrazide | 123-33-1 | 3.2E+04 | n | 4.1E+05 | nm | | | | | 1.0E+04 | n | | 2.1E+00 | n | |
| | | | | 1.0E-04 | P | | | | | 1 | 0.1 | | Malononitrile | 109-77-3 | 6.3E+00 | n | 8.2E+01 | n | | | | | 2.0E+00 | n | | 4.1E-04 | n | |
| | | | | 3.0E-02 | H | | | | | 1 | 0.1 | | Mancozeb | 8018-01-7 | 1.9E+03 | n | 2.5E+04 | n | | | | | 5.4E+02 | n | | 7.6E-01 | n | |
| | | | | 5.0E-03 | I | | | | | 1 | 0.1 | | Maneb | 12427-38-2 | 3.2E+02 | n | 4.1E+03 | n | | | | | 9.8E+01 | n | | 1.4E-01 | n | |
| | | | | 1.4E-01 | I | 5.0E-05 | I | | | 1 | | | Manganese (Diet) | 7439-96-5 | | | | | | | | | | | | | | |
| | | | | 2.4E-02 | S | 5.0E-05 | I | | | 0.04 | | | Manganese (Non-diet) | 7439-96-5 | 1.8E+03 | n | 2.6E+04 | n | 5.2E-02 | n | 2.2E-01 | n | 4.3E+02 | n | | 2.8E+01 | n | |
| | | | | 9.0E-05 | H | | | | | 1 | 0.1 | | Mephosfolan | 950-10-7 | 5.7E+00 | n | 7.4E+01 | n | | | | | 1.8E+00 | n | | 2.6E-03 | n | |
| | | | | 3.0E-02 | I | | | | | 1 | 0.1 | | Mepiquat Chloride | 24307-26-4 | 1.9E+03 | n | 2.5E+04 | n | | | | | 6.0E+02 | n | | 2.0E-01 | n | |
| 1.1E-02 | P | | | 4.0E-03 | P | | | | | 1 | 0.1 | | Mercaptobenzothiazole, 2- | 149-30-4 | 4.9E+01 | c** | 2.1E+02 | c* | | | | | 6.3E+00 | c* | | 1.8E-02 | c* | |
| | | | | | | | | | | | | | Mercury Compounds | | | | | | | | | | | | | | | |

TR=1E-06
THQ=1

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (see FQ #31); H = HEAST; F = See FAQ; W = see user guide Section 2.3.5; E = see user guide Section 2.3.6; L = see user's guide Section 5.2; M = mutagen; S = see user's guide Section 5; V = volatile; R = RBA applied (see user's guide Section 5.10) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (see user's guide Section 5.13); s = concentration may exceed Csat (see user's guide Section 5.12)

| Toxicity and Chemical-specific Information | | | | | | | | | | | | | Contaminant | | Screening Levels | | | | | | | | | | | | Protection of Ground Water SSLs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFO (mg/kg-day)$^{-1}$ | key | IUR (ug/m$^3$)$^{-1}$ | key | $RfD_o$ (mg/kg-day) | key | $RfC_i$ (mg/m$^3$) | key | vol | muta gen | GIABS | ABS | $C_{sat}$ (mg/kg) | Analyte | CAS No. | Resident Soil (mg/kg) | key | Industrial Soil (mg/kg) | key | Resident Air (ug/m$^3$) | key | Industrial Air (ug/m$^3$) | key | Tapwater (ug/L) | key | MCL (ug/L) | | Risk-based SSL (mg/kg) | key | MCL-based SSL (mg/kg) |
| | | | | 3.0E-04 | I | 3.0E-04 | S | | | 0.07 | | | ~Mercuric Chloride (and other Mercury salts) | 7487-94-7 | 2.3E+01 | n | 3.5E+02 | n | 3.1E-01 | n | 1.3E+00 | n | 5.7E+00 | n | 2 | | | | |
| | | | | | | 3.0E-04 | I | V | | 1 | | 3.13E+00 | ~Mercury (elemental) | 7439-97-6 | 1.1E+01 | ns | 4.6E+01 | ns | 3.1E-01 | n | 1.3E+00 | n | 6.3E-01 | n | 2 | | 3.3E-02 | n | 1.0E-01 |
| | | | | 1.0E-04 | I | | | | | 1 | | | ~Methyl Mercury | 22967-92-6 | 7.8E+00 | n | 1.2E+02 | n | | | | | 2.0E+00 | n | | | 1.4E+01 | n | |
| | | | | 8.0E-05 | I | | | | | 1 | 0.1 | | ~Phenylmercuric Acetate | 62-38-4 | 5.1E+00 | n | 6.6E+01 | n | | | | | 1.6E+00 | n | | | 5.0E-04 | n | |
| | | | | 3.0E-05 | I | | | V | | 1 | | | Merphos | 150-50-5 | 2.3E+00 | n | 3.5E+01 | n | | | | | 6.0E-01 | n | | | 5.9E-02 | n | |
| | | | | 1.0E-04 | O | | | | | 1 | 0.1 | | Merphos Oxide | 78-48-8 | 6.3E+00 | n | 8.2E+01 | n | | | | | 2.8E-01 | n | | | 1.4E-03 | n | |
| | | | | 6.0E-02 | I | | | | | 1 | 0.1 | | Metalaxyl | 57837-19-1 | 3.8E+03 | n | 4.9E+04 | n | | | | | 1.2E+03 | n | | | 3.3E-01 | n | |
| | | | | 1.0E-04 | I | 3.0E-02 | P | V | | 1 | | 4.58E+03 | Methacrylonitrile | 126-98-7 | 7.5E+00 | n | 1.0E+02 | n | 3.1E+01 | n | 1.3E+02 | n | 1.9E+00 | n | | | 4.3E-04 | n | |
| | | | | 5.0E-05 | I | | | | | 1 | 0.1 | | Methamidophos | 10265-92-6 | 3.2E+00 | n | 4.1E+01 | n | | | | | 1.0E+00 | n | | | 2.1E-04 | n | |
| | | | | 2.0E+00 | I | 2.0E+01 | I | V | | 1 | | 1.06E+05 | Methanol | 67-56-1 | 1.2E+05 | nms | 1.2E+06 | nms | 2.1E+04 | n | 8.8E+04 | n | 2.0E+04 | n | | | 4.1E+00 | n | |
| | | | | 1.5E-03 | O | | | | | 1 | 0.1 | | Methidathion | 950-37-8 | 9.5E+01 | n | 1.2E+03 | n | | | | | 2.9E+01 | n | | | 7.1E-03 | n | |
| | | | | 2.5E-02 | I | | | | | 1 | 0.1 | | Methomyl | 16752-77-5 | 1.6E+03 | n | 2.1E+04 | n | | | | | 5.0E+02 | n | | | 1.1E-01 | n | |
| 4.9E-02 | C | 1.4E-05 | C | | | | | | | 1 | 0.1 | | Methoxy-5-nitroaniline, 2- | 99-59-2 | 1.1E+01 | c | 4.7E+01 | c | 2.0E-01 | c | 8.8E-01 | c | 1.5E+00 | c | | | 5.3E-04 | c | |
| | | | | 5.0E-03 | I | | | | | 1 | 0.1 | | Methoxychlor | 72-43-5 | 3.2E+02 | n | 4.1E+03 | n | | | | | 3.7E+01 | n | 40 | | 2.0E+00 | n | 2.2E+00 |
| | | | | 8.0E-03 | P | 1.0E-03 | P | V | | 1 | | 1.15E+05 | Methoxyethanol Acetate, 2- | 110-49-6 | 1.1E+02 | n | 5.1E+02 | n | 1.0E+00 | n | 4.4E+00 | n | 2.1E+00 | n | | | 4.2E-04 | n | |
| | | | | 5.0E-03 | P | 2.0E-02 | I | V | | 1 | | 1.06E+05 | Methoxyethanol, 2- | 109-86-4 | 3.3E+02 | n | 3.5E+03 | n | 2.1E+01 | n | 8.8E+01 | n | 2.9E+01 | n | | | 5.9E-03 | n | |
| | | | | 1.0E+00 | X | | | V | | 1 | | 2.90E+04 | Methyl Acetate | 79-20-9 | 7.8E+04 | ns | 1.2E+06 | nms | | | | | 2.0E+04 | n | | | 4.1E+00 | n | |
| | | | | | | 2.0E-02 | P | V | | 1 | | 6.75E+03 | Methyl Acrylate | 96-33-3 | 1.5E+02 | n | 6.1E+02 | n | 2.1E+01 | n | 8.8E+01 | n | 4.2E+01 | n | | | 8.9E-03 | n | |
| | | | | 6.0E-01 | I | 5.0E+00 | I | V | | 1 | | 2.84E+04 | Methyl Ethyl Ketone (2-Butanone) | 78-93-3 | 2.7E+04 | n | 1.9E+05 | nms | 5.2E+03 | n | 2.2E+04 | n | 5.6E+03 | n | | | 1.2E+00 | n | |
| | | 1.0E-03 | X | 1.0E-03 | P | 2.0E-05 | X | V | | 1 | | 1.80E+05 | Methyl Hydrazine | 60-34-4 | 1.4E-01 | c** | 6.2E-01 | c** | 2.8E-03 | c** | 1.2E-02 | c** | 5.6E-03 | c** | | | 1.3E-06 | c** | |
| | | | | | | 3.0E+00 | I | V | | 1 | | 3.36E+03 | Methyl Isobutyl Ketone (4-methyl-2-pentanone) | 108-10-1 | 3.3E+04 | ns | 1.4E+05 | nms | 3.1E+03 | n | 1.3E+04 | n | 6.3E+03 | n | | | 1.4E+00 | n | |
| | | | | | | 1.0E-03 | C | V | | 1 | | 1.01E+04 | Methyl Isocyanate | 624-83-9 | 4.6E+00 | n | 1.9E+01 | n | 1.0E+00 | n | 4.4E+00 | n | 2.1E+00 | n | | | 5.9E-04 | n | |
| | | | | 1.4E+00 | I | 7.0E-01 | I | V | | 1 | | 2.36E+03 | Methyl Methacrylate | 80-62-6 | 4.4E+03 | ns | 1.9E+04 | ns | 7.3E+02 | n | 3.1E+03 | n | 1.4E+03 | n | | | 3.0E-01 | n | |
| | | | | 2.5E-04 | I | | | | | 1 | 0.1 | | Methyl Parathion | 298-00-0 | 1.6E+01 | n | 2.1E+02 | n | | | | | 4.5E+00 | n | | | 7.4E-03 | n | |
| | | | | 6.0E-02 | X | | | | | 1 | 0.1 | | Methyl Phosphonic Acid | 993-13-5 | 3.8E+03 | n | 4.9E+04 | n | | | | | 1.2E+03 | n | | | 2.4E-01 | n | |
| | | | | 6.0E-03 | H | 4.0E-02 | H | V | | 1 | | 3.93E+02 | Methyl Styrene (Mixed Isomers) | 25013-15-4 | 3.2E+02 | n | 2.6E+03 | ns | 4.2E+01 | n | 1.8E+02 | n | 2.3E+01 | n | | | 3.8E-02 | n | |
| 9.9E-02 | C | 2.8E-05 | C | | | | | | | 1 | 0.1 | | Methyl methanesulfonate | 66-27-3 | 5.5E+00 | c | 2.3E+01 | c | 1.0E-01 | c | 4.4E-01 | c | 7.9E-01 | c | | | 1.6E-04 | c | |
| 1.8E-03 | C | 2.6E-07 | C | | | 3.0E+00 | I | V | | 1 | | 8.87E+03 | Methyl tert-Butyl Ether (MTBE) | 1634-04-4 | 4.7E+01 | c | 2.1E+02 | c | 1.1E+01 | c | 4.7E+01 | c | 1.4E+01 | c | | | 3.2E-03 | c | |
| | | | | 3.0E-04 | X | | | | | 1 | 0.1 | | Methyl-1,4-benzenediamine dihydrochloride, 2- | 615-45-2 | 1.9E+01 | n | 2.5E+02 | n | | | | | 6.0E+00 | n | | | 3.6E-03 | n | |
| | | | | | | 3.0E+00 | X | V | | 1 | | 2.45E+03 | Methyl-2-Pentanol, 4- | 108-11-2 | 5.4E+04 | ns | 2.3E+05 | nms | 3.1E+03 | n | 1.3E+04 | n | 6.3E+03 | n | | | 1.4E+00 | n | |
| 9.0E-03 | P | | | 2.0E-02 | X | | | | | 1 | 0.1 | | Methyl-5-Nitroaniline, 2- | 99-55-8 | 6.0E+01 | c* | 2.6E+02 | c* | | | | | 8.2E+00 | c* | | | 4.6E-03 | c* | |
| 8.3E+00 | C | 2.4E-03 | C | | | | | | | 1 | 0.1 | | Methyl-N-nitro-N-nitrosoguanidine, N- | 70-25-7 | 6.5E-02 | c | 2.8E-01 | c | 1.2E-03 | c | 5.1E-03 | c | 9.4E-03 | c | | | 3.2E-06 | c | |
| 1.3E-01 | C | 3.7E-05 | C | | | | | | | 1 | 0.1 | | Methylaniline Hydrochloride, 2- | 636-21-5 | 4.2E+00 | c | 1.8E+01 | c | 7.6E-02 | c | 3.3E-01 | c | 6.0E-01 | c | | | 2.6E-04 | c | |
| | | | | 1.0E-02 | A | | | | | 1 | 0.1 | | Methylarsonic acid | 124-58-3 | 6.3E+02 | n | 8.2E+03 | n | | | | | 2.0E+02 | n | | | 5.8E-02 | n | |
| | | | | 2.0E-04 | X | | | | | 1 | 0.1 | | Methylbenzene,1-4-diamine monohydrochloride, 2- | 74612-12-7 | 1.3E+01 | n | 1.6E+02 | n | | | | | 4.0E+00 | n | | | | | |
| 1.0E-01 | X | | | 3.0E-04 | X | | | | | 1 | 0.1 | | Methylbenzene-1,4-diamine sulfate, 2- | 615-50-9 | 5.4E+00 | c** | 2.3E+01 | c* | | | | | 7.8E-01 | c** | | | | | |
| 2.2E+01 | C | 6.3E-03 | C | | | | | | M | 1 | 0.1 | | Methylcholanthrene, 3- | 56-49-5 | 5.5E-03 | c | 1.0E-01 | c | 1.6E-04 | c | 1.9E-03 | c | 1.1E-03 | c | | | 2.2E-03 | c | |
| 2.0E-03 | I | 1.0E-08 | I | 6.0E-03 | I | 6.0E-01 | I | V | M | 1 | | 3.32E+03 | Methylene Chloride | 75-09-2 | 5.7E+01 | c** | 1.0E+03 | c** | 1.0E+02 | c** | 1.2E+03 | c** | 1.1E+01 | c** | 5 | | 2.9E-03 | c** | 1.3E-03 |
| 1.0E-01 | P | 4.3E-04 | C | 2.0E-03 | P | | | | M | 1 | 0.1 | | Methylene-bis(2-chloroaniline), 4,4'- | 101-14-4 | 1.2E+00 | c | 2.3E+01 | c* | 2.4E-03 | c | 2.9E-02 | c | 1.6E-01 | c | | | 1.8E-03 | c | |
| 4.6E-02 | I | 1.3E-05 | C | | | | | | | 1 | 0.1 | | Methylene-bis(N,N-dimethyl) Aniline, 4,4'- | 101-61-1 | 1.2E+01 | c | 5.0E+01 | c | 2.2E-01 | c | 9.4E-01 | c | 4.8E-01 | c | | | 2.6E-03 | c | |
| 1.6E+00 | C | 4.6E-04 | C | | | 2.0E-02 | C | | | 1 | 0.1 | | Methylenebisbenzenamine, 4,4'- | 101-77-9 | 3.4E-01 | c | 1.4E+00 | c | 6.1E-03 | c | 2.7E-02 | c | 4.7E-02 | c | | | 2.1E-04 | c | |
| | | | | | | 6.0E-04 | I | | | 1 | 0.1 | | Methylenediphenyl Diisocyanate | 101-68-8 | 8.5E+05 | nm | 3.6E+06 | nm | 6.3E-01 | n | 2.6E+00 | n | | | | | | | |
| | | | | 7.0E-02 | H | | | V | | 1 | | 5.00E+02 | Methylstyrene, Alpha- | 98-83-9 | 5.5E+03 | ns | 8.2E+04 | ns | | | | | 7.8E+02 | n | | | 1.2E+00 | n | |
| | | | | 1.5E-01 | I | | | | | 1 | 0.1 | | Metolachlor | 51218-45-2 | 9.5E+03 | n | 1.2E+05 | nm | | | | | 2.7E+03 | n | | | 3.2E+00 | n | |
| | | | | 2.5E-02 | I | | | | | 1 | 0.1 | | Metribuzin | 21087-64-9 | 1.6E+03 | n | 2.1E+04 | n | | | | | 4.9E+02 | n | | | 1.5E-01 | n | |
| | | | | 2.5E-01 | I | | | | | 1 | 0.1 | | Metsulfuron-methyl | 74223-64-6 | 1.6E+04 | n | 2.1E+05 | nm | | | | | 4.9E+03 | n | | | 1.9E+00 | n | |
| | | | | 3.0E+00 | P | | | V | | 1 | | 3.42E-01 | Mineral oils | 8012-95-1 | 2.3E+05 | nms | 3.5E+06 | nms | | | | | 6.0E+04 | n | | | 2.4E+03 | n | |
| 1.8E+01 | C | 5.1E-03 | C | 2.0E-04 | I | | | V | | 1 | | | Mirex | 2385-85-5 | 3.6E-02 | c | 1.7E-01 | c | 5.5E-04 | c | 2.4E-03 | c | 8.8E-04 | c | | | 6.3E-04 | c | |
| | | | | 2.0E-03 | I | | | | | 1 | 0.1 | | Molinate | 2212-67-1 | 1.3E+02 | n | 1.6E+03 | n | | | | | 3.0E+01 | n | | | 1.7E-02 | n | |
| | | | | 5.0E-03 | I | | | | | 1 | | | Molybdenum | 7439-98-7 | 3.9E+02 | n | 5.8E+03 | n | | | | | 1.0E+02 | n | | | 2.0E+00 | n | |
| | | | | 1.0E-01 | I | | | | | 1 | | | Monochloramine | 10599-90-3 | 7.8E+03 | n | 1.2E+05 | nm | | | | | 2.0E+03 | n | 4000 | | | | |
| | | | | 2.0E-03 | P | | | | | 1 | 0.1 | | Monomethylaniline | 100-61-8 | 1.3E+02 | n | 1.6E+03 | n | | | | | 3.8E+01 | n | | | 1.4E-02 | n | |
| | | | | 2.5E-02 | I | | | | | 1 | 0.1 | | Myclobutanil | 88671-89-0 | 1.6E+03 | n | 2.1E+04 | n | | | | | 4.5E+02 | n | | | 5.6E+00 | n | |
| | | | | 3.0E-04 | X | | | | | 1 | 0.1 | | N,N'-Diphenyl-1,4-benzenediamine | 74-31-7 | 1.9E+01 | n | 2.5E+02 | n | | | | | 3.6E+00 | n | | | 3.7E-01 | n | |
| | | | | 2.0E-03 | I | | | V | | 1 | | | Naled | 300-76-5 | 1.6E+02 | n | 2.3E+03 | n | | | | | 4.0E+01 | n | | | 1.8E-02 | n | |
| | | | | 3.0E-02 | X | 1.0E-01 | P | V | | 1 | | | Naphtha, High Flash Aromatic (HFAN) | 64742-95-6 | 2.3E+03 | n | 3.5E+04 | n | 1.0E+02 | n | 4.4E+02 | n | 1.5E+02 | n | | | | | |
| 1.8E+00 | C | 0.0E+00 | C | | | | | | | 1 | 0.1 | | Naphthylamine, 2- | 91-59-8 | 3.0E-01 | c | 1.3E+00 | c | | | | | 3.9E-02 | c | | | 2.0E-04 | c | |
| | | | | 1.2E-01 | O | | | | | 1 | 0.1 | | Napropamide | 15299-99-7 | 7.6E+03 | n | 9.8E+04 | n | | | | | 2.0E+03 | n | | | 1.3E+01 | n | |
| | | 2.6E-04 | C | 1.1E-02 | C | 1.4E-05 | C | | | 1 | 0.1 | | Nickel Acetate | 373-02-4 | 6.7E+02 | n | 8.1E+03 | n | 1.1E-02 | c** | 4.7E-02 | c** | 2.2E+02 | n | | | 4.5E-02 | n | |
| | | 2.6E-04 | C | 1.1E-02 | C | 1.4E-05 | C | | | 1 | 0.1 | | Nickel Carbonate | 3333-67-3 | 6.7E+02 | n | 8.1E+03 | n | 1.1E-02 | c** | 4.7E-02 | c** | 2.2E+02 | n | | | | | |
| | | 2.6E-04 | C | 1.1E-02 | C | 1.4E-05 | C | V | | 1 | | | Nickel Carbonyl | 13463-39-3 | 8.2E+02 | n | 1.1E+04 | n | 1.1E-02 | c** | 4.7E-02 | c** | 2.2E-02 | c** | | | | | |
| | | 2.6E-04 | C | 1.1E-02 | C | 1.4E-05 | C | | | 0.04 | | | Nickel Hydroxide | 12054-48-7 | 8.2E+02 | n | 1.1E+04 | n | 1.1E-02 | c** | 4.7E-02 | c** | 2.0E+02 | n | | | | | |
| | | 2.6E-04 | C | 1.1E-02 | C | 2.0E-05 | C | | | 0.04 | | | Nickel Oxide | 1313-99-1 | 8.4E+02 | n | 1.2E+04 | n | 1.1E-02 | c** | 4.7E-02 | c** | 2.0E+02 | n | | | | | |
| | | 2.4E-04 | I | 1.1E-02 | C | 1.4E-05 | C | | | 0.04 | | | Nickel Refinery Dust | E715532 | 8.2E+02 | n | 1.1E+04 | n | 1.2E-02 | c** | 5.1E-02 | c** | 2.2E+02 | n | | | 3.2E+01 | n | |
| | | 2.6E-04 | C | 2.0E-02 | I | 9.0E-05 | A | | | 0.04 | | | Nickel Soluble Salts | 7440-02-0 | 1.5E+03 | n | 2.2E+04 | n | 1.1E-02 | c** | 4.7E-02 | c** | 3.9E+02 | n | | | 2.6E+01 | n | |
| 1.7E+00 | C | 4.8E-04 | I | 1.1E-02 | C | 1.4E-05 | C | | | 0.04 | | | Nickel Subsulfide | 12035-72-2 | 4.1E-01 | c | 1.9E+00 | c | 5.8E-03 | c** | 2.6E-02 | c** | 4.5E-02 | c | | | | | |
| | | 2.6E-04 | C | 1.1E-02 | C | 1.4E-05 | C | | | 1 | 0.1 | | Nickelocene | 1271-28-9 | 6.7E+02 | n | 8.1E+03 | n | 1.1E-02 | c** | 4.7E-02 | c** | 2.2E+02 | n | | | | | |
| | | | | 1.6E+00 | I | | | | | 1 | | | Nitrate | 14797-55-8 | 1.3E+05 | nm | 1.9E+06 | nm | | | | | 3.2E+04 | n | 10000 | | | | |
| | | | | | | | | | | 1 | | | Nitrate + Nitrite (as N) | E701177 | | | | | | | | | | | 10000 | | | | |
| | | | | 1.0E-01 | I | | | | | 1 | | | Nitrite | 14797-65-0 | 7.8E+03 | n | 1.2E+05 | nm | | | | | 2.0E+03 | n | 1000 | | | | |
| | | | | 1.0E-02 | X | 5.0E-05 | X | | | 1 | 0.1 | | Nitroaniline, 2- | 88-74-4 | 6.3E+02 | n | 8.0E+03 | n | 5.2E-02 | n | 2.2E-01 | n | 1.9E+02 | n | | | 8.0E-02 | n | |

TR=1E-06
THQ=1.0

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (see FQ #31); H = HEAST; F = See FAQ; W = see user guide Section 2.3.5; E = see user guide Section 2.3.6; L = see user's guide Section 5.2; M = mutagen; S = see user's guide Section 5; V = volatile; R = RBA applied (see user's guide Section 5.10) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (see user's guide Section 5.13); s = concentration may exceed Csat (see user's guide Section 5.12)

| Toxicity and Chemical-specific Information | | | | | | | | | | | | | Contaminant | | Screening Levels | | | | | | | | | | | Protection of Ground Water SSLs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFO (mg/kg-day)$^{-1}$ | key | IUR (ug/m$^3$)$^{-1}$ | key | $RfD_o$ (mg/kg-day) | key | $RfC_i$ (mg/m$^3$) | key | vol | muta gen | GIABS | ABS | $C_{sat}$ (mg/kg) | Analyte | CAS No. | Resident Soil (mg/kg) | key | Industrial Soil (mg/kg) | key | Resident Air (ug/m$^3$) | key | Industrial Air (ug/m$^3$) | key | Tapwater (ug/L) | key | MCL (ug/L) | Risk-based SSL (mg/kg) | key | MCL-based SSL (mg/kg) |
| 2.0E-02 | P | | | 4.0E-03 | P | 6.0E-03 | P | | | 1 | 0.1 | | Nitroaniline, 4- | 100-01-6 | 2.7E+01 | c** | 1.1E+02 | c* | 6.3E+00 | n | 2.6E+01 | n | 3.8E+00 | c* | | 1.6E-03 | c* | |
| | | 4.0E-05 | I | 2.0E-03 | I | 9.0E-03 | I | V | | 1 | | 3.05E+03 | Nitrobenzene | 98-95-3 | 5.1E+00 | c* | 2.2E+01 | c* | 7.0E-02 | c | 3.1E-01 | c | 1.4E-01 | c* | | 9.2E-05 | c* | |
| | | | | 3.0E+03 | P | | | | | 1 | 0.1 | | Nitrocellulose | 9004-70-0 | 1.9E+08 | nm | 2.5E+09 | nm | | | | | 6.0E+07 | n | | 1.3E+04 | n | |
| | | | | 7.0E-02 | H | | | | | 1 | 0.1 | | Nitrofurantoin | 67-20-9 | 4.4E+03 | n | 5.7E+04 | n | | | | | 1.4E+03 | n | | 6.1E-01 | n | |
| 1.3E+00 | C | 3.7E-04 | C | | | | | | | 1 | 0.1 | | Nitrofurazone | 59-87-0 | 4.2E-01 | c | 1.8E+00 | c | 7.6E-03 | c | 3.3E-02 | c | 6.0E-02 | c | | 5.4E-05 | c | |
| 1.7E-02 | P | | | 1.0E-04 | P | | | | | 1 | 0.1 | | Nitroglycerin | 55-63-0 | 6.3E+00 | n | 8.2E+01 | n | | | | | 2.0E+00 | n | | 8.5E-04 | n | |
| | | | | 1.0E-01 | I | | | | | 1 | 0.1 | | Nitroguanidine | 556-88-7 | 6.3E+03 | n | 8.2E+04 | n | | | | | 2.0E+03 | n | | 4.8E-01 | n | |
| | | 8.8E-06 | P | | | 5.0E-03 | P | V | | 1 | | 1.80E+04 | Nitromethane | 75-52-5 | 5.4E+00 | c* | 2.4E+01 | c* | 3.2E-01 | c* | 1.4E+00 | c* | 6.4E-01 | c* | | 1.4E-04 | c* | |
| | | 2.7E-03 | H | | | 2.0E-02 | I | V | | 1 | | 4.86E+03 | Nitropropane, 2- | 79-46-9 | 1.4E-02 | c | 6.0E-02 | c | 1.0E-03 | c | 4.5E-03 | c | 2.1E-03 | c | | 5.4E-07 | c | |
| 2.7E+01 | C | 7.7E-03 | C | | | | | | M | 1 | 0.1 | | Nitroso-N-ethylurea, N- | 759-73-9 | 4.5E-03 | c | 8.5E-02 | c | 1.3E-04 | c | 1.6E-03 | c | 9.2E-04 | c | | 2.2E-07 | c | |
| 1.2E+02 | C | 3.4E-02 | C | | | | | | M | 1 | 0.1 | | Nitroso-N-methylurea, N- | 684-93-5 | 1.0E-03 | c | 1.9E-02 | c | 3.0E-05 | c | 3.6E-04 | c | 2.1E-04 | c | | 4.6E-08 | c | |
| 5.4E+00 | I | 1.6E-03 | I | | | | | V | | 1 | | | Nitroso-di-N-butylamine, N- | 924-16-3 | 9.9E-02 | c | 4.6E-01 | c | 1.8E-03 | c | 7.7E-03 | c | 2.7E-03 | c | | 5.5E-06 | c | |
| 7.0E+00 | I | 2.0E-03 | C | | | | | | | 1 | 0.1 | | Nitroso-di-N-propylamine, N- | 621-64-7 | 7.8E-02 | c | 3.3E-01 | c | 1.4E-03 | c | 6.1E-03 | c | 1.1E-02 | c | | 8.1E-06 | c | |
| 2.8E+00 | I | 8.0E-04 | C | | | | | | | 1 | 0.1 | | Nitrosodiethanolamine, N- | 1116-54-7 | 1.9E-01 | c | 8.2E-01 | c | 3.5E-03 | c | 1.5E-02 | c | 2.8E-02 | c | | 5.6E-06 | c | |
| 1.5E+02 | I | 4.3E-02 | I | | | | | | M | 1 | 0.1 | | Nitrosodiethylamine, N- | 55-18-5 | 8.1E-04 | c | 1.5E-02 | c | 2.4E-05 | c | 2.9E-04 | c | 1.7E-04 | c | | 6.1E-08 | c | |
| 5.1E+01 | I | 1.4E-02 | I | 8.0E-06 | P | 4.0E-05 | X | V | M | 1 | | 2.37E+05 | Nitrosodimethylamine, N- | 62-75-9 | 2.0E-03 | c | 3.4E-02 | c | 7.2E-05 | c | 8.8E-04 | c | 1.1E-04 | c | | 2.7E-08 | c | |
| 4.9E-03 | I | 2.6E-06 | C | | | | | | | 1 | 0.1 | | Nitrosodiphenylamine, N- | 86-30-6 | 1.1E+02 | c | 4.7E+02 | c | 1.1E+00 | c | 4.7E+00 | c | 1.2E+01 | c | | 6.7E-02 | c | |
| 2.2E+01 | I | 6.3E-03 | C | | | | | V | | 1 | | 1.08E+05 | Nitrosomethylethylamine, N- | 10595-95-6 | 2.0E-02 | c | 9.1E-02 | c | 4.5E-04 | c | 1.9E-03 | c | 7.1E-04 | c | | 2.0E-07 | c | |
| 6.7E+00 | C | 1.9E-03 | C | | | | | | | 1 | 0.1 | | Nitrosomorpholine [N-] | 59-89-2 | 8.1E-02 | c | 3.4E-01 | c | 1.5E-03 | c | 6.5E-03 | c | 1.2E-02 | c | | 2.8E-06 | c | |
| 9.4E+00 | C | 2.7E-03 | C | | | | | | | 1 | 0.1 | | Nitrosopiperidine [N-] | 100-75-4 | 5.8E-02 | c | 2.4E-01 | c | 1.0E-03 | c | 4.5E-03 | c | 8.2E-03 | c | | 4.4E-06 | c | |
| 2.1E+00 | I | 6.1E-04 | I | | | | | | | 1 | 0.1 | | Nitrosopyrrolidine, N- | 930-55-2 | 2.6E-01 | c | 1.1E+00 | c | 4.6E-03 | c | 2.0E-02 | c | 3.7E-02 | c | | 1.4E-05 | c | |
| | | | | 1.0E-04 | X | | | | | 1 | 0.1 | | Nitrotoluene, m- | 99-08-1 | 6.3E+00 | n | 8.2E+01 | n | | | | | 1.7E+00 | n | | 1.6E-03 | n | |
| 2.2E-01 | P | | | 9.0E-04 | P | | | V | | 1 | | 1.51E+03 | Nitrotoluene, o- | 88-72-2 | 3.2E+00 | c* | 1.5E+01 | c* | | | | | 3.1E-01 | c* | | 3.0E-04 | c* | |
| 1.6E-02 | P | | | 4.0E-03 | P | | | | | 1 | 0.1 | | Nitrotoluene, p- | 99-99-0 | 3.4E+01 | c** | 1.4E+02 | c* | | | | | 4.3E+00 | c* | | 4.0E-03 | c* | |
| | | | | 3.0E-04 | X | 2.0E-02 | P | V | | 1 | | 6.86E+00 | Nonane, n- | 111-84-2 | 1.1E+01 | ns | 7.2E+01 | ns | 2.1E+01 | n | 8.8E+01 | n | 5.3E+00 | n | | 7.5E-02 | n | |
| | | | | 1.5E-02 | O | | | | | 1 | 0.1 | | Norflurazon | 27314-13-2 | 9.5E+02 | n | 1.2E+04 | n | | | | | 2.9E+02 | n | | 1.9E+00 | n | |
| | | | | 3.0E-03 | I | | | | | 1 | 0.1 | | Octabromodiphenyl Ether | 32536-52-0 | 1.9E+02 | n | 2.5E+03 | n | | | | | 6.0E+01 | n | | 1.2E+01 | n | |
| | | | | 5.0E-02 | I | | | | | 1 | 0.006 | | Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) | 2691-41-0 | 3.9E+03 | n | 5.7E+04 | n | | | | | 1.0E+03 | n | | 1.3E+00 | n | |
| | | | | 2.0E-03 | H | | | | | 1 | 0.1 | | Octamethylpyrophosphoramide | 152-16-9 | 1.3E+02 | n | 1.6E+03 | n | | | | | 4.0E+01 | n | | 9.6E-03 | n | |
| 7.8E-03 | O | | | 1.4E-01 | O | | | | | 1 | 0.1 | | Oryzalin | 19044-88-3 | 7.0E+01 | c | 2.9E+02 | c | | | | | 7.9E+00 | c | | 1.5E-02 | c | |
| | | | | 5.0E-03 | I | | | | | 1 | 0.1 | | Oxadiazon | 19666-30-9 | 3.2E+02 | n | 4.1E+03 | n | | | | | 4.7E+01 | n | | 4.8E-01 | n | |
| | | | | 2.5E-02 | I | | | | | 1 | 0.1 | | Oxamyl | 23135-22-0 | 1.6E+03 | n | 2.1E+04 | n | | | | | 5.0E+02 | n | 200 | 1.1E-01 | n | 4.4E-02 |
| 7.3E-02 | O | | | 3.0E-02 | O | | | | | 1 | 0.1 | | Oxyfluorfen | 42874-03-3 | 7.4E+00 | c | 3.1E+01 | c | | | | | 5.4E-01 | c | | 4.3E-02 | c | |
| | | | | 1.3E-02 | I | | | | | 1 | 0.1 | | Paclobutrazol | 76738-62-0 | 8.2E+02 | n | 1.1E+04 | n | | | | | 2.3E+02 | n | | 4.6E-01 | n | |
| | | | | 4.5E-03 | I | | | | | 1 | 0.1 | | Paraquat Dichloride | 1910-42-5 | 2.8E+02 | n | 3.7E+03 | n | | | | | 9.0E+01 | n | | 1.2E+00 | n | |
| | | | | 6.0E-03 | H | | | | | 1 | 0.1 | | Parathion | 56-38-2 | 3.8E+02 | n | 4.9E+03 | n | | | | | 8.6E+01 | n | | 4.3E-01 | n | |
| | | | | 5.0E-02 | H | | | V | | 1 | | | Pebulate | 1114-71-2 | 3.9E+03 | n | 5.8E+04 | n | | | | | 5.6E+02 | n | | 4.5E-01 | n | |
| | | | | 3.0E-01 | O | | | | | 1 | 0.1 | | Pendimethalin | 40487-42-1 | 1.9E+04 | n | 2.5E+05 | nm | | | | | 1.4E+03 | n | | 1.6E+01 | n | |
| | | | | 2.0E-03 | I | | | V | | 1 | | 3.12E-01 | Pentabromodiphenyl Ether | 32534-81-9 | 1.6E+02 | ns | 2.3E+03 | ns | | | | | 4.0E+01 | n | | 1.7E+00 | n | |
| | | | | 1.0E-04 | I | | | | | 1 | 0.1 | | Pentabromodiphenyl ether, 2,2',4,4',5- (BDE-99) | 60348-60-9 | 6.3E+00 | n | 8.2E+01 | n | | | | | 2.0E+00 | n | | 8.7E-02 | n | |
| | | | | 8.0E-04 | I | | | V | | 1 | | | Pentachlorobenzene | 608-93-5 | 6.3E+01 | n | 9.3E+02 | n | | | | | 3.2E+00 | n | | 2.4E-02 | n | |
| 9.0E-02 | P | | | | | | | V | | 1 | | 4.57E+02 | Pentachloroethane | 76-01-7 | 7.7E+00 | c | 3.6E+01 | c | | | | | 6.5E-01 | c | | 3.1E-04 | c | |
| 2.6E-01 | H | | | 3.0E-03 | I | | | V | | 1 | | | Pentachloronitrobenzene | 82-68-8 | 2.7E+00 | c* | 1.3E+01 | c | | | | | 1.2E-01 | c | | 1.5E-03 | c | |
| 4.0E-01 | I | 5.1E-06 | C | 5.0E-03 | I | | | | | 1 | 0.25 | | Pentachlorophenol | 87-86-5 | 1.0E+00 | c | 4.0E+00 | c | 5.5E-01 | c | 2.4E+00 | c | 4.1E-02 | c | 1 | 5.7E-05 | c | 1.4E-03 |
| 4.0E-03 | X | | | 2.0E-03 | P | | | | | 1 | 0.1 | | Pentaerythritol tetranitrate (PETN) | 78-11-5 | 1.3E+02 | n | 5.7E+02 | c** | | | | | 1.9E+01 | c** | | 2.8E-02 | c** | |
| | | | | | | 1.0E+00 | P | V | | 1 | | 3.88E+02 | Pentane, n- | 109-66-0 | 8.1E+02 | ns | 3.4E+03 | ns | 1.0E+03 | n | 4.4E+03 | n | 2.1E+03 | n | | 1.0E+01 | n | |
| | | | | | | | | | | | | | Perchlorates | | | | | | | | | | | | | | | |
| | | | | 7.0E-04 | I | | | | | 1 | | | ~Ammonium Perchlorate | 7790-98-9 | 5.5E+01 | n | 8.2E+02 | n | | | | | 1.4E+01 | n | | | | |
| | | | | 7.0E-04 | I | | | | | 1 | | | ~Lithium Perchlorate | 7791-03-9 | 5.5E+01 | n | 8.2E+02 | n | | | | | 1.4E+01 | n | | | | |
| | | | | 7.0E-04 | I | | | | | 1 | | | ~Perchlorate and Perchlorate Salts | 14797-73-0 | 5.5E+01 | n | 8.2E+02 | n | | | | | 1.4E+01 | n | 15.0(F) | | | |
| | | | | 7.0E-04 | I | | | | | 1 | | | ~Potassium Perchlorate | 7778-74-7 | 5.5E+01 | n | 8.2E+02 | n | | | | | 1.4E+01 | n | | | | |
| | | | | 7.0E-04 | I | | | | | 1 | | | ~Sodium Perchlorate | 7601-89-0 | 5.5E+01 | n | 8.2E+02 | n | | | | | 1.4E+01 | n | | | | |
| | | | | 2.0E-02 | P | | | | | 1 | 0.1 | | Perfluorobutane sulfonic acid (PFBS) | 375-73-5 | 1.3E+03 | n | 1.6E+04 | n | | | | | 4.0E+02 | n | | 1.3E-01 | n | |
| | | | | 2.0E-02 | P | | | | | 1 | 0.1 | | Perfluorobutanesulfonate | 45187-15-3 | 1.3E+03 | n | 1.6E+04 | n | | | | | 4.0E+02 | n | | 1.3E-01 | n | |
| | | | | 5.0E-02 | I | | | | | 1 | 0.1 | | Permethrin | 52645-53-1 | 3.2E+03 | n | 4.1E+04 | n | | | | | 1.0E+03 | n | | 2.4E+02 | n | |
| 2.2E-03 | C | 6.3E-07 | C | | | | | | | 1 | 0.1 | | Phenacetin | 62-44-2 | 2.5E+02 | c | 1.0E+03 | c | 4.5E+00 | c | 1.9E+01 | c | 3.4E+01 | c | | 9.7E-03 | c | |
| | | | | 2.4E-01 | O | | | | | 1 | 0.1 | | Phenmedipham | 13684-63-4 | 1.5E+04 | n | 2.0E+05 | nm | | | | | 3.8E+03 | n | | 2.1E+01 | n | |
| | | | | 3.0E-01 | I | 2.0E-01 | C | | | 1 | 0.1 | | Phenol | 108-95-2 | 1.9E+04 | n | 2.5E+05 | nm | 2.1E+02 | n | 8.8E+02 | n | 5.8E+03 | n | | 3.3E+00 | n | |
| | | | | 4.0E-03 | I | | | | | 1 | 0.1 | | Phenol, 2-(1-methylethoxy)-, methylcarbamate | 114-26-1 | 2.5E+02 | n | 3.3E+03 | n | | | | | 7.8E+01 | n | | 2.5E-02 | n | |
| | | | | 5.0E-04 | X | | | | | 1 | 0.1 | | Phenothiazine | 92-84-2 | 3.2E+01 | n | 4.1E+02 | n | | | | | 4.3E+00 | n | | 1.4E-02 | n | |
| | | | | 2.0E-04 | X | | | V | | 1 | | 1.29E+02 | Phenyl Isothiocyanate | 103-72-0 | 1.6E+01 | n | 2.3E+02 | ns | | | | | 2.6E+00 | n | | 1.7E-03 | n | |
| | | | | 6.0E-03 | I | | | | | 1 | 0.1 | | Phenylenediamine, m- | 108-45-2 | 3.8E+02 | n | 4.9E+03 | n | | | | | 1.2E+02 | n | | 3.2E-02 | n | |
| 1.2E-01 | P | | | 4.0E-03 | P | | | | | 1 | 0.1 | | Phenylenediamine, o- | 95-54-5 | 4.5E+00 | c* | 1.9E+01 | c | | | | | 6.5E-01 | c | | 1.7E-04 | c | |
| | | | | 1.0E-03 | X | | | | | 1 | 0.1 | | Phenylenediamine, p- | 106-50-3 | 6.3E+01 | n | 8.2E+02 | n | | | | | 2.0E+01 | n | | 5.4E-03 | n | |
| 1.9E-03 | H | | | | | | | | | 1 | 0.1 | | Phenylphenol, 2- | 90-43-7 | 2.8E+02 | c | 1.2E+03 | c | | | | | 3.0E+01 | c | | 4.1E-01 | c | |
| | | | | 2.0E-04 | H | | | | | 1 | 0.1 | | Phorate | 298-02-2 | 1.3E+01 | n | 1.6E+02 | n | | | | | 3.0E+00 | n | | 3.4E-03 | n | |
| | | | | | | 3.0E-04 | I | V | | 1 | | 1.61E+03 | Phosgene | 75-44-5 | 3.1E-01 | n | 1.3E+00 | n | 3.1E-01 | n | 1.3E+00 | n | 6.3E-01 | n | | 1.6E-04 | n | |
| | | | | 2.0E-02 | I | | | | | 1 | 0.1 | | Phosmet | 732-11-6 | 1.3E+03 | n | 1.6E+04 | n | | | | | 3.7E+02 | n | | 8.2E-02 | n | |
| | | | | | | | | | | | | | Phosphates, Inorganic | | | | | | | | | | | | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Aluminum metaphosphate | 13776-88-0 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Ammonium polyphosphate | 68333-79-9 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |

TR=1E-06
HQ=1

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (see FQ #31); H = HEAST; F = See FAQ; W = see user guide Section 2.3.5; E = see user guide Section 2.3.6; L = see user's guide Section 5.2; M = mutagen; S = see user's guide Section 5; V = volatile; R = RBA applied (see user's guide Section 5.10) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (see user's guide Section 5.13); s = concentration may exceed Csat (see user's guide Section 5.12)

| Toxicity and Chemical-specific Information | | | | | | | | | | | | Contaminant | | Screening Levels | | | | | | | | | | | Protection of Ground Water SSLs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFO (mg/kg-day)$^{-1}$ | key | IUR (ug/m$^3$)$^{-1}$ | key | $RfD_o$ (mg/kg-day) | key | $RfC_i$ (mg/m$^3$) | key | vol | mutagen | GIABS | ABS | $C_{sat}$ (mg/kg) | Analyte | CAS No. | Resident Soil (mg/kg) | key | Industrial Soil (mg/kg) | key | Resident Air (ug/m$^3$) | key | Industrial Air (ug/m$^3$) | key | Tapwater (ug/L) | key | MCL (ug/L) | Risk-based SSL (mg/kg) | key | MCL-based SSL (mg/kg) |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Calcium pyrophosphate | 7790-76-3 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Diammonium phosphate | 7783-28-0 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Dicalcium phosphate | 7757-93-9 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Dimagnesium phosphate | 7782-75-4 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Dipotassium phosphate | 7758-11-4 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Disodium phosphate | 7558-79-4 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Monoaluminum phosphate | 13530-50-2 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Monoammonium phosphate | 7722-76-1 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Monocalcium phosphate | 7758-23-8 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Monomagnesium phosphate | 7757-86-0 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Monopotassium phosphate | 7778-77-0 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Monosodium phosphate | 7558-80-7 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Polyphosphoric acid | 8017-16-1 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Potassium tripolyphosphate | 13845-36-8 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Sodium acid pyrophosphate | 7758-16-9 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Sodium aluminum phosphate (acidic) | 7785-88-8 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Sodium aluminum phosphate (anhydrous) | 10279-59-1 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Sodium aluminum phosphate (tetrahydrate) | 10305-76-7 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Sodium hexametaphosphate | 10124-56-8 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Sodium polyphosphate | 68915-31-1 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Sodium trimetaphosphate | 7785-84-4 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Sodium tripolyphosphate | 7758-29-4 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Tetrapotassium phosphate | 7320-34-5 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Tetrasodium pyrophosphate | 7722-88-5 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Trialuminum sodium tetra decahydrogenoctaorthophosphate (dihydrate) | 15136-87-5 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Tricalcium phosphate | 7758-87-4 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Trimagnesium phosphate | 7757-87-1 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Tripotassium phosphate | 7778-53-2 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 4.9E+01 | P | | | | | 1 | | | ~Trisodium phosphate | 7601-54-9 | 3.8E+06 | nm | 5.7E+07 | nm | | | | | 9.7E+05 | n | | | | |
| | | | | 3.0E-04 | I | 3.0E-04 | I | V | | 1 | | | Phosphine | 7803-51-2 | 2.3E+01 | n | 3.5E+02 | n | 3.1E-01 | n | 1.3E+00 | n | 5.7E-01 | n | | | | |
| | | | | 4.9E+01 | P | 1.0E-02 | I | | | 1 | | | Phosphoric Acid | 7664-38-2 | 3.0E+06 | nm | 2.9E+07 | nm | 1.0E+01 | n | 4.4E+01 | n | 9.7E+05 | n | | | | |
| | | | | 2.0E-05 | I | | | V | | 1 | | | Phosphorus, White | 7723-14-0 | 1.6E+00 | n | 2.3E+01 | n | | | | | 4.0E-01 | n | | 1.5E-03 | n | |
| | | | | | | | | | | | | | Phthalates | | | | | | | | | | | | | | | |
| 1.4E-02 | I | 2.4E-06 | C | 2.0E-02 | I | | | | | 1 | 0.1 | | ~Bis(2-ethylhexyl)phthalate | 117-81-7 | 3.9E+01 | c* | 1.6E+02 | c | 1.2E+00 | c | 5.1E+00 | c | 5.6E+00 | c* | 6 | 1.3E+00 | c* | 1.4E+00 |
| 1.9E-03 | P | | | 2.0E-01 | I | | | | | 1 | 0.1 | | ~Butyl Benzyl Phthalate | 85-68-7 | 2.9E+02 | c* | 1.2E+03 | c | | | | | 1.6E+01 | c | | 2.4E-01 | c | |
| | | | | 1.0E+00 | I | | | | | 1 | 0.1 | | ~Butylphthalyl Butylglycolate | 85-70-1 | 6.3E+04 | n | 8.2E+05 | nm | | | | | 1.3E+04 | n | | 3.1E+02 | n | |
| | | | | 1.0E-01 | I | | | | | 1 | 0.1 | | ~Dibutyl Phthalate | 84-74-2 | 6.3E+03 | n | 8.2E+04 | n | | | | | 9.0E+02 | n | | 2.3E+00 | n | |
| | | | | 8.0E-01 | I | | | | | 1 | 0.1 | | ~Diethyl Phthalate | 84-66-2 | 5.1E+04 | n | 6.6E+05 | nm | | | | | 1.5E+04 | n | | 6.1E+00 | n | |
| | | | | 1.0E-01 | I | | | V | | 1 | | | ~Dimethylterephthalate | 120-61-6 | 7.8E+03 | n | 1.2E+05 | nm | | | | | 1.9E+03 | n | | 4.9E-01 | n | |
| | | | | 1.0E-02 | P | | | | | 1 | 0.1 | | ~Octyl Phthalate, di-N- | 117-84-0 | 6.3E+02 | n | 8.2E+03 | n | | | | | 2.0E+02 | n | | 5.7E+01 | n | |
| | | | | 1.0E+00 | H | | | | | 1 | 0.1 | | ~Phthalic Acid, P- | 100-21-0 | 6.3E+04 | n | 8.2E+05 | nm | | | | | 1.9E+04 | n | | 6.8E+00 | n | |
| | | | | 2.0E+00 | I | 2.0E-02 | C | | | 1 | 0.1 | | ~Phthalic Anhydride | 85-44-9 | 1.3E+05 | nm | 1.6E+06 | nm | 2.1E+01 | n | 8.8E+01 | n | 3.9E+04 | n | | 8.5E+00 | n | |
| | | | | 7.0E-02 | I | | | | | 1 | 0.1 | | Picloram | 1918-02-1 | 4.4E+03 | n | 5.7E+04 | n | | | | | 1.4E+03 | n | 500 | 3.8E-01 | n | 1.4E-01 |
| | | | | 1.0E-04 | X | | | | | 1 | 0.1 | | Picramic Acid (2-Amino-4,6-dinitrophenol) | 96-91-3 | 6.3E+00 | n | 8.2E+01 | n | | | | | 2.0E+00 | n | | 1.3E-03 | n | |
| | | | | 9.0E-04 | X | | | | | 1 | 0.1 | | Picric Acid (2,4,6-Trinitrophenol) | 88-89-1 | 5.7E+01 | n | 7.4E+02 | n | | | | | 1.8E+01 | n | | 8.4E-02 | n | |
| | | | | 7.0E-05 | O | | | | | 1 | 0.1 | | Pirimiphos, Methyl | 29232-93-7 | 4.4E+00 | n | 5.7E+01 | n | | | | | 8.5E-01 | n | | 8.1E-04 | n | |
| 3.0E+01 | C | 8.6E-03 | C | 7.0E-06 | H | | | | | 1 | 0.1 | | Polybrominated Biphenyls | 59536-65-1 | 1.8E-02 | c* | 7.7E-02 | c* | 3.3E-04 | c | 1.4E-03 | c | 2.6E-03 | c* | | | | |
| | | | | | | | | | | | | | Polychlorinated Biphenyls (PCBs) | | | | | | | | | | | | | | | |
| 7.0E-02 | S | 2.0E-05 | S | 7.0E-05 | I | | | V | | 1 | 0.14 | | ~Aroclor 1016 | 12674-11-2 | 4.1E+00 | n | 2.7E+01 | c** | 1.4E-01 | c | 6.1E-01 | c | 2.2E-01 | c** | | 2.1E-02 | c** | |
| 2.0E+00 | S | 5.7E-04 | S | | | | | V | | 1 | 0.14 | | ~Aroclor 1221 | 11104-28-2 | 2.0E-01 | c | 8.3E-01 | c | 4.9E-03 | c | 2.1E-02 | c | 4.7E-03 | c | | 8.0E-05 | c | |
| 2.0E+00 | S | 5.7E-04 | S | | | | | V | | 1 | 0.14 | | ~Aroclor 1232 | 11141-16-5 | 1.7E-01 | c | 7.2E-01 | c | 4.9E-03 | c | 2.1E-02 | c | 4.7E-03 | c | | 8.0E-05 | c | |
| 2.0E+00 | S | 5.7E-04 | S | | | | | V | | 1 | 0.14 | | ~Aroclor 1242 | 53469-21-9 | 2.3E-01 | c | 9.5E-01 | c | 4.9E-03 | c | 2.1E-02 | c | 7.8E-03 | c | | 1.2E-03 | c | |
| 2.0E+00 | S | 5.7E-04 | S | | | | | V | | 1 | 0.14 | | ~Aroclor 1248 | 12672-29-6 | 2.3E-01 | c | 9.5E-01 | c | 4.9E-03 | c | 2.1E-02 | c | 7.8E-03 | c | | 1.2E-03 | c | |
| 2.0E+00 | S | 5.7E-04 | S | 2.0E-05 | I | | | V | | 1 | 0.14 | | ~Aroclor 1254 | 11097-69-1 | 2.4E-01 | c** | 9.7E-01 | c* | 4.9E-03 | c | 2.1E-02 | c | 7.8E-03 | c* | | 2.0E-03 | c* | |
| 2.0E+00 | S | 5.7E-04 | S | | | | | V | | 1 | 0.14 | | ~Aroclor 1260 | 11096-82-5 | 2.4E-01 | c | 9.9E-01 | c | 4.9E-03 | c | 2.1E-02 | c | 7.8E-03 | c | | 5.5E-03 | c | |
| | | | | 6.0E-04 | X | | | V | | 1 | 0.14 | | ~Aroclor 5460 | 11126-42-4 | 3.5E+01 | n | 4.4E+02 | n | | | | | 1.2E+01 | n | | 2.0E+00 | n | |
| 3.9E+00 | W | 1.1E-03 | W | 2.3E-05 | W | 1.3E-03 | W | V | | 1 | 0.14 | | ~Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189) | 39635-31-9 | 1.3E-01 | c* | 5.2E-01 | c* | 2.5E-03 | c | 1.1E-02 | c | 4.0E-03 | c | | 2.8E-03 | c | |
| 3.9E+00 | W | 1.1E-03 | W | 2.3E-05 | W | 1.3E-03 | W | V | | 1 | 0.14 | | ~Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167) | 52663-72-6 | 1.2E-01 | c* | 5.1E-01 | c* | 2.5E-03 | c | 1.1E-02 | c | 4.0E-03 | c | | 1.7E-03 | c | |
| 3.9E+00 | W | 1.1E-03 | W | 2.3E-05 | W | 1.3E-03 | W | V | | 1 | 0.14 | | ~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157) | 69782-90-7 | 1.2E-01 | c* | 5.0E-01 | c* | 2.5E-03 | c | 1.1E-02 | c | 4.0E-03 | c | | 1.7E-03 | c | |
| 3.9E+00 | W | 1.1E-03 | W | 2.3E-05 | W | 1.3E-03 | W | V | | 1 | 0.14 | | ~Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156) | 38380-08-4 | 1.2E-01 | c* | 5.0E-01 | c* | 2.5E-03 | c | 1.1E-02 | c | 4.0E-03 | c | | 1.7E-03 | c | |
| 3.9E+03 | W | 1.1E+00 | W | 2.3E-08 | W | 1.3E-06 | W | V | | 1 | 0.14 | | ~Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169) | 32774-16-6 | 1.2E-04 | c* | 5.1E-04 | c* | 2.5E-06 | c | 1.1E-05 | c | 4.0E-06 | c | | 1.7E-06 | c | |
| 3.9E+00 | W | 1.1E-03 | W | 2.3E-05 | W | 1.3E-03 | W | V | | 1 | 0.14 | | ~Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123) | 65510-44-3 | 1.2E-01 | c* | 4.9E-01 | c* | 2.5E-03 | c | 1.1E-02 | c | 4.0E-03 | c | | 1.0E-03 | c | |
| 3.9E+00 | W | 1.1E-03 | W | 2.3E-05 | W | 1.3E-03 | W | V | | 1 | 0.14 | | ~Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118) | 31508-00-6 | 1.2E-01 | c* | 4.9E-01 | c* | 2.5E-03 | c | 1.1E-02 | c | 4.0E-03 | c | | 1.0E-03 | c | |
| 3.9E+00 | W | 1.1E-03 | W | 2.3E-05 | W | 1.3E-03 | W | V | | 1 | 0.14 | | ~Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105) | 32598-14-4 | 1.2E-01 | c* | 4.9E-01 | c* | 2.5E-03 | c | 1.1E-02 | c | 4.0E-03 | c | | 1.0E-03 | c | |
| 3.9E+00 | W | 1.1E-03 | W | 2.3E-05 | W | 1.3E-03 | W | V | | 1 | 0.14 | | ~Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114) | 74472-37-0 | 1.2E-01 | c* | 5.0E-01 | c* | 2.5E-03 | c | 1.1E-02 | c | 4.0E-03 | c | | 1.0E-03 | c | |
| 1.3E+04 | W | 3.8E+00 | W | 7.0E-09 | W | 4.0E-07 | W | V | | 1 | 0.14 | | ~Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126) | 57465-28-8 | 3.6E-05 | c* | 1.5E-04 | c* | 7.4E-07 | c | 3.2E-06 | c | 1.2E-06 | c | | 3.0E-07 | c | |
| 2.0E+00 | I | 5.7E-04 | I | | | | | V | | 1 | 0.14 | | ~Polychlorinated Biphenyls (high risk) | 1336-36-3 | 2.3E-01 | c | 9.4E-01 | c | 4.9E-03 | c | 2.1E-02 | c | | | 0.5 | | | |
| 4.0E-01 | I | 1.0E-04 | I | | | | | V | | 1 | 0.14 | | ~Polychlorinated Biphenyls (low risk) | 1336-36-3 | | | | | 2.8E-02 | c | 1.2E-01 | c | 4.4E-02 | c | 0.5 | 6.8E-03 | c | 7.8E-02 |
| 7.0E-02 | I | 2.0E-05 | I | | | | | V | | 1 | 0.14 | | ~Polychlorinated Biphenyls (lowest risk) | 1336-36-3 | | | | | 1.4E-01 | c | 6.1E-01 | c | | | 0.5 | | | |
| 1.3E+01 | W | 3.8E-03 | W | 7.0E-06 | W | 4.0E-04 | W | | | 1 | 0.14 | | ~Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77) | 32598-13-3 | 3.8E-02 | c* | 1.6E-01 | c* | 7.4E-04 | c | 3.2E-03 | c | 6.0E-03 | c* | | 9.4E-04 | c* | |
| 3.9E+01 | W | 1.1E-02 | W | 2.3E-06 | W | 1.3E-04 | W | V | | 1 | 0.14 | | ~Tetrachlorobiphenyl, 3,4,4',5- (PCB 81) | 70362-50-4 | 1.2E-02 | c* | 4.8E-02 | c* | 2.5E-04 | c | 1.1E-03 | c | 4.0E-04 | c | | 6.2E-05 | c | |

TR=1E-06
THQ=1

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (see FQ #31); H = HEAST; F = See FAQ; W = see user guide Section 2.3.5; E = see user guide Section 2.3.6; L = see user's guide Section 5.2; M = mutagen; S = see user's guide Section 5; V = volatile; R = RBA applied (see user's guide Section 5.10) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (see user's guide Section 5.13); s = concentration may exceed Csat (see user's guide Section 5.12)

| Toxicity and Chemical-specific Information | | | | | | | | | | | | | Contaminant | | Screening Levels | | | | | | | | | | | | Protection of Ground Water SSLs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFO (mg/kg-day)$^{-1}$ | key | IUR (ug/m$^3$)$^{-1}$ | key | $RfD_o$ (mg/kg-day) | key | $RfC_i$ (mg/m$^3$) | key | vol | muta gen | GIABS | ABS | $C_{sat}$ (mg/kg) | Analyte | CAS No. | Resident Soil (mg/kg) | key | Industrial Soil (mg/kg) | key | Resident Air (ug/m$^3$) | key | Industrial Air (ug/m$^3$) | key | Tapwater (ug/L) | key | MCL (ug/L) | Risk-based SSL (mg/kg) | key | MCL-based SSL (mg/kg) |
| | | | | | | 6.0E-04 | I | | | 1 | 0.1 | | Polymeric Methylene Diphenyl Diisocyanate (PMDI) | 9016-87-9 | 8.5E+05 | nm | 3.6E+06 | nm | 6.3E-01 | n | 2.6E+00 | n | | | | | | |
| | | | | | | | | | | | | | Polynuclear Aromatic Hydrocarbons (PAHs) | | | | | | | | | | | | | | | |
| | | | | 6.0E-02 | I | | | V | | 1 | 0.13 | | ~Acenaphthene | 83-32-9 | 3.6E+03 | n | 4.5E+04 | n | | | | | 5.3E+02 | n | | 5.5E+00 | n | |
| | | | | 3.0E-01 | I | | | V | | 1 | 0.13 | | ~Anthracene | 120-12-7 | 1.8E+04 | n | 2.3E+05 | nm | | | | | 1.8E+03 | n | | 5.8E+01 | n | |
| 1.0E-01 | E | 6.0E-05 | E | | | | | V | M | 1 | 0.13 | | ~Benz[a]anthracene | 56-55-3 | 1.1E+00 | c | 2.1E+01 | c | 1.7E-02 | c | 2.0E-01 | c | 3.0E-02 | c | | 1.1E-02 | c | |
| 1.2E+00 | C | 1.1E-04 | C | | | | | | | 1 | 0.13 | | ~Benzo(j)fluoranthene | 205-82-3 | 4.2E-01 | c | 1.8E+00 | c | 2.6E-02 | c | 1.1E-01 | c | 6.5E-02 | c | | 7.8E-02 | c | |
| 1.0E+00 | I | 6.0E-04 | I | 3.0E-04 | I | 2.0E-06 | I | | M | 1 | 0.13 | | ~Benzo[a]pyrene | 50-32-8 | 1.1E-01 | c | 2.1E+00 | c | 1.7E-03 | c** | 8.8E-03 | n | 2.5E-02 | c | 0.2 | 2.9E-02 | c | 2.4E-01 |
| 1.0E-01 | E | 6.0E-05 | E | | | | | | M | 1 | 0.13 | | ~Benzo[b]fluoranthene | 205-99-2 | 1.1E+00 | c | 2.1E+01 | c | 1.7E-02 | c | 2.0E-01 | c | 2.5E-01 | c | | 3.0E-01 | c | |
| 1.0E-02 | E | 6.0E-06 | E | | | | | | M | 1 | 0.13 | | ~Benzo[k]fluoranthene | 207-08-9 | 1.1E+01 | c | 2.1E+02 | c | 1.7E-01 | c | 2.0E+00 | c | 2.5E+00 | c | | 2.9E+00 | c | |
| | | | | 8.0E-02 | I | | | V | | 1 | 0.13 | | ~Chloronaphthalene, Beta- | 91-58-7 | 4.8E+03 | n | 6.0E+04 | n | | | | | 7.5E+02 | n | | 3.9E+00 | n | |
| 1.0E-03 | E | 6.0E-07 | E | | | | | | M | 1 | 0.13 | | ~Chrysene | 218-01-9 | 1.1E+02 | c | 2.1E+03 | c | 1.7E+00 | c | 2.0E+01 | c | 2.5E+01 | c | | 9.0E+00 | c | |
| 1.0E+00 | E | 6.0E-04 | E | | | | | | M | 1 | 0.13 | | ~Dibenz[a,h]anthracene | 53-70-3 | 1.1E-01 | c | 2.1E+00 | c | 1.7E-03 | c | 2.0E-02 | c | 2.5E-02 | c | | 9.6E-02 | c | |
| 1.2E+01 | C | 1.1E-03 | C | | | | | | | 1 | 0.13 | | ~Dibenzo(a,e)pyrene | 192-65-4 | 4.2E-02 | c | 1.8E-01 | c | 2.6E-03 | c | 1.1E-02 | c | 6.5E-03 | c | | 8.4E-02 | c | |
| 2.5E+02 | C | 7.1E-02 | C | | | | | | M | 1 | 0.13 | | ~Dimethylbenz(a)anthracene, 7,12- | 57-97-6 | 4.6E-04 | c | 8.4E-03 | c | 1.4E-05 | c | 1.7E-04 | c | 1.0E-04 | c | | 9.9E-05 | c | |
| | | | | 4.0E-02 | I | | | | | 1 | 0.13 | | ~Fluoranthene | 206-44-0 | 2.4E+03 | n | 3.0E+04 | n | | | | | 8.0E+02 | n | | 8.9E+01 | n | |
| | | | | 4.0E-02 | I | | | V | | 1 | 0.13 | | ~Fluorene | 86-73-7 | 2.4E+03 | n | 3.0E+04 | n | | | | | 2.9E+02 | n | | 5.4E+00 | n | |
| 1.0E-01 | E | 6.0E-05 | E | | | | | | M | 1 | 0.13 | | ~Indeno[1,2,3-cd]pyrene | 193-39-5 | 1.1E+00 | c | 2.1E+01 | c | 1.7E-02 | c | 2.0E-01 | c | 2.5E-01 | c | | 9.8E-01 | c | |
| 2.9E-02 | P | | | 7.0E-02 | A | | | V | | 1 | 0.13 | 3.94E+02 | ~Methylnaphthalene, 1- | 90-12-0 | 1.8E+01 | c | 7.3E+01 | c | | | | | 1.1E+00 | c | | 6.0E-03 | c | |
| | | | | 4.0E-03 | I | | | V | | 1 | 0.13 | | ~Methylnaphthalene, 2- | 91-57-6 | 2.4E+02 | n | 3.0E+03 | n | | | | | 3.6E+01 | n | | 1.9E-01 | n | |
| | | 3.4E-05 | C | 2.0E-02 | I | 3.0E-03 | I | V | | 1 | 0.13 | | ~Naphthalene | 91-20-3 | 3.8E+00 | c* | 1.7E+01 | c* | 8.3E-02 | c* | 3.6E-01 | c* | 1.7E-01 | c* | | 5.4E-04 | c* | |
| 1.2E+00 | C | 1.1E-04 | C | | | | | | | 1 | 0.13 | | ~Nitropyrene, 4- | 57835-92-4 | 4.2E-01 | c | 1.8E+00 | c | 2.6E-02 | c | 1.1E-01 | c | 1.9E-02 | c | | 3.3E-03 | c | |
| | | | | 3.0E-02 | I | | | V | | 1 | 0.13 | | ~Pyrene | 129-00-0 | 1.8E+03 | n | 2.3E+04 | n | | | | | 1.2E+02 | n | | 1.3E+01 | n | |
| | | | | 2.0E-02 | P | | | | | 1 | 0.1 | | Potassium Perfluorobutane Sulfonate | 29420-49-3 | 1.3E+03 | n | 1.6E+04 | n | | | | | 4.0E+02 | n | | | | |
| 1.5E-01 | I | | | 9.0E-03 | I | | | | | 1 | 0.1 | | Prochloraz | 67747-09-5 | 3.6E+00 | c | 1.5E+01 | c | | | | | 3.8E-01 | c | | 1.9E-03 | c | |
| | | | | 6.0E-03 | H | | | V | | 1 | | | Profluralin | 26399-36-0 | 4.7E+02 | n | 7.0E+03 | n | | | | | 2.6E+01 | n | | 1.6E+00 | n | |
| | | | | 1.5E-02 | I | | | | | 1 | 0.1 | | Prometon | 1610-18-0 | 9.5E+02 | n | 1.2E+04 | n | | | | | 2.5E+02 | n | | 1.2E-01 | n | |
| | | | | 4.0E-02 | O | | | | | 1 | 0.1 | | Prometryn | 7287-19-6 | 2.5E+03 | n | 3.3E+04 | n | | | | | 6.0E+02 | n | | 9.0E-01 | n | |
| | | | | 7.5E-02 | I | | | | | 1 | 0.1 | | Pronamide | 23950-58-5 | 4.7E+03 | n | 6.2E+04 | n | | | | | 1.2E+03 | n | | 1.2E+00 | n | |
| | | | | 1.3E-02 | I | | | | | 1 | 0.1 | | Propachlor | 1918-16-7 | 8.2E+02 | n | 1.1E+04 | n | | | | | 2.5E+02 | n | | 1.5E-01 | n | |
| | | | | 5.0E-03 | I | | | | | 1 | 0.1 | | Propanil | 709-98-8 | 3.2E+02 | n | 4.1E+03 | n | | | | | 8.2E+01 | n | | 4.5E-02 | n | |
| 1.9E-01 | O | | | 4.0E-02 | O | | | | | 1 | 0.1 | | Propargite | 2312-35-8 | 2.8E+00 | c | 1.2E+01 | c | | | | | 1.6E-01 | c | | 1.1E-02 | c | |
| | | | | 2.0E-03 | I | | | V | | 1 | | 1.11E+05 | Propargyl Alcohol | 107-19-7 | 1.6E+02 | n | 2.3E+03 | n | | | | | 4.0E+01 | n | | 8.1E-03 | n | |
| | | | | 2.0E-02 | I | | | | | 1 | 0.1 | | Propazine | 139-40-2 | 1.3E+03 | n | 1.6E+04 | n | | | | | 3.4E+02 | n | | 3.0E-01 | n | |
| | | | | 2.0E-02 | I | | | | | 1 | 0.1 | | Propham | 122-42-9 | 1.3E+03 | n | 1.6E+04 | n | | | | | 3.5E+02 | n | | 2.2E-01 | n | |
| | | | | 1.0E-01 | O | | | | | 1 | 0.1 | | Propiconazole | 60207-90-1 | 6.3E+03 | n | 8.2E+04 | n | | | | | 1.6E+03 | n | | 5.3E+00 | n | |
| | | | | | | 8.0E-03 | I | V | | 1 | | 3.26E+04 | Propionaldehyde | 123-38-6 | 7.5E+01 | n | 3.1E+02 | n | 8.3E+00 | n | 3.5E+01 | n | 1.7E+01 | n | | 3.4E-03 | n | |
| | | | | 1.0E-01 | X | 1.0E+00 | X | V | | 1 | | 2.64E+02 | Propyl benzene | 103-65-1 | 3.8E+03 | ns | 2.4E+04 | ns | 1.0E+03 | n | 4.4E+03 | n | 6.6E+02 | n | | 1.2E+00 | n | |
| | | | | | | 3.0E+00 | C | V | | 1 | | 3.49E+02 | Propylene | 115-07-1 | 2.2E+03 | ns | 9.3E+03 | ns | 3.1E+03 | n | 1.3E+04 | n | 6.3E+03 | n | | 6.0E+00 | n | |
| | | | | 2.0E+01 | P | | | | | 1 | 0.1 | | Propylene Glycol | 57-55-6 | 1.3E+06 | nm | 1.6E+07 | nm | | | | | 4.0E+05 | n | | 8.1E+01 | n | |
| | | | | | | 2.7E-04 | A | | | 1 | 0.1 | | Propylene Glycol Dinitrate | 6423-43-4 | 3.9E+05 | nm | 1.6E+06 | nm | 2.8E-01 | n | 1.2E+00 | n | | | | | | |
| | | | | 7.0E-01 | H | 2.0E+00 | I | V | | 1 | | 1.06E+05 | Propylene Glycol Monomethyl Ether | 107-98-2 | 4.1E+04 | n | 3.7E+05 | nms | 2.1E+03 | n | 8.8E+03 | n | 3.2E+03 | n | | 6.5E-01 | n | |
| 2.4E-01 | I | 3.7E-06 | I | | | 3.0E-02 | I | V | | 1 | | 7.77E+04 | Propylene Oxide | 75-56-9 | 2.1E+00 | c | 9.7E+00 | c | 7.6E-01 | c* | 3.3E+00 | c* | 2.7E-01 | c | | 5.6E-05 | c | |
| | | | | 1.0E-03 | I | | | V | | 1 | | 5.30E+05 | Pyridine | 110-86-1 | 7.8E+01 | n | 1.2E+03 | n | | | | | 2.0E+01 | n | | 6.8E-03 | n | |
| | | | | 5.0E-04 | I | | | | | 1 | 0.1 | | Quinalphos | 13593-03-8 | 3.2E+01 | n | 4.1E+02 | n | | | | | 5.1E+00 | n | | 4.3E-02 | n | |
| 3.0E+00 | I | | | | | | | | | 1 | 0.1 | | Quinoline | 91-22-5 | 1.8E-01 | c | 7.7E-01 | c | | | | | 2.4E-02 | c | | 7.8E-05 | c | |
| | | | | 9.0E-03 | I | | | | | 1 | 0.1 | | Quizalofop-ethyl | 76578-14-8 | 5.7E+02 | n | 7.4E+03 | n | | | | | 1.2E+02 | n | | 1.9E+00 | n | |
| | | | | | | 3.0E-02 | A | | | 1 | | | Refractory Ceramic Fibers (units in fibers) | E715557 | | | | | 3.1E+01 | S | 1.3E+02 | S | | | | | | |
| | | | | 3.0E-02 | I | | | | | 1 | 0.1 | | Resmethrin | 10453-86-8 | 1.9E+03 | n | 2.5E+04 | n | | | | | 6.7E+01 | n | | 4.2E+01 | n | |
| | | | | 5.0E-02 | H | | | V | | 1 | | | Ronnel | 299-84-3 | 3.9E+03 | n | 5.8E+04 | n | | | | | 4.1E+02 | n | | 3.7E+00 | n | |
| | | | | 4.0E-03 | I | | | | | 1 | 0.1 | | Rotenone | 83-79-4 | 2.5E+02 | n | 3.3E+03 | n | | | | | 6.1E+01 | n | | 3.2E+01 | n | |
| 2.2E-01 | C | 6.3E-05 | C | | | | | | M | 1 | 0.1 | | Safrole | 94-59-7 | 5.5E-01 | c | 1.0E+01 | c | 1.6E-02 | c | 1.9E-01 | c | 9.6E-02 | c | | 5.9E-05 | c | |
| | | | | 5.0E-03 | I | | | | | 1 | | | Selenious Acid | 7783-00-8 | 3.9E+02 | n | 5.8E+03 | n | | | | | 1.0E+02 | n | | | | |
| | | | | 5.0E-03 | I | 2.0E-02 | C | | | 1 | | | Selenium | 7782-49-2 | 3.9E+02 | n | 5.8E+03 | n | 2.1E+01 | n | 8.8E+01 | n | 1.0E+02 | n | 50 | 5.2E-01 | n | 2.6E-01 |
| | | | | 5.0E-03 | C | 2.0E-02 | C | | | 1 | | | Selenium Sulfide | 7446-34-6 | 3.9E+02 | n | 5.8E+03 | n | 2.1E+01 | n | 8.8E+01 | n | 1.0E+02 | n | | | | |
| | | | | 1.4E-01 | O | | | | | 1 | 0.1 | | Sethoxydim | 74051-80-2 | 8.8E+03 | n | 1.1E+05 | nm | | | | | 1.6E+03 | n | | 1.4E+01 | n | |
| | | | | | | 3.0E-03 | C | | | 1 | | | Silica (crystalline, respirable) | 7631-86-9 | 4.3E+06 | nm | 1.8E+07 | nm | 3.1E+00 | n | 1.3E+01 | n | | | | | | |
| | | | | 5.0E-03 | I | | | | | 0.04 | | | Silver | 7440-22-4 | 3.9E+02 | n | 5.8E+03 | n | | | | | 9.4E+01 | n | | 8.0E-01 | n | |
| 1.2E-01 | H | | | 5.0E-03 | I | | | | | 1 | 0.1 | | Simazine | 122-34-9 | 4.5E+00 | c* | 1.9E+01 | c | | | | | 6.1E-01 | c | 4 | 3.0E-04 | c | 2.0E-03 |
| | | | | 1.3E-02 | I | | | | | 1 | 0.1 | | Sodium Acifluorfen | 62476-59-9 | 8.2E+02 | n | 1.1E+04 | n | | | | | 2.6E+02 | n | | 2.1E+00 | n | |
| | | | | 4.0E-03 | I | | | | | 1 | | | Sodium Azide | 26628-22-8 | 3.1E+02 | n | 4.7E+03 | n | | | | | 8.0E+01 | n | | | | |
| 2.7E-01 | H | | | 3.0E-02 | I | | | | | 1 | 0.1 | | Sodium Diethyldithiocarbamate | 148-18-5 | 2.0E+00 | c | 8.5E+00 | c | | | | | 2.9E-01 | c | | 1.8E-04 | c | |
| | | | | 5.0E-02 | A | 1.3E-02 | C | | | 1 | | | Sodium Fluoride | 7681-49-4 | 3.9E+03 | n | 5.8E+04 | n | 1.4E+01 | n | 5.7E+01 | n | 1.0E+03 | n | 4000 | 1.5E+02 | n | 6.0E+02 |
| | | | | 2.0E-05 | I | | | | | 1 | 0.1 | | Sodium Fluoroacetate | 62-74-8 | 1.3E+00 | n | 1.6E+01 | n | | | | | 4.0E-01 | n | | 8.1E-05 | n | |
| | | | | 1.0E-03 | H | | | | | 1 | | | Sodium Metavanadate | 13718-26-8 | 7.8E+01 | n | 1.2E+03 | n | | | | | 2.0E+01 | n | | | | |
| | | | | 8.0E-04 | P | | | | | 1 | | | Sodium Tungstate | 13472-45-2 | 6.3E+01 | n | 9.3E+02 | n | | | | | 1.6E+01 | n | | | | |
| | | | | 8.0E-04 | P | | | | | 1 | | | Sodium Tungstate Dihydrate | 10213-10-2 | 6.3E+01 | n | 9.3E+02 | n | | | | | 1.6E+01 | n | | | | |
| 2.4E-02 | H | | | 3.0E-02 | I | | | | | 1 | 0.1 | | Stirofos (Tetrachlorovinphos) | 961-11-5 | 2.3E+01 | c* | 9.6E+01 | c | | | | | 2.8E+00 | c | | 8.2E-03 | c | |
| | | | | 6.0E-01 | I | | | | | 1 | | | Strontium, Stable | 7440-24-6 | 4.7E+04 | n | 7.0E+05 | nm | | | | | 1.2E+04 | n | | 4.2E+02 | n | |
| | | | | 3.0E-04 | I | | | | | 1 | 0.1 | | Strychnine | 57-24-9 | 1.9E+01 | n | 2.5E+02 | n | | | | | 5.9E+00 | n | | 6.5E-02 | n | |
| | | | | 2.0E-01 | I | 1.0E+00 | I | V | | 1 | | 8.67E+02 | Styrene | 100-42-5 | 6.0E+03 | ns | 3.5E+04 | ns | 1.0E+03 | n | 4.4E+03 | n | 1.2E+03 | n | 100 | 1.3E+00 | n | 1.1E-01 |
| | | | | 3.0E-03 | P | | | | | 1 | 0.1 | | Styrene-Acrylonitrile (SAN) Trimer | 57964-39-3 | 1.9E+02 | n | 2.5E+03 | n | | | | | 4.8E+01 | n | | | | |

TR=1E-06
THQ=1.

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (see FQ #31); H = HEAST; F = See FAQ; W = see user guide Section 2.3.5; E = see user guide Section 2.3.6; L = see user's guide Section 5.2; M = mutagen; S = see user's guide Section 5; V = volatile; R = RBA applied (see user's guide Section 5.10) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (see user's guide Section 5.13); s = concentration may exceed Csat (see user's guide Section 5.12)

| Toxicity and Chemical-specific Information | | | | | | | | | | | | | Contaminant | | Screening Levels | | | | | | | | | | | Protection of Ground Water SSLs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFO (mg/kg-day)$^{-1}$ | key | IUR (ug/m$^3$)$^{-1}$ | key | $RfD_o$ (mg/kg-day) | key | $RfC_i$ (mg/m$^3$) | key | vol | mutagen | GIABS | ABS | $C_{sat}$ (mg/kg) | Analyte | CAS No. | Resident Soil (mg/kg) | key | Industrial Soil (mg/kg) | key | Resident Air (ug/m$^3$) | key | Industrial Air (ug/m$^3$) | key | Tapwater (ug/L) | key | MCL (ug/L) | Risk-based SSL (mg/kg) | key | MCL-based SSL (mg/kg) |
| | | | | 1.0E-03 | P | 2.0E-03 | X | | | 1 | 0.1 | | Sulfolane | 126-33-0 | 6.3E+01 | n | 8.2E+02 | n | 2.1E+00 | n | 8.8E+00 | n | 2.0E+01 | n | | 4.4E-03 | n | |
| | | | | 8.0E-04 | P | | | | | 1 | 0.1 | | Sulfonylbis(4-chlorobenzene), 1,1'- | 80-07-9 | 5.1E+01 | n | 6.6E+02 | n | | | | | 1.1E+01 | n | | 6.5E-02 | n | |
| | | | | | | 1.0E-03 | C | V | | 1 | | | Sulfur Trioxide | 7446-11-9 | 1.4E+06 | nm | 6.0E+06 | nm | 1.0E+00 | n | 4.4E+00 | n | 2.1E+00 | n | | | | |
| | | | | | | 1.0E-03 | C | | | 1 | | | Sulfuric Acid | 7664-93-9 | 1.4E+06 | nm | 6.0E+06 | nm | 1.0E+00 | n | 4.4E+00 | n | | | | | | |
| 2.5E-02 | I | 7.1E-06 | I | 5.0E-02 | H | | | | | 1 | 0.1 | | Sulfurous acid, 2-chloroethyl 2-[4-(1,1-dimethylethyl)phenoxy]-1-methylethyl | 140-57-8 | 2.2E+01 | c | 9.2E+01 | c | 4.0E-01 | c | 1.7E+00 | c | 1.3E+00 | c | | 1.5E-02 | c | |
| | | | | 3.0E-02 | H | | | | | 1 | 0.1 | | TCMTB | 21564-17-0 | 1.9E+03 | n | 2.5E+04 | n | | | | | 4.8E+02 | n | | 3.3E+00 | n | |
| | | | | 7.0E-02 | I | | | | | 1 | 0.1 | | Tebuthiuron | 34014-18-1 | 4.4E+03 | n | 5.7E+04 | n | | | | | 1.4E+03 | n | | 3.9E-01 | n | |
| | | | | 2.0E-02 | H | | | | | 1 | 0.1 | | Temephos | 3383-96-8 | 1.3E+03 | n | 1.6E+04 | n | | | | | 4.0E+02 | n | | 7.6E+01 | n | |
| | | | | 1.3E-02 | I | | | | | 1 | 0.1 | | Terbacil | 5902-51-2 | 8.2E+02 | n | 1.1E+04 | n | | | | | 2.5E+02 | n | | 7.5E-02 | n | |
| | | | | 2.5E-05 | H | | | V | | 1 | | 3.09E+01 | Terbufos | 13071-79-9 | 2.0E+00 | n | 2.9E+01 | n | | | | | 2.4E-01 | n | | 5.2E-04 | n | |
| | | | | 1.0E-03 | I | | | | | 1 | 0.1 | | Terbutryn | 886-50-0 | 6.3E+01 | n | 8.2E+02 | n | | | | | 1.3E+01 | n | | 1.9E-02 | n | |
| 5.0E-03 | C | 1.3E-06 | C | | | | | V | | 1 | 0.1 | | Tert-Butyl Acetate | 540-88-5 | 8.0E+00 | c | 3.5E+01 | c | 2.2E+00 | c | 9.4E+00 | c | 3.3E+00 | c | | 7.6E-04 | c | |
| | | | | 1.0E-04 | I | | | | | 1 | 0.1 | | Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47) | 5436-43-1 | 6.3E+00 | n | 8.2E+01 | n | | | | | 2.0E+00 | n | | 5.3E-02 | n | |
| | | | | 3.0E-04 | I | | | V | | 1 | | | Tetrachlorobenzene, 1,2,4,5- | 95-94-3 | 2.3E+01 | n | 3.5E+02 | n | | | | | 1.7E+00 | n | | 7.9E-03 | n | |
| 2.6E-02 | I | 7.4E-06 | I | 3.0E-02 | I | | | V | | 1 | | 6.80E+02 | Tetrachloroethane, 1,1,1,2- | 630-20-6 | 2.0E+00 | c | 8.8E+00 | c | 3.8E-01 | c | 1.7E+00 | c | 5.7E-01 | c | | 2.2E-04 | c | |
| 2.0E-01 | I | 5.8E-05 | C | 2.0E-02 | I | | | V | | 1 | | 1.90E+03 | Tetrachloroethane, 1,1,2,2- | 79-34-5 | 6.0E-01 | c | 2.7E+00 | c | 4.8E-02 | c | 2.1E-01 | c | 7.6E-02 | c | | 3.0E-05 | c | |
| 2.1E-03 | I | 2.6E-07 | I | 6.0E-03 | I | 4.0E-02 | I | V | | 1 | | 1.66E+02 | Tetrachloroethylene | 127-18-4 | 2.4E+01 | c** | 1.0E+02 | c** | 1.1E+01 | c** | 4.7E+01 | c** | 1.1E+01 | c** | 5 | 5.1E-03 | c** | 2.3E-03 |
| | | | | 3.0E-02 | I | | | | | 1 | 0.1 | | Tetrachlorophenol, 2,3,4,6- | 58-90-2 | 1.9E+03 | n | 2.5E+04 | n | | | | | 2.4E+02 | n | | 1.8E-01 | n | |
| 2.0E+01 | H | | | | | | | V | | 1 | | | Tetrachlorotoluene, p- alpha, alpha, alpha- | 5216-25-1 | 3.5E-02 | c | 1.6E-01 | c | | | | | 1.3E-03 | c | | 4.5E-06 | c | |
| | | | | 5.0E-04 | I | | | | | 1 | 0.1 | | Tetraethyl Dithiopyrophosphate | 3689-24-5 | 3.2E+01 | n | 4.1E+02 | n | | | | | 7.1E+00 | n | | 5.2E-03 | n | |
| | | | | | | 8.0E+01 | I | V | | 1 | | 2.05E+03 | Tetrafluoroethane, 1,1,1,2- | 811-97-2 | 1.0E+05 | nms | 4.3E+05 | nms | 8.3E+04 | n | 3.5E+05 | n | 1.7E+05 | n | | 9.3E+01 | n | |
| | | | | 2.0E-03 | P | | | | | 1 | 0.0007 | | Tetryl (Trinitrophenylmethylnitramine) | 479-45-8 | 1.6E+02 | n | 2.3E+03 | n | | | | | 3.9E+01 | n | | 3.7E-01 | n | |
| | | | | 2.0E-05 | S | | | | | 1 | | | Thallic Oxide | 1314-32-5 | 1.6E+00 | n | 2.3E+01 | n | | | | | 4.0E-01 | n | | | | |
| | | | | 1.0E-05 | X | | | | | 1 | | | Thallium (I) Nitrate | 10102-45-1 | 7.8E-01 | n | 1.2E+01 | n | | | | | 2.0E-01 | n | | | | |
| | | | | 1.0E-05 | X | | | | | 1 | | | Thallium (Soluble Salts) | 7440-28-0 | 7.8E-01 | n | 1.2E+01 | n | | | | | 2.0E-01 | n | 2 | 1.4E-02 | n | 1.4E-01 |
| | | | | 1.0E-05 | X | | | V | | 1 | | | Thallium Acetate | 563-68-8 | 7.8E-01 | n | 1.2E+01 | n | | | | | 2.0E-01 | n | | 4.1E-05 | n | |
| | | | | 2.0E-05 | X | | | V | | 1 | | | Thallium Carbonate | 6533-73-9 | 1.6E+00 | n | 2.3E+01 | n | | | | | 4.0E-01 | n | | 8.3E-05 | n | |
| | | | | 1.0E-05 | X | | | | | 1 | | | Thallium Chloride | 7791-12-0 | 7.8E-01 | n | 1.2E+01 | n | | | | | 2.0E-01 | n | | | | |
| | | | | 1.0E-05 | S | | | | | 1 | | | Thallium Selenite | 12039-52-0 | 7.8E-01 | n | 1.2E+01 | n | | | | | 2.0E-01 | n | | | | |
| | | | | 2.0E-05 | X | | | | | 1 | | | Thallium Sulfate | 7446-18-6 | 1.6E+00 | n | 2.3E+01 | n | | | | | 4.0E-01 | n | | | | |
| | | | | 4.3E-02 | O | | | | | 1 | 0.1 | | Thifensulfuron-methyl | 79277-27-3 | 2.7E+03 | n | 3.5E+04 | n | | | | | 8.6E+02 | n | | 2.6E-01 | n | |
| | | | | 1.0E-02 | I | | | | | 1 | 0.1 | | Thiobencarb | 28249-77-6 | 6.3E+02 | n | 8.2E+03 | n | | | | | 1.6E+02 | n | | 5.5E-01 | n | |
| | | | | 7.0E-02 | X | | | | | 1 | 0.0075 | | Thiodiglycol | 111-48-8 | 5.4E+03 | n | 7.9E+04 | n | | | | | 1.4E+03 | n | | 2.8E-01 | n | |
| | | | | 3.0E-04 | H | | | | | 1 | 0.1 | | Thiofanox | 39196-18-4 | 1.9E+01 | n | 2.5E+02 | n | | | | | 5.3E+00 | n | | 1.8E-03 | n | |
| 1.2E-02 | O | | | 2.7E-02 | O | | | | | 1 | 0.1 | | Thiophanate, Methyl | 23564-05-8 | 4.7E+01 | c* | 2.0E+02 | c | | | | | 6.7E+00 | c* | | 5.7E-03 | c* | |
| | | | | 1.5E-02 | O | | | | | 1 | 0.1 | | Thiram | 137-26-8 | 9.5E+02 | n | 1.2E+04 | n | | | | | 2.9E+02 | n | | 4.2E-01 | n | |
| | | | | 6.0E-01 | H | | | | | 1 | | | Tin | 7440-31-5 | 4.7E+04 | n | 7.0E+05 | nm | | | | | 1.2E+04 | n | | 3.0E+03 | n | |
| | | | | | | 1.0E-04 | A | V | | 1 | | | Titanium Tetrachloride | 7550-45-0 | 1.4E+05 | nm | 6.0E+05 | nm | 1.0E-01 | n | 4.4E-01 | n | 2.1E-01 | n | | | | |
| | | | | 8.0E-02 | I | 5.0E+00 | I | V | | 1 | | 8.18E+02 | Toluene | 108-88-3 | 4.9E+03 | ns | 4.7E+04 | ns | 5.2E+03 | n | 2.2E+04 | n | 1.1E+03 | n | 1000 | 7.6E-01 | n | 6.9E-01 |
| | | 1.1E-05 | C | | | 8.0E-06 | C | V | | 1 | | | Toluene-2,4-diisocyanate | 584-84-9 | 6.4E+00 | n | 2.7E+01 | n | 8.3E-03 | n | 3.5E-02 | n | 1.7E-02 | n | | 2.5E-04 | n | |
| 1.8E-01 | X | | | 2.0E-04 | X | | | | | 1 | 0.1 | | Toluene-2,5-diamine | 95-70-5 | 3.0E+00 | c** | 1.3E+01 | c* | | | | | 4.3E-01 | c** | | 1.3E-04 | c** | |
| | | 1.1E-05 | C | | | 8.0E-06 | C | V | | 1 | | 1.71E+03 | Toluene-2,6-diisocyanate | 91-08-7 | 5.3E+00 | n | 2.2E+01 | n | 8.3E-03 | n | 3.5E-02 | n | 1.7E-02 | n | | 2.6E-04 | n | |
| | | | | 5.0E-03 | P | | | | | 1 | 0.1 | | Toluic Acid, p- | 99-94-5 | 3.2E+02 | n | 4.1E+03 | n | | | | | 9.0E+01 | n | | 2.3E-02 | n | |
| 1.6E-02 | P | 5.1E-05 | C | | | | | | | 1 | 0.1 | | Toluidine, o- (Methylaniline, 2-) | 95-53-4 | 3.4E+01 | c | 1.4E+02 | c | 5.5E-02 | c | 2.4E-01 | c | 4.7E+00 | c | | 2.0E-03 | c | |
| 3.0E-02 | P | | | 4.0E-03 | X | | | | | 1 | 0.1 | | Toluidine, p- | 106-49-0 | 1.8E+01 | c* | 7.7E+01 | c* | | | | | 2.5E+00 | c* | | 1.1E-03 | c* | |
| | | | | 3.0E+00 | P | | | V | | 1 | | 3.42E-01 | Total Petroleum Hydrocarbons (Aliphatic High) | E1790670 | 2.3E+05 | nms | 3.5E+06 | nms | | | | | 6.0E+04 | n | | 2.4E+03 | n | |
| | | | | | | 6.0E-01 | P | V | | 1 | | 1.41E+02 | Total Petroleum Hydrocarbons (Aliphatic Low) | E1790666 | 5.2E+02 | ns | 2.2E+03 | ns | 6.3E+02 | n | 2.6E+03 | n | 1.3E+03 | n | | 8.8E+00 | n | |
| | | | | 1.0E-02 | X | 1.0E-01 | P | V | | 1 | | 6.86E+00 | Total Petroleum Hydrocarbons (Aliphatic Medium) | E1790668 | 9.6E+01 | ns | 4.4E+02 | ns | 1.0E+02 | n | 4.4E+02 | n | 1.0E+02 | n | | 1.5E+00 | n | |
| | | | | 4.0E-02 | P | | | | | 1 | 0.1 | | Total Petroleum Hydrocarbons (Aromatic High) | E1790676 | 2.5E+03 | n | 3.3E+04 | n | | | | | 8.0E+02 | n | | 8.9E+01 | n | |
| | | | | 4.0E-03 | P | 3.0E-02 | P | V | | 1 | | 1.82E+03 | Total Petroleum Hydrocarbons (Aromatic Low) | E1790672 | 8.2E+01 | n | 4.2E+02 | n | 3.1E+01 | n | 1.3E+02 | n | 3.3E+01 | n | | 1.7E-02 | n | |
| | | | | 4.0E-03 | P | 3.0E-03 | P | V | | 1 | | | Total Petroleum Hydrocarbons (Aromatic Medium) | E1790674 | 1.1E+02 | n | 6.0E+02 | n | 3.1E+00 | n | 1.3E+01 | n | 5.5E+00 | n | | 2.3E-02 | n | |
| 1.1E+00 | I | 3.2E-04 | I | 9.0E-05 | P | | | | | 1 | 0.1 | | Toxaphene | 8001-35-2 | 4.9E-01 | c* | 2.1E+00 | c* | 8.8E-03 | c | 3.8E-02 | c | 7.1E-02 | c* | 3 | 1.1E-02 | c* | 4.6E-01 |
| | | | | 3.0E-05 | X | | | | | 1 | 0.1 | | Toxaphene, Weathered | E1841606 | 1.9E+00 | n | 2.5E+01 | n | | | | | 6.0E-01 | n | | 9.3E-02 | n | |
| | | | | 7.5E-03 | I | | | | | 1 | 0.1 | | Tralomethrin | 66841-25-6 | 4.7E+02 | n | 6.2E+03 | n | | | | | 1.5E+02 | n | | 5.8E+01 | n | |
| | | | | 3.0E-04 | A | | | V | | 1 | | | Tri-n-butyltin | 688-73-3 | 2.3E+01 | n | 3.5E+02 | n | | | | | 3.7E+00 | n | | 8.2E-02 | n | |
| | | | | 8.0E+01 | X | | | | | 1 | 0.1 | | Triacetin | 102-76-1 | 5.1E+06 | nm | 6.6E+07 | nm | | | | | 1.6E+06 | n | | 4.5E+02 | n | |
| | | | | 3.4E-02 | O | | | | | 1 | 0.1 | | Triadimefon | 43121-43-3 | 2.1E+03 | n | 2.8E+04 | n | | | | | 6.3E+02 | n | | 5.0E-01 | n | |
| 7.2E-02 | O | | | 2.5E-02 | O | | | V | | 1 | | | Triallate | 2303-17-5 | 9.7E+00 | c | 4.6E+01 | c | | | | | 4.7E-01 | c | | 1.0E-03 | c | |
| | | | | 1.0E-02 | I | | | | | 1 | 0.1 | | Triasulfuron | 82097-50-5 | 6.3E+02 | n | 8.2E+03 | n | | | | | 2.0E+02 | n | | 2.1E-01 | n | |
| | | | | 8.0E-03 | I | | | | | 1 | 0.1 | | Tribenuron-methyl | 101200-48-0 | 5.1E+02 | n | 6.6E+03 | n | | | | | 1.6E+02 | n | | 6.1E-02 | n | |
| | | | | 5.0E-03 | I | | | V | | 1 | | | Tribromobenzene, 1,2,4- | 615-54-3 | 3.9E+02 | n | 5.8E+03 | n | | | | | 4.5E+01 | n | | 6.4E-02 | n | |
| | | | | 9.0E-03 | X | | | | | 1 | 0.1 | | Tribromophenol, 2,4,6- | 118-79-6 | 5.7E+02 | n | 7.4E+03 | n | | | | | 1.2E+02 | n | | 2.2E-01 | n | |
| 9.0E-03 | P | | | 1.0E-02 | P | | | | | 1 | 0.1 | | Tributyl Phosphate | 126-73-8 | 6.0E+01 | c* | 2.6E+02 | c* | | | | | 5.2E+00 | c* | | 2.5E-02 | c* | |
| | | | | 3.0E-04 | P | | | | | 1 | 0.1 | | Tributyltin Compounds | E1790678 | 1.9E+01 | n | 2.5E+02 | n | | | | | 6.0E+00 | n | | | | |
| | | | | 3.0E-04 | I | | | | | 1 | 0.1 | | Tributyltin Oxide | 56-35-9 | 1.9E+01 | n | 2.5E+02 | n | | | | | 5.7E+00 | n | | 2.9E+02 | n | |
| | | | | 3.0E+01 | I | 5.0E+00 | P | V | | 1 | | 9.10E+02 | Trichloro-1,2,2-trifluoroethane, 1,1,2- | 76-13-1 | 6.7E+03 | ns | 2.8E+04 | ns | 5.2E+03 | n | 2.2E+04 | n | 1.0E+04 | n | | 2.6E+01 | n | |
| 7.0E-02 | I | | | 2.0E-02 | I | | | | | 1 | 0.1 | | Trichloroacetic Acid | 76-03-9 | 7.8E+00 | c | 3.3E+01 | c | | | | | 1.1E+00 | c | 60 | 2.2E-04 | c | 1.2E-02 |
| 2.9E-02 | H | | | | | | | | | 1 | 0.1 | | Trichloroaniline HCl, 2,4,6- | 33663-50-2 | 1.9E+01 | c | 7.9E+01 | c | | | | | 2.7E+00 | c | | 7.4E-03 | c | |
| 7.0E-03 | X | | | 3.0E-05 | X | | | | | 1 | 0.1 | | Trichloroaniline, 2,4,6- | 634-93-5 | 1.9E+00 | n | 2.5E+01 | n | | | | | 4.0E-01 | n | | 3.6E-03 | n | |
| | | | | 8.0E-04 | X | | | V | | 1 | | | Trichlorobenzene, 1,2,3- | 87-61-6 | 6.3E+01 | n | 9.3E+02 | n | | | | | 7.0E+00 | n | | 2.1E-02 | n | |
| 2.9E-02 | P | | | 1.0E-02 | I | 2.0E-03 | P | V | | 1 | | 4.04E+02 | Trichlorobenzene, 1,2,4- | 120-82-1 | 2.4E+01 | c** | 1.1E+02 | c** | 2.1E+00 | n | 8.8E+00 | n | 1.2E+00 | c** | 70 | 3.4E-03 | c** | 2.0E-01 |

TR=1E-06
HQ=1

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (see FQ #31); H = HEAST; F = See FAQ; W = see user guide Section 2.3.5; E = see user guide Section 2.3.6; L = see user's guide Section 5.2; M = mutagen; S = see user's guide Section 5; V = volatile; R = RBA applied (see user's guide Section 5.10) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (see user's guide Section 5.13); s = concentration may exceed Csat (see user's guide Section 5.12)

| Toxicity and Chemical-specific Information | | | | | | | | | | | | | Contaminant | | Screening Levels | | | | | | | | | | | Protection of Ground Water SSLs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFO (mg/kg-day)$^{-1}$ | key | IUR (ug/m$^3$)$^{-1}$ | key | $RfD_o$ (mg/kg-day) | key | $RfC_i$ (mg/m$^3$) | key | vol | mutagen | GIABS | ABS | $C_{sat}$ (mg/kg) | Analyte | CAS No. | Resident Soil (mg/kg) | key | Industrial Soil (mg/kg) | key | Resident Air (ug/m$^3$) | key | Industrial Air (ug/m$^3$) | key | Tapwater (ug/L) | key | MCL (ug/L) | Risk-based SSL (mg/kg) | key | MCL-based SSL (mg/kg) |
| | | | | 2.0E+00 | I | 5.0E+00 | I | V | | 1 | | 6.40E+02 | Trichloroethane, 1,1,1- | 71-55-6 | 8.1E+03 | ns | 3.6E+04 | ns | 5.2E+03 | n | 2.2E+04 | n | 8.0E+03 | n | 200 | 2.8E+00 | n | 7.0E-02 |
| 5.7E-02 | I | 1.6E-05 | I | 4.0E-03 | I | 2.0E-04 | X | V | | 1 | | 2.16E+03 | Trichloroethane, 1,1,2- | 79-00-5 | 1.1E+00 | c** | 5.0E+00 | c** | 1.8E-01 | c** | 7.7E-01 | c** | 2.8E-01 | c** | 5 | 8.9E-05 | c** | 1.6E-03 |
| 4.6E-02 | I | 4.1E-06 | I | 5.0E-04 | I | 2.0E-03 | I | V | M | 1 | | 6.92E+02 | Trichloroethylene | 79-01-6 | 9.4E-01 | c** | 6.0E+00 | c** | 4.8E-01 | c** | 3.0E+00 | c** | 4.9E-01 | c** | 5 | 1.8E-04 | c** | 1.8E-03 |
| | | | | 3.0E-01 | I | | | V | | 1 | | 1.23E+03 | Trichlorofluoromethane | 75-69-4 | 2.3E+04 | ns | 3.5E+05 | nms | | | | | 5.2E+03 | n | | 3.3E+00 | n | |
| | | | | 1.0E-01 | I | | | | | 1 | 0.1 | | Trichlorophenol, 2,4,5- | 95-95-4 | 6.3E+03 | n | 8.2E+04 | n | | | | | 1.2E+03 | n | | 4.0E+00 | n | |
| 1.1E-02 | I | 3.1E-06 | I | 1.0E-03 | P | | | | | 1 | 0.1 | | Trichlorophenol, 2,4,6- | 88-06-2 | 4.9E+01 | c** | 2.1E+02 | c** | 9.1E-01 | c | 4.0E+00 | c | 4.1E+00 | c** | | 4.0E-03 | c** | |
| | | | | 1.0E-02 | I | | | | | 1 | 0.1 | | Trichlorophenoxyacetic Acid, 2,4,5- | 93-76-5 | 6.3E+02 | n | 8.2E+03 | n | | | | | 1.6E+02 | n | | 6.8E-02 | n | |
| | | | | 8.0E-03 | I | | | | | 1 | 0.1 | | Trichlorophenoxypropionic acid, -2,4,5 | 93-72-1 | 5.1E+02 | n | 6.6E+03 | n | | | | | 1.1E+02 | n | 50 | 6.1E-02 | n | 2.8E-02 |
| | | | | 5.0E-03 | I | | | V | | 1 | | 1.28E+03 | Trichloropropane, 1,1,2- | 598-77-6 | 3.9E+02 | n | 5.8E+03 | ns | | | | | 8.8E+01 | n | | 3.5E-02 | n | |
| 3.0E+01 | I | | | 4.0E-03 | I | 3.0E-04 | I | V | M | 1 | | 1.40E+03 | Trichloropropane, 1,2,3- | 96-18-4 | 5.1E-03 | c | 1.1E-01 | c | 3.1E-01 | n | 1.3E+00 | n | 7.5E-04 | c | | 3.2E-07 | c | |
| | | | | 3.0E-03 | X | 3.0E-04 | P | V | | 1 | | 3.11E+02 | Trichloropropene, 1,2,3- | 96-19-5 | 7.3E-01 | n | 3.1E+00 | n | 3.1E-01 | n | 1.3E+00 | n | 6.2E-01 | n | | 3.1E-04 | n | |
| | | | | 2.0E-02 | A | | | | | 1 | 0.1 | | Tricresyl Phosphate (TCP) | 1330-78-5 | 1.3E+03 | n | 1.6E+04 | n | | | | | 1.6E+02 | n | | 1.5E+01 | n | |
| | | | | 3.0E-03 | I | | | | | 1 | 0.1 | | Tridiphane | 58138-08-2 | 1.9E+02 | n | 2.5E+03 | n | | | | | 1.8E+01 | n | | 1.3E-01 | n | |
| | | | | | | 7.0E-03 | I | V | | 1 | | 2.79E+04 | Triethylamine | 121-44-8 | 1.2E+02 | n | 4.8E+02 | n | 7.3E+00 | n | 3.1E+01 | n | 1.5E+01 | n | | 4.4E-03 | n | |
| | | | | 2.0E+00 | P | | | | | 1 | 0.1 | | Triethylene Glycol | 112-27-6 | 1.3E+05 | nm | 1.6E+06 | nm | | | | | 4.0E+04 | n | | 8.8E+00 | n | |
| | | | | | | 2.0E+01 | P | V | | 1 | | 4.81E+03 | Trifluoroethane, 1,1,1- | 420-46-2 | 1.5E+04 | ns | 6.2E+04 | ns | 2.1E+04 | n | 8.8E+04 | n | 4.2E+04 | n | | 1.3E+02 | n | |
| 7.7E-03 | I | | | 7.5E-03 | I | | | V | | 1 | | | Trifluralin | 1582-09-8 | 9.0E+01 | c** | 4.2E+02 | c* | | | | | 2.6E+00 | c* | | 8.4E-02 | c* | |
| 2.0E-02 | P | | | 1.0E-02 | P | | | | | 1 | 0.1 | | Trimethyl Phosphate | 512-56-1 | 2.7E+01 | c* | 1.1E+02 | c* | | | | | 3.9E+00 | c* | | 8.6E-04 | c* | |
| | | | | 1.0E-02 | I | 6.0E-02 | I | V | | 1 | | 2.93E+02 | Trimethylbenzene, 1,2,3- | 526-73-8 | 3.4E+02 | ns | 2.0E+03 | ns | 6.3E+01 | n | 2.6E+02 | n | 5.5E+01 | n | | 8.1E-02 | n | |
| | | | | 1.0E-02 | I | 6.0E-02 | I | V | | 1 | | 2.19E+02 | Trimethylbenzene, 1,2,4- | 95-63-6 | 3.0E+02 | ns | 1.8E+03 | ns | 6.3E+01 | n | 2.6E+02 | n | 5.6E+01 | n | | 8.1E-02 | n | |
| | | | | 1.0E-02 | I | 6.0E-02 | I | V | | 1 | | 1.82E+02 | Trimethylbenzene, 1,3,5- | 108-67-8 | 2.7E+02 | ns | 1.5E+03 | ns | 6.3E+01 | n | 2.6E+02 | n | 6.0E+01 | n | | 8.7E-02 | n | |
| | | | | 1.0E-02 | X | | | V | | 1 | | 2.96E+01 | Trimethylpentene, 2,4,4- | 25167-70-8 | 7.8E+02 | ns | 1.2E+04 | ns | | | | | 6.5E+01 | n | | 2.2E-01 | n | |
| | | | | 3.0E-02 | I | | | | | 1 | 0.019 | | Trinitrobenzene, 1,3,5- | 99-35-4 | 2.2E+03 | n | 3.2E+04 | n | | | | | 5.9E+02 | n | | 2.1E+00 | n | |
| 3.0E-02 | I | | | 5.0E-04 | I | | | | | 1 | 0.032 | | Trinitrotoluene, 2,4,6- | 118-96-7 | 2.1E+01 | c** | 9.6E+01 | c** | | | | | 2.5E+00 | c** | | 1.5E-02 | c** | |
| | | | | 2.0E-02 | P | | | | | 1 | 0.1 | | Triphenylphosphine Oxide | 791-28-6 | 1.3E+03 | n | 1.6E+04 | n | | | | | 3.6E+02 | n | | 1.5E+00 | n | |
| | | | | 2.0E-02 | A | | | | | 1 | 0.1 | | Tris(1,3-Dichloro-2-propyl) Phosphate | 13674-87-8 | 1.3E+03 | n | 1.6E+04 | n | | | | | 3.6E+02 | n | | 8.0E+00 | n | |
| | | | | 1.0E-02 | X | | | | | 1 | 0.1 | | Tris(1-chloro-2-propyl)phosphate | 13674-84-5 | 6.3E+02 | n | 8.2E+03 | n | | | | | 1.9E+02 | n | | 6.5E-01 | n | |
| 2.3E+00 | C | 6.6E-04 | C | | | | | V | | 1 | | 4.67E+02 | Tris(2,3-dibromopropyl)phosphate | 126-72-7 | 2.8E-01 | c | 1.3E+00 | c | 4.3E-03 | c | 1.9E-02 | c | 6.8E-03 | c | | 1.3E-04 | c | |
| 2.0E-02 | P | | | 7.0E-03 | P | | | | | 1 | 0.1 | | Tris(2-chloroethyl)phosphate | 115-96-8 | 2.7E+01 | c* | 1.1E+02 | c* | | | | | 3.8E+00 | c* | | 3.8E-03 | c* | |
| 3.2E-03 | P | | | 1.0E-01 | P | | | | | 1 | 0.1 | | Tris(2-ethylhexyl)phosphate | 78-42-2 | 1.7E+02 | c* | 7.2E+02 | c | | | | | 2.4E+01 | c* | | 1.2E+02 | c* | |
| | | | | 8.0E-04 | P | | | | | 1 | | | Tungsten | 7440-33-7 | 6.3E+01 | n | 9.3E+02 | n | | | | | 1.6E+01 | n | | 2.4E+00 | n | |
| | | | | 2.0E-04 | A | 4.0E-05 | A | | | 1 | | | Uranium (Soluble Salts) | E715565 | 1.6E+01 | n | 2.3E+02 | n | 4.2E-02 | n | 1.8E-01 | n | 4.0E+00 | n | 30 | 1.8E+00 | n | 1.4E+01 |
| 1.0E+00 | C | 2.9E-04 | C | | | | | | M | 1 | 0.1 | | Urethane | 51-79-6 | 1.2E-01 | c | 2.3E+00 | c | 3.5E-03 | c | 4.2E-02 | c | 2.5E-02 | c | | 5.6E-06 | c | |
| | | 8.3E-03 | P | 9.0E-03 | I | 7.0E-06 | P | | | 0.026 | | | Vanadium Pentoxide | 1314-62-1 | 4.6E+02 | c** | 2.0E+03 | c** | 3.4E-04 | c* | 1.5E-03 | c* | 1.5E+02 | n | | | | |
| | | | | 5.0E-03 | S | 1.0E-04 | A | | | 0.026 | | | Vanadium and Compounds | 7440-62-2 | 3.9E+02 | n | 5.8E+03 | n | 1.0E-01 | n | 4.4E-01 | n | 8.6E+01 | n | | 8.6E+01 | n | |
| | | | | 1.0E-03 | I | | | V | | 1 | | | Vernolate | 1929-77-7 | 7.8E+01 | n | 1.2E+03 | n | | | | | 1.1E+01 | n | | 8.9E-03 | n | |
| | | | | 1.2E-03 | O | | | | | 1 | 0.1 | | Vinclozolin | 50471-44-8 | 7.6E+01 | n | 9.8E+02 | n | | | | | 2.1E+01 | n | | 1.6E-02 | n | |
| | | | | 1.0E+00 | H | 2.0E-01 | I | V | | 1 | | 2.75E+03 | Vinyl Acetate | 108-05-4 | 9.1E+02 | n | 3.8E+03 | ns | 2.1E+02 | n | 8.8E+02 | n | 4.1E+02 | n | | 8.7E-02 | n | |
| | | 3.2E-05 | H | | | 3.0E-03 | I | V | | 1 | | 2.47E+03 | Vinyl Bromide | 593-60-2 | 1.2E-01 | c* | 5.2E-01 | c* | 8.8E-02 | c* | 3.8E-01 | c* | 1.8E-01 | c* | | 5.1E-05 | c* | |
| 7.2E-01 | I | 4.4E-06 | I | 3.0E-03 | I | 1.0E-01 | I | V | M | 1 | | 3.92E+03 | Vinyl Chloride | 75-01-4 | 5.9E-02 | c | 1.7E+00 | c | 1.7E-01 | c | 2.8E+00 | c | 1.9E-02 | c | 2 | 6.5E-06 | c | 6.9E-04 |
| | | | | 3.0E-04 | I | | | | | 1 | 0.1 | | Warfarin | 81-81-2 | 1.9E+01 | n | 2.5E+02 | n | | | | | 5.6E+00 | n | | 5.9E-03 | n | |
| | | | | 2.0E-01 | S | 1.0E-01 | S | V | | 1 | | 3.90E+02 | Xylene, P- | 106-42-3 | 5.6E+02 | ns | 2.4E+03 | ns | 1.0E+02 | n | 4.4E+02 | n | 1.9E+02 | n | | 1.9E-01 | n | |
| | | | | 2.0E-01 | S | 1.0E-01 | S | V | | 1 | | 3.88E+02 | Xylene, m- | 108-38-3 | 5.5E+02 | ns | 2.4E+03 | ns | 1.0E+02 | n | 4.4E+02 | n | 1.9E+02 | n | | 1.9E-01 | n | |
| | | | | 2.0E-01 | S | 1.0E-01 | S | V | | 1 | | 4.34E+02 | Xylene, o- | 95-47-6 | 6.5E+02 | ns | 2.8E+03 | ns | 1.0E+02 | n | 4.4E+02 | n | 1.9E+02 | n | | 1.9E-01 | n | |
| | | | | 2.0E-01 | I | 1.0E-01 | I | V | | 1 | | 2.60E+02 | Xylenes | 1330-20-7 | 5.8E+02 | ns | 2.5E+03 | ns | 1.0E+02 | n | 4.4E+02 | n | 1.9E+02 | n | 10000 | 1.9E-01 | n | 9.9E+00 |
| | | | | 3.0E-04 | I | | | | | 1 | | | Zinc Phosphide | 1314-84-7 | 2.3E+01 | n | 3.5E+02 | n | | | | | 6.0E+00 | n | | | | |
| | | | | 3.0E-01 | I | | | | | 1 | | | Zinc and Compounds | 7440-66-6 | 2.3E+04 | n | 3.5E+05 | nm | | | | | 6.0E+03 | n | | 3.7E+02 | n | |
| | | | | 5.0E-02 | I | | | | | 1 | 0.1 | | Zineb | 12122-67-7 | 3.2E+03 | n | 4.1E+04 | n | | | | | 9.9E+02 | n | | 2.9E+00 | n | |
| | | | | 8.0E-05 | X | | | | | 1 | | | Zirconium | 7440-67-7 | 6.3E+00 | n | 9.3E+01 | n | | | | | 1.6E+00 | n | | 4.8E+00 | n | |

TR=1E-06
THQ=1

# Toxicity Characteristic - Maximum Concentration of Contaminants
**(Determine Levels using TCLP, Test Method 1311, EPA SW-846)**
**40CFR 261.24**

| USEPA Hazardous Waste Number | Constituent | CAS Number | Regulatory Level (mg/l) |
|---|---|---|---|
| D004 | **Arsenic** | 7440-38-2 | **5.0** |
| D005 | **Barium** | 7440-39-3 | **100.0** |
| D018 vol | Benzene | 71-43-2 | 0.5 |
| D006 | **Cadmium** | 7440-43-9 | **1.0** |
| D019 vol | Carbon Tetrachloride | 56-23-5 | 0.5 |
| D020 pest | Chlordane | 57-74-9 | 0.03 |
| D021 vol | Chlorobenzene | 108-90-7 | 100.0 |
| D022 vol | Chloroform | 67-66-3 | 6.0 |
| D007 | **Chromium** | 7440-47-3 | **5.0** |
| D023 semivol | o-Cresol | 95-48-7 | 200.0* |
| D024 semivol | m-Cresol | 108-39-4 | 200.0* |
| D025 semivol | p-Cresol | 106-44-5 | 200.0* |
| D026 semivol | Cresol | - - -- - - - - | 200.0* |
| D016 herbicide | 2,4-D | 94-75-7 | 10.0 |
| D027 vol | 1,4-Dichlorobenzene | 106-46-7 | 7.5 |
| D028 vol | 1,2-Dichloroethane | 107-06-2 | 0.5 |
| D029 vol | 1,1-Dichloroethylene | 75-35-4 | 0.7 |
| D030 semivol | 2,4-Dinitrotoluene | 121-14-2 | 0.13 |
| D012 pest | Endrin | 72-20-8 | 0.02 |
| D031 pest | Heptachlor, and its epoxide | 76-44-8 | 0.008 |
| D032 semivol | Hexachlorobenzene | 118-74-1 | 0.13 |
| D033 semivol | Hexachloro-1,3-butadiene | 87-68-3 | 0.5 |
| D034 semivol | Hexachloroethane | 67-72-1 | 3.0 |
| D008 | **Lead** | 7439-92-1 | **5.0** |
| D013 pest | Lindane | 58-89-9 | 0.4 |
| D009 | **Mercury** | 7439-97-6 | **0.2** |
| D014 pest | Methoxychlor | 72-43-5 | 10.0 |
| D035 vol | Methyl Ethyl Ketone (MEK) (2-Butanone) | 78-93-3 | 200.0 |
| D036 semivol | Nitrobenzene | 98-95-3 | 2.0 |
| D037 semivol | Pentachlorophenol | 87-86-5 | 100.0 |
| D038 semivol | Pyridine | 110-86-1 | 5.0 |
| D010 | **Selenium** | 7782-49-2 | **1.0** |
| D011 | **Silver** | 7440-22-4 | **5.0** |
| D039 vol | Tetrachloroethylene | 127-18-4 | 0.7 |
| D015 pest | Toxaphene | 8001-35-2 | 0.5 |
| D040 vol | Trichloroethylene | 79-01-6 | 0.5 |
| D041 semivol | 2,4,5-Trichlorophenol | 95-95-4 | 400. |
| D042 semivol | 2,4,6-Trichlorophenol | 88-06-2 | 2.0 |
| D017 herbicide | 2,4,5-TP (Silvex) | 93-72-1 | 1.0 |
| D043 vol | Vinyl Chloride | 75-01-4 | 0.2 |

* If the o-, m-, and /or p-Cresol concentrations cannot be differentiated, then the total cresol (D026) concentration (200 ppm) is used.
Compounds presented in **blue** are the RCRA eight priority metals
Vol – Volatile organic compound
Semivol – Semi volatile organic compound
Pest - Pesticide

DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

**Water Quality Control Commission**

**REGULATION NO. 41 - THE BASIC STANDARDS FOR GROUND WATER**

**5 CCR 1002-41**

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DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

**Water Quality Control Commission**

**REGULATION NO. 41 - THE BASIC STANDARDS FOR GROUND WATER**

**5 CCR 1002-41**

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## 41.1 AUTHORITY

These regulations are promulgated pursuant to the Colorado Water Quality Control Act, sections 25-8-101 through 25-8-703 C.R.S., (1982 and 1985 Supp.). In particular, they are promulgated under the following sections 25-8-202, 25-8-203, and 25-8-204.

## 41.2 PURPOSE

The purpose of these regulations is to establish statewide standards and a system for classifying ground water and adopting water quality standards for such classifications to protect existing and potential beneficial uses of ground waters.

## 41.3 DEFINITIONS

The following definitions are applicable to these regulations.

1. “Activity” is any operation that may discharge or cause a discharge of pollutants to ground waters including but not limited to, point source discharges, pits, ponds, and lagoons used for storage, treatment and/or disposal of pollutants, land application of wastewater, and non-point source discharges. Activity shall not include related operations, no matter how closely integrated physically or legally.

2. “Agricultural Uses” are the existing or potential future uses of ground water for the cultivation of soil, the production of crops, and/or the raising of livestock.

3. “Background Level” is the level of any parameter in the ground water within a specified area as determined by representative measurements of the ground water quality unaffected by the activity.

4. “Contamination” is that condition where the concentration level of a pollutant exceeds naturally occurring background levels.

5. “Domestic Uses” are those existing or potential future uses of ground water for household or family use, including, but not limited to: drinking, gardening, municipal, and/or farmstead uses.

6. “Existing Activity” means any activity whose plans and specifications have been approved by the Division, or which has commenced or completed construction, prior to the effective date of the 1990 amendments to this regulation.

7. “Ground Water” are subsurface waters in a zone of saturation which are or can be brought to the surface of the ground or to surface waters through wells, springs, seeps or other discharge areas.

8. “New Activity” means any activity that does not qualify as an existing activity.

9. “Parameter” is the physical, chemical, biological, or radiological constituent or characteristic of the ground water such as; temperature, pH, and ground water level.

10. “Point Of Compliance” means a vertical surface that is located at some specified distance hydrologically downgradient of the activity being monitored for compliance; provided that the Commission may establish a point of compliance other than a vertical surface on a site-specific basis pursuant to section 41.6 (E).

11. “Site Boundary” means the outermost perimeter of the property or lease boundary of a facility for which the owner and/or operator has control.

12. “Specified Area” is that area within which the ground water is classified.

13. “Standard” is a narrative and/or numeric restriction established by these regulations and applied to ground waters to protect one or more existing or potential future uses.

14. “TDS” is the total dissolved solids in water.

## 41.4 CLASSIFICATION OF GROUND WATERS

### A. Ground Water Classifications

The Commission hereby establishes the following classifications for ground water:

1. Domestic Use - Quality

2. Agricultural Use - Quality

3. Surface Water Quality Protection

4. Potentially Usable Quality

5. Limited Use and Quality

### B. Criteria Used to Identify Classifications for Ground Water

The ground water classifications shall be implemented and applied to ground waters within a specified area (as determined in accordance with section 41.4(c) based upon use, quality and other information demonstrating the following:

1. Ground water within a specified area shall be classified “Domestic Use - Quality” when:

    a. Ground water is used for domestic use within the specified area; or

    b. If ground water is not currently used for domestic use within the specified area, the available information, including information regarding background levels, demonstrates that future domestic use of water within the specified area is reasonably probable; or

    c. The most recent State Engineer's well records or applicable water court decrees reveal that ground water is permitted or decreed for domestic use within the specified area, unless other information demonstrates that domestic use is not being made of the ground water and is not likely to be made; or

d. The background levels are generally adequate to assure compliance with the Human Health Standards listed in Table 1 and TDS levels are less than 10,000 mg/l.

The determination of whether or not background levels are generally adequate shall be made considering the number of parameters that meet or exceed table Values, the extent of any exceedances of table Values, the risk to the public health associated with any such exceedance, and the adequacy of the database available for such determinations.

2. Ground water within a specified area shall be classified “Agricultural Use - Quality” when:

a. Ground water is used for agricultural use within the specified area; or

b. If ground water is not used for agricultural use within the specified area, the available information, including information regarding background levels, demonstrates that future agricultural use of water within the specified area is reasonably probable; or

c. The most recent State Engineer's well records or applicable water court decrees reveal that ground water is permitted or decreed for agricultural use within the specified area, unless other information demonstrates that agricultural use is not being made of the ground water and is not likely to be made; or

d. The background levels are generally adequate to assure compliance with the Agricultural Standards listed in Table 3 and TDS levels are less than 10,000 mg/l.

The determination of whether or not background levels are generally adequate shall be made considering the number of parameters that meet or exceed table values, the extent of any exceedances of table values, the risk to crops and/or livestock associated with any such exceedance, and the adequacy of the database available for such determinations.

3. Ground water within a specified area shall be classified “Surface Water Quality Protection” when:

A proposed or existing activity does or will impact ground waters such that water quality standards of classified surface water bodies within the specified area will be exceeded.

4. Ground water within a specified area shall be classified “Potentially Usable Quality” when:

a. TDS levels are less than 10,000 mg/l; and

b. Ground water is not used for domestic or agricultural uses within the specified area; and

c. Background levels are generally not adequate to assure compliance with the Human Health and Agricultural Standards listed in Tables 1 and 3, or the information is insufficient to make such a determination; and

d. Domestic or agricultural use of the ground water can be reasonably expected in the future, considering background levels of water quality; geologic and hydrologic conditions; the degree to which any particular types of pollutants present are subject to treatment; the economic reasonableness of such treatment; the impact of treatment requirements on water quantity; whether or not pollution arises from natural sources; and other relevant factors.

5. Ground water within a specified area shall be classified “Limited Use and Quality” when:

a. TDS levels are equal to or in excess of 10,000 mg/l; or

b. The ground water has been exempted under Rule 324(B) of the "Rules and Regulations, Rules of Practice and Procedure" (2 CCR 404-1) of the Oil and Gas Conservation Commission, pursuant to the Colorado Oil and Gas Conservation Act, Title 60, Article 34, C.R.S. (1982); or

c. The criteria specified in sections 41.4(B)1, 2, 3, or 4 are not met.

**C. Specified Area**

1. When an activity exists or is proposed, the shape, depth, boundaries, and extent of a specified area shall be determined by considering:

   a. the presence, extent, and nature of existing uses of ground water that may be affected by the activity, and the nature of reasonably expected future uses of ground water that may be affected by the activity; and

   b. the nature and location of the activity and of its discharge; and

   c. existing ground water quality that may be affected by the activity; and

   d. relevant geologic and hydrogeologic conditions, including but not limited to the presence of ground water hydrologically connected to surface waters and recharge areas.

2. In the absence of an existing or proposed activity, the shape, depth, boundaries, and extent of a specified area may be determined by considering:

   a. the presence, extent, and nature of existing uses of ground water and the nature of reasonably expected future uses of ground water; and

   b. existing ground water quality; and

   c. relevant geologic and hydrogeologic conditions, including but not limited to the presence of ground water hydrologically connected to surface waters and recharge areas.

## 41.5 GROUND WATER QUALITY STANDARDS

The water quality standards specified in subsection B below are deemed necessary and appropriate to protect ground water uses as specified in section 41.4, and shall be adopted to protect such classified uses. The standards specified in subsections A and C apply to all State ground waters, unless alternative site-specific standards have been adopted for a specified area pursuant to subsection D below.

**A. Narrative Standards**

1. Ground Water shall be free from pollutants not listed in the tables referred to in section 41.5(B), which alone or in combination with other substances, are in concentrations shown to be:

   a. Carcinogenic, mutagenic, teratogenic, or toxic to human beings, and/or,

   b. A danger to the public health, safety, or welfare.

2. Determinations made pursuant to section 41.7 of specific numerical limitations under this subsection shall be based upon the best scientific information currently available.

**B. Numeric Standards**

1. The numeric standards shall be measured as total concentrations unless otherwise specified in Tables 1 through 4.

2. When a ground water has a multi-use classification, the most restrictive standard for a parameter shall apply.

3. The following numeric standards shall apply:

   a. "Domestic Use-Quality" - The Human Health and Secondary Drinking Water Standards listed in Tables 1 and 2, respectively, except as specified in section 41.5(B)5 or 41.5(B)(6).

   b. "Agricultural Use - Quality" - The Agricultural Standards listed in Table 3, except as specified in section 41.5(B)5.

   c. "Surface Water Quality Protection" - The standards necessary to prevent the exceedance of surface waters standards.

   d. "Potentially Usable Quality" - appropriate standards considering those factors listed in section 41.4(B)(4)(d).

4. The TDS limitation listed in Table 4 shall apply to the following classes:

   "Agricultural Use - Quality"

   "Surface Water Quality Protection"

   "Potentially Usable Quality"

5. For ground water classified "Domestic Use - Quality" or "Agricultural Use - Quality," where a table value is exceeded by the background level, the applicable standard for that parameter shall be either 1) the table value or 2) the background level for that parameter. This determination shall be made considering the increased risk to public health, crops, or livestock associated with the background levels, the extent of the exceedance above the table value, the degree to which the pollution is deemed correctable and subject to treatment; and the economic reasonableness of such treatment requirements.

6. The Commission may adopt site-specific standards in lieu of those listed in Tables 1, 2, 3 and 4 taking into account the factors prescribed in Section 25-8-204(4), C.R.S. and section 41.4. The downgrading factors described in Regulation No. 31, section 6(2)(B) of the Basic Standards and Methodology for Surface Water shall not apply to the establishment of site-specific standards under this subsection.

**C. Statewide Standards**

1. Radioactive materials and Organic pollutants in ground waters shall not exceed the following levels, unless alternative, site-specific standards for these substances have been adopted by the Commission:

   a. For radioactive materials and organic pollutants listed in subsections 2 and 3 below, levels shall not exceed those specified in those subsections.

b. For all other radioactive materials and organic pollutants, they shall be maintained at the lowest practical level.

c. Where site-specific standards have been adopted, they shall apply in lieu of the standards set forth in this subsection.

2. Radioactive Materials Standards:

**Radioactive Materials Standards[1]**

| **Parameter** | **Standard** |
|---|---|
| Americium[2] | 0.15 |
| Cesium 134 | 80 |
| Plutonium 239[2], and 240[2] | 0.15 |
| Radium 226[2] and 228[2] | 5 |
| Strontium 90[2] | 8 |
| Thorium 230[2] and 232[2] | 60 |
| Tritium | 20,000 |

pCi/l = Picocuries Per Liter

[1] In site-specific cases, when it has been demonstrated that there are negligible differences between the results of dissolved (filtered) samples and total (unfiltered) samples, then dissolved results may be utilized for implementing the radioactive material standards.

[2] Radionuclide samples for these materials should be analyzed using unfiltered (total) samples.

3. Interim Organic Pollutant Standards:

Note that all standards in table A are being adopted as “interim standards.” These interim standards will remain in effect until alternative permanent standards are adopted by the Commission in revisions to this regulation or site-specific standards determinations. Although fully effective with respect to current regulatory applications, these interim standards shall not be considered final or permanent standards subject to restrictions such as antibacksliding or downgrading.

**TABLE A**

**GROUND WATER ORGANIC CHEMICAL STANDARDS**

**(in micrograms per liter)**

| **Parameter** | **CAS No.** | **STANDARD[1]** |
|---|---|---|
| Acenaphthene | 83-32-9 | 420 |
| Acetochlor | 34256-82-1 | 140 |
| Acetone | 67-64-1 | 6300 |
| Acrolein | 107-02-8 | 3.5 |
| Acrylamide[C,8] | 79-06-1 | 0.022 |
| Acrylonitrile[C] | 107-13-1 | 0.065 |
| Alachlor | 15972-60-8 | 2.0[M] |
| Aldicarb | 116-06-3 | 7.0[M] |
| Aldicarb Sulfone | 1646-88-4 | 7.0[M] |
| Aldicarb Sulfoxide | 1646-87-3 | 7.0[M] |
| Aldrin[C] | 309-00-2 | 0.0021 |
| Aniline[C] | 62-53-3 | 6.1 |
| Anthracene (PAH) | 120-12-7 | 2100 |
| Aramite[C] | 140-57-8 | 1.4 |
| Atrazine | 1912-24-9 | 3.0[M] |
| Azobenzene[C] | 103-33-3 | 0.32 |
| Benzene[C,2] | 71-43-2 | 5.0[M] |
| Benzidine[C] | 92-87-5 | 0.00015 |
| Benzo(a)anthracene (PAH)[C] | 56-55-3 | 0.0048 |
| Benzo(a)pyrene (PAH)[C, 6] | 50-32-8 | 0.0048 to 0.2[M] |
| Benzo(b)fluoranthene (PAH)[C] | 205-99-2 | 0.0048 |

**TABLE A**

**GROUND WATER ORGANIC CHEMICAL STANDARDS**

**(in micrograms per liter)**

| Parameter | CAS No. | STANDARD[1] |
|---|---|---|
| Benzo(k)fluoranthene (PAH)[C] | 207-08-9 | 0.0048 |
| Benzotrichloride[C] | 98-07-7 | 0.0027 |
| Benzyl chloride[C] | 100-44-7 | 0.21 |
| Bis(chloromethyl)ether (BCME)[C] | 542-88-1 | 0.00016 |
| Biphenyl | 92-52-4 | 4.4 |
| Bromate[C] | 15541-45-4 | 0.05 |
| Bromobenzene | 108-86-1 | 56 |
| Bromodichloromethane (THM)[C, 7] | 75-27-4 | 0.56 |
| Bromoform (THM)[C, 7] | 75-25-2 | 4 |
| Butyl benzyl phthalate | 85-68-7 | 1,400 |
| Carbofuran[6] | 1563-66-2 | 35 to 40[M] |
| Carbon tetrachloride[C, 6] | 56-23-5 | 0.5 to 5[M] |
| Chlordane[C, 6] | 57-74-9 | 0.10 to 2[M] |
| Chlordecone [C] | 143-50-0 | .0035 |
| Chlorethyl ether (BIS-2)[C] | 111-44-4 | 0.032 |
| 4-Chloro-3-methylphenol | 59-50-7 | 210 |
| Chlorobenzene | 108-90-7 | 100[M] |
| Chloroform (THM)[C, 7] | 67-66-3 | 3.5 |
| Chloroisopropyl ether (BIS-2) | 108-60-1 | 280 |
| Chloronapthalene | 91-58-7 | 560 |
| Chlorophenol, 2- | 95-57-8 | 35 |
| Chlorphrifos | 2921-88-2 | 21 |

**TABLE A**

**GROUND WATER ORGANIC CHEMICAL STANDARDS**

**(in micrograms per liter)**

| **Parameter** | **CAS No.** | **STANDARD[1]** |
|---|---|---|
| Chrysene (PAH)[C] | 218-01-9 | 0.0048 |
| Dalapon | 75-99-0 | 200[M] |
| DDD[C] | 72-54-8 | 0.15 |
| DDE[C] | 72-55-9 | 0.1 |
| DDT[C] | 50-29-3 | 0.1 |
| Di(2-ethylhexyl)adipate | 103-23-1 | 400[M] |
| Dibenzo(a,h)anthracene (PAH)[C] | 53-70-3 | 0.0048 |
| 1,2-Dibromo-3-Chloropropane (DBCP) | 96-12-8 | 0.2[M] |
| Dibromochloromethane (THM)[3, 7] | 124-48-1 | 14 |
| Dibromoethane 1,2[C] | 106-93-4 | 0.018 |
| Dicamba | 1918-00-9 | 210 |
| Dichloroacetic acid[C] | 79-43-6 | 0.7 |
| Dichlorobenzene 1,2 | 95-50-1 | 600[M] |
| Dichlorobenzene 1,3 | 541-73-1 | 94 |
| Dichlorobenzene 1,4 | 106-46-7 | 75[M] |
| Dichloroethane 1,2[C, 6] | 107-06-2 | 0.38 to 5[M] |
| Dichloroethylene 1,1 | 75-35-4 | 7[M] |
| Dichloroethylene 1,2-cis[6] | 156-59-2 | 14 to 70[M] |
| Dichloroethylene 1,2-trans[6] | 156-60-5 | 140 or 100[M] |
| Dichloromethane (methylene chloride) [C,6,8] | 75-09-2 | 5.6 or 5[M] |
| Dichlorophenol 2,4 | 120-83-2 | 21 |
| Dichlorophenoxyacetic acid (2,4-D) | 94-75-7 | 70[M] |

**TABLE A**

**GROUND WATER ORGANIC CHEMICAL STANDARDS**

**(in micrograms per liter)**

| **Parameter** | **CAS No.** | **STANDARD[1]** |
|---|---|---|
| Dichloropropane 1,2[C, 6] | 78-87-5 | 0.52 to 5[M] |
| Dichlorvos[C] | 62-73-7 | 0.12 |
| Diclorobenzidine[C] | 91-94-1 | 0.078 |
| Dieldrin[C] | 60-57-1 | 0.002 |
| Diethyl phthalate | 84-66-2 | 5,600 |
| Diisopropylmethylphosphonate (DIMP)[4] | 1445-75-6 | 8 |
| Dimethylphenol 2,4 | 105-67-9 | 140 |
| Di-n-butyl phthalate | 84-74-2 | 700 |
| Dinitro-o-cresol 4,6 | 534-52-1 | 0.27 |
| Dinitrophenol 2,4 | 51-28-5 | 14 |
| Dinitrotoluene 2,4[C] | 121-14-2 | 0.11 |
| Dinoseb | 88-85-7 | 7[M] |
| Dioxane 1,4-[C] | 123-91-1 | 0.35 |
| Dioxin (2,3,7,8 TCDD)[C, 6] | 1746-01-6 | $2.2 \times 10^{-7}$ to $3.0 \times 10^{-5}$, [M] |
| Diphenylhydrazine 1,2[C] | 122-66-7 | 0.044 |
| Diquat[6] | 85-00-7 | 15 to 20[M] |
| Endosulfan | 115-29-7 | 42 |
| Endosulfan sulfate | 1031-07-8 | 42 |
| Endosulfan, alpha | 959-98-8 | 42 |
| Endosulfan, beta | 33213-65-9 | 42 |
| Endothall | 145-73-3 | 100[M] |
| Endrin | 72-20-8 | 2[M] |

**TABLE A**

**GROUND WATER ORGANIC CHEMICAL STANDARDS**

**(in micrograms per liter)**

| **Parameter** | **CAS No.** | **STANDARD[1]** |
|---|---|---|
| Endrin aldehyde | 7421-93-4 | 2.1 |
| Epichlorohydrin[C] | 106-89-8 | 3.5 |
| Ethylbenzene | 100-41-4 | 700[M] |
| Ethylene Dibromide[C, 6] (1,2-dibromoehtane) | 106-93-4 | 0.02 to 0.05[M] |
| Ethylene glycol monobutyl ether (EGBE) (2-Butoxyethanol) | 111-76-2 | 700 |
| Ethylhexyl phthalate (BIS-2)[C, 6](DEHP) | 117-81-7 | 2.5 to 6[M] |
| Fluoranthene (PAH) | 206-44-0 | 280 |
| Fluorene (PAH) | 86-73-7 | 280 |
| Folpet[C] | 133-07-3 | 10 |
| Furmecyclox[C] | 60568-05-0 | 1.2 |
| Glyphosate | 1071-83-6 | 700[M] |
| Heptachlor[C, 6] | 76-44-8 | 0.008 to 0.4[M] |
| Heptachlor epoxide[C, 6] | 1024-57-3 | 0.004 to 0.2[M] |
| Hexachlorobenzene[C, 6] | 118-74-1 | 0.022 to 1.0[M] |
| Hexachlorobutadiene | 87-68-3 | 0.45 |
| Hexachlorocyclohexane, Alpha[C] | 319-84-6 | 0.0056 |
| Hexachlorocyclohexane, Gamma (Lindane) | 58-89-9 | 0.2[M] |
| Hexachlorocyclopentadiene[6] 50[M] | 77-47-4 | 42 to 50[M] |
| Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-hcdd)[C] | 19408-74-3 | 5.60E-06 |
| Hexachloroethane[C] | 67-72-1 | 0.88 |
| Hexanone 2 | 591-78-6 | 35 |

**TABLE A**

**GROUND WATER ORGANIC CHEMICAL STANDARDS**

**(in micrograms per liter)**

| **Parameter** | **CAS No.** | **STANDARD[1]** |
|---|---|---|
| Hydrazine/Hydrazine sulfate[C] | 302-01-2 | 0.012 |
| Indeno (1,2,3-cd) pyrene (PAH)[C] | 193-39-5 | 0.0048 |
| Isophorone[3] | 78-59-1 | 140 |
| Malathion | 121-75-5 | 140 |
| Methanol | 67-56-1 | 14,000 |
| Methoxychlor[6] | 72-43-5 | 35 to 40[M] |
| Methylene bis(N,N'-dimethyl)aniline 4,4'[C] | 101-61-1 | 0.76 |
| Metribuzin | 21087-64-9 | 180 |
| Mirex | 2385-85-5 | 1.4 |
| Naphthalene (PAH) | 91-20-3 | 140 |
| Nitrobenzene | 98-95-3 | 14 |
| Nitrophenol 4 | 100-02-7 | 56 |
| Nitrosodimethylamine N[C](NDMA) | 62-75-9 | 0.00069 |
| Nitrosodiphenylamine N[C] | 86-30-6 | 7.1 |
| N-Nitrosodiethanolamine[C] | 1116-54-7 | 0.013 |
| N-Nitrosodi-n-propylamine[C] | 621-64-7 | 0.005 |
| N-Nitroso-N-Methylethylamine[C] | 10595-95-6 | 0.0016 |
| Oxamyl (vydate)[6] | 23135-22-0 | 175 to 200[M] |
| PCBs[C, 5, 6] | 1336-36-3 | 0.0175 to 0.5[M] |
| Pentachlorobenzene | 608-93-5 | 5.6 |
| Pentachlorophenol[C, 6] | 87-86-5 | 0.088 to 1.0[M] |
| Perchlorate | 7790-98-9 | 4.9 |

**TABLE A**

**GROUND WATER ORGANIC CHEMICAL STANDARDS**

**(in micrograms per liter)**

| **Parameter** | **CAS No.** | **STANDARD[1]** |
|---|---|---|
| Phenol | 108-95-2 | 2,100 |
| Picloram | 1918-02-1 | 490 |
| Prometon | 1610-18-0 | 100 |
| Propylene oxide[C] | 75-56-9 | 0.15 |
| Pyrene (PAH) | 129-00-0 | 210 |
| Quinoline[C] | 91-22-5 | 0.012 |
| Simazine | 122-34-9 | 4[M] |
| Styrene | 100-42-5 | 100[M] |
| Tetrachlorobenzene 1,2,4,5 | 95-94-3 | 2.1 |
| Tetrachloroethane 1,1,2,2 | 79-34-5 | 0.18 |
| Tetrachloroethylene (PCE)[6] | 127-18-4 | 17 or 5[M] |
| Tetrahydrofuran | 109-99-9 | 6,300 |
| Toluene[6] | 108-88-3 | 560 to 1,000[M] |
| Total Trihalomethanes (TTHMs)[7] | N/A | 80[M] |
| Toxaphene[C, 6] | 8001-35-2 | 0.032 to 3[M] |
| Trichlorobenzene 1,2,4 | 120-82-1 | 70[M] |
| Trichloroacetic acid[C] | 76-03-9 | 0.52 |
| Trichloroethane 1,1,1 (1,1,1-TCA)[6] | 71-55-6 | 14,000 or 200[M] |
| Trichloroethane 1,1,2[3, 6] (1,1,2-TCA) | 79-00-5 | 2.8 to 5[M] |
| Trichloroethylene (TCE) | 79-01-6 | 5[M] |
| Trichloropropane 1,2,3[C,8] | 96-18-4 | 3.7E-4 |

**TABLE A**

**GROUND WATER ORGANIC CHEMICAL STANDARDS**

**(in micrograms per liter)**

| **Parameter** | **CAS No.** | **STANDARD[1]** |
|---|---|---|
| Trichlorophenol 2,4,5 | 95-95-4 | 700 |
| Trichlorophenol 2,4,6[C] | 88-06-2 | 3.2 |
| Trichlorophenoxyproprionic acid (2,4,5-tp) (Silvex) | 93-72-1 | 50[M] |
| Vinyl Chloride[C, 6] | 75-01-4 | 0.023 to2[M] |
| Xylenes (total)[6] | 1330-20-7 | 1,400 to 10,000[M] |

Notes and Abbreviations:

[1] All standards are chronic or 30-day standards. They are based on information contained in EPA's Integrated Risk Information System (IRIS) and/or EPA lifetime health advisories for drinking water using a $10^{-6}$ incremental risk factor unless otherwise noted.

[2] The standard for Benzene has been established at the MCL (q.v. 41.17)

[3] Standards for Group C compounds that have both published toxicity and carcinogenic risk data are calculated based on toxicity data and then adjusted downward using an uncertainty factor of 10.

[4] The Diisopropylmethylphosphonate (DIMP) standard was adopted in 1993 (q.v. 41.16)

[5] PCBs are a class of chemicals that include aroclors, 1242, 1254, 1221, 1232, 1248, 1260, and 1016, CAS numbers 53469-21-9, 11097-69-1, 11104-28-2, 11141-16-5, 12672-29-6, 11096-82-5, and 12674-11-2 respectively. The human-health criteria apply to total PCBs, i.e. the sum of all congener or all isomer analyses.

[6] Whenever a range of standards is listed and referenced to this footnote, the first number in the range is a strictly health-based value, based on the Commission's established methodology for human health-based standards. The second number in the range is a maximum contaminant level, established under the federal Safe Drinking Water Act has been determined to be an acceptable level of this chemical in public water supplies, taking treatability and laboratory detection limits into account. The Commission intends that control requirements for this chemical be implemented to attain a level of ambient water quality that is at least equal to the first number in the range except as follows:

- Wherever the Commission has adopted alternative, site-specific standards for the chemical, the site-specific standards shall apply instead of these statewide standards.
- The implementing agency has determined that setting the protection level to the second number in the range is consistent with the current and reasonably anticipated future uses of the groundwater, factoring in site-specific information, such as: existing prohibitions on groundwater use; whether the location is within the boundaries of an existing or reasonably anticipated public water supply; the proximity of the site to existing and reasonably anticipated water wells; whether or not the aquifer can produce water at a rate capable of supporting the anticipated use; or it can be demonstrated that access to groundwater is prohibited, unavailable or present at insufficient quantities for reliable use.

The Commission does not intend the adoption of this range of standards to result in changes to clean-up requirements previously established by an implementing agency, unless such change is mandated by the implementing agency pursuant to its independent statutory authority.

[7] For aquifer storage and recovery facilities, if the source of this chemical in ground water is potable water provided by a drinking water system with a Colorado PWSID that meets all applicable federal Safe Drinking Water Act and corresponding State requirements at the time that it is utilized for aquifer storage and recovery or artificial recharge, then the separate total trihalomethane standard will apply to the ground water in question, rather than the individual standards for bromodichloromethane, bromoform, chloroform, and/or dibromochloromethane. For any parameter for which there is a Maximum Containment Level (MCL) established by the Safe Drinking Water Act, as identified in Table A with Footnote "M", the MCL shall apply as the standard for groundwater when potable water is used for ASR or artificial recharge.

[8] Mutagenic compound, age dependent factors were used in calculating standard.

N/A – not applicable

[C] Carcinogens classified by the EPA as A, B1, or B2.

[M] Drinking water MCL.

CAS No. - Chemical Abstracts Service Registry Number

THM - Halomethanes

4. Whenever the practical quantitation limit, or PQL, for a pollutant is higher (less stringent) than a standard listed in subsection 2 or 3 above, the PQL shall be used in regulating specific activities. PQL's may be established by the applicable implementing agency or in consultation with the Water Quality Control Division.

5. Nothing in this regulation shall be interpreted to preclude:

   a. An agency responsible for implementation of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. 9601, et seq., as amended, from selecting a remedial action and a point of compliance that are more or less stringent than would be achieved by compliance with the statewide numerical standards established in this subsection, or alternative site-specific standards adopted by the Commission, where a determination is made that such a variation is authorized pursuant to the applicable provisions of CERCLA; or

   b. An agency responsible for implementation of Subtitle C of the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. 6901, et seq., as amended, or the Colorado Hazardous Waste Act, C.R.S. 25-15-101, et seq., as amended, from applying background levels or establishing "alternate concentration limits" and a point of compliance that differ from the statewide numerical standards established in this subsection, or alternative site-specific standards adopted by the Commission, for purposes of establishing hazardous waste management or corrective action requirements, where a determination is made that such background levels or alternate concentration limits are authorized by the regulations adopted pursuant to these statutory authorities; or

   c. An agency responsible for implementation of a storage tank (ST) program, pursuant to C.R.S. 25-18-101 et seq., as amended, from issuing a regulatory determination, including a point of compliance, that is more or less stringent than would be achieved by compliance with the statewide numerical standards established in this subsection, or alternative site-specific standards adopted by the Commission, where a determination is made that the ground water quality protection criteria identified in applicable ST regulations are satisfied.

6. Interim Narrative Standard

   a. The "Interim Narrative Standard" in 41.5(C)(6)(b)(i) below is applicable to all ground water, to which standards have not already been assigned in the state, with the exception of those areas where the total dissolved solids (TDS) are equal to or exceed 10,000 mg/l. This standard is applicable independent of and in addition to the statewide standards for radioactive materials and organic pollutants established in this section 41.5.C.

   b. i. Until such time as use classifications and numerical standards are adopted for the ground water on a site-specific basis throughout the state, and subject to the provisions of subsection (ii) below, ground-water quality shall be maintained for each parameter at whichever of the following levels is less restrictive:

      (A) existing ambient quality as of January 31, 1994, or

(B) that quality which meets the most stringent criteria set forth in Tables 1 through 4 of "The Basic Standards for Ground Water."

ii. The interim standard shall not be interpreted or applied as defining or limiting the potential need for remediation of contaminated ground water where remedial requirements are established under state or federal law. It is the Commission's intent that, to the maximum degree technically feasible and economically reasonable, remedial efforts should be directed at cleaning up ground water contaminated by human activities to a degree such that it is usable for all existing and potential beneficial uses; this interim narrative standard is not intended to define when such remediation is or is not feasible. Where contamination already exists, this interim standard is merely intended to assure that conditions are not allowed to deteriorate further pending remedial action. The appropriate level of clean-up to be achieved may be addressed by this Commission in a future classification and standard-setting proceeding, or by other agencies with jurisdiction over remedial actions.

iii. In applying this interim narrative standard, the Commission intends that agencies with authority to implement this standard will exercise their best professional judgment as to what constitutes adequate information to determine or estimate existing ambient quality, taking into account the location, sampling date, and quality of all available data. Data generated subsequent to January 31, 1994, shall be presumed to be representative of existing quality as of January 31, 1994, if the available information indicates that there have been no new or increased sources of ground water contamination initiated in the area in question subsequent to that date. If available information is not adequate to otherwise determine or estimate existing ambient quality as of January 31, 1994, such ground water quality for each parameter shall be assumed to be no worse that the most stringent levels provided for in Tables 1 through 4 of "The Basic Standards for Ground Water," unless the Commission has adopted alternative numerical standards for a given specified area.

**D. Site-specific radioactive materials and organic pollutant standards**

1. In determining whether to adopt site-specific standards to apply in lieu of the statewide standards established in subsection C above, the Commission shall first determine the appropriate ground water classifications within a specified area, in accordance with section 41.4.

2. The Commission shall then determine whether numerical standards other than some or all of the statewide standards established in subsection C above would be more appropriate for protection of the classified uses, taking into account the factors prescribed in section 25-8-204(4), C.R.S. and section 41.4. The downgrading factors described in Regulation No. 31, section 6(2)(B) of the Basic Standards and Methodologies for Surface Water shall not apply to the establishment of site-specific standards under this subsection.

## 41.6 POINT OF COMPLIANCE

A. In order to effect compliance with ground water standards, one or more points of compliance shall be established. The term “point of compliance” shall be assumed to cover situations with one or several points of compliance. An activity shall comply with ground water quality standards established under section 41.5 at the point of compliance. The establishment of a point of compliance shall not be required at the time of classification of any ground water pursuant to section 41.4. The point of compliance for those activities regulated by an implementing agency is discussed in subsection B of this section. Unless modified by the applicable implementing agency or the Commission, the criteria for establishing a point of compliance for the statewide standards established in section 41.5(C)(2) and (3) are set forth in subsection (C) of this section. For those activities regulated by the Water Quality Control Division through permit or control regulations, the point of compliance shall be established under the provisions of subsection (D) of this section. Nothing in this regulation shall lessen the Division's existing authority to consider these ground water standards when setting limits for surface water discharges which impact ground water. The Commission may establish points of compliance in lieu of those established by the Division or this rule, on a case-by-case basis as described in subsection (E).

B. For the purposes of this subsection, the following agencies are referred to as “implementing agencies”:

> The Division of Reclamation, Mining and Safety; the State Engineer; the Oil and Gas Conservation Commission; and the state agencies responsible for activities related to the federal “Resource Conservation and Recovery Act of 1976”, as amended, and related state programs.

Per the provisions of section 25-8-202 C.R.S., implementing agencies shall establish the point of compliance for those activities under their control. The points of compliance established in section 41.6 (C) and (D) of this regulation shall not apply to activities regulated by an implementing agency, unless the Commission has determined after rulemaking that the point of compliance established by the implementing agency is not adequate to satisfy the requirements of section 25-8-202(7). The Commission may then establish, through rulemaking, a site-specific point of compliance which shall supersede any point of compliance established by the implementing agencies.

C. In the absence of a point of compliance established by the Division, and unless modified by the Commission in accordance with section 41.6 (E) or subject to alternative regulatory requirements in accordance with section 41.5 (C)(5), the point of compliance for the statewide standards established in section 41.5 (C)(2) and (3) shall be located as follows.

1. For facilities at which ground water contamination existed as of September 30, 1989:

   a. If the contamination is identified and reported to the division or other appropriate implementing agency on or before September 30, 1992, then the point of compliance shall be at whichever of the following locations is closest to the contamination source:

      i. The site boundary; or

      ii. The hydrologically downgradient limit of the area in which contamination exists when identified.

b. If the contamination is not identified and reported to the division or other appropriate implementing agency on or before September 30, 1992, then the point of compliance shall be at whichever of the following locations is closest to the contamination source:

i. The site boundary; or

ii. The hydrologically downgradient limit of the area in which contamination exists as of September 30, 1989; or

iii. If the location specified in (ii) can not be identified, then at the hydrologically downgradient limit of the area below the activity potentially impacting ground water quality.

2. For all other facilities, at the hydrologically downgradient limit of the area below the activity potentially impacting ground water quality.

D. Within a specified area for which ground water quality classifications have been established and unless modified by the Commission in a site-specific hearing in accordance with section 41.6 (E), the point of compliance for those activities regulated by the Division through discharge permit regulations or control regulations shall be established by the Water Quality Control Division in accordance with the following criteria.

1. For all existing activities the point of compliance will be set as follows:

a. Except for surface water discharges, at some distance hydrologically downgradient from the activity that is causing, or which has the potential to cause, the contamination, based on one of the following criteria, and selecting that distance closest to the activity:

i. A specified distance, as determined by (b) below; or

ii. The hydrologically downgradient limit of the area in which contamination has been identified; or

iii. The site boundary.

b. In determining a specified distance the division shall take into consideration the following factors;

i. The classified use, established by the Commission, for any ground water or surface water which could be impacted by contamination from the activity;

ii. The geologic and hydrologic characteristics of the site, such as depth to ground water, ground water flow direction and velocity, soil types, surface water impacts, and climate;

iii. The toxicity, mobility, and persistence in the environment of contaminants used or stored at the facility or discharged from the facility;

iv. Established wellhead protection areas;

v. The potential of the site as an aquifer recharge area; and

vi. Recommendations submitted by the facility owner or operator, including technical and economic feasibility.

c. For surface water discharges that impact ground water, the point of compliance shall be established in accordance with the provisions of the Colorado Discharge Permit System Regulations, Regulation No. 61 (5 CCR 1002-61).

2. For any new activity the point of compliance will be set as follows:

a. Unless modified by the division as specified in (b) below, the point of compliance will be set at the hydrologically downgradient limit of the area below the activity potentially impacting ground water quality.

b. The point of compliance determined in (a) above may be modified by the Division on a case-by-case basis with consideration of the following factors:

i. The classified use, established by the Commission, for any ground water or surface water which could be impacted by contamination from the activity;

ii. The geologic and hydrologic characteristics of the site, such as depth to ground water, ground water flow direction and velocity, soil types, surface water impacts, and climate;

iii. The toxicity, mobility, and persistence in the environment of contaminants used or stored at the facility or discharged from the facility;

iv. Established wellhead protection areas;

v. The potential of the site as an aquifer recharge area; and

vi. Recommendations submitted by the facility owner or operator, including technical and economic feasibility.

E. When considering a request to adopt a site-specific point of compliance to apply in lieu of that established in subsection (C) or (D) above:

1. The Commission shall establish a more stringent site-specific point of compliance where determined necessary to protect human health and the environment, taking into account the potential for vertical migration of contamination, the number, quantity, nature, and persistence in the environment of the contaminants present, technological feasibility, economic reasonableness, upgradient levels of contamination, geohydrological data and features, the classified uses established by the Commission for any ground water or surface water which would be impacted by contamination from the activity, and other environmental data or other relevant information as determined by the Commission; or

2. If the Commission determines that a less stringent point of compliance would protect human health and the environment, and the point of compliance established pursuant to subsection (C) or (D) is technologically infeasible or economically unreasonable, it shall establish an alternate site-specific point of compliance, taking into account the potential for vertical migration of contamination, the number, quantity, nature, and persistence in the environment of the contaminants present, technological feasibility, economic reasonableness, upgradient levels of contamination, point of use treatment, geohydrological data and features, the classified uses established by the Commission for any ground water or surface water which would be impacted by contamination from the activity, and other environmental data or other relevant information as determined by the Commission.

## 41.7 IMPLEMENTATION

A. Except for sections 41.5(C) and 41.6(A) and (B), these regulations shall not be deemed automatically applicable to any ground waters of the State.

B. The Commission is responsible for classifying the ground waters of the State and promulgating water quality standards as set forth in sections 25-8-202(1)(a), 25-8-203 and 25-8-204, C.R.S.

The Commission may classify ground waters and promulgate water quality standards in accordance with the provisions of sections 41.4 and 41.5 of the regulations, upon its own motion or upon petition submitted by the division, any other state agency, or any interested person, including a regulated entity or a person who may be affected by ground water quality.

C. The determination to accept or deny a petition for consideration under this section, and the scheduling of such petitions for hearing, shall be at the discretion of the Commission, provided, however, that the Commission shall be required to hear any petition for a sitespecific standard or a site-specific point of compliance for radioactive materials and organic pollutant standards submitted pursuant to section 41.5(D). In making such determinations the Commission shall consider the hardship or impact that inaction may have upon the petitioner, other interested persons, and the ground waters of the State; the relative hardships or impacts that may be caused where more than one petition is submitted or is pending; the stage of development of an appropriate data base for decision-making; the Commission's workload and priorities for action; and other relevant factors.

D. Hearings under this section shall be held in accordance with section 24-4-103, C.R.S. and the Commission's Procedural Regulations.

E. The Commission may consider a change in classifications or water quality standards based upon substantial new information demonstrating that the current classifications or standards should no longer apply. The determination to accept or deny a petition for consideration under this subsection shall be made in accordance with subsection B, above, provided that no ground waters shall be considered for reclassification or changes in water quality standards more than once in any twelve month period.

F. The Commission may grant variances from the standards specified in section 41.5 of these regulations on a case-by-case basis considering the factors listed in section 25-8-204(4) C.R.S., and where it is demonstrated by a preponderance of the evidence that a variance from the water quality standards specified in section 41.5 is most appropriate to the protection of the classified uses. The extent and duration of any such variance shall be made on a case-by-case basis.

G. When the Commission has established statewide standards or classification(s) and standards for ground water in a specified area, those classifications and standards shall be used with respect to the regulation and subsequent enforcement of specific activities by the Commission, the Administration and other State agencies, consistent with applicable law.

H. When the Commission has not established classification(s) and standards for ground water in a specified area, the Commission recommends the classifications and standards set forth in these regulations as guidance for use by other State agencies in the implementation of ground water protection responsibilities, on a case-by-case basis, consistent with applicable law. This shall not be construed as a delegation by the Commission of its authority to classify ground water and promulgate water quality standards.

I. Existing discharges of pollutants to ground water shall be deemed “activities” as defined in section 41.3(1), and are not exempt from regulation, unless specific statutory or regulatory provisions require otherwise.

## 41.8 SEVERABILITY

The provisions of these regulations are severable, and if any provisions or the application of the provisions to any circumstances is held invalid, the application of such provision to other circumstances, and the remainder of these regulations, shall not be affected thereby.

**TABLE 1**

| **TABLE 1**<br>Domestic Water Supply – Human Health Standards | |
|---|---|
| **Parameter** | **Standard[1]** |
| ***Biological*** | |
| Total Coliforms (30 day average) | 2.2 [a]org/100 ml |
| Total Coliforms (max in 30 days) | 23org/100 ml |
| ***Inorganic*** | |
| Antimony (Sb)[d, M] | 0.006mg/l |
| Asbestos [M] | 7,000,000fibers/Liter |
| Arsenic (As)[d, M] | 0.01mg/l |
| Barium (Ba)[d, M] | 2.0mg/l |
| Beryllium (Be)[d, M] | 0.004mg/l |
| Cadmium (Cd)[d, M] | 0.005mg/l |
| Chromium (Cr)[c, d, M] | 0.1mg/l |
| Cyanide [Free] (CN)[M] | 0.2mg/l |
| Fluoride (F)[d, M] | 4.0mg/l |
| Lead (Pb)[d] | 0.05mg/l |
| Mercury (inorganic) (Hg)[d,M] | 0.002mg/l |
| Molybdenum (Mo) [d] | 0.21mg/l |
| Nickel (Ni)[d] | 0.1mg/l |
| Nitrate (NO3)[d, M] | 10.0mg/l as N |
| Nitrite (NO2)[d, M] | 1.0mg/l as N |
| Total Nitrate+Nitrite ($NO_2$+$NO_3$-N)[d, f] | 10.0mg/l as N |
| Selenium (Se)[d, M] | 0.05mg/l |
| Silver (Ag)[d] | 0.05mg/l |
| Thallium (Tl)[d, M] | 0.002mg/l |
| Uranium (U) [d, 2] | 0.0168 to 0.03[M]mg/l |
| ***Radiological[b, d]*** | |
| Gross Alpha Particle Activity[i, M] | 15 pCi/l |
| Beta and Photon Emitters[e] | 4 mrem/year |

**TABLE 2** **Domestic Water Supply – Drinking Water Standards**

| Parameter | Standard |
|---|---|
| Chlorophenol | 0.0002 mg/l |
| Chloride (Cl) d | 250 mg/l |
| Color | 15 color units |
| Copper (Cu) d | 1 mg/l |
| Corrosivity | Noncorrosive |
| Foaming Agents | 0.5 mg/l |
| Iron (Fe) d | 0.3 mg/l |
| Manganese (Mn) d | 0.05 mg/l |
| Odor | 3 threshold odor numbers |
| pH | 6.5 - 8.5 |
| Phenol | 0.3 mg/l |
| Sulfate (SO 4 ) d | 250 mg/l |
| Zinc (Zn) d | 5 mg/l |

**Table 3** **Agricultural Standards**

| Parameter | Standard |
|---|---|
| Aluminum (Al) d, f | 5 mg/l |
| Arsenic (As) d | 0.1 mg/l |
| Beryllium (Be) d | 0.1 mg/l |
| Boron (B) d, g | 0.75 mg/l |
| Cadmium (Cd) d | 0.01 mg/l |
| Chromium (Cr) d | 0.1 mg/l |
| Cobalt (Co) d | 0.05 mg/l |
| Copper (Cu) d | 0.2 mg/l |
| Fluoride (F) d | 2 mg/l |
| Iron (Fe) d | 5 mg/l |
| Lead (Pb) d, f | 0.1 mg/l |
| Lithium (Li) d, h | 2.5 mg/l |
| Manganese (Mn) d, j | 0.2 mg/l |
| Mercury (Hg) d, f | 0.01 mg/l |
| Nickel (Ni) d | 0.2 mg/l |
| Nitrite (NO 2 -N) d, f | 10 mg/l as N |
| Nitrite & Nitrate (NO 2 +NO 3 -N) d, f | 100 mg/l as N |
| Selenium (Se) d | 0.02 mg/l |
| Vanadium (V) d | 0.1 mg/l |
| Zinc (Zn) d | 2 mg/l |
| pH | 6.5 - 8.5 |

**TABLE 4 TDS Water Quality Standards**

| Background TDS Value (mg/l) | Maximum Allowable TDS Concentrations |
|---|---|
| 0 - 500 | 400 mg/l or 1.25 times the background level, whichever is least restrictive |
| 501 - 10,000 | 1.25 times the background value |
| 10,001 or greater | No limit |

1 Chronic or 30-day standard based on information contained in EPA's Integrated Risk Information System (IRIS) using a 10-6 incremental risk factor.

2 Whenever a range of standards is listed and referenced to this footnote, the first number in the range is a strictly health-based value, based on the Commission's established methodology for human health-based standards. The second number in the range is a maximum contaminant level, established under the federal Safe Drinking Water Act that has been determined to be an acceptable level of this chemical in public water supplies, taking treatability and laboratory detection limits into account. The Commission intends that control requirements for this chemical be implemented to attain a level of ambient water quality that is at least equal to the first number in the range except as follows:

- Where ground water quality exceeds the first number in the range due to a release of contaminants that occurred prior to September 15, 2012, (regardless of the date of discovery or subsequent migration of such contaminants) clean-up levels for the entire contaminant plume shall be no more restrictive than the second number in the range or the ground water quality resulting from such release, whichever is more protective.
- Wherever the Commission has adopted alternative, site-specific standards for the chemical, the site-specific standards shall apply instead of these statewide standards.

The Commission does not intend the adoption of this range of standards to result in changes to clean-up requirements previously established by an implementing agency, unless such change is mandated by the implementing agency pursuant to its independent statutory authority.

a When the Membrane Filter Technique is used for analysis, the average of all samples taken within thirty days must be less than 1 organism per 100 milliliters of sample. When the Multiple Tube Fermentation Method is used for analysis, the limit is less than 2.2 org/100 ml.

b If the identity and concentration of each radionuclide in a mixture are known, the limiting value would be derived as follows: Determine, for each radionuclide in the mixture, the ratio between the quantity present in the mixture and the limit specified. The sum of such ratios for all radionuclides in the mixture shall not exceed "1" (i.e. unity). A radionuclide may be considered as not present in a mixture if the ratio of the concentration to the limit does not exceed 1/10 and the sum of such ratios for all radionuclides considered as not present in the mixture does not exceed 1/4.

c The chromium standard is based on the total concentration of both trivalent and hexavalent forms of dissolved chromium.

d Measured as dissolved concentration. The sample water shall be filtered through a 0.45 micron membrane filter prior to preservation. The total concentration (not filtered) may be required on a case-by-case basis if deemed necessary to characterize the pollution caused by the activity.

e If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 mrem per year. Except for Tritium and Strontium 90 the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents shall be calculated on the basis of a 2 liter per day drinking water intake using the 168-hour data listed in "Maximum Permissible Body Burden and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure," NBS Handbook 69, as amended, August 1963, US Department of Commerce.

f These more stringent levels are necessary to protect livestock watering. Levels for parameters without this footnote are set to protect irrigated crops at the same level. Where a party can demonstrate that a livestock watering use of ground water is not reasonably expected, the applicable standard for lead is 5.0 mg/l.

g This level is set to protect the following plants in ascending order of sensitivity: Pecan, Black Walnut, Persian (English) Walnut, Jerusalem Artichoke, Navy Bean, American Elm, Plum, Pear, Apple, Grape (Sultanina and Malaga), Kadota Fig, Persimmon, Cherry, Peach, Apricot, Thornless Blackberry, Orange, Avocado, Grapefruit, Lemon. Where a party can demonstrate that a crop watering use of ground water is not reasonably expected, the applicable standard for boron is 5.0 mg/l.

h This level protects all crops, except citrus which do not grow in Colorado and therefore a more stringent level of protection is not required.

i The Gross Alpha Activity standard excludes alpha activity due to Radon and Uranium.

j This standard is only appropriate where irrigation water is applied to soils with pH values lower than 6.0.

M Drinking water MCL.

## 41.9 Reserved.

**41.10 Reserved.**

**41.11 Reserved.**

**41.12 STATEMENT OF BASIS AND PURPOSE**

Statement of Basis and Purpose for adopting the Regulations entitled: “The Basic Standards for Ground Waters”. In accordance with 24-4-103(4), CRS (1982 and 1985 Supp.), the Commission adopts this Statement of Basis and Purpose.

**PURPOSE**

“The Basic Standards for Ground Waters” establishes a system of classifications (classes) for determining the appropriate degree of protection (standards) necessary to maintain beneficial uses of ground waters. These standards and classes are intended to complement regulations 3.1.0, “The Basic Standards and Methodologies” which are primarily applicable to surface waters. Together, regulations 3.1.0 and 3.11.0 protect all state waters as defined in Section 25-8-203, CRS (1982). Separate regulations for surface and ground waters are appropriate, because the surface water classification system is not easily adopted to ground waters.

These regulations are the first step in developing a comprehensive, statewide ground water protection program. The complete program will include control regulations which will enforce the water quality standards. These additional regulations may include amending the current CDPS permit regulations and adopting activity-specific control regulations.

It is not the intent of the Commission to control existing or future uses of ground water (i.e., domestic, agricultural, or industrial uses). The intent is to protect ground water quality from uncontrolled degradation and thereby protect existing and future uses of ground water.

It is not the intent of the Commission or the Division by virtue of adoption of these regulations or subsequent control regulations, to duplicate ground water regulations adopted by other state or federal programs. When an activity that impacts ground water appears to be unregulated or inadequately regulated with respect to those impacts, the Division will conduct a thorough review of any applicable authorities prior to proposing a control regulation.

**NEED FOR REGULATIONS**

Ground water is the primary water source for seventy-five percent of the public water supply systems of the state (defined in the Colorado Primary Drinking Water Regulations).

There are approximately 825,000 people in Colorado that rely either wholly or partially on ground water. Ground water use to support new urban areas is increasing as surface water supplies become more difficult to obtain in some metropolitan areas. Agriculture also relies heavily on ground water for the production of crops and livestock. An estimated 1.5 million acres are presently being irrigated with ground water and approximately 12,500 well permits have been issued for livestock watering.

Currently, public water supply systems using ground water are not required to treat the water prior to distribution except for disinfection. In 1974, the federal “Safe Drinking Water Act” (SDWA) was passed which required regular testing of public water supplies to ensure compliance with the maximum contaminant levels (MCLs). However, the regulations do not require testing for even 1% of the synthetic chemicals in use in the nation today. The 1986 amendments to the Safe Drinking Water Act will increase the number of chemicals to be tested by public water systems. However, neither the SDWA nor the 1986 amendments required testing of private or agricultural supply wells.

Although the state's lack of a comprehensive data base prevents demonstrating a widespread contamination problem, there are many reasons for adopting a regulation which creates a framework for further ground water quality protection. These reasons are:

1. The increasing reliance on ground water by public and private water supply systems in a water-short state mandates protection of subsurface water quality. There may not be any alternative surface supplies available in the event of contamination.

2. Severe ground water contamination has occurred in several specific locations in Colorado. This regulation is a necessary step to prevent a proliferation of ground water problems.

3. The high expense of clean up of already polluted ground water fully justifies a strong, thorough effort to prevent any contamination which will impair the usefulness of ground water.

4. The Commission has been recognized, at the state level, as the agency responsible for coordinating a state ground water protection program. Examples of this responsibility include:

    i. By its enabling statute, the Water Quality Control Commission is the ultimate state agency authority for the protection of the waters of the State, including subsurface waters.

    ii. In an executive order issued on July 15, 1985, Governor Lamm stated that the Colorado Department of Health is given primary responsibility for coordinating the state's ground water quality protection effort.

5. Coordination of various federal and state ground water protection programs is consistent with federal policy. In 1984, EPA developed a ground water protection strategy. One of the main objectives of the strategy was to achieve greater consistency in decision making on ground water protection and clean-up. EPA is providing the Water Quality Control Division with technical and financial support for the development and implementation of a ground water protection program. In 1986, Congress amended the Safe Drinking Water Act so as to encourage state programs for well head protection.

6. Since other state agencies (and counties) are required to protect ground water incidental to regulating other activities, the Commission should assume-at the least-a coordinating role in assuring consistent protection of ground water quality. By promulgating a definition of the various uses of ground water and the numerical maximum chemical concentrations necessary to protect those uses, the Commission is establishing a common denominator such that ground waters will be classified and protected.

7. In the future, other causes of ground water contamination which are not now regulated may be found. A regulatory structure in place now which defines the level of risk of contamination and levels of control required will be useful when addressing future problems. Relying upon a framework of uses to be protected, future legislation, control regulations by the Commission, or regulations by other agencies, may be developed to address presently unregulated causes of contamination.

8. With standards defined to protect uses, the Division will be able to develop permit limits for surface and subsurface discharges to ground water, where other regulations authorize Division control of such surface activity.

**PUBLIC INPUT AND COMMISSION GOAL**

The Commission and Division appointed an AD Hoc Ground Water Advisory Committee in 1982. The Committee represented the various entities who would be most affected by a ground water protection program. On May 15, 1984, the Committee recommended, and the Colorado Water Quality Control Commission adopted, the following statement pertaining to ground water protection:

"The goal of the Water Quality Control Commission is to provide maximum beneficial use of ground water resources, while assuring the safety of the users by preventing or controlling those activities which have the potential to impair existing or future beneficial uses of ground water or to adversely affect the public health. The necessary program is to be instituted in a manner that is consistent with and complementary to the provisions of the Colorado Water Quality Control Act."

This Basic Standards Regulation for ground water, which is adopted after exhaustive public rulemaking hearings, is consistent with this goal. The focus of the Basic Standards Regulation for ground water is the identification of ground water use or uses and the quality level to be maintained to assure its usefulness. This is a framework around which existing and future licensing and permitting regulations revolve in authorizing, conditioning, limiting and denying activities which could impair existing or future beneficial uses of ground water.

**DISCUSSION OF REGULATIONS**

Classification System

The classification system is a framework of uses of ground water which are to be assigned on a site-specific basis by the Commission so that standards for chemical pollutants can be assigned on a site-specific basis by the Commission so that standards for chemical pollutants can be assigned at levels necessary to protect the use.

A five (5) class system was developed for these regulations. This system is based on existing and potential future uses and actual water quality data.

1. Domestic Use - Quality
2. Agricultural Use - Quality
3. Surface Water Quality Protection
4. Potentially Usable Quality
5. Limited Use and Quality

Ground water may be assigned more than one class because it may have more than one existing or potential use.

While selection of any of these classes for a specific site is to protect the quality of the water for that beneficial use, because the classification may be based on a potential use, the classification is no warranty that the existing quality is entirely fit for that use by one who does or intends to put it to such use.

The selection of classifications for particular ground water within a specified area shall be by the Commission. The selection of particular classes shall be based upon specific criteria found in the regulations which describe each class.

The regulations provide that ground water may be classified “Domestic Use - Quality” or “Agricultural Use - Quality” if the ground water is either “used” or reasonably likely to be used for domestic or agricultural purposes within the specified area, or if the most recent state engineer's well records or applicable court decrees reveal that ground water is “permitted” or “decreed” for such uses within the specified area. For purposes of classification of ground water pursuant to these two provisions, the Commission presumes (1) that the “use” of ground water is after a legal withdrawal, and (2) that the pertinent state engineer's well record reveals a valid permit, and that the applicable court decree is perfected. If a domestic or agricultural use classification is based solely upon well records or court decrees, that classification may be rebutted by information demonstrating that domestic or agricultural use of ground water is not being made and is not likely to be made in the future.

Selection of applicable classes for a specified area shall occur when there is an activity which affects or has the potential to affect ground water quality within a specified area, and when a specified area for that activity is determined. Upon identification of the activity and determination of the specified area by the Commission, the owner/operator of the activity gathers information within the specified area. The owner/operator of the activity then submits this information to the Commission, pursuant to Section 3.11.7.

**SPECIFIED AREA**

The specified area is that area within which the ground water is classified. The Commission must determine the appropriate shape, depth, boundaries, and extent of a specified area such that existing and potential uses of ground waters are identified and protected from discharges to ground water by activities.

A specified area will be determined as early as possible after an activity has been identified. The Commission assumes that the specified area may be modified as more hydrologic and geologic information is acquired. The Commission may determine a specified area in the absence of an activity.

A conservative area of two lateral miles around the activity in question will presumptively be used as the initial specified area. The Commission finds this area to be reasonable for the following reasons:

a. Geraghty and Miller, Inc. performed a national survey, for USEPA Headquarters, of 68 ground water contamination sites. The study revealed that 95% of the plumes of contamination were limited to within 2 miles of the source. Geraghty and Miller, Inc. performed an in-house survey of 73 more such sites (a total of 141 sites) which also revealed that 95% of these plumes of contamination were limited to 2 miles from the source;

b. The ICF Corporation performed a national survey, for USEPA Headquarters, of 150 RCRA sites. In this study, ICF found that 95% of the distances from the source to ground water discharge boundries were within 2 miles.

c. Geraghty and Miller, Inc. performed a national survey, for USEPA Headquarters, of large ground water pumping systems (i.e., municipal water supply wells). This survey revealed that approximately 95% of these wells had a capture zone (i.e., zone of influence) within a 2 mile radius.

**GROUND WATER QUALITY STANDARDS**

The promulgated Water Quality Standards include narrative and numeric standards.

**NARRATIVE STANDARDS**

The narrative standards consider all man-induced alterations of ground water. Since the Commission cannot, and will not, control the withdrawal and use of ground water, the narrative standards are designed to protect all potential uses of the waters. The narrative standards prohibit the introduction of non-natural chemicals where best available information indicates a potential threat to the public health, safety or welfare.

The Colorado Primary Drinking Water Regulations (CPDWR) do not include MCLs (maximum contaminent levels) for many chemicals such as dioxin, TCE, and EDB. There are often health advisories and other scientific studies indicating that a specific chemical is carcinogenic, mutagenic, toxic, or poses a danger to public health, safety, or welfare. The Commission will have the ability to make a specific determination of a limit for that constituent in ground water. This section allows the Commission to make such a determination in the absence of an MCL for the chemical. The toxic and hazardous pollutant lists developed pursuant to sections 301 (a)(1) and 311 (b)(2)(A) of the federal Clean Water Act and contaminants (pollutants) that have had an EPA Health Advisory developed for them will be used as a basis for determining what specific compounds will be included.

**NUMERIC STANDARDS**

The numeric standards are contained in Tables 1, 2, 3, and 4. These standards apply to classified ground water.

The majority of the numeric standards listed in Table 1 are the maximum contaminant levels (MCLs) for public drinking water supplies, as established by the National Primary Drinking Water Regulations. The remainder are derived from the Colorado Basic Surface Water Standards. These human health levels are set to protect the public from acute poisoning and from long-term “chronic” effects. The MCLs are also contained in the CPDWR. The limits for radioactive constituents; Cesium, Plutonium, Thorium and Tritium are those which would limit human exposure to four (4) millirems/year. Table 1 will be expanded as MCLs for additional parameters are developed under the National Primary Drinking Water Regulations. The numeric standards listed in Table 1 are applicable to ground waters classified “Domestic Use-Quality”.

Table 2 contains additional numeric standards for “Domestic Use - Quality” ground waters. Much debate and discussion revolved around the need for these standards. These parameters are the National Secondary Drinking Water Standards and are instituted to maintain a ground water as a drinking water source requiring very little treatment. In the judgement of the USEPA Administrator, these limits are a requisite to protect the public welfare.

Contaminants (pollutants) contained in Table 2 are those which may adversely affect the aesthetic quality of a drinking water such as taste, odor, color, and appearance and which thereby may deter public acceptance of and confidence in that ground water source as a drinking water supply.

Numeric standards meant to protect a water source for agricultural uses are listed in Table 3. Table 3 numeric values were developed through Commission review of Water Quality Criteria in 1972, EPA/R/73/033 (March 1973). The value of the molybdenum was developed from information provided by AMAX and the Cottor Corporation. These values are set at levels to protect livestock and crops. All “Agricultural Use - Quality” ground waters must meet these standards when implemented by any agency.

Much public input and debate revolved around Table 4, “TDS Water Quality Standards.” Some parties wanted less or no degradation of ground water, while other parties felt that more was warrented. The division proposed this version which allows for limited degradation.

The TDS numeric standard is implemented on a sliding scale and is applicable to all classes of ground water, except “Domestic Use - Quality” and “Limited Use and Quality” ground waters. TDS Table 4 values are applicable to “Agricultural Use - Quality” , “Surface Water Quality Protection” and “Potentially Usable Quality” ground waters, because these three classes are not subject to Table 2 for sulfates and chlorides; a TDS limitation for these three classes assumes some level of anti-degradation.

By maintaining a TDS concentration within a range, an existing or potential use should not be impacted. The sliding scale allows for a twenty-five percent increase for all ground waters with a background TDS concentration greater than 500 mg/l. If the background concentration is less than 400 mg/l then the maximum allowable concentration of TDS is 500 mg/l. This value is the secondary drinking water standards and is instituted to maintain a high quality water. Total dissolved solids concentrations of less than 500 mg/l are not expected to impair any ground water use. The twenty-five percent allowable incremental increase for waters with a background between 500 and 10,000 mg/l would afford a greater degree of protection to ground water with lower TDS concentrations. Ground waters with TDS concentrations greater than 10,000 mg/l would not have a numeric limit.

The term “representative” contained within the definition for background level implies standard acceptable monitoring, sampling, and analytical procedures, which are available.

The criteria for determining background levels will be established by the Commission. It is important that the regulated entity work closely with the agency requiring the background level determination.

It is intended that the monitoring and sampling protocols shall be those procedures best capable for obtaining ground water samples which are representative of the water quality being monitored.

The following documents may provide useful guidance:

1. “Manual of Ground-Water Sampling Procedures” , Scalf, M.R., et al., 1981. National Water Well Association, Worthington, Ohio.

2. “Procedures for the Collection and Preservation of Ground Water and Surface Water Samples and for the Installation of Monitoring Wells” , U.S. Dept. of Energy, January, 1981. GJ/TMC-08, UC-70A.

3. “Practical Guide for Ground-Water Sampling” , Barcelona, M.J., et al., EPA/600/2-85/104 September, 1985.

The analytical method selected for a parameter should be that which can measure the lowest detection limit for the parameter, unless a standard is within the range of another approved method. Approved analytical methods include those contained in the “Standard Methods for the Examination of Water and Wastewater,” 16th or most recent edition, or “Methods for Chemical Analysis of Water and Wastes,” EPA, Office of Technology Transfer, or 40 CFR “Guidelines Establishing Test Procedures for the analysis of Pollutants under the Clean Water Act (CWA).”

The owner/operator reporting the results of the laboratory studies shall identify the detection limit and method used for the analysis of each parameter.

**POINT OF COMPLIANCE**

The Commission intends to allow for flexibility in locating the point or points of compliance within the specified area. After the point or points of compliance are determined, applicable ground water quality standards are to be met at these locations.

Mining activities are recognized to occur within ground water bodies and that water quality within the disturbed area will obviously change. The point(s) of compliance established outside the area anticipated to be disturbed may protect the water body while allowing the mining activity.

The Commission envisions that future and/or amended regulations will specify the design criteria and/or monitoring requirements necessary at the point or points of compliance. Down-gradient ground water monitoring locations may correspond to the point of compliance for the regulated activity.

**IMPLEMENTATION**

The Commission has considered several approaches to implementation of these regulations. The proposed rule initially included a provision for automatic applicability, with appeals to the Commission for reclassification. The parties raised strong objections to this proposal based on due process and statutory grounds. In its deliberations the Commission deleted this approach and proposed to the delegate classification and standard setting authority to other state agencies. The Attorney General's office indicated that the approach would constitute an unlawful delegation of the Commission's statutory duties. Next the Commission proposed to include a procedure for appeals to the Commission, but the delegation issue continued to be raised by the Attorney General's office and at least one party. The implementation provisions adopted in this rule are a response to objections raised by parties and the Attorney General.

The Commission assumes full responsibility for classification and standard setting at this time. Ample opportunity for comment has been provided at each juncture in the process, and the Commission has afforded the parties two additional four day comment periods.

In the absence of some delegation of responsibility to other agencies, the Commission anticipates a potential workload beyond its capabilities to absorb. The final rule establishes a list of factors to be considered in acting upon petitions for rulemaking hearings, in recognition of the time and resource limitations placed upon the Commission.

Reconsideration of classifications and standards by the Commission is permissible in the final rule. However, the Commission has determined that C.R.S. 25-8-207 was intended to apply only to surface waters and is not applicable to ground water.

A variance provision has been included in the final rule. The burden of proof is on the proponent of a variance to demonstrate that Table Values need not be adopted in order to protect classified uses. Variances can be granted at the time that standards are initially adopted or in a proceeding under Section 3.11.7(D).

When the Commission has adopted classifications and standards, such regulations should be applied by the Commission, the Division and other state agencies in carrying out their ground water protection responsibilities. The Commission has favored the delegation of responsibilities to other agencies, but has eliminated that approach based upon the objections of the Attorney General. However, the Commission hopes that other agencies with the authority to do so will follow the classification and standards system established by the regulations even in the absence of rulemaking by the Commission to establish classifications and standards for a specified area.

Ground water in a specified area shall not be deemed classified under C.R.S. 25-8-203, and standards shall not be deemed to be set under C.R.S. 25-8-204, in the absence of rulemaking by the Commission.

FISCAL IMPACT STATEMENT FOR THE BASIC STANDARDS FOR GROUND WATER

The Colorado Water Quality Control Commission promulgates this regulation entitled “The Basic Standards for Ground Water” under the authority to classify waters of the state and to establish water quality standards to support those classifications, Section(s) 25-8-202, 203, and 204 CRS.

The regulation establishes a system for classifying ground water and describing those classifications by use and quality. The standards, when applied to specific classes of ground water, become the baseline by which one can establish if water quality has been degraded or water use has been impaired or precluded. At this point there is no economic impact with respect to these regulations, except the cost associated with adopting the regulations. As control or other regulations are proposed which will implement the classification and standards system, the actual costs and benefits for each such proposal will be developed and considered. These regulations as originally proposed would have been automatically applicable to all sources of ground water contamination. This concept has been eliminated in the final rule.

This statement discusses potential economic impacts form future regulations that may be adopted to implement this regulation. All statements regarding values and costs are subject to change during the future adoption of specific control regulations.

**COSTS**

The fiscal impacts may occur at two different points in the regulatory system. If the regulations are implemented through source controls, then the entities responsible for the source (activity) will bear the cost. In socio-economic terms, this is the most equitable way to pay for the cost of prevention. The responsible entity may either pass the costs on to their consumers and have a relatively small percent increase in costs of service over a large user base, or absorb the costs without changing the price of their goods or services.

If the regulations are implemented by pathway elimination (i.e., alternate water supplies or point-of-use water treatment), then the question is who bears the costs? If the owner or operator of the source (activity) pays for pathway elimination, then the cost remains spread over the users of the product. If the pathway is eliminated and the cost is borne by the ground water users who are not responsible for the source, then the cost may be borne by a larger but less appropriate user base.

Finally, if neither the source nor the pathway are controlled and contaminated ground water is delivered to its ultimate user, then the individual water user carries the burden associated with increased health costs and risks.

Treatment of waste prior to discharge as a result of a control regulation is a viable alternative but the burden is upon the facility to provide the treatment. The elimination or reduction of the discharge includes design criteria such as pond linings, leak collection and/or detection. These costs can be significant but are limited to the life of the facility plus some limited post closure period. Eliminating or reducing the discharge is already required under several state statutes for some facilities such as certain solid waste disposal facilities.

Treatment of waste prior to discharge is an effective option for controlling contamination but is capital-intensive in terms of initial costs. This is a cost of production, manufacturing or operation and is considered a cost of doing business. The treatment of waste prior to discharge is already required for facilities that discharge to surface water.

Treatment of water at the point of use is the most costly option because it requires recapturing a much larger volume of contaminated water and redistribution of the water as well as treatment and maintenance. When this is related to private water supplies and maintenance, the cost rises because the treatment is not centralized.

One example of point-of-use treatment costs is nitrate removal system for the McFarland Mutual Water Company water supply in McFarland, California. The capital cost in 1983 was $900,000 for a one million gallon per day facility. Operating costs are twenty-four cents per 1,000 gallons.

In Colorado, provision of an alternate water supply could arguably be the most expensive option depending on the location of the contaminated resource. For example in the Denver area the cost to replace a water supply for South Adams County Water and Sanitation District (30,000 residents) is approximately $20.9 million for water from the Metro Water Development Authority and $34 million for water from the Burlington Ditch. This does not include the costs of treating the water. In rural areas, the replacement cost may not be as high as in the Denver area but alternate water supplies are not likely to be readily available.

Finally, the costs associated with cleanup of contaminated ground water tends to be the most expensive. Remedial cleanup is not always feasible, it is always costly. The costs associated with implementing these regulations as preventative measures are significantly less than the costs of implementing them as reactive or “cleanup” measures.

When used in the reactive sense, the costs of cleanup and contamination investigation have been described by Geraghty and Miller Ground Water Contamination , 1984, page 16. “Hydrogeologic investigations to define contamination problems can cost from $25,000 to $250,000. Litigation may lead to doubling of this price. The minimum costs of the ground water phase of a partial cleanup and containment project is $500,000.”

In Santa Clara, California, IBM has spent $20 million and Fairchild has spent $16 million to cleanup ground water contamination. California has had some nineteen sites put on the Superfund National Priorities List because the small companies which are responsible do not have the funds to pursue cleanup activities.

In Colorado, the costs estimated for the cleanup of the Rocky Mountain Arsenal are estimated in the billions of dollars. The time needed for such cleanup is estimated to be several decades. Indeed, there will be costs associated with these rules that are likely to be large. However, when compared to the benefits or elimination of risk to the public health, those costs are warranted.

In terms of monitoring requirements, the agencies that may have to consider these standards in their permitting actions already require specific monitoring and hydrogeologic analyses to be performed. Therefore, no new monitoring requirements or costs may be associated with these rules when implemented under existing regulatory controls unless frequency of sampling or the number of parameters is increased by the agency.

Monitoring requirements, when implemented under the Commission's future regulations, will be an additional cost to facilities which will be controlled by those regulations. The Colorado Mining Association has estimated that a new investigation designed to comply with monitoring requirements which may result from future control regulations, may cost $500,000 the first year and $68,000 for each additional year. Monitoring programs for other types of activities may be lesser or greater than these figures depending on the nature of the activity and the specific requirements of the future control regulations.

State agencies, including the Division, will incur costs to adopt the future classifications, standards and control regulations and to implement them. It is not now known the magnitude of such costs or whether they will be paid by the taxpayers of the state or by facility owners through cash funding mechanisms such as discharge permit fees.

**BENEFITS**

There are no specific benefits which can be attributed to this present Commission action since these regulations only set up a framework for additional future regulations and their implementation. Several potential benefits may be realized by such future action. The most obvious possible benefit would be the protection of human health. Prevention of ground water contamination which would otherwise result in long-term illness is a benefit. The prevention of the costs of remedial medical care for the sick, additional health insurance premiums and costs to business for long-term illnesses and the costs to society for caring for chronically ill patients, not to mention the reduction of human suffering, is a distinct benefit.

Possible environmental benefits are related to the preservation of a valuable resource in a water scarce state. In many areas of Colorado, ground water is the only source of water for agriculture. The prevention of contamination of ground water allows the agriculture use to continue through the irrigation of crops or watering of livestock. Such crops and livestock make up a significant segment of the Colorado economy, the protection of which is a benefit.

PARTIES TO THE PROCEEDINGS OF THE PUBLIC RULEMAKING HEARING FOR THE BASIC STANDARDS FOR GROUND WATER

1. CF&I Steel Corporation
2. The Colorado Water Congress
3. The Colorado Mining Association
4. Yuma County Ground Water Management Districts
5. Metropolitan Denver Sewage Disposal District
6. AMAX, Inc.
7. The City of Northglenn
8. The Colorado Association of Commerce & Industry
9. Committee on Oil Shale of the Rocky Mountain Oil and Gas Association
10. The City of Colorado Springs
11. The Adolph Coors Company
12. Cathedral Bluffs Shale Oil Company
13. The Special Districts Association
14. Colorado Petroleum Association
15. Gulf and Western, Inc.

## 41.13 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY AND PURPOSE(1989 REVISIONS)

The provisions of section 25-8-202(1)(b), (2) and (7); and 25-8-204; C.R.S., provide the specific statutory authority for adoption of the attached regulatory amendments. The Commission also adopted, in compliance with section 24-4-103(4) C.R.S., the following statement of basis and purpose.

### A. OVERVIEW

Since the Commission adopted The Basic Standards for Ground Water in 1987, no specific ground water quality classifications and standards have been adopted for any state ground waters. The purpose of the adoption of the statewide standards that are the subject of this action is to provide a statewide baseline of protection by establishing standards that will apply broadly to Colorado ground waters, for certain toxic organic pollutants and radioactive materials.

As a part of the same proceeding that led to the adoption of these ground water standards, the Commission has adopted similar statewide surface water standards for organic pollutants in section 3.1.11 of the Basic Standards and Methodologies for Surface Water, and deleted certain very general statewide ground water quality standards previously contained in that document. As explained more fully in the Statement of Basis and Purpose for those changes (section 3.1.22), the Commission has adopted an expanded set of numerical basic surface water standards for toxic organic pollutants in part due to requirements of the federal Clean Water Act. Although that Act does not contain any requirements for the adoption of ground water quality standards, the Commission believes that it is appropriate in this instance to provide consistent levels of protection for both surface and ground water resources. The principal difference between the two sets of standards is the lack of aquatic life standards for ground water, because ground water quality does not affect aquatic life unless it emerges at some point and becomes surface water (which is then subject to surface water standards).

Evidence has been submitted that on a site-specific basis some ground waters have become substantially contaminated with organic pollutants, e.g. as a result of past disposal practices. Although there is no information currently indicating that such contamination is widespread, the Commission believes that the best policy option is to adopt numerical standards now, to help assure that these pollutants do not become a more widespread problem.

The organic chemicals for which standards are being adopted generally are not naturally occurring water quality constituents. Therefore, the Commission has determined that a statewide approach to adoption of water quality standards for these substances is the most efficient and appropriate means of assuring human health and environmental protection in a timely manner. Where there may be naturally occurring levels of some specific pollutants for which standards are adopted, or where other site-specific factors warrant, the Commission has preserved the flexibility to adopt alternative, site-specific standards, as discussed further below.

In addition to the adoption of the new organic pollutant standards, the Commission also adopted new ground water quality standards for a limited list of radioactive materials. These standards are identical to those which have been and will continue in place for surface waters. The Commission rejected a proposal to adopt a new numerical uranium standard for ground water at this time, because the Commission believes that this issue warrants more specific analysis prior to such action. For example, the consistency with established surface water quality standards for uranium in several basins needs to be more fully considered.

Considering the desirability of having consistent levels of protection for surface and ground waters and the potentially serious adverse impacts from these pollutants, the Commission has determined that the record in this proceeding demonstrates the need for the adoption of these standards. Recently adopted legislation-Senate Bill 181 in the 1989 session-includes new provisions that apply when the Commission adopts “rules more stringent than corresponding enforceable federal requirements.” Section 25-8-202(8)(a), C.R.S. The Commission interprets these provisions to be inapplicable to this rulemaking, since there are no “corresponding enforceable federal requirements” that establish ambient ground water quality standards. Section 303 (c)(2)(B) of the 1987 amendments to the federal Clean Water Act includes a directive that, whenever states revise surface water quality standards, they adopt standards for certain toxic pollutants. However, no federal standards—no enforceable federal requirements—are established for these pollutants, and the directive that states act applies only to surface water, not ground water.

Moreover, even if this section did apply, the Commission finds that the standards adopted are based on sound scientific and technical evidence in the record. This basis is demonstrated in part by the testimony submitted by witnesses for the Division and for EDF, including the underlying analyses and studies referenced therein. The Commission's evaluation of the available information, and its assessment of how this information should be reflected in the standards, is also addressed in the discussion of “Basis for Specific Standards” set forth below. Finally, these standards are necessary to protect the public health, beneficial uses of water, and the environment of the State-in part due to the fact that there are no corresponding enforceable federal requirements. As mentioned above, the Commission believes that the best policy to assure protection of these uses is to adopt uniform, preventive standards. Without such standards in place, waters that have not yet been affected by the discharge or presence of such toxic pollutants may be adversely affected in the future, and protection of their present and future uses would then not be assured. The approach adopted by the Commission attempts to assure protection of uses by initially applying the standards broadly, but at the same time assures economic reasonableness by providing flexibility to revise the standards on a site-specific basis and to take site-specific circumstances into account in determining the need to apply the standards in regulating individual entities. See, e.g., the discussion below regarding “Point of Compliance”.

Finally, in addition to the revisions discussed in more detail below, the Commission has made relatively minor changes to sections 3.11.2 and 3.11.7 for consistency with the major changes being adopted.

## B. RELATION OF STANDARDS TO CLASSIFICATIONS

In contrast to the approach the Commission has taken for the new surface water organic pollutant standards, applicability of the new ground water standards is not tied to the presence of corresponding ground water use classifications. For the reasons discussed above, and because it is likely to take several years to adopt site-specific ground water classifications throughout the State, the Commission has decided as a matter of policy that these standards now being adopted should apply statewide on an immediate basis.

During the course of the proceeding, other alternatives were considered. For example, one option discussed was applying the standards to (1) all nontributary ground water, (2) all tributary ground water that has been classified “domestic use-quality”, (3) all tributary ground water located in aquifers that have been or are being used for domestic water supply purposes, and (4) all ground water that is tributary to streams or stream segments which are classified for domestic water supply. Alternatives such as this have the disadvantage of requiring potentially difficult factual determinations regarding precisely where the standards apply. While such issues could be resolved by the Division as they arise, this system would make it difficult for the public to know in advance where the standards apply.

The intent of such alternatives was to avoid unnecessarily stringent requirements that could result from applying the standards to ground water that does not warrant protection as an actual or potential drinking water supply. However, the Commission believes that this goal can be achieved by a simpler approach. Pursuant to recently adopted legislation (SB181), other state regulatory agencies with ground water quality protection responsibilities have the flexibility to determine appropriate points of compliance when implementing these standards. (See section 3.11.6(D) and the discussion under G., below.) Second, the Commission has included language in section 3.11.5(C)(5) to clarify that certain federal program regulatory determinations regarding ground water quality would not be superceded by the Commission's standards, where such programs dictate a contrary result. (See the discussion under F., below.) Finally, the Commission has preserved the option of establishing different site-specific standards to apply in place of the statewide standards, where determined appropriate following a rulemaking hearing before the Commission. (See section 3.11.5(D), and the discussion under D., below.)

The Commission believes that the combination of these provisions provides ample means of assuring that unnecessarily stringent regulation, based on the statewide standards, can be avoided.

## C. BASIS FOR SPECIFIC STANDARDS

A wide range of approaches to setting standards for the organic pollutants were considered during the course of this proceeding. These ranged from setting “zero” standards for some pollutants (carcinogens), to setting standards only for chemicals for which maximum contaminant levels (MCLs) have been adopted, to setting standards based on practical quantitation limits (PQLs).

The standards adopted have been established as interim rather than permanent standards principally because it is clear to the Commission that the development of appropriate numerical criteria to protect various beneficial uses from organic pollutant impacts is a rapidly evolving area that is still very much in flux. For example, there are currently significant differences among the various criteria, advisories, and maximum contaminant levels available for a number of specific pollutants. As new information becomes available and potential conflicts among the various numerical levels are resolved, it may be appropriate in specific instances in the future to adopt permanent standards either more or less stringent than the interim standards being established at this time. However, given the importance of controlling toxic pollutants in the environment, the Commission believes that it is necessary to move forward with the adoption of interim statewide standards at this time, and that the interim standards adopted are reasonable based on the best currently available information.

The organic pollutant standards have been divided into two categories—Table A for carcinogens and Table B for non-carcinogens. For non-carcinogens, the interim standards are based on MCLs, or lifetime exposure levels derived from the “reference dose” for constituents for which no MCLs have been adopted. Non-MCL standards generally are based on EPA health advisories or integrated risk in formation system (IRIS) data. The Commission has determined that this is the best information currently available as to the appropriate criteria for protection of human health for non-carcinogens.

For the Table A carcinogens, the interim standards are again based on MCLs for constituents for which these limits have been developed. For non-MCLs, standards based on the 1 ×t; 10 -6 risk level have been adopted. Recognizing that there is no scientifically “correct” risk level, the Commission has selected this level as a matter of policy, because it believes this is an appropriately conservative and protective level for human health risks.

To determine which specific pollutants to list on Table A, any particular compound was considered to be carcinogenic if it has been classified by EPA as either a Group A (known human carcinogen) or Group B (probable human carcinogen) compound. Compounds classified as Group C (possible human carcinogen), Group D (information inadequate to assess), or Group E (not anticipated to be a carcinogen), were treated as non-carcinogenic and listed on Table B. A few specific compounds classified by EPA as Group B/C were considered carcinogens and included in Table A.

## D. SITE-SPECIFIC STANDARDS

Section 3.11.5(D) clarifies the Commission's ability to adopt site-specific standards to apply in lieu of the statewide standards where appropriate. Rather than attempt to anticipate all potential factual justifications for different site-specific standards, the Commission has determined that it is most appropriate simply to refer to the standard statutory and regulatory criteria for such determinations.

The Commission believes that because these standards are being adopted without taking site-specific factual circumstances into account, any revised site-specific standards based on such a site-specific analysis should not be considered a downgrading. Rather, this would simply be a determination that different numerical standards are adequate to protect the uses in question. The fact that downgrading criteria would not apply to such circumstances is a material assumption upon which the Commission relies in adopting these statewide standards.

## E. USE OF DETECTION LEVELS

Section 3.11.5(C)(4) explains how detection levels are to be used in implementing the new standards, in view of the fact that in many instances the standards are lower (more stringent) than common detection levels. The Commission believes that it is appropriate to recognize the limits of current detection technology by clarifying that specified detection levels will be used for purposes of establishing performance standards.

The specific detection levels to be used for these statewide standards are being specified in the regulation. Although this is not the Commission's normal practice, it has determined that this step is appropriate in this instance because the need to comply with very stringent standards for organic pollutants will be new to many regulated entities.

The Commission has decided to rely for now on detection levels based on practical quantitation limits (PQLs) associated with GC-MS laboratory analysis techniques, except where only a GC-based PQL exists. For those compounds which have an MCL as the standard, the corresponding detection method was adopted. The Commission has decided not to require detection to the generally more stringent GC-PQLs in all circumstances, in order to temper the economic impact of this new set of standards. Of course, as scientific knowledge and technology advance, this decision may be reconsidered in subsequent rulemaking hearings. In a few specific instances where national guidance is not available, PQLs have been established based on the Colorado Health Department Laboratory's best professional judgment.

## F. RELATIONSHIP TO OTHER PROGRAMS

Concerns were raised during the hearing process regarding the relationship of these new statewide organic pollutant standards to environmental standards that might be established under federally-dictated environmental programs. The Commission does not intend to attempt to preempt such programs by the adoption of these standards. To address the programs where there appeared to be a potential for conflict, the Commission has added new subsection 3.11.5(C)(5), relating to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and Resource Conservation and Recovery Act (RCRA) Subtitle C and I programs. This section clarifies the Commission's intent that both a compliance level or performance standard, and a point of compliance that differ from those established in this regulation or in a site-specific hearing by the Commission can be utilized by the relevant agencies where authorized by those programs.

The Commission also notes that, in accordance with Senate Bill 181, for certain categories of activities these standards will be implemented initially by other state “implementing agencies.” Section 25-8-202(7), C.R.S. The Commission believes that this system should be efficient and effective. Moreover, if at any time it appears that the other agencies are not taking adequate steps to assure compliance with the standards, the Commission is authorized by SB181 to step back in and take appropriate action.

## G. POINT OF COMPLIANCE

The Commission has added significant new provisions to section 3.11.6, regarding points of compliance. In subsection (A) the Commission has now noted the integral relationship between numerical standards and points of compliance. In subsection (B), the Commission has specified points of compliance to apply for the new statewide organic pollutant and radioactive materials standards, unless a different site-specific point of compliance is later adopted by the Commission, or applied by another agency pursuant to its independent authorities.

For situations where significant ground water quality contamination has not yet occurred, the Commission believes that the downgradient limit of the area above which potentially polluting activities are located—the edge of the disturbed area—is a reasonable and environmentally protective point of compliance. However, for situations where contamination exists as of the effective date of these regulatory amendments, the Commission recognizes that it may not always be feasible to clean-up the ground water to the levels established by these statewide standards back to the edge of the disturbed area. Therefore, the alternative potential points of compliance listed in section 3.11.6(B)(1) have been established for such situations. This approach is being adopted to help assure the administrative practicality of applying the new statewide standards, to reduce the administrative burden of potentially numerous site-specific rulemaking hearings before the Commission, and the potential resulting delays in remediation of contaminated sites.

It was suggested during the course of the proceeding that subsection 3.11.6(B)(1) should make a further distinction between facilities at which control requirements have been established as of the effective date of these amendments, and facilities at which such requirements have not been established as of that date. The Commission has rejected this option for several reasons. First, significant factual and legal uncertainties could arise in determining which facilities are ones “at which control requirements have been established.” For example, have control requirements “been established” for a hazardous waste disposal facility operating without a permit?

Second, in order to achieve a preventive program, the Commission believes that activities and facilities that pollute ground water should be put on notice now that they may some day need to comply with these standards, even if they are not currently subject to specific regulatory requirements under an existing program. Section 3.11.6(B)(1) already allows an effective “grandfathering” of some pollution that has occurred prior to the effective date of these statewide standards. The Commission sees no reason to adopt a general grandfathering of future ground water pollution. If site-specific inequities would result from application of the statewide standards and points of compliance, that can be addressed in a site-specific hearing before the Commission (or, in some instances, by the implementing agency). Moreover, if new control regulations are proposed in the future, in a rulemaking proceeding to consider their adoption the Commission would consider whether application of the points of compliance established in this regulation would be appropriate in that new program. If such application would lead to unreasonable or inequitable results, the Commission could apply different provisions at the time, while still protecting the appropriate beneficial uses.

The Commission's overriding concern is that a point of compliance be established that is protective of human health and the environment. The Commission is adopting section 3.11.6(C) to provide further clarification of the approach that it intends to take to considering site-specific points of compliance. That section provides that when requested in a site-specific hearing, the Commission shall adopt a point of compliance closer to the existing source of contamination when the alternative points of compliance provided in section 3.11.6(B)(1) are not protective of human health and the environment. Conversely, section 3.11.6(C) also requires the Commission, when requested in a site-specific hearing, to establish a point of compliance further from the source of contamination than the alternatives provided in section 3.11.6(B) considering the enumerated factors, so long as the point of compliance remains protective of human health and the environment.

By establishing the alternative points of compliance in section 3.11.6(B)(1), for facilities with ground water contamination existing as of the effective date of these amendments, the Commission does not intend to supercede any more stringent ground water quality remediation requirements that may apply under other state or federal authorities. The Commission is attempting in section 3.11.6(B), as a matter of administrative necessity, to provide an initial baseline of protection, while avoiding potential unreasonably stringent results from the application of its statewide standards that are being adopted without taking site-specific conditions into account. Where a more stringent result is required or has been or is determined appropriate as a result of a site-specific analysis under another agency's program, such as RCRA or CERCLA, the Commission does not intend section 3.11.6(B)(1) to preempt that result. The alternative points of compliance established in section 3.11.6(B)(1) shall carry no presumptive weight in a site-specific standards hearing. In site-specific hearings, it is the Commission's intention to consistently apply the standards for establishing a point of compliance in similar circumstances at all remedial sites across the State.

Finally, the Commission has added a new subsection 3.11.6(D) to implement relevant portions of Senate Bill 181. In accordance with this Act, this subsection defers the initial authority to establish points of compliance to the appropriate “implementing agency.” SB181 contemplates that implementing agencies will establish points of compliance for activities under their jurisdiction, in accordance with criteria established through rulemaking after public hearing and consultation with the Commission and Division, so as to protect present and future beneficial uses of water. Correspondingly, the ultimate authority of the Commission is retained to step back in and establish points of compliance if necessary to assure a consistent statewide water quality control program, in accordance with the specific provisions of SB181. The Commission intends to monitor the implementation of SB181 closely. In particular, the Commission intends to conduct an informal review of the implementation of these standards one year after their effective date. Hopefully, by that time other agencies will have had an opportunity to complete any required rulemaking and begin applying the standards where appropriate. If necessary, the Commission will at that time consider taking additional action of its own to assure that the standards are implemented in a timely and effective manner.

## H. ECONOMIC REASONABLENESS

The new statewide standards for organic pollutants could have an adverse fiscal impact on any persons discharging such pollutants to state waters. It is impossible to quantify that impact at this time. Such impacts will depend to a large degree on the nature of any control regulations subsequently adopted by the Commission to implement these standards, as well as any potential future amendments to the discharge permit regulations to address discharges to ground water. The impacts will also depend on the requirements of other state agencies to implement or assure compliance with water quality standards adopted by the Commission. However, the Commission believes that in general the cost associated with compliance with the standards will be counter-balanced by the environmental benefits associated with protecting beneficial uses, although these benefits are also impossible to quantify at this time. Specifically with respect to future activities that may be subject to these standards, evidence was submitted indicating that preventing ground water contamination generally is less costly than after-the-fact clean-up or remediation.

The Commission has incorporated several elements into these amendments in an effort to make them as economically reasonable as possible, consistent with providing adequate protection of human health and the environment. Examples of these elements include:

1. Use of MCLs, which are set at levels that take technological feasibility into account, as standards for any pollutants for which these levels have been established;

2. Reliance on accepted detection levels as compliance thresholds where the actual standards are more stringent;

3. Establishment of more lenient points of compliance for situations with existing contamination;

4. Explicit deference to points of compliance established by certain state “implementing agencies;”

5. Provisions for adoption of site-specific standards and site-specific points of compliance to apply in lieu of the statewide provisions where appropriate; and

6. Explicit deference to certain federal regulatory programs which may apply different standards.

Each of these elements is discussed in more detail above, in earlier sections of this statement.

PARTIES TO THE PROCEEDINGS OF THE PUBLIC RULEMAKING HEARING FOR THE BASIC STANDARDS FOR GROUND WATER

1. Holme, Roberts & Owen
2. Vranesh & Raisch
3. Colorado Mining Association
4. City of Colorado Springs
5. North Front Range Regional Planning Agency
6. Homestake Mining Company
7. Rocky Mountain Oil & Gas Association
8. Amoco Production Company
9. Saunders, Snyder, Ross & Dickson
10. Welborn, Dufford, Brown & Tooley
11. Environmental Defense Fund

## 41.14 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY, AND PURPOSE (1990 REVISIONS)

The provisions of sections 25-8-202(1)(a), (b), and (2); 25-8-203; and 25-8-204; C.R.S., provide the specific statutory authority for adoption of the attached regulatory amendments. The Commission also adopted, in compliance with section 24-4-103(4) C.R.S., the following Statement of Basis and Purpose.

### A. POINT OF COMPLIANCE

The Commission has revised section 3.11.6 to eliminate the previous requirement that the Commission establish a point of compliance at the time of each ground water classification proceeding. The Commission determined that the former approach will often be inappropriate, where classifications are not being established to address a specific contamination source. At the time of a classification proceeding, the Commission may not be aware of all contamination sources within the specified area. In addition, the Commission has determined that establishment of points of compliance by the Division in the first instance is more consistent with the new framework established by Senate Bill 181, adopted in 1989. In this regulation the Commission is now establishing criteria to be taken into account by the Division in establishing such points of compliance. This structure is then parallel to that for other SB181 implementing agencies, who establish points of compliance in accordance with criteria adopted through rulemaking.

A definition of the term “point of compliance” has also been added by the regulatory amendments. The definition reflects the Commission's view that it generally will be more practical to determine compliance with the standards at a vertical surface downgradient from the regulated activity (as opposed to a point directly below the activity). However, the Commission retains authority to designate a point of compliance other than a vertical surface on a case-by-case basis when a site-specific point of compliance is adopted under section 3.11.6 (E).

**IMPLEMENTING AGENCY COORDINATION**

In response to SB181, the Commission has amended the Basic Standards for Ground Water to clarify that a point of compliance for activities that are regulated by implementing agencies identified in that statute is not a part of this regulation. Consistent with the spirit of SB181, these other implementing agencies will have the first opportunity to assure that adequate water quality protection is provided by the facilities in question. The Commission anticipates that Memoranda of Agreement entered into between the Water Quality Control Commission and Division and appropriate other agencies will provide a mechanism to assure that the other agencies' programs provide protection that is comparable to that provided by this regulation. Pursuant to SB181, the ultimate authority of the Commission is retained to apply additional regulation to such facilities if necessary to ensure a consistent statewide water quality control program. The Commission intends to monitor the implementation of SB181 closely to assure that an acceptable overall water quality control program is maintained.

A question was raised during the hearing as to whether Commission oversight pursuant to SB 181 of other agencies' activities would be only programmatic, or might also address individual, site-specific actions by such agencies. The Commission anticipates that its oversight generally will be programmatic. However, the Commission has authority to act with respect to individual situations, if it believes its intervention is necessary to assure compliance with the intent of the Water Quality Control Act. Of course, even if the Commission did choose to act in such circumstances, it would be limited to acting through the adoption of control regulations or permit regulations.

**WATER QUALITY CONTROL DIVISION IMPLEMENTATION**

Section 3.11.6 (D) creates authority for the Water Quality Control Division to establish points of compliance whenever it has authority to do so pursuant to discharge permit regulations or control regulations. The Commission has scheduled a rulemaking hearing later this year to consider revisions to the discharge permit regulations, 6.1.0 (5 CCR 1002-2) to address discharges to ground water. At this time there are no control regulations governing ground water impacts, and no specific regulations of this type have been scheduled for consideration by the Commission. However, the Commission believes that it is advisable to have the point of compliance process in place, so that it should not be necessary to revise this regulation when new control regulations are adopted or the permit regulations are revised.

The Commission intends that determinations of a point of compliance within classified areas, as well as for statewide standards, by the Division will be appealable. The exact process for such appeals would be set forth in amendments to the permit regulations or any new control regulation.

**WHERE THE STANDARD IS APPLIED**

After standards, the most important issue regarding ground water protection is the physical point at which the standard should be applied. At what point in the aquifer does contamination constitute noncompliance? Among the points considered were the site boundary, the limit of existing contamination, or some specified distance from the contamination source.

It was determined that the site boundary should set the outer limit for a point of compliance (except for surface water discharges, as discussed below) because it distinguished areas that a responsible party controls from areas where the general public may be affected. For the inner limit we chose the edge of the activity or contamination source boundary to minimize the area affected. These limits are consistent with previous Commission rulings on the statewide standards.

For existing activities contamination may have, to some extent, merged with the immediate surroundings, making the contamination source boundary difficult and expensive to define. Where the standards might be exceeded only in the immediate vicinity of a source, the cost of remediation to avoid the exceedence might be unjustified in relation to the benefits of remediation. Therefore, for existing activities the regulation allows the Division to establish the point of compliance at a specified distance from the contamination source, taking into account site-specific facts in accordance with criteria spelled out in the regulation. Application of the standards at the specific activity boundary might not serve the intended purpose of avoiding large expenditures for very little gain, and yet setting some large arbitrary distance would be insufficiently protective. For those facilities who have conducted prior investigations to discover and map the extent of existing contamination, the option exists to set the point of compliance at the leading edge of the plume.

For new activities, new opportunities for site selection and preparation become available. For new sites we propose to apply the standards at the specific activity boundary. In effect, this is as protective as applying them at the specific contamination source (e.g., the point at the bottom of an impoundment at which a leak occurs), while allowing some benefit from sorption and dilution in immediately adjacent ground, in case small leaks occur.

**HOW THE STANDARD IS APPLIED**

The Commission recognized the difficulty of complying with a concentration limit standard at a fixed point in space, when operating within the temporal and spatial variations inherent in ground water flow.

The intent of any permit or control regulation should be to permit sampling frequency and interpretation that adequately reflects groundwater quality variation over time. Owners and operators should have latitude in this regard provided that an acceptable minimum number of samples are taken from each well annually. At the discretion of the owner/operator a shorter sampling interval may be employed to demonstrate that an exceedence of standards is due to temporal effects. This interval should be determined after evaluating the aquifer's effective porosity, hydraulic conductivity, and hydraulic gradient (which would govern rates of flow), and the fate and transport characteristics of the potential contaminants. This additional effort should help identify seasonal trends in the data and permit evaluation of the effects of seasonal variation or slugs of contamination if present in the samples. To better characterize spatial variability, an owner/operator may wish to install and sample from multiple background and compliance wells. If sufficient data is made available through these additional efforts, the owner/operator may employ statistical procedures such as moving averages and trend analysis to reduce seasonal and temporal effects. Utilization of site-specific characterizations to statistically evaluate an exceedence of standards requires detailed knowledge of the site. For owners/operators to use these methods they should be able to identify the uppermost aquifer, and aquifers hydraulically interconnected beneath the facility property, including groundwater flow direction and rate, and the basis for that identification.

In many situations it may benefit the owner/operator to install intermediate monitoring points. These monitoring points could be closer to the source or activity, or within the unsaturated zone. The monitoring points could function to alert the owner/operator to a potential contamination problem before it reaches the point of compliance.

**“CONTAMINATION” DEFINITION**

Because it is used several times in the point of compliance provisions, a definition of the term “contamination” has been added to the definitions section. This term is defined broadly, to provide a threshold determination of when non-naturally occurring pollution is present, and to help identify the appropriate locations for points of compliance. This definition does not determine who is responsible for cleaning up any specific contamination. It is not the Commission's intention by this broad definition to make individuals responsible for contamination caused by others. Nor is it the Commission's intention to adopt an antidegradation standard for ground water. The regulation does not state that all “contamination” must be avoided or cleaned up; rather, any adopted ground water standards remain the target for regulatory activities.

**HYDROLOGICALLY DOWNGRADIENT LIMIT**

Concern was expressed during the hearing regarding the use of the term “hydrologically downgradient limit.” This phrase is commonly used in the industry. Generally, it refers to the “downstream” edge of the ground water in question. For example, “the hydrologically downgradient limit of the area below the activity potentially impacting ground water quality” is located by a vertical plane at the immediate edge of the surface activity in question, on the side of the activity toward which the ground water is flowing.

**SURFACE WATER DISCHARGES**

The Commission has included in section 3.11.6 (D) language to address points of compliance for surface water discharges that may adversely impact ground water. Specifically, the Commission has added a cross-reference to the Discharge Permits System Regulations, where such points of compliance will be addressed. The Commission also added language to section 3.11.6 (D)(1)(b)(iii) and (D)(2)(b)(iii) to add the quality of water discharged to the factors to be considered by the Division in setting points of compliance.

**B. OTHER REVISIONS**

**1. Table Corrections.**

Other changes to the Basic Standards, first pointed out at the triennial review, involve corrections to table 1 and table A. In table 1 duplicative standards that are already established in the statewide standards for radioactive materials and organic pollutants have been deleted. In table A the detection level for the pesticides chlordane, DDT, and dieldrin were incorrectly listed in the GC/MS column. The corrected detection level of 0.1 ug/l is now under the GC column heading. These pesticides are part of a chemical group known as chlorinated organics and therefore should be tested by the GC method only. Concern was expressed at the hearing as to whether a second column confirmation would be conducted to achieve these practical quantitation limits. Dr. Sexton of the Health Department Laboratory testified that they routinely use such confirmations in accordance with the EPA methods.

**2. Molybdenum Standard.**

The Commission has agreed in response to a proposal by AMAX, Inc. to delete the previous molybdenum standard from Table 3, Agricultural Standards. The Commission has taken this action because it does not believe that the information submitted in the hearing was adequate to support any specific numerical standard at this time. The Commission has not made a determination that molybdenum poses no risk to potential beneficial uses of ground water, If better information is submitted at a later date regarding an appropriate numerical protection level for molybdenum, the Commission will reconsider the potential need for a standard at that time.

PARTIES TO THE PROCEEDINGS OF THE PUBLIC RULEMAKING HEARING FOR THE BASIC STANDARDS FOR GROUND WATER

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11. Environmental Defense Fund

## 41.15 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY, AND PURPOSE (1991 REVISIONS)

The provisions of section 25-8-202(1)(a),(b) and (2); 25-8-203; and 25-8-204; C.R.S., provide the specific statutory authority for adoption of the attached regulatory amendments. The Commission also adopted, in compliance with section 24-4-103(4) C.R.S., the following statement of basis and purpose.

### STATEWIDE NUMERICAL STANDARDS

#### 1. Organic Chemicals.

In 1989, the Commission adopted certain interim organic pollutant standards, applicable to ground water statewide. Several revisions and additions to those interim standards are now being adopted. In general, the primary purpose of these changes is to provide a more thorough system to assure protection of Colorado's water resources with respect to potential adverse impacts from organic chemicals. One change adopted is to combine previous Tables A and B into a single, consolidated Table A. The Commission believes that this format will be easier to read, and helps to assure elimination of potential inconsistencies between the separate tables.

#### a. Risk-based Water Supply Standards.

When the Commission adopted interim organic chemical standards in 1989, the Commission adopted standards based on maximum contaminant levels (MCLs) for all pollutants for which MCLs had been established under the Safe Drinking Water Act. The Commission has now reevaluated this policy and adopted health-based standards for these constituents instead of standards equal to the MCLs, whenever health-based criteria are available. Several considerations have led to this new approach.

The vast majority of the standards adopted in 1989 were already set equal to health-based criteria. MCLs generally are more lenient than health-based criteria, and have been developed taking into account laboratory detection limits and the economic ability of water suppliers to treat for removal of these constituents. The Commission already has attempted to temper the application of stringent health-based standards for non-MCLs organic pollutants by providing for the application of the practical quantitation limit (PQL) concept in determining compliance with the standards. Any dilution present prior to the point of compliance would further temper the application of these standards. Therefore, the Commission has determined that it is a more appropriate policy to base these water quality standards on health-based criteria, rather than MCLs. Revisions have been made to the standards, as now contained in the consolidated Table A.

**b. Other Revisions.**

Standards for a number of additional organic chemicals have been added to the Basic Standards for Organic Chemicals Table in the Basic Standards and Methodologies for Surface Water to help complete Colorado's compliance with section 303(c)(2)(B) of the federal Clean Water Act. The chemicals added are ones listed as priority toxic pollutants, and for which EPA has developed human health or aquatic life criteria under the Clean Water Act. The same additions have been made to the revised Table A in this regulation, for consistency between ground and surface water standards for organic chemicals.

The Commission decided not to include in the consolidated Table standards for total trihalomethanes or for polynuclear aromatic hydrocarbons (PAHs) as a class. The Commission believes that it is more practical to regulate individual chemicals in these groups. Some evidence was submitted indicating that not all PAHs should have the same standard. For now the Commission has adopted these standards based on the available EPA criteria, although if more specific evidence on this issue is brought to the Commission in the future, revisions can be considered.

Several minor clarifications have been adopted for Table A. A footnote has been added to the “standard” column to indicate that these are chronic water quality standards. The “detection levels” column has been relabeled “PQLs”, to clarify that the values indicated are practical quantitation limits. In addition, the PQLs for a few parameters were revised to be consistent with the current information from the Colorado Department of Health laboratory.

PARTIES TO THE RULEMAKING HEARING FOR BASIC STANDARDS & METHODOLOGIES FOR SURFACE AND GROUND WATER

1. Adams Rib Recreational Area
2. EG&G Rocky Flats
3. Northwest Colorado Council of Governments
4. The Grand County Water & Sanitation District #1, Fraser Sanitation District and Winter Park Water and Sanitation District
5. The Metro Wastewater Reclamation District
6. Amax, Inc.
7. Kodak Colorado Division
8. Paramount Communications Inc.
9. Schlage Lock Company
10. The Colorado Water Congress
11. Chevron Shale Oil Company
12. Adolph Coors Company
13. Remedial Programs Section, Hazardous Materials & Waste Management Division, Colorado Department of Health
14. Umetco Minerals Corporation
15. Martin Marietta Corporation
16. Shell Oil Company
17. Cotter Corporation
18. Union Oil Company of California
19. Supervisory Committee of the Littleton-Englewood Bi-City Wastewater Treatment Plant
20. Arapahoe County Water and Wastewater Authority
21. City of Colorado Springs Wastewater Department
22. Colorado Wastewater Utility Council
23. Colorado Mining Association
24. Getty Oil Exploration Company and Texaco
25. Colorado River Water Conservation District
26. Exxon Company, USA
27. St. Vrain and Left Hand Conservancy District
28. Division of Wildlife
29. North Front Range Water Quality Planning Association

30. City of Westminster
31. City of Colorado Springs Water Department
32. Res-ASARCO
33. Three Lakes Water & Sanitation District
34. City of Arvada
35. Northern Colorado Water Conservancy District and the Municipal Subdistrict, Northern Colorado Water Conservancy District
37. Environmental Defense Fund
38. Cherokee Water and Sanitation District, Security Sanitation District, and the Fountain Sanitation District

## 41.16 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY, AND PURPOSE (1993 REVISIONS-DIMP STANDARD)

The provisions of Colorado Revised Statutes (C.R.S.) Sections 25-8-202(1)(b), (2), and 25-8-204 provide the specific statutory authority for adoption of the attached regulatory amendment regarding a statewide ground water standard for diisopropylmethylphosphonate. In support of the regulatory amendment and in accordance with 24-4-103(4) C.R.S., the following statement of basis and purpose is provided.

### I. Overview

### a. Diisopropylmethylphosphonate (DIMP)

The purpose of this hearing was to consider the adoption of statewide water quality standards for diisopropylmethylphosphonate (DIMP). DIMP is a liquid chemical, a by-product from the manufacture and detoxification of a nerve agent, Sarin or GB (isopropylmethanefluorophosphonate), produced by the U.S. Army (Army) at the Rocky Mountain Arsenal in the 1950s. This is an area on the Front Range of the Rocky Mountains, just north of Denver. The Army disposed of DIMP, along with other chemicals, primarily in surface impoundments at the Rocky Mountain Arsenal where it leached into the underlying soils and ground water. The Water Quality Control Commission has heard testimony indicating that DIMP contamination has been detected in the surface and ground water within and outside the boundaries of the Rocky Mountain Arsenal, although ground water contamination exists in the greatest concentrations and is the most prevalent.

The Commission has heard evidence demonstrating that a significant quantity of ground water in the vicinity of the Rocky Mountain Arsenal is contaminated with DIMP. DIMP has been detected in certain drinking water wells located up to 5 miles downgradient of the Rocky Mountain Arsenal. In addition, the evidence indicates that DIMP-contaminated ground water near the Rocky Mountain Arsenal discharges to certain irrigation ditches and affects First Creek, a tributary to the South Platte River. For approximately the last three years, the State has been providing bottled water for consumption and cooking to residents and businesses whose wells were found to contain DIMP, although it is uncertain how long funds will be available to continue this program.

**b. Scope of Evidence and Information**

The Commission was presented with, and considered, a voluminous amount of evidence in this rulemaking. The majority of the evidence addressed the risk associated with exposure to DIMP and the toxicity of the chemical. The Commission heard approximately twenty-five hours of oral testimony from more than twenty witnesses for the Colorado Department of Health, the Army, the Shell Oil Company (Shell), the Arsenal Action Alliance, and the Environmental Protection Agency (EPA), as well as comments by members of the public and commentary by an expert advisory panel of toxicologists. The Commission received and considered literally thousands of pages of written testimony and exhibits from parties and the expert advisory panel. A Regulatory Analysis was prepared by Water Quality Control Division staff in response to a request by one of the parties. The Commission devoted a significantly greater amount of time in hearing testimony and considering written submissions, compared to the majority of water quality standard-setting proceedings it undertakes. Moreover, this hearing addressed the adoption of a water quality standard for a single contaminant, whereas most hearings address multiple pollutants and multiple segments.

Because of the importance of this proceeding, prior to the hearing the Commission took the unprecedented step of requesting that the parties and the Department of Health fund an independent expert advisory panel to provide testimony to the Commission on toxicology issues relating to DIMP. The expert advisory panel, which consisted of three toxicologists who were qualified to discuss risk assessment, assisted the Commission in objectively understanding the large volume of evidence regarding the toxicity of DIMP. The expert advisory panel provided a background educational briefing to the Commission, reviewed the written record, prepared a report for the Commission generally discussing the toxicity information and the different positions of the parties, attended the hearing and asked questions of witnesses, made an oral presentation to the Commission, and responded to questions from the Commission. The Commission found the explanation and clarification of the large amount of evidence by the expert advisory panel very helpful. In accordance with an agreement between the Department of Health, Shell and the Army, and upon advice by the Attorney General's Office, the panel did not advocate or offer a recommendation as to whether a water quality standard for DIMP should be adopted, or, if so, at what level.

Prior to these proceedings, there were no enforceable federal or state standards for DIMP. In 1989, the EPA's Office of Drinking Water issued a lifetime Health Advisory, which is not an enforceable standard, of 600 ug/l (micrograms per liter, also expressed as parts per billion) for DIMP. The EPA Health Advisory is based on a 1980 study of beagle dogs exposed to DIMP over a period of ninety days. 1

The Department of Health initiated these water quality proceedings by requesting that the Commission adopt a statewide standard for DIMP of 8 ug/l, based on its evaluation of the relevant toxicology studies and selection of the 1979 Aulerich mink study 2 as the critical study upon which to base the water quality standard. In the Aulerich study, a significant number of female mink died over the course of their one year exposure to DIMP. Based on this and a more recent study with mink 3 , the Department of Health is concerned about the public health threat associated with DIMP exposure, particularly long-term or lifetime exposure, and derived its proposed standard to protect against these possible effects. In deriving its proposed standard of 8 ug/l for DIMP, the Department of Health followed EPA risk assessment methodology published in EPA's Integrated Risk Information System (IRIS) guidance. The Department of Health presented witnesses and exhibits supporting its recommended standard for DIMP of 8 ug/l. The State's consultant, Dr. Edward Calabrese, recommended a more stringent standard of 0.36 ug/l based on the Aulerich study, but employed certain factors in deriving that recommendation which the Department of Health, based on its professional judgment and the IRIS guidance, chose not to incorporate in its derivation of the recommended standard.

The EPA provided a witness who explained the toxicological basis for that agency's DIMP Health Advisory, and also discussed other issues related to the toxicity of DIMP. The Army and Shell offered witnesses and exhibits supporting the EPA Health Advisory of 600 ug/l on a site-specific basis, although one witness for Shell supported a standard of 500 ug/l later in the proceedings.

The Arsenal Action Alliance provided testimony and exhibits supporting its recommendation that a DIMP standard of 0 ug/l be adopted by the Commission. This position was based largely on that entity's general policy concerns regarding toxins and pollutants in the environment, although it referenced as support Dr. Calabrese's 1990 report regarding DIMP toxicity. The Commission also heard considerable testimony from the public regarding the significant health concerns raised by the presence of DIMP in domestic water supplies.

Accordingly, the toxicological testimony supporting the various recommended standards primarily involved three studies, the 1980 Hart dog study lasting ninety days, the 1992 Bucci study with mink lasting ninety days, and the 1979 Aulerich mink study lasting one year. As the expert advisory panel acknowledged, interpreting the toxicological data from these and the other relevant DIMP studies in the risk assessment context involves professional judgment, and there were differing opinions among the various experts on behalf of the parties regarding the results of these studies.

One question that arose near the conclusion of this process was whether a transcript of the Commission's deliberations regarding the issues raised in this rulemaking proceeding should be made a part of the hearing record. The Commission has decided not to include the deliberations transcript in the record, because it believes that to do so may result in confusion regarding the basis for the Commission's ultimate determination. During deliberations it is typical for many perspectives to be offered and many options advanced and “tested” by individual Commission members. However, it is ultimately only this Statement of Basis, Specific Statutory Authority, and Purpose that accurately reflects the final views of the full Commission. It is this document that sets forth the basis for the Commission's decision, not some or all of the individual comments made during the deliberative process.

**c. Summary of Basis for Decision**

Following consideration of the extensive information briefly summarized above, the Commission has decided to establish a statewide interim ground water quality standard for DIMP at 8.0 ug/l, with an accompanying practical quantitation limit (PQL) of 1.0 ug/l. The ultimate basis for this decision is a policy judgment regarding what level of DIMP is protective of public health and the beneficial uses of water, in the face of credible but differing scientific interpretation of the information regarding the toxicity of DIMP.

The Commission has experienced considerable frustration in coming to the realization that the extensive information and data presented in the record does not lead to the identification of one scientifically “correct” value for the toxicity of DIMP upon which all experts can agree. EPA, which issued a lifetime Health Advisory for DIMP, has indicated that it has “low confidence” in the standard it recommends. Based upon the information provided by the parties, the public, and the Department of Health staff, and the explanations and clarifications of this scientific evidence provided by the expert advisory panel, it is the Commission's judgment that it is ultimately faced with a range of scientifically supportable interpretations of the evidence regarding the toxicity of DIMP. The Commission acknowledges that each of these interpretations carries with it a degree of uncertainty. In the face of this uncertainty, the Commission must exercise its policy judgment. Even a decision to adopt no standard for DIMP would entail substantial uncertainty — uncertainty as to whether public health and the beneficial uses of water would be adequately protected until better information might become available in the future.

Fully cognizant of the existing scientific uncertainty, the Commission has determined that there is a need for the adoption of a statewide ground water quality standard for DIMP at the level of 8 ug/l, in view of the evidence submitted regarding the presence of DIMP in some waters of the State as described above and the evidence regarding the toxicological risk posed by DIMP (as discussed briefly above, and further discussed in section II of this Statement of Basis and Purpose). This standard is derived from the results of the 1979 Aulerich study. The Commission is concerned by the death of female mink observed at each dose level in that study, and cannot ignore these results. The Commission believes that the statewide standard of 8 ug/l is necessary to protect public health and the beneficial uses of waters of the State at this time, and that the standard is based on sound scientific and technical evidence in the record.

The Army and Shell have stated their belief that the Commission's selection of an 8 ug/l standard is based upon a public policy choice that “was not supported by the weight of the scientific evidence.” This assertion is a misleading characterization of the basis for the Commission's action. The Commission finds that there is substantial and sufficient scientific and technical evidence in the record to support this standard. The fact that other standards could also be defended from a scientific and technical standpoint based upon the information submitted does not mean that there is no such basis for the standard selected.

This Statement of Basis, Specific Statutory Authority, and Purpose does set forth “an evaluation of the scientific or technological rationale justifying the rule,” as required by the State Administrative Procedure Act. §24-4-103(4)(c). Indeed, in view of the importance of and controversy surrounding this determination, the Commission has taken pains to assure that this evaluation is substantially more extensive than that typically provided for the adoption of water quality standards. However, the Commission rejects the interpretation of the Administrative Procedure Act and Water Quality Control Act requirements implicit in the position advocated by the Army and Shell, which would appear to lead to the conclusion that whenever there is scientific disagreement or any remaining level of uncertainty regarding the appropriate standard to be adopted, the Commission is required to adopt the least stringent scientifically defensible standard. The Commission does not believe that this interpretation is mandated by law, and in fact believes that it would be contrary to the Commission's mission as set forth in the Water Quality Control Act.

The Commission previously considered the adoption of water quality standards for DIMP in January, 1991. The Commission eventually decided not to adopt any standards for DIMP as a result of that proceeding, in part based upon the representations of the Army that new DIMP toxicity studies then being conducted and scheduled for completion in 1992 would provide additional information that might address some of the uncertainty surrounding the interpretations of the studies completed prior to that time. It had been the Commission's hope that a new mink study of at least one year's duration, including at least one reproductive cycle for female mink, would be completed to essentially reassess the results of the 1979 Aulerich mink study, which was the focus of substantial debate in 1991 and again in this 1993 rulemaking hearing. Unfortunately, the additional studies conducted were not of a design or duration to provide this reassessment. Moreover, based upon the information presented in these proceedings it now appears unlikely that a new study of this scope, design and duration is likely to be completed in the foreseeable future. Therefore, the Commission believes that further delay or inaction on its part would be inappropriate. Accordingly, the Commission believes it must exercise its judgment based upon the information available now as presented in the 1993 rulemaking hearing, and adopt a standard to protect against the potential adverse health effects associated with DIMP exposure and to help ensure that DIMP does not become a more widespread threat to human health and the waters of the State.

This decision does not mean that the Commission is not open to reconsidering appropriate water quality standards for DIMP should additional relevant information become available in the future. Consistent with the Commission's practice for statewide standards for other organic chemicals, the DIMP standard is being adopted as an interim statewide standard. This standard is fully effective and enforceable once promulgated. However, the “interim” label recognizes the potential for future modifications should additional relevant information become available. In this regard, the Commission's statement concerning the adoption of interim statewide organic pollutant standards in 1989 applies here:

As new information becomes available and potential conflicts among the various numerical levels are resolved, it may be appropriate in specific instances in the future to adopt permanent standards either more or less stringent than the interim standards being established at this time. However, given the importance of controlling toxic pollutants in the environment, the Commission believes that it is necessary to move forward with the adoption of interim statewide standards at this time, and that the interim standards adopted are reasonable based on the best currently available information.

## II. Selection of Numerical Level for Standard

### a. Toxicological Basis

As briefly described above, the Water Quality Control Commission has heard and considered substantial testimony and scientific evidence regarding the toxicity of DIMP and the risk associated with DIMP exposure. The Commission believes that a statewide interim standard for DIMP of 8 ug/l is necessary and appropriate to protect the citizens of Colorado and the waters of the State, and is based on sound scientific evidence as presented by the Department of Health and the parties to the hearing. The Commission's determination follows EPA risk assessment methodology, as applied to the available information regarding DIMP toxicity. In summary form, the Commission's substantive basis for adopting the 8 ug/l statewide standard for DIMP in ground water is described below.

There are no studies of human exposure to DIMP that can be used in deriving a health-based drinking water standard. Of the most relevant animal studies regarding DIMP toxicity, the Commission has identified the 12 month mink study undertaken by Aulerich, as the critical animal study from which to derive a water quality standard. The Commission believes this is the critical study because none of the other species of animal used in other DIMP studies are proven to be of superior extrapolative relevance to humans; the 12 month mink study had the longest duration of all the animal studies; the 12 month study used a relatively large number of animals; and, the mink in the 12 month study proved to be the most sensitive of all the animals exposed to DIMP (exhibiting an increasing linear mortality relationship to their exposure to DIMP). This selection of the critical study comports with accepted risk assessment principles, including EPA's IRIS guidance.

The Commission recognizes the disagreement among scientific experts regarding the cause of death of mink in the 1979 Aulerich study and the issues surrounding background mortality for mink. However, the Commission agrees with the expert advisory panel's conclusion that the possibility that the mink deaths resulted from administration of DIMP could not be ruled out. The Aulerich 12 month mink study is the only study lasting one full year. Although experts debate over the significance of the results of the Aulerich study, the Commission recognizes that a dose-response relationship was exhibited during the study. This fact is troubling and cannot be ignored from a public health perspective, particularly because the end-point was mortality. No other studies to date have addressed female mink exposed before, during and through the reproductive cycle. The Commission also recognizes that adverse blood effects, among others, were observed in mink in the 90 day Bucci study, and that these effects were still increasing in severity when the study was completed at 90 days.

Given the Aulerich study's statistically significant mortality rate at the highest dose level, the statistically significant linear dose-response relationship across all doses, and the highly biologically significant endpoint, the Commission believes it is an appropriate scientific and policy decision to base the DIMP standard of 8 ug/l on the information available currently to the Commission regarding mortality in female mink. The Commission recognizes that there was a difference of opinion among experts in the hearing regarding the relevance of the linear regression (trend) analysis of mortality across the different dose levels to select a Lowest Observed Adverse Effect Level. One member of the expert advisory panel commented that such trend analysis could result in more false positive conclusions compared to other relevant statistical tests. Recognizing this concern as well as the advantages of trend analysis, the difference of opinion among experts, and that the end-point was mortality in female mink, the Commission has chosen to use this potentially more conservative approach as part of its analysis.

The Commission recognizes there was considerable debate in the testimony regarding whether to incorporate in the statistical analysis of the 1979 Aulerich DIMP study the female mink deaths observed in the control group of a parallel 1979 study with dicyclopentadiene (DCPD). The expert advisory panel discussed the results of the DCPD study and noted that, because of atypical circumstances, they "should be factored in the overall analysis" of the results of the Aulerich DIMP study. The Commission has considered this information, as well as countervailing evidence presented that it is unorthodox to use data from a different study to statistically evaluate the results of the primary study that is being considered, and that statistical comparison using the concurrent control group from the primary study is the norm. There was evidence both supporting and challenging the notion that the two studies were sufficiently similar to allow their respective results to be commingled. There is considerable professional judgment involved in evaluating the available data in risk assessment, and the Commission is concerned by the direct linear increase in female mink mortality observed between the control group and the successive treatment groups in the 1979 Aulerich DIMP study. Considering the above, the Commission has decided to follow scientific convention and use only the data from the 1979 Aulerich DIMP study to evaluate the death of female mink in that study.

With the selection of the Aulerich study as the critical study, following accepted risk assessment guidance, the Commission derives the recommended standard as follows:

(1) The Lowest Observable Adverse Effect Level (LOAEL) 4 in the 12 month mink study was at the 11 mg/kg/day dose level (the lowest dose) because at this dose level the end-point of concern (female mink mortality) was both statistically and biologically significant. 5

(2) In accordance with EPA methodology for risk assessment, the relevant Uncertainty Factors to be applied to the LOAEL of 11 mg/kg/day in the Aulerich study are: (i) interspecies variation, (10), (ii) intra-species variation (10), (iii) less than lifetime exposure (10), and (iv) conversion from LOAEL to NOAEL (10), for a total Uncertainty Factor of 10,000.

(3) The Commission recognizes that the LOAEL identified in the critical study was for death in female mink. This critical effect level, therefore, is actually a Frank Effect level. 6 Given that the endpoint was a Frank Effect Level and not a subtle, reversible toxic effect, and that the critical study has not been replicated to verify the results or better characterize the biological response in that study, it is appropriate to consider the application of a Modifying Factor 7 . The Commission chooses to follow the professional judgment of the Department of Health that in this instance the appropriate Modifying Factor is 1 because of the overall protection provided by the four Uncertainty Factors adopted by the Commission, although it appears that the evidence could also support a larger Modifying Factor. Therefore, the total Uncertainty Factor of 10,000 will not change based on the Modifying Factor.

(4) Deriving a safe human dose, commonly referred to as the Reference Dose (or RfD), the LOAEL is divided by the final total Uncertainty Factor of 10,000.

$$\frac{11 \text{ mg/kg/day}}{10{,}000} = 0.0011 \text{ mg/kg/day}$$

(5) The water quality standard is derived using standard EPA methodology - multiplying the Reference Dose by (i) the average adult body weight of 70 kg and (ii) the relative source contribution from water of 20% (0.2), and then dividing this figure by (iii) the average drinking water consumption of 2 liters/day.

$$\frac{0.0011 \text{ mg/kg/day} \times 70 \text{ kg} \times 0.2}{2 \text{ l/day}} = 0.0077 \text{ mg/l.}$$

0.0077 mg/l = 7.7 ug/l, which is rounded to 8 ug/l.

Based on the information available and evidence presented during these rulemaking proceedings, the Commission believes the statewide groundwater standard for DIMP of 8 ug/l is necessary, scientifically justified and supported by the record. Also, as described above, the Commission has fully considered the relevant evidence regarding the risk associated with the pollutant, and the extent of such pollution to be tolerated as a goal, in deciding to adopt the standard for DIMP of 8 ug/l.

**b. Technological Basis**

Based on evidence presented to the Commission in these proceedings, the Commission believes it is technically and economically feasible and practical to treat water contaminated with DIMP with granular activated carbon to achieve a DIMP effluent concentration in water of 8 ug/l or less. There is evidence in the record that other treatment technologies might also be practical and technically and economically feasible to achieve the adopted standard.

The Commission recognizes that the Army and Shell are currently undertaking ground water remediation at and near the Rocky Mountain Arsenal employing granular activated carbon; that their existing ground water treatment systems are treating ground water for DIMP prior to discharge and are capable of achieving the adopted DIMP standard of 8 ug/l; that the existing ground water treatment systems may have to be reconfigured or costs associated with those systems may be increased; and that, if adopted as an applicable or relevant and appropriate requirement under the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) remediation process or applied as a standard pursuant to any other law, new or additional ground water treatment systems may be required of the Army and Shell in order to meet the adopted statewide ground water standard for DIMP. The Commission recognizes that costs may be associated with meeting the adopted standard if DIMP is discovered in ground water elsewhere in the State. 8 It is the hope of the Commission that public health and the waters of the State can be protected in a cost-effective manner when the standards it adopts are applied in any regulatory or remedial context. However, the Commission finds that in general the costs associated with compliance with the adopted DIMP standard, wherever compliance may be required, will be counter-balanced by the public health and water quality benefits achieved.

**c. Consideration of Statutory Requirements**

As described in part above, in promulgating the statewide ground and surface water quality standards for DIMP, the Commission has considered the factors enumerated in Section 25-8-204(4), C.R.S. The Commission has considered evidence regarding the extent of DIMP contamination and the risk associated with DIMP exposure. The Commission is aware that DIMP is a non-naturally occurring pollutant and it is also a “continuous” pollutant in the ground water (versus “intermittent” or “seasonal” ) in the currently known affected area. The Commission has also considered the technical evidence regarding treatment, and has concluded that treatment techniques to achieve the statewide standard of 8 ug/l are available, practical, and technically and economically feasible. As discussed above, the Commission recognizes the potential economic impacts associated with the adopted standard for DIMP, but believes these potential impacts will be counter-balanced by the public health and water quality benefits achieved. No evidence was submitted indicating that treatment for DIMP would have a significant impact on water quantity. Based on all the evidence presented, as summarized above, the Commission believes that there is a strong need for a statewide standard for DIMP of 8 ug/l at this time to support the beneficial uses of State waters, including drinking water, and that the standard adopted is appropriate and scientifically supported by the record.

### d. Senate Bill 181 Requirements

Colorado Senate Bill 181, adopted in the 1989 legislative session and codified in part in Section 25-8-202(8)(a), C.R.S., includes provisions that apply when the Commission adopts “rules more stringent than corresponding enforceable federal requirements.” In the 1989 revision to the Basic Standards for Ground Water 3.11.0 (5 CCR 1002-8), the Commission interpreted these provisions to be inapplicable to the rulemaking since there were no “corresponding enforceable federal requirements” that establish ambient ground water quality standards. Likewise, the provisions of C.R.S. Section 25-8-202(8)(a) are inapplicable to the proposed rulemaking on DIMP because, as stated above, there are no enforceable federal requirements for DIMP. Even if Section 25-8-202(8)(a) were applicable, the Commission finds that the standard adopted is based on sound scientific and technical evidence in the record.

## III. Decision to Adopt a Statewide Standard

In establishing a statewide standard for DIMP the Commission has determined that DIMP should be controlled on a statewide basis, wherever it is found in the waters of the State, within or outside the Rocky Mountain Arsenal. While the present known contaminated area is limited, the Commission recognizes that the ultimate clean-up and remediation actions for the Rocky Mountain Arsenal may not be finally determined, or may not be put in place, for many years. In establishing a statewide standard, the Commission also intends to ensure that future disposal and handling practices associated with the clean-up and remediation do not adversely affect surface or ground water resources anywhere in the State, and that new contamination problems associated with DIMP do not arise elsewhere in the future.

Much of the rationale for the Commission's 1989 adoption of statewide standards for organic chemicals applies with respect to DIMP (see, Section 3.11.10; revised in 1991, Section 3.11.12). The Commission believes that as a matter of policy all potential beneficial uses of water should be protected on a statewide basis from potential contamination from non-naturally occurring organic chemicals. This policy was reflected in the Commission's 1989 adoption of statewide standards for surface and ground water for approximately 55 organic chemicals. The current adoption of the DIMP standard is a consistent extension of this policy. As with the other organic chemicals, DIMP is a non-naturally occurring pollutant for which a statewide standard is appropriate. Unlike certain other potential pollutants, there is no need to take natural background levels for DIMP into account on a site-specific basis in adopting standards. DIMP is a “continuous” pollutant in the ground water at and near the Rocky Mountain Arsenal, with an estimated half-life of over 500 years, so the adoption of a statewide standard that applies at all times, and that protects future water supplies, is appropriate. As Water Quality Control Division staff testified, there are other statewide standards for chemicals that exist in limited areas of the State, such as chlorobenzene, for example.

The Commission also intends to set a statewide standard in order to protect any state waters that are not yet known to have DIMP contamination, if any are found to exist. The Commission intends that the standard should be applied uniformly wherever DIMP may be a concern in the State, currently or in the future, and that the standard is generally applicable and legally enforceable throughout the State pursuant to statute and associated regulations.

The parties to the hearing have expressed differing opinions regarding the Commission's intent on how its statewide water quality standards will be used as cleanup standards in other statutory programs. In a letter to the Commission, Shell appears to interpret Sections 3.11.5(C)(5)(a) (regarding statewide ground water standards) and 3.1.11(5) (regarding statewide surface water standards), 5 C.C.R. 1002-8, of the Commission's regulations to mean that the Commission "did not intend" for its standards to be applicable or relevant and appropriate requirements (ARARs) under CERCLA (i.e., cleanup standards) or to be enforced as cleanup standards under other statutes. Shell interprets those sections to mean that the Commission believes "it is in the discretion of other agencies" to apply or ignore the statewide standards as cleanup standards, and that the Commission intended to "specifically defer to the discretion of other agencies in setting cleanup levels at Superfund sites." This is an inaccurate expression of the Commission's intent. Instead, the Commission intends for its standards to be used as cleanup requirements, including at CERCLA sites, except in the limited circumstances where " a determination is made that such a variation is authorized pursuant to the applicable provisions" of those federal statutes [ § 3.11.5(C)(5)(a); § 3.1.11(5)].

These cited sections were added to the Commission's regulations in 1989 as simple clarifying statements to address potential conflicts between the Commission's statewide standards and other remediation requirements under the federal programs. The Commission is simply stating that it does not attempt to preempt a federal law, such as CERCLA, by mandating the use of its specific water quality standards as cleanup standards in instances where the federal program is authorized to use a different standard, more or less stringent, and where such programs dictate that the different standard be applied. See e.g., § 3.11.10 (F). The Commission's regulations do not provide that any agency has open-ended discretion to choose to apply or disregard the Commission's standards as cleanup requirements. The Commission intends for its standards to be used as cleanup standards; the Commission understands that in certain federal programs, such as CERCLA, the federal agency can waive a state standard, but only if certain specific statutory requirements have been met. From the Commission's perspective, the standards cannot be waived based on the federal agency's mere discretion whether to use them or not.

**IV. Selection of a Practical Quantitation Limit**

The Commission has heard testimony from the Department of Health's Laboratory on its routine analytical capability and procedure for DIMP analysis, and has determined that the Practical Quantitation Limit (PQL) for DIMP should be set at 1.0 ug/l. The Commission credited the testimony that the Department of Health Laboratory has devised a reliable and effective methodology for analyzing DIMP. The Commission also considered the evidence that the Army has been reporting levels of DIMP above .392 ug/l since 1988, demonstrating that the Department of Health Laboratory's PQL could be reproduced by other laboratories. The basis for this PQL is consistent with that underlying PQLs for other statewide organic chemical standards. Because the adopted standard is higher than the PQL of 1.0 ug/l, this value should have little practical significance.

PARTIES TO THE RULEMAKING HEARING

1. Colorado Department of Health
2. United States Department of the Army
3. South Adams County Water and Sanitation District
4. Shell Oil Company
5. Arsenal Action Alliance

**41.17 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY, AND PURPOSE (1993 REVISIONS)**

The provisions of section 25-8-202(1)(a), (b) and (2); 25-8-203; and 25-8-204; C.R.S., provide the specific statutory authority for adoption of the attached regulatory amendments. The Commission also adopted, in compliance with section 24-4-103(4) C.R.S., the following statement of basis and purpose.

**ADDITIONAL ORGANIC CHEMICALS - TABLE A**

In 1991, Table A, Ground Water Organic Chemical Standards, was updated to set health risk-based standards where MCLs had been established earlier. In this rulemaking, the same policy was followed for forty-five additional organic chemicals that have been promulgated by EPA in the National Primary Drinking Water Regulations as Maximum Contaminant Levels (MCLs), either in EPA's Phase II Rule (Fed. Reg. Jan. 30, 1991), or the Phase V Rule (Fed. Reg. July 17, 1992). Rather than establish the MCL as the standard, however, the Commission chose to continue with its policy to set a health risk-based standard at the 1:1,000,000 level using the same rationale as it did in 1991. That rationale is that MCLs are inappropriate as stream or ground water standards because they include economics and technical feasibility of removal in their development, whereas a standard is designed to fully protect the use of the water. Since dilution is present to temper the effect of applying the health-based standards to dischargers, along with the PQL, the net effect should not be overly burdensome on the regulated community. Where the necessary information in the integrated Risk Information System (IRIS) was not available to establish the health risk-based standard, the MCL was adopted as the standard. As more information becomes available over time, the Commission intends to convert all standards to the health risk-based level.

For benzene, the policy outlined above was not followed. At the informational hearing in February, 1993, the Commission heard considerable testimony concerning the implications that the health-based benzene standard of 1 ug/1 had been having on remedial activities associated with fuel contaminated areas. The MCL level of 5 ug/1 appears to provide sufficient health protection while recognizing the practical difficulties of removing benzene contamination to levels below that concentration.

The organic chemicals chlorophenol and phenol were moved from Table 1 (Human Health Standards) to Table 2 (Secondary Drinking Water Standards), and the proposed standards were set equal to the Ambient Water Quality Criteria for the chemicals. The reason for the change is that although the two chemicals pose a significant health risk at much higher concentrations, taste and odor considerations are a concern at lower concentrations.

PQL's for the organic chemicals proposed in this rulemaking were provided by the Colorado Department of Health Laboratory, and were calculated by multiplying the Method Detection Limit (“MDL” ), Estimated Detection Limit (“EDL” ), or other detectable level as published by EPA by a factor of ten (10).

It was determined during this rulemaking hearing that PQL's in the Basic Standards for Ground Water, and also in the Basic Standards and Methodologies for Surface Water, will receive further consideration by the Commission and the Division in the next year.

**ADDITIONS TO TABLE 1**

Four metals standards were added to Table 1 of the Basic Standards for Ground Water. The basis for the addition was the federal Phase V Rule, published in the Federal Register on July 17, 1992. All additional standards were set at the MCL level. Cyanide, one of the Phase V MCLs, was not changed since Table 1 already contained a cyanide standard at a level more stringent than the MCL.

During the rulemaking hearing, the Metro Wastewater Reclamation District pointed out that there is no laboratory test for free cyanide, and that the acid dissociable should be used. Since this proposal was not part of the public notice and was raised so late in the process, it was determined that the Division would address the issue in a rulemaking proposal during the next year.

**CHANGES TO 3.11.5 (C)(5)(c)**

The change in wording made in the section referenced above was necessary to update the statutory reference for the Storage Tank program in the Hazardous Materials and Waste Management Division. This change will allow a consistent regulatory approach by the Storage Tank program to ground water contamination caused by either underground or above-ground tanks.

**CHANGES TO 3.11.6(A)**

The change to 3.11.6(A) has been made for purposes of clarifying that the Division has existing authority to consider ground water standards when setting limits for surface water discharges which impact ground water.

A party to the proceeding is in a position where it has alluvial wells in close proximity to a proposed surface water discharge to a frequently dry stream. This party has raised the issue that the sole biological standard of total coliform bacteria may be inadequate to protect public health from direct or indirect discharges to ground water, and that this is particularly the case in instances where a surface discharge impacts ground water.

PARTIES TO THE DECEMBER, 1993 RULEMAKING HEARING

1. Shell Oil Company
2. The City of Colorado Springs
3. Arapahoe County Water and Wastewater Authority
4. Storage Tank Technology, Inc.
5. Martin Marietta Corporation
6. The Coors Brewing Company

## 41.18 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY, AND PURPOSE (1994 REVISIONS)

The provisions of section 25-8-202(1)(a), (b) and (2); 25-8-203; and 25-8-204; C.R.S., provide the specific statutory authority for adoption. The Commission also adopted, in compliance with section 24-4-103(4) C.R.S., the following statement of basis and purpose of these amendments.

**STATEMENT OF BASIS AND PURPOSE**

During the December, 1993, hearing on the basic Standards for Ground Water, a number of parties and members of the public spoke and submitted evidence on the difficulties of implementing Practical Quantitation Limits (PQL's). It was determined at that time that the Division would consider the problem during this proceeding. A determination has been made that PQL's are more appropriately addressed within the Regulations for State Discharge Permit System, allowing more flexibility in applying the PQL's to regulated discharges. The PQL column in Table A has been removed, as have all footnotes to the Table A that pertained to PQL's. Note that the same modifications have been made to the Basic Standards and Methodologies for Surface Water (3.1.0).

Parties to this hearing also suggested that the Commission consider replacing the current bromodichloromethane, bromoform, chloroform, and dibromochloromethane standards with a total trihalomethanes (THMs) standard based on the current drinking water maximum contaminant level for total THMs, as was done in this hearing for surface water. The Commission has declined to do so, since one of the major factors applicable to the surface water situation—impact on dischargers—has not been demonstrated to apply with respect to ground water.

PARTIES TO THE JULY 11, 1994 HEARING

1. Sierra Club and Colorado Environmental Coalition
2. City of Colorado Springs
3. Conoco, Inc.
4. Shell Oil Co.
5. Metro Wastewater Reclamation District, the City of Fort Collins, the Silver Coalition, and the Cyprus Climax Metals Company
6. Coors Brewing Company
7. City of Pueblo
8. ASARCO, Inc.

**41.19 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY, AND PURPOSE (1996 REVISIONS)**

The provisions of section 25-8-202(1)(a), (b) and (2); 25-8-203; and 25-8-204; C.R.S., provide the specific statutory authority for adoption. The Commission also adopted, in compliance with section 24-4-103(4) C.R.S., the following statement of basis and purpose.

**BASIS AND PURPOSE:**

This hearing was held to consider changes recommended in the triennial review informational hearing for the ground water standards and classifications regulations “The Basic Standards for Ground Water” 3.11.0, and “The Classifications and Water Quality Standards for Ground Water” 3.12.0. With a few exceptions, the majority of the changes proposed were of a “housekeeping” nature aimed at improving the clarity, organization, and useability of both sets of regulations.

The Commission has moved the statewide interim narrative standard for ground water from 3.12.0 to 3.11.0. This was done to consolidate all statewide standards in the basic standards regulation. This action was warranted due to the Commission's action, in December, 1994 to apply the interim narrative standard to all ground waters of the state. Note that the Statements of Basis and Purpose for the original adoption of the interim narrative standard and for applying it statewide are located in 3.12.11 and 3.12.13.

Changes to the Table 1 values for asbestos, barium, chromium and selenium were adopted for both 3.11.0 and 3.12.0 to reflect the current domestic use values found in the Colorado Primary Drinking Water Regulations . This change was particularly important for selenium as background levels in many areas of the state exceed the previous table value of 0.01 mg/l. Six changes were made to Table A in order to make these values reflect maximum contaminant levels (MCLs) found in the Safe Drinking Water Act, or the 10 -6 risk levels reported in EPA's IRIS System.

PARTIES TO THE RULEMAKING HEARING

1. Coors Brewing Company
2. CF&I Steel, L.P.
3. The United States Department of Energy
4. Cherry Creek Basin Water Quality Authority
5. City of Westminister
6. Kaiser-Hill Company, L.L.C.

**41.20 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY, AND PURPOSE (1996 REVISIONS)**

The provisions of section 25-8-202(1)(a), (b) and (2); 25-8-203; and 25-8-204; C.R.S., provide the specific statutory authority for adoption. The Commission also adopted, in compliance with section 24-4-103(4) C.R.S., the following statement of basis and purpose.

**BASIS AND PURPOSE**

**1. Summary**

In this rulemaking proceeding, the Commission adopted a revised basic standard for ground water for plutonium (Pu) and established an additional basic standard for ground water for americium (Am).

**2. Background**

The Commission previously adopted a basic standard for plutonium of 15 pCi/L and had no basic standard for americium. A basic standard was considered in this hearing for americium because it is closely associated with plutonium and these two radionuclides generally occur together. The current basic standard of 15 pCi/L plutonium was calculated using methodologies in the 1976 National Interim Primary Drinking Water Regulations and was consistent with a goal of keeping exposures below 4 millirems per year. The Basis and Purpose indicated that it was necessary and important to restrict levels because of the difficulty of removing this radionuclide by conventional treatment procedures and because the potential adverse effect on human health suggests that extreme caution be exercised in its release to State waters. Since plutonium is predominantly an alpha emitter, the basic standard was made consistent with the 15 pCi/L alpha standard. (A site-specific standard, based on ambient conditions, was set in 1990. Note that this hearing also addressed site-specific standards, which are further discussed in section 3.8.48 of this Statement of Basis and Purpose.)

**3. Basis for Commission Decision**

Since the previous basic standard was set, several changes have occurred: 1) a new methodology for assessing carcinogens has become the standard practice, 2) new data have resulted in periodic updates to the slope factors used in this methodology, and 3) a more refined Commission policy on appropriate levels of protection for carcinogens has been developed. This latter risk-based policy also parallels a national trend towards risk-based approach to environmental cleanup standards.

The 15 pCi/L dose-based approach was calculated using a “reference-man” and considered exposure during his working life. It was an approach designed to address questions related to occupational exposure. It did not consider sex, age and organ-specific factors over a lifetime. In contrast, the new slope factor methodology, used in EPA's 1989 Risk Assessment Guidance for Superfund Sites, is more complete, more applicable to a general population and has become the standard practice for calculating risk.

The Commission adopted a basic standard of 0.15 pCi/L for plutonium and americium, calculated using a 1×t;10 -6 risk level, based on residential use. This risk level is consistent with the Commission's policy for human health protection.

The Commission also considered a request by the Water Quality Control Division to annotate the new standards for plutonium and americium as total (unfiltered) water. The Commission heard disputed testimony on this issue and could not reach a consensus to require unfiltered samples in all circumstances. The Division will have discretion to consider appropriate sampling techniques in implementing the adopted standards.

PARTIES TO THE RULEMAKING

1. State of Colorado Division of Wildlife
2. U.S. Department of Energy
3. Kaiser-Hill Company, LLC
4. City of Broomfield
5. City of Westminster
6. U.S. EPA Region VIII

7. City of Thornton
8. City of Arvada
9. City of Northglenn

## 41.21 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY AND PURPOSE; JULY, 1997 RULEMAKING

The provisions of sections 25-8-202 and 25-8-401, C.R.S., provide the specific statutory authority for adoption of the attached regulatory amendments. The Commission also adopted, in compliance with section 24-4-103(4) C.R.S., the following statement of basis and purpose.

**BASIS AND PURPOSE**

The Commission has adopted a revised numbering system for this regulation, as a part of an overall renumbering of all Water Quality Control Commission rules and regulations. The goals of the renumbering are: (1) to achieve a more logical organization and numbering of the regulations, with a system that provides flexibility for future modifications, and (2) to make the Commission's internal numbering system and that of the Colorado Code of Regulations (CCR) consistent. The CCR references for the regulations will also be revised as a result of this hearing.

## 41.22 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY AND PURPOSE; JANUARY, 1999 RULEMAKING

The provisions of sections 25-8-202; 25-8-204; 25-8-402, C.R.S., provide the specific statutory authority for adoption. The Commission also adopted, in compliance with section 24-4-103(4) C.R.S., the following statement of basis and purpose.

**BASIS AND PURPOSE**

This revisions is to reconfirm the previous action taken by the Commission to include correct publication in the Colorado Code of Regulations Statement of Basis, Specific Statutory Authority and Purpose for the December, 1996 rulemaking hearing.

## 41.23 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY, AND PURPOSE (2001 REVISIONS)

The provisions of section 25-8-202(1)(a), (b) and (2); 25-8-203; and 25-8-204; C.R.S., provide the specific statutory authority for adoption. The Commission also adopted, in compliance with section 24-4-103(4) C.R.S., the following statement of basis and purpose.

**BASIS AND PURPOSE**

This hearing was held to consider changes recommended in the triennial informational hearing for the ground water standards and classifications regulation “The Basic Standards for Ground Water” 41. Significant changes were made to Table A “Ground Water Organic Chemical Standards” with the addition of new chemical standards and changes to existing standards. The changes are in keeping with the Commission's Policy 96-2 to coordinate surface and ground water standards. The changes and additions to Table A reflect the changes to the surface water Human Health Based Water Supply Standards adopted by the Commission in the Basic Standards and Methodologies for Surface Water, Regulation 31, triennial review hearing July 10, 2000.

Many of the surface water standards are based upon EPA-established drinking water standards, under the Safe Drinking Water Act (SDWA), or water quality criteria developed pursuant or section 304(a) of the federal Clean Water Act. Since these standards and criteria are modified from time to time, it is necessary to review the existing Colorado standards in comparison to the latest available information. As a result of this review, the Commission adopted revisions to the standards to conform with the latest available information as to protective levels for the various chemicals.

In adopting these standards for ground water, 39 new organic chemical standards were added to Table A, 25 existing standards were changed, and two chemicals were renamed. Two organic Chemicals were renamed in Table A: Dichloromethane CAS No. 75-09-2 is now Methylene chloride C , and Di(2 ethylhexyl)phthalate C CAS No. 117-81-7 is now Ethylhexyl phthalate (BIS-2) C .

The Commission has adopted amendments to section 41.5.B to provide for the establishment of alternative standards to the site-specific water quality standards for the Domestic Use - Quality classification. Prior to this amendment this alternative was not possible because section 41.5.B.3.a provided that the human health standards (Table 1) and the secondary drinking water standards (Table 2) apply to ground water classified Domestic Use - Quality. No alternative standards to the Table 1 and 2 standards were provided for in the original regulation. The Commission believes that the option of site-specific standards should be allowed taking into account the factors set forth in §25-8-204(4) C.R.S. The language adopted by the Commission is similar to the language included in section 41.5.D.2 that allows the Commission to adopt sitespecific standards for radioactive materials and organic pollutants.

Additional changes proposed to Regulation 41 were of a “housekeeping” nature to update the regulation and to correct typographical errors.

PARTIES TO THE RULEMAKING

1. Climax Molybdenum Company

## 41.24 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY AND PURPOSE; SEPTEMBER 2004 RULEMAKING

The provisions of sections 25-8-202; 25-8-204; 25-8-402, C.R.S., provide the specific statutory authority for adoption. The Commission also adopted, in compliance with section 24-4-103(4) C.R.S., the following statement of basis and purpose.

**BASIS AND PURPOSE:**

This hearing was held to consider changes recommended in an Informational Hearing for Regulation 41, The Basic Standards for Ground Water. The majority of the changes involved modifications to the organic chemical standards in Table A, as well as the addition of new standards for twenty-one carcinogenic organic chemicals. During this hearing the Commission also considered the organic chemical standards contained in Regulation 31, The Basic Standards and Methodologies for Surface Water. Other changes, for Regulation 41, included renaming Tables 1 and 2 to parallel the nomenclature used in Policy 96-2, the Commission’s policy on human-health based water quality criteria. Additionally, several footnotes for Tables 1 and 2 were updated to clarify and identify the source of the associated numeric standards. References to Practical Quantitation Limits (PQL) were modified to reflect the Commission’s decision to remove the determination of appropriate PQLs from the Rulemaking process. The Commission understands that the Water Quality Control Division is developing a PQL guidance document, which will contain those PQLs deemed acceptable to the Division. In addition, the Water Quality Control Division, or applicable implementing agency, may establish site-specific or discharge-specific PQLs. Finally, additional clarification was added to the table of Radioactive Standards to reflect the Commission’s decision to allow discretion in considering appropriate sampling techniques in implementing these standards.

In November 2000, EPA disapproved surface water standards for several Group C organic chemicals because the proposed standards were not based on carcinogenic risk. Group C carcinogens are typically classified, based on limited evidence, as possible human carcinogens. Historically, due to the lack of substantive carcinogenic evidence, the Commission has not established carcinogenic-based standards for Group C chemicals, but rather adopted standards based on toxicity.

Based on published human-health risk data there are three classes of Group C compounds, which include:

Those compounds with published toxicity (RfD) values,Those compounds with published cancer slope factors (q1*), and Those compounds with published RfD and q1* values.

Previously, the Commission has promulgated standards for the Group C compounds in the first and third class based on toxicity and for the second class based on carcinogenicity. However, this treatment of the class 3 Group C compounds resulted in EPA disapproving the standards.

In order to resolve this issue with EPA, during this hearing, the Commission adopted a standard for these Group C compounds based on toxicity, but with an additional margin of safety to account for any unknown carcinogenic effects. Using this method the standards for Group C compounds, with both RfD and q1* values, are based on toxicological data, and then adjusted downward using an uncertainty factor of 10. The Commission believes that this methodology is consistent with SDWA practices and will be protective of human health.

The Commission also decided to add numeric standards for twenty-one additional organic chemicals that are classified as either Group A, known human carcinogens, or Group B, probable human carcinogens.

One of the new standards that was the subject of extensive written and oral testimony in this hearing is a standard for 1,4-dioxane. Based upon the current status of the scientific evidence as disclosed at the hearing, with specific reference to the number for 1,4-dioxane found in EPA's IRIS database, the Commission adopted a standard of 6.1 ug/l to apply for a period of five years, with a standard of 3.2 µg/l becoming effective at the end of the five-year period. The Commission is aware of the fact that EPA is re-examining its criteria for 1,4-dioxane. However, that effort likely will take a number of years and the result is uncertain, and there is a current need to address this chemical in the water quality standards context. Because 6.1 ug/l is the value typically used to date for 1,4-dioxane remedial activities in Colorado, the adoption of this value as a water quality standard will provide a basic level of protection of human health while essentially preserving the status quo regarding clean-up requirements for the next five years. This standard provides protection within the same order of magnitude as the 3.2 ug/l standard that results from application of the Commission's generally accepted methodology for establishing health-based standards. The Commission sees no reason in this matter to deviate from its policy regarding the order of magnitude of risk used for the protection of human health.

If no further action is taken by the Commission, the 3.2 ug/l standard will go into effect after five years. If EPA's pending review of 1,4-dioxane results in a revision of the current IRIS value, the Commission can consider a corresponding revision of its water quality standards at that time.

The Commission notes that the adopted standards are consistent with the Department of Public Health and Environment's policy on the use of IRIS in setting standards. The Commission understands that remediation action levels applied by implementing agencies at currently contaminated sites may be set at a different, higher number based on a site-specific risk analysis as referenced in the CDPHE policy. The Commission also notes that it may adopt site-specific standards for 1,4-dioxane if warranted by a site-specific risk assessment. The Commission has adopted numerous site-specific standards for other chemicals where it was determined that such standards appropriately account for site-specific circumstances.

Further, to clarify the use of this standard in a regulatory context, the Commission requests that the Division promptly develop a practical quantitation limit (PQL) for 1,4-dioxane. Consistent with other provisions of this regulation, the PQL will be used as the compliance threshold for implementation of these standards. The Commission notes that it may be appropriate to establish a site-specific PQL for individual discharges, if warranted by the unique characteristics of a particular discharge.

In adopting standards for 1,4-dioxane, the Commission has considered the factors listed in section 25-8-204, C.R.S., as follows:

(a) The need for standards which regulate specified pollutants

1,4-dioxane is a Group B2, probable human carcinogen and has been found as a ground water contaminant in the State of Colorado. In addition, following treatment ground water contaminated with 1,4-dioxane is discharged to Colorado surface waters.

(b) Such information as may be available to the commission as to the degree to which any particular type of pollutant is subject to treatment; the availability, practicality, and technical and economic feasibility of treatment techniques; the impact of treatment requirements upon water quantity; and the extent to which the discharge to be controlled is significant

1,4-dioxane is most commonly treated with a combination of advanced oxidation processes (AOP) in combination with ultraviolet light (UV). This remediation technology, though relatively new, is rapidly becoming a more common technique. The AOP/UV treatment techniques will have minimal impact on water quantity. Evidence was submitted indicating that 1,4-dioxane treatment costs could be substantial in some circumstances, although there was conflicting evidence regarding treatment costs. Because the standard that will be in effect for the next five years is set at the level already most commonly used as a 1,4-dioxane remediation goal, the adopted standard will not have a major impact on treatment costs during this period. The Commission intends that discharge permits issued while the 6.1 ug/l standard is in effect will include effluent limits based on that standard until the expiration of the existing permit. Renewal permits will be subject to the standard in effect at the time of renewal. Moreover, to the extent that the adopted standards do result in increased treatment costs, the Commission believes that such costs must be weighed against the benefits of the protection of public health, including the preventative benefits of reducing the likelihood of future exposure to 1,4-dioxane.

As to the extent to which this pollutant is significant, since 1, 4-dioxane is primarily used as a solvent stabilizer, it will most likely be found in areas with known chlorinate solvent contamination. Chlorinated solvents have been in use since the 1960s, with more widespread use occurring in the late 1970s and early 1980s due to the increasing production of electronic circuits.

(c) The continuous, intermittent, or seasonal nature of the pollutant to be controlled

1,4-dioxane is characterized by a high solubility (infinitely soluble/miscible), moderate vapor pressure, and low Henry's Law Constant, all of which indicate that this chemical will be persistent within the aquatic environment. Additionally, the available data indicate that 1,4-dioxane will not readily degrade in the environment.

(d) The existing extent of pollution or the maximum extent of pollution to be tolerated as a goal

The Hazardous Materials and Waste Management Division reports that 1,4-dioxane has been found at 9 sites and is suspected at 19 others. The standards adopted by the Commission establish the maximum extent of 1,4-dioxane to be tolerated as a human health goal, for the reasons set forth in this Statement of Basis and Purpose.

(e) Whether the pollutant arises from natural sources

1,4-dioxane contamination does not arise from natural sources.

(f) Beneficial uses of water

The 1,4-dioxane standards are adopted to protect domestic water supply uses.

(g) Such information as may be available to the Commission regarding the risk associated with the pollutants including its persistence, degradability, the usual or potential presence of the affected organisms in any waters, the importance of the affected organisms, and the nature and extent of the effect of the pollutant on such organisms

1,4-dioxane is a highly persistent contaminant. Very little degradation is observed in the ambient environment. The standards are being adopted to protect human health, so humans are the affected "organisms". 1,4-Dioxane is classified by EPA as a probable human carcinogen (Group B2). Conflicting evidence was submitted regarding the level at which 1,4-dioxane poses a human health risk. Some parties argued that a different toxicity model than that used to develop the current IRIS value for 1,4-dioxane should be used to characterize its toxicity. Some parties also argued that a 1,4-dioxane standard should be established based on a PQL for this chemical, but the Commission believes that the standard should be health-based. The Commission acknowledges that there are conflicting scientific interpretations of the available information and that further review and analysis of the toxicity of 1,4-dioxane is warranted. However, the outcome of that further review is uncertain and the Commission does not believe that there is sufficient evidence to invalidate the current EPA IRIS value at this time. The Commission believes that the record supports the scientific and technical validity of the standards that it is adopting. Moreover, in the face of conflicting scientific information, as a matter of policy the Commission has decided to err in the direction of protection of public health in approving the 6.1 ug/l and 3.2 ug/l standards for 1,4-dioxane.

Since the 1989 hearing, there has been debate about whether standards for parameters with MCLs should be based on the MCLs or purely health-based numbers. The arguments for MCLs focused on whether it is reasonable to require ground water remediation to a level below that required for drinking water. The arguments for health-based standards focused on maximizing human-health protection, putting the clean-up burden on pollution sources, and protection of ground water as a resource.

In this hearing, the Commission adopted a hybrid MCLG/MCL proposal that provides much of the benefits advocated for each of the above options. This hybrid approach allows for existing ground water contamination to be addressed at levels that are deemed safe for drinking water sources, but allow for the protection of ground water as a resource by implementing a more protective human-health health based standard for future contamination. The Commission decided that implementation of this range of standards should be based on the date of the discharge that subsequently caused contamination of the ground water. In some cases, especially where the ground water contamination may not be discovered immediately, the contamination will have subsequently migrated. In these instances, it is the Commission's intent that the original date of the release that caused the contamination, not the date of the identification or subsequent extent of any migration of that contamination, shall be used to determine the appropriate standard for the resulting contaminant plume.

Additionally, the hybrid MCLG/MCL proposal was concurrently considered for Regulation 31, The Basic Standards and Methodologies for Surface Water, and the adoption of this rule for ground water provides a consistent approach to addressing water quality for all waters of the State.

For existing aquifer storage and recovery facilities an issue, which was presented to the Commission regarding the MCLG/MCL proposal, was the potential impact this rule could have on existing aquifer storage and recovery, or artificial recharge projects. Cognizant of both the drought and the corresponding potential future implementation of the various forms of anthropogenic recharge, the Commission decided adopt a total trihalomethanes (TTHM) standard. In order to assure that the ground water quality standards do not limit continued aquifer storage and recovery at these facilities using potable finished water, the Commission adopted a standard for TTHM. However, the Commission also elected to leave the existing standards for bromodichloromethane, bromoform, chloroform and dibromochloromethane in place in order to address ground water contamination due to other possible sources of these chemicals (e.g. from spills or industrial activity).

The applicability of Footnote 7 (allowing compliance with TTHMs rather than the separate standards for bromodichloromethane, bromoform, chloroform, and dibromochloromethane) to other sources of water and aquifers requires further evaluation. The Commission requests that the Division coordinate with stakeholders using and developing aquifer storage and recovery projects regarding these organic standards and their statewide applicability and provide a status report regarding whether modifications to the statewide organic standards for aquifer storage projects will likely be proposed.

The Commission is not aware of other instances where the ground water quality standards are likely to limit the ability to undertake such ground water recharge projects. If such circumstances should arise in the future the Commission can revisit other aspects of this regulation at that time. Alternatively, proponents of such projects could request site-specific ground water quality classifications and standards.

Tables 1 and 2 were renamed and revised to be more consistent with the description of the various standards in both Regulation 31 and Policy 96-2. Several footnotes were added or modified to further clarify the existing numeric standards.

A footnote was added to the radioactive standards table to reflect the Commission's decision in 1996 (41.20) to allow the Division latitude in requiring total or dissolved samples. In the 1996 hearing the Commission decided to allow the Division discretion to consider appropriate sampling techniques in implementing the radionuclide standards. Since that time there has been considerable interest in additional clarification of the implementation of these standards, and therefore the Commission elected to adopt additional footnotes clarifying the radioactive standards.

PARTIES TO THE RULEMAKING HEARING

1. Schlage Lock Company
2. Teck Cominco Limited
3. Raytheon Aircraft Company
4. City and County of Denver
5. Waste Management of Colorado
6. Lockheed Martin Space Systems Company
7. Barrick Gold Corporation
8. Shell Oil Company
9. Colorado Wastewater Utility Council
10. The City of Boulder
11. Emerson Electric Company
12. Colorado Association of Commerce and Industry
13. Metro Wastewater Reclamation District
14. Dover Industries, Inc.
15. Colorado Mining Association
16. The Board of County Commissioners of El Paso County
17. The JRW Family Limited Partnership
18. The South Adams County Water and Sanitation District
19. Colorado Department of Transportation
20. U.S. Environmental Protection Agency

21. Stephen A. Bain
22. U.S. Department of Energy, Rocky Flats Project Office
23. John D. Fognani & Suzanna K. Moran
24. Alliant Techsystems Inc.

## 41.25 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY AND PURPOSE; DECEMBER 10, 2007 RULEMAKING; EFFECTIVE MAY 31, 2008

The provisions of sections 25-8-202(1)(b); 25-8-204; 25-8-402, C.R.S., provide the specific statutory authority for adoption. The Commission also adopted, in compliance with section 24-4-103(4) C.R.S., the following statement of basis and purpose.

**BASIS AND PURPOSE:**

1. Statewide Standards - Interim Organic Pollutant Standards

In this rulemaking, the Commission adopted revised and new organic chemical standards in section 41.5(C)(3). In an effort to keep ground water and surface water organic chemical standards consistent, the changes to section 41.5(C)(3) were considered during the same hearing that addressed changes to the statewide surface water organic chemical standards in Regulation No. 31 (Basic Standards and Methodologies for Surface Water).

In adopting these new and revised organic chemical standards, the Commission continued to rely on its past policy decisions and precedence documented in Commission Policy 96-2. Additionally, as per Departmental policy the Commission has relied on the United States Environmental Protection Agency's (EPA) Integrated Risk Information System (IRIS) as its first tier source of toxicological data. Review of the IRIS data that had been updated since the last revisions to 41.5(C)(3) indicated that the water quality standards for two organic chemicals, toluene and 1,2-dibromoethane, needed to be revised.

At the last hearing addressing section 41.5(C)(3), in September 2004, during which the Commission adopted water quality standards for several carcinogenic compounds, EPA had requested that a future rulemaking consider water quality standards for non-carcinogenic compounds. For this hearing the Commission reviewed several non-carcinogenic compounds that lacked water quality standards. This review identified four pesticides that the Commission elected to adopt water quality standards for: acetochlor, dicamba, metribuzin, and prometon. The Commission also corrected several typographical errors and added common synonyms for some of the organic chemicals.

2. Table Value Criteria – Tables 1 through 4

The Commission elected to adopt EPA's maximum contaminant level (MCL) for arsenic and uranium as Domestic Water Supply – Human Health Standards (Table 1). EPA promulgated a MCL of 30 µg/l for uranium in December of 2003, and a MCL of 10 µg/l for arsenic in January of 2006. The Commission has previously adopted these MCLs as surface water-water supply standards, and in an effort to keep the surface and ground water standards consistent, now adopts them as ground water standards.

The Commission received testimony regarding the association of molybdenum as a ground water contaminant in several uranium and vanadium processing and mining sites throughout the Colorado. During the 1990 hearing (q.v. section 41.14), the Commission had elected to delete the molybdenum standard until additional scientific data was available. In August of 1993, IRIS published additional findings and finalized an RfD for molybdenum. During this hearing the Commission elected to adopt a Domestic Water Supply – Human Health Standards (Table 1) for molybdenum based on this updated toxicological data, as well as testimony regarding both existing and planned uranium and vanadium mining and milling activities throughout the State.

The Water Quality Control Division submitted testimony regarding its efforts to update and issue new general ground water discharge permits, and during that process requested additional clarification regarding the existing fecal coliform standard. The Commission updated the fecal coliform standard to clarify both the averaging period and the allowable maximum over that same averaging period. In determining the appropriate maximum and averaging period the Commission relied on EPA's water reuse guidance (EPA/625/R-04/108) for unrestricted urban reuse.

During the Issues Formulation and Informational Hearing the Commission received testimony regarding the Agricultural Standards (Table 3) and the implementation of the manganese standard. The original agricultural manganese standard was derived from EPA's 1972 Water Quality Criteria ("Blue Book" ), and addressed crop toxicity in acidic soils. In order to remain consistent with the 1972 criteria, as well as with Regulation No. 31, the Commission elected to add a footnote to specify that the agricultural manganese standard is only applicable in those areas where acidic soils exist.

3. Other Changes to the Regulation

During the Issues Formulation and Informational Hearing an issue was raised regarding activities that increase naturally occurring contamination, with the intent at that time being that revisions to section 41.5(A), the narrative standards, would address this issue. Additional investigation into the issue discovered that the narrative standards, as currently adopted in Regulation No. 41, are only implemented during a ground water classification hearing. The Commission believes that this poses two problems. First, as written, the narrative standards did not apply to all State waters which conflicts with the intention of the Colorado Water Quality Control Act (CWQCA). Second, the narrative standards have not been specifically adopted for all of the current ground water classifications.

One purpose of narrative standards is to provide general qualitative guidance for situations that lack quantifiable, or scientifically predicted, outcomes. Narrative standards define broad guidelines that are intended to meet general water quality goals. For these reasons, narrative standards are applicable when numeric criteria cannot be established, or applied, to a specific discharge or release. Additionally, narrative standards are critical for addressing emergency circumstances when the dynamics of the situation prevent timely scientific review or the normal Commission procedure.

For these reasons the Commission believes that applying the narrative standards to all ground water is appropriate and effectively solves the issues before them. By making the narrative standards statewide standards the Commission fulfills the intent of the CWQCA, implements the narrative standards for all existing ground water classifications, and addresses the issue of anthropogenic increases to naturally occurring ground water contamination.

The Commission revised the paragraph regarding "implementing agencies" to recognize the recent reorganization of the Division of Minerals and Geology into the Division of Reclamation, Mining, and Safety. The Commission also changed the reference to the agency responsible for the Resource Conservation and Recovery Act to recognize that both the Hazardous Materials and Waste Management Division and the Department of Labor and Employment implement different aspects of this statute.

In the 2004 hearing the Commission adopted footnote 7which included a total trihalomethane (TTHM) standard applicable to existing aquifer storage and recovery (ASR) facilities that use potable finished water. The Commission's intention in doing so was to assure that the ground water organic chemical standards did not limit continued ASR at existing facilities. ASR has been identified by the Colorado General Assembly and the Colorado Water Conservation Board as a potential way to maximize use of aquifers through conjunctive use of surface and ground water resources. ASR has also been identified by the South Platte River Task Force as a potential tool to address water issues in the South Platte River Basin.

In order to assure that the ground water quality standards do not limit future use of ASR, the Commission adopted changes to footnote 7 deleting the reference to facilities that existed as of September 14, 2004, thereby applying the TTHM standard to all ASR facilities using finished potable water that meets all applicable federal and state drinking water requirements. In addition, the Commission adopted a new provision that applies the maximum containment level (MCL) as the standard for ground water that must be met by ASR facilities using finished potable water.

PARTIES TO THE RULEMAKING

1. Centennial Water and Sanitation District, Town of Castle Rock, Castle Pines Metropolitan District, Consolidated Mutual Water Company, Rangeview Metropolitan District
2. Metro Wastewater Reclamation District
3. Colorado Wastewater Utility Council
4. City of Boulder
5. City of Colorado Springs and Colorado Springs Utilities
6. City and County of Denver Department of Environmental Health
7. Climax Molybdenum Company
8. Information Network for Responsible Mining (INFORM), High Country Citizens' Alliance (HCCA), and Coloradoans Against Resource Destruction (CARD)
9. United States Environmental Protection Agency, Region 8
10. U.S. Department of Energy (DOE) Office of Legacy Management
11. Upper Black Squirrel Creek Ground Water Management District

## 41.26 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY AND PURPOSE; OCTOBER 13, 2009 RULEMAKING; EFFECTIVE NOVEMBER 30, 2009

The provisions of sections 25-8-202(1)(b); 25-8-204; 25-8-402, C.R.S., provide the specific statutory authority for adoption. The Commission also adopted, in compliance with section 24-4-103(4) C.R.S., the following statement of basis and purpose.

**BASIS AND PURPOSE**

During its September 2004 rulemaking, the Commission adopted two standards for 1,4 dioxane -- 6.1 ug/L to be effective through March 21, 2010; and 3.2 ug/L to become effective on March 22, 2010. The dual standard was adopted, in part, due to the uncertainty about the risks posed by 1,4 dioxane and the fact that EPA was in the process of updating the Integrated Risk Information System ("IRIS" ) database for that compound. At that time, the Commission adopted the 6.1 µg/L value (which had been typically used for remedial activities in Colorado) as a temporary standard in order to maintain the status quo for a period of five years to give EPA time to complete its IRIS update. The Commission determined that if EPA's pending review resulted in a change in the IRIS value, the Commission could consider a corresponding revision of its standards. As of this date, EPA has not completed the IRIS review.

In May 2009, EPA released an updated draft toxicological review on 1,4 dioxane for external peer review. According to the current schedule, final completion of the IRIS update should occur before the end of 2011.

## 41.27 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY AND PURPOSE; AUGUST 13, 2012 RULEMAKING; FINAL ACTION SEPTEMBER 11, 2012; EFFECTIVE JANUARY 31, 2013

The provisions of sections 25-8-202(1)(b); 25-8-204; 25-8-402, C.R.S., provide the specific statutory authority for adoption. The Commission also adopted, in compliance with section 24-4-103(4) C.R.S., the following statement of basis and purpose.

**BASIS AND PURPOSE**

1. Statewide Standards - Interim Organic Pollutant Standards

In this rulemaking, the Commission adopted revised and new organic chemical standards in section 41.5(C)(3). In an effort to keep ground water and surface water organic chemical standards consistent, the changes to section 41.5(C)(3) were considered during the same hearing that addressed changes to the statewide surface water organic chemical standards in Regulation No. 31 (Basic Standards and Methodologies for Surface Water).

In adopting these new and revised organic chemical standards, the Commission continued to rely on its past policy decisions and precedence documented in Commission Policy 96-2. Additionally, as per Departmental policy, the Commission has relied on the United States Environmental Protection Agency's (EPA) Integrated Risk Information System (IRIS) as its first tier source of toxicological data. Review of the IRIS data that had been updated since the last revisions to 41.5(C)(3) indicated that the water quality standards for acrylamide, carbon tetrachloride, 1,2-cis dichloroethylene,1,2-trans dichloroethylene, 1,4-dioxane, hexachloroethane, nitrobenzene, pentachlorophenol, tetrachloroethylene (PCE), and 1,1,1-trichloroethane, needed to be revised. This review also identified new compounds in the IRIS data that the Commission elected to adopt as water quality standards, these were: acetone, bromobenzene, chlordecone, 1,2-dibromoethane, dichloromethane, ethylene glycol monobutyl ether (EGBE) (2-Butoxyethanol), 2-hexanone, perchlorate, trichloroacetic acid, 1,2,3-trichloropropane.

The compounds acylamide, dichloromethane, and 1,2,3-trichloropropane are mutagenic compounds, and the resulting standards were calculated following EPA guidance on calculating drinking water supply standards for mutagenic compounds. Footnote 8 was added to indicate that these compounds were calculated using age dependent factors.

The EPA IRIS updates also included instances where the updated human health criteria is less stringent than the maximum contaminant level (MCL) promulgated under the federal Safe Drinking Water Act. In these instances, the Commission adopted two values shown as a range, with the updated human health criteria being the first number in the range and the federal MCL being the second number in the range. In such cases, the implementing agency must establish the protection level that is determined by the agency to be consistent with the current and future uses of the ground water. The compounds that have a range with the human health criteria being higher than the MCL are 1,2-trans dichloroethylene, tetrachloroethylene (PCE), and 1,1,1 trichloroethane (1,1,1-TCA). Footnote 6 to Table A was amended to clarify the standards implementation intent of the Commission when a human health based standard is a higher numeric value than the maximum contaminant level in a range between the human health based standard and the maximum contaminant level.

The Commission also corrected several typographical errors and added common synonyms for some of the organic chemicals.

The Commission heard testimony from several parties asserting that the revised standard adopted for 1,4 dioxane may not be attainable with economical treatment technologies and in some instances may be difficult to measure using current laboratory analytical techniques. Such technical and economic issues are often addressed by EPA in establishing a Maximum Contaminant Level (MCL) under the Safe Drinking Water Act, and the Commission has in the past established a range for a particular chemical, with the health-based standard being the minimum and the MCL the maximum, since EPA has determined that MCLs represent an acceptable level to provide in public drinking water. However, no MCL has been developed for 1,4 dioxane. The Commission therefore did not adopt a range and instead set the statewide standard for 1,4 dioxane at a level to protect human health, based on the currently available scientific information and applying the Commission's established risk-based policy approach. The Commission believes that the concerns raised are better addressed with respect to site-specific implementation issues and notes that there may be a need for site-specific standards for 1,4-dioxane and other regulated organic chemicals to address site-specific economic and/or technical treatment capabilities. The Division concurred with the parties' testimony regarding these concerns and expressed willingness to work with parties who propose site-specific solutions to the Commission.

2. Table Value Criteria – Tables 1 through 4

The Commission revised the Table 1 standard for molybdenum from 35 ug/l to 210 ug/l in an effort to keep the surface and ground water standards consistent. The Division presented evidence during the hearing that the total recoverable form of molybdenum can be translated to the dissolved form in a 1:1 ratio.

The Commission revised Table 1 standard for uranium to be a hyphenated value. The Commission retained the 30 µg/L value, the maximum contaminant level (MCL) from EPA's 2000 radionuclides rule under the Safe Drinking Water Act, and added a value of 16.8 µg/L. The 16.8 µg/L value is derived from use of the reference dose and relative source contribution from the 2000 radionuclides rule in Equation 1-1 of Policy 96-2. This equation and the resulting value are based purely upon the protection of human-health and do not take treatment or economic considerations into account as does the MCL. Footnote 2 to Tables 1-4 will be applied to the revised uranium value.

PARTIES TO THE RULEMAKING

1. Climax Molybdenum Company
2. Metro Wastewater Reclamation District
3. Lowry Environmental Protection/Cleanup Trust Fund
4. South Adams County Water and Sanitation District
5. Brown Group Retail, Inc.
6. International Risk Group, LLC
7. Environmental Protection Agency
8. City of Boulder

## 41.28 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY AND PURPOSE; APRIL 11, 2016 RULEMAKING; FINAL ACTION MAY 9, 2016; EFFECTIVE DATE JUNE 30, 2016

The provisions of sections 25-8-202(1)(b); 25-8-204; 25-8-402, C.R.S., provide the specific statutory authority for adoption. The Commission also adopted, in compliance with section 24-4-103(4) C.R.S., the following statement of basis and purpose.

**BASIS AND PURPOSE:**

1. Statewide Standards - Interim Organic Pollutant Standards

The Commission adopted revised and new organic chemical standards in section 41.5(C)(3). In an effort to keep ground water and surface water organic chemical standards consistent, the changes to section 41.5(C)(3) were considered during the same hearing that addressed changes to the statewide surface water organic chemical standards in Regulation No. 31 (Basic Standards and Methodologies for Surface Water).

In adopting these new and revised organic chemical standards, the Commission continued to rely on its past policy decisions and precedence documented in Commission Policy 96-2. Additionally, as per Departmental policy, the Commission has relied on the United States Environmental Protection Agency's (EPA) Integrated Risk Information System (IRIS) as its first tier source of toxicological data. Review of the IRIS data that had been updated since the last revisions to 41.5(C)(3) indicated that the water quality standard for tetrachloroethylene (TCE), needed to be revised. EPA expressed concerns regarding the proposed hybrid standard approach for TCE. In light of the impact that a decision on the hybrid standard for TCE may have on other hybrid standards adopted by the WQCC, and because the human health risk of maintaining the current standard of 5 mg/L is not an order of magnitude above the risk for a standard of .76 mg/L, the Commission decided to not modify the TCE standard at this hearing. The Commission expects the broader issue of hybrid standards will be discussed with EPA and the stakeholders, and that the issue may be revisited at a future hearing. The IRIS review also identified new compounds in the IRIS data that the Commission elected to adopt as water quality standards, these were: biphenyl, methanol, and tetrahydrofuran.

2. Table A, Footnote 6

The Commission amended Footnote 6 to Table A in section 41.5(C)(3) to clarify the standards implementation intent of the Commission when a human health based standard is a higher numeric value than the maximum contaminant level in a range between the human health based standard and the maximum contaminant level.

The Commission deleted implementation language for organic chemicals that was deemed no longer necessary.

The Commission added to the footnote an explanation of its intent with how an implementing agency can establish a protection level when there is site-specific information that demonstrates that there is no current or reasonably anticipated future uses of groundwater.

3. Practical Quantification Limitations (PQLs)

The Commission heard testimony that it is no longer necessary for the Division to approve the Practical Quantification Limitations (PQLs) used by the groundwater standards implementing agencies. The groundwater implementing agencies have their own PQLs or PQL equivalents established under their own authorities. Therefore, section 41.5(C)(4) was amended to remove the requirement of the WQCD approving PQL's for the groundwater standards implementing agency.

PARTIES TO THE RULEMAKING

1. Environmental Protection Agency

## 41.29 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY AND PURPOSE: AUGUST 8, 2016 RULEMAKING; FINAL ACTION NOVEMBER 14, 2016; EFFECTIVE DATE DECEMBER 30, 2016

The provisions of C.R.S. sections 25-8-202; 25-8-203; 25-8-204; 25-8-402, provide the specific statutory authority for adoption of this regulation. The Commission also adopted, in compliance with section 24-4-103(4) the following statement of basis and purpose.

41.29STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY AND PURPOSE: AUGUST 8, 2016 RULEMAKING; FINAL ACTION NOVEMBER 14, 2016; EFFECTIVE DATE DECEMBER 30, 2016

**BASIS AND PURPOSE**

The Water Quality Control Commission amended Regulation 41.5(B)(6) to authorize the Commission to adopt site-specific standards in Regulation #42 for agricultural standards (listed in Tables 3 and 4) as well as domestic water supply standards (listed in Tables 1 and 2). The Commission determined that correcting the existing inconsistency between domestic and agricultural standards and expanding the Commission's authorization to adopt site-specific groundwater standards was consistent with the Commission's authority under the Water Quality Control Act, the overall policies of Regulations #41 and #42, and the Commission's 2001 discussion to allow consideration of site-specific standards for the agricultural standards in Tables 3 and 4.

PARTIES TO THE RULEMAKING

1. Cherokee Metropolitan District
2. Upper Black Squirrel Ground Water Management District
3. Wayne E. Booker Revocable Living Trust and Frances G. Booker Revocable Living Trust
4. The Farmer Family

# Appendix D City and County of Denver – Guidance for Reuse of Soil on City Projects

**Department of Environmental Health**
Division of Environmental Quality
200 W 14th Ave, Suite 310
Denver, CO 80204
p: 720-913-1311
f: 720-865-5534
www.denvergov.org/deh

**INTEROFFICE MEMORANDUM**

**TO:** City and County of Denver Department Executive Directors

**FROM:** Bob McDonald, Executive Director

**DATE:** October 05, 2017

**SUBJECT:** Guidance for Reuse of Soil on City Projects

There is increasing demand in and around the City and County of Denver (City) for soil available for reuse. Such reuse offers several benefits to the City including reduced waste, hauling costs, disposal fees, and vehicle emissions.

As the local public health authority, the City's Department of Environmental Health (DEH) has determined that all reusable soil must be adequately characterized based on the intended reuse to ensure the protection of public health and the environment. If the soil is not suitable for reuse per these guidelines, it must be disposed at the City-owned Denver Arapahoe Disposal Site (DADS) in accordance with the City's Executive Order No. 115.

This guidance provides criteria by which City employees and/or third parties may, or may not, reuse soil from City projects at both City-owned properties and properties owned by others. DEH sign off will be required for any reuse options. As such, to promote safe and sustainable reuse, it is within DEH's purview to implement the following requirements for City soils to be reused:

1. For onsite reuse, City personnel are responsible for contacting DEH[1] when they want to reuse soil or receive a request to reuse soil. DEH is responsible for promptly informing the requestor of City sampling frequency and analysis requirements based on contaminants of concern from recognized environmental conditions, which are designed to promote safe and sustainable reuse.

2. For off-site reuse and/or material to be imported to a site, the person or entity requesting to reuse the soil must adequately characterize the soil by sampling at least every 500 cubic

[1] Diane DeLillio, 720-865-5448, diane.delillio@denvergov.org

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www.denvergov.org/deh

yards to be excavated (or alternative frequency as determined by DEH) and analyze those soil samples for, at a minimum:

a. Volatile organic constituents;
b. Semi-volatile organic constituents;
c. Total petroleum hydrocarbons;
d. Pesticides;
e. Herbicides;
f. Polychlorinated biphenyls (PCBs);
g. Arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver; and
h. Asbestos – if debris is found and if suspect asbestos-containing material is found in the debris (e.g., transite, ash, brick mortar, asphalt shingles, etc.)

3. In general, the person or entity requesting to reuse the soil shall pay all costs associated with the sampling and analysis of the soil.

4. Before the City will release the soil for reuse, the party requesting the excess soil must indicate the land use of the accepting site and demonstrate to DEH's satisfaction that the soil meets the criteria based on the designated land use of the receiving site. See Exhibit 1 for additional guidance.

5. Maintain the documentation for sample collection, analytical results, and the environmental consultant's field notes and evaluation.

6. Any third party will be required to sign a release to accept the soil from the City and to release the City from liability.

Attachments: Exhibit 1 – Soil Reuse Acceptance Criteria Guidance Table
Exhibit 2 - Draft Release for Third Party Acceptance

CC: Jessica Brody, CAO
Lee Zarzecki, CAO
Zachery Clayton, DEH
Gregg Thomas, DEH

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# Exhibit 1 - Soil Reuse Acceptance Criteria Guidance Table

| Land Use | Examples | Applicable Soil Reuse Acceptance Criteria* |
|---|---|---|
| Recreational | Parks, Open Space | All Contaminants except Arsenic (Residential)<br><br>Arsenic Standard |
| Residential | Single Family, Multi-family, Mixed-use with residential component | All Contaminants except Arsenic (Residential)<br><br>Arsenic Standard |
| Right of Ways (not inclusive of utilities) | Roads, sidewalks, bike paths | All Contaminants except Arsenic (Composite Worker)<br><br>Arsenic Standard |
| Utility corridors (underground) | Storm water, Waste water, | All Contaminants except Arsenic (Composite Worker)<br><br>Arsenic Standard |
| City-owned facilities | Maintenance garages, office buildings, safety buildings | All Contaminants except Arsenic (Composite Worker)<br><br>Arsenic Standard |

* Screening values presented in the Regional Screening Levels table are based on human health risk from the combined exposure of direct soil ingestion, dermal contact with soil and inhalation of vapors or particulates associated with soil. Other pathways, such as indoor air or groundwater protection, may need to be considered on a site-specific basis. Some sites in sensitive ecological settings may need to be evaluated for potential ecological risk. These screening levels may not be applicable to sites within and/or subject to other regulatory programs (i.e., RCRA Corrective Action, Leaking Underground Storage Tanks, Superfund Operable Unit, etc.)

In addition, the reuse of any regulated asbestos-containing soil ("RACS") or suspect-RACS must be conducted in accordance with state regulations governing the management of RACS, 6 CCR 1007-2, § 5.5.

DEH is committed to assisting all agencies and projects to perform soil disturbing activities in a cost-effective and sustainable manner while ensuring protection of public health and the environment.

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**PRIVILEGED AND CONFIDENTIAL/ATTORNEY WORK PRODUCT**

# AGREEMENT AND RELEASE FOR EXCESS SOIL REUSE

This Agreement and Release ("Agreement") is made by and between _____ (the "Accepting Party") and the City and County of Denver (the "City") (collectively, the "Parties").

## RECITALS

WHEREAS, the City has determined that it has excess soil available; and

WHEREAS, the Accepting Party has requested excess soil from the City for reuse at ___[address of reuse location]___; and

WHEREAS, the Accepting Party has sampled and analyzed the excess soil and determined it to be suitable for the intended reuse; and

NOW, THEREFORE, in consideration of the premises and agreements contained herein, the Parties agree as follows:

1. Recitals Binding. The Parties agree that the Recitals stated above are an integral part of the Agreement and are binding.

2. Conveyance of Ownership. The City agrees to convey to the Accepting Party ownership of up to __[maximum volume]__ cubic yards of excess soil.

3. Acceptance "AS-IS". The Accepting Party acknowledges that the City has made no representations or warranties regarding the environmental or geotechnical suitability of the excess soil. The Accepting Party acknowledges that it is assuming ownership of the excess soil based solely on its analysis of the soil. The Accepting Party accepts the excess soil "AS IS."

4. Payment. The Accepting Party shall pay to the City good and valuable consideration in the amount of TEN DOLLARS ($10.00), the sufficiency of which is hereby acknowledged.

5. Transportation to Receiving Site. The Accepting Party will transport, or arrange to transport, the excess soil from __[address]__ to the reuse location at a time, place, and manner acceptable to the City.

6. Defense and Indemnification

a. The Accepting Party agrees to defend, indemnify, reimburse and hold harmless City, its appointed and elected officials, agents and employees for, from and against all liabilities, claims, judgments, suits or demands for damages to persons or property arising out of, resulting from, or relating to the reuse of the excess soil, unless such Claims have been specifically determined by the trier of fact to be the sole negligence or willful misconduct of the City.

b. Accepting Party's duty to defend and indemnify City shall arise at the time written notice of the Claim is first provided to City regardless of whether Claimant has filed suit

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on the Claim. Accepting Party's duty to defend and indemnify City shall arise even if City is the only party sued by claimant and/or claimant alleges that City's negligence or willful misconduct was the sole cause of claimant's damages.

c. Accepting Party shall defend any and all Claims which may be brought or threatened against City and shall pay on behalf of City any expenses incurred by reason of such Claims including, but not limited to, court costs and attorney fees incurred in defending and investigating such Claims or seeking to enforce this indemnity obligation. Such payments on behalf of City will be in addition to any other legal remedies available to City and will not be the City's exclusive remedy.

7. City Execution of Agreement. The Agreement will not be effective or binding on the City until it has been fully executed by all required signatories of the City and County of Denver, and if required by Charter, approved by the City Council.

8. Authority.

a. The Parties to this Agreement agree that each Party has authority to execute this Agreement.

b. The Parties to this Agreement have carefully read, and know and understand, the full contents of this Agreement and are voluntarily entering into this Agreement.

c. The Parties to this Agreement are competent to enter into this Agreement.

9. Governing Law and Venue. The Agreement will be construed and enforced in accordance with applicable federal law, the laws of the State of Colorado, and the Charter, Revised Municipal Code, ordinances, regulations and Executive Orders of the City and County of Denver, which are expressly incorporated into the Agreement. Unless otherwise specified, any reference to statutes, laws, regulations, charter or code provisions, ordinances, executive orders, or related memoranda, includes amendments or supplements to same. Venue for any legal action relating to the Agreement will be in the District Court of the State of Colorado, Second Judicial District (Denver District Court).

10. Entire Agreement: The Parties to this Agreement have not relied on any statement, representation, omission, inducement or promise of any other Party (or any officer, agent, employee, representative, or attorney for any other Party) in executing this Agreement, or in making the settlement provided for herein, except as expressly stated in this Agreement. The Agreement contains the entire understanding of the Parties relating to the subject matter of the Agreement. No promise, inducement or agreement which is not specifically provided in this Agreement has been made by any party to this Agreement, and no warranties, representations, or undertakings are made by the Parties hereto except as are expressly provided herein.

11. Electronic Signatures and Electronic Records. The Accepting Party consents to the use of electronic signatures by the City. The Agreement, and any other documents requiring a signature under the Agreement, may be signed electronically by the City in the manner specified by the City. The Parties agree not to deny the legal effect or enforceability of the Agreement solely because it is in electronic form or because an electronic record was used in its formation. The

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Parties agree not to object to the admissibility of the Agreement in the form of an electronic record, or a paper copy of an electronic document, or a paper copy of a document bearing an electronic signature, on the ground that it is an electronic record or electronic signature or that it is not in its original form or is not an original.

[Remainder of the Page Intentionally Left Blank]

[Signature Pages Follow]

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# Appendix E City and County of Denver – Asbestos-Contaminated Soil Management Standard Operating Procedure

# ASBESTOS-CONTAMINATED SOIL MANAGEMENT STANDARD OPERATING PROCEDURE
## For City and County of Denver

**December 3, 2010**

Denver
Environmental Health
*Promoting Healthy Communities*

City and County of Denver
Department of Environmental Health
Division of Environmental Quality
200 West 14th Avenue, Department 310
Denver, Colorado 80204
311

# ASBESTOS-CONTAMINATED SOIL MANAGEMENT STANDARD OPERATING PROCEDURE
## For City and County of Denver

**December 3, 2010**

Prepared by:

Steve Gonzales
State of Colorado Certified Project Designer

Reviewed by:

Dave Erickson
State of Colorado Certified Building Inspector

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CDPHE Notification Forms

# APPENDIX B

CDPHE Approval letter and City's Responses to CDPHE Comments

# ACRONYMS AND DEFINITIONS

## Acronyms

| | |
|---|---|
| ABI | Asbestos building inspector |
| ACM | Asbestos-containing materials |
| ACS | Asbestos-contaminated soil |
| AMS | Asbestos Air Monitoring Specialist, CDPHE Certified |
| APCD | Air Pollution Control Division |
| AQCC | Air Quality Control Commission |
| CCOD | City and County of Denver |
| CDPHE | Colorado Department of Public Health and Environment |
| City | City and County of Denver |
| DADS | Denver Arapahoe Disposal Site |
| DOT | Department of Transportation |
| EPA | United States Environmental Protection Agency |
| ESA | Environmental Site Assessment |
| GIS | Geographic information system |
| GPS | Global positioning system |
| HASP | Health and Safety Plan |
| HEPA | High efficiency particulate air |
| HMWMD | Hazardous Materials Waste Management Division |
| MMP | Materials Management Plan |
| MPH | Miles per hour |
| NESHAP | National Emissions Standards for Hazardous Air Pollutants |
| NIOSH | National Institute of Occupational Safety and Health |
| NVLAP | National voluntary Laboratory Accreditation Program |
| OSHA | Occupational Safety and Health Administration |
| PCM | Phase Contract Microscopy |
| PEL | Permissible Exposure Limit |
| PLM | Polarized Light Microscopy |
| POLY | Polyethylene |
| PPE | Personal Protective Equipment |
| SCMP | Soil Characterization and Management |
| SOP | Standard operating procedure |
| TEM | Transmission electron microscope |
| TSCA | Toxic Substances Control Act |

## Definitions

**"Air Monitoring Specialist"** means a person who performs air monitoring referred to in this guidance and who is certified to perform air monitoring in accordance with Air Regulation No. 8, Part B.

**"Asbestos Supervisor"** means a person who has been certified as an asbestos Supervisor in accordance with Air Regulation No. 8, Part B.

**"Asbestos Project Designer"** or **"Project Designer"** means a person who has been certified as an asbestos Project Designer in accordance with Air Regulation No. 8, Part B.

**"Adequately wet"** means sufficiently mix or penetrate with liquid to completely prevent the release of particulate material and fibers into the ambient air. If visible emissions are observed coming from asbestos-contaminated soil or asbestos-containing material, then the material has not been adequately wetted. However, the absence of visible emissions is not sufficient evidence of being adequately wet. Guidance on determining when a material is adequately wet can be found in EPA's *Asbestos NESHAP Adequately Wet Guidance*, EPA 340/1-90-019 (December 1990).

**"Asbestos"** means the asbestiform varieties of serpentine (chrysotile), riebeckite (crocidolite), amosite (cummingtonite-grunerite), anthophyllite, and actinolite-tremolite.

**"Asbestos contaminated soil"** means soil containing any amount of asbestos.

**"Asbestos waste"** means any asbestos-containing material whether it contains friable or non-friable asbestos, that is not intended for further use. This term includes but is not limited to asbestos mill tailings, asbestos from pollution control devices, and containers that contain asbestos.

**"Asbestos containing material"** means any material that contains more than one percent (1%) asbestos by weight, area or volume.

**"Certified Asbestos Building Inspector" (ABI)** means a person certified in accordance with Air Regulation No. 8, Part B, to perform asbestos inspection and sampling, and who has a minimum of six (6) months experience in asbestos-contaminated soil inspections.

**"Consultant"** means entity contracted to perform training, inspections, and air monitoring related to soil disturbing activities in accordance with the SCMP.

**"Contractor"** means entity contracted to perform soil disturbing activities in accordance with the SOP.

**"Facility Component"** means any component associated with a structure, installation, or building and includes buried utilities, tanks, structures or other installations.

**"Friable"** means that the material, when dry, may be crumbled, pulverized, or reduced to powder by hand pressure, and includes previously non-friable material after such previously non-friable material becomes damaged to the extent that when dry it may be crumbled, pulverized, or reduced to powder by hand pressure.

**"Leak tight"** means that solids, liquids, or gases cannot escape or spill out. It also means dust tight.

**"Mechanical"** means operated or produced by mechanism or machine. This may include, but shall not be limited to, an excavator, backhoe, grader, tiller, auger, or hand shovel.

**"Non-friable"** means material which, when dry, may not be crumbled, pulverized, or reduced to powder by hand pressure.

**"Site"** or **"solid waste disposal site"** means the location for a facility chosen based upon geologic, hydrogeologic and operational considerations. For the purpose of Section 5.5 of the Solid Waste Regulations "site" means the area or areas where soil-disturbing activities are occurring or will occur.

**"Soil-disturbing activities"** means excavation, grading, tilling, or any other mechanical activity used to disturb the soil.

**"Visible emissions"** means any emissions which are visually detectable without the aid of instruments, coming from material containing asbestos, asbestos waste, asbestos-contaminated soil, or from handling and disposal of asbestos waste, material containing asbestos or asbestos-contaminated soil.

**"Work Area"** means the area where soil disturbing activities are occurring. For asbestos contaminated soil disturbance, Work Area also means the regulated/controlled area boundary.

Purpose and Scope

# 1 Introduction

This Standard Operating Procedure (SOP) provides written procedures that are the minimum requirements for the proper training, handling, packaging and disposal of asbestos-contaminated soil (ACS) or asbestos containing material (ACM) during soil disturbing activities for City and County of Denver (City) properties or property owned by others where the City is performing work. This SOP shall be followed whenever soil excavation or disturbance will occur in areas where ACS or ACM is known or suspected to exist. This SOP satisfies the Section 5.5.3(C) and 5.5.4(B): Soil Characterization and Management Plan Requirements of the Colorado Solid Waste Regulations (6CCR 1007-2, Part 1).

When using this SOP for a specific project, appropriate notification shall be provided to the Colorado Department of Public Health and Environment, Hazardous Materials and Waste Management Division (CDPHE) using the CDPHE notification forms attached to this SOP (Appendix A). Note that for existing projects, where project information has already been provided to CDPHE, notification shall be provided to the established CDPHE contact, and use of the forms in Appendix A may not be necessary.

This SOP should be used as a guideline for implementing appropriate management and disposal practices, and may be supplemented with additional site-specific addendums which describe current site conditions and past characterization efforts. In addition, site-specific management plans, Material Management Plans (MMPs) for other regulated material, and/or Health and Safety Plans (HASPs) for site-specific safe work practices will be appended to this SOP when appropriate. Such addendums and management plans will be submitted to the CDPHE using the same CDPHE notification requirements noted above.

CDPHE has reviewed, commented on earlier version and has approved this SOP. The CDPHE Letter approving this SOP is included in Appendix B. Appendix B also includes the City's responses to CDPHE comments on an earlier draft version of this SOP.

# 2 Site Information, Conditions and Planned Soil Disturbing Activities

## 2.1 Site Information Background

Knowledge of potential or known asbestos in soil occurrence is gained through a review of environmental and historical conditions of a site, or prior site characterizations, investigations or assessments. Results of the environmental and historical review will be used to classify the site according to the potential for asbestos to be present in soil, and the appropriate level of response, characterization and management activities, if any, for a site.

## 2.2 Review of Environmental and Historical Conditions

A review of environmental and historical conditions may consist of a Phase I Environmental Site Assessment (ESA), or a less formal environmental screen. The review may include, as necessary:

- Historical aerial photographs;
- Sanborn Fire Insurance maps;
- Historical city directories;
- City and County of Denver historical landfill map and database;
- Standard environmental record sources;
- Site visit;
- Utility plans and maps;
- Previous environmental studies;
- Building department records;
- County assessor's office records;
- Geologic maps;
- Investigation of other historical site conditions and uses;
- Interviews with site owners, operators, and government officials.

## 2.3 ACS Potential Classification

Results of the environmental and historical review are used to classify the site according to the potential for asbestos to be present in soil. The classification is used to determine the appropriate level of response, characterization and management activities, if any, for a site. Figure 1 depicts the site classification system and the response actions that flow from each classification.

### 2.3.1 Known ACS

A site that is classified as having known ACS is one where confirmed asbestos material in the soil was identified from subsurface soil investigation or from visual observations of the surface, sidewalls, embankments, etc. Soil disturbance activities on sites with known ACS will follow the management practices outlined in Section 7.0 of this SOP. Additional site characterization, if appropriate, will be conducted according to the procedures outlined in Section 6.0 of this SOP.

### 2.3.2 Reason to Believe

A site that is classified as Reason to Believe is one where evidence from environmental and historical reviews indicates that ACM could be encountered. Such evidence could include the presence of buried building debris or landfills in which construction debris or ACM is believed to have been deposited. Soil disturbing activities on sites classified as Reason to Believe will follow management practices of Section 7 of this SOP.

The presence of the following materials alone would not justify classifying a site as Reason to Believe:

- Wood
- Glass
- Metal
- Gravel
- Unfinished (no surface coating) concrete slab[1]
- Brick – other than fire brick[2]

Brick and concrete typically are considered to be free of asbestos and rarely or only occasionally will contain asbestos. If ACM is identified in these or other materials the appropriate management practices outlined in Section 7.0 of this SOP will be implemented during soil disturbing activities. Additional site characterization, if appropriate, will be conducted according to the procedures outlined in Section 6.0 of this SOP.

### 2.3.3 No Reason to Know or Believe

A site that is classified as having No Reason to Know or Believe is one where environmental and historical reviews do not identify the potential for asbestos containing materials to be on site even though waste material identified above and not typically associated with asbestos may be present.

Procedures in Section 7.0 of this SOP would not be implemented at a site classified as No Reason to Know or Believe.

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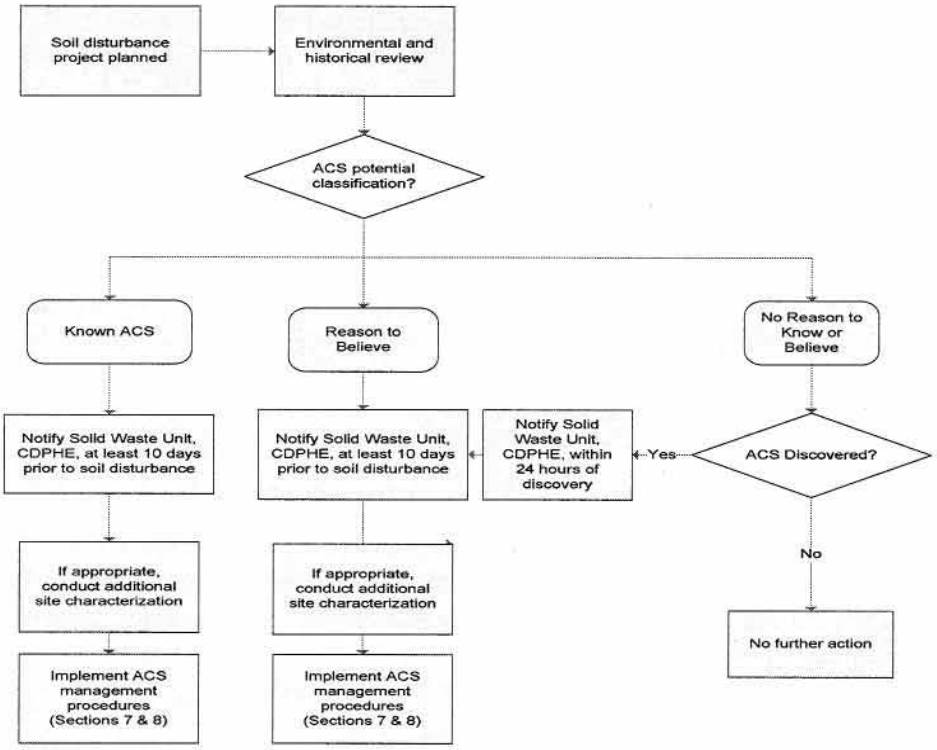
[1] Addition of asbestos to concrete slab was not a common use of asbestos. However, manufactured asbestos and Portland cement products were common including water pipes, simulated ceramic bathroom tiles, facings of acoustical materials, electrical switchboard panels, laboratory tabletops, electrical conduits, and even smaller diameter pipes were used for purlins and trusses in wartime construction to conserve steel and lumber.

[2] Asbestos was historically used in the fabrication of fire brick. Asbestos containing fire brick was used around boilers and furnaces and was cemented in place with asbestos furnace cement. Today, fire brick is manufactured without asbestos and much of the older asbestos fire brick has been removed and replaced with non-asbestos fire brick. Discussion of fire brick will be included in City-provided asbestos awareness training.

Figure 1. Site Review and ACS Potential Classification Flowchart



# 3 Primary Contacts, Roles and Responsibilities

For projects where asbestos in soil will be disturbed, personnel from the following departments and agencies will be identified for each site.

| *Organization* | *Role/Responsibility* | *Contact Information* |
|---|---|---|
| City and County of Denver Specific Division | Project Management | To be determined |
| City and County of Denver Department of Environmental Health | Environmental Compliance | Steve Gonzales<br>Phone: 720.865.5447<br>Email: steve.gonzales@denvergov.org |
| CDPHE Hazardous Materials and Waste Management Division (HMWMD) | Regulatory Agency | CDPHE Project Manager<br>Solid Waste Unit<br>Phone:<br>Email: |
| Excavation Contractor | Site excavation and as needed management of ACS in accordance with this SOP | To be determined |
| ACS Consultant | ACS Consulting (soil characterization, remediation oversight, soil observation, ACM identification and air monitoring) | To be determined |

Additionally, an asbestos building inspector certified in accordance with Air Regulation No. 8, Part B with at least six months of asbestos in soil experience (ABI) will be selected and independently retained by the excavation contractor. Requirements and responsibilities of the ABI, excavation contractor (contractor) and ACS consultant are discussed in the following subsections.

## 3.1 Asbestos Building Inspector Requirements

At sites classified as "Known ACS" or "Reason to Believe" where one could reasonably expect to encounter ACM an ABI will be on-site during soil disturbing activities to observe and identify potential ACM which may be encountered.

The ABI will be responsible for the following:

- Be on-site during soil disturbing and soil loading operations;
- Identify suspect ACM as soil is being excavated;
- Complete necessary sampling of suspect ACM in accordance with Section 6.1 of this SOP;
- Complete daily logs detailing site activities;
- Maintain pertinent documentation related to adherence of the SOP, including sampling results, air monitoring data, waste manifests, photographs, etc., and
- Verify implementation and adherence of the SOP in the event that ACM is identified during excavation of soil at the site.

## 3.2 Contractor Requirements

Contractors performing ACM or ACS removal activities will be responsible for the following:

- Providing the ABI and the City with documentation that all individuals performing ACM or ACS disturbing activities have completed asbestos contaminated soil awareness training that provides information necessary to perform their duties in a way that ensures compliance with the requirements of Section 5.5 of the Solid Waste Regulations, Section 5.0 of this SOP, and asbestos awareness training per Occupational Safety and Health Administration (OSHA) standards set forth at 29 CFR 1926.1101 (k) (9) (vii). All records that document the training, experience or certification requirements required in Section 5.5 of the Solid Waste Regulations shall be available for Division review throughout the duration of ACM or ACS disturbing activities;
- Preparing and implementing a HASP in accordance with all applicable regulations, including OSHA. The contractor will be responsible for the health and safety of its employees, sub-contractors, consultants, etc., as well as providing all necessary training and personal protective equipment (PPE) for completion of work at the site;
- Maintenance of all necessary site control to prevent unauthorized entry into any regulated work area;
- Verifying that ACM or ACS disturbance-related waste material is not disposed on the site, disposed into storm drains, sanitary sewers, streams, irrigation facilities or waterways;
- Removing non-salvageable, non-hazardous materials and equipment from the site and disposing at DADS in accordance with local, state and federal laws;
- Ensuring that all special personnel and required equipment are provided to haul construction debris to DADS;
- Ensuring that any special handling charges imposed by Waste Management at DADS are paid; and
- The contractor will be responsible for adherence to this plan at the direction of the ABI.

# 4 Regulatory Summary and Regulatory References

## 4.1 CDPHE Hazardous Materials Waste Management Division (HMWMD) – "Asbestos-Contaminated Soils" not associated with the "Built Environment"

To address asbestos in soil, the CDPHE HMWMD has established specific management requirements for asbestos in soil under Section 5.5 of the Regulations Pertaining to Solid Waste Disposal Sites and Facilities (6 CCR 1007-2). Disposal of ACM, and work done in ACS, must comply with this regulation. The requirements of Section 5.5 of the Solid Waste Regulations apply to the owner or operator of any property with ACS at which soil-disturbing activities are occurring or planned for any area containing ACS. The requirements of Section 5.5 are triggered when the owner or operator knows of or believes ACS is present at a site, (through confirmation by analysis of observed material that is suspected of containing asbestos), or has reason to know or believe that visible asbestos will be encountered. An owner or operator who has no reason to know of or suspect ACS at a site does not have a duty to sample or otherwise investigate for ACS prior to commencing excavation, or other soil disturbing activities, at the site. It is important to understand that there is no language in the Solid Waste Regulations that requires an owner or operator to perform soil-disturbing activities, or to remediate ACS. The regulations include specific requirements that apply if ACS is disturbed or will be disturbed.

To supplement the regulation, CDPHE developed a guidance document intended to provide direction to contractors, consultants and property owners who are involved in soil disturbing activities in areas with known or suspected ACS, or where ACS is discovered. The guidance is meant to assist in compliance with the Solid Waste Regulations, and where applicable, Air Quality Control Commission Regulation No. 8, Part B (5 CCR 1001-10, Part B - Asbestos).

In accordance with Section 5.5.2 of the Solid Waste Regulations, the following projects are exempt from the requirements of Section 5.5 of the Solid Waste Regulations, but may be subject to other sections of the Solid Waste Regulations or other regulatory programs:

1. In situations where the soil contains solely non-friable ACM, that has not been rendered friable, the non-friable material can be removed from the soil and properly disposed in accordance with Section 5.2 of the Solid Waste Regulations. The surrounding soil would not be considered to be ACS, and therefore would not be subject to the requirements of Section 5.5 of the Solid Waste Regulations. The determination that a material is non-friable must be made by an ABI who has been certified in accordance with AQCC Regulation No. 8, Part B, and who has a minimum of six (6) months experience in ACS inspections (see Section 5.4 Worker Training).
2. The requirements of Section 5.5 of the Solid Waste Regulations do not apply to asbestos abatement of facility components (including pipes, ducts and boilers) conducted in accordance with AQCC Regulation No. 8, Part B, unless the total quantity of asbestos-containing material to be removed from a facility component that is on or in soil that will be disturbed falls below Regulation No. 8 trigger levels. Disposal of asbestos must comply with Sections 5.1 through 5.4 of the Solid Waste Regulations.

3. The requirements of Section 5.5 of the Solid Waste Regulations do not apply to spill response activities that are subject to the requirements of AQCC Regulation No. 8, Part B. As above, disposal of asbestos must still comply with Sections 5.1 through 5.4 of the Solid Waste Regulations.
4. Ambient occurrences of asbestos that are not due to site-specific activities. Ambient occurrences of asbestos may include, but are not limited to, naturally occurring asbestos or the distribution of asbestos from normal wear of automotive products.
5. Projects involving excavations with a total volume of less than 1 cubic yard of soil using low-emission excavation methods such as hand held tools or light equipment.
6. Projects conducted directly by a homeowner at their primary residence, including residential landscaping projects and other private residential soil-disturbing projects conducted after the primary dwelling is built, (e.g., planting trees, digging holes for fence posts, installing sign posts, gardening, or other projects done by private individuals at their primary residence.

The exemption for asbestos abatement projects conducted under AQCC Regulation No. 8, Part B includes asbestos debris that may come into contact with soil during demolition of structures with ACM and materials containing trace amounts of asbestos (including trace soil in crawlspaces, loose fill vermiculite, etc) that can legally remain during demolition and be disposed of as normal demolition debris. Any asbestos debris left behind after the completion of a demolition project and associated site cleanup would be subject to the requirements of Section 5.5 of the Solid Waste Regulations if disturbed in the future.

### 4.2 Federal and State Agencies

The EPA National Emissions Standards for Hazardous Air Pollutants (NESHAPs)/CDPHE Air Pollution Control Division (APCD) regulations primary consideration under this SOP is adherence to CDPHE Regulation 8 requirements for the discovery of ACM on buried facility components such as piping, boilers, etc and the proper removal in accordance with the EPA NESHAPs and CDPHE Regulation 8. Under CDPHE Regulation 8, secondary consideration under this SOP is the proper removal of all construction debris including non-friable materials allowed to remain during demolition, asbestos containing joint compound (where composite result reported less than 1%) and trace-1% asbestos materials. Where demolition debris is allowed to remain after demolition activities have been completed, any presence of asbestos in the soil would then be subject to the CDPHE HMWMD ACS regulations outlined in 6 CCR 1007-2 Section 5.5.

All work on ACM or ACS must comply with the applicable requirements of EPA, OSHA, DOT and CDPHE Regulation 8.

### 4.3 Facility Components

Removal of ACM on a facility component with asbestos quantities above the following trigger levels is subject to the notification, permit, and abatement requirements of AQCC Regulation No. 8, and shall not be conducted under this SOP:

i. 260 linear feet on pipes;

ii. 160 square feet on other surfaces, or;
iii. The volume equivalent of a 55-gallon drum.

However, removal of asbestos-containing material on a facility component, that is below the AQCC Regulation No. 8 trigger levels, and that is located on or in soil that will be disturbed, shall be conducted under this SOP in accordance with work practices in AQCC Regulation No. 8, Part B, Section III.O. This removal is not subject to the notification or permit requirements of Air Regulation No. 8; and OSHA Asbestos Standard for the construction Industry, 1926. 1101.

If there is asbestos-contaminated soil associated with the facility component, and less than one cubic yard of ACS will be disturbed, no notification will be made to CDPHE HMWMD. The subject ACS will be managed and removed utilizing wet methods and low-emission excavation techniques (hand tools). The CABI will ensure proper disposal of this ACS in accordance with Section 7.4.9 of this SOP.

If there is asbestos-contaminated soil associated with the facility component, and greater than one cubic yard of ACS will be disturbed, CDPHE HMWMD will be notified and the requirements in this SOP will be fully implemented.

# 5 Training Requirements

## 5.1 SOP circulation

Entities/persons involved with soil disturbing activities shall be provided a copy of this SOP prior to performing work.

## 5.2 Awareness Training

On-the-job asbestos soils awareness training as defined in Section 5.5.6 of the Solid Waste Regulations will be provided to all workers directly involved in soil disturbing activities on soil disturbing projects, including heavy equipment operators where there is known ACS or a reason to believe ACS may be encountered. The City's Department of Environmental Health, Environmental Quality Division (EQ) is available to any City department and/or City contractor as an ABI resource to provide the awareness training as follows:

> *"On-the-job" asbestos soils awareness training as defined in Section 5.5.6 of the Solid Waste Regulations will be provided to workers directly involved in soil-disturbing activities on sites where there is known ACS or a "reason to believe" ACS may be encountered. The training will address such topics as history and background of asbestos, identifying types of asbestos, health effects, engineering controls, and actions to take when suspect asbestos materials are encountered. The training will be conducted with oversight and curriculum development by a currently certified asbestos building inspector, asbestos supervisor or project designer.*

The awareness training will provide information necessary for the individuals to perform their duties in a way that ensures compliance with the requirements of Section 5.5 of the Solid Waste Regulations. The training will be conducted by an Asbestos Supervisor, ABI or Project Designer, certified in accordance with AQCC Regulation No. 8, Part B, and who has a minimum of six (6) months experience in asbestos-contaminated soil management.

## 5.3 ACS Soil Disturbance Training

Personnel overseeing, directing and/or handling ACM or ACS during soil excavation activities shall have the following minimum training:

Asbestos-contaminated soil training that provides information necessary to perform their duties in a way that ensures compliance with the requirements of Section 5.5 of the Solid Waste Regulations, including on-the-job ACS awareness training as discussed in Section 5.2 above. This training will be conducted by an Asbestos Supervisor, ABI or Project Designer, certified in accordance with AQCC Regulation No. 8, part B, and who has a minimum of six months experience in asbestos-contaminated soil management.

Training in accordance with OSHA standard 1926.1101(k)(9)(vii) is also required for those performing soil disturbing activities in an area with ACM or ACS.

This training requirement applies to equipment operators but is not required for drivers of trucks carrying contaminated material for disposal to approved landfills.

### 5.4 ACS Inspection, SOP Preparation, and Air Monitoring Training

Individuals performing soil inspection (for purposes of identifying suspect ACM) must have a current ABI certification in accordance with AQCC Regulation No. 8, Part B, and must have a minimum of six months experience conducting ACS inspections. When a team of ABIs are used for inspection and sampling, the team-lead inspector must have a minimum six months experience (oversight inspectors are allowed to collect bulk samples, etc without the minimum six months experience).

Individuals preparing and signing Soil Characterization and Management Plans (SCMPs) must have a current Asbestos Project Designer certification in accordance with AQCC Regulation No. 8, Part B.

Individuals performing asbestos air monitoring (alone) associated with ACS disturbing activities must have a current Air Monitoring Specialist (AMS) certification in accordance with AQCC Regulation No. 8, Part B. Air monitoring oversight can be provided by non-AMS certified staff including sample analysis, mobilization of equipment, etc.

### 5.5 Additional Considerations

It is the contractor's responsibility to provide training to all employees who have the potential for exposure to asbestos in the proper use of PPE and have a current annual physical with a medical release/respirator use form in accordance with the employer's medical surveillance program. Personal exposure air monitoring will be conducted in accordance with the employer's exposure assessment program.

# 6 Immediate and Interim Actions upon Discovery of Suspected ACM

This section describes the immediate and interim actions that will be implemented when suspected ACM or ACS is discovered. When suspected ACM or ACS is discovered during excavation activities at the project, the critical requirement is to avoid generating airborne soil or being in direct contact with contaminated soil, thereby limiting potential exposure to asbestos fibers. Field personnel shall take actions necessary to assure that the suspect material is not disturbed while waiting for appropriately trained personnel to arrive on site. DEH is available to any City department and/or City contractor as an ABI resource to implement this SOP as required.

## 6.1 Immediate Actions upon Discovery of Suspected ACM

The CDPHE will be notified at least 10 days prior to any planned soil disturbing activity in areas of known or suspected ACS or ACM. In the event that visible ACS or ACM in soil is discovered the Division will be notified of this discovery no later than 24 hours after discovery. The CDPHE can be notified by using the Notification Form in Appendix A of this plan and faxed to 303-759-5355 or emailed to comments.hmwmd@state.co.us. For emergency repair projects to utilities, etc., notification will be provided to CDPHE by the next business day. Note that for existing projects, where project information has already been provided to CDPHE, notification shall be provided to the established CDPHE contact and use of the form in Appendix A may not be necessary. Notification information for DEH is provided in Section 3.0 of this SOP. Figure 2 depicts the general procedure for Immediate and Interim Action upon Discovery of Suspected ACM.

This SOP has been prepared to minimize potential delays, and to develop approved standard procedures that the contractor or City personnel will implement as needed for applicable soil disturbing activities. These standard procedures once approved by the CDPHE, will satisfy the requirements for a SCMP.

The following outlines procedures to be followed to minimize the potential for release of airborne asbestos fibers when suspect ACM or ACS is discovered.

- Stop work immediately upon encountering material that is suspected of containing asbestos.

- Adequately wet area with water before performing sampling activities that will disturb the material (note: visual inspection does not require wetting). Maintain wet conditions throughout sampling activities. If leaving the site unattended, cover the disturbed soil with a layer of 6-mil polyethylene (poly) sheeting, or spray with magnesium chloride solution in sufficient amounts to wet the soil to prevent drying and dust generation.

- Demarcate area suspected of containing asbestos with barrier tape, or other means, and provide site access control. Access can be prevented by means of fencing or security personnel.

- Disturb soil as little as possible to perform sampling activities as described in Section 6.2.

- A layer of 6-mil poly may be used to prevent cross contamination onto clean soils during initial characterization activities by placing the poly on the ground an then placing the potentially contaminated soil directly on the poly.

- Generate no visible emissions (dust) during characterization activities.

The ABI will collect samples of the suspect asbestos materials according to procedures provided in Section 6.2. The samples will be analyzed using polarized light microscopy (PLM) to identify the presence of asbestos fibers.

Clothing and equipment that has come in contact with suspect asbestos will be considered potentially contaminated until/unless analytical results indicate the material does not contain any asbestos. Workers and equipment will be decontaminated on site; dirt and debris should not leave the immediate work area. Heavy equipment will be left on site until analytical results are received unless the equipment has been decontaminated. The following procedures can be modified by the ABI based on the project scale and the potential level of exposure:

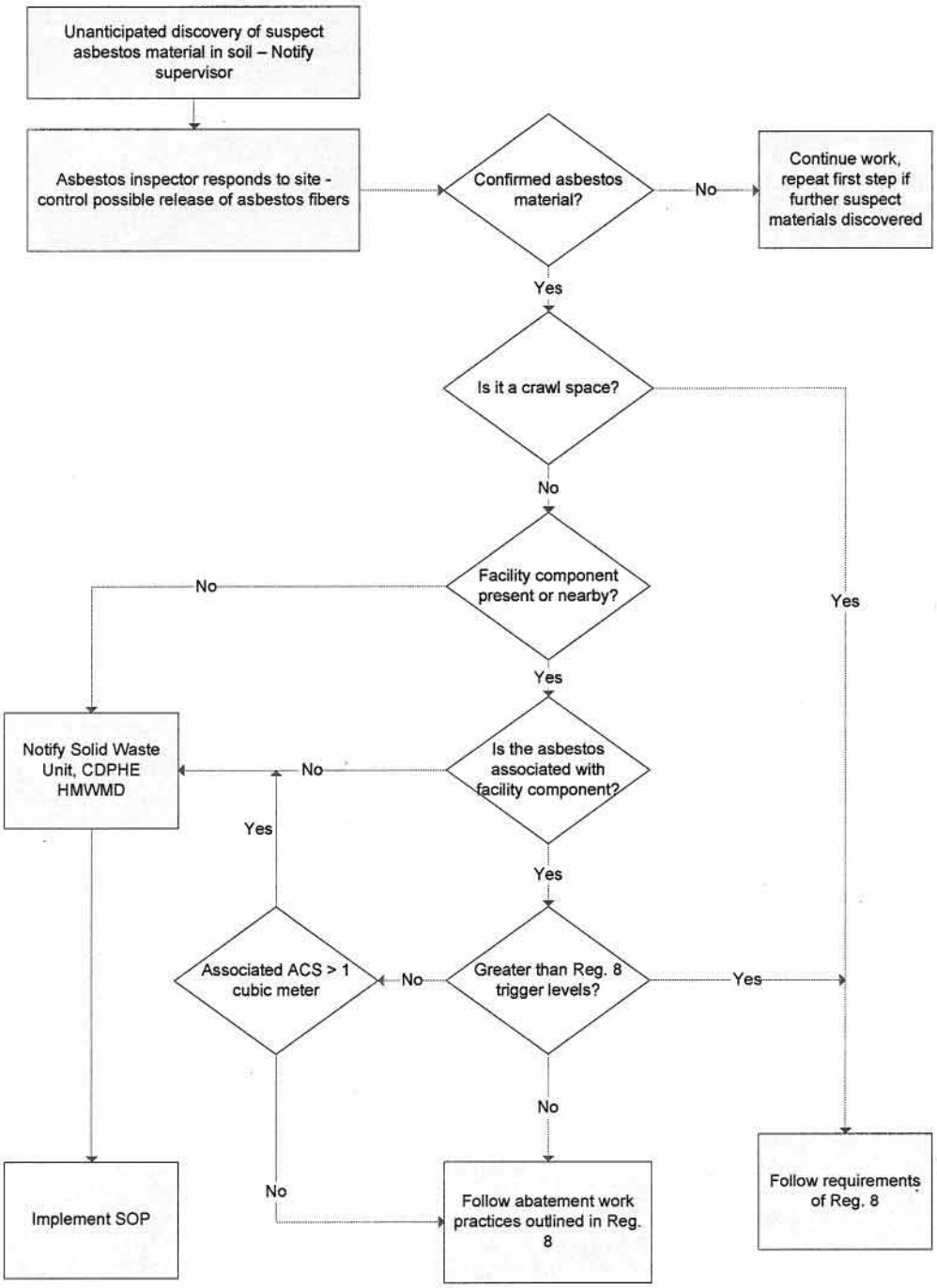
- Decontaminate workers by removing visible soil and dust with water or damp wipes or rags. Place wipes and rags in a plastic bag and label as "investigation-derived waste", "date" and "company name". If additional clothing is available, clothes should be changed and potentially contaminated clothing should be bagged separately from wipes and rags.

- Decontaminate equipment by removing gross soils and dust, then washing the equipment. Decontamination of equipment should be conducted by a certified asbestos worker wearing proper PPE. Materials used for decontamination should be bagged and labeled as above. Decontamination rinse water should be collected and filtered to five microns prior to disposal, or filtered water can be reused for wetting of asbestos-contaminated areas that will be removed. If areas where filtered decontamination water has been applied are not going to be excavated prior to drying, the surface must be covered or stabilized until excavation occurs to prevent the emissions of any asbestos fibers that were not removed during filtration. If disposal of decontamination water to the sanitary sewer is anticipated, rinse water should be filtered to five microns. Please see Section 7.4.11 of the SOP for more information regarding equipment decontamination.

- Based on analytical results of suspect materials, if asbestos is present, dispose of bags by double bagging and disposing as asbestos waste at DADS, or with ACM removed in accordance with this plan. If analytical results indicate that no asbestos is present, bags can be disposed as non-asbestos solid waste.

After confirmation of ACM or ACS by the ABI, the ABI will direct the contractor on full implementation of this SOP.

Figure 2. Unanticipated discovery of asbestos in soil flowchart



## 6.2 Interim Actions upon Discovery of Suspected ACM

Site characterization to identify the extent of ACM may be required to help develop the scope of work required to manage ACM disturbed in soil. Site characterization activities are described below.

### 6.2.1 Site Characterization

In the event that suspect ACM is visually identified by the ABI, steps outlined in Section 7.0 will be implemented. The following steps will be applied to sample and analyze suspect ACM identified by the ABI:

- Samples of suspect ACM shall be placed in appropriate sample containers such as sample bags or jars;
- Care should be taken to ensure that suspect ACM is adequately wetted to prevent visible emissions during the sampling process;
- The ABI will classify the suspect ACM as friable or non-friable;
- A field sampling form or log book entry will be maintained for each sample obtained. The form or log book entry will include the location using a hand-held GPS instrument, date and time of each sample, description of the type of material, assessment of friability of the material and other made.
- Proper chain-of-custody procedures will be followed for all samples collected.

The following analytical procedures will be followed for analysis of suspect asbestos materials:

- Samples of suspect ACM will be analyzed by a National Voluntary Laboratory Accreditation Program (NVLAP)-accredited laboratory by PLM methodology to determine if any asbestos fibers are present. Alternatively, suspect ACM can be assumed to contain asbestos rather than sample and await analytical results.

If assumed ACM is present in soil or ACM is confirmed in soil by the ABI, the ABI will direct the contractor on full implementation of this SOP.

# 7 Removal of Asbestos-Contaminated Soil

## 7.1 ACS Management Procedures

The following sections provide general ACS management procedures to be utilized when disturbing ACS. Section 7.2 describes notification procedures, Section 7.3 describes management of limited quantities of ACM and the remaining sections describe management of significant quantities of ACM (note notification to CDPHE, worker protection and proper disposal will apply to both types of discoveries). Minimum engineering controls and air monitoring will be implemented any time excavation activities are occurring in an area of Known ACS, or at a site that is classified as Reason to Believe.

### 7.1.1 Minimum Engineering Controls for Known or Reason to Believe Sites

Minimum engineering controls should include, but not be limited to:

- If multiple excavations are occurring simultaneously where ACM is potentially present, then multiple ABIs must be available to observe each active excavation.
- The ABI must be located or positioned to positively identify the presence or absence of suspect ACM. The ABI and equipment operator should have a means of continuously communicating with each other.
- A misting system, spray bar, or equivalent spray device should be mounted on each bucket or excavator that is disturbing debris and/or ACS to ensure that there are no emissions.
- A person with a fire hose on low pressure and equipped with a ball valve (or equivalent) will be present at the point of excavation to prevent and not cause fugitive dust emissions and potential asbestos fiber emissions to comply with the regulations.

## 7.2 Notifications for Planned ACS or ACM Disturbance

The CDPHE will be notified at least 10 days prior to any planned soil disturbing activity in areas of known ACM or ACS. The CDPHE can be notified by using the Notification Form provided in Appendix A, and faxed to 303-759-5355, or emailed to comments.hmwmd@state.co.us. For emergency repair projects to utilities etc., notification will be provided to CDPHE by the next business day. Note that for existing projects, where project information has already been provided to CDPHE, notification shall be provided to the established CDPHE contact, and use of the forms in Appendix A may not be necessary.

## 7.3 Removal by Hand - Limited Quantity ACM Discovery Management and Disposal "Pick and Go"

If ACM or suspect ACM is encountered in soil and consists of less than 25 separate pieces of ACM in a single location that is less than 10 cubic feet (with multiple pieces of ACM within a few inches of each other to be treated as one piece of ACM), the ABI may direct the removal of these pieces of ACM using the procedures listed below:

1. Use water to adequately wet the material and surrounding soil;

2. For non-friable ACM, gather and place the ACM and several inches of surrounding soil in six- millimeter bags (double bags);

3. For friable ACM gather and place ACM and three cubic feet of surrounding soil in six-millimeter bags (double bags). Continue work with extra attention to possible additional ACM in that vicinity;

4. Stage waste bags in a lined drum or roll-off container. Identify drums or containers as solid waste that contains asbestos for disposal at DADS in accordance with CDPHE regulations and this SOP; and

5. Conduct a follow-up visual inspection of the area and repeat procedures 1 through 4 above as necessary.

All personnel involved in the removal of Limited Quantity ACM will wear at a minimum a half-face air purifying respirator with HEPA filtration, disposable protective suit, over booties and gloves. Decontamination of all tools and equipment involved in the removal of ACM is required prior to leaving the designated work area. Refer to Sections 7.4.10 and 7.4.11 of this plan for equipment and worker decontamination procedures.

## 7.4 Excavation and Earthmoving, Known ACS or ACM

The following subsections apply to excavation or earthmoving work in areas where ACM or ACS has been identified.

### 7.4.1 Site Control, Demarcation, Fencing and Wind Screening

The designated work area consists of the immediate area where ACM or ACS has been observed. The designated work area can be demarcated on all four sides using a movable/portable wind barrier to prevent wind dispersal of soil during excavation activities. Moveable/portable wind barriers can be placed on all four sides and immediately adjacent to the point of excavation, and should be of adequate height and configuration (size) to minimize wind soil dispersal at the point of excavation. For large projects with widespread removal of ACS, the requirement for the use of windbreak barriers may be modified or waived For smaller areas or highly mobile removal activities, moveable "directional" mobile wind fencing can be used, and should be positioned upwind and adjacent to soil removal activities at all times. Where only directional wind fencing is used, asbestos barrier tape should be installed to identify the remaining boundary of the Work Area (where wind fence is not positioned)

### 7.4.2 Protection of Adjacent Structures

When the designated work area is close (i.e. 50 feet) to occupied structures, external barriers may need to be constructed. Exposed openings in the structure, including windows, doorways, vents or other openings should be sealed with 6-mil poly.

### 7.4.3 Soil Wetting and Stabilization

Soil within the designated work area will be adequately wetted to prevent any fugitive dust emissions that may be generated during initial setup and mobilization into the area. The contractor shall use water hoses from a tank truck or directly from a fire hydrant or other water source. Water will be applied at low pressure so as to not generate dust or splattering. During all soil disturbing activities, wetting of soil will be sufficient to ensure soils are adequately wet (no visibly dry soil and no visible emissions) throughout the soil disturbing activities.

### 7.4.4 Dust and Emissions Control

General dust control will be achieved by use of water trucks that will regularly spread water on all access roads throughout the project site to ensure no visible dust generation by vehicle traffic during soil disturbing activities.

Water will be applied for dust control within all disturbed areas. The contractor will maintain the dust control process throughout the course of the project during soil disturbing activities. Removal of soil and debris from the designated work area will be performed with heavy equipment which has been adapted to have a water misting system installed to minimize dust emissions at the point of removal. Water will be applied in a manner that does not cause run-off or splattering. In addition, a water misting system will be constructed to wet the material at the point of loading into the dumpster prior to final packaging. Additional hand wetting using a water hose equipped with a ball valve for misting will be used to eliminate fugitive emissions, but avoid splatter or drift from spraying.

Whenever ACM or ACS is disturbed, the contractor will ensure that no emissions are generated. The City's consultant will be on site to monitor the moisture of the soil being excavated to ensure that it is adequately wet (and to observe for any visible emissions). An ABI will conduct these visual inspections.

If emissions are observed during the removal process, soil disturbing activities will immediately cease and work practices will be reviewed and modified by the contractor. The consultant will log all instances where visible dust emissions occurred and immediately notify the City and CDPHE by phone and in writing, of all occurrences, and will obtain any direction from the City and CDPHE.

### 7.4.5 Personal Protective Equipment

During soil disturbing activities, all persons within the designated work area shall utilize appropriate PPE, as identified in OSHA's general requirements for asbestos workers (29 CFR 1910.1001). PPE shall include appropriate respiratory protection with a minimum half face respirator with HEPA filtration required anytime active soil disturbance is occurring, protective full body Tyvek© suit with attached hood and booties, gloves, rubber boots, and other protective wear as appropriate based on conditions (cold stress, heat stress, insects, etc).

### 7.4.6 Removal/Excavation

Utilizing an excavator, mini excavator or backhoe with a bucket mounted spray bar system; the soil excavation will proceed within the designated work area. The spray bar system will consist of nozzles inside the back top edge of the bucket and two outside the bucket with nozzle's spray

pattern overlapping that will eliminate fugitive dust during loading, but avoid splatter or drift from spraying. Additional hand wetting will be conducted at the point of excavation using a water hose equipped with a ball valve and nozzle for misting. The low pressure ball valve and nozzle should allow water application in an outward fan of fine spray or mist that will knock down potential fiber emissions while also preventing splattering or runoff.

Excavation of ACS will not overreach the bounds of wetting. For projects involving relatively shallow ACS occurrence, excavation will be conducted in 6-inch and 1-foot lifts to ensure that disturbed soil remains adequately wet. For projects involving ACS at depth, such as a landfill, excavation in lifts may not be practical. In these instances, wetting may take place as the excavation proceeds, with wetting being conducted using hand held low pressure hoses. The soil may be mixed within the excavation, using the excavator bucket, until it is adequately wet. The soil may then be moved from the excavation into the lined trailer. If ACM is present in the excavation side-walls or floor, the material will be wetted and stabilized with magnesium chloride if left overnight, or covered with poly sheeting if ACM in the excavation side-wall or floor will remain exposed for a longer period of time. At no time shall soil that is not adequately wet be removed from the excavation. During the removal process, all areas of impact will be kept adequately wet. Water will be applied at low pressure so as not to generate dust or splattering and will be applied at the point of contact. The excavator will handle the material wet and direct load the soil into a tractor trailer or end dump.

Poly sheeting will be placed over uncontaminated soils in the swing radius of the excavator and along the transport route of loading equipment to prevent cross-contamination. Care will be taken to avoid contamination of the excavating equipment. This will be accomplished by driving and keeping excavating equipment on non-contaminated soil.

If the excavating equipment has to be placed on contaminated soil, the soil will be covered with 6-mil poly to avoid contamination of the rig. If the rig is driven over contaminated soil, the soil will be adequately wetted to avoid air emissions. Equipment that comes in contact with contaminated soil, or that was within the designated work area will be decontaminated. Conduct work with appropriate phasing/sequencing that will minimize cross-contamination potential.

### 7.4.7 Soil Stockpiling

Stockpiling of ACS will only occur under CDPHE and City approval, as removal of ACS should be under a direct load approach whenever possible. When soil movement and stockpiling is necessary, stockpiled ACS must be stabilized and covered when not in use and must not be allowed to remain on site longer than 5 working days.

### 7.4.8 Truck/Container Staging/Lining and Waste Loading

All truck drivers will be instructed to close all windows and shut off air delivery systems (fans on air-conditioning and heating systems) when entering the loading area. All travel and positioning of waste transport truck/trailers should be on visually verified clean soil to minimize the need for decontamination procedures. At the loading location, a 10-mil poly sheeting or thicker "lay-down pad" will be placed on the ground under dumpsters/trucks to catch any spilled material. Spilled ACM or ACS will be cleaned up immediately and not allowed to dry out or accumulate. Additional poly can be draped over trailer tires/fenders to minimize the need for

decontamination after loading. After the load has been secured and load cover tarp is installed, the poly sheeting lay down loading pad will be properly decontaminated prior to the truck moving forward, using wet methods such as hoses and brooms and squeegees.

### 7.4.9 Waste Transportation and Disposal

Containers of non-friable ACM, soil with visible non-friable asbestos or ACS with no visible asbestos will be managed in accordance with the requirements of Section 5.5.7 (B) and 5.2 of the Solid Waste Regulations. In accordance with the disposal requirements for non-friable ACM at least one 6-mil poly liner will be in trucks used for transport of soil that contains visible non-friable ACM. Poly liners should be designed and sized for the container to be used and should be folded over sides of trailers and containers to protect against contamination during loading and to facilitate decontamination. After loading, the liners will be sealed so that it remains leak-tight during transportation and disposal operations. Containers of non-friable ACM and soil shall be labeled with "asbestos, danger", the name of the generator, and placed on top of sealed liner.

Containers of friable ACM, or soil with visible friable asbestos, shall be labeled, in accordance with the requirements of Section 5.3 of the Solid Waste Regulations. The disposal requirements for friable asbestos waste (Section 5.3.5(A) of the Solid Waste Regulations) require that at least two 6-mil poly liners be used to encapsulate soil that contains visible friable asbestos. Poly liners should be designed and sized for the container to be used and should be folded over sides of trailers and containers to protect against contamination during loading and to facilitate decontamination. After loading, both liners should be sealed separately. The liners shall be sealed so that they remain leak-tight during transportation and disposal operations and labeled in accordance with Section 5.3.5(B) of the Solid Waste Regulations.

In addition, DOT asbestos placards shall be placed on all four vertical sides of the container or vehicle being used for transport of ACM and ACS. The contractor should direct the schedule of transportation of asbestos-contaminated soil. When loaded, each truck will be assigned a manifest to serve as the shipping document for that particular load.

ACM or ACS shall be transported and disposed in a leak-tight container in accordance with the CDPHE disposal requirements. Documentation stating that the ACM or ACS originating from the site will not be used as daily cover or sold as clean fill shall accompany each load of ACM or ACS removed from the site.

Disposal of ACM or ACS will be conducted as follows in accordance with Section 5.5.7 of the Solid Waste Regulations:

1. ACS containing visible friable asbestos will be disposed in a leak tight container as friable asbestos waste in accordance with the requirements of Section 5.3 of the Solid Waste Regulations.
2. ACS containing only visible non-friable asbestos, that has not been rendered friable, will be disposed of as non-friable asbestos in accordance with Section 5.2 of the Solid Waste Regulations.
3. ACS containing no visible asbestos will be disposed in a manner similar to non-friable asbestos waste, as described in Section 5.2 of the Solid Waste Regulations.

### 7.4.10 Personnel Decontamination

At the beginning of each work day workers who will be in the area of active ACS disturbance will don disposable protective suits (Tyvek), disposable gloves and disposable boot covers (excluding truck drivers). For most projects, worker decontamination will consist of removal of the Tyvek suit, gloves, and boot covers, which should then be containerized and disposed as asbestos waste. Any non-disposable personnel items must be decontaminated with water or wet wiping.

During all soil-disturbing activities in areas with friable asbestos, a fully functioning decontamination unit or trailer can be available onsite for worker decontamination as specified by the contractor's HASP. The decontamination unit will be centrally located among investigation areas and will consist of three chambers with operational hot and cold running water for the shower. The decontamination unit may be utilized by the workers each time they exit the work area. All contaminated disposable personnel protective equipment shall be containerized and disposed as asbestos waste. Water from the decontamination unit will be filtered to 5 micron and disposed of in the sanitary sewer.

### 7.4.11 Equipment Decontamination

All equipment and tools that come into contact with, or are used for removal of ACM or ACS will be decontaminated (free of all visible dust and debris) using wet cleaning methods, prior to leaving the work zone. Equipment decontamination can occur in areas of asbestos-contaminated soil or within a decontamination station. If decontamination occurs over asbestos contaminated soil the area will be kept wet or stabilized and soil in the area will subsequently removed for disposal. Alternatively, equipment decontamination will be conducted within a decontamination station constructed adjacent to the work zone. The decontamination station will be constructed of 10-mil poly sheeting (and other materials as necessary, such as ethylene propylene diene monomer [EPDM] rubber roofing, etc) in such a way as to capture all contaminated material and wastewater from the decontamination process. All wastewater from the decontamination station will be filtered to a minimum of 5-microns prior to use as wetting water for an area of ACS that subsequently will be removed or discharge to a sanitary sewer.

## 7.5 Wind and Work Stoppage Conditions

ACS disturbance operations will not be conducted if winds produce visible emissions of dust or create dust when moving equipment or soil. All wind speed measurements will be taken at locations in close proximity to, and representative of, the designated work area in which the ACS is being handled. Wind speed measurements will be recorded at least every 30 minutes and during wind gusts by an AMS. This frequency will be increased at the AMS's discretion when it has been determined that wind conditions may be approaching threshold limits. It will be the responsibility of the AMS to take and record all wind speed measurements onto the daily logs.

**Shutdown conditions:** ACS removal/disturbance operations will immediately and temporarily cease when one or more of the following conditions have been met:

1. Any wind gust reaching or exceeding 20 mph as determined by hand-held instruments;

2. Sustained wind speeds reaching or exceeding 12 mph averaged over a period of 10 minutes;
3. Winds are producing visible emissions or creating movement of dust or debris in or near the removal/disturbance area; or
4. Winds are impacting the ability of engineering controls to work as designed.

During wind-related work shutdowns, other work activities not involving soil removal or disturbance (e.g., lining dumpsters) may continue.

**Resume Conditions:** ACS disturbance activities may resume after all of the following conditions have been met:

1. All wind gust readings for a period of 20 minutes drop below 20 mph as determined by hand-held instruments;
2. Sustained wind speeds are below 12 mph averaged over a period of 20 minutes;
3. Winds are no longer producing visible emissions or creating movement of dust in or around the removal/disturbance area; and
4. Winds are not impacting on the ability of engineering controls to work as designed.

## 7.6 Air Monitoring Requirements Associated with Engineering Controls

During soil disturbing activities in areas of known ACS or where there is reason to believe ACM or ACS may be encountered, the AMS will collect air samples to assist in determining the adequacy of the engineering and environmental controls employed at the site. The daily air monitoring sampling scheme, monitoring type, sample frequency, duration and analysis are listed in Table 1. Progressive air monitoring will be implemented when excavation activities are occurring in a fill area in which one can expect to encounter ACM or ACS even prior to identification of ACM and when suspect ACM has been observed. All air samples will be collected by an AMS. Depending on the size of the work area and the type of soil being removed, air monitoring may include personnel air monitoring only, or personnel monitoring and perimeter air monitoring for large open areas. In general, personnel air monitoring only (i.e., no perimeter monitoring) shall be used when disturbing no more than a 100 x 100 foot area at a time. Where only personnel air monitoring being performed, personnel air monitoring must be in an area representative of the designated work area. However, if the work area is proximate to occupied buildings residential homes, or areas of public access perimeter air monitoring may be necessary even if the work area is smaller than 100 x 100 feet, in order to demonstrate that no asbestos fibers have left the work area.

### 7.6.1 Personal Air Monitoring Associated with OSHA

It is the contractor's responsibility to ensure that personal air monitoring shall be performed in accordance with all OSHA requirements and the site Health and Safety Plan during disturbance of known and suspect asbestos in soil. In addition to OSHA requirements, for all ACS excavation activities, at least two different workers or 25 percent of the workers, whichever is greater, and who are expected to have the worst-case exposure to asbestos during excavation shall be monitored to assist in determining the adequacy of engineering and environmental controls employed at the site.

### 7.6.2 Perimeter Air Monitoring

Generally, perimeter air monitoring will be performed during excavation of greater than 100 x 100 feet of disturbances of ACS. Perimeter air monitoring may be required in smaller excavations where friable ACM exists and soil disturbance occurs immediately adjacent to sensitive receptors such as occupied buildings, residential homes or areas of public access or if personnel monitoring is not representative of the work area.

### 7.6.3 Air Sample Analysis

Air samples shall be submitted for total fiber analysis using phase contrast microscopy (PCM) by an asbestos accredited laboratory at the end of each work day. The two samples with the highest fiber concentrations by PCM will be analyzed by transmission electron microscopy (TEM) for asbestos fibers. Table 1 summarizes the number and location of personnel and perimeter air samples and sample analysis requirements including when TEM analysis is required. Air monitoring sampling protocols are described below.

#### 7.6.3.1 Sampling Media

Air samples will be collected by drawing air through a 25-millimeter mixed cellulose ester filter, 0.8-micron pore size, with an open-faced, long cowl using low-flow personal sampling pumps at approximately two liters per minute (or flow rate to provide a sufficient limit of quantitation/limit of detection [LOQ/LOD]). Each low-volume pump will be fitted with a computer microchip, which electronically regulates airflow and allows a fixed flow rate of air to pass over the face of the filter. The flow rate and the volume of air passed through the filter will be determined based on the National Institute for Occupational Safety and Health (NIOSH) 7400 analytical method. Each pump will be calibrated before and after the collection of each sample using a primary standard.

#### 7.6.3.2 Sample Analysis

Sample analyses will be performed by an analyst using PCM according to the NIOSH 7400 Method. The analyst will be an AMS and a participant in the NIOSH Proficiency Analytical Testing Program and have been deemed proficient. Analyses of TEM air samples will be submitted to an accredited laboratory using TEM according to the Asbestos Hazard Emergency Response Act protocol.

#### 7.6.3.3 Reporting

PCM verbal results will be made available by the start of the next business day or as soon as practical after the start of the next business day. TEM verbal results will be made available within 24-hours of receipt of samples by the laboratory, and written results will be made available within 24 hours from the time the verbal result is received. CDPHE will be immediately notified if any sample results show any concentration of airborne asbestos fibers. If any asbestos fibers are detected by TEM, all soil disturbance activities will be stopped and engineering controls will be evaluated by contractor and consultant, and will be discussed with City and CDPHE to determine if changes in engineering controls or additional PPE are required.

### 7.7 Final Inspection Procedures

As the project progresses, visual inspection will be performed to ensure that all observable ACM has been removed from the soil surface. The soil will be removed in a manner that will provide a flat, even surface (with no spoil piles) for visual inspection. The inspections will be performed for the surface area removed that day, as a preliminary inspection. Due to the wet nature of the removal and the soil, adequate drying time is required before a final visual inspection can be conducted.

The removal of soil in the debris field area will be considered complete when sufficient soil has been excavated based on construction plans.

### 7.8 Managing ACS left in place

Where ACM is observed at the depth and extent of excavation the area shall be covered with a geotech membrane and labeled as asbestos-contaminated soil. The geotech membrane should be covered with clean soil to protect and maintain the geotech membrane in place. Prior to covering with clean soil, photographs will be taken from each compass point of the boundary, and the corner points of the boundary shall be obtained using a GPS with sub-foot accuracy. This information will be maintained by DEH and other City departments as appropriate.

### 7.9 Spill Control

Where ACM or ACS is spilled during loading or transport, the contractor shall ensure the spilled ACM or ACS is immediately collected in accordance with wetting and emission control provisions of this SOP.

### 7.10 Erosion Control

To control wind erosion of ACM or ACS, use of silt fencing or wind fencing may be used, where appropriate. Stabilize friable ACS by covering with magnesium chloride (or equivalent soil stabilizer) or 6-mil poly until removal can occur. Securely fasten poly sheeting to prevent removal by the wind.

To control water erosion, the use of silt fencing, erosion control mats, straw waddles or equivalent erosion control methods shall be used in areas where run-off is likely. Where ACM or ACS will remain follow the procedure described above in Section 7.8.

# 8 Special Considerations

## 8.1 Importing and Exporting Soil

The contractor shall notify and receive approval from the City project manager prior to any soil being exported or imported to the site. The contractor shall coordinate any inspections, observation, or testing requested by the City project manager for any exported or imported soils to the site.

## 8.2 Soil Stockpiling Management Procedures

Stockpiling of ACS will only occur for waste segregation and loading, as provided in this plan. Stockpiled ACS must be stabilized and covered when not in use, and must not be allowed to remain on site longer than 5 working days.

## 8.3 Emergency Buried Utility Repair Projects

Specific provisions of this SOP require some planning and response time that may not be appropriate in an emergency response situation to repair a buried utility. This section identifies the minimum requirements under this SOP for the first 24 hours of excavation and repair, to ensure that necessary repairs can be made to buried utilities promptly in an emergency situation where the utility must be repaired immediately (which may include evening and weekend work). Where suspect ACM is encountered during the emergency response, only worker protection, adequate wetting and no visible emission provisions of this SOP will apply within the first 24 hours. The remaining provisions including notification to CDPHE HMWMD, material characterization, asbestos awareness training, air monitoring, disposal etc. will take effect after the first 24 hours of the excavation and repair event. Ensuring adequate wetting and no visible emissions during the first 24-hours of the emergency excavation will allow necessary work to continue and will provide a window for implementing remaining provisions of this SOP including testing of suspect materials, and where suspect ACM is identified, implementing management actions under this SOP. Suspect ACS that has been excavated during the emergency repair shall not be placed back into the hole/pit until characterization can be conducted by an ABI. Appropriate worker protection (respirator, disposable suit, gloves, etc.) shall be utilized when any suspect ACM is encountered.

# 9 References

CDPHE. 2006. *Asbestos-Contaminated Soil Guidance Document.* Prepared in draft form April 2006 by the Hazardous Materials and Waste Management Division.

CDPHE. 2006. *Asbestos-Contaminated Soil Regulations.* Section 5.5 of the Hazardous Materials and Waste Management Division's Regulations Pertaining to Solid Waste Disposal Sites and Facilities

CDPHE. 2008, Air Quality Control Commission Regulation No. 8, Part B (5 CCR 1001-10, Part B - Asbestos).

OSHA. *Construction Industry Standards for Asbestos.* 29 CFR 1926.110

## Table 1: Air Monitoring Requirements

| Excavation of Fill Areas by Mechanical Means Where There is Reason to Know or Believe ACM Could be Encountered but Prior to Identification of ACM or ACS | | | |
|---|---|---|---|
| **Monitoring Type** | **Sampling Frequency** | **Duration** | **Analysis** |
| Personal Air Monitoring | One sample per shift for each of two workers closest to disturbance activity but not inside heavy equipment | Ongoing | PCM analysis to support project air monitoring requirements. Any sample with PCM results exceeding 0.01 fibers/cc must be analyzed by TEM. |
| Area of Disturbance Perimeter Sampling | NONE | N/A | N/A |

| Removal by Hand or Hand-Held Equipment of Limited Quantity ACM | | | |
|---|---|---|---|
| **Monitoring Type** | **Sampling Frequency** | **Duration** | **Analysis** |
| Personal Air Monitoring | One sample per shift for each of two workers closest to disturbance activity but not inside heavy equipment | Ongoing | PCM on two workers – if analysis yields results with detectable fiber levels (based on fiber count) then submit for TEM analysis for subsequent three non friable and friable asbestos discovery events. If no asbestos fibers identified, PCM for subsequent events. Any sample with PCM results exceeding 0.01 fibers/cc must be analyzed by TEM. In the event that ACS disturbance is ongoing for multiple weeks, TEM analysis will be performed for two consecutive days every other week. |
| Area of Disturbance Perimeter Sampling | NONE | N/A | N/A |

| Removal by mechanical means (heavy equipment bucket, excavator, backhoe, etc) of Non-Friable ACM that has not been rendered friable | | | |
|---|---|---|---|
| **Monitoring Type** | **Sampling Frequency** | **Duration** | **Analysis** |
| Personal Air Monitoring | One sample per shift for each of two workers closest to disturbance activity but not inside heavy equipment | Ongoing | Submit personnel and perimeter samples (5 samples) for PCM analysis. If analysis yields results with detectable fiber levels |

## Table 1: Air Monitoring Requirements

| | | | |
|---|---|---|---|
| Area of Disturbance Perimeter Sampling | Two downwind perimeter samples and one upwind perimeter sample from immediate *Area of Disturbance* | Ongoing | (based on fiber count) then conduct TEM analysis on two (2) highest PCM samples to evaluate engineering controls. Any sample with PCM results exceeding 0.01 fibers/cc must be analyzed by TEM. For large areas of disturbance, additional perimeter monitoring points shall be added if the active area of soil disturbance is larger than approximately 1 acre in size. One additional monitoring point should be added for each additional 200 linear feet of perimeter (approximately 1 sample per additional ¼ acre increase in area). The AMS should place downwind floating samplers at least 50 feet from any other sample point. For active areas of soil disturbance greater than 1 acre, additional samples shall be analyzed by TEM at a minimum rate of 25% of the total number of samples collected, based on highest PCM results. However, TEM analysis is not required if PCM results are non-detect (based on fiber count). |

**Removal of Friable ACM by mechanical means (heavy equipment bucket, excavator, backhoe, etc)**

| Monitoring Type | Sampling Frequency | Duration | Analysis |
|---|---|---|---|
| Personal Air Monitoring | 1 sample per shift for each of 2 workers closest to disturbance activity but not inside heavy equipment | Ongoing | Submit personnel and perimeter samples (8 samples) for PCM analysis. If analysis yields results with detectable fiber levels (based on fiber count) then conduct TEM analysis on two (2) highest PCM samples to evaluate engineering controls. Any sample with PCM results exceeding 0.01 fibers/cc must be analyzed by TEM. For large areas of disturbance, additional perimeter monitoring points shall be added if the |
| Area of Disturbance Perimeter Sampling | 6 perimeter samples from immediate *Area of Disturbance* per day; including 4 points of compass and 2 downwind floaters | Ongoing | |

## Table 1: Air Monitoring Requirements

| | |
|---|---|
| | active area of soil disturbance is larger than approximately 1 acre in size. One additional monitoring point should be added for each additional 200 linear feet of perimeter (approximately 1 sample per additional ¼ acre increase in area). The AMS should place downwind floating samplers at least 50 feet from any other sample point. For active areas of soil disturbance greater than 1 acre, additional samples shall be analyzed by TEM at a minimum rate of 25% of the total number of samples collected, based on highest PCM results. However, TEM analysis is not required if PCM results are non-detect (based on fiber count). |

If engineering controls are deemed to be adequate by the ABI and air monitoring specialist (AMS); *and* ongoing project air monitoring data supports this conclusion, the number and frequency of TEM and PCM analyses may be reduced following HMWM Division approval.

# Appendix A

## CDPHE Notification Forms

## Colorado Department of Public Health and Environment
## Hazardous Materials and Waste Management Division
## Asbestos Contaminated Soil Notification Form

### *24 HOUR NOTIFICATION OF UNPLANNED ASBESTOS DISCOVERY*

For 24-hour notification of the unplanned discovery of asbestos-contaminated soil, a completed a copy of this form should be faxed to 303-759-5355 Attn: Solid Waste Unit Leader, or emailed to comments.hmwmd@state.co.us . If the Hazardous Materials and Waste Management Division has not pre-approved standard operating procedures that will be implemented, you must then submit a **Soil Characterization and Management Plan** to the Division for approval. If the Division has pre-approved standard operating procedures that will be implemented, you only need to submit a completed copy of this form.

The Soil Characterization and Management Plan should be mailed to: Colorado Department of Public Health and Environment, Division-B2 Attn: Solid Waste Unit Leader, 4300 Cherry Creek Drive South, Denver CO 80246-1530 or emailed to: comments.hmwmd@state.co.us .

| | | | |
|---|---|---|---|
| **Date and time reported:** | | | |
| **Contact person for entity performing soil-disturbing activity:** | | **Phone:** | **Ext:** |
| **Organization, company or agency:** | | | |
| **Address:** | | | |
| **City:** | **State:** | **Zip:** | |
| **Name of property owner/operator or property representative:** | | | |
| **Owner/operator contact (if different):** | | **Phone:** | **Ext:** |
| **Address:** | | **Fax:** | |
| **City:** | **State:** | **Zip:** | |
| **Discovery date:** | **Discovery time (include AM or PM):** | | |
| **Location of property:** (Street address or other location description – e.g. highway mile marker) | **Street Address:** | | |
| | **County:** | **City:** | **Zip:** |
| **General Site Description:** | | | |
| **Activity resulting in discovery:** | | | |
| **Description of material encountered:** | | | |
| **Description of access or emissions controls implemented:** | | | |

**Has the Division pre-approved standard procedures that will be implemented?** ☐ **yes** ☐ **no**

**If "no," implement interim actions and submit a Soil Characterization and Management Plan for Division review and approval.**

**Colorado Department of Public Health and Environment**
**Hazardous Materials and Waste Management Division**
**Asbestos Contaminated Soil Notification Form**

## *10 DAY NOTIFICATION OF PLANNED ASBESTOS MANAGEMENT*

For notification of planned management of asbestos-contaminated soil, a completed copy of this form should be submitted to the Hazardous Materials and Waste Management Division at least 10 working days prior to any planned soil-disturbing activity. If the Division has not pre-approved standard operating procedures that will be implemented, you must also submit a **Soil Characterization and Management Plan** to the Division for approval. If the Division has pre-approved standard operating procedures that will be implemented, then you only need to submit a completed copy of this form.

The form and plan can be mailed to: Colorado Department of Public Health and Environment, Division-B2 Attn: Solid Waste Unit Leader, 4300 Cherry Creek Drive South, Denver CO 80246-1530
or emailed to: comments.hmwmd@state.co.us .

| | | | |
|---|---|---|---|
| **Date and time reported:** | | | |
| **Contact person for entity performing soil-disturbing activity:** | | **Phone:** | **Ext:** |
| **Organization, company or agency:** | | | |
| **Address:** | | | |
| **City:** | **State:** | **Zip:** | |
| **Name of property owner/operator or property representative:** | | | |
| **Owner/operator contact (if different):** | | **Phone:** | **Ext:** |
| **Address:** | | **Fax:** | |
| **City:** | **State:** | **Zip:** | |

| | | | |
|---|---|---|---|
| **Location of property:** (Street address or other location description – e.g. highway mile marker) | **Street Address:** | | |
| | **County:** | **City:** | **Zip:** |
| **General Site Description:** | | | |
| **Description of planned soil-disturbing activities:** | | | |
| **Description of material that will be disturbed:** | | | |

**Has the Division pre-approved standard procedures that will be implemented?** ☐ **yes** ☐ **no**

**If "no," submit a Soil Characterization and Management Plan for Division review and approval.**

# Appendix B

## CDPHE Approval Letter and City's Responses to CDPHE Comments

# STATE OF COLORADO

Bill Ritter, Jr., Governor
Martha E. Rudolph, Executive Director

Dedicated to protecting and improving the health and environment of the people of Colorado

4300 Cherry Creek Dr. S.
Denver, Colorado 80246-1530
Phone (303) 692-2000
TDD Line (303) 691-7700
Located in Glendale, Colorado

http://www.cdphe.state.co.us

Laboratory Services Division
8100 Lowry Blvd.
Denver, Colorado 80230-6928
(303) 692-3090

Colorado Department
of Public Health
and Environment

December 7, 2010

Mr. Dave Erickson
CCOD, Department of Environmental Health
200 W. 14th Avenue, Department 310
Denver, CO 80204

RE: Final Agency Action: Approval of *Asbestos-Contaminated Soil Management Standard Operating Procedure for City and County of Denver*, dated December 3, 2010

Dear Mr. Erickson:

On December 6, 2010, the Hazardous Materials and Waste Management Division of the Colorado Department of Public Health and Environment ("the Division") received the revised *Asbestos-Contaminated Soil Management Standard Operating Procedure (SOP) for City and County of Denver*, dated December 3, 2010. The Division has completed its review and is pleased to approve this standard operating procedure for asbestos-contaminated soil management projects in the City and County of Denver.

The Division is authorized to bill for its review of technical submittals, pursuant to 6 CCR 1007-2, Part 1, Section 1.7. An invoice for the Division's review of the subject document will be transmitted to you under separate cover. Should you have any questions regarding this correspondence, please call Cindy Smith at (303) 692-3409.

Sincerely,

Cindy M. Smith
Environmental Protection Specialist
Solid Waste and Material Management Unit
Solid and Hazardous Waste Program

cc: Charles Johnson, CDPHE
Alice Luhan, CCOD Department of Environmental Health, 200 W. 14th Avenue, Dept. 310, Denver, CO 80204
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File: SW/DNV/SOP 3.10

Department of Environmental Health, Environmental Quality
Responses to June 16, 2010 CDPHE comments on City and County of Denver
Asbestos-Contaminated Soil Management Standard Operating Procedure (SOP)
July 23, 2010 – Revised November 19, 2010

Comment 1: Page 3, Section 2.3.2, High Potential ACS, change this section heading to "High Potential ACS – Reason to Know or Believe".

Response: The heading for Section 2.3.2 was changed to "Reason to Believe".

Comment 2: Page 3, Section 2.3.3, Elevated Potential ACS, change this section heading to "Elevated Potential ACS – Reason to Believe."

Response: Consistent with 6 CCR 1007-2 Regulations Pertaining to Solid Waste Sites and Facilities and in accordance with discussion among CDPHE and CCOD personnel on August 12, 2010, reference to Elevated Potential ACS (Section 2.3.3) has been eliminated from the SOP. Instead, subsections under Section 2.3 *ACS Potential Classification* are limited to "Known ACS", "Reason to Believe", and "No Reason to Know or Believe".

Comment 3: Page 3, Section 2.3.3, Elevated Potential ACS, third sentence, replace the work "moderate" with "elevated" to use consistent terminology.

Response: As noted in response to Comment 2, reference to "Elevated Potential ACS" has been eliminated and the requested change cannot be made.

Comment 4: Page 3, Section 2.3.3, Elevated Potential ACS, modify the fourth sentence such that it states" Where a site has been classified as having an elevated potential to encounter ACS, an ABI will be present during soil-disturbing activities because it has been established that there is reason to believe ACS may be encountered.

Response: The City has modified Section 2.3 (and Section 2.3.3) to read as follows:

## 2.3 ACS Potential Classification

Results of the environmental and historical review are used to classify the site according to the potential for asbestos to be present in soil. The classification is used to determine the appropriate level of response, characterization and management activities, if any, for a site. Figure 1 depicts the site classification system and the response actions that flow from each classification.

### 2.3.1 Known ACS

A site that is classified as having known ACS is one where confirmed asbestos material in the soil was identified from subsurface soil investigation or from visual observations of the surface, sidewalls, embankments, etc. Soil disturbance activities on sites with known ACS will follow the management practices outlined in Section 7.0 of this SOP. Additional site characterization, if appropriate, will be conducted according to the procedures outlined in Section 6.0 of this SOP.

### 2.3.2 Reason to Believe

A site that is classified as Reason to Believe is one where evidence from environmental and historical reviews indicates that ACM could be encountered. Such evidence could include the presence of buried building debris or landfills in which construction debris or ACM is believed to have been deposited.

The presence of the following materials alone would not justify classifying a site as Reason to Believe:

- Wood
- Glass
- Metal
- Gravel
- Unfinished (no surface coating) concrete slab [1]
- Brick – other than fire brick[2]

Brick and concrete typically are considered to be free of asbestos and rarely or only occasionally will contain asbestos. If ACM is identified in these or other materials the appropriate management practices outlined in Section 7.0 of this SOP will be implemented during soil disturbing activities. Additional site characterization, if appropriate, will be conducted according to the procedures outlined in Section 6.0 of this SOP.

### 2.3.3 No Reason to Know or Believe

A site that is classified as having No Reason to Know or Believe is one where environmental and historical reviews do not identify the potential for asbestos containing materials to be on site even though waste material identified above and not typically associated with asbestos may be present.

Procedures in Section 7.0 of this SOP would not be implemented at a site classified as No Reason to Know or Believe.

Comment 5: Page 3, Section 2.3.3. Elevated Potential ACS, delete the last sentence of the paragraph.

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[1] Addition of asbestos to concrete slab was not a common use of asbestos. However, manufactured asbestos and Portland cement products were common including water pipes, simulated ceramic bathroom tiles, facings of acoustical materials, electrical switchboard panels, laboratory tabletops, electrical conduits, and even smaller diameter pipes were used for purlins and trusses in wartime construction to conserve steel and lumber.

[2] Asbestos was historically used in the fabrication of fire brick. Asbestos containing fire brick was used around boilers and furnaces and was cemented in place with asbestos furnace cement. Today, fire brick is manufactured without asbestos and much of the older asbestos fire brick has been removed and replaced with non-asbestos fire brick. Discussion of fire brick will be included in City-provided asbestos awareness training

Response: Please see response to comment 4.

Comment 6: Page 3, Section 2.3.4: Low Potential ACS, change this section heading to Low Potential ACS – No Reason to Know or Believe."

Response: The requested change has been made.

Comment 7: Page 4, Figure 1, last box under Low Potential, change Section "4" to Section "6".

Response: Figure 1 was revised to reflect changes in the text as noted in response to Comment 4.

Comment 8: Page 4, Figure 1, last box under High Potential, delete current language and state that "An ABI will be present during soil-disturbing activities."

Response: Figure 1 has been revised to reflect the response to Comment 4.

Comment 9: Page 4, Figure 1, under High Potential, add last box that contains language "If ACM is observed, implement ACS management procedures of Section 7 and Section 8."

Response: Please see response to Comment 8.

Comment 10: Page 4, Figure 1, the boxes under "Elevated Potential" should reflect same approach and language as boxes under "High Potential" because you've already established a "reason to believe" that asbestos may be encountered on these sites.

Response: Please see response to Comment 8.

Comment 11: Page 6, Section 4.1, first sentence; delete "ACM" and insert 'asbestos'.

Response: The requested change has been made.

Comment 12: Page 6, Section 4.1, delete third, fourth and fifth paragraphs. This is extraneous information that doesn't belong in the SOP, and may confuse the reader trying to implement this procedure.

Response: The requested change has been made.

Comment 13: Page 7, Section 4.1 delete first paragraph.

Response: The requested change has been made.

Comment 14: Page 7, Section 4.1 item 2, add language to this paragraph to clarify that the subject exemption from Section 5.5 applies, unless the total quantity of asbestos-

containing material to be removed from a facility component falls below Regulation No. 8 trigger levels and the facility component is located on or in soil that will be disturbed.

Response: As requested in Comment 16 below, text from Section 4.2 in which trigger levels are discussed, has been inserted in Section 4.1.

Comment 15: Pages 7 and 8, Section 4.2, delete first, second, third, fourth, and fifth paragraphs. This is extraneous information that doesn't belong in the SOP and may confuse the reader trying to implement this procedure.

Response: Response: The requested change has been made.

Comment 16: Pages 8 and 9, Section 4.2, extract items 1, 2 and 3 from this section and insert this discussion on Page 6, Section 4.1 just below the existing first paragraph.

Response: Response: The requested change has been made.

Comment 17: Page 9, Section 4.2, delete second paragraph beginning with "Under EPA NESHAPS/CDPHE APCD regulations…" This is good information regarding Regulation No. 8 but does not belong in this which was written to address activities under Solid Waste oversight

Response: This paragraph has been retained to provide the reader with information regarding facility components that may be buried on a site.

Comment 18: Page 10, Section 5.2, modify first sentence such that it begins "On-the-job asbestos-contaminated soil awareness training…"

Response: The requested change has been made.

Comment 19: Page 10, Section 5.2, there appears to be a conflict between the first sentence in first paragraph which states that "on-the-job asbestos-contaminated soil awareness training will be provided to all workers directly involved in soil disturbing activities on soil disturbing projects, including heavy equipment operators", and the first sentence in the second paragraph which states that "on-the-job asbestos soils awareness training as defined in Section 5.5.6 of the Solid Waste Regulations will be provided to workers directly involved in soil-disturbing activities on sites where there is known ACS or a "reason to believe ACS may be encountered." Please provide clarifying language that differentiates the training discussed in these two paragraphs.

Response: The first paragraph of Section 5.2 has been revised to read as follows:

On-the-job asbestos contaminated soil awareness (ACS) training as defined in Section 5.5.6 of the Solid Waste Regulations will be provided to all workers directly involved in soil disturbing activities on soil disturbing projects, including heavy equipment operators where these is known ACS or a reason to believe ACS may be encountered. EQ is

available to any City department and/or City contractor as an ABI resource to provide the awareness training as follows:

Comment 20: Page 10, Section 5.2, third paragraph, first two sentences, replace the word "must" with "will".

Response: The requested change has been made.

Comment 21: page 10, Section 5.3, delete item 1 and item 3 from the section, as these are not training requirements. This language can be incorporated in other relevant sections of the SOP.

Response: The requested change has been made.

Comment 22: Page 10, Section 5.3, item 2, insert "as discussed in Section 5.2 above" after "on-the-job ACS awareness training" to clarify that this is the same ACS awareness training required for soil disturbance in areas with a potential for asbestos.

Response: The requested change has been made for sites classified as "Reason to Believe".

Comment 23: Page 11, Section 5.5, modify first sentence to state "CCOD will require individuals with the potential for exposure to asbestos fibers to be trained in the proper…"

Response: The City relies on its contractors to provide proper training to their employees. Accordingly, the first sentence of Section 5.5 was modified to read as follows: "It is the contractor's responsibility to provide training to all employees who have the potential for exposure to asbestos fibers in the proper usage of personal protective equipment and ensure that they have a current annual physical with a medical release/respirator usage form in accordance with the employer's medical surveillance program."

Comment 24: Page 11, Section 5.5, second sentence, replace the word "should" with "will".

Response: The requested change has been made.

Comment 25: Page 12, Section 6, delete first sentence of second paragraph and re-write to indicate that CDPHE will be notified at least 10 working days prior r to any soil disturbing activities in areas of known or high potential ACS. The approved SOP does not renounce the need to notify the Department of soil disturbing projects.

Response: The first sentence was replaced with the following sentence: "The CDPHE will be notified at least 10 days prior to any planned soil disturbing activity in areas of known or suspected ACS or ACM."

Comment 26: Page 13, Figure 2, make separate boxes for the current "facility component" diamond to outline options for above trigger level and below trigger level scenarios. You may refer to the flow chart in the current CDPHE guidance document.

Response: The requested change has been made.

Comment 27: page 14, fourth paragraph, modify first sentence to state "Clothing and equipment that has come into contact with suspect asbestos will be considered potentially contaminated until/unless analytical results indicate the material does not contain any asbestos."

Response: The requested change has been made.

Comment 28: page 14, fourth paragraph, modify third sentence to state "Heavy equipment will be left on site until analytical results are received, unless the equipment has been decontaminated."

Response: The requested change has been made.

Comment 29: Page 14, third bullet, modify first sentence to state "Decontaminate workers by removing visible soil and dust with water or damp wipes or rags."

Response: The requested change has been made.

Comment 30: Page 14, fourth bullet, refer to Section 7.4.11 of the SOP for equipment decontamination.

Response: The requested change has been made.

Comment 31: Page 14, fifth bullet, delete specific reference to DADS landfill

Response: Reference to DADS landfill has been retained; asbestos contaminated soil from City-funded projects must be transported and disposed of at DADS landfill.

Comment 32: Page 14, last sentence, add language acknowledging option to assume ACM and follow Section 7 of the SOP (rather than sample and await analytical results).

Response: The last sentence was revised to read as follows: "If assumed ACM is present in soil or ACM is confirmed in soil by the ABI, the ABI will direct the contractor on full implementation of this SOP."

Comment 33:: Page 15, Section 6.1 second sentence, replace the word "site" with "soil".

Response: The requested change has been made.

Comment 34: Page 15, Section 6.1, first paragraph, the first and second sentence appear to contradict each other. If the point is to look for ACM the ABI should be there all the time. Please clarify and re-write.

Response: The first paragraph of Section 6.1 (now 6.2) has been revised to read as follows:

"6.2 Interim Actions upon Discovery of Suspected ACM
Site characterization to identify the extent of ACM may be required to help develop the scope of work required to manage ACM disturbed in soil. Site characterization activities are described below.

6.2.1 Site Characterization

In the event that suspect ACM is visually identified by the ABI, steps outlined in Section 7.0 will be implemented. The following steps will be applied to sample and analyze suspect ACM identified by the ABI:"

Comment 35: Page 15, Section 6.1, immediately following second sentence, insert language stating "per Section 5.2 of this SOP, all workers will have asbestos awareness training and if debris is identified, the ABI will be called."

Response: Section 6.1 has been revised and is now Section 6.2. Also, please see response to Comment 34.

Comment 36: Page 15, Section 6.1, first paragraph, third sentence, delete specific reference to DADS and replace with "an approved disposal facility".

Response: Please see response to Comment 31.

Comment 37: Page 16, Section 7.1, first paragraph, last sentence, include "Elevated Potential."

Response: The last sentence was modified to read: " Minimum engineering controls and air monitoring will be implemented any time excavation activities are occurring in an area of Known ACS, at a site that is classified as Reason to Believe."

Comment 38: Page 16, Section 7.1.1, modify fourth bullet to state " A person with a fire hose on low pressure and equipped with a ball valve (or equivalent) will be present at the point of excavation to prevent and not cause fugitive dust emissions and potential asbestos fiber emissions…"

Response: The requested change has been made.

Comment 39: Page 16, Section 7.2, modify this section to provide for a 10-day notice to the Department, as discussed in comment #25 above, or delete. Notification is discussed in Section 7.4; therefore, Section 7.2 is unnecessary.

Response: Text in Section 7.4 regarding notification was moved to Section 7.2. The first sentence of Section 7.2 reads as follows: "The CDPHE will be notified at least 10 days prior to any planned soil disturbing activity in areas of known ACM or ACS".

Comment 40: Page 17, Section 7.4.1, add language to this section explaining that, for large projects with widespread removal of ACS, the requirement for the use of windbreak barriers may be modified or waived

Response: The following sentence was added to Section 7.4.1: "For large projects with widespread removal of ACS, the requirement for the use of windbreak barriers may be modified or waived."

Comment 41: Page 18, Section 7.4.4, third paragraph, second sentence, please clarify that an asbestos soil inspector will perform this function.

Response: In Section 7.4.4, third paragraph, second sentence, the words "The Consultant" were replaced with "An ABI".

Comment 42: Page 18, Section 7.4.6, first paragraph, second sentence, delete the words "provide adequate wetting to".

Response: The requested change has been made.

Comment 43: Page 18, Section 7.4.6 first paragraph, second sentence, add the words "during loading" immediately following eliminate fugitive dust.

Response: The requested change has been made.

Comment 44: Page 19, Section 7.4.6, regarding second paragraph, first sentence, it has been the Division's observation that it is not always practical to remove soil in lifts during deep excavation projects. Add a paragraph to Section 7.4.6 that addresses wetting for deeper excavations. You may choose to borrow language from the following excerpt:

> *Excavation equipment will be fitted with a spray bar to contain any emissions inadvertently generated during the removal process, as well as a hand held misting system/water spray at the excavation point to ensure adequate soil wetting. Excavation of asbestos-contaminated soil will not overreach the bounds of wetting. For projects involving relatively shallow ACS occurrence, excavation will be conducted in 6-inch and 1-foot lifts to ensure that disturbed soil remains adequately wet. For projects involving ACS at depth, such as a landfill, excavation in lifts may not be practical. In these instances, wetting may take place as the excavation proceeds, with wetting being conducted using hand held low pressure hoses. The soil may be mixed within the excavation, using the excavator bucket, until it is adequately wet. The soil may then be moved from the excavation into the lined trailer. At no time shall soil that is not adequately wet*

*be removed from the excavation. During the removal process, all areas of impact will be kept adequately wet with amended water. Amended water will be applied at low pressure so as not to generate dust or splattering and will be applied at the point of contact. The excavator will handle the material wet and direct load the soil into a tractor trailer or end dump.*

Response: Portions of the second paragraph of Section 7.4.6 were replaced with the excerpted language provided in Comment 44.

Comment 45: Page 19, Section 7.4.8, modify third sentence to state "At the loading location, a ten-mil polyethylene sheeting or thicker lay-down pad will be installed on the ground under dumpsters/trucks to catch any spilled material."

Response: The requested change has been made.

Comment 46: Page 19, Section 7.4.8, modify sixth sentence to state "After the load has been secured and load cover tarp is installed, the poly sheeting lay down loading pad will be properly decontaminated prior to the truck moving forward, using wet methods such as hoses and brooms and squeegees."

Response: The requested change has been made.

Comment 47: Page 19, Section 7.4.9, modify first sentence to state "Containers of non-friable ACM, or soil with visible non-friable asbestos, will be labeled in accordance with the requirements of Section 5.5.7 (B) and 5.2 of the Solid Waste Regulations.

Response: The requested change has been made.

Comment 48: Page 20, Section 7.4.9, second paragraph last sentence, add language "and labeled in accordance with Section 5.3.5(B) of the Solid Waste Regulations."

Response: The requested change has been made.

Comment 49: Page 20, Section 7.4.10 Personnel Decontamination, the proposed approach to personnel decontamination may be more costly and laborious than necessary. Specifically, workers are not required to wear double suits and CDPHE Regulation No. 8 requirements don't apply to outdoor asbestos-contaminated soil projects. You may choose to borrow worker decontamination language from 9.2 of the RTD SOP:

*During all soil-disturbing activities in areas with friable asbestos, a fully functioning decontamination unit or trailer shall be available onsite for worker decontamination. The decontamination unit will be centrally located between the investigation areas. The decontamination unit will consist of three (3) chambers and has fully operational hot and cold running water for the shower.*
*At the beginning of each day workers that will be in the area of active ACS disturbance will don disposable protective suits (Tyvek), disposable gloves and*

*disposable boot covers (excluding truck drivers). For most projects, worker decontamination may consist of removal of Tyvek suit, gloves, and boot covers, which should then be containerized and disposed as asbestos waste. Any non-disposable personnel items must be decontaminated with water or wet wiping. The decontamination unit, as indicated in the Contractors Health and Safety Plan, may be utilized by the workers each time they exist the work area. All contaminated disposable personnel protective equipment shall be containerized and disposed as asbestos waste. Water from the decontamination unit will be filtered to 5 micron and disposed of in the sanitary sewer.*

Response: The first paragraph in Section 7.4.10 was replaced with the suggested worker decontamination language from 9.2 of the RTD SOP.

Comment 50: Page 21, Section 7.4.11, Equipment Decontamination, you may want to delete the reference to HEPA vacuuming methods and just cite decontamination via wet methods using hoses, brooms and squeegees. Generally, it is not practical to use a high efficiency particulate air (HEPA) filter equipped vacuum to decontaminate heavy equipment used for excavation purposes in the outdoor environment.

Response: Reference to HEPA vacuuming methods was removed from Section 7.4.11.

Comment 51: Page 21, Section 7.4.11, Equipment Decontamination, while full utilization of a decontamination station will often be necessary, you might add language that contemplates instances where decontamination can occur over areas of asbestos-contaminated soil, as long as the area will be kept wet, or stabilized, and the area is identified for subsequent removal.

Response: The following text was inserted to Section 7.4.11 immediately following the first sentence: "Equipment decontamination can occur in areas of asbestos-contaminated soil or within a decontamination station. If decontamination occurs over asbestos contaminated soil the area will be kept wet or stabilized and soil in the area will subsequently removed for disposal. Alternatively…"

Comment 52: Page 21, Section 7.5, first paragraph, modify third sentence to indicate that wind speed measurements will be recorded every 30 minutes and during gusts.

Response: The requested change has been made.

Comment 53: Section 7.6, Air Monitoring, add clarifying language to the sixth or seventh sentence stating that "in instances where personnel-only air monitoring is being performed (no perimeter monitoring), personnel monitoring must be representative of the work area."

Response: The requested change has been made.

Comment 54: Page 22, Section 7.6.2, add a sentence that contemplates the fact that perimeter monitoring may be necessary for soil-disturbing projects with areas-of-disturbance even smaller than 100 x 100 feet. For example, in smaller areas where known friable ACM exists and soil disturbance is occurring immediately adjacent to sensitive receptors such as occupied buildings, residential homes, or areas of public access.

Response: Section 7.6.2 was revised to the following: "Generally, perimeter air monitoring will be performed during excavation of greater than 100 x 100 feet of disturbances of ACS. Perimeter air monitoring may be required in smaller excavations where friable ACM exists and soil disturbance occurs immediately adjacent to sensitive receptors such as occupied building, residential homes or areas of public access."

Comment 55: Page T-1, Table 1: Air Monitoring Requirements, modify the first table heading such that it reads "Excavation by Mechanical Means in Areas where there is Reason to Know or Believe that ACM will be encountered".

Response: The requested change has been made.

Comment 56: Page T-2, Table 1: Air Monitoring Requirements, under heading Removal of Friable ACM by mechanical means (heavy equipment bucket, excavator, backhoe, etc), please re-format columns to make table more readable.

Response: The requested change has been made.

Comment 57: Page T-3, last sentence, delete the language "SOPs may contain language specifying that "and "based on methodology describe in the approved SOP."

Response: The requested change has been made.

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

## Wastewater Capital Projects Management
## Standard Construction Specifications

# Measurement and Payment

March 15, 2016

**01-5213 Temporary Office Facilities**

No quantity measurement will be made for any of the work and materials required to accomplish this aspect of the project and payment will be based upon the percentage of this work item completed in accordance with the plans and specifications and as approved by the City Construction Project Manager.

*This item includes: furnishing, installing, maintaining, cleaning, periodic inspections, adjustments and modifications, and removal of all temporary office facilities; providing utilities and services including but not limited to the following: water, electric, telephone, DSL hard line, acceptable scanner, copy machine, printer, internet, sanitary facilities, security measures, storage areas, etc. and payment of associated monthly bills during project duration; development and maintenance of access and haul routes, furnishing and installation of temporary construction fencing; securing temporary facility location, securing of required permits, payment of all associated fees, restoring the site to a better or equal condition than prior to use, and all other equipment and labor required for the implementation, maintenance and removal of all temporary office facilities.*

*At the option of the Construction Project Manager, one quarter of the lump sum price for temporary office facilities may be paid to the Contractor at the time of the first monthly progress payment, the second quarter may be paid at the time of the second monthly progress payment, and the third quarter may be paid to the Contractor at the time of the third monthly progress payment, or at the discretion of the Construction Project Manager. The total payment for this bid item shall not exceed seventy-five percent (75%) of the lump sum price during construction. The remaining twenty-five percent (25%) shall be paid after all facilities have been completely removed and the location of said facilities has been returned to an equal or better condition than prior to use by the Contractor.*

**02-2213 Vibration Assessment**

No quantity measurement will be made for any of the work and materials required to accomplish this aspect of the project and payment will be based upon the completion of the work in accordance with the Contract Documents.

*The lump sum price for Vibration Assessment shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: all labor, equipment, materials, subcontractors, and transportation to and from project site required to complete vibration monitoring and assessment during the entire project duration regardless of extensions; furnishing submittals, baseline and monthly reports; theft and vandalism protection; web based data access and site training; incidentals; meetings and coordination with business owners and residents as necessary during construction; and all other related and necessary materials work and equipment required to accomplish this item in accordance with the Contract Documents*.

*At the option of the Construction Project Manager, one third of the lump sum price for this item may be paid to the Contractor upon satisfactory completion of and/or incorporation of proper measures. The second third may be paid upon fifty percent completion of the work as determined by the percent of work completed on the day of progress payment. The last third may be paid to the Contractor at the time of final progress payment or at the discretion of the Construction Project Manager.*

## 02_8216.10 Certified Asbestos Inspector (CABI)/Air Monitor

No quantity measurement will be made for any of the work and materials required to accomplish this aspect of the construction and payment will be based upon completion of the work in accordance with the Contract Documents. The lump sum price bid shall include the coordination and performance of an onsite CABI and air monitoring.

*The lump sum price for the CABI/air monitor shall include all of the Contractor's costs of whatsoever nature, including licensing and certification of the CABI. The price bid shall include: all labor, materials and equipment required for the inspector to monitor the construction site, evaluate potential asbestos containing material, and collect air fiber samples; lab testing as required; and all other related and necessary materials, work, and equipment required for completion of this work in accordance with the Contract Documents. Duties of the CABI/Air monitor shall be to monitor and cause to enforce that all project activities, excavations, and site controls are in compliance with Denver Environmental Health – Asbestos-Contaminated Soil Management Standard Operating Procedure (current version); all state and federal laws and regulations and guidelines; provide asbestos awareness training for all personnel associated with the project; and any other duties as defined within a site specific Material Management Plan.*

*At the option of the Construction Project Manager, monthly percentage payments, based upon Period of Performance, may be paid to the contractor upon satisfactory completion of and/.or proper controls submitted in monthly payment application, or at the discretion of the Construction Project Manager. Up to the last progress payment or at the discretion of the Construction Project Manager.*

## 31-3223.12 Soil Improvement by Compaction Grouting

The measurement for payment of this item will be the total number of vertical lineal feet of soil improvement by compaction grouting as measured between bedrock (or depth of refusal) and the subgrade of the proposed facility to be supported (treated area).

Measurement will be based on the total vertical linear feet that the grout injection rod advances from the existing ground surface to bedrock or refusal less the plan depth at the grout port location (as shown on the plans) for rod advancement measured from ground surface to subgrade of the facility to be supported (untreated area). Drilling logs showing actual vertical lineal footages of rod advancement depth through the untreated area and into the treated area shall be provided by the contractor as basis for payment of this item.

Payment will be made based upon documented drilling logs showing the vertical linear feet of complete, in place, in a manner satisfactory to the Construction Project Manager, provided, however no payment will be made for compaction grouting due to negligence or unauthorized operations by the Contractor.

*The unit price bid per vertical linear foot of compaction grouting within the treated zone shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: all labor, equipment, materials, grout, testing ground/structure monitoring system, installation and removal of grout pipes, furnish and injection of compaction grout, monitoring of ground/structure movements; survey, following the grouting sequence of operations as set forth in the contract documents, monitoring of all vertical measurements, all revisions of work*

*plans and retesting to establish if grouting meets the contract requirements; hauling and disposal of construction debris, unsuitable material and contaminated materials at the Denver Arapahoe Disposal Site (DADS); in accordance with all specifications included within the contract documents. The Contractor shall be responsible for obtaining all permits, field verification of all utilities*

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**31-3223.12a Overburden Penetration for Compaction Grouting**

The measurement for payment of this item will be the total number of vertical linear feet of overburden penetration during soil improvement by compaction grouting as measured between the existing ground surface to the subgrade of the proposed facility to be supported (untreated area). Measurement will be based on vertical linear feet (plan depth) at the grout port location (as shown on the plans) for rod advancement measured from ground surface to subgrade of the facility to be supported (untreated area). Drilling logs showing actual vertical lineal footages of rod advancement depth through the untreated area and into the treated area shall be provided by the contractor as basis for payment of this item.

Payment will only be made based upon the plan depth of overburden penetration measured in vertical linear feet and as documented in drilling logs showing the vertical linear feet of overburden penetration, where successful grout placement has occurred, and as in a manner satisfactory to the Construction Project Manager, provided, however no payment will be made for overburden penetration due to negligence or unauthorized operations by the Contractor.

*The unit price bid per linear foot of overburden penetration for compaction grouting shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: steel casing pipe and all labor, equipment, materials and all other related and necessary items, complete in accordance with the Contract Documents.*

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**2-1.1a Remove Combination Concrete Curb, Gutter and Sidewalk (2'8")**
**2-1.1b Remove Combination Concrete Curb, Gutter and Sidewalk (3'11")**
**2-1.2a Remove 6" Concrete Curb and/or Gutter**
**2-1.2b Remove 9" Concrete Curb and/or Gutter**
**2-1.3 Remove Concrete Curb Head**
**2-1.4 Remove Handicap Concrete Curb Ramp**
**2-1.5 Remove Concrete Median Strip**
**2-2.1 Remove Concrete Sidewalk**
**2-2.1a Remove Concrete Sidewalk/Bike Path**
**2-2.2 Remove Concrete Driveway Paving**
**2-2.4 Remove Concrete Channel Paving**
**2-2.5 Remove Miscellaneous Concrete Flatwork**

The measurement for payment of this item will be the total number of linear feet or square feet of existing concrete curb and gutter, combination concrete curb and gutter, concrete curb head, concrete handicap curb ramp, concrete median strip, concrete sidewalk, concrete bike path, concrete driveway pavement, concrete slab, concrete alley return, concrete alley paving, concrete channel paving or any other type of miscellaneous concrete flatwork as specified in the Contract Documents or designated by the Construction Project Manager to be removed for construction of the proposed sewer and/or appurtenances; provided, however, no

measurement for payment will be made for concrete flatwork removed or damaged due to negligence or unauthorized operations by the Contractor.

*The unit price bid per linear foot or square foot removal of this item shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation, concrete sawing or otherwise effectively cutting the concrete item smoothly and squarely in a manner satisfactory to the Construction Project Manager; excavation and overexcavation; removal and disposal of unsuitable material, existing flatwork and/or any reinforcing materials per the requirements set forth in the Contract Documents; and all other related and necessary materials, work, and equipment required to remove this item in accordance with the Contract Documents.*

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**2-2.6 Remove and Replace Flagstone Curb Head**

**2-2.7 Remove and Replace Flagstone Walk**

The measurement for payment of this item will be the total number of linear feet of Flagstone Curb Head or the total square feet of flagstone walk required to be removed or placed for construction of the proposed sewer and/or appurtenances; provided, however, no measurement for payment will be made for flagstone removed and replaced due to negligent or unauthorized operations by the Contractor.

*The unit price bid per linear foot or square foot removal and replacement of this item shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation, sawing or otherwise effectively cutting the flagstone item smoothly and squarely in a manner satisfactory to the Construction Project Manager; excavation and over excavation; removal and disposal of unsuitable material; storing on site for reuse; placement and/or replacement of flagstone; furnishing of new flagstone or equivalent stone as necessary; cutting, shaping, leveling, grouting, spacing; bedding, supply and placement of select subgrade material or select fill as necessary, compaction, and all other related and necessary materials, work, and equipment required to remove and replace this item in accordance with the Contract Documents.*

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**2-2.8 Remove Asphalt Walk**

The measurement and payment of this item will be the total number of linear feet of asphalt walk required to be removed, and/or removed and replaced for the proposed sewer and/or appurtenances; provided, however, no measurement for payment will be made for asphalt walk removal or replacement required due to negligent or unauthorized operations by the Contractor.

*The unit price bid per linear foot removal, removal and replacement, or placement of this item shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation, grading and shaping; placement of bedding; excavation and overexcavation; removal and disposal of unsuitable material; placement and/or replacement; furnishing of asphalt; leveling and compaction, and all other related and necessary materials, work, and equipment required to remove this item in accordance with the Contract Documents.*

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**2-3 Remove Concrete Wheel Stops**

The measurement for payment of this item will be the total number existing wheel stops required to be removed or placed for construction of the proposed sewer and/or appurtenances; provided, however, no measurement for payment will be made for wheel stops removed and replaced due to negligent or unauthorized operations by the Contractor.

*The unit price bid per wheel stop removal shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation, sawing or otherwise effectively removing the wheel stop in a manner satisfactory to the Construction Project Manager; excavation and overexcavation; removal and disposal of unsuitable material; storing on site for reuse; placement of replacement; furnishing of new wheel stops; cutting, leveling, grouting, spacing; bedding, compaction, and all other related and necessary materials, work, and equipment required to remove this item in accordance with the Contract Documents.*

**2-3.1 Remove Concrete Alley Gutter**
**2-3.2 Remove Concrete Alley Returns**
**2-3.3 Remove Concrete Alley Paving**
**2-3.4 Remove Concrete Street Intersection Gutter (Crosspan) and/Or Valley Gutter**
**2-3.5 Remove Concrete Street Paving**

The measurement for payment of this item will be the total number of square feet of concrete required to be removed for construction of the proposed sewer; provided, however, no payment will be made for damaged material required to be removed due to negligence or unauthorized operations by the Contractor or any Subcontractors.

*The unit price bid per square foot for removing this item shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: concrete sawing and otherwise effectively cutting the existing concrete smoothly and squarely in a manner satisfactory to the Construction Project Manager; removal and disposal of concrete, asphalt, and/or any reinforcing materials, including removal of the square radius beyond the lip of the standard two-foot gutter; furnishing additional base material; subgrade preparation and compaction; rotomilling within the effective removal limits; and all other related and necessary materials, work, and equipment required to accomplish the removal of this item in accordance with the Contract Documents.*

*In addition to the above listed items, the unit price bid per square foot removal of concrete street intersection gutter and/or valley gutter shall include repaving of the street within the effective removal limits to a point not less than 2-inches below the new finished street grade (matching cross street crowns to within 2-inches of finished street grade to the satisfaction of the Construction Project Manager), including surrounding areas damaged during removal. The effective removal limits encompass the surface area shown on the Project Paving Schematic included within the Contract Documents. This area varies based on location within the project. The additional 2-inches of paving within the effective removal limits, as well as all required rotomilling and asphalt placement outside the limits will be paid for using bid items*

*provided for elsewhere in the Contract Documents. No separate measurement or payment will be made for additional paving materials or rotomilling necessary for adherence to this item, all such costs will be included in the square foot price for removal.*

**2-4 Remove Concrete Steps**

The measurement for payment of this item will be the total number of square feet of concrete steps required to be removed for construction of the proposed sewer and/or appurtenances; provided, however, no measurement for payment will be made for concrete steps removed and replaced due to negligent or unauthorized operations by the Contractor.

*The unit price bid per square foot of concrete steps, which shall be quantified by the width of the stairs multiplied by the summation of each stair hypotenuse (the hypotenuse of the rise and run of each stair). The unit price shall include all of the Contractor's costs of whatsoever nature.*

*The price bid shall include: excavation, sawing or otherwise effectively removing the steps in a manner satisfactory to the Construction Project Manager; excavation and overexcavation; removal of any foundation concrete; removal and disposal of unsuitable material; backfilling of foundation with suitable bedding, compaction, and all other related and necessary materials, work, and equipment required to remove this item in accordance with the Contract Documents.*

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**2-5 Remove Concrete Retaining Wall**

The measurement for payment of this item will be the total number of linear feet of retaining wall, including attached railing and/or fence required to be removed for construction of the proposed sewer and/or appurtenances; provided, however, no measurement for payment will be made for retaining wall removal required due to negligent or unauthorized operations by the Contractor.

*The unit price bid per linear foot of retaining wall removal shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation, sawing or otherwise effectively removing the wall in a manner satisfactory to the Construction Project Manager; excavation and overexcavation; removal of any foundation concrete; removal of tie backs, drainage pipe; removal and disposal of fence and/or railings; removal and disposal of unsuitable material; removal of brick, wood, cinder block, steel sheeting, or rock walls; backfilling of foundation with suitable bedding, compaction, and all other related and necessary materials, work, and equipment required to remove this item in accordance with the Contract Documents.*

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**2-6 Remove Concrete Headwall**

No partial measurement for payment will be made for this item, removal and payment will be based upon complete removal of the concrete headwall and/or attached railing and/or fence to the satisfaction of the Construction Project Manager or to the requirements of the Contract Documents; provided, however, no measurement for payment will be made for retaining wall removal required due to negligent or unauthorized operations by the Contractor.

*The unit price bid per lump sum concrete headwall removal shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: effectively removing the wall in a manner satisfactory to the Construction Project Manager; excavation and overexcavation; removal of any foundation concrete; removal of tie backs, drainage pipe; removal and disposal of unsuitable material; removal of brick, wood, cinder block, steel sheeting, or rock headwalls; removal and disposal of fence and/or railings; backfilling of foundation with suitable bedding, compaction, and all other related and necessary materials, work, and equipment required to remove this item in accordance with the Contract Documents.*

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**2-11 Remove or Abandon Existing Pipe and Box Culverts**
**8-4 Remove Existing Waterline**

The measurement and payment for this item will be the total number of linear feet of existing pipe, flared end sections, box culvert, and/or waterline of the dimensions specified, required to be removed or abandoned for construction of the proposed sewer and/or appurtenances; however, no payment will be made for pipe removed or abandoned due to negligence or unauthorized operations by the Contractor.

*The unit price bid per linear foot of removal or abandonment shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation; care and diversion of drainage courses; removal of pipe, cone sections and sewer appurtenances as necessary to*

*complete the removal or abandonment as specified in the Contract Documents including removal and disposal of the existing conduit and appurtenances (per State and Local requirements where applicable for lines containing asbestos); hauling and disposal of construction debris, unsuitable material and contaminated materials at the Denver Arapahoe Disposal Site (DADS); removal of pavement, sod and other surfacing materials; excavation, including exploratory excavation; diversion, cutting and plugging of pipe, as necessary, per the Contract Documents, any additional labor, equipment and materials required to disconnect the existing facility as required by the owner, salvaging of pipe when directed by the Construction Project Manager or when specified in the Contract Documents, placing of the salvaged pipe on the job site in a location designated by the Construction Project Manager; reforming and reshaping of manhole inverts as required; backfilling to final grade with approved backfill material; filling of abandoned pipe with an approved CLSM or alternately approved product, per the requirements set forth in the Standard Construction Specifications; compaction of materials as necessary; paving, curb, gutter, sidewalk, landscaping and any other surface restoration required due to removal of associated items; coordination with utility owner as required and all other related and necessary materials, work, and equipment required to complete removal or abandonment in accordance with the Contract Documents.*

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**2-11.8 Remove Abandoned Steam Pipe With Asbestos Lining (<24" Diameter)**

The measurement for payment of this item will be the total number of linear feet of pipe required to be removed and transported to an approved disposal site for construction of the proposed sewer; provided, however, no payment will be made for removal due to negligence or unauthorized operations by the Contractor or any Subcontractors.

The removal of abandoned steam pipe with asbestos lining shall comply with Colorado State Regulation No. 8, Part B, which incorporates the Environmental Protection Agency (EPA) National Emissions Standards for Hazardous Air Pollutants (NESHAP) Regulations for Asbestos (40 CFR Part 61). More specifically, the removal activity must comply with § III.S.4. (Other Non-friable Asbestos-Containing Materials) and if at a quantity above trigger levels (§I.B.104) are also subject to § III.E. (State Notifications) of the stated regulation. If during abatement, the asbestos cement product becomes friable, the project activity shall meet and conform with all the requirements in sections I (Definitions), II (Certification Requirements), and III (Abatement, Renovation and Demolition Projects) of the stated regulation. All abatement projects involving asbestos products are subject to Occupation Safety and Health Administration (OSHA) Standards for Asbestos (29 CFR Parts 1910.1001 and 1926.1101). Transportation of asbestos-containing waste materials is regulated by the Colorado Department of Transportation (CDOT). All expenses incurred to comply with the above noted items shall be borne by the Contractor.

*The unit price bid per linear foot for removal shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation; care and diversion of drainage courses; removal of pipe, insulating materials and appurtenances; removal of pavement, sod, and other surfacing materials; excavation, including exploratory excavation; coordination and interaction with abandoned facility owner to ensure that a chain of custody is maintained; hauling and disposal of construction debris, excess excavated material, damaged materials and asbestos contaminated materials at the Denver Arapahoe Disposal Site (DADS) unless otherwise specified or required by State regulations; backfilling and compaction to final grade with an approved backfill material; and all other related and necessary materials, work and equipment required to remove the existing abandoned steam pipe with asbestos lining in accordance with the Contract Documents.*

**2-12.1 Remove Existing Sanitary Manhole**
**2-12.2 Remove Existing Storm Manhole**
**2-12.3 Abandon Existing Sanitary Manhole**
**2-12.4 Abandon Existing Storm Manhole**
**2-12.7 Remove Existing Structure**
**2-13.1 Remove Existing Storm Inlet**
**2-13.2 Remove Existing Special Storm Inlet**

The measurement for payment of this item will be the total number of manholes, inlets or structures required to be removed or abandoned for construction of the proposed sewer and/or appurtenances; however, no payment will be made for structures removed due to negligence or unauthorized operations by the Contractor.

*The unit price bid per manhole, inlet or structure removal and/or abandonment shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation, overexcavation, exploratory excavation; care and diversion of drainage courses; removal of brick, grate, ring and cover, manhole barrel sections, concrete and any related reinforcing materials, unsuitable material, reducers, etc. to a minimum of 2 foot below finish grade; removal of pavement and sod; cutting and plugging of associated pipe per the Contract Documents, or as required by the Construction Project Manager; salvaging of ring and cover or grates when so designated by the Construction Project Manager; storing of all salvaged materials on the job site at a location designated by the Construction Project Manager; disposal of unsuitable material; placement of approved backfill material and/or Controlled Low Strength Material to final grade elevation, compaction; removal and replacement of paving, curb, gutter, sidewalk, landscaping and any other surface restoration required due to removal of associated item, unless specifically provided for elsewhere in the Contract Documents; and all other related and necessary materials, work, and equipment required to remove, abandon and/or salvage the existing structure in accordance with the Contract Documents.*

**2-14 Remove Riprap**
**2-15 Remove Gabions**

The measurement for payment of this item will be the total number of cubic yards of riprap, gabions or other rock materials required to be removed for construction of the proposed sewer and/or appurtenances; provide, however no measurement for payment will be made for rock required to be removed due to negligence or unauthorized operations by the Contractor.

*The unit price bid shall include all of the Contractor's costs of whatsoever nature. The price bid for removal shall include; excavation, backfilling, removal and disposal of unsuitable material, compaction and all other related and necessary materials, work, and equipment required to remove the riprap or gabions in accordance with the Contract Documents.*

**2-16.1 Remove Chain Link Fence**
**2-16.2 Remove Wood Fence**
**2-16.3a Remove Single Swing Gate**
**2-16.3b Remove Double Swing Gate**
**2-16.4 Remove Security Fence**
**2-18 Remove Permanent Barricades**
**2-21.1 Remove Guard Rail**

**2-21.2 Remove Hand Rail**

The measurement for payment of this item will be the total number of linear feet of wood fence, chain link fence, security fencing, gate work, guard rail, hand rail, or the number of barricades required to be removed for construction of the proposed sewer and/or appurtenances; provided, however, no measurement for payment will be made for items required to be removed due to negligence or unauthorized operations by the Contractor.

*The unit price bid per linear foot of removal shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: removal and disposal of materials to include: concrete bases, rails, posts, pickets, wire, fabric, slats, w-beams, nails, nuts, bolts, fencing, etc.; removal and salvage of materials if determined to be reusable by the Construction Project Manager; filling postholes, backfilling and regrading as necessary to promote drainage and eliminate safety hazards; and all other related and necessary materials, work and equipment required to complete the removal in accordance with the Contract Documents.*

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**2-17.1 Remove and Replace/Relocate Utility Poles**
**2-17.2 Temporary Utility Pole**
**2-17.3 Remove and Replace/Relocate Sign**
**2-17.5 Remove and Replace Parking Meter Pole**

The measurement and payment of this item will be the total number of utility poles, parking meter poles and/or signs required to be removed and/or removed and relocated or replaced, and the total number of temporary poles placed and removed, for construction of the proposed sewer and/or appurtenances; provided, however, no measurement for payment will be made for poles removed due to unauthorized operations of the Contractor.

*The unit price bid shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: coordination with the utility owner; adherence to rules and procedures set forth by utility owners; scheduling relocates as required to insure that no time is lost for the project; excavation; removal and storage of poles and/or signs; replacement with new pole and/or signs if necessary; bedding, select fills, backfilling and compaction; removal and replacement of guy wires; drilling, casings; installation of new foundations to utility owner or Construction Project Manager's requirements as necessary; disposal of all trash and construction unsuitable material associated with this bid item; and all other related and necessary materials, labor and equipment required to complete the construction in accordance with the Contract Documents.*

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**2-17.7 Relocate Existing Utility**

No quantity measurement will be made for any of the work and materials required to accomplish this aspect of the construction project and payment will be based upon the completion of the work in accordance with the Contract Documents.

*The lump sum cost for coordination and relocation of the specified existing utility line shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: coordination with the utility owner as necessary to complete the relocation; adherence to rules, regulations, specifications and procedures set forth by utility owner; obtaining all required permits and paying associated fees; railroad flagging/inspection and fees as necessary; shoring and trench support; hand digging as necessary; removal and disposal of concrete encasement material; removal and disposal of abandoned appurtenances; scheduling, rescheduling and facilitating all relocations as required to ensure the project stays on time, all associated delay costs; excavation as necessary for relocation of existing utility; removal, disposal and hauling of*

*all construction debris, excess excavated material, unsuitable materials and manifested contaminated materials at the Denver Arapahoe Disposal Site (DADS), recycle and salvage of materials as required by contract; temporary utility supports; relocation of the utility; providing temporary service and rerouting as necessary; preserving service and continuity as required by utility owner; cutting of existing utility conduit and line as necessary; providing all materials, equipment and specialty labor necessary for reconnection of specific utility; brushing, cleaning and pigging of utility conduit as required by owner; providing and installing marking/tracing wire; concrete encasement of relocated utility as required and per utility company standards; traffic control supporting a standalone configuration; air testing; material testing; relocation engineering and plan development; directional boring if needed; removal and replacement of concrete flatwork at directional bore pits; specialized welding at points of connection and pipe junctions; backfilling and compaction after completion of relocate; and all other related and necessary materials, work and equipment required to relocate the existing utility as required in the Contract Documents or as directed by the Construction Project Manager.*

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**2-19 Remove Existing Culvert**

The measurement for payment of this item will be the total number of linear feet of concrete culvert or concrete channel required to be removed for construction of the proposed sewer and/or appurtenances; provided, however, no measurement for payment will be made for removal of culvert due to negligence or unauthorized operations by the Contractor.

*The linear foot price bid for culvert removal shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation, including overexcavation to remove unsuitable foundation material; removal and disposal of all culvert materials including pipe, wood, concrete, reinforcing; backfilling and compaction; and all other related and necessary materials, work and equipment required to remove the culvert in accordance with the Contract Documents.*

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**2-20a Remove Trolley Tracks**
**2-20b Remove Railroad Tracks**

The measurement for payment of this item will be the actual number of linear feet per pair of trolley, street car, or railroad tracks required to be removed for construction; provided, however, no payment will be made for track removed due to negligence or unauthorized operations by the Contractor.

*The unit price bid per linear foot removal of this item shall include all of the Contractor's costs of whatsoever nature. The linear foot price bid (per pair of rails) shall include: removal of paving within the entire track facility footprint and adjacent paving requiring removal to properly complete this item; cutting and disposal; stockpiling, storage and protection; or recycling of rails; removal and disposal of ties, fasteners, spikes, special joints; removal and disposal of special bedding and/or ballast under the tracks, removal and disposal of concrete panels and/or rubber matting; hauling and disposal of all excess excavated at the Denver Arapahoe Disposal Site; backfilling and compaction of subgrade with suitable material; temporary driving surfaces required prior to final pavement or new track installation, maintenance of temporary driving surfaces to includes removal and installation of new temporary surfaces as necessary prior to final treatment; and all other related and necessary materials, work and equipment required for removal of this item in accordance with the Contract Documents.*

**2-22 Remove Parking Lot Trench Drain**

The measurement for payment of this item removal will be the actual number of linear feet of trench drain required to be removed for construction of the proposed sewer and/or appurtenances; provided, however, no payment will be made for trench drain removed due to negligence or unauthorized operations by the Contractor.

*The unit price bid per linear foot removal of this item shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation, removal of concrete, unsuitable material, grates, backfilling and compaction; and all other related and necessary materials, work and equipment required for removal of this item in accordance with the Contract Documents.*

**2-23 Remove Decorative Landscaping**

No quantity measurement will be made for any of the work and materials required to remove and replace this item. Payment will be based upon completion of the work in accordance with the Contract Documents; provided, however, no payment will be made for removing and replacing decorative landscaping required to be replaced due to negligent or unauthorized operations by the Contractor.

*The lump sum bid price shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation; removal and replacement of concrete, rock; removal and replacement of plants; disposal of excess excavated materials; topsoil, fertilizer, water, storage and all other related and necessary materials, work and equipment, required to replace the decorative landscaping in accordance with the Contract Documents.*

**2-24 Remove and Replace Bus Stop**

The measurement and payment of this item will be the total number of bus stops to be removed and replaced for construction of the proposed sewer and/or appurtenances; provided, however, no measurement for payment will be made for bus stops removed and/or replaced due to unauthorized operations by the Contractor.

*The unit price bid shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: coordination with the Regional Transportation District (RTD); adherence to the rules and procedures set forth by RTD; scheduling all necessary relocates and utility disconnections/reconnections, as required, to insure that no time is lost on the project; excavation, removal and disposal of materials as necessary; removal, storage, and replacement of poles, signs, benches, shelters, trash cans, guy wires and all other appurtenances associated with the bus stop; installation and removal of temporary bus stops, as required by RTD; removal and replacement of concrete bus pads, pavement, subgrade material, curb, gutter and sidewalk, landscaping materials and all other items required to complete construction of the proposed sewer and/or appurtenance and replace the bus stop in the same or better condition upon completion; and all other related and necessary materials, labor and equipment required to complete the construction in accordance with the Contract Documents.*

**3-2 Hauling of Contaminated Materials to Denver/Arapahoe Disposal Site (DADS)**

The measurement for payment of this item will be the number of tons of contaminated material required to be hauled off to the Denver/Arapahoe Disposal Site for construction of the proposed sewer and/or appurtenances; provided, however, no measurement for payment will be made for hauling of non-contaminated materials and contaminated materials not authorized by the Construction Project Manager. Payment shall be based upon weights obtained from a certified mobile scale, or at a location agreed to with the Construction Project Manager prior to commencement of activities. Certified weight tickets from the agreed to scale shall be used for payment purposes. Payment shall not be made for muck excavation necessary to poor shoring methods or unauthorized operations by the contractor.

*The unit price bid per ton of contaminated material disposal shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation; identification, storage, loading; hauling, wrapping and obtaining weights on a certified scale prior to disposal; providing a mobile scale, disposal of debris at the Denver Arapahoe Disposal Site; acquisition of all required permits; all special personnel and equipment required to haul the construction debris to DADS; laboratory testing as required; equipment decontamination; fugitive dust control, containment and monitoring; compliance with Denver Environmental Health – Asbestos-Contaminated Soil Management Standard Operating Procedure (current version); management of on-site treatment; stockpiling, profiling, storage and disposal of contaminated materials; implementation and coordination of Federal, State and Municipal Rules and Regulations as required by the respective agencies and governmental entities; all fees and fines associated and all other related and necessary materials, work, and equipment required for removal of this item in accordance with the Contract Documents.*

**3-3 Hazardous Waste Disposal**

The measurement for payment of this item will be the total number of tons of hazardous waste required to be removed and hauled off, for construction of the proposed sewer and/or appurtenances; provided, however, no measurement for payment will be made for removal and disposals not authorized by the Construction Project Manager. Payment shall be based upon weights obtained from a certified scale agreed to with the Construction Project Manager prior to commencement of activities. Certified weight tickets from the agreed to scale shall be used for payment purposes. Payment shall not be made for muck excavation necessary to poor shoring methods or unauthorized operations by the contractor.

*The unit price bid per ton of Hazardous Waste disposal shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: all required permits and fees; excavation, loading, hauling and obtaining weights at a certified scale prior to disposal; and backfilling; disposal of hazardous waste at the Denver Arapahoe Disposal Site; and as required by State and Federal regulations; and all other related and necessary materials, work, and equipment required for hazardous waste disposal in accordance with the Contract Documents.*

**3-4 Rock Excavation**

The measurement for payment of this item will be the total number of cubic yards of rock required to be removed for construction of the proposed sewer and/or appurtenances; provided, however, no measurement for payment will be made for rock excavation beyond the

maximum prescribed trench width or for depths exceeding 12 inches below the pipe nor for excavation due to negligence or unauthorized operations by the Contractor.

*The unit price bid per cubic yard of rock excavation shall include all of the Contractor's costs of whatsoever nature required to perform the excavation and to replace the void area with granular bedding and/or any other material specifically approved by the Construction Project Manager. The price bid shall include: excavation, blasting, removal and disposal of rock unsuitable material; furnishing, placing and compacting the approved backfill material required to fill the void area; and all other related and necessary materials, work, and equipment required to excavate the rock in accordance with the Contract Documents.*

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**3-5 Muck Excavation**

The measurement and payment for this item will be the total number of tons of muck required to be excavated and disposed of; provided, however, no measurement for payment will be made for any excavation of material that does not meet the definition of muck as described in the technical specifications or as determined by the Construction Project Manager. Measurement for muck excavation will be made only to the limits specifically determined by the Construction Project Manager. Payment shall be based upon weights obtained from a certified scale agreed to with the Construction Project Manager prior to commencement of activities. Certified weight tickets from the agreed to scale shall be used for payment purposes. Payment shall not be made for muck excavation necessary to poor shoring methods or unauthorized operations by the contractor.

*The unit price bid per ton of muck removal shall include all of the Contractor's costs of whatsoever nature: The price bid shall include: excavation; loading, hauling and obtaining weights at a certified scale prior to disposal; removal and disposal of muck at the Denver Arapahoe Disposal Site; dewatering; placing and compacting approved select materials in void areas left by the excavation in a timely fashion; and all other related and necessary materials, labor, and equipment required to remove the muck in accordance with the Contract Documents or as directed by the Construction Project Manager.*

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**3-6 Construct, Repair, or Stabilize Embankments**

The measurement and payment for this item will be the total number of cubic yards of embankment materials required for construction of the proposed sewer and/or appurtenances; provided, however, no payment will be made for embankment materials not authorized by the Construction Project Manager.

*The unit price bid per cubic yard of embankment construction shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation, haul, furnishing and placement of embankment materials, geotextiles, soils, compaction, placement of riprap, concrete, grouting, grading; and all other related and necessary materials, work, and equipment required to construct the embankment in accordance with the Contract Documents.*

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**3-7a Health & Safety Plan**

No quantity measurement will be made for any of the work and materials required to accomplish this aspect of the construction project and payment will be based upon the completion of the work in accordance with the Contract Documents.

*The lump sum payment for health and safety plans shall include all of the Contractor's costs of whatsoever nature. The lump sum price bid shall include: creation and modification of a Health & Safety Plan, facilities coordination for health and safety; training of all personnel as necessary to perform work; coordination of Federal and Municipal Rules and Regulations as required by the respective agencies and municipalities; all fees, and fines due to non-compliance with regulations, monitoring of the health and safety plan; contaminant testing as required; and all other related and necessary materials, work and equipment required to complete this item in accordance with the Contract Documents.*

*At the option of the Construction Project Manager, monthly percentage payments, based upon Period of Performance, may be paid to the contractor upon satisfactory completion of and/or proper controls submitted in monthly payment applications. At the discretion of the Construction Project Manager, payment may be withheld for any Non-conformance reports issued for failure to comply with the accepted Health & Safety Plan.*

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**3-7b Material Management Plan**

No quantity measurement will be made for any of the work and materials required to accomplish this aspect of the construction project and payment will be based upon the completion of the work in accordance with the Contract Documents.

*The lump sum payment for materials management plan shall include all of the Contractor's costs of whatsoever nature. The lump sum price bid shall include: creation of and modification of a Material Management Plan; facilities coordination for health and safety; training of all personnel as necessary to perform work; coordination for testing and disposal of materials; waste classification, profiling and manifesting, protecting workers and the public from exposure to contaminants; decontamination procedures for personnel and equipment; fugitive dust control, containment and monitoring; compliance with Denver Environmental Health – Asbestos-Contaminated Soil Management Standard Operating Procedure (current version); management of on-site treatment, storage and disposal; procurement and stockpiling of lined containers; waste classification, profiling and manifesting; protecting workers and the public from exposure to contaminants: Decontamination of anything exposed to contaminated substances; fugitive dust control and containment including monitoring implementation and coordination of Federal, State and Municipal Rules and Regulations as required by the respective agencies and governmental entities; all fees and fines associated with the Material Management Plan; contaminant testing as required; and all other related and necessary materials, work and equipment required to complete this item in accordance with the Contract Documents.*

*At the option of the Construction Project Manager, monthly percentage payments, based upon Period of Performance, may be paid to the contractor upon satisfactory completion of and/or proper controls submitted in monthly payment applications. At the discretion of the Construction Project Manager, payment may be withheld for any non-conformance reports issued for failure to comply with the accepted Materials Management Plan.*

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**3-8 Unclassified Excavation**
**5-3b Overexcavation**

The accepted quantities will be paid for at the contract unit price for unclassified excavation or overexcavation. The measurement for payment of this item will be the number of cubic yards

of material required to be removed for construction, excluding demolition and removal items specified elsewhere. The measurement and payment for overexcavation or unclassified excavation shall be defined based on field conditions (insitu) prior to commencing operations (excavated volumes shall not be allowed) and agreed to by the Construction Project Manager. If feasible, a before and after field survey may be conducted to define this volume. In either method, this area shall be defined as the unclassified or over excavation zone. The quantity paid shall not include any material excavated above the proposed facility subgrade, as shown within the contract documents.

*The unit price bid per cubic yard of excavation shall include all of the Contractor's costs of whatsoever nature. The unit price bid shall include: all labor, equipment, materials and incidentals required to excavate the materials, loading, hauling and disposal on-site and off-site to the Denver Arapahoe Disposal Site, and stockpiling of materials; placement as subgrade and/or topsoil elsewhere on site as specified within the contract documents; placement for embankments, water conditioning and compaction to specified limits. Embankment construction will not be measured separately but will be included as a separate unclassified excavation bid item with additional notes.*

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**5-1 Structural Fill**
**5-2a Subgrade Material (Select Backfill)**
**5-2b Topsoil**
**5-4 Crusher Fines**
**5-5 Recycled Concrete**
**5-8 Crushed Gravel Base Course (CDOT Class 6 Road Base)**

The measurement for payment of this item will be the number of tons of structural fill, subgrade material, topsoil, crusher fines, and/or recycled concrete placed and accepted for construction of the proposed facilities and/or appurtenances. No measurement for payment will be made for materials that are placed without specific written approval of the Construction Project Manager. In addition, no payment will be made for: placement due to poor subgrade preparation, cave-ins, and/or negligent or unauthorized activities by the Contractor. This item shall follow the requirements set forth in Section 5.0 of the Standard Construction Specifications.

All delivery trucks shall be plainly numbered and all records of gross, tare and net weights (determined by use of a certified scale) shall be kept in detail and furnished to the Construction Project Manager upon request. These records will be used for payment purposes, and may be reviewed by the Construction Project Manager at any time.

*The unit price bid per ton of classified material shall include all of the Contractor's costs of whatsoever nature. The price bid shall include; excavation and preparation of subgrade; removal and disposal of all unsuitable materials; furnishing of approved materials, transporting, weighing at a certified scale as required for payment placing, addition of water as necessary and compacting the classified material; finish grading; and all other related and necessary materials, work, labor and equipment required to complete the site preparation and placement of the classified material in accordance with the Contract Documents.*

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**5-3a Overexcavation and Replacement With Select Backfill Material**

The measurement and payment for this item will be the total number of cubic yards of overexcavation and replacement with select backfill material (and/or stabilization materials

consisting of 1-1/2 inch angular aggregate as approved by the Construction Project Manager) required to construct the proposed facilities and/or appurtenances; provided, however, no measurement for payment will be made for overexcavation and replacement required due to negligence or unauthorized activities by the Contractor. The measurement for overexcavation and replacement shall start at the proposed pipe or facility subgrade, extend downward as required to produce a stable sub-base for the proposed infrastructure and extend a maximum trench width as defined in the most recent addition of the Standard Detail drawings or a maximum width agreed to by the Construction Project Manager prior to commencing overexcavation. This area shall be defined as the stabilization zone.

Payment will be solely based on the cubic yards of approved select material imported and installed within the stabilization zone defined above. Separate payment will not be made for the overexcavation under this bid item. Select material must conform to the requirements set forth in Section 5.0 of the Standard Construction Specifications. The Contractor must obtain approved submittals for all select materials used under this item from the Construction Project Manager, to ensure that the material proposed for use meets the field conditions and intended use. All delivery trucks shall be plainly numbered and all records of gross, tare and net weights (determined by use of a certified scale) as well as load volumes and weights shall be kept in detail and furnished to the Construction Project Manager upon request. These records will be used for verification purposes during payment and may be reviewed by the Construction Project Manager at any time. All hauling and disposal of construction or contaminated materials generated due to construction activities must be managed in strict conformance with the Standard Construction Specifications.

*The unit price bid per cubic yard of overexcavation and replacement shall include all of the Contractor's costs of whatsoever nature. The unit price bid shall include: trench protection, overexcavation, removal and disposal of material within the stabilization zone, removal and disposal of unsuitable material, hauling and disposal to the Denver Arapahoe Disposal Site (DADS); furnishing and installation of approved select materials, transporting, weighing at a certified scale as required for verification of payment; compaction and installation of approved select materials; dewatering as necessary to allow installation and stabilization of select materials; furnishing and installation of geotextiles or filter fabrics as required in the Contract Documents, and all other related and necessary materials, work, labor and equipment required to complete the removal in accordance with the Contract Documents.*

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**5-7 Controlled Low Strength Material (CLSM)**

The measurement and payment for this item will be the total number of cubic yards of Controlled Low Strength Material, controlled density fill, etc. approved for construction of the proposed facilities and/or appurtenances; provided, however, no measurement for payment will be made for materials required due to careless or unauthorized activities by the Contractor.

*The unit price bid per cubic yard shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: furnishing and hauling; placement, as directed by the Construction Project Manager; maintaining the mixture to the requirements provided for within the Contract Documents; protection of existing facilities; and all other related and necessary materials, work, and equipment required to furnish the material in accordance with the Contract Documents.*

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**5-9 Permeation Grouting**

The measurement and payment for this item will be per linear foot of tunnel center line that requires permeation grouting, as shown in the plans and/or as approved for construction of the proposed facilities and/or appurtenances. This is a one time, linear foot payment per tunnel, from face of structure to face of structure, no further payment will be made for additional permeation grouting needed or for careless or unauthorized activities by the Contractor.

*The unit price bid per linear foot shall include all of the Contractor's costs of whatsoever nature. The price bid shall include and is not limited to: mobilization, demobilization and remobilization of all equipment and materials as necessary to complete the work and/or accommodate access restrictions to property and special requests by property owners; permits, rental fees for offsite storage of equipment and materials; site clearing and construction access necessary for site preparation; dewatering, water control; utility locates and potholing of existing utilities prior to drilling; support of steel casing; removal, transport and disposal of muck; surface monitoring, deep settlement monitoring, surveying, surface pressure tests, monitoring of surface for leakage; design of grout program; development and submittal of a grouting layout plan; installation and removal of sleeve port pipes for grouting operations; supply, mixing, field and lab testing, and installation of chemical grout; monitoring and reporting of grouting operations; clean up and restoration of all surface features effected by grouting operations; abandonment of bore holes; furnishing and hauling; placement, as directed by the Construction Project Manager; maintaining the mixture to the requirements provided for within the Contract Documents; protection of existing facilities; demonstrating the effectiveness of grouting program; additional permeation grouting outside the estimated limits shown in the drawings as necessary for construction and all other related and necessary materials, work, and equipment required to furnish the material in accordance with the Contract Documents.*

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**8-1.1 Dip AWWA C151, Class 50 Water Line**
**8-1.3 PVC AWWA C900, Class 200 and Class 150 Water Line**
**8-1.6 PVC AWWA C905 DR18 Water Line**

The measurement and payment of each specific size of waterline pipe, except segments as may be otherwise provided for in the Contract Documents, will be the actual number of linear feet of pipe required to be removed and relocated or installed, complete, in place, as measured along the centerline of the waterline pipe from given station to given station, from center of valve to center of valve or from center of manhole to center of manhole with deductions made for the internal diameter or dimensions of manholes, structures and/or valves; provided, however, no measurement for payment will be made for pipe removed or damaged due to negligence or unauthorized operations by the Contractor.

*The unit price bid per linear foot for the construction of each section of waterline shall include all of the Contractor's costs of whatsoever nature for the complete construction of the pipeline in accordance with the requirements of the Board of Water Commissioners of Denver. The price bid shall include: furnishing of temporary sanitary facilities, bottled water and coordinating shut off to correspond with non-work hours, including night and weekends if necessary, payment of all associated inspection fees, trench sloping, benching, bracing, shoring and/or sheeting for pipe and associated appurtenances to assure safe working conditions; removal and disposal of the existing conduit and appurtenances (per State and Local requirements where applicable for lines containing asbestos), including valves, water meter's, stop boxes, fire hydrants, pressure regulating devices, restraints, and fittings; furnishing and installing required waterline pipe,*

*fittings, appurtenances, temporary facilities and blow offs; tapping and/or connecting to mainlines, installing required copper service line pipe or structures; cutting and/or plugging of all abandoned facilities crossed during construction; furnishing and installing special fittings and restraints, including: transitional pipe sections required to properly connect different types of pipe and/or any other special fittings not specifically provided for elsewhere in the Contract Documents; joints and jointing materials, including: grout, mortar, gaskets, seals, bolts, connecting bands, and other miscellaneous items as required to construct the specific pipe section; removal and disposal of pavement, roadway surface materials, concrete flatwork, sod, landscaping, stumps, brush and any other materials encountered prior to excavation; excavation, including exploratory excavation, as required by the Construction Project Manager; over-excavation to remove unsuitable foundation material and replacement with granular or other approved select materials; constructing the specified bedding including the furnishing, placing, and compaction of sand, gravel, rock and controlled low strength materials, as required by the Denver Water Board; supply and installation of protective coatings or wrappings, locate wires and boxes; backfilling to include furnishing, transporting, and placement of any additional suitable backfill material required (except for those classified backfill materials provided for elsewhere in the Contract Documents); compaction and backfilling as specified (no additional or separate payment will be made for excess excavated material used as backfill or select material elsewhere on the project); restoration of ground surface to its original condition; grading and leveling; care and diversion of drainage courses; pumping and provision of facilities for diversion of flows; trench dewatering; protection, adjustment and/or reconnection of aboveground and underground utilities and service connections, replacement of hydrant laterals and assemblies damaged during crossing, reconnection of water services; coordination of gas service and electric relocates; crossing of existing and abandoned utilities; hauling and disposal of construction debris, excess excavated material, damaged materials and contaminated materials at the Denver Arapahoe Disposal Site (DADS), recycle and salvage of materials as necessary; saw cutting and/or rotomilling within mainline ($B_f$ extents) and lateral trench extents prior to excavation; removal and replacement and/or relocation of signs, and pipe bollards; providing for additional traffic control, to include barricades, detours and flagmen unless provided for elsewhere in the Contract Documents; removal and replacement of all traffic signal and/or activated loops; valve operation tests, pipe chlorination, clear water tests, pressure tests, locate wire testing; and all other related and necessary materials, labor and equipment required to construct a complete operable pipeline in accordance with the Contract Documents and in accordance with the Denver Water Board Standards.*

*In addition to the above, the unit price bid per linear foot for slip lining, bursting, jacking, tunneling, boring and/or micro tunneling shall include the following: installation of jacking, tunneling and/or boring pits and related equipment; launching and access pits; automated spoil transportation systems; hoists; signal systems, safety equipment; sealing materials, grout, sand, casings, skids and end seals as approved by the Construction Project Manager and as required by the Denver Water Board, filling of all annular spaces and any other necessary labor; purchase, delivery and installation of all equipment and materials required to install the pipe segment and/or associated casing per the Contract Documents; heating and butt fusion jointing; removal and replacement of existing waterlines, valves, hydrants, vaults, restraints, sod, seeding, sprinkler systems, trees, bushes, shrubs, bike path, curb, gutter, sidewalk, pavement, asphalt base course, asphalt wearing surface, and any other surface restoration and/or removal/replacement required within the areas impacted due to these operations.*

### 8-1.2 Install Water Valve, Water Meter and Stop Box

The measurement and payment for this item will be the total number of water valves, water meters and stop boxes required to be installed for construction of the proposed sewer and/or appurtenances; provided, however, no measurement for payment will be made for items required to be installed due to negligent or unauthorized operations by the Contractor.

*The unit price bid for installation of this item shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation, backfilling and compaction; removal and disposal of the existing water valve, water meter and/or stop box; installing required copper service line or other pipe, installation of the item in accordance with the requirements of the Denver Water Board; supply and installation of all components required to complete the work, including stop(curb) boxes; removal and disposal of pavement and unsuitable material; and all other related and necessary materials, labor, and equipment required for removal and replacement of each item in accordance with the Contract Documents, and in accordance with Denver Water Board Standards.*

### 8-1.4 Temporary Water Main Bypass

The measurement for payment of this item will be the actual number of linear feet from the center of intersection to the center of intersection for the block being bypassed. Every block requiring temporary water main bypass will only be paid once and all work necessary within the block measured shall be included within this item. Only those sections specifically authorized by the Construction Project Manager will be bypassed and measured for payment.

*The unit price bid per linear foot for this item shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: furnishing and setting up of all equipment, labor, and materials required to temporarily bypass the existing water main around the facilities being repaired, reconstructed, or constructed to all properties being served within the effected construction areas and as approved by the Construction Project Manager; installation and maintenance of entire temporary water bypass system during the work to ensure uninterrupted service, safe operation and multimodal access by owners; vacuum breakers and inclement weather devices or procedures to protect system; supply of temporary service connections and fire services in accordance with Denver Water requirements; valve operation tests, pipe chlorination, clear water tests, pressure tests and locate wire testing; permits and fees from applicable entities; compaction and backfilling as specified (no additional or separate payment will be made for excess excavated material used as backfill or select material elsewhere on the project); materials testing and quality control; supplying of energy required to operate all bypass equipment; temporary installation of bypass piping under the pavement of cross streets, or raised transitional crossings as may be required per the approved traffic control plan; temporary surfacing; restoration of ground surface to its original condition including removal and replacement of sod, seeding, sprinkler systems, trees, bushes, shrubs, bike path, curb, gutter, sidewalk, pavement (concrete, asphalt base course, asphalt wearing surface, sub grade materials, etc.) and any other surface restoration and/or removal/replacement within the areas impacted due to these operations; removal and replacement of water fixtures, fire hydrants, valves, or any other appurtenances as necessary*

*to permit bypassing; hauling and disposal of construction debris, excess excavated material, damaged materials, unsuitable material and contaminated materials at the Denver Arapahoe Disposal Site (DADS); and all other related and necessary equipment, work, and materials required to complete the water bypassing as required in the Contract Documents or as directed by the Construction Project Manager.*

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**8-1.5a Lead Service Line Replacement, <2"ID**
**8-1.5b Lead Service Line Replacement, >2"ID**

The measurement for payment of this item will be the actual number of lineal feet of lead water service line removed and replaced as measured from the corporation stop or tee on the water main to the centerline of the external water meter. Lead services shall be replaced with a minimum size copper service line of ¾,"or to a size adequate to supply all the requirements of the property being served in accordance with Denver Water specifications and details. No measurement for payment will be made for lead service line replacement required due to negligence or unauthorized operations by the Contractor.

*The unit price bid per lead service line replacement shall include all of the Contractor's costs of whatsoever nature for the complete removal and replacement of the lead service line in accordance with the requirements of Denver Water, exclusive of appurtenances or items otherwise provided for in the Contract Documents. The price bid shall include: trench sloping, benching, bracing, shoring and/or sheeting for service lines and associated appurtenances to assure safe working conditions; barricades, fencing and signage as necessary to ensure the safety of the public; removal and disposal of the existing lead service line and appurtenances (per State and Local requirements where applicable), including valves, and fittings; furnishing, transporting, and installing required copper service line pipe, fittings, valves, and appurtenances; providing temporary service and facilities as necessary during construction; tapping and/or connecting to mainlines and/or meters; furnishing and installing special fittings for connection to the water meter, not specifically provided for elsewhere in the Contract Documents; gaskets, seals, bolts, connecting bands, and other miscellaneous items as required to construct the service line; saw cutting and/or rotomilling within trench section prior to excavation; removal and disposal of asphalt, millings, roadway surfacing materials, sod, surfacing materials, stumps, brush and unsuitable material prior to excavation; excavation, including exploratory excavation, as required by the Construction Project Manager; over-excavation to remove unsuitable foundation material and replacement with granular or other approved select materials at the specific written approval of the Construction Project Manager; constructing the specified bedding including the furnishing, placing, and compaction of sand, gravel, rock or controlled low strength materials, as required by Denver Water; supply and installation of protective coatings or wrappings, locate wires and boxes; backfilling to include furnishing, transporting, and placement of any additional suitable backfill material required (except for those classified backfill materials provided for elsewhere in the Contract Documents); compaction and backfilling as specified (no additional or separate payment will be made for excess excavated material used as backfill or select material elsewhere on the project); grading and leveling; restoration of ground surface to its original condition including the removal and replacement of sod, seeding, sprinkler systems, trees, bushes, shrubs, bike path, curb, gutter, sidewalk, pavement, asphalt base course, asphalt wearing surface and any other surface restoration and/or removal/replacement required within areas impacted due to these operations; care and diversion of drainage courses; trench dewatering; protection, adjustment and/or reconnection of aboveground and underground utilities; coordination of gas service and electric relocates; crossing of existing and abandoned*

*utilities; hauling and disposal of construction debris, excess excavated material, damaged materials and contaminated materials at the Denver Arapahoe Disposal Site (DADS); removal and replacement and/or relocation of signs, and pipe bollards; providing for additional traffic control, to include barricades, detours and flagmen as specified per the approved MHT/Street Occupancy permit; removal and replacement of all traffic signal and/or activated loops; valve operation tests, pipe chlorination, clear water tests, pressure tests, locate wire testing; permits and fees from applicable entities; and all other related and necessary materials, labor and equipment required to construct a complete operable water service line in accordance with the Contract Documents and in accordance with Denver Water specifications and standards.*

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**8-2 Remove Fire Hydrant Assembly**

The measurement and payment for this item will be the total number of fire hydrants required to be removed for construction of the proposed sewer and/or appurtenances; provided, however, no payment will be made for hydrants replaced due to negligent or unauthorized operations by the Contractor.

*The unit price bid for removal of this item shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation; removal and disposal(or recycling as applicable) of hydrant, fittings, restraints, valves and appurtenances; plugging and capping of hydrant service line as required; backfilling and compaction; removal and disposal of pavement and unsuitable material; and all other related materials, work, and equipment required for removal of this item in accordance to the Contract Documents, and in accordance to the Denver Water standards.*

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**8-3 Reset or Install Fire Hydrant Assembly**

The measurement and payment for this item will be the total number of fire hydrants required to be reset and/or placed for construction of the proposed sewer and/or appurtenances; provided, however, no payment will be made for hydrants reset and/or installed without authorization by the Construction Project Manager or due to negligent operations of the Contractor.

*The unit price bid for this item shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation; furnishing, installation and assembly of all materials including but not limited to: hydrant, risers, fittings, restraints, valves and appurtenances; resetting existing hydrants as permitted; backfilling and compaction; removal and disposal of pavement and unsuitable material; operation tests, chlorination tests, clear water tests, pressure tests, and all other related and necessary materials, work, and equipment required for installation of the fire hydrant assembly in accordance with Denver Water standards.*

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**12-1.1 6" Curb and Gutter – 2' Pan (CDOT T2, IIB)**
**12-1.2 6" Curb and Gutter – 1' Spill Pan (CDOT T2 IB)**
**12-1.4 9" Curb and Gutter**
**12-1.5 Combination Curb, Gutter and Sidewalk (2'-8")**
**12-1.6 Combination Curb, Gutter and Sidewalk (3'-11")**
**12-1.6a Combination Curb, Gutter and Sidewalk (4'-11")**
**12-1.7 6" Concrete Curb Head**

**12-1.8 Handicap Concrete Curb Ramp**
**12-1.9 Gutter Overlay**
**12-2.1 Concrete Sidewalk**
**12-2.2 Reinforced Concrete Sidewalk**
**12-2.3 Concrete Bike Path**
**12-2.4 Miscellaneous Concrete Flatwork**
**12-3 Concrete Valley Gutter (all sizes)**
**12-4.1 Concrete Street Intersection Gutter (Crosspan)**
**12-4.2 Concrete Street Intersection Gutter with Slot**
**12-4.3 Special Precast Concrete Intersection Gutter**
**12-5.1 Concrete Driveway Paving**
**12-5.2 Concrete Apron**
**12-5.3 Concrete Bus Pad**
**12-5.4 Concrete Alley Gutters**
**12-5.5 Concrete Alley Paving**
**12-5.6 Concrete Alley Returns**
**12-5.7 Concrete Street Paving**
**12-6 Concrete Median Strip**
**12-8 Concrete Steps**

The measurement and payment for installation of this item will be the total number of linear feet for: gutter overlay, curb and gutter, curb head, combination curb gutter and sidewalk, or the total number of square feet for: median strips, sidewalk, bike path, driveway pavement, street paving, crosspans, handicap curb ramps, alley paving, alley gutters, alley returns, single or double flare aprons, bus pads, valley gutter, concrete steps or any other type of miscellaneous concrete flatwork placed and accepted; provided, however, no measurement and payment will be made for flatwork placed due to careless or unauthorized operations by the Contractor.

All concrete ingredients and additives must be combined and mixed at the batch plant prior to transport. Onsite additions to the concrete mix, of any type, will not be allowed without prior authorization of the Construction Project Manager.

*The unit price bid per square foot of concrete steps shall be quantified by the width of the stairs multiplied by the summation of each stair hypotenuse (the hypotenuse of the rise and run of each stair). The unit price bid per linear foot or square foot placement of these items shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: sawcutting and/or rotomilling surrounding surface to allow placement, removal of pavement or roadway surfacing; concrete sawing, furnishing and placing the concrete; forming, finishing and curing compounds; contraction and expansion joints where required by Construction Project Manager, including partial depth sawcuts; joint sealing compounds; reinforcing as required and specified; providing high early concrete as necessary to meet specific project needs; concrete additives including, but not limited to: set retarders, accelerators and polypropylene fibrillated fibers as directed and approved by Construction Project Manager; edging the concrete surface; furnishing, transporting, installing and compaction of materials required for a stable sub-base; removal and disposal of unsuitable subgrade materials (including frost), replacement with suitable backfill as necessary; backfilling and pavement around new flatwork; protection from freezing and vandalism; and all other related and necessary materials, work and equipment required to construct this item in accordance with the Contract Documents.*

**12-7 Non-reinforced Concrete Median Barrier**
**12-9 Concrete Headwall**
**12-10 Concrete Lined Ditches**
**12-11 Concrete Planters**
**12-12 Concrete Cradle for Class "A" Bedding**
**12-13 Concrete Encasement around Pipe**
**12-14 Concrete Cut-Off Wall**
**12-16a Concrete Retaining Wall**
**12-16b Block Retaining Wall**

The measurement for payment of bulk concrete items such as median barriers, cradles, encasements, cut off walls, lined ditches and planters will be the total number of cubic yards of concrete required for construction. The measurement and payment for retaining walls will be a lump sum payment for each wall and type as indicated in the contract documents. The measurement and payment for headwalls will be based upon the actual number required as indicated within the contract documents for construction of the proposed sewer and/or appurtenance. No payment will be made for any of these items replaced due to negligent or unauthorized operations by the Contractor.

*The unit price bid per cubic yard, lump sum or each for these items shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: furnishing, transporting, and installing concrete materials, steel reinforcement, add mixtures and fiber reinforcement as required, and block materials; excavation and overexcavation; furnishing, transporting and installing necessary subgrade, bedding and drainage materials, forming and curing compounds; finishing and edging of concrete; winter protection; backfilling and compaction; grinding, patching and finishing of concrete wall surfaces, application of wall finishes as indicated in the contract documents, installation and furnishing of all fence and/or railing noted for individual wall segments; hauling and disposal of construction debris, excess excavated material, damaged materials and contaminated materials to the Denver Arapahoe Disposal Site (DADS); and all other related and necessary materials, work and equipment required to construct this item in accordance with the Contract Documents.*

**16-1 Security Fence**
**16-2a Single Swing Gate**
**16-2b Double Swing Gate**
**16-3 Chain Link Fence**
**16-4 Wood Fence**
**16-5 Single Steel Post Guardrail**
**16-6 Single Wood Post Guardrail**
**16-7 Permanent Barricades**
**16-8 Hand Rail**

The measurement and payment for this item will be the total number of linear feet of security fence with view obscuring material (privacy screen), chain link fence, wood fence, guardrail, hand rail, and permanent barricades or the total number of swing gates required to be placed for construction, as agreed upon by the Construction Project Manager; provided, however, no measurement for payment will be made for fence work required to be placed due to negligence or unauthorized operations by the Contractor.

*The unit price bid per lineal foot or per item placement shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: furnishing and placement of new fencing materials to the height specified in the Contract Documents, including rails, posts, pickets, hardware, locks, paints, special treatments, concrete for posts, single swing gates, double swing gates, steel posts for guard rail, guard rail, wood posts; maintenance, relocation and removal of security fencing, hand rails; replacement of electric outlets, security wire (barbed, razor, etc.) and all other related and necessary materials, work and equipment required to construct the fence work in accordance with the Contract Documents.*

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**20-1 Asphalt Temporary Patching**

The measurement for payment of this item will be the actual number of square yards per inch of asphalt temporary patching mix placed, complete and in place, after the area has been properly backfilled and compacted, as required for the proposed sewer and/or appurtenances; provided, however, no measurement for payment will be made for asphalt temporary mix placed in areas not specifically approved by the Construction Project Manager, or required due to careless or unauthorized operation by the Contractor.

The asphalt temporary mix may consist of either hot or cold asphaltic surface material. Unless otherwise specified in the Contract Documents, the minimum thickness of asphalt temporary patching mix required is two inches (2").

*The unit price bid per square yard per inch of asphalt temporary patching mix shall include all of the Contractor's costs of whatsoever nature for the complete construction of the sewer, appurtenances, street or items otherwise indicated within the Contract Documents. The price bid shall include: all preparatory work for placement to grade; disposal of construction debris and unsuitable materials at the Denver/Arapahoe Disposal Site (DADS); street sweeping; removal and disposal of backfill or subgrade materials to the required elevation and preparation for temporary asphalt placement; temporary asphalt material, hauling, rolling, and compaction; maintenance of the temporary patch to include regrading, recompacting, and renewing the material at sufficient intervals of time to ensure a smooth, dust/mud free driving and/or walking surface; temporary striping as required; removal and disposal of temporary asphalt mix prior to permanent asphalt paving operations; and all other related and necessary materials, work and equipment required to furnish and place the asphalt temporary patch in a manner satisfactory to the Construction Project Manager and in accordance with the Contract Documents.*

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**20-2 Asphalt Surface Course**

The measurement for payment of this item will be the actual number of square yards per inch of hot mix asphalt surface course, in place, complete, and accepted by the Construction Project Manager, as required for construction of the proposed improvements in accordance with the Contract Documents; provided, however, no measurement for payment will be made for hot mix asphalt surface course placed in areas not specifically approved by the Construction Project Manager, nor required due to careless or unauthorized operation by the Contractor.

Unless otherwise directed by the Construction Project Manager, the hot mix asphalt surface course shall be placed at a minimum of two-inch (2") thickness and only in the areas indicated within the Contract Documents. This item may be used for work within the trench limits and/or outside the trench limits as indicated within the Contract Documents and as directed by the Construction Project Manager.

*The unit price bid per square yard per inch for hot mix asphalt surface course shall include all of the Contractor's costs of whatsoever nature for the complete construction of the proposed sewer, appurtenances, street or items otherwise indicated within the Contract Documents. The price bid shall include: obtaining all necessary permits and paying any associated fees; additional milling and/or sawcutting of the existing pavement to ensure a smooth and square joint between existing and new pavement; loading, hauling, and disposal of existing asphalt , all related construction debris and unsuitable materials at the Denver/Arapahoe Disposal Site (DADS); recycling of appropriate materials generated during the work; asphalt tack coat; hot mix asphalt, hauling, placing, rolling, and compaction; raising of manhole rings; street sweeping and clean up; traffic control not provided for elsewhere in this Contract Documents; temporary striping as required; QC testing; and all other necessary materials, work, and equipment required for placement of the hot mix asphalt surface course in a manner satisfactory to the Construction Project Manager and in accordance with the Contract Documents.*

**20-3 Asphalt Base Course**

The measurement for payment of this item will be the actual number of square yards per inch of hot mix asphalt base course, in place, complete, and accepted by the Construction Project Manager, as required for construction of the proposed improvements in accordance with the Contract Documents; provided, however, no measurement for payment will be made for hot mix asphalt base course placed in areas not specifically approved by the Construction Project Manager, nor required due to careless or unauthorized operation by the Contractor.

Unless otherwise directed by the Construction Project Manager, the hot mix asphalt base course paving shall be placed to the depth and only in the areas specified in the Contract Documents. This item may be used for work within the trench limits and/or outside the trench limits as indicated within the Contract Documents and as directed by the Construction Project Manager.

*The unit price bid per square yard per inch of hot mix asphalt base course shall include all of the Contractor's costs of whatsoever nature for the complete construction of the proposed sewer, appurtenances, street or items otherwise indicated within the Contract Documents. The price bid shall include: obtaining all necessary permits and paying any associated fees; saw cutting and/or milling the existing pavement smoothly and squarely in a manner satisfactory to the Construction Project Manager to assure a smooth joint (ripping and wheel-cutting is not permitted); loading, hauling, removal and disposal of existing asphalt pavement, unsuitable material and excess excavated material at the Denver/Arapahoe Disposal Site (DADS); subgrade preparation, backfilling and compaction to include furnishing, transporting and placement of any additional suitable backfill material required; recycling of appropriate materials generated during the work; asphalt tack coat; hot mix asphalt, hauling, placing, rolling, and compaction; street sweeping and clean up; traffic control not provided for elsewhere in the Contract Documents; temporary striping as required; QC testing; and all other necessary materials, work, and equipment required for placement of the hot mix asphalt base course in a manner satisfactory to the Construction Project Manager and in accordance with the Contract Documents.*

**20-4 Asphalt Rotomilling**

The measurement for payment of this item will be the actual number of square yards per inch of asphalt or concrete material rotomilled to the depth specified within the Contract Documents or as directed by the Construction Project Manager to complete the proposed street paving. No measurement for payment will be made for asphalt or concrete rotomilled in areas which

are not specifically approved by the Construction Project Manager, indicated within the Contract Documents or required due to careless or unauthorized operations by the Contractor.

No measurement for payment will be made under this bid item for rotomilling within the designated pipe trench limits or other miscellaneous areas where sewer, appurtenances or associated flatwork are to be constructed. These costs shall be included in the unit price bid for the related pipe, structures, or appurtenances and are provided for elsewhere in the Contract Documents. This pay item will be used to pay for rotomilling required after installation of the proposed sewer and/or appurtenances for milling on either side of the trench limits prior to placement of the asphalt base and/or surface course, and as specified within the Contract Documents or as directed by the Construction Project Manager.

*The unit price bid per square yard per inch of rotomill shall include all of the Contractor's work of whatsoever nature for the complete construction as indicated within the Contract Documents. The price bid shall include: obtaining all necessary permits and paying any associated fees; loading; hauling, removal and disposal of unsuitable materials, millings and excess excavated material at the Denver/Arapahoe Disposal Site (DADS) or recycling as appropriate; traffic control not provided for elsewhere in the Contract Documents; street sweeping; surface preparation; and all other necessary materials, work, and equipment required for rotomilling in a manner satisfactory to the Construction Project Manager and in accordance with the Contract Documents.*

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**20-5 Asphalt Patch**

The measurement for payment of this item will be the actual number of square yards per inch thickness of hot mix asphalt used for asphalt patching purposes, complete, in place and accepted by the Construction Project Manager; provided, however, no measurement for payment will be made for asphalt patching placed in areas not specifically approved by the Construction Project Manager, or required due to careless or unauthorized operations by the Contractor.

This pay item will be used to pay for asphalt material used outside the limits established in Pay Items 20-2 and 20-3. This pay item will be used to pay for replacement of street paving outside the normal specified limits in areas deemed necessary by the Construction Project Manager.

*The unit price bid per square yard per inch of thickness of hot mix asphalt patching shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: obtaining all necessary permits; paying any associated fees; saw cutting and/or milling the existing pavement smoothly and squarely in a manner satisfactory to the Construction Project Manager to assure a smooth joint (ripping and wheel-cutting is not permitted); loading, hauling, removal and disposal of existing asphalt pavement, rotomillings, unsuitable material and/or excess excavated material; subgrade preparation, backfilling and compaction of subgrade to include furnishing, transporting and placement of any additional suitable backfill material required; asphaltic tack coat; fresh asphalt hauling, placing, rolling, and compaction; street sweeping and clean up; traffic control not provided for elsewhere in the Contract Documents; temporary striping as required; QC testing; and all other necessary materials, work, and equipment required for placement of the hot mix asphalt trench pavement in a manner satisfactory to the Construction Project Manager and in accordance with the Contract Documents.*

**20-6 Placement (Only) For Recycled Asphalt**

The measurement for payment of this item will be the actual number of square yards per inch thickness of recycled asphalt pavement placed, complete, in place, and accepted by the Construction Project Manager, as required for construction of the proposed sewer and/or appurtenances; provided, however, no measurement for payment will be made for recycled asphalt pavement placed in areas not specifically approved by the Construction Project Manager, or required due to careless or unauthorized operations by the Contractor, or pavement damage caused by the Contractor's equipment or method of operation.

*The unit price bid per square yard per inch of recycled asphalt shall include all of the Contractor's costs of whatsoever nature for the complete construction of the proposed sewer, appurtenances, or items otherwise provided for elsewhere in the Contract Documents. The price bid shall include: obtaining all necessary permits and paying all associated fees; saw cutting to achieve a smooth joint; asphalt tack coat; asphalt hauling, placement, rolling, and compaction; disposal of unsuitable material; street sweeping and cleanup; and all necessary materials, work, and equipment required to furnish and place the recycled asphalt pavement smoothly and squarely in a manner satisfactory to the Construction Project Manager in accordance with the Contract Documents.*

**20-7 Install Asphalt Path**

The measurement and payment for this item will be the actual number of square yards per inch thickness of hot mix asphalt placed to the dimensions shown in the Contract Documents or as directed by the Construction Project Manager, complete, in place, accepted, and as required for construction of the proposed sewer and/or appurtenances; provided, however no measurement for payment will be made for asphalt path placed in areas not specifically approved by the Construction Project Manager or required due to careless or unauthorized operations by the Contractor.

*The unit price bid per square yard per inch of hot mix asphalt shall include all of the Contractor's costs of whatsoever nature for the complete construction of the proposed sewer, appurtenances, or items otherwise provided for elsewhere in the Contract Documents. The price bid shall include: obtaining all necessary permits and paying all associated fees; saw cutting to achieve a straight joint; weed removal, grubbing, subgrade preparation, removal and disposal of unsuitable material and excess excavated material, placement of select subgrade material as necessary, compaction, installation of weed block fabric; asphalt tack coat; asphalt hauling, placement, rolling, and compaction; permanent stripping as required; disposal of unsuitable material; street sweeping and cleanup; and all necessary materials, work, and equipment required to furnish and place the hot mix asphalt path smoothly and squarely in a manner satisfactory to the Construction Project Manager in accordance with the Contract Documents.*

**20-8 Asphalt Curb Head**

The measurement for payment of this item will be the total number of linear feet of asphalt curb head required to be placed for construction of the proposed sewer and/or appurtenances; provided, however, no measurement for payment for asphalt curb will be made for curb head required to be placed due to negligence or unauthorized operations by the Contractor.

*The unit price bid for placement of this item shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: asphalt hauling, placement, rolling, compaction, shaping; excavation, backfilling and compaction; stabilizing the sub base; establishing grade; providing all labor, equipment and materials required to place asphalt curb as required and specified in the Contract Documents; disposal of excess or unsuitable materials including asphalt, concrete, landscaping materials etc; saw cutting, milling; street sweeping and clean up; traffic control not provided for elsewhere in the Contract Documents; asphalt tack coat; replacement and reestablishment of landscaping, sod, seed, irrigation systems and/or any other items impacted during placement of this item; and all other related and necessary materials work and equipment required to place this item in accordance with the Contract Documents or at the direction of the Construction Project Manager.*

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**20-9a Saw Cut Asphalt/Concrete (0-150 LF)**

The measurement and payment for saw cutting from 0-150 linear feet will be the actual number of linear feet up to 10-inches of depth of asphalt or concrete that is saw cut and accepted; however, no measurement for payment will be made due to negligent or unauthorized operations by the Contractor.

*The unit price bid will be the actual number of linear feet of asphalt or concrete that is saw cut to the full depth and shall include all of the Contractor's costs of whatsoever nature. The unit price bid shall include but not be limited to: mobilization, traffic control, surface preparation, clean up and disposal of debris, fugitive dust control, slurry removal and protection of storm water inlets; protection of utilities, street cut and occupancy permits, and all other related and necessary materials, work and equipment required to complete the saw cut as directed by the Construction Project Manager and in accordance with the Contract Documents*.

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**20-9b Saw Cut Asphalt/Concrete (>150 LF)**

The measurement and payment for saw cutting distances greater than 150 lineal feet will be the actual number of linear feet up to 10-inches of depth of asphalt or concrete that is saw cut and accepted; however, no measurement for payment will be made due to negligent or unauthorized operations by the Contractor.

*The unit price bid will be the actual number of linear feet of asphalt or concrete that is saw cut to the full depth and shall include all of the Contractor's costs of whatsoever nature. The unit price bid shall include but not be limited to: mobilization, traffic control, surface preparation, clean up and disposal of debris, fugitive dust control, slurry removal and protection of storm water inlets; protection of utilities, street cut and occupancy permits, and all other related and necessary materials, work and equipment required to complete the saw cut as directed by the Construction Project Manager and in accordance with the Contract Documents.*

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**21-1 Concrete Pavement**

The measurement and payment for this item will be the actual number of square feet of concrete placed and accepted; provided, however, no measurement for payment will be made for concrete pavement outside of the prescribed trench width or other dimensions as shown in the Contract Documents. Pavement required to be replaced due to careless or unauthorized operations by the Contractor will not be included in the amount computed for payment.

All concrete ingredients and additives must be combined and mixed at the batch plant prior to transport. Onsite additions, to the concrete mix, of any type will not be allowed without prior authorization of the Construction Project Manager.

*The unit price bid per square foot of pavement shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: forming, reinforcing chairs or supports as required by the Construction Project Manager, concrete, reinforcement, doweling; excavation; disposal of unsuitable material; curing compounds; contraction and expansion joints where required by Construction Project Manager, including partial depth sawcuts; joint sealing compounds; reinforcing as required and specified; providing high early concrete as necessary to meet specific project needs; concrete additives including, but not limited to; set retarders, accelerators and polypropylene fibrillated fibers as directed and approved by Construction Project Manager; finishing and edging; furnishing, transporting, installing, and compaction of all materials required for a stable subbase; removal and disposal of excess subgrade materials; QC testing; and all other related and necessary materials, work and equipment required to construct the pavement in accordance with the Contract Documents.*

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**22-1 Earthwork**

The measurement and payment for this item will be the total number of square yards of material to be removed and/or filled for construction as shown in the plans. The measurement for payment of this item will be based on the actual surface area within the footprint of the proposed embankment prior to construction activities.

The unit bid price per square yard of earthwork shall include: all labor, equipment , material, subcontractors and incidentals required to perform earthwork as identified within the contract documents; clearing and grubbing; excavation; loading, hauling and disposal of excess excavated material and debris, stockpiling as necessary; hauling, procurement, placement and compaction of embankment materials as required; grading; diversion of water courses and/or dewatering operations as necessary; compaction to specified limits; excavation below the grades shown on plans to remove unsuitable foundation material, replacement of unsuitable foundation materials with suitable select materials; QC testing; and all other materials, work and equipment required to complete the construction in accordance with the contract documents.

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**27-1 Steel Sheet Piling**

The measurement and payment for this item will be the actual number of horizontal lineal feet of steel sheet piling installed, regardless of depth needed, accepted, and left in place (or removed after completion of construction activities) up to one foot above the top of the new sewer pipe and/or appurtenance or the utility being protected. Provided, however, no measurement for payment will be made for steel sheet piling placed due to careless or unauthorized operations by the Contractor.

*The unit bid price per linear foot of steel sheet piling shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: placement, excavation, materials, diversion of water courses, welding where required, removal where applicable, backfilling and compaction; cutting of the steel sheeting smoothly and squarely in a manner satisfactory to the Construction Project Manager.*

**30-1 Riprap**
**30-2 Grouted Rip Rap**
**30-2a Grouted Boulders (2-Foot Diameter)**
**30-2b Grouted Boulders (3-Foot Diameter)**
**30-2c Grouted Boulders (5-Foot Diameter)**
**30-2k Boulder (4-Foot Diameter)**
**30-2l Boulder (5-Foot Diameter)**
**30-3 Rock Filled Gabions**
**30-4 Derrick Stone/Riprap Outfall**

The measurement for payment of this item will be the total number of square yards of riprap, soil riprap, grouted riprap, grouted boulders and/or derrick stone, or the total number of boulders, or the total number of tons used for rock filled gabions required to be furnished and placed on site for construction of the proposed sewer and/or appurtenances; provided, no measurement for payment will be made for items installed due to careless or unauthorized operations by the Contractor.

*The unit price bid per square yard of riprap, soil riprap, grouted riprap, grouted boulders and derrick stone, shall be quantified based on the area of the installed surface directly parallel with the ground. The unit price bid per square yard, per ton, or per boulder shall include: clearing and grubbing; excavation; preparation of bedding/subgrade areas to include over excavation, furnishing, transporting, installing and compaction of all materials required for a stable sub-base and as shown in the details; removal and disposal of excess excavated materials; diversion of water courses and/or dewatering operations as necessary; supply and installation of filter and/or stabilization materials; filter and riprap drains; drain materials; concrete and/or grout; grouting of riprap or boulders; placing of riprap or boulders to the elevations shown on the Contract Documents or as directed by the Construction Project Manager; mattress units and materials for rock filled gabions; overexcavation and replacement with suitable materials; hauling and placing of all materials; and all other materials, work and equipment required to complete construction in accordance with the Contract Documents.*

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**30-2e 36" Grouted Boulder Edge**
**30-2f 48" Grouted Boulder Edge**

The measurement and payment of this item will be the total linear feet of boulder edge required to be furnished and placed on site for construction of the proposed channel; provided, no measurement for payment will be made for items installed due to careless or unauthorized operations by the Contractor.

*The unit price bid per linear foot of boulder edge shall be quantified based on the length of installed boulder along the proposed channel edge. The unit price bid per linear foot of boulder shall include: excavation; preparation of bedding/subgrade areas to include over-excavation as necessary; clearing and grubbing; furnishing, transporting, installing and compaction of all materials (bedding, rip rap, rock, or select fill) required for a stable sub-base and as shown in details; removal and disposal of excess excavated materials; diversion of water courses and/or dewatering operations as necessary placing of boulders to the elevations shown on the Contract Documents or as directed by the Construction Project Manager; grouting of boulders as shown in the details; installation of weep holes*

*as required; hauling and placing of all materials; and all other materials, work and equipment required to complete construction in accordance with the Contract Documents.*

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**34-2 C-76 RCP**
**34-3 C-361 RCP**
**34-4 C-506 ARCH Pipe**
**34-5 C-507 RCP**
**34-6.1 Box Culvert - Cast-In-Place**
**34-6.2 Box Culvert - Precast**
**34-7.1 PVC Pipe**
**34-7.2 PVC Slipliner Pipe**
**34-7.3 PVC Pipe with Steel Casing**
**34-8.1 HDPE SDR 17 Pipe By Bursting (PE 345434E)**
**34-9.1 ASTM A746 D.I. Pipe**
**34-10.4 Steel Casing Pipe BY JACKING/BORING with Centrifugally Cast Concrete Liner**
**34-10.5 Steel Pipe by JACKING/BORING**
**34-11.1 PVC Pipe By Jacking/Boring With Steel Casing**
**34-11.2 C-76 RCP, Class V By Jacking/Boring, Joint Type R-2**
**34-11.3 C-361 RCP By Jacking/Boring (see notes for class & cover depth)**
**34-11.4 HDPE SDR 17 Pipe By Jacking/Boring With Steel Casing (PE 345434E)**
**34-11.5 C-76 RCP, Class III By Jacking/Boring With Steel Casing**
**34-11.6 RPMP By Jacking/Boring**
**34-11.7 C-76 RCP, Class III By Jacking/Boring, Steel Bell Band**
**34-11.8 C-76 RCP, Class V By Jacking/Boring, Steel Bell Band**
**34-11.9 RPMP by Open Cut**
**34-11.10 RCBC ByJacking/Boring**

The measurement and payment of each specific size or type of pipe, except segments as may be otherwise provided for in the Contract Documents, will be the actual number of linear feet of sewer pipe installed, complete, in place, as measured along the centerline of the pipe from inside face of manhole to inside face of manhole, from inside face of manhole to given station, from given station to given station, or from center of manhole to center of manhole with deductions made for the internal diameter or dimensions of manholes and/or structures. Where special fittings have been specified and provided for elsewhere in the Contract Documents, deductions will be made for their lengths.

Open Cut

*The unit price bid per linear foot for the construction of each section of pipeline shall include all of the Contractor's costs of whatsoever nature for the complete construction of the pipeline, exclusive of manholes, appurtenances, or items otherwise provided for in the Contract Documents. The bid item shall include: trench sloping, benching, bracing, shoring and/or sheeting for pipe and associated appurtenances to assure safe working conditions; design of shoring, stamping and approval by an Engineer licensed in the State of Colorado, submittal as required; furnishing, transporting and installing all pipe and materials; tapping and/or connecting to mainline pipes, structures, stub outs or block outs; concrete coring; plugging of all abandoned lines crossed during construction; furnishing and installing special fittings, including: trash racks, concrete pipe plugs as required, transitional pipe sections required to properly*

*connect different classes of pipe without a manhole or structure and any other special fittings not provided for elsewhere in the Contract Documents; joints and jointing materials, including: grout ,mortar, fiberglass resin, gaskets, seals, bolts, concrete collars, connecting bands, and other miscellaneous items as required to construct the specific pipe joint per manufacturer and City standards; saw cutting and/or rotomilling within mainline ($B_f$ extents) and lateral trench extents prior to excavation; removal and disposal of pavement, roadway surface materials, concrete flatwork, sod, landscaping, stumps, brush, unsuitable material within the trench width and any other materials encountered prior to excavation; excavation, including exploratory excavation, as required by the Construction Project Manager; over-excavation to remove unsuitable foundation material and replacement with granular or other approved select materials; constructing the specified bedding including the furnishing, placing, and compaction of sand, gravel and rock as required for class B bedding or approved substitution; supply and installation of protective coatings or wrappings; backfilling to include furnishing, transporting, and placement of any additional suitable backfill material required (except for those classified backfill materials provided for elsewhere in the Contract Documents); compaction and backfilling as specified, no additional or separate payment will be made for excess excavated material used as backfill or select material elsewhere on the project; restoration of ground surface to its original condition; grading and leveling; care and diversion of drainage courses; pumping and provision of facilities for diversion of flows; trench dewatering; protection and adjustment of aboveground and underground utilities and service connections or laterals, including water service reconnections and adjustments; sanitary sewer encasement; adjustment and reconnection of sanitary sewer services from mainline sewer to a point where proper connection and drainage can be achieved, unless provided for elsewhere in the Contract Documents; removal and replacement of hydrant laterals and assemblies damaged or relocated during crossing; coordination of gas service and electric relocates; crossing of existing and abandoned utilities; cutting and/or plugging of abandoned or crossed lines where indicated in the Contract Documents, or as directed by the Construction Project Manager; hauling and disposal of construction debris, excess excavated material, damaged materials, unsuitable materials and manifested contaminated materials at the Denver Arapahoe Disposal Site (DADS), recycle and salvage of materials as necessary; removal and replacement and/or relocation of signs, and pipe bollards; providing for additional traffic control, to include barricades, detours and flagmen unless provided for elsewhere in the Contract Documents; removal and replacement of all traffic signal and/or activated loops; QC testing for all associated work components; and all other related and necessary materials, labor and equipment required to construct a complete operable pipeline in accordance with the Contract Documents.*

*Tunneling*

*In addition to the above, the unit price bid per linear foot for slip lining, bursting, jacking, tunneling, boring and/or micro tunneling shall include the following: installation of jacking, tunneling and/or boring pits, intermediate jacking stations, rescue pits and related equipment; launching and access pits; design of bracing/shoring for all pits by an Engineer licensed in the State of Colorado; dewatering and water control; installation and maintenance of pit safety equipment; removal of shaft support systems; utility coordination, locating and potholing within pit and tunnel locations prior to starting construction operations; compensation grouting, all equipment and materials necessary to complete this work, developing and submitting detailed grout programs; installation of grout pipes; monitoring, recording and reporting of grouting operations; associated QC testing; removal of grout pipes after completion of tunneling, subsurface investigation and testing prior to installation; installation, monitoring/recording, maintenance and removal upon completion of surface monitoring points/arrays, deep settlement monitoring points, inclinometers and all related equipment*

*and/or software; steel joint rings on reinforced concrete pipe; automated spoil transportation systems; hoists; fluids and slurries; signal systems, safety equipment; protective joint seals/wraps; sealing materials, joint cushions, reaction thrust blocks, grout, sand, casings, skids and end seals as approved by the Construction Project Manager; filling of all annular spaces after completion of tunnel installation via contact grouting; steel casing pipe and welding to create water tight joints and any other necessary labor, equipment and materials; purchase, delivery and installation of all equipment and materials required to install the pipe segment and/or associated casing per the Contract Documents; heating and butt fusion jointing; within pit locations: removal and replacement of existing waterlines, valves, hydrants, vaults, restraints, sod, seeding, sprinkler systems, trees, bushes, shrubs, bike path, curb, gutter, sidewalk, pavement, asphalt base course, asphalt wearing surface, and any other surface restoration and/or removal/replacement required within the areas impacted due to these operations.*

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**34-12.1 4' Diameter Precast Manhole**
**34-12.2 5' Diameter Precast Manhole**
**34-12.3 6' Diameter Precast Manhole**

The measurement and payment for manholes shall be the total number of individual manholes, complete, in place required for construction of the proposed sewer and /or appurtenances.

*The unit price bid per manhole structure shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: furnishing, transporting and installation of all materials, excavation including overexcavation to remove unsuitable foundation material and replacement with suitable material; sheeting and/or bracing; forming; cast-in-place or precast bases; concrete; steel reinforcement; precast barrel sections, flat tops and cones; brick, mortar, plastic joint sealant and grout; manhole steps, rings, cover, cast iron riser rings as specified by the Construction Project Manager; construction and shaping of the manhole base invert as shown in the standard details, and to incorporate lateral connections and flows into the main channel; water stop gaskets, all boots and bands; cutting and plugging of existing sewer lines as required; reconnection of existing lateral sewer lines to new structure as required, including pipe, couplings and all other materials, equipment and labor required to complete proper reconnection; core drilling into structure as necessary; construction of stub-outs or block-outs; elimination of infiltration; removal and replacement of pavement, base course, sub-base material, sod and other surfacing materials; backfill and compaction; and all other related and necessary materials, work and equipment required to construct the manholes, complete in accordance with the Contract Documents.*

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**34-12.4 Type B Manhole**
**34-12.5 Type P Manhole**
**34-12.6 Outfall Structure**
**34-12.7 Special Structure**

The measurement and payment for cast in place manholes and/or structures shall be the total number of manholes or structures, complete, in place, required for construction of the proposed sewer and/or appurtenances.

*The unit price bid per manhole and/or structure shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: furnishing, transporting and installation of all materials, excavation (including overexcavation to remove unsuitable foundation material and replacement with suitable material); sheeting and/or bracing; forming; concrete; providing high*

*early concrete as necessary to meet specific project needs; concrete additives including, but not limited to; set retarders, accelerators and polypropylene fibrillated fibers as directed and approved by Construction Project Manager; steel reinforcement; precast barrel sections, flat tops and cones; brick, mortar, plastic joint sealant and grout; manhole rings, covers and cast iron riser rings as specified by the Construction Project Manager; construction and shaping of the manhole base invert as shown in the Standard Construction Specifications, and to incorporate lateral connections and flows into the main channel; beveling and shaping of entrance/exit as required; cutting and plugging of existing sewer lines as required; reconnection of existing lateral sewer lines to new structure as required, including pipe, couplings and all other materials, equipment and labor required to complete proper reconnection; core drilling into structure as necessary; construction of stub-outs or block-outs; construction of waterproof joints; installation of water stop gaskets, boots and bands; elimination of infiltration; removal and replacement of pavement, base course, sub-base material, sod, decorative landscaping and other surfacing materials; backfill and compaction; and all other related and necessary materials, work and equipment required to construct the manholes and/or structures, complete, in accordance with the Contract Documents.*

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**34-12.8 Uncover and Raise (Adjust) Manhole**

The measurement and payment for this item will be the number of vertical linear feet of manhole height required to be located, uncovered, and raised for construction of the proposed sewer and/or appurtenances as required in the Contract Documents, by the Construction Project Manager or as determined via video inspection. Payment will be based upon completion of the work to a manner satisfactory to the Construction Project Manager and in accordance with the Contract Documents. No measurement for payment will be made for manhole adjustments required due to negligence or unauthorized operations by the Contractor.

*The unit bid for completion of this item shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: locating, including electronic sensing if needed; excavation and overexcavation; removal and disposal of unsuitable material and excess excavated materials; backfill with approved materials; compaction; furnishing and transporting of all materials and equipment; cutting or adjusting of the manhole in a manner satisfactory to the Construction Project Manager; furnishing and placement of concrete, brick, mortar, concrete risers, concrete barrels, flat tops, cones, rings, covers, cast iron risers, plastic joint sealant, grout, manhole steps and all other related and necessary materials, work and equipment required to adjust manholes in accordance with the Contract Documents.*

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**34-12.9 Adjust Utility Lids**

The measurement and payment for this item will be the number of utility lids including but not limited to fiber optic, telecommunications, pull boxes, valve boxes, electrical vaults, water vaults, utility manhole lids, etc. required to be uncovered, raised and adjusted to final grade for construction of the proposed sewer and/or appurtenances as required in the Contract Documents, or as required by the Construction Project Manager. Payment will be based upon completion of the work to a manner satisfactory to the Construction Project Manager and in accordance with the Contract Documents. No measurement for payment will be made for utility lid adjustments required due to negligence or unauthorized operations by the Contractor.

*The unit bid for completion of this item shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: locating, including electronic sensing if needed; excavation*

*and overexcavation; removal and disposal of unsuitable material and excess excavated materials; backfill with approved materials; compaction; furnishing and transporting of all materials and equipment; cutting or adjusting of the utility lid in a manner satisfactory to the Construction Project Manager; furnishing and placement of concrete, brick, mortar, concrete and/or cast iron risers, concrete barrels, flat tops, cones, rings, covers, grout, joint sealants, and all other related and necessary materials, work and equipment required to adjust utility lids in accordance with the Contract Documents.*

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**34-13.1 Pipe Outside Drop**

The measurement for payment of this item will be the total number of outside sanitary drops of the specified diameter required for construction of the proposed sewer facilities; provided, however, no measurement for payment will be made for outside drops not approved by the Construction Project Manager.

*The unit price bid per outside drop shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: pipe and fittings, including additional pipe and/or materials necessary to connect the existing sewer to drop; concrete encasement and reinforcement; excavation and backfill; trench supporting; reshaping of inverts and benches to the top of the highest incoming pipe; reconnection of sidelines; forming and steel reinforcement; and all other related and necessary materials, work and equipment required to construct the outside drop in accordance with the Contract Documents.*

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**34-14.1 RCP Precast Bend**
**34-14.3 RCP Flared End Section with Trash Rack**
**34-14.4 Concrete Collars**
**34-14.5 Flap Gate/Storm Control**

The measurement for payment of each specific size or type of special fitting shall be the total number of fittings required for construction of the proposed sewer and/or appurtenances.

*The price bid per special fitting shall include all of the contractor's costs of whatsoever nature. The price bid shall include: furnishing, transporting and installing all pipe specials and materials; joints and jointing materials; fasteners and tie downs; pipe collars and closures; bolts, grout, mortar, O-rings, connecting bands; excavation and compaction; shoring and backfilling; removal and disposal of unsuitable material and construction debris; adaptable trash racks for flared end sections; flap gates, assembly and installation; and all other related and necessary materials, work and equipment required to furnish and install these items in accordance with the Contract Documents.*

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**34-15.1 Sewer Tap Location and Verification**

The measurement for payment of this item will be the actual number of sewer service connections (sewer taps) required to be located and determined to be active; provided, however, no payment will be made due to negligence or unauthorized operations by the Contractor and only those sections specifically authorized by the Construction Project Manager shall be measured for payment.

*The unit price bid for locating all sewer service connections and verification of active sewer taps shall include all of the Contractor's costs of whatsoever nature for the complete verification and location of each active sewer tap. The price bid shall include: providing 48 hours public notification in advance of the work, furnishing and setting up all equipment required for location and/or verification and digital video and written log documentation of active sewer taps; labor; energy supply required for all equipment; permits and fees; coordination with locators (IUG and/or related utility companies); advance coordination and planning with facility owner to ensure access to mainline sewer; location (vertically and horizontally) and verification of active and capped sewer taps by digging, vacuuming, sensing, electronic locators, televising, dye testing, smoke tracing, and/or any other means necessary to ensure tap location, verification and adequate elevation for connection to sewer main per the Contract Documents; excavation, backfill, compaction; temporary and/or permanent paving; removal and replacement of curb, gutter, sidewalk, sod, sprinkler lines, etc. damaged during location and verification; removal and disposal of unsuitable material and construction debris; and all other related and necessary materials, work, and equipment required to complete this item in accordance with the Contract Documents.*

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**34-15.2 Reconnect Sanitary Sewer Services (Open Cut)**

The measurement and payment for each service connection, reconnection and/or adjustment shall be the total number of connections, reconnections and/or adjustments required for construction of the proposed sewer and/or appurtenance.

*The price bid for this item of work shall include all of the Contractor's costs of whatsoever nature. The price bid shall include; locating and verifying of service connections unless provided for elsewhere in the Contract Documents; furnishing and installing all pipe, fittings and materials; disconnecting/reconnecting and plugging existing services; plugging all necessary lines; construction of new services from mainline sewer to a point where proper connection and drainage can be achieved; chasing sewer taps from point of crossing or conflict with mainline to a point where proper relocation/reconnection can be attained; removal and replacement of sod, curb, gutter, and pavement outside mainline trench extents and all other surface items within affected areas; crossing of existing and abandoned facilities; excavation and backfill; bedding and compaction; temporary bypass pumping; extension of building sewers where required; loading, hauling and disposal of construction debris, excess excavated material, and contaminated materials at the Denver Arapahoe Disposal Site (DADS); and all other related and necessary materials, work, and equipment required to construct the service connection or reconnection in accordance with the Contract Documents.*

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**34-15.3 Utility Exploratory Investigation**

The measurement for payment of this item will be the actual number of field locations or verifications required for construction of the proposed sewer and/or appurtenances as required in the Contract Documents, or as directed by the Construction Project Manager.

*The unit price bid per location or verification shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: mobilization and furnishing of all equipment required for location or verification of storm , sanitary or any other utility; acquisition of all permits; coordinating and scheduling the work with appropriate locating entities; coordination of this component of the work in a manner that ensures completion of the overall project per the critical path schedule and in accordance with the contract documents, excavation and backfill, including Controlled Low Strength Materials as required; paving ,patching and*

*compaction; location of the utility by digging, vacuuming , sensing, or employment of other methods in utility location and/or verification; and all other related and necessary materials, work, and equipment required for location or verification of the sewer or utility as required in the Contract Documents or as directed by the Construction Project Manager.*

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**34-16.1 #14 Inlet**
**34-16.2 Single #16 Inlet**
**34-16.3 Double #16 Inlet**
**34-16.4 Triple #16 Inlet**
**34-16.5 Parking Lot Trench Drain**

The measurement for payment of each specific size and/or type of inlet will be the individual structure, complete, in place in accordance with the Contract Documents.

*The unit price bid per inlet structure shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: furnishing, transporting, and installing all materials; excavation, including overexcavation to remove unsuitable foundation materials; concrete, pipe collars, reinforcement steel, mortar and grout; manhole lids, rings, covers, grates, frames and curb boxes; open throat construction; galvanized steel rods; manhole steps; concrete ribbed deflectors; backfilling and compaction; removal and replacement of pavement, base coarse, sub-base materials, sod, decorative landscaping and any other surfacing materials; constructing and shaping of the base and invert; replacement of curb, gutter and sidewalk between the transitions as stipulated on the Details; and all other related and necessary materials, work, and equipment required to construct the storm inlet in accordance with the Contract Documents.*

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**34-16.8 Adjust Existing Inlet Structure**

The measurement and payment for this bid item will be the actual number of existing inlet structures (excluding flagstone curb head) adjusted. Payment will be based upon completion of the work to a manner satisfactory to the Construction Project Manager and in accordance with the Contract Documents. No measurement for payment will be made for existing inlet structure adjustments due to negligence or unauthorized operations by the Contractor.

*The unit price bid will be the actual number of existing inlet structures (Inlet Grates, Frames, Beams, Curb Boxes, etc.), excluding flagstone curb head, adjusted. The unit price bid will include but shall not be limited to: mobilization; raising, lowering, moving, adding and/or removing of concrete, masonry, brick, mortar, concrete risers, inlet grates, plastic joint sealant, grout and all other related and necessary materials, work and equipment required to adjust inlet structures in accordance with the Contract Document; resetting of grates; replacement of curb, gutter and sidewalk between the inlet transitions as stipulated in the Details; traffic control; surface preparation and compaction as necessary; obtaining of a street occupancy permits and street cut permits; locating, including electronic sensing if needed; removal and disposal of construction debris; furnishing and transporting of all materials and equipment; and all other related and necessary materials, work and equipment required for the adjustment of the existing inlet structure.*

**34-17.1 Pre-Video Inspection of Sewer Pipe**
**34-17.2 Cleaning of Sanitary Sewer Pipe**
**34-18.2 Cleaning of Storm Sewer Pipe**

The measurement for payment of this item will be the actual number of linear feet of sewer line cleaned and/or pre-video inspected and documented on the log sheet as measured along the centerline of the pipe from center of manhole to center of manhole with deductions made for the diameter of structures and appurtenances. Only those sections specifically authorized by the Construction Project Manager or noted in the Contract Documents will be measured for payment.

*The unit price bid per linear foot of sewer line cleaning and/or pre-video inspection shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: providing 48 hours public notification in advance of the work furnishing and setting up of all equipment, labor, and materials necessary to clean and perform pre-video inspection of the sewer, including an intrinsically safe camera, as necessary; recording all information on USB Plug and Play device (flash drive or hard drive) for review by City; submittal of video in MP4 format and logs in .pdf format, both of which must be submitted in accordance to the naming convention required within the applicable Standard Construction specification section; Identification and locating of all active and inactive (capped) sewer taps, to include linear footage from center upstream manhole, by dye testing, electronic sensing, smoke tracing or use of any other means necessary to verify the active taps; determination of taps requiring trimming; locating, identifying and reporting structurally deficient pipe sections for replacement or point repair; completion of additional pre-installation inspections and sewer cleaning as necessary prior to CIPP installation; supply energy for all equipment; obtain permits for the inspection and covering any related fees; furnishing and setting up all equipment and labor necessary to clean the sewer; furnishing of water for jetting; removal of all foreign material from the sewer line that will prevent installation of cured in place products; all inspection and cleaning of manholes; by-pass pumping and/or diversion of sewer flows around the section of pipe to be cleaned and to another sewer line accepted by the Construction Project Manager to receive such bypass; temporary installation of bypass piping under the pavement of cross streets, or raised transitional crossings as may be required per the approved traffic control plan; repaving of street cuts after completion of bypassing; removal and replacement of manhole rings, covers, steps and cone sections as necessary to permit bypassing; storage of cleaning sediment on the job site in containers or other approved methods; maintaining storage during the waiting time for laboratory test results on the sediment; disposal of sediment according to Local, Federal, and State environmental requirements; removal and disposal of unsuitable material and construction debris; and all other related and necessary equipment, work, and materials required to accomplish this item in accordance with the Contract Documents.*

**34-17.3 Sanitary Sewer By-Pass**
**34-18.3 Storm Sewer By-Pass**

The measurement for payment of this item will be the number of linear feet of sewer line as measured along the centerline of the pipe run, where the work (ie: lining, repairing or replacing) is occurring from center of upstream manhole to center of downstream manhole and shall only be paid for once during the time necessary to complete each section of work. Bypass plans shall be submitted by the Contractor to the Construction Project Manager for review and shall include written by-pass pumping plans on the approved MHT map for the proposed bypass pumping segment, including plans for contingency activities in the event of weather changes,

equipment malfunction, or other disruptions. Bypass plans shall include providing a 48 hour public notification in advance of the work. Only those sections specifically identified within the contract documents or authorized by the Construction Project Manager will be bypassed and measured for payment. All by-pass activities will be performed using materials and methods that result in a complete system that provides zero leakage during all components of by-pass operations.

*The unit price bid per linear foot for this item shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: furnishing and setting up of all equipment, labor, measurement and determination of sewer flow, all materials required to pump or divert sewer flows around the section of pipe or manhole being lined, repaired, reconstructed, or constructed to another sewer line accepted by the Construction Project Manager to receive such bypass; supplying of energy required to operate all bypass equipment; temporary installation of bypass piping under the pavement of cross streets, or raised transitional crossings as may be required per the approved traffic control plan; repaving of streets after completion of bypassing; removal and replacement of manhole rings, covers, steps and cone sections as necessary to permit bypassing; cleanup and removal of unsuitable material; and all other related and necessary equipment, work, and materials required to complete the bypassing as required in the Contract Documents or as directed by the Construction Project Manager.*

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**34-17.4 Cured-in-Place-Pipe**

The measurement for payment of this item will be the actual number of linear feet of cured-in-place pipe installed, measured along the centerline of the pipe from center of manhole to center of manhole. Only those sections specifically authorized by the Project Manager or noted in the Contract Documents will be measured for payment.

*The unit price bid per linear foot of the Cured-In-Place-Pipe shall include all of the Contractor's costs of whatsoever nature. The price bid shall include, but is not limited to: providing 48 hours public notification in advance of the work, furnishing all equipment, materials, and labor necessary to complete CIPP installation; furnishing and setting up of all equipment, labor, and materials required to pump or divert sewer flows around the section of pipe being lined to another sewer line accepted by the Construction Project Manager to receive such bypass; supplying of energy required to operate all bypass equipment; temporary installation of bypass piping under the pavement of cross streets, or raised transitional crossings as may be required per the approved traffic control plan; repaving of streets after completion of bypassing; removal and replacement of manhole rings, covers, steps and cone sections as necessary to permit bypassing; cleanup and removal of unsuitable material; all other related and necessary materials, work, and equipment required to complete by pass; post-installation inspection video and engineering inspections of the sewer being rehabilitated; use of intrinsically safe equipment as necessary; recording all information on USB Plug and Play device (flash drive or hard drive) for review by City; submittal of video in MP4 format and logs in .pdf format, both of which must be submitted in accordance to the naming convention required within the applicable Standard Construction specification section; Identification and locating of all active and inactive (capped) sewer taps, to include linear footage from center upstream manhole, by dye testing, electronic sensing, smoke tracing or use of any other means necessary to verify the active taps; completion and submittal of written logs and digital as-constructed drawings; determination of taps requiring trimming; locating, identifying and reporting structurally deficient pipe sections for replacement or point repair, completion of additional pre-installation inspections and sewer cleaning as necessary prior to CIPP installation; supply energy for all equipment; obtain all*

*required permits for CIPP installation, materials used, the inspection and covering any related fees; furnishing and setting up all equipment and labor necessary to: clean the sewer; furnish water for jetting, perform bypass pumping required to install product; providing power for de-rooting equipment and other types of machinery; removal and disposal of all foreign material from the sewer line that will prevent installation of cured in place linings; storage of cleaning sediment on the job site in containers or other approved methods; maintaining storage during the waiting time for laboratory test results on the sediment; disposal of sediment according to Local, Federal, and State environmental requirements; all public information and notifications; attending the weekly construction meeting and any other meeting required by the Project Manager; all inspection and cleaning of manholes; removal and disposal of unsuitable material and construction debris; furnishing and setting up all equipment, materials, and labor necessary for the construction process; furnishing water, steam and energy required for the rehabilitation process; furnishing, installing and applying the Cured-In-Place-Pipe Material; curing the CIPP liner, cutting, trimming and brushing active sewer service connection; hydrophilic water swelling material as needed to prevent infiltration between the CIPP liner and host pipe at each manhole; providing access to the City and County of Denver, or their designee, for the purpose of obtaining samples of installed material for onsite and laboratory testing; incidentals referenced in other sections of the Specifications; and all other related and necessary materials, work, and equipment required to complete this item in accordance with the Contract Documents.*

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**34-17.5 Grinding**

The measurement for payment of this item will be the actual number of linear feet of grinding within the sewer line submitted and approved by the Project Manager.

It shall be the Contractor's responsibility to notify the Project Manager of pipe segments that require grinding to facilitate CIPP installation. Only those sections specifically designated by the Construction Project Manager will be ground and measured for payment. Measurement shall commence at the point at which the obstruction is encountered and terminate the point at which the obstruction is removed. Payment for grinding will not be made due to negligence or unauthorized operations by the Contractor.

*The unit price bid per linear feet of sewer line grinding shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: providing 48 hours public notification in advance of the work, providing pre and post digital verification video of the specific pipe segments proposed for grinding, removal of roots, protruding objects, chemical deposits, unsuitable material or any other materials as directed by the Construction Project Manager prior to placement of any liner; grinding via mechanical, chemical or other approved methods; furnishing and setting up of all equipment and labor necessary to inspect the line to be rehabilitated; video inspection of the line to locate and identify live sewer taps and to locate taps that require trimming; recording of the video inspection; removal of all materials from the pipe walls that will prevent the proper installation of cured-in-place or formed-in-place plastic liners; furnishing of water and power for de-rooting equipment; storing of cleaning sediments on the job site in containers or other Federal or locally approved storage methods; maintaining of stored materials during the time required to obtain laboratory tests; transporting of the sediment for disposal to a landfill upon receipt of laboratory tests results showing that all tests meet Federal and local standards for normal disposal, payment of disposal and landfill fees, if the material is being hauled to any site other than Denver/Arapahoe Disposal Site (DADS); cleaning and inspection of manholes; and all other related and necessary materials, work and equipment required to complete this item in accordance with the Contract Documents.*

**34-17.6a Sanitary Sewer Service Reactivation for CIPP**
**34-17.6b Storm Sewer Service Reactivation for CIPP**

The measurement for payment of this item will be the actual number of sewer service taps required to be reactivated as determined to be active during the pre-video inspection study. No measurement for payment will be made for taps which are opened/reactivated and have not been determined to be active. The Contractor shall accept all responsibility to provide residents, businesses, etc. with an established and reconnected sewer service. No measurement will be made for sewer service reactivations due to negligent or unauthorized operations by the Contractor.

*The unit price bid shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: furnishing and setting up of all equipment and labor necessary to locate and reactivate active services; cutting and brushing of CIPP material and linings, coatings and/or coverings required to open active sewer services; removal and disposal of all unsuitable material; providing 48 hours public notification in advance of the work and notifying residents and business upon reactivation; and all other related and necessary materials, work and equipment required to complete this item in accordance with the Contract Documents or at the direction of the Construction Project Manager.*

**34-17.7 Extended Tap Cutting**

The measurement and payment for this item will be the actual number of submitted and approved extended taps or services that would have to be cut or otherwise repaired for construction of the proposed sewer and or appurtenances. No measurement will be made for extended tap cutting required due to negligent or unauthorized operations by the Contractor.

*The unit price bid shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: furnishing of all equipment and labor required to cut the extended tap; cutting of the tap to a smooth and hydraulically functional opening; furnishing of power for all equipment; video-inspection and locating of the extended tap; removal and disposal of materials; and all other related and necessary materials, work and equipment required to complete this item in accordance with the Contract Documents or at the direction of the Construction Project Manager.*

**34-17.8 Intrinsically Safe Electrical Equipment**

No measurement for payment will be made for any of the work and materials required to accomplish this aspect of the construction project and payment will be based upon the completion of the work in accordance with the Contract Documents.

The areas/extents within the Contract Documents requiring the use of explosion proof equipment shall be determined by the Contractor. Damage and repair to the sanitary system and surrounding areas due to misuse of equipment, faulty equipment or negligence are the responsibility of the Contractor.

*The lump sum price bid for Intrinsically Safe Electrical Equipment shall include all of the Contractor's costs of whatsoever nature. The lump sum price bid shall include: furnishing, installing, and activating the camera; all labor of whatsoever nature to the various areas of construction, and all other related and necessary materials, work, and equipment required to accomplish this item in a manner satisfactory to the Construction Project Manager and in accordance with the Contract Documents.*

**36-1 Install Railroad Tracks**

The measurement for payment of this item will be the actual number of linear feet of railroad tracks constructed, including appurtenances, as shown within the contract documents; provided, however, no payment will be made for track installation outside the project limits or for track installation due to negligence or unauthorized operations by the Contractor. Payment will be based upon each pair of tracks constructed, as measured along the centerline of the newly installed tracks.

*The unit price bid per pair of railroad tracks shall include all of the Contractor's costs of whatsoever nature. The linear foot price bid per pair of railroad tracks shall include: all work and materials required to install the tracks per the Governing Railroad Company, contract documents and design criteria; procurement, including protection and stockpiling of materials removed and approved for re-use, hauling, delivery and installation of ballast; track hardening; railroad ties; pre-stressed concrete panels; full depth asphalt or concrete paving up to the concrete panels as delineated by the area perpendicular to the length of tracks being replaced and within 25 feet of the centerline of the tracks on each side; joining of rails; fasteners, spikes, special joints; grading the subgrade and special bedding under the tracks; hauling and disposal of all excavated material which is not recyclable to the Denver Arapahoe Disposal site; backfilling and compaction; and all other related and necessary materials, work and equipment required for the installation of this item in accordance with the Contract Documents.*

**40-1 Seeding and Mulching**

The measurement and payment for this item will be the total number of square feet of seed, mulch and required soil amendment placed for construction of the proposed sewer and or appurtenances; however, no measurement will be made for seed and mulch placed due to negligent or unauthorized operations by the Contractor.

*The unit price bid per square foot of seed and mulch placed shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: furnishing, transporting and placing of seed, mulch, erosion control fabric, blankets or protective coverings; protection and care of stockpiled seed and mulch; preparation, fertilization and soil amendment; furnishing of new seed and mulch of like quality to replace any improperly maintained seed and mulch; watering, raking and rolling the ground surface after placement of seed and mulch; placement of erosion blanket on all slopes greater than 3:1; and all other related and necessary materials, work and equipment required to furnish and place the seed and mulch, complete, in accordance with the Contract Documents.*

**40-2 Seeding**

The measurement and payment for this item will be the total number of square feet of seed to be placed for construction of the proposed sewer and/or appurtenances; however, no measurement for payment will be made for seeding required due to negligent or unauthorized operations by the Contractor.

*The unit per square foot of seed placed shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: preparation of soils, ripping and tilling, cleaning, fertilization, leveling to the elevations specified in the Contract Documents; furnishing of seed as specified in the Contract Documents; placing of the seed, wetting, and compaction; erosion control fabric,*

*blankets, or protective coverings as required; watering; reseeding and/or replacement of any improperly maintained seed; and all other related and necessary materials, work, and equipment required to place the seed in accordance with the Contract Documents.*

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**40-3 Sodding**

The measurement and payment for this item will be the total number of square feet of sod required to be placed for construction of the proposed sewer and/or appurtenances; provided, however no measurement will be made for sod placed due to negligent or unauthorized operations by the Contractor.

*The unit price bid per square foot shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: preparation and cleaning of the ground surface; furnishing of sod as specified in the Contract Documents or to the same quality as the existing sod; replacement of any improperly maintained sod; proper placement of the sod; watering, rolling and compaction; clean up and disposal of unsuitable material; and all other related and necessary materials, work and equipment required to place the sod in accordance with the Contract Documents.*

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**40-4a Install Sprinkler Line**

**40-4b Relocate Existing Sprinkler Line**

The measurement and payment for this item will be the total number of linear feet of sprinkler line required to be installed or relocated for construction of the proposed sewer and/or appurtenances; provided, however no measurement will be made for sprinkler placed due to negligent or unauthorized operations by the Contractor.

*The unit price bid shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation, furnishing of materials, protection and installing pipework and heads; adjusting heads; fittings and connections; backfilling, grading, installing and adjusting valves; and all other related and necessary materials, work, and equipment required to install the sprinkler system in accordance with the Contract Documents or as directed by the Construction Project Manager.*

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**40-5 Install or Relocate Sprinkler System**

No quantity measurement will be made for any of the work and materials required to install and/or relocate sprinkler systems. Payment will be based upon completion of the work in accordance with the Contract Documents; provided, however, no payment will be made for installing and/or relocating sprinkler systems due to negligent or unauthorized operations by the Contractor.

*The lump sum bid price shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation, furnishing and installation of all sprinkler system materials and materials necessary for relocation of an existing system; protection and installing pipework and heads; adjusting heads; fittings and connections; backfilling, grading, installing and adjusting valves; trace wires; electrical hookups, valve boxes and controls; pressure testing of system; winterization and recharging of system as necessary during project period of performance; and all other related and necessary materials, work, and equipment required to install and/or relocate the sprinkler system in accordance with the Contract Documents or as directed by the Construction Project Manager.*

**40-6 Decorative Landscaping**

No quantity measurement will be made for any of the work and materials required to remove and replace this item. Payment will be based upon completion of the work in accordance with the Contract Documents; provided, however, no payment will be made for removing and replacing decorative landscaping required to be replaced due to negligent or unauthorized operations by the Contractor.

*The lump sum bid price shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: excavation; removal and replacement of concrete, rock; removal and replacement of plants, mulch, support systems and retaining structures; disposal of excess excavated materials; topsoil, fertilizer, water, storage and all other related and necessary materials, work and equipment, required to replace the decorative landscaping in accordance with the Contract Documents.*

**40-7 Remove Trees (>6" Diameter)**

**40-8 Remove Bushes**

The measurement for payment of this item will be the total number of trees, bushes, shrubs or landscaping units, required to be removed for construction of the proposed sewer as specified in the Contract Documents and directed by the Construction Project Manager; provided, however, no measurement for payment will be made for items removed which are less than six (6) inches in diameter at a height of one (1) foot above the existing ground.

*The unit price bid per tree, bush, shrub or specified landscaping item removal shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: removal of a sufficient length of the root system to insure that the tree, bush, shrub or landscaping unit will not continue to grow; disposal of all materials removed; acquisition of all permits required for removal; backfilling with soil material approved by the Construction Project Manager; and all other related and necessary materials, work and equipment required to remove trees in accordance with the Contract Documents.*

**40-9 Remove and Transplant Trees (>6" Diameter)**

**40-10 Replace Bushes and/or Shrubs**

The measurement for payment of this item will be the total number of trees required to be removed and transplanted and/or the total number of shrubs and/or bushes required to be replaced for construction of the proposed sewer; provided, however, no measurement for payment will be made for trees required to be removed and transplanted, or shrubs and/or bushes required to be replaced due to negligent or unauthorized operations by the Contractor.

*The unit price bid per tree removal and transplant or shrub and/or bush replacement shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: removal, storing, planting, replanting or replacing, puddling, backfilling, and all other related and necessary materials, work and equipment required to remove and transplant the tree or replace the shrub and/or bush in accordance with the Contract Documents.*

**40-11 Replace Green Ash Tree (2" Caliper)**

**40-12 Replace Tree (>6" Diameter)**

The measurement for payment for tree planting or replanting will be the total number or trees required to be placed per plans and due to construction of the proposed sewer; provided, however, no measurement for payment will be made for trees planted due to negligent or unauthorized operations by the Contractor.

*The unit price bid per tree placement or replacement shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: removal, storing, replanting or replacing, backfilling, staking and supporting devices; formed wells and/or cages; insulating wrap; protection from animals; watering and care throughout the warranty period; and all other related and necessary materials, work and equipment required to plant and replant the tree in accordance with the Contract Documents.*

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**40-13 Shade Trees (> 2" Caliper)**

**40-14 Ornamental Trees (> 2" Caliper)**

The measurement for payment for tree planting will be the total number of trees required to be placed per plans and due to construction of the work; provided, however, no measurement for payment will be made for trees planted due to negligent or unauthorized operations by the Contractor.

*The unit price bid per tree placement shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: delivery, temporary protection, storage, planting, backfilling, staking and temporary support devices; formed wells and/or cages; insulting wrap; protection from animals; watering and care throughout the warranty period; and all other related and necessary materials, work and equipment required to plant the tree in accordance with the Contract Documents.*

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**40-15 Landscape Improvements**

No quantity measurement will be made for any of the work and materials required for this item in construction of the proposed landscape and irrigation improvements. Payment will be based upon completion of the work in accordance with the Contract Documents; provided, however, no payment will be made for any work performed due to negligent or unauthorized operations by the Contractor.

*The lump sum bid price shall include all of the Contractor's costs of whatsoever nature. The price bid shall include all of the work and equipment, and all other related and necessary materials, required to construct all of the proposed landscape and irrigation improvements shown on the landscape/irrigation plans, in accordance with the Contract Documents.*

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**41-1 Traffic Control**

No quantity measurement will be made for any of the work and materials required to accomplish this aspect of the construction project and payment will be based upon the completion of the work in accordance with the Contract Documents.

*The lump sum price for Traffic Control shall include all of the Contractor's costs of whatsoever nature. The lump sum bid price shall include: All coordination with relevant agencies and utility companies; including by-pass pumping plans on the MHT plans submitted to City and County of Denver- Public Works Right of Way Services; furnishing, installing, moving, maintaining and removing all temporary traffic signs, barricades, channeling devices, warning lights, delineators, and any other equipment or personnel as required by the latest revision of the "Manual on*

*Uniform Traffic Control Devices for Streets and Highways", and the requirements set forth by the City and County of Denver, Transportation Engineering Division; all signs, emergency replacements, warning lights, variable message boards, traffic cones, and barricades; approved traffic maintenance plans as required; concrete median barriers as required; lane markings and temporary striping; flagging and notification of property owners; traffic control management; furnishing, installing, adjusting, maintaining and removing all special signs required to direct pedestrians and/or vehicles to businesses or parking facilities disrupted due to construction activities; additional traffic control and safety devices as required by the Construction Project Manager; and all other related and necessary materials, work, and equipment required to accomplish this item in accordance with the Contract Documents.*

*At the option of the Construction Project Manager payment will be made in percentage installments based upon type, location and scope of work in relation to the period of performance.*

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**41-2 Rerouting and Construction of Bike Path**

No quantity measurement will be made for any of the work and materials required to accomplish this aspect of the construction project and payment will be based upon the completion of the work in accordance with the Contract Documents.

*The lump sum price bid for rerouting and construction of bike paths shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: furnishing, installing, moving, maintaining and removing all temporary traffic signs, barricades, channelization devices, warning lights, delineators, bike path signage and any other equipment or personnel required for safe conductance and detouring of bike path personnel off and around the designated construction zone in a safe and professional manner; construction of safety fence, including placement of concrete barriers; coordination with Parks and/or Traffic personnel; obtaining of necessary permits and paying associated fees; water control; placement of rock or pavement for temporary bike path; and all other related and necessary materials, work, and equipment required to accomplish this item in accordance with the Contract Documents or the direction of the Construction Project Manager.*

*At the option of the Construction Project Manager, one third of the lump sum price for this item may be paid to the Contractor upon satisfactory completion of and/or incorporation of proper controls, the second third may be paid upon fifty percent completion of the work as determined by the percent of work completed on the day of progress payment, and the last third may be paid to the Contractor at the last progress payment or at the discretion of the Construction Project Manager.*

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**42-1 Railroad Control**

No measurement will be made for any of the work and materials required to accomplish this aspect of the construction project and payment will be based upon the percent completion of the work in accordance with the Contract Documents.

The City and County of Denver (railroad Licensee) will obtain all necessary license agreements. The contractor(agent of Licensee including subcontractors, officers, agents and employees; and others acting under the licensee or agent of licensee's authority) will be responsible for the acquisition and maintenance of all railroad protective liability insurance as required by the railroad crossing agreements included within the bid document package, and which is deemed

necessary by the railroad to complete construction. In no way should the railroad pipeline crossing agreement be used to dictate railroad flagger/inspector participation in a project. Railroad Flagger/inspector participation shall be determined by local railroad officials.

*The lump sum price for Railroad Control shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: acquisition of additional insurance required by the railroad company to work within railroad right-of-ways, or as otherwise noted within the license agreement; acquisition of all permits, payment of all railroad flagging, inspection and associated permit fees; detouring, railroad traffic control, as required; furnishing of approved base materials, as required to bring the subgrade up to ballast elevation; supplying materials required to protect railroad tracks for equipment crossing; adhering to the conditions of permits, easements, and railroad agreements; preparation of submittals required by the railroad and receipt of approvals prior to work, design and stamping by an Engineer licensed in the State of Colorado as necessary; notification of the railroad and the public of proposed work; arrangements with the railroad for use of railroad property not covered under permits, easements, or railroad agreements; coordination with the railroad and its sub tiers for removal and replacement of the track and its related facilities; railroad safety training for all personnel working within the railroad right-of-way; and all other related and necessary materials, work and equipment required to accomplish this item in accordance with Right of Entry Permits, Pipeline Crossing Agreements and adherence to the latest edition of the American Railway Engineering and Maintenance-of-Way Association (AREMA) Standards, the Contract Documents or as directed by the Construction Project Manager.*

*At the option of the Construction Project Manager, monthly percentage payments, based upon Period of Performance, may be paid to the contractor upon satisfactory completion of and/.or proper controls submitted in monthly payment application, or at the discretion of the Construction Project Manager. Up to the last progress payment or at the discretion of the Construction Project Manager.*

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**43-1 Storm Water Management**

No quantity measurement will be made for any of the work and materials required to accomplish this aspect of the construction project and payment will be based upon the completion of the work in accordance with the Contract Documents.

*The lump sum price for Storm Water Management shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: implementing measures per Best Management Practices (BMPs); obtaining all permits and paying any associated fees (i.e. NPDES, etc.); coordination with State and Local agencies as required to setup all required plans for the project; furnishing, installing and removing erosion control materials required by the Contractor's plans; protection of existing flow lines, inlets and manholes; care and diversion of drainage courses; pumping and bypass pumping; construction and design of special erosion control plans for emergency situations that develop during construction or unexpected weather conditions; providing filter fabric, bales, stakes, rock, filter material, silt fence, gabions, wire mesh, temporary berms, temporary diversions, temporary slope drains, check dams, geotextile protection, sediment traps and basins; clearing and grubbing for placement of planned control features, etc.; flushing, jetting and/or removal of construction debris from existing systems as required by the Construction Project Manager; stabilization of the work area by seeding and/or mulching during and after construction; disposal of work materials; maintenance of all erosion control features and seeded areas, so they function properly during construction; testing of*

*sediment and disposal as required; and all other related and necessary materials, work and equipment required to accomplish this item in accordance with the Contract Documents.*

*At the option of the Construction Project Manager, one third of the lump sum price for this item may be paid to the Contractor upon satisfactory completion of and/or incorporation of proper controls, the second third may be paid upon fifty percent completion of the work as determined by the percent of work completed on the day of progress payment and the last third may be paid to the Contractor at the time of final progress payment or at the discretion of the Construction Project Manager.*

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**44-1 Dewatering**

No quantity measurement will be made for any of the work and materials required to accomplish this aspect of the construction project and payment will be based upon the completion of the work in accordance with the Contract Documents. This bid item is for dewatering to accomplish the work, however no payment will be made for dewatering due to failure to protect the excavation from storm events, failure to protect existing utilities or dewatering included elsewhere in these contract documents. No payment will be made for this lump sum item without specific written approval of the Construction Project Manager.

*The lump sum price for dewatering shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: pumping and bypass pumping; furnishing of all equipment and manpower; furnishing and installing erosion control materials; obtaining all required discharge permits and paying associated fees; excavation, haul, backfill; installation of caissons, pump pits, piping and drainage courses; disposal of excess and contaminated water; water testing; and all other related and necessary materials, work and equipment required to accomplish this item in accordance with the Contract Documents.*

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**44-2 Water Treatment**

No quantity measurement will be made for any of the work and materials required to accomplish this aspect of the construction project and payment will be based upon the completion of the work in accordance with the Contract Documents

*The lump sum price for treatment of contaminated water shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: pumping and bypass pumping; sampling and/or water testing; furnishing of all labor, equipment and materials for treatment of contaminated water on site; furnishing and installing of erosion control materials; obtaining all required discharge permits and paying of associated fees; installation of caissons, pumps, pump pits and drainage courses; disposal of excess and contaminated water; excavation, haul , backfill; and all other related and necessary materials and equipment required to accomplish this item in accordance with the Contract Documents. All work must proceed in a manner that does not delay the project*

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**45-1 CIPP Laboratory Testing**

The measurement for payment of this item will be the actual number of laboratory tests required for completion of this project and/or installation of related appurtenances.

*The unit price bid shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: coordination with a third party tester, creating the sample, for third party transport to the testing lab; receipt of written results by the Construction Project Manager; testing of: final CIPP product, sediment removed from sewer line during cleaning, water quality, soils or other types of laboratory tests as required by the Construction Project Manager; tests shall determine materials composition, concentrations of chemicals, or contaminants present, Atterberg soils limits, soil stress, permeability, volatile organic compounds; testing of CIPP pipe as outlined in the Technical Specifications; and all other related and necessary materials, work and equipment required to complete this item in accordance with the Contract Documents and as directed by the Construction Project Manager.*

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**45-2 Quality Control Testing**

No quantity measurement will be made for any of the work and materials required to accomplish this aspect of the construction and payment will be based upon completion of the work in accordance with the Contract Documents. The lump sum price bid shall include the coordination and performance of quality control testing for all facets of the Work in accordance with the City's Frequency of Testing standards.

*The lump sum price for Quality Control Testing shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: procurement and payment of professional services; testing of: soils, asphalt, concrete and any materials incorporated into the work (bedding, controlled low strength materials, select or imported fill, etc.) in accordance with the Contract Documents; all testing associated with any form of grouting, as specified in these contract documents; coordination and scheduling of testing; travel to and from work site; additional testing by the Contractor for its own use; re-testing of work components (backfill, concrete used in structures, etc.) as necessary to ensure conformance with Contract Documents, re-testing of work components due to failing QA test results by owner; delivery and transport to testing lab; furnishing of written results to the Construction Project Manager; and all other related and necessary materials, work and equipment required to complete this item in accordance with the Contract Documents and as directed by the Construction Project Manager.*

*At the option of the Construction Project Manager, one quarter of the lump sum price for quality control testing may be paid to the Contractor at the time of the first monthly progress payment, the second quarter may be paid at the time of the second monthly progress payment, and the third quarter may be paid to the Contractor at the time of the third monthly progress payment, or at the discretion of the Construction Project Manager. The total payment for this bid item shall not exceed seventy-five percent (75%) of the lump sum price during construction. The remaining twenty-five percent (25%) shall be paid after substantial completion of the work and only after all project testing and/or results have been completed and/or provided for project recordation. Any costs paid by the City which are the result of retesting previously failing QA events may be deducted from the Contractor's payment, as applicable and as determined by the Construction Project Manager.*

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**46-1 Pavement Marking (Paint)**
**46-2 Epoxy Pavement Marking**
**46-3 Thermoplastic Pavement Marking**
**46-4 Preformed Plastic Pavement Marking**
**46-5 Pavement Marking Tape**

The measurement for payment of this item will be the actual square feet of pavement marking material or paint installed, as required to accomplish this aspect of the construction. Payment will be based upon completion of the work in accordance with the Contract Documents.

*The unit price square foot shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: pavement marking plans when required; furnishing and installation of paint, marking tape, thermoplastic and methyl methacylate materials; furnishing of all equipment required for application of all pavement marking materials; sandblasting and high pressure cleaning to remove all dirt, laitance, and curing compound residues; and all other related and necessary materials, work and equipment for pavement marking as required in the Contract Documents or as directed by the Construction Project Manager.*

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**47-1 Construction Surveying**

No quantity measurement will be made for any of the work or materials required to accomplish this aspect of the construction project and payment will be based upon the completion of the work in accordance with the Contract Documents.

*The lump sum cost shall include all of the Contractor's cost of whatsoever nature. The price bid shall include: construction surveying and staking; boundary staking; re-staking as necessary during construction; maintenance and submittal of as-built records, red-lined drawings, final survey and recordation, and prints necessary for the creation of as-built documents for all elements of the project to the Construction Project Manager ; elevation/survey checks as requested by the City during construction; verification of all survey control points, City of Denver range points, section corners and benchmarks prior to starting work; submittal of required items to the City Survey per the specifications; traffic control required to perform work under this bid item; and all other related and necessary materials, work and equipment required to accomplish this item in accordance with the Contract Documents.*

All work performed within this bid item shall be done under the supervision of a Professional Land Surveyor (PLS) or Professional Engineer (PE) who is experienced and competent in storm sewer construction, sanitary sewer construction and roadway construction surveying and is licensed in the State of Colorado.

At the option of the Construction Project Manager, one quarter of the lump sum price for Construction Surveying may be paid to the Contractor at the time of the first monthly progress payment, the second quarter may be paid to the Contractor at the time of the second monthly progress payment, and the third quarter may be paid to the Contractor at the time of the third monthly progress payment, or at the discretion of the Construction Project Manager. The total payment for this bid item shall not exceed seventy-five percent (75%) of the lump sum price during construction. The remaining twenty-five percent (25%) shall be paid after submittal of final survey and recordation documents to the Construction Project Manager for creation of as-built drawings.

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**47-2 Survey Monumentation**

The measurement and payment of this item will be the total number of survey monuments removed and replaced for construction of the proposed sewer and/or appurtenances as indicated within the contract documents; provided, however, no measurement for payment will be made for survey monumentation required due to careless or unauthorized operations

by the Contractor. No measurement will be made for locating survey monuments, preserving and referencing monuments within the project limits.

*The unit price bid shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: record searches and research; locating, preserving, referencing, adjusting, installing and/or restoring survey monumentation as described within the contract documents; the preparation and depositing of monument tie-out sheets and final monumentation diagram; traffic control required to perform work under this bid item; construction survey checklists, equipment calibrations; monumentation related survey records; and all other related and necessary materials, work and equipment required to accomplish this item in accordance with the Contract Documents.*

All work performed within this bid item shall be done under the supervision of a Professional Land Surveyor (PLS) who is experienced and competent in storm sewer construction, sanitary sewer construction, roadway construction surveying, boundary surveying and is licensed in the State of Colorado.

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**50-1 Mobilization**

No quantity measurement will be made for any of the work and materials required to accomplish this aspect of the construction project and payment will be based upon the completion of the work in accordance with the Contract Documents

*The lump sum cost shall include all of the Contractor's costs of whatsoever nature. The price bid shall include: mobilization and demobilization to the site or sites defined within the contract documents, multiple mobilizations and demobilizations to accommodate construction moratoriums, events, schools, and/or special circumstances outlined in the Contract Documents; transporting all equipment and materials; temporary sanitary facilities; complete setup, removal, repair, coordination and payment of fees associated with temporary staging facilities; project signs; obtaining groundwater discharge permits and all additional permits required by state and local agencies to complete any facet of the work; fugitive dust control in accordance with D.R.M.C. Title II Chapter 4 Sec. 4-25 throughout entire project duration, development of fugitive particulate control plans as required and street sweeping and site cleanup as necessary; loading, hauling and disposal of all construction related debris and excess excavated material not provided for elsewhere in the Contract Documents; advance coordination, notification and scheduling with City and County of Denver agencies, all affected utility companies, railroads, businesses, and homeowners; scheduling of work to accommodate residents, business owners and special circumstances encountered during construction and/or as indicated in the Contract Documents; all aspects of public information services as required with the Standard Construction Specifications for the project; night and weekend work as necessary; any labor of whatsoever nature required in various areas of construction site as necessary to complete the work in accordance with the Contract Documents. The contractor shall be responsible for all maintenance of parks facilities affected by construction activities. This includes, but is not limited to, the maintenance and irrigation of landscaping items outside of the work area which are disconnected from service due to construction operations. All cost for this work shall be included within this bid item and no additional payment will be made. At the option of the Construction Project Manager, payment may be made in percentage installments based upon type, location and scope of work in relation to the period of performance. . The total payment for this bid item shall not exceed seventy-five percent (75%) of the lump sum price during construction. The remaining twenty-five percent (25%) shall be paid after final site cleanup, completion of all punch list items and demobilization from site.*

**50-1a Emergency Mobilization**

No quantity measurement will be made for any of the work and materials required to accomplish this aspect of the construction and payment will be based upon the completion of the work in accordance with the Contract Documents. The required time for mobilization to site shall be five (5) hours from official written notification.

*The measurement for payment of this item will be the actual number of emergency mobilizations required to complete the work in accordance with the Contract Documents and shall include all of the Contractor's costs of whatsoever nature. Each individual site response officially requested by the Construction Project Manager shall be considered one emergency mobilization. The price bid shall include: emergency mobilization; demobilization; transporting all equipment and materials; temporary sanitary facilities; complete setup, removal, repair, coordination and payment of fees associated with temporary staging facilities; obtaining groundwater discharge permits and all additional permits required by state and local agencies to complete any facet of the work; fugitive dust control in accordance with D.R.M.C. Title II Chapter 4 Sec. 4-25 throughout entire project duration, development of fugitive particulate control plans as required and street sweeping and site cleanup as necessary; loading, hauling and disposal of all construction related debris and excess excavated material not provided for elsewhere in the Contract Documents; advance coordination, notification and scheduling with City and County of Denver agencies, all affected utility companies, railroads, businesses, and homeowners; scheduling of work to accommodate residents, business owners and special circumstances encountered during construction and/or as indicated in the Contract Documents; all aspects of public information services as required with the Standard Construction Specifications for the project; night and weekend work as necessary; any labor of whatsoever nature required in various areas of construction site as necessary to complete the work in accordance with the Contract Documents.*

**END OF MEASUREMENT AND PAYMENT**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management Standard Construction Specifications

**March 15, 2016**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management Standard Construction Specifications

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CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management Standard Construction Specification

## 01-00 Scope

These Standard Construction Specifications set forth the provisions applicable to storm, sanitary and other related construction on Wastewater Capital projects, as specified. The general contractor is responsible for all materials and equipment necessary to perform all operations in connection with the construction of the facilities as described in approved plans, the most recent edition of these Standard Construction Specifications and the Wastewater Management Division Standard Details.

**END OF SPECIFICATION**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management Standard Construction Specification

## 01-1416 PUBLIC INFORMATION SERVICES

## PART 1- General

### 1.01 Description

The Work consists of providing various public involvement activities for the Project. Additional requirements may be included elsewhere within the Contract Documents.

Public information services shall include, at minimum, the following:

a) Responding to questions concerning Project activities and schedules
b) Participating in, and documenting meetings held with affected individuals, residents and/or business
c) Maintaining ongoing communication with residents and businesses directly impacted by construction activities and traffic control plans for the project
d) Maintaining a written log which documents calls and concerns. The log shall include: the nature of the concern, response(s) provided, date of completion for any required remedial action and any necessary future follow up with a frequency.

### 1.02 Submittals

The following shall be submitted to the Construction Project Manager:

a) All construction notification letters intended for use on the project, shall be submitted for approval by the Construction Project Manager prior to issuance of a notice to proceed. Updated notification letters intended for distribution to the public will require re-review and approval prior to issuance and may require additional time for coordination through the district City Council office.
b) The qualifications of the Contractor's assigned Public Information Manager shall be submitted to the Construction Project Manager prior to the preconstruction meeting for review
c) An updated written log for calls and concerns received will be submitted on a weekly basis, unless directed otherwise

## Part 2 – Product

## Part 3 – Execution

## 3.01 Public Information Manager

A Public Information Manager (PIM) for the Project shall be designated by the Contractor at the preconstruction meeting. The PIM shall be primarily responsible for maintaining communications and providing information on a regular basis to businesses and property owners affected by and adjacent to the work. The PIM shall be available on every calendar day and at all times during the course of the project from Contract Award through issuance of Final Acceptance. Interpretation services may be necessary and must be made available to ensure appropriate assistance is provided.

The PIM shall have a minimum of two Projects of previous experience in work with communications on similar Projects.

If directed by the Construction Project Manager, the PIM shall:

a) attend regularly scheduled meetings of local neighborhood and business associations to discuss the project and schedule
b) provide interpretation services
c) distribute additional notifications to the public which provide project related information, service interruptions, or general construction progress updates
d) provide timely input and review public information intended for use in neighborhood newsletters or publications, City Council updates, and local news media interviews or articles
e) provide information, documents, photographs, input and review for information posted on City sponsored websites
f) coordinate and communicate with adjacent projects/work, as well as utility companies working within the project limits to ensure proper notification of effected residents and business owners occurs and does not negatively impact the project

## 3.02 Public Information Phone Line

The Contractor shall provide a public information, local call line for the Project which is accessible 24 hours a day, 7 days a week. The public information line shall be answered by a person with direct knowledge of the Project or by an answering machine with current Project information that is updated on a weekly basis and allows the recording of a messaged from the caller. Cellular phones are acceptable. All calls shall be returned by the PIM or their designee within 24 hours. This phone number shall also appear on the project signs and on all information distributed for the Project.

## 3.03 Construction Notification Letter

The Contractor shall be required to prepare, submit for review and distribute construction notifications a minimum of 7 calendar days prior to starting work on each block. Notification and coordination shall occur with: property owners, tenants and/or businesses directly adjacent to or affected by the work, as well as those on side streets near the work site. It is the Contractor's responsibility to maintain ongoing communication with the affected property owners, tenants and/or businesses.

The notification shall provide a brief summary of the Project scope, work activities associated with the type of construction, general safety guidelines for the public and an anticipated completion date for the Project. In addition, the notification shall provide the name of the PIM and their telephone number. Notifications shall be updated and redistributed every two to

three weeks until construction is completed. The Contractor shall allow time for the Construction Project Manager to review and approve all updated notification letters prior to distribution.

**End of Specification**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management Standard Construction Specification

## 01-5213 TEMPORARY OFFICE FACILITIES

## PART 1- General

### 1.01 Description

This specification covers temporary office facilities during construction activities above that normally provided by the Contractor for use by the City and their designated personnel. This specification only applies when the corresponding bid item for temporary office facilities is included and is specifically stipulated in the contract documents.

The purpose of the temporary office facilities is to provide the necessary working area and resources for project team member meetings, City Construction Project Managers, City Construction Project Inspectors, Project Resident Engineers, or their designees.

The City and County of Denver is not responsible for the safety of the temporary office facilities and compliance with this specification does not relieve the Contractor of full responsibility for damage caused by the Contractor's operations.

### 1.02 Submittals

All submittals for this item shall be provided to the City Construction Project Manager for record keeping purposes and verification of conformance with the contract documents. These submittals or approval of the submittals does not shift liability or relieve the Contractor from full responsibility for adherence to specification.

Provide a detailed submittal for review and acceptance by the City Construction Project Manager detailing the product requirements described in Part 2 of this specification. Detail the location and layout of the temporary office facilities in the submittal(s).

## PART 2- Product

### 2.01 Temporary Office Space

The Contractor shall furnish and maintain a temporary office facility at or adjacent to the work site for use by City Construction Project Managers, City Construction Project

Inspectors, Project Resident Engineers, and/or their designees. An individual desk space is required for City Construction Project Inspectors, the City Construction Project Manager, and/or Project Resident Engineer; and additional space may be needed for specialty inspectors (geotechnical, structural, etc.)

Each individual desk space shall include one standard size desk with drawers, one desk chair and one side chair, a book case, a plan rack, a waste basket, lighting (50 foot candles at desk top), a duplex electrical outlet (110-volt), access to high speed internet (minimum 20Mbps), and a printer (capable of printing and scanning standard, legal, and 11-inch by 17-inch color prints).

The temporary office shall be structurally sound, secure, vandal resistant, weather tight, with floors raised above ground and have interior and exterior lighting. The temporary office shall be provided with automatic heating and mechanical cooling equipment to maintain comfort conditions of 70 degrees Fahrenheit year round and provide convenient access to potable drinking water and toilet facilities cleaned at least twice per month.

### 2.02 Temporary Meeting Space

The Contractor shall furnish and maintain a temporary meeting space at the work site within the temporary office facility for use by project team members during meetings. The temporary meeting space shall be large enough to accommodate at least 8-persons, including a table and chairs. The meeting space shall have multiple wall mounted cork boards and white boards and a large wall mounted display clock for help in facilitating meetings.

## PART 3- Execution

Provide the City with and maintain full access to the temporary office facilities at least two weeks prior to starting ground disturbance at the project site. Allow the City and/or their designees' full access to the temporary office facilities during the duration of the project; including weekends, nights, and holidays if warranted by the project. Provide temporary access roads and maintenance if required to maintain access to the temporary office facilities. Provide snow removal as required.

The temporary office facilities shall be removed within 30 days after they are no longer needed or as directed by the City Construction Project Manager.

**END OF SPECIFICATION**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management Standard Construction Specification

## 2.0 Site Preparation

### 2.0.1 General

The site of all trenches shall be cleared of all vegetation, stumps, roots, sod, and debris prior to excavating. Fences, walls, curbs, sidewalks, gutters, crosspans, poles, or any other structures stipulated on the drawings to be removed, or otherwise authorized by the Construction Project Manager to be removed, shall be removed and later replaced in a manner acceptable to the City and equivalent to its original undisturbed condition. Except as otherwise shown on the Drawings or otherwise specified herein all unsalvageable materials shall be removed or hauled from the site and disposed of by the Contractor at his expense. Unless otherwise specified in the Contract Documents or elsewhere in these Standard Construction Specifications, all salvageable materials and items shall become the property of the City. If, in the event it is specified that certain salvageable materials are to become property of the Contractor, no payment will be made for the removal of those items or materials.

### 2.0.2 Stockpiling of Excavated Materials, Pipe, Etc.

In accordance with and in addition to the requirements set forth in GC's 801-807 of the General Contract Conditions, no excavated materials, pipe, equipment, or any other items shall be stockpiled or stored on private property without the express written approval of the property owner of record. Duplicate copies of any written approval or authorization given to the Contractor shall be submitted to the Construction Project Manager and shall be so worded as to hold harmless the City of any responsibility whatsoever related to the stockpiling and storage of material and equipment. All costs incurred shall be borne by the Contractor.

### 2.0.3 Construction Easements

All additional temporary construction easements that the Contractor feels are necessary to perform the required work shall be coordinated, obtained and paid for by the Contractor. If these easements are granted to the Contractor, they shall be so worded as to hold harmless the City of any responsibility whatsoever related to any temporary construction easement obtained by the Contractor. Duplicate copies of the written authorization shall be submitted to the Construction Project Manager. All costs incurred under this item shall be borne solely by the Contractor.

**End of Specification**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management Standard Construction Specification

## 02-2213 Vibration Assessment

## Part 1 - General

### 1.01 Description

This specification covers vibration monitoring during construction activities to include an existing condition survey, baseline equipment monitoring and the establishment of a vibration monitoring program for use during construction operations. . This specification only applies when the corresponding bid item for vibration assessment is included and is specifically stipulated in the contract documents.

The purpose of the vibration monitoring program is to assess possible impacts that construction activities might have to adjacent facilities during all phases of the work. These facilities include, but are not limited to buildings, bridges, underground utilities, surface facilities, structure foundations, and all other facilities within the proximity of the work.

The City and County of Denver is not responsible for the safety of the Work and compliance with this specification does not relieve the Contractor of full responsibility for damage caused by the Contractor's operations.

### 1.02 Submittals

All submittals are submitted to the Construction Project Manager for record keeping purposes and verification of conformance with the contract documents. These submittals do not shift liability or relieve the Contractor from full responsibility for damage that is deemed to be caused by the Contractor's operations.

A. An independent vibration monitoring consultant will be used to fulfill the requirements of this section. The Contractor shall submit references for the consultant detailing at least

two projects completed in the past five years where the vibration monitoring consultant has satisfactorily monitored construction operations by recording maximum peak particle velocities (PPVs). Include contact information for each reference. This information shall be submitted to the Construction Project Manager for acceptance prior to beginning use of the Consultant's services.

B. The Contractor shall submit any facility condition survey that is done to the Construction Project Manager within 2 weeks of completion of the survey.
C. At a minimum, the Contractor shall submit any data and documentation derived from vibration monitoring along with interpretations of the results from the vibration monitoring consultant to the Construction Project Manager on a monthly basis.
D. The contractor shall offer formal training on how to access any web base data access site. A technical manual detailing all procedures for accessing the site shall be offered at the training session and submitted to the Construction Project Manager.

# Part 2 – Product

# Part 3 – Execution

## 3.01 Facility Condition Survey

This work shall consist of performing a facility condition survey(s) and preparing permanent records as indicated in this specification prior to the commencement of work, after completion of work, and at locations and times during construction as needed to verify that adjacent facilities have not been damaged by any element of the work.

## 3.02 Vibration Monitoring Consultant

A. The Contractor shall, as specifically indicated in this specification, provide vibration monitoring to verify that construction activities will not or have not damaged adjacent facilities.
B. The Contractor will obtain the services of an independent vibration monitoring consultant to assist in developing an existing condition survey, establish a vibration monitoring plan to include baseline and continuous monitoring, and interpret the results of the vibration monitoring as it relates to adjacent facilities.
C. Vibration monitoring will be done near elements of the construction work which are likely to have the largest potential to damage adjacent facilities during the course of construction operations. This monitoring will be used to establish a baseline reading of these activities and will be done at a location of the work which is least likely to damage adjacent property. The vibration monitoring consultant will review the results of the

baseline monitoring program and submit the results and their interpretation of the findings to the Construction Engineer in a report submitted on a monthly basis.

D. Vibration monitoring will take place on a continuous basis during all construction activities. Continuous vibration monitoring will be done throughout the project at locations that are nearest the construction activities and which have the potential to damage nearby facilities. The location and number of vibration monitoring instruments will be as directed by the vibration monitoring consultant based on the results of the baseline monitoring, their interpretation of these results, and their experience based on the type of activity and proximity to nearby facilities.

E. The Consultant/Contractor shall provide protection for all instrumentation from vandalism or theft. Any costs associated with vandalism or theft shall be born by the general contractor. The City and County of Denver shall at no time entertain any claim for loss associated with vandalism or theft of instrumentation.

F. The vibration monitoring consultant will be a PE licensed in the state of Colorado, and will have performed vibration monitoring services in Colorado to include monitoring construction operations to record maximum peak particle velocities.

G. The Consultant/Contractor will submit monthly reports to the Construction Project Manager which detail the baseline monitoring results, a summary of the continuous vibration monitoring results at locations nearest the construction activities and include a summary interpretation of all the results collected over the past month.

**END OF SPECIFICATION**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management Standard Construction Specification

## 3.0 Existing Facilities

### 3.0.1 General

The Contractor shall at all times take extreme and proper precautions for the protection of utilities, the presence of which are known or can be determined by the examination of appropriate utility maps, use of electronic locating, exploratory excavations, etc. The Contractor shall be responsible for all costs associated with the repair of any service and/or utility damaged by construction.

The Contractor shall notify Denver Water, Xcel Energy, telephone, cable and fiber optic companies, as well as property owners and all other interested parties, prior to commencement of work in order to ensure that there will not be service interruptions during construction. Existing utility lines and utility poles, trees, shrubbery, fences, water mains, gas mains, sewers, cables, conduits, curb, gutter, walks, and other structures in the vicinity of the work not authorized to be removed, shall be supported and protected from damage by the Contractor until all construction and related work is complete. The Contractor shall be liable for all damages to existing facilities, structures, and property.

### 3.0.2 Utilities

Utilities, underground and above-ground, shall include but not be limited to: fiber optics (including empty ducts), gas, telephone, electric, steam, water, sanitary and storm sewers, telegraph lines, conduits, all abandoned utilities, etc., and their accessories, appurtenances and service connections. The type, size, location, and number of all known above-ground and underground utilities have been shown on the drawings, however, no guarantee is made as to the true size, location or number of such utilities. It shall be the responsibility of the Contractor to verify the existence and location (vertically and horizontally) of all underground utilities along the route of the work, to ensure construction as shown in the Contract Documents. The omission from or the inclusion of existing or abandoned utility locations on the drawings is not to be considered as the nonexistence of, or a definite location of, said utilities.

### 3.0.3 Exploratory Excavations

Exploratory excavations shall only be paid at locations designated in the Contract Documents or as specifically approved by the Construction Project Manager, in writing. Otherwise, all costs incurred by the Contractor in making exploratory excavations shall be considered to be

included in the unit price bid for constructing each section of sewer line, structures, laterals and/or appurtenances.

In addition to those areas as may be designated in the Contract Documents, it shall be the Contractor's responsibility to excavate and locate all utilities and appurtenances which may affect construction or require protection during construction of the project scope. All exploratory excavations shall occur far enough in advance of the sewer facility construction to permit any necessary relocation or adjustment of the sewer facility without delaying the project.

### 3.0.4 Relocation and Adjustment

If it is determined prior to, or during construction that any underground or aboveground utilities (as defined within this specification) are required to be relocated or adjusted, the Contractor shall notify the utility owner well in advance of the Contractor's approach of such utility so that arrangements with the owner or owners of the affected utility can be completed without delaying construction. It is the Contractor's responsibility to coordinate all utility relocations and adjustments required to complete the scope of work designated within the construction plans and documents. All utilities requiring relocation and/or adjustment shall be constructed in accordance with each specific owner's requirements, standard specifications, and applicable agreements. The costs associated with utility coordination, relocations, adjustments; and/or construction delays due to improper planning, scheduling or advance notification of utility owners by the Contractor, shall be included within the related pipe segments, structures and appurtenances. Unless otherwise provided for in the Contract Documents or specified elsewhere, the responsibility of relocating both underground and aboveground utilities within the project limits shall be borne by the Contractor. If operations by the Contractor cause damage to any utilities lying outside of the prescribed maximum trench width the utility shall be repaired at the sole expense of the Contractor. The Construction Project Manager may order such utilities to be protected or relocated at the sole expense of the Contractor.

#### 3.0.4.1 Water Services

The type, size and location of water services are not shown on the construction plans and it shall be the Contractor's responsibility to identify and locate the services affected during construction. The Contractor is required to coordinate all water service relocations with Denver Water, well in advance of approach

The Contractor is required to maintain service and adjust all water service taps and/or connections encountered during construction. Service adjustments and reconnections for homeowners, businesses, and facilities with special circumstances will be completed during a timeframe which accommodates their needs. All work will be performed by a licensed plumber or journeyman drainlayer and shall be in accordance with Denver Water Standard Construction Specifications. No separate payment will be made for any of the work involved for this item and all costs incurred will be considered to be included in the applicable unit price bid for the associated pipe segments, structures and appurtenances.

#### 3.0.4.2 Gas Services

The type, size and location of gas services are not shown on the construction plans, and it shall be the Contractor's responsibility to identify and locate the services affected during construction. The Contractor is required to coordinate all gas service relocations with the utility owner, well in advance of approach. All work involved and costs incurred for this item will be included within the applicable unit price bid for the associated pipe segments, structures and appurtenances.

#### 3.0.4.3 Sewer Services

1. Adjusting

   All storm and sanitary sewer services and/or connections crossed during construction shall be adjusted by the Contractor as required to maintain service. A licensed plumber or a licensed drainlayer shall perform all such work. Unless otherwise provided for in the Contract Documents, no separate payment will be made for any of the work involved for this item and all costs incurred will be considered to be included in the applicable unit price bid for the associated pipe segments, structures and appurtenances.

2. Reconnection

   Where existing sanitary and/or storm sewer lines with service and/or lateral connections are being replaced, reconnection will be required at the locations shown in the contract documents, in addition to those located in the field by the Contractor and identified by the Construction Project Manager as active connections. Reconnection will also be required where a service or lateral connection was damaged as a result of work associated with this project. The contractor is also required to immediately and fully mitigate all damage to public or private property associated with the damaged service and/or lateral connection. This full and immediate mitigation shall be conducted regardless of apparent "fault" of the damage. The connections shall be reconnected by the Contractor utilizing standard tee or wye fittings, factory manufactured saddle taps, applicable pipe and reinforced concrete collars, adjustable repair couplings, etc. as specifically approved for construction by the Construction Project Manager. All service connections on PVC lines shall be constructed in accordance within these Standard Construction Specifications. Connections to sewer lines and structures shall be made using coring machines, keyhole saws, or other methods approved by the Construction Project Manager; jack-hammering or break in connections are not permitted. The Contractor will perform this work utilizing a licensed plumber or journeyman drainlayer. All connections must be reconnected to the new sewer line within twelve hours of discontinuance of service.

3. Location and Verification

   All sewer services and/or lateral connections shall be located and verified by the Contractor prior to construction (both vertically and horizontally). The Contractor shall notify the owner well in advance of access to mainline sewers to allow coordination and planning with the pertinent maintenance groups. All costs associated with delays and maintenance of mainline facilities will be incurred by the Contractor. The Construction

Project Manager shall be notified immediately of any information acquired from locates and verifications which may affect the design or original scope of work.

Unless provided for elsewhere in the Contract Documents or specified elsewhere, no separate payment will be made for any of the work involved for these items and all costs incurred will be included in the applicable unit price bid for the associated pipe segments, structures and appurtenances.

### 3.0.5 Abandonment

All existing sewer facilities to be plugged and abandoned in place are specifically shown on the Construction Drawings. Unless otherwise specified in the Contract Documents or elsewhere in the Special Conditions, the procedures and methods for the abandonment of said facilities shall conform to the following.

#### 3.0.5.1 Manholes/Inlets/Structures

Manholes, inlets or miscellaneous structures to be abandoned in place shall have all pipes entering or exiting the structure plugged with lean concrete. Manhole tops or cone sections shall be removed to the first full barrel diameter section, and/or to a point not less than 24-inches below final grade. The structure shall then be backfilled and compacted in accordance with Backfill Method B as specified within these Standard Construction Specifications. Backfill material may be either: select backfill, clean suitable excavated material, or controlled low strength material approved by the Construction Project Manager. Surface restoration for the surrounding area shall be done in accordance within these Standard Construction Specifications.

Manhole rings, covers, inlet grates, frames, precast flat tops, cone sections, or other salvageable items shall be salvaged, stored and delivered to such location as prescribed by the Construction Project Manager.

The payment for abandoning manholes, inlets, and/or miscellaneous structures as described above; along with the materials, equipment and labor necessary to complete all surface restoration associated with these items shall be included within the appropriate bid item (regardless of the size or depth of item abandoned). Refer to applicable Measurement and Payment description for specific item inclusions.

#### 3.0.5.2 Sewer Lines

Sewer lines to be abandoned in place shall be plugged with lean concrete and standard manufactured plugs or caps at both upstream and downstream ends of the abandoned section. If the manholes, inlets, etc. are also abandoned in place, or if the structure is to be removed completely, all sewer lines shall be plugged upstream and downstream of the removed structure following removal.

Sewer lines with an internal diameter of 24-inches or larger shall be filled with sand, pumped grout mixtures, or flowable fill, prior to final plugging. Unless otherwise noted in the Contract Documents, sewer lines with an internal diameter of 21-inches and smaller shall be plugged at entrance and exit ends with approved grout mixtures or concrete.

Unless provided for elsewhere in the Contract Documents or specified elsewhere, no separate payment will be made for any of the work involved for these items and all costs

incurred will be included in the applicable unit price bid for the associated pipe segments, structures and appurtenances.

### 3.0.6 Crossing of Existing Utilities

See Wastewater Management Division Standard Detail S-350, for requirements and general notes.

**End of Specification**

CITY AND COUNTY OF DENVER
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# Wastewater Capital Projects Management Standard Construction Specification

## 4.0 Utility Trenching and Excavation

### 4.0.1 General

All excavations, trenching, shoring and stockpiling of excavated materials shall be in strict compliance with the applicable Occupational Safety and Health Act (OSHA) rules and regulations.

Except where shown otherwise on the Drawings, and except when the Construction Project Manager provides written permission to do otherwise, all trench excavation shall be made by open cut to the depth required to construct the pipe line as shown on the Drawings and specified herein. Permission for tunnel work may be granted by the construction project manager for crossing under sidewalks, driveways, or existing utility lines. No separate payment will be made for any of the work involved for these items and all costs incurred will be included in the applicable unit price bid for the associated pipe segments, structures and appurtenances.

The length of trench permitted to be open at any one time may be limited when, in the opinion of the Construction Project Manager, such limitation is necessary for the safety and convenience of the public; however, in no case shall the length of open trench exceed 400 feet, except when the Construction Project Manager provides written permission to do otherwise. All trenches and excavations left overnight shall be protected as specified by the Construction Project Manager. This may include, but is not limited to: fencing, concrete, barriers, additional signage or any other measures required to provide public safety.

### 4.0.2 Subsurface Information

Whenever subsurface exploration, consisting of test holes and borings, has been made along the route of the work, the information obtained from these test holes will be included in both the Bid Submittal Package and the Contract Documents.

Subsurface information is provided for general information, and conditions may vary due to the location on jobsite and time of year. The City does not accept any responsibility for assumptions or generalizations made by the Contractor. Each bidder and Contractor must form their own opinion of the character of the work and of the materials to be excavated, and must make their own interpretations and investigations regarding all conditions affecting the work to be done.

### 4.0.3 Trench Width

Except as may be otherwise specified on the Drawings, the maximum clear trench width measured at a point one (1) foot above the top of the pipe barrel shall not be greater than that set forth in the most recent edition of the Wastewater Management Division Standard Detail Drawings.

The trench width shall be sufficient to permit the pipe to be placed and jointed properly and to allow for the construction of appropriate structures and appurtenances. Adequate width shall be provided to allow backfill to be placed and compacted as specified. Pipe shall not be installed in a bedding trench having a width (as measured one (1) foot above the top of the pipe) greater than the outside diameter of the pipe plus sixteen (16) inches for pipe having internal diameters of thirty-three (33) inches or less. Bedding trench shall not be greater than the outside diameter of the pipe plus twenty-four (24) inches for all pipes with internal diameters of thirty-six (36) inches or more.

If the stated maximum trench widths are exceeded either through accident or otherwise and if the Construction Project Manager determines that the design loading of the pipe will be exceeded, the Contractor will be required to either support the pipe with an improved trench bottom or to use a stronger class of pipe. The cost of such remedial measures shall be entirely at the Contractor's own expense. If deemed necessary, the Contractor shall brace or shore this portion of the trench excavation to maintain the required trench width at the top of the pipe.

### 4.0.4 Trench Walls

All trench sidewalls shall be properly sloped, benched, braced, shored or sheeted to assure safe working conditions and to prevent cave-ins. All trench operations including sloping or benching of the trench sidewalls and stockpiling of excavated materials shall be confined to the width of the permanent rights-of-way plus any temporary construction easements.

#### 4.0.4.1 Sloping or Benching

Sloping or benching of the trench walls will normally be allowed, provided that such sloping or benching complies with all applicable State and Federal requirements as defined within these Standard Construction Specifications; and provided further, that such sloping or benching does not endanger adjacent utilities or structures or the public. In the event the Contractor elects to slope or bench the trench sidewalls, the sloping or benching shall terminate at a depth not less than one (1) foot above the top of the pipe barrel and, from that point to the bottom of the excavation, the trench wall shall be vertical (with adequate shoring as necessary). All additional costs for backfilling and surface restoration, for trenches which exceed the maximum width defined within the Standard Constructions shall be borne by the Contractor.

#### 4.0.4.2 Bracing Shoring, Sheeting

The sides of the excavation shall be securely held in place with suitable bracing and shoring wherever necessary to prevent caving. In addition, bracing, shoring, sheeting, etc. shall be in accordance with all applicable State and Federal. Shoring shall be removed as the work

and backfilling operations progress, unless ordered by the Construction Project Manager to be left in place. The Contractor will be responsible for minimizing the disturbance of compacted bedding during advancement and removal of shoring within the bedding trench zone. All voids and separations shall be backfilled and recompacted with the appropriate bedding materials and in conformance with these Standard Construction Specifications. The Contractor will be paid for shoring so ordered left in place on the basis of invoiced material only. All other shoring shall be considered as incidental to construction and all costs incurred, except for materials ordered to be left in place, will be considered to be included in the unit price bid for the construction of each section of sewer, associated structures, laterals and appurtenances.

The decision to brace, shore or sheet the excavation shall be entirely the Contractor's responsibility. However, if the Construction Project Manager is of the opinion that any part of the excavation is not properly supported, the placement of additional supports or implementation of other methods by and at the expense of the Contractor may be required. Compliance with such order shall not relieve or release the Contractor from his/her responsibilities to provide a safe work zone.

### 4.0.5 Preparation of Foundation for Pipe Laying

When the excavation is in firm soil, care shall be taken to avoid excavation below the established grade (i.e. the specified overdepth to accommodate the particular class of bedding). The different methods and classes of bedding are described within these Standard Construction Specifications.

#### 4.0.5.1 Dewatering

During construction, the Contractor shall provide and maintain adequate equipment to properly remove and dispose of all water entering the trench or other part of the work. In water bearing strata, well points, sub drains or any other method approved by the Construction Project Manager that may be required to provide a dry trench.

Pipe trenches shall be kept free from water during excavation, fine grading, pipe laying and jointing. Dewatering, sufficient to provide a completely dry trench, shall be maintained during all pipe laying and jointing operations. The Contractor shall be responsible for damage resulting from the dewatering operations.

The discharge from any trench dewatering operations shall be conducted to natural drainage channels or other structures as approved by the Construction Project Manager and in accordance with applicable permits. Ground water shall not be discharged into sanitary sewers.

Unless provided for in the Contract Documents, dewatering shall be considered as incidental to construction and all costs incurred will be considered to be included in the unit price bid for the construction of each section of sewer line, associated structures, laterals and appurtenances.

#### 4.0.5.2 Overexcavation and Replacement with Select Backfill Material

If soft or otherwise unsuitable foundation material is encountered during the course of completing the work, it shall be removed and replaced with select backfill material and/or

angular rock bedding material so as to provide a suitable foundation for the pipe, structure and/or appurtenance or roadway, as determined by the Construction Project Manager.

In the event that overexcavation and replacement with select backfill material is below the water table, the sub-bedding material shall consist of 3/4 to 1-1/2-inch rock (or larger if approved). All work shall conform to the most recent edition of the Wastewater Management Division Standard Details.

If provided for in the Contract Documents, the cost of overexcavation and replacement with select backfill material will be paid for per the associated measurement and payment description. If no pay item for such work is included in the Contract Documents, the Contractor shall consider all costs incurred to be included in the unit prices bid for the construction of each section of sewer, associated structures, laterals and appurtenances.

At the option of the Construction Project Manager, select backfill material meeting the requirements of these Standard Construction Specifications may be delivered to the job site for the Contractor's use. The Contractor will be paid for placement of this material and the removal and disposal of the overexcavated material per the associated measurement and payment description.

### 4.0.6 Unsuitable Materials Excavation

Unsuitable material encountered within an excavated area during construction shall be excavated and disposed of by the Contractor as directed by the Construction Project Manager. Payment for excavation, disposal and replacement of unsuitable materials will not be paid for unless specifically authorized in writing by the Construction Project Manager. It may be necessary for the Contractor to rework, solely at the Contractor's own expense; dry, wet or otherwise satisfactory excavated material as necessary to obtain conformance with backfill requirements. Unsuitable materials are defined as:

1. Rock Excavation: Rock shall be defined as material consisting of igneous, metamorphic and sedimentary materials which cannot be excavated without blasting or the use of rippers, or boulders or other detached stones having a volume of ½ cubic yard or more, or having a specific gravity of at least 2.24 and weight not less than 140.4 pounds per cubic foot. The unit price bid for rock excavation will include granular bedding, select material, or any other material specifically approved in writing by the Construction Project Manager required to fill the excavated area.
2. Soil and excavated material containing rubbish, organics, frozen material, broken pavement, debris, stones larger than three (3) inches in diameter.
3. Muck, defined as an organic soil consisting of highly decomposed materials with more than 30% organic material and are generally referred to as peat or muck. These soils have bulk densities as low as 25 to 37 $lb/ft^3$.
4. Material determined to be of such an unstable nature as to be incapable of being compacted to the specified density using ordinary methods, at optimum moisture content.
5. Material which is too wet to be properly compacted and circumstances prevent suitable in-place drying prior to incorporation into the work.

6. For backfill to be used within a street, roadway or any other area where the degree of compaction is critical, material having a plasticity index greater than twenty (20) shall be considered unsuitable.
7. Material otherwise unsuitable for the planned use per the Contract Documents.

### 4.0.7 Pavement and Sidewalk Cuts

Where excavation is required under concrete or asphalt paved areas, including gutters and walks, the surfacing material shall be cut or rotomilled in such a manner as to produce a smooth, structurally sound, straight cut edge and confine the excavation to a minimum practical width. All pavement removals shall be neatly cut, rectangular or trapezoidal in shape, and edges shall be parallel, perpendicular or skewed up to 45º. The pavement or concrete shall be cut or removed at least one (1) foot beyond the top width of the trench on each side. All broken pavement, asphalt, concrete or other debris resulting from this initial work shall be immediately removed from the job site or stockpiled in an approved manner so that it is kept separated from the remaining trench excavation. This debris will not be allowed to be mixed in the trench backfill material.

### 4.0.8 Cut-off Walls

Cut-off walls are only required as noted in the contract documents and as specifically requested by the Construction Project Manager to prevent migration of water through the pipe bedding zone. The Construction Project Manager may specify alternate locations from those shown in the plans. Concrete cut-offs are the preferred installation method. Refer to Wastewater Management Division Standard Detail S-301.1 figure 2 for typical locations and additional information.

**End of Specification**

CITY AND COUNTY OF DENVER
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# Wastewater Capital Projects Management Standard Construction Specification

## 5.0 Bedding and Backfilling

### 5.0.1 General

This section outlines the guidelines and requirements for pipe bedding and backfilling operations required to complete construction per the Contract Documents.

### 5.0.2 Pipe Bedding

Unless specified otherwise on the Drawings or elsewhere in the Contract Documents, or directed otherwise by the Construction Project Manager, the Contractor shall bed all conduit according to the Class B Bedding method using a crushed granular, mineral aggregate material as noted in these Standard Construction Specifications and install the required geotextile over the pipe and/or bedding. Substitutions of recycled materials or manufactured materials in place of mineral aggregate mixtures for pipe bedding will not be allowed. If, in the course of construction, it is determined that the pipe foundation is unsatisfactory or the prescribed maximum allowable trench width is exceeded, the Construction Project Manager may require that an alternate class of bedding be installed. The Contractor shall be required to place the improved bedding class or make other remedies, at his/her expense.

No separate payment will be made for placement of the required bedding material. All costs incurred will be considered to be included in the unit price bid for each section of sewer line, associated structures, laterals and appurtenances.

#### 5.0.2.1 Bedding Materials

**1. #67 Bedding**

This bedding shall consist of a durable crushed granular material with a well graded mineral aggregate mixture, which will provide good stability. This bedding shall not contain recycled or manufactured materials. The size range of the aggregate shall be from 1/4-inch minimum to 3/4-inch maximum with a maximum amount of fines passing a No. 8 sieve not to exceed 5% by weight and shall conform to ASTM C-33 or ASTM D-448, gradation size #67. At least 50% of the material greater than the 3/8-inch sieve shall contain particles having 3 or more fractured faces.

| CLASS 67 GRADATION | |
|---|---|
| **Nominal Size** | **Percent Passing by Weight** |
| ¾ | 90-100 |
| ⅜ | 20-55 |
| No. 4 | 0-10 |
| No. 8 | 0-5 |

**2. Special Bedding Material**

Special bedding material shall only be used where required within the Contract Documents and as specifically approved by the Construction Project Manager. This material is intended for use on rigid pipe of sixty (60) inches or greater in diameter and shall not be used with flexible conduits. Additionally, this bedding shall not contain recycled or manufactured materials. The following gradation requirements shall apply:

| SPECIAL BEDDING MATERIAL | |
|---|---|
| **Nominal Size** | **Percent Passing by Weight** |
| ⅜ | 100 |
| No. 4 | 80-100 |
| No. 16 | 35-65 |
| No. 50 | 10-25 |
| No. 100 | 5-10 |
| No. 200 | 3-8 |

**3. Alternate Classes of Bedding**

Alternate classes of bedding may be required within the Contract Documents or requested within the project scope. All such bedding materials must be submitted and separately approved for use by the Construction Project Manager. Recycled or manufactured materials will not be considered and alternate bedding materials used on site which have not been approved shall be rejected and the removal and replacement of these materials will be at the Contractor's expense.

### 5.0.2.2 Bedding Requirements

On rigid pipe of fifteen (15) inches or less in diameter and on all pipe classified as flexible, the bedding shall be continued until the bedding is filled to one foot above the top of the pipe. On rigid pipes eighteen (18) inches or greater in diameter, the bedding can be terminated at a point equal to the spring line of the pipe.

| Conduit Type | Bedding Requirements* | |
|---|---|---|
| | ≤15" Diameter | ≥18" Diameter |
| Reinforced Concrete Pipe (RCP, HERCP, etc.) | 1' Above Top of Pipe | Spring Line of Pipe |
| Reinforced Polymer Mortar Pipe (RPMP) | 1' Above Top of Pipe | |
| Ductile Iron Pipe (DIP) | 1' Above Top of Pipe | |
| Corrugated Metal Pipe (CMP, CSP, ASP, etc.) | 1' Above Top of Pipe | |
| Polyvinyl Chloride Pipe (PVC) | 1' Above Top of Pipe | |
| High Density Polyethylene Pipe (HDPE) | 1' Above Top of Pipe | |
| Reinforced Concrete Box Culvert (RCB or RCBC) | 6" Below Outside of Box | |
| * Based on internal diameter or equivalent internal diameter of conduit | | |

### 5.0.2.3 Bedding Methods

**1. Class A Pipe Bedding**

Class A Bedding shall be defined as that method of bedding by which additional supporting strength of the pipe is attained by supporting the lower part of the pipe with a concrete cradle or distributing trench loads on the upper portion of the pipe by means of a concrete arch.

In those instances where Class A Bedding is required, the Contractor shall construct either a concrete cradle or concrete arch as specifically noted in the Contract Documents or as directed by the Construction Project Manager. Class A Bedding shall be constructed of non-reinforced concrete with a minimum 28-day compressive strength ($f'_c$) of no less than 2000 psi, unless otherwise noted. Additional requirements for either type of construction are specified below. Class A Bedding will normally not be allowed for flexible type installations such as corrugated steel pipe, plastic pipe, etc.

After concrete cradle or arch bedding has been constructed, no backfilling shall be completed above the pipe until the concrete has attained the required minimum compressive strength. Where sheeting is removed or left in place, all cavities remaining, adjoining and/or behind shall be firmly filled with a suitable backfill material.

**a. Concrete Cradle**

This method of Class A Bedding construction shall consist of bedding the lower part of the pipe in a poured-in-place concrete cradle. The minimum thickness of concrete under and around the conduit shall not be less than that specified on the most recent edition of the Wastewater Management Division Standard Detail Drawings.

The concrete shall extend upward around the pipe a minimum distance of ¼ of the outside diameter (but not less than 4-inches), measured from the lowest portion of the pipe exterior. The width of the concrete cradle shall be at least equal to the outside diameter plus 8-inches. Blocking material required to support the pipe prior to placement of concrete shall have a minimum compressive strength of 2000 psi. The remaining excavation to a point two (2) feet above the top of pipe shall be backfilled and compacted in accordance with Backfill Method B as specified in Section 5.0 of the Standard Construction Specifications.

**b. Concrete Arch**

This method of Class A Bedding construction shall consist of bedding the upper part of the pipe in a poured-in-place concrete arch. The minimum thickness of concrete over and around the conduit shall not be less than that specified in the most recent edition of the Wastewater Management Division Standard Detail Drawings.

The concrete shall extend upward around the pipe a minimum distance of ½ the outside diameter plus 4-inches, measured from the spring line of the pipe. The width of the concrete arch shall be at least equal to the outside diameter plus 8-inches. Where a concrete arch is required, the lower portion of the pipe (from spring line down) shall be bedded with Class B bedding, in accordance with this section. The remaining excavation to a point two (2) feet above the top of pipe shall be backfilled and compacted in accordance with Backfill Method B as specified in Section 5.0 of these Standard Construction Specifications.

**2. Class B Pipe Bedding**

Class B Bedding shall be defined as that method of bedding in which the pipe is set on an approved granular material. The trench shall be excavated to a depth below the bottom of the pipe as specified in the Wastewater Management Division Standard Details. The overexcavation shall be backfilled and compacted with a clean granular material free from organic and/or unsuitable materials. The material shall be placed under the pipe and on either side of the pipe up to depths specified within these Standard Construction Specifications. The placing shall be done in a manner which will assure no separation or change in uniform gradation.

All bedding material shall be placed under the pipe haunches, then brought up in six inch (6") lifts (maximum) and compacted by hand operated mechanical vibrators equally and thoroughly along each side of the pipe in such a manner as to avoid displacement of, or damage to the pipe. All bedding material shall be compacted to a density of at least ninety percent (90%) as determined by the Modified Proctor Method, AASHTO designation T-180, before the next lift is placed. Refer to Wastewater Management Division Standard Detail S-301.2 for additional information.

In no case will jetting or flooding be allowed as means for consolidation or compaction of the bedding material. Cut-off walls will be required to be installed as described in these Standard Construction Specifications and as shown on the Wastewater Management Division Standard Details.

### 5.0.3 Backfill

Excavated material will be considered suitable for backfill purposes, provided its use results in a well-compacted stable condition. All backfill material shall be free from rubbish, organics, frozen material, broken pavement, debris, stones larger than three (3) inches in diameter, or other unsuitable materials.

Material having a plasticity index greater than twenty (20) shall not be used for backfill within a street, roadway, or any other area where the degree of compaction is critical. It may be necessary for the Contractor, at his/her sole expense, to dry, wet, mix or otherwise rework satisfactory excavated material as necessary to obtain conformance with these Standard Construction Specifications.

The use of squeegee material or pea gravel will not be allowed as backfill material due to their free flowing nature if undermined. These materials may be used as pipe bedding if required by a specific utility owner, but they must be consolidated by vibration prior to backfilling operations.

When, in the opinion of the Construction Project Manager, the excavated material is unsuitable for use as backfill, or when there is a shortage of satisfactory backfill material within the project limits, the Contractor shall locate and furnish all necessary suitable backfill material and shall dispose of the unacceptable material. All excess backfill or unacceptable excavated material shall be disposed of off the rights-of-way and public property by the Contractor, unless directed otherwise by the Construction Project Manager. Backfilling shall be performed in strict conformance with these Standard Construction Specifications.

#### 5.0.3.1 Trench Backfill

The entire area from pipe subgrade to the finished surface elevation shall make up the trench backfill zone. This zone consists of two (2) main sections described below: the Bedding Trench and the Backfill Above Bedding Trench. All areas outside of this zone will be considered Backfill Outside the Trench.

Unless otherwise set forth in the Contract Documents, the cost of the bedding and trench backfill requirements shall be included in the associated unit price bid for the respective sewer line, associated structures, laterals and appurtenances.

1. **Bedding Trench**

   The Bedding Trench is defined as starting at the subgrade of the specified overdepth required to accommodate the particular class of bedding below the bottom of the pipe and extends vertically to a point where the bedding is terminated (as defined under Bedding Requirements above).

   The bedding trench shall be backfilled with an approved bedding material, in accordance with Class A or Class B Bedding methods immediately after the pipe is laid, except where the pipe must remain exposed for leakage tests (subject to the provisions of these Standard Construction Specifications).

2. **Backfill Above Bedding Trench**

   Backfill Above the Bedding Trench shall be considered as starting one foot above rigid pipe fifteen (15) inches in diameter or less and for all pipe classified as flexible; or at the spring-line for rigid pipe eighteen (18) inches and larger in diameter. All material below these areas shall be considered as bedding material. Refer to the Bedding Requirement table included within this section for further clarity based on pipe types.

3. **Backfill Outside the Trench**

   All backfilling required during construction which is outside of the Trench Backfill Zone, as defined above, will be considered Backfill Outside the Trench. These materials shall meet the requirements set forth in this specification.

   Backfill for cast-in-place or precast structures and appurtenances, including but not limited to: manholes, transition structures, junction structures, vaults, inlets and concrete box culverts, shall start at the subgrade for the structure, or appurtenance. As a minimum requirement all structures, inlets, manholes and appurtenances will follow Method B backfill procedures as described in this specification. All remaining operations which fall under Backfill Outside the Trench will follow method A backfill procedures as a minimum, unless specified otherwise in the Contract Documents or directed by the Construction Project Manager.

### 5.0.3.2 Backfilling Methods

After the specified pipe bedding has been placed, compacted and approved, and after the requirements for the bedding trench have been fulfilled and the Construction Project Manager has approved the commencement of backfilling operations, the balance of the trench shall be backfilled and compacted in accordance with one of the methods described below. The contractor shall not temporarily backfill trenches and return later to re-excavate and meet the backfill method requirements. The Contractor shall consider the minimum backfill and compaction requirements to be in conformance with Backfill Method A for pipeline trenches and Backfill Method B for pipe bedding, backfill under or around manholes, structures, inlets, utilities and appurtenances, unless specified otherwise in the Contract Documents.

The use of hand held tools or devices to meet compaction requirements shall be continued around and above the pipe section during the trench backfilling process until a minimum

vertical height above the pipe of two (2) feet is reached. Thereafter, the use of approved compaction equipment (vibratory, sheepsfoot, rubber-tire, etc.) may be utilized. Impact, free fall, stomping and jetting operations are not permitted unless specifically approved by the Construction Project Manager.

The Contractor shall exercise the utmost care during compaction by any of the methods described below, to assure that no damage will occur to the sewer, appurtenances or other existing utilities. Any damage resulting from compaction shall be repaired or replaced at the Contractors expense.

1. **Backfill Method A**

   The backfill shall be placed in horizontal layers of such depths as are specified below for the material being placed and the type of equipment being used. Granular soils shall be compacted by vibration; whereas cohesive soils shall be compacted by a kneading action.

   Material for mechanically compacted backfill shall be placed in lifts, which, prior to compaction, shall not exceed the thickness specified below for the various type of equipment:

   a. Vibratory equipment, including vibratory plates, vibratory smooth-wheel rollers, and vibratory pneumatic-tired rollers - maximum lift thickness of two (2) feet;

   b. Rolling equipment, including sheepsfoot (both vibratory and non-vibratory), grid, smooth-wheel (non-vibratory), pneumatic-tired (non-vibratory), and segmented wheels-maximum lift thickness of one (1) foot;

   c. Hand-directed mechanical tampers - maximum lift thickness of six (6) inches.

   Permission to use specific compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage to adjacent ground, existing improvements, or improvements installed under the Contract Documents. The Contractor shall make his/her own determination in this regard.

   It will be the Contractors responsibility to maintain a minimum of eighty-five (85%) density from the top of bedding to a distance of two (2) feet over the top of pipe. The density from two (2) feet over the top of pipe to the subgrade surface shall maintain a minimum of ninety percent (90%) density. Regardless of facility depth, the last foot of subgrade material shall be compacted to a minimum density of ninety percent (90%). All densities shall be determined by the Modified Proctor Method, AASHTO Designation T-180. Each lift of backfill material shall have the proper moisture content and consistency to permit compaction to the designated density. The compacted material may be tested at any time for adherence to these Standard Construction Specifications.

2. **Backfill Method B**

   This method of backfilling requires placement in six (6) inch lifts. Each lift will have the proper moisture content and consistency to permit compaction to the prescribed density. Each lift will be uniformly and completely compacted by either handheld pneumatic or mechanical tampers to a density of at least equal to ninety percent (90%) of the density

determined by the Modified Proctor Method, AASHTO designation T-180, before the next lift is placed.

3. **Backfill Method C**

   Other methods of backfill placement and compaction to the prescribed density may be submitted to the Construction Project Manager by the Contractor. These methods will not be used without the prior written approval of the Construction Project Manager.

#### 5.0.3.3 Select Backfill Materials

Select materials shall only be used as backfill when specifically shown in the Contract Documents or as approved and authorized by the Construction Project Manager and will only be placed to the specified depths in those areas as shown on the Contract Documents or as ordered by the Construction Project Manager. The materials listed here are only intended for backfilling purposes and shall not be used for pipe bedding at any time. Prior to using select materials onsite, the Contractor shall submit product documentation for approval. All select material placed without approval from the Construction Project Manager will be rejected and the Contractor will incur all costs associated with removal and replacement of the material.

1. **Subgrade Material (Select Backfill)**

   Select subgrade material, which may also be specified as "select backfill material" in other locations within the Contract Documents, shall be defined as a well graded mixture of sound mineral aggregate particles containing sufficient, proper quality binding material to secure a firm, stable foundation when placed and compacted. When tested with laboratory sieves, the material shall meet the following gradation requirements:

| Standard Sieve Size | % Passing (by Weight) |
|---|---|
| 3 inch | 100 |
| No. 10 | 80 maximum |
| No. 200 | 0-15 maximum |

All select subgrade material shall be of such quality that material passing a No. 40 sieve will have a liquid limit of not more than thirty five (35) and a plasticity index of not over six (6) when tested in conformity with AASHTO Designations T-89 and T-91 respectively. In addition, the City will take soil-bearing tests where necessary, to evaluate the quality of materials produced from pit sources. If the bearing value or stabilometer values of pit materials are considered to be adequate, minor deviations (less than five percent) from the liquid limit and plasticity index criteria specified shall not be considered to be a basis for rejection of the material. It shall be the responsibility of the Contractor to locate material meeting these Standard Construction Specifications and to secure approval of the Construction Project Manager before such material is delivered to the project. If at

any time during the construction, such tests reveal that the material being delivered is not of suitable quality for the purpose for which it is intended, the City reserves the right to direct the Contractor to change pit locations as necessary, at no cost to the City. If the Contractor so elects, he/she may, at his/her own expense, remove and dispose of the excavated material even if the Construction Project Manager considers it satisfactory for use as backfill, and replace it, at his/her own expense with select backfill material.

**2. Structural Fill**

Structural Fill shall be defined as a well graded mixture of sound mineral aggregate particles void of debris containing sufficient proper quality binding materials to secure a firm, stable foundation when placed and compacted. When tested with laboratory sieves, the material shall meet the following gradation requirements:

| Standard Sieve Size | % Passing (by Weight) |
|---|---|
| 2 inch | 100 |
| No. 4 | 30-100 |
| No. 50 | 10-60 |
| No. 200 | 5-20 |

Bearing value and or stabilometer tests by CBR or R value methods may be required to properly evaluate the quality of the material.

Colorado Department of Transportation approved class 4, 5, or 6 base course materials typically meet the above specifications. A report showing the gradation analysis and test results for the materials proposed for Structural Fill shall be required by the Construction Project Manager prior to placement and in accordance to AASHTO designations T-89 and T-91.

**3. Recycled and Processed Materials**

Recycled and processed materials shall include: recycled concrete, aggregates, asphalt, crushed gravel base course (road base), crusher fines or any other materials specified as such. The use of these materials within the construction site shall be limited to those areas designated within the Contract Documents or approved by the Construction Project Manager.

The following gradations are provided as a guideline for recycled and processed materials commonly used in construction and represent only a portion of those available for use. Approved submittals will be required prior to placement, to ensure that the material type and particle distribution are suitable for the intended application. All materials of this category placed without previous approval of the Construction Project Manager shall be rejected and all costs incurred for removal and replacement of these materials will be at the Contractor's expense.

a. Crushed Recycled Concrete

| Standard Sieve Size | % Passing (by Weight) |
|---|---|
| 1½ inch | 100 |
| ¾ inch | 40-75 |
| ¼ inch | 25-50 |
| No. 40 | 5-20 |
| No. 200 | 10 max |

b. Crushed Recycled Asphalt Pavement

| Standard Sieve Size | % Passing (by Weight) |
|---|---|
| 1½ inch | 100 |
| ¾ inch | 40 minimum |

c. Crushed Gravel Base Course (CDOT Class 6 Road Base)

| Standard Sieve Size | % Passing (by Weight) |
|---|---|
| ¾ inch | 100 |
| No. 4 | 30-65 |
| No. 8 | 25-55 |
| No. 200 | 3-12 |

d. Crusher Fines

Crusher fine material shall meet the gradation shown in the following table. The material shall consist of fine mineral fragments resulting from rock crushing operations.

| Standard Sieve Size | % Passing (by Weight) |
|---|---|
| ⅜ inch | 100 |
| No. 4 | 90-100 |
| No. 8 | 55-80 |
| No. 16 | 40-70 |

| Standard Sieve Size | % Passing (by Weight) |
|---|---|
| No. 30 | 25-50 |
| No. 200 | 6-15 |

**4. Controlled Low Strength Material (CLSM)**

Controlled Low Strength Materials (CLSMs) consist of a well-graded mixture of mineral aggregates, cementitious materials, water and admixtures. Other common names for CLSMs include: flowable fill, flowfill, non-shrink backfill, fly ash fill and controlled density fill.

The contractor will be required to submit a mix design and test data to the Construction Project Manager for approval, prior to excavating the area for which CLSMs are proposed for use. All materials of this category placed without previous approval, or which do not perform as specified, will be rejected by the Construction Project Manager and all costs incurred for removal and replacement of these materials will be at the Contractor's expense.

All CLSMs shall adhere and conform to the following, unless noted otherwise:

a. The mix must be capable of freely flowing to fill all voids in trenches or other areas without compaction or other additional effort,

b. The mix must be of uniform density and low permeability to prevent migration of adjacent fines into the set mix,

c. Must be placed in a uniform manner that will prevent voids or segregation of the backfill and shifting of pipelines, structures and appurtenances. Foreign material that falls into the trench prior to, or during placement shall be immediately removed,

d. The CLSM shall be produced using a central-mixed concrete plant or other approved method,

e. Chemical admixtures containing chlorides shall not be used unless approved otherwise,

f. CLSMs will be classified as either Standard Aggregate or Fine Aggregate CLSM according to the table below. Submitted CLSMs must follow the gradation guideline provided here, unless approved otherwise:

| Standard Sieve Size | % Passing (by Weight) |
|---|---|
| 1 inch (For Standard Aggregate CLSM)<br>⅜ inch (For Fine Aggregate CLSM) | 100<br>100 |
| No. 8 | 50 minimum |

| | |
|---|---|
| No. 200 | 0-30 maximum |

g. The 28-day compressive strength must be between 50 and 150psi, unless otherwise directed by the Construction Project Manager. Test cylinders may be required to insure that the specified strength is obtained. The compressive strength shall be determined by ASTM D4832, "Preparation of Testing of Soil-Cement Slurry Test Cylinders",

h. The mix shall have a slump between 7 and 10 inches as per AASHTO Designation T 119-82,

i. When CLSMs are placed within the right-of-way, or they are to be covered by paving materials, the final set product must achieve a maximum indentation diameter of 3-inches prior to covering and opening the area to traffic. Penetration resistance shall be as measured by ASTM C6024, "Standard Test Method for Ball Drop on Controlled Low Strength Material to Determine Suitability for Load Application",

j. Final set product shall excavate easily, minimizing the risk of damage to buried utilities during future work,

k. Must be placed within 2 hours after mixing at the batch plant, unless otherwise approved or specified by the Construction Project Manager,

l. Delivery tags shall be collected from the delivery driver and provided to the Project Inspector or Construction Project Manager. The delivery tag shall contain the supplier name, the mix identifying name and/or number as listed in the supplier's submitted mix design. The Project Inspector or Construction Project Manager may reject any mix that does not appear to meet the requirements of this specification (segregation, insufficient slump, open graded aggregates, etc.).

**5. Topsoil**

Topsoil shall be defined as soil that contains the sufficient organic materials necessary to support growth of grass, which is free of all types of debris, weeds, stones or other unsuitable materials. Topsoil will be required to be placed and compacted whenever excavation occurs through parks or other landscaped areas and the excavated material is deemed to be unsuitable for growth. Placement will be required from the existing subgrade to the depth specified in the Contract Documents or as otherwise directed by the Construction Project Manager. All topsoil used within the construction site shall conform to the Contract Documents and/or the specifications set forth by the owner of property affected during construction. Topsoil may also be specified as Class B Topsoil.

Class B topsoil shall be the original top layer of the soil profile formed under natural conditions, technically defined as the "A" horizon by the Soil Society of America. It shall have demonstrated by evidence of healthy vegetation growing or having grown on it,

prior to stripping, that it is well drained and does not contain substances toxic to plant life. It shall be the responsibility of the Contractor to locate material meeting these Standard Construction Specifications and to certify that the material is suitable for the intended purpose. The contractor must also secure approval of the Construction Project Manager before such material is delivered to the project.

Topsoil shall not be placed until the areas to be covered have been properly prepared and grading operations in the area have been completed. Topsoil does not require compaction but shall be keyed to the underlying material by the use of rollers or other equipment suitable for the purpose. Water shall be applied to the surface in a fine spray by nozzles or spray bars in such a manner that the operation does not wash or erode the topsoil areas.

**6. Other Classified Select Materials**

Alternate select materials, stabilization materials, and angular rock bedding materials shall be considered as other classified select materials.

Whenever the excavated material is deemed to be unsuitable for backfill and there is no requirement for the placement of any of the above specified select materials, other classified select materials shall be placed and compacted. It shall be the responsibility of the Contractor to locate such material and to secure written approval of the Construction Project Manager before such material is delivered to the project.

### 5.0.3.4 Unsuitable Material

Unsuitable material encountered within the project boundaries during construction shall be excavated and disposed of by the Contractor. Unsuitable material is defined as:

1. Soil and excavated material containing debris, weeds, asphalt, stones or concrete (larger than 3-inches in diameter), rubbish, and frost or other frozen particles,
2. Material determined to be of such an unstable nature as to be incapable of being compacted to the specified density using ordinary methods, at optimum moisture content,
3. Material which is too wet to be properly compacted and circumstances prevent suitable in-place drying prior to incorporation into the work,
4. Material otherwise unsuitable for the planned use per the Contract Documents.
5. Any fill material or soils not meeting regulatory and City standards for contamination

The presence of excessive moisture in a material is not, by itself, sufficient cause for determining that the material is unsuitable. Additionally, material which becomes unsuitable due to negligence or the means and methods utilized by the contractor will not be considered for payment. The costs incurred to remove and replace these materials shall be included in the associated unit price bid for the respective sewer line, associated structures, laterals and/or appurtenances.

The cost of removal of unsuitable backfill material and replacement with suitable material encountered while completing the project scope and which do not meet the above, will be paid for per the applicable bid items and in accordance with the associated measurement and payment description.

**End of Specification**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management Standard Construction Specification

## 6.0 Surface Restoration

### 6.1 General

Where pavement, curb and gutter, sidewalks, drainage culverts, headwalls, or other structures or improved surfaces, landscaping, etc., have been removed during the course of the work, such items shall be restored to a condition at least equal to that prior to removal and to the same elevation and alignment. The subgrade for all restored surfaces shall be thoroughly compacted to the specified limits by mechanical or hand tampers.

### 6.2 Asphalt Replacement

Except as modified herein, asphaltic concrete paving material to be replaced over trench excavations shall conform to the MGPEC asphalt paving requirements.

#### 6.2.1 Thickness

Unless otherwise stipulated in the **Proposal** or on the Plans, all asphalt pavement required to be removed for trench or structural excavation shall be replaced with a "full depth" asphaltic concrete paving section conforming to the depths specified on the Plans.

#### 6.2.2 Materials

The materials to be used for asphaltic concrete pavement shall confirm to **Item 20** of the **Standard Construction Specifications** and the herein described modifications, additions or deletions.

### 6.3 Gravel Surfaced Streets and Alleys

Where excavation occurs in streets, alleys, or other areas which have only a gravel surface, such surfacing shall be replaced with gravel surfacing material equal in depth to that which existed before construction but not less than 3 inches compacted depth minimum. The surface shall conform to the original finish grade.

If the Contractor so elects, the existing gravel surfacing may be excavated down to a depth and width designated by the Project Construction Engineer, stockpiled in an area separate

from the excavated trench material, and later replaced to the required depth after the trench has been properly backfilled.

No separate measurement for payment will be made of any work or material stipulated above that is necessary to remove and later replace the gravel surfacing, and all costs incurred will be considered to be included in the unit price bid for the construction of the appropriate section of sewer line or the associated structure.

## 6.4 Sidewalk, Curb and Gutter, Concrete Pavement

Where sidewalks, curb together, culverts and other obstacles are removed in the prosecution of the work. The Contractor shall consolidate the backfill in the same manner as specified for paved streets and shall then replace sidewalks curb and gutter, etc. in accordance with standard specifications for class of work involved. Where sod areas are encountered, the sod shall be removed and replaced with new at the original grade and elevation after consolidation of the backfill. Sprinkler systems shall be protected or removed and replaced as required.

## 6.5 Sod

Sod, defined as densely grassed turf, which is removed, may be put back if it has been properly stored and remains in a healthy condition. If so stipulated in the Contract, the cost of replacing sod will be paid in the manner described under Measurement and Payment. If no pay item for replacing sod is included in the Contract, the Contractor shall consider that all costs incurred in replacing sod are to be included in the unit price bid for each section of sewer line or the associated structure.

## 6.6 Concrete Alley Pavement Replacement

Except as modified herein, concrete alley pavement replacement over trench excavations shall conform to **Item 4** of the **Standard Construction Specifications**.

### 6.6.1 Materials

The materials to be used for concrete alley pavement replacement shall conform to Item 20 Grass Sodding and the herein described modifications, additions or deletions.

a. **Wire Mesh**. Reinforcing steel (6" x 6", W1.4 x W1.4) wire mesh shall be used for reinforcement of the concrete pavement over For replacement of full width alley concrete paving, the reinforcing steel wire mesh will extend the full alley width, per Wastewater Management Division Standard Detail S-205.

b. **Concrete Aggregates**. Concrete shall conform to Paragraph 12.2, "materials", sub-paragraph b(2) of the Standard Specifications.

c. **Joint Sealer**. Silicone joint sealer shall be a one part, low modulus, silicone formulation, designed for use in highway joint sealing applications and meeting Federal Specifications TT-S-001543A and TT-S-00230C. Primer shall be used if required by the manufacturer.

Acetic acid cure sealants are not acceptable.

Test methods shall be as follows:

| | | |
|---|---|---|
| Flow | MIL S 8802 | |
| Extrusion Rate | MIL S 8802 | |
| Track Free Time | MIL S 8802 | |
| Specific Gravity | ASTM D 792, Method A | |
| Durometer Hardness | ASTM D 2240 | |
| Tensile Stress | ASTM D-412 | (DIE C) |
| Elongation | ASTM D-412 | (DIE C) |
| Ozone & Resistance | ASTM D-793-75 | |

Bond to concrete mortar: Briquettes molded in accordance with AASHTO T 132-74 sawed in half and bonded with a thin section of sealant and tested in accordance with AASHTO T 132-74. Briquettes shall be dried to constant weight in oven at 110 degrees C+ degrees.

GESCS4403 Highway Joint Sealant and Dow Corning 888 Silicone Joint Sealant are approved for sealing joints. "Backer Rod" used in joints for Portland Cement Concrete Pavement shall be closed cell, polyethylene form rod conforming to the following specifications:

| | | |
|---|---|---|
| Diameter | Joint width + 1/78" | |
| Density | 2.0 lbs./cu. ft. | ASTM D-1622 |
| Tensile | 15 psi | ASTM D-1623 |
| Water Absorption | 0.5% by volume | ASTM C-509 |
| Compression Reflection | 25% @ 8 psi | ASTM D-1621 |

### 6.6.2 Construction Requirements

a. **Alley Paving**.

"Concrete driveways which abut the alley must be placed separately, creating a cold joint between the concrete driveway and the alley for the full depth of the alley paving."

b. **Expansion Joints**.

"Expansion joints shall be placed at the end of block property lines and where the alley changes directions. Construction of the expansion joints will be as shown on the Wastewater Management Division Standard Details. Expansion joints shall also be required at structures, vaults, retaining walls, poles, etc. or as required by the Project Construction Engineer."

c. **Dummy Groove Contraction Joints**. The Contractor has the option to use the dummy groove contraction joints as follows:

"All contraction joints will be saw cut as shown on the Wastewater Management Division Standard Details. The saw cut will be 1-1/2 inches deep by 3/8 inch minimum width to a maximum of 1/2 inch for the full width of the alley. Contraction joints will be spaced a maximum of fifteen (15) feet apart along the length of the alley and must be sawed consecutively in the direction of the pour. Only by approval of the Construction Project Manager may a joint be skipped and sawed later. Transverse contraction joints shall be placed at each utility pole, manhole, and at the ends of retaining walls, or as directed by the Project Construction Engineer. Contraction joints shall extend through any alley curbhead. Concrete joint sealer shall be a grey silicone joint sealant as manufactured by G.E., Dow-Corning or an approved equal. All joint sealers and backer rods shall be installed in accordance with the manufacture's requirements. The silicone shall meet all applicable AASHTO, ASTM and Federal Specification TT-S-0021543A and TT-S-00230C.

Saw cut joints to be sealed shall be filled with joint sealing material before the pavement is opened to traffic and as soon after completion of the curing period as is feasible. Just before sealing, each joint shall be thoroughly cleaned of all foreign material, including membrane curing compound, and joint faces shall be clean and surface-dry when seal is applied. Where cleaning of the joints is by compressed air, the compressed air shall be oil free. The sealing materials shall be applied to each joint opening in accordance with the details shown in the plans, to the manufacturer's specifications or as directed by the Project Construction Engineer. The joint filling shall be done without spilling material on the exposed surfaces of the concrete. Any excess material on the surface of the concrete pavement shall be removed immediately and the pavement surface cleaned. The use of sand or similar material to cover the seal shall not be permitted. Joint sealing material shall not be placed when the air temperature in the shade is less than 50 degrees F., unless approved by the Project Construction Engineer.

Should other cleaning methods prove unsatisfactory, the Construction Project Manager may require sandblasting or another method inside of the contraction joints to remove incompressible materials. The Contractor may wish to install the backer rod on top of the sawed joint in order to keep it clean and later depress the rod when the silicone sealant is installed. The joints shall be sealed by first priming the joint, if required by the silicone sealant manufacturer and then placing a backer rod compatible with silicone and sealing with an approved liquid silicone joint sealant. The joints should by approved by the Construction Project Manager prior to sealing."

d. **Opening to Traffic**. Add the following after the first sentence of Paragraph 35.3I: "Or until field-cured concrete cylinders have obtained a compressive strength of 3500 psi and all contraction joints have been cleaned and sealed."

e. **Raised Lips**. No extra payment will be made for raised slope paving required to widen alleys to meet existing improvements shall be paid for as Concrete Alley Paving.

f. **Finish**. As shown the plans, or where longitudinal slopes exceed 7%, or where required by the Project Construction Engineer, a 3/16 inch metal time finish shall be applied

perpendicular to the centerline in accordance with Colorado Department of Highway specifications.

**End of Specification**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management Standard Construction Specification

## 7.1 TUNNELING, JACKING AND BORING

### 7.1.1 Definitions

#### 7.1.1.1 Geotechnical Data Report (GDR)

A document which presents an interpretation of the known subsurface data for the project. The purpose of the GDR is to compile all geological, geotechnical, groundwater, and other data obtained from the geotechnical investigations for use by the various participants in the project. If available, this information will be included within the contract documents as specifically applicable to the project.

#### 7.1.1.2 Geotechnical Baseline Report (GBR)

The intent of a GBR is to clearly and contractually define the geotechnical conditions through which tunneling will occur in order to evaluate a differing site condition (if encountered) and it is used as a basis of bid for the contractor. By assessing the anticipated geotechnical conditions for a project and providing baselines in the contract, the contractor has a basis from which to prepare their bid and select their means and methods. The baseline conditions do not necessarily reflect the actual conditions; they are not geotechnical fact to be encountered. Rather, they represent the owner's assumption of existing geotechnical conditions for the project. If available, **this** information will be included within the contract documents as specifically applicable to the project. Regardless of inclusion, this information shall be investigated, interpreted, verified and/or developed by the contractor prior to commencement of the work.

#### 7.1.1.3 Tunnel Shield

A steel shell shaped to fit the excavation line of the tunnel that provides protection at the tunnel face for the construction personnel and space for the tunnel excavation and support operations. The shield may be fitted with boom-mounted tools such as an excavator for excavating the tunnel and mechanical devices for erecting the tunnel supports, or hand mining may be performed inside the shield.

#### 7.1.1.4 Tunnel Boring Machine (TBM)

A machine that uses a full-face cutter head to excavate a circular tunnel.

#### 7.1.1.5 Pipe Jacking

The one-pass trenchless installation of a pipe by jacking the pipe behind a TBM or Tunnel Shield.

#### 7.1.1.6 Permeation Grouting

The direct pressure injection of a chemical fluid grout into the ground to fill the spaces between and bind together soil particles, without causing excessive movement or fracturing of the soil formation. Permeation grouting is performed prior to commencement of tunneling operations to provide a more consistent and stable soil matrix. If applicable, the general extents of permeation grouting for a specific project may be shown in the plans.

#### 7.1.1.7 Compensation Grouting

Compensation grouting is a grouting technique utilized to control ground settlement during soft ground tunneling. Compensation grouting involves the injection of a low slump mortar-like grout under high pressure to compact and displace the adjacent soils. The grout does not penetrate soil pores but displaces the subsurface soils by forming a homogeneous grout bulb near the grout pipe tip. Typically, compensation grouting is done after completion of tunneling to correct for settlement. Compensation grouting may also be performed concurrently with the progress of the tunnel while adjusted grouting parameters continually with reference to measured movements of the ground and/or surface structures, to keep settlement and deformations within specified limits.

#### 7.1.1.8 Contact Grouting

The controlled injection of fluid grout at the interface between the pipeline and the ground to achieve continuous contact and fill the annular space, after pipe jacking has been completed.

#### 7.1.1.9 Inclinometer

An electronic probe lowered within a casing that senses changes in inclination along the casing axis. Inclinometers are used to record the magnitude and depth of horizontal ground displacement. For tunneling purposes, they are typically installed adjacent to pit locations.

#### 7.1.1.10 Surface Monitoring Point

A marker or point fixed to the ground surface and/or structures along a proposed alignment that is monitored by a professional land surveyor licensed in the state of Colorado using survey control to determine vertical and/or horizontal displacements that may occur during construction.

#### 7.1.1.11 Surface Monitoring Point Array

A grouping or arrangement of surface monitoring points along the proposed tunnel alignment to determine vertical and/or horizontal displacements that may occur during construction.

#### 7.1.1.12 Deep Settlement Monitoring Point

A sleeved rod installed to a specific depth, above the crown of the tunnel, which is used to detect ground movement directly above the tunnel. Also referred to as a single-point fixed borehole extensometer or Borros anchor.

## 7.1.2 Section Includes

This item includes construction via tunneling, jacking and/or boring as shown on the Construction Drawings. The work includes: excavation of the tunnel, installation of carrier pipe, pipe, contact grouting around the pipe after tunneling, installation and monitoring of geotechnical instrumentation, disposal of excavated soils and compensation grouting as necessary during tunneling operations to control settlement to within acceptable limits. If the need for permeation grouting prior to starting the tunneling is anticipated, a separate bid item will be included within the contract documents.

## 7.1.3 Requirements

The Contractor must adhere to all requirements contained with the Contract Documents, as well as access permits between the City and facility owners within the project limits.

A pre-excavation permeation grouting program shall be implemented prior to beginning tunnel excavation to improve ground behavior and reduce the potential for ground loss during tunneling. Requirements for this program are provided within these Standard Construction Specifications.

The Contractor shall determine tunneling and support equipment, materials, and methods subject to the limitations specified herein and elsewhere in the Construction Documents. It is the responsibility of the Contractor to safely construct the tunnel and provide the finished product within the requirements specified and shown. The Contractor shall design his tunnel means and methods to allow for performance of the work as specified herein.

The Contractor shall have the sole responsibility for maintenance and protection of existing utilities, railroad tracks, structures, and facilities within the zone of construction. Location of utilities shown on the Construction Drawings shall be considered approximate. The Contractor shall be responsible for locating each utility potentially impacted by the work to verify location prior to beginning the tunneling work.

The Contractor shall allow the Engineer, the City's Construction Project Manager, and the City's Project Management Team access to the shafts and tunnel.

## 7.1.4 Submittals

### 7.1.4.1 Preconstruction

Submit the following a minimum of 8 weeks prior to mobilization of tunneling equipment to allow for review by the City's Construction Project Manager and any other affected project stakeholders:

1. A detailed work plan including descriptions of methods and equipment to be utilized in completing the work, schedule for tunnel construction, and details of proposed tunnel construction procedures.

2. A detailed scale drawing showing tunnel layout, shaft locations and dimensions, equipment and staging areas.

3. Procedures for measuring excavation quantities versus forward progress during the tunneling operation.

4. A description and drawings of proposed methods and procedures for excavating the tunnel, including details for tunnel shield or TBM, breasting capabilities, method of controlling line and grade of the tunnel, and steering provisions for making line-and-grade corrections. Include details of provisions for supporting the face of the tunnel when tunneling operations are interrupted.

5. Contact grouting plans and procedures including: description of the grout system and grout equipment including grout pumps, mixers, delivery systems, and monitoring systems; number and spacing of grout holes; procedures for monitoring grout placement and controlling pressures; sequence of construction; grout material and properties; grout mix design including fluidizers, accelerators, and other additives; grout material properties including density, viscosity, bleeding, shrinkage, expansion, and set time.

6. Work plan and shop drawings showing: jacking frame and thrust block design, layout and details, including reaction transfer calculations. The thrust block backstop shall be normal (square) with the proposed pipe alignment and shall be designed to withstand the maximum jacking pressure to be used with a factor of safety of at least two, without excessive deflection or displacement.

7. Design calculations demonstrating that the pipe is capable of sustaining the maximum stresses to be imposed during jacking with a factor of safety of at least two. The calculations shall take into account: ground loads per the Geotechnical Data Report if available; live loads and surcharge loads from equipment; Cooper E80 loads; and jacking forces. Calculations to be performed and stamped by a professional engineer registered in the State of Colorado.

8. Submittal of a settlement control plan and applicable contingency plans prior to construction, including the proposed locations of surface monitoring points and arrays, deep settlement monitoring points, and inclinometers; equipment and materials to be used; and installation procedures.

9. Five days prior to commencement of grouting or construction of any kind, the contractor shall submit the installed location of all surface monitoring points, deep monitoring points and inclinometers. The Contractor shall submit drawings showing the surveyed location, the instrument identification number, the instrument type, the installation date and time, established elevations, initial elevations, offset and stationing, initial coordinates, boring logs, and the anchor to tip elevation and instrument length, when applicable.

**7.1.4.2 During Construction**

Written Daily Logs. The Daily Logs shall be recorded for each shift and shall be submitted to the City's Construction Project Manager within one working day of excavation at each location. As a minimum, the logs shall include the following:

- The station of the face of the excavation and advance distance;

- Length of pipe installed;
- The date, starting time, and finish time;
- Any unusual conditions, breakdowns, and delays;
- Excavated muck quantity;
- An accounting of volume of spoil in relation to the lineal foot advancement of the tunneling head
- Contact grouting performed;
- Results of pipe joint pressure testing; and
- Results of instrumentation monitoring.

## 7.1.5 Materials

### 7.1.5.1 Tunnel Shield or Tunnel Boring Machine (TBM)

The tunnel shield or TBM shall be designed to sustain ground loads which may be imposed upon it as well as any loads imposed by the thrust jacks, steering mechanisms, and other appurtenances. Tunnel excavation equipment shall be capable of maintaining a stable face in all expected ground conditions. The tunnel shield or TBM shall be steerable and capable of being controlled to the desired line and grade indicated on the Construction Drawings within the tolerances specified herein. Equip the tunnel shield or TBM with a laser control system to permit continuous and accurate monitoring of line and grade. The tunnel shield or TBM shall have suitable breasting tables, a closeable cutter wheel with flood doors, or such other appropriate provisions, as necessary, to support the tunnel face and minimize loss of ground. Mechanical or hydraulic excavators shall not interfere with breasting system or face support provisions. Excavator shall be capable of operation when fully retracted within the tunnel shield.

The tunnel shield or TBM shall have a propulsion system capable of moving the shield or machine forward while maintaining the construction tolerances with respect to line and grade. The propulsion system shall include a thrust ring or other provision that will distribute the jacking forces uniformly against the casing or jack pipe so the shield or machine can be advanced without damaging or distorting the pipe.

### 7.1.5.2 Contact Grout

Contact grout shall be a stable colloidal suspension of cement, bentonite, water, fluidifier, and admixtures. Sand may be added, provided the grout is demonstrated to have suitable flow characteristics and to adequately fill the annular space between the pipeline and the ground being tunneled through.

The grout mix shall be the responsibility of the Contractor. The Contractor shall adjust the water-solids ratio of the grout as necessary to grout effectively and to fill all voids within the zone of grout influence; however, at all times the grout shall have a water-solids ratio of between 1:1 and 3:1 by volume, and a bentonite content of no more than two percent, and no hole shall be completed with a water-solids ratio above 1:1 by weight.

### 7.1.5.3 Pipe

The pipe to be installed via tunneling shall be indicated within the plans and in accordance with the applicable portion of these Standard Construction Specifications.

**7.1.5.4 Casing Pipe, Spacers and End Seals**

Where tunneling operations are completed via boring and where specifically called out in the contract documents, a casing pipe, spacers and end seals shall be required.

The casing pipe shall be of welded steel pipe conforming to the requirements of ASTM A53 Grade B or AWWA C200, having minimum yield strength of 35,000 psi of the size and wall thickness as shown below or as otherwise noted in the Contract Documents. i.e. See wall thickness in Additonal Notes ==➔

Casing shall be kept on line and grade as required within this specification. Joints in the casing shall be field welded around the entire joint perimeter to produce a watertight seal. Welds shall be of a size to develop the full strength of the pipe materials.

Factory manufactured casing spacers shall be installed on all carrier pipes passing through a casing pipe. Wooden skids will not be allowed.

All casing spacers shall adhere and conform to the following:

1. All casing spacers shall be Model SSI8 or SSIM (field adjustable) for carrier pipes up to 24-inches in diameter and Model SSI12 for larger diameter carrier pipe sizes as designed and manufactured by Advance Products & Systems, Inc., Lafayette, LA., or an approved equal. The runners shall be at least 7-inches long for SSI8 and SSIM models or 11-inches long for SSI12 models and they shall be manufactured of high abrasion resistant, low coefficient of friction, glass filled polymer.
2. The casing spacers shall be center restrained to limit vertical movement of the carrier pipe in the casing.
3. Casing spacers shall be bolt-on-style with a shell made of at least two halves.
4. Spacing is approximately 3 per joint of pipe or 1 spacer per every 7 feet maximum.
5. The band material shall be manufactured of a minimum 14 gauge T-304 stainless steel and 10 gauge T-304 stainless steel risers when needed.
6. The casing spacers shall have a flexible PVC or EPDM liner having a minimum thickness of 0.090 inches with a hardness of Durometer “A” 85-90.
7. All welds are to be chemically cleaned and passivated.
8. All hardware shall be stainless steel.

After insertion of the carrier pipe into the casing, the ends of the casing shall be closed by installing ⅛" thick synthetic rubber end seals such as the Model “AC” pull-on end seal, as manufactured by Advance Products & Systems, Inc., Lafayette, LA, or an approved equal. Ends seals shall be attached using minimum ½” wide T-304 stainless steel bandings utilizing a worm gear mechanism.

## 7.1.6 Instrumentation

### 7.1.6.1 Surface Monitoring Point Array

Surface monitoring points shall consist of a stable non-destructive pin, nail, point, or other identifiable element with the locations clearly identified where the ground surface consists of sidewalk, curb, rail, or other structure. Where the ground surface consists of soil, vegetation, or ballast, the surface monitoring point shall consist of a minimum 1-foot long rebar anchor driven flush with the ground. The anchor shall be grouted in place. Each surface monitoring point shall have a tag or marking indicating the identification number, tunnel station, and offset from centerline.

### 7.1.6.2 Surface Monitoring Point Array

The surface monitoring point array shall consist of multiple surface monitoring points installed and arranged in accordance with the Contractors submitted and approved work plan, and as outlined within these specifications.

### 7.1.6.3 Deep Settlement Monitoring Point

Deep settlement monitoring points shall consist of a rebar anchor installed within a casing to a depth of 3 feet above the top of the tunnel, as shown on the Construction Drawings. Each point shall have a tag or marking indicating the identification number, tunnel station, and offset from centerline. Deep settlement monitoring points shall be installed in accordance with the Contractor's submitted and approved work plan and they shall be protected by traffic rated roadway boxes.

### 7.1.6.4 Inclinometer

Inclinometers are only required if specifically called out within the contract documents.

If required, they shall consist of inclinometer casing installed and grouted within vertical boreholes in the in situ soil. A probe, lowered within the casing, senses changes in inclination along the casing axis, and is used to calculate and monitor the magnitude and depth of horizontal ground displacements. Inclinometers shall be protected by roadway boxes.

Inclinometer casing shall be approximately 70 mm (2.75 in.) standard flush coupled such as Model No. 51150210 manufactured by Slope Indicator Company, Seattle; or approved equivalent.

Inclinometer Probe and Assembly. One inclinometer assembly shall be furnished including a sensor (probe) on a minimum 100 ft long cable, a pulley assembly, and a case. This equipment shall be Model No. 50302910 (sensor), and associated pulley assembly, and case manufactured by Slope Indicator Company, Seattle, WA or approved equivalent.

Inclinometer Readout Unit. Furnish one inclinometer readout unit. The readout unit shall be model No. 50310900 manufactured by Slope Indicator Company, Seattle, WA or approved equivalent. Readout unit provided shall be compatible with inclinometer probe and shall be calibrated to probe by manufacturer prior to shipment.

Inclinometer Software. Computer software required to reduce, analyze, and plot the inclinometer data using a compatible personal computer (PC) shall be furnished. Furnish Datamate Manager Software supplied by Slope Indicator Company, Seattle, WA or approved equivalent, or software compatible with other approved readout units.

Provide a cement-bentonite grout for installing inclinometer casing within drill hole. Grout mix shall be in accordance with manufacturer's requirements, and shall have up to 20 percent bentonite content by weight of cement; add enough bentonite to create a grout with a Marsh funnel number of 55 seconds.

### 7.1.7 Commencement of Work

Do not begin tunneling until:

1. Required submittals have been reviewed and approved by the Engineer, applicable utility companies, and stakeholders.

2. A pre-construction meeting with the Engineer, City's Construction Project Manager, City's Project Management Team, applicable utility companies, stakeholders and Contractor has been conducted.

3. Shaft excavation and support have been satisfactorily completed in accordance with the Contract Documents.

4. Permeation grouting has been satisfactorily completed in accordance with the Contract Documents.

5. All instrumentation has been installed and initial measurements have been obtained

### 7.1.8 General Tunneling Requirements

Conduct all operations such that trucks and other construction vehicles do not create a dust nuisance in the streets and adjacent properties. All work shall be done so as not to disturb railroad tracks, roadways, adjacent structures, landscaped areas, or utilities other than as shown on the Construction Drawings. Any damage shall be immediately repaired to the satisfaction of the property owner, residents, agency or utility having jurisdiction, and the City at no additional cost to the City.

No gasoline-powered equipment shall be permitted. Diesel, electrical, hydraulic, and air powered equipment is acceptable, subject to applicable City, State, and Federal regulations. There will be no classification for excavated materials and the term "excavation" shall include all materials excavated or removed from the tunnel, regardless of the type, character, composition or condition of the material so excavated.

The tunnel shall be excavated to the lines, grades and dimensions required to ensure installation of the pipeline as indicated on the Construction Drawings. The tunnel excavation shall begin at the downstream end and work upstream unless approved otherwise.

Methods of construction for the tunnel shall ensure the safety of the work, the Contractor's employees, the public, and adjacent property, whether public or private. Perform all work in accordance with all current applicable permit conditions, regulations, and codes of federal, state, and local agencies. Comply with all applicable provisions of 29 CFR Part 1926, Subpart S, Underground Construction by OSHA. Comply with standards and guidelines provided by the American Railway Engineering and Maintenance-of-Way Association (AREMA), as applicable to the work. In the event of conflict, the strictest or most restrictive shall govern.

### 7.1.9 Tunnel Construction

Tunnel excavation shall be performed in a manner that will minimize movement of the ground in front of and surrounding the tunnel, and to minimize loss of ground, surface settlement, heave of the ground surface, and movement of railroad tracks, structures, and utilities above and adjacent to the tunnel. The Contractor shall ensure that movement (settlement or heave) at the ground surface does not exceed 0.25-inches, unless noted otherwise within the contract documents.

Support the ground continuously and in a manner that will prevent loss of ground and maintain the stability of the tunnel perimeter and face. Support the tunnel face by positive means during all shut down periods.

Maintain clean working conditions at all times inside the tunnel, and remove all excavated soil (muck), grout spills, and any other material not required for tunneling. All construction debris shall be removed from the site and disposed of daily by the Contractor at the disposal site designated elsewhere in the Construction Documents.

Provide all temporary electrical, water, telephone, and other facilities required to complete the tunnel.

Provide access for Engineer, City's Construction Project Manager and City's Project Management Team to inspect and observe the work or to perform independent line and grade surveys.

Perform tunneling work in accordance with the working hours established for the project. In case of emergency or work stoppages likely to endanger the stability of the excavation or adjacent structures, maintain a full work force 24 hours per day, including weekends and holidays, until emergency or hazardous conditions no longer jeopardize stability and safety of the work.

### 7.1.10 Tunnel Line and Grade

The longitudinal centerline of the tunnel shall be sufficiently true and accurate to the tunnel profile grade line to stay within the following tolerances during and upon completion of tunneling: invert of the pipe shall be within 1.5 inches horizontally and 1 inch vertically of the plan line and grade. Survey the pipe invert upon every advancement of the pipe to ensure the elevation and alignment is within the tolerances specified above.

Pipe installation shall be invert elevation controlled and reverse grades are prohibited. Deviations from the design tunnel invert shall not exceed the tolerances specified above at

any point during construction and corrections shall not exceed a rate of 3 inches per 100 feet or a lesser rate as determined by the structural characteristics of the pipe.

If the Contractor is unable to maintain these tolerances, he shall bear the full responsibility and expense for correction (redesign, easement acquisition, retunneling, etc.). If design tolerances are exceeded and redesign is required, the Contractor shall obtain the services of a professional engineer registered in the State of Colorado for the redesign. Plans showing the changes shall be submitted to the Engineer for review and approval.

### 7.1.11 Pipe Jacking

Immediately before joining pipe, the end of the pipe shall be thoroughly cleaned and lubricated with an approved lubricant. The axial forces from the thrust jacks shall be distributed to the pipe uniformly to prevent damage to the ends of the pipe, using pipe cushioning in accordance with approved submittals.

If any part or parts of the pipe becomes unserviceable because the pipe is chipped, gouged, or otherwise damaged before or during installation, it shall be rejected and removed from the site. The City's Construction Project Manager shall make the final determination on rejection and removal of the pipe.

After pipe installation is completed, individual joints shall be pressure tested with a portable hydrostatic tester to 13 psi, in lieu of line infiltration, exfiltration, or air testing.

### 7.1.12 Contact Grouting

The annulus between the pipe and the ground shall be grouted after pipe jacking is completed. Grouting shall be performed over the entire 360˚circumference of the tunnel. The number and location of grout holes in each pipe shall be determined by the Contractor but a minimum of six holes per 20-foot pipe section shall be used. Rings of grout holes shall be spaced at intervals of six feet or less.

Grout shall consist of Portland cement and water or of Portland cement, sand, and water. Grout mixtures may contain bentonite or fly ash. The grout shall consist of 2 parts Portland cement, 1 part fly ash, and not to exceed 6 parts clean, dry, sand.

Contact grout shall be free of lumps when put into the mixer, and the grout mix shall be constantly agitated. Grout shall flow unimpeded and completely fill all voids. Perform the injection of grout continuously on any one pipe section. Fill spaces and voids until completed, so as to avoid disturbance of grout which has taken an initial set.

The grouting process shall be so operated and controlled that the grout will be delivered uniformly and steadily. If, during the grouting of any pipe, grout is found to flow from adjacent grout pipes, such pipes from which grout is flowing shall be closed with valves or plugged with wooden plugs. Where such closing is not essential, ungrouted pipes shall be left open to facilitate the escape of air and water from the space being grouted.

Grouting shall progress from grout pipe to grout pipe in accordance with approved submittals. In going from lower to higher grout pipes, do not make connections to the higher grout pipes until the grout has completely filled the space below the higher grout

pipes. As the grouting proceeds, the escape of grout from the upper pipes in turn shall be permitted as an indication of successive satisfactory filling of voids with grout.

Protect and preserve the interior surfaces of the pipe from damage. Minimize grout drop and proceed with cleanup immediately after grouting. Any damage to the pipe caused by or occurring during the grouting operations shall be repaired. The interior lining of the pipe shall be smooth and free from defects.

Maintain and submit records of grouting operations for each shift, including the location and a detailed log of each grout hole, time of each change of grouting operations, pressures, rates of pumping, grout mix, and grout take at each grout hole hook-up.

After grouting, holes shall be filled with dry packed cement mortar grout. Threaded plugs shall be installed flush with the inside face and the remaining void shall be filled with a non-shrink grout rated to 4000 psi.

### 7.1.13 Installation of Instrumentation

Instrumentation shall be installed at the locations shown on approved shop drawings. Instruments shall be installed in accordance with the approved installation schedule. All instruments shall be clearly marked, labeled, and protected to avoid being obstructed or otherwise damaged by construction operations, the general public, or railroad operations.

Locate conduits and underground utilities in all areas where subsurface geotechnical instrumentation is to be drilled and installed. Subsurface geotechnical instrumentation locations shall be modified, as approved by the City's Construction Engineer, to avoid interference with existing conduits, railroad tracks, utilities, and foundation elements. Repair damage to existing utilities resulting from instrument installations at no additional cost to the City.

Surface monitoring points and arrays shall be installed over the centerline of the tunnel and at offsets as shown in the Contractor's approved submittals to determine the lateral and longitudinal extent of ground movement. The longitudinal spacing of the points shall be a minimum of one every 25 feet along tunneled portions of the project, as allowable based on surface features. The longitudinal spacing of the arrays shall be a minimum of one every 75 feet along tunneled portions of the project, as allowable based on surface features. The arrays shall be centered across the proposed tunnel(s).

Individual surface monitoring points shall be placed along each side of each shaft, a distance of 5 feet and 10 feet from the shaft wall; a minimum of 6 points per shaft shall be installed.

Deep settlement monitoring points shall be installed in accordance with approved shop drawings. The bottom of the instrument shall be located 3 feet above the crown of the tunnel.

Immediately following installation, the location of the top of all instruments shall be surveyed to provide horizontal and vertical coordinates. Data shall be provided to the City's Construction Project Manager in accordance with the submittal requirements specified herein. Re-surveying from control points shall be required a minimum of every two weeks or more frequently as required to address potential disturbances or resolve conflicting data.

### 7.1.14 Installation of Inclinometers

Inclinometers, if required within the contract documents, shall be installed within 5 feet of each shaft as shown on the plans and/or as approved in the submitted shop drawings. Inclinometer casing shall extend from the ground surface to a depth at least 15 feet below the base of the shaft excavation.

Conduct drilling operations using appropriate methods that are consistent with geologic conditions presented in the Geotechnical Baseline Report. Provide drill casing if required to hold drill hole open. Drill hole or inside of casing, if applicable, shall provide a clear opening (6 inches) in diameter or greater. A log of the soils encountered during drilling shall be accurately maintained, and a copy shall be provided to the City's Construction Project Manager in accordance with the time restrictions stated herein.

Install inclinometer casing in accordance with the manufacturer's recommendations and approved shop drawings. Grout the annulus between the inclinometer casing and the ground using a non-shrink cement grout.

Install protective housing with locking cap and padlock. Protective housing shall be installed within an approved flush-mounted traffic rated roadway box or vault so as not to obstruct vehicle or foot traffic.

### 7.1.15 Instrumentation Monitoring and Reporting

The Contractor shall take initial readings of all instruments to establish a baseline and provide the City's Construction Project Manager with this data, in accordance with the requirements specified herein. The Contractor will read required instrumentation and provide the City's Construction Project Manager with these data. Surface monitoring points and arrays and deep settlement monitoring points within 50 feet of the working face of the tunnel shall be surveyed daily. Inclinometers shall be monitored daily. The frequency of monitoring may be modified by the Engineer or the City's Construction Project Manager.

The Contractor shall provide data from readings of all instruments to the City's Construction Project Manager within one working day of obtaining the information. The data shall include a copy of the data sheets containing a cumulative history of readings, including weather conditions, temperature, and proximity of the excavation to the instrument location itself, at the time of each reading.

The Contractor shall abide by the following Response Values:

| Instrument | Threshold Value | Shutdown Value |
|---|---|---|
| Surface Monitoring Points and Arrays | 1.5-inch H or V for Shafts<br>0.13-inch H or V for Tunnels | 3-inch H or V for Shafts<br>0.25-inch H or V for Tunnels |
| Inclinometer | 1.5-inch H or V for Shafts | 3-inch H or V for Shafts |
| Deep Settlement Monitoring Points | 2-inch V | 4-inch V |

If a threshold response value is reached, the Contractor shall meet with the City's Construction Project Manager to discuss his/her means and method to determine what changes, if any, shall be made to better control movement. If a shutdown response value is reached, the Contractor shall stop all work immediately. The Contractor shall meet with the City's Construction Project Manager, the Engineer, and the City's Project Management Team to develop a plan of action before work can be resumed. All costs associated with shutdown due to reaching maximum limits shall borne by the Contractor.

Remove all instrumentation during the cleanup and restoration work or as required by the City's Construction Project Manager. All roadway boxes shall be removed. At a minimum, fill the inclinometer casing and deep settlement point casing with a lean cement grout and cut off the upper 3 feet of the instrument and casing which extend below grade.

### 7.1.16 Cleanup and Restoration

Remove all equipment, unused materials, and debris from the site at the end of the job. Restoration shall follow construction as the work progresses and shall be completed as soon as possible and to the satisfaction of the applicable utility owners and stakeholders. Restore and repair any damage resulting from surface movement caused by the work. Any property or improvements damaged or destroyed, shall be restored to a condition equal to or better than existing prior to construction at no additional cost to the City. Restoration shall be completed immediately if a third party or the City is inconvenienced by the damage, and in no case later than thirty (30) days after the damage is discovered. This provision for restoration shall include all property which was affected by the construction operations.

**END OF SPECIFICATION**

# 7.2 MICRO TUNNELING

## 7.2.1 General

Where indicated on the Drawings, or where field conditions dictate that open trenching for the pipeline across railroad tracks, highways, or other obstructions is prohibited, the pipe shall be installed by jacking, tunneling, boring and casing methods, or micro tunneling.

Should the General Contractor, in the process of Project construction, elect to propose that a portion of the pipe be installed by micro tunneling, rather than by jacking, boring or trenching operations, the subject cost shall not total more than the aggregate sum of the removal and replacement costs that such an activity would replace.

## 7.2.2 Shop Drawings

Detailed shop drawings will be required for all pipe jacking, tunneling and boring installations.

## 7.2.3 Construction

Work specified in this Section describes the construction of sanitary sewers by jacking fiberglass reinforced polymer mortar (RPM) behind a remotely operated, steerable, micro-tunneling boring machine (MTBM), with RPM serving as both the primary tunnel liner during construction and sanitary sewer pipe (secondary tunnel liner) after completion of construction. The General Contractor shall select and utilize methods and equipment compatible with the selected dimensions of the tunnel and with the anticipated geologic conditions described in the Geotechnical Report (GR).

The micro-tunneling boring machine (MTBM) may be either of the following:

1. **Slurry Shield**

   An MTBM in which the tendency of soil at the excavation face to run or flow uncontrollably into the MTBM is prevented by the counterbalancing force of bentonite slurry contained at the face of the MTBM. During boring, the excavated material is mixed with the bentonite slurry and pumped through a pipe for disposal.

2. **Earth Pressure-Balance Shield**

An MTBM in which the tendency of the soil at the excavation face to run or flow uncontrollably into the MTBM is prevented by the counterbalancing force of the excavated material which is contained, under pressure, at the face of the MTBM. During boring, the excavated material is mixed with water or bentonite slurry and pumped through a pipe for disposal or by a balanced screw auger or screw conveyor system.

During tunneling and construction operations, the following shall be followed:

a. Control groundwater in accordance with specified requirements during all micro-tunnel excavation.

b. Perform micro-tunneling operations in a manner that will minimize loss of ground and minimize settlement of the ground surface, structures, and utilities above and adjacent to the tunnel.

c. The General Contractor shall perform pre-construction and post-construction surveys of all structures, residences, and other facilities adjacent to the areas of the tunnel.

d. Maintain clean working conditions at all times inside the tunnel and pits. All muck, slush, grout spills, ponded water, and any other material not required for tunneling shall be removed from the excavations in a timely manner.

e. All work of excavating, lining, grouting and construction of the jacking operation shall be so executed that ground settlement or loss will be minimized; the completed sewer pipe shall have full bearing against earth, and no voids or pockets will be left in any portion of the Work. The peripheral space between the support elements and the excavated surface (i.e., the diameter of the excavated hole is no larger in diameter than 3/4 inch more than the pipe outside diameter) shall be filled with the bentonite lubricating material. If the diameter of the excavated hole is greater than 3/4 inch more than the outside diameter of the pipe, it shall be promptly filled with suitable material, such as grout, as accepted by the Construction Project Manager. This may require jacking or the pipe be discontinued and additional access pits installed at no extra cost to the City.

f. The General Contractor shall be aware that various existing soil borings, piezometers or instrument wells coincide with the proposed sewer pipe alignment. These may or may not have been backfilled with grout and therefore caution should be used in tunneling through these existing borings. General Contractor shall take mitigating measures at no additional cost to the CITY to counter any effect these bore holes, piezometers or instrument wells may have on tunneling operations.

g. All excavations shall remain within the easements and rights of way indicated on the Drawings, to the lines and grades designated on the Drawings, and use methods which include due regard for safety of workmen, adjacent structures, utilities, and the public. Methods of excavation shall be at the General Contractor's option, subject to the review of the Construction Project Manager. Shape the excavation to

fit the sewer pipe section and of sufficient size to allow the construction of the sewer pipe to the lines and grades indicated on the Drawings.

#### 7.2.3.1 Casing Pipe Installation Method

The General Contractor shall have the option to select the method of micro-tunneled casing pipe installation, subject to approval by the Construction Project Manager.

The excavated size of the tunnel shall be determined by the General Contractor based on construction requirements for the secondary lining system, and is subject to the limitations shown on the Drawings.

### 7.2.4 References

All work shall be performed in accordance with applicable regulations of all federal, state, and local regulations, codes, and standards.

## 7.2.5 Existing Conditions

#### 7.2.5.1 Restrictions

The General Contractor shall comply with all restrictions set as conditions under which the easement or permission was granted to the Owner to perform the work of this Contract. These restrictions are included with these Specifications. The General Contractor is presumed to have fully determined all special requirements that pertain to each length of sewer in tunnel constructed under this Section.

#### 7.2.5.2 Preliminary Inspections

The General Contractor shall inspect the locations where the access pits and tunnels are to be built to familiarize himself with the conditions under which the Work will be performed and with all necessary detail as to the orderly prosecution of the work in conformance with Instructions for Bidders. The omission of any details necessary for the satisfactory prosecution of the WORK in its entirety, which may not appear herein, shall not relieve the General Contractor of his full responsibility.

#### 7.2.5.3 Soil, Rock and Groundwater

The General Contractor acknowledges that certain soils reports, borings, and other Geotechnical data, more particularly described or referenced in the Standard Construction Specifications of the Contract, have been made available for inspection and review. The borings were made for the use of the City in the design of the Project and are not intended to be interpreted for use in temporary construction facilities designed by the General Contractor.

#### 7.2.5.4 Utilities

The General Contractor shall be responsible for the protection of all utilities encountered during the Work of this Contract. The known utilities are shown on the Contract Drawings and the General Contractor shall take every precaution when working near the utility to locate and protect these utilities. All damage to the existing utilities shall be the sole

responsibility of the General Contractor. The General Contractor shall replace, repair, remedy, or compensate for all damages at no additional cost to the Owner.

#### 7.2.5.5 Structures

The General Contractor shall be responsible for the protection of all structures, roads and railroads above or adjacent to the tunnel, within the framework and criteria set forth in the Contract Documents.

### 7.2.6 Definitions

1. **Micro Tunneling**

   Shall be defined as a method of installing pipe, by jacking the pipe behind a remotely controlled, steerable, guided articulated Micro-Tunneling Boring Machine (MTBM). The MTBM, which is connected to and followed by the pipe being installed, shall ensure that the soils being excavated are fully controlled at all times.

2. **Jacked Pipe**

   Shall be defined as the General Contractor's sewer pipe that serves as initial construction lining and tunnel support, installed by the General Contractor for stability and safety during construction, and as the sewer line or permanent secondary liner.

3. **Jacking System**

   A system of jacks which pushes the sewer pipe. Capacity of jacks and extension rate is synchronized with excavation rate of the machine.

4. **Intermediate Jacking Station**

   Hydraulic jacks installed at intermediate locations in the pipe string to allow selective shoving of discrete segments of the total pipe.

5. **Slurry System**

   Transportation of excavated material in slurry flow matched to excavation rate. System balances groundwater pressures and separates soil from slurry at end of process. Soil separation methods are not limited to mechanical means. Soil separation method may be chemical in nature.

6. **Laser**

   An optical system projecting a beam to a target to provide guidance for the micro-tunnel excavation.

7. **TV**

   A television system which monitors the progress and alignment of the micro-tunneling machine and pipe.

8. **Controls**

   The system which synchronizes excavation, removal of the excavated material, and jacking of pipe to maintain overall balance to provide complete and adequate ground support at all times.

## 7.2.7 Quality Assurance

### 7.2.7.1 General Contractor

The General Contractor must provide proof of successful experience with micro tunnel excavation and support at the depths shown, in the soil and groundwater conditions expected, with the lining systems shown and with the General Contractor's proposed equipment.

### 7.2.7.2 Project Superintendent

The project superintendent shall have at least five years of tunneling experience and shall have worked on at least two micro-tunneling projects in similar ground conditions using equipment similar to the equipment required for this project. The machine operator shall have at least three years of micro-tunneling experience and shall have worked on at least one tunnel project using the same equipment required for this project.

## 7.2.8 Quality Control

General Contractor shall establish and maintain quality control for operations under this Section to assure compliance with contract requirements and maintain records of his quality control for materials, equipment, and construction operations including but not limited to the following:

### 7.2.8.1 Preparatory Inspection

Preparatory inspection shall be conducted prior to commencing work and should include the following as a minimum requirement:

1. Check pipe for conformance to approved certified tests.
2. Check pipe for proper storage and handling.
3. Discuss and review pipe installation procedure with the Construction Project Manager. Discussion shall include placement of pipe, joint preparation and application of each pipe used.

### 7.2.8.2 Initial Inspection

Initial inspection shall be conducted after a representative sample of the work is complete and should include the following as a minimum requirement.

1. Check for proper depth and grade for pipe.
2. Check method of joining pipes.
3. Check the pipe for proper alignment.

## 7.2.9 Tolerances

Excavation and jacking of the sewer pipe shall be controlled by the General Contractor to allow construction of the sewer to a true circular shape and to within 1.5 inches on line and 1 inch on grade. Variations from line and grade tolerances listed herein may be allowed

provided the line and grade variation is regular and only in one direction, and that the final grade of flow line is in the direction indicated on the Drawings. When the excavation is off line and grade, the General Contractor shall make corrections to plan line and grade at the rate of 3 inches per 100 feet.

The General Contractor shall survey the tunnel at 50-foot intervals or a minimum of once per tunnel drive to ensure the alignment is within the tolerances specified. The survey shall be conducted immediately behind the tunnel excavation to allow immediate correction of misalignment. Tunnel excavation shall not precede surveyed verification of the alignment by more than 100 feet, or more frequently if line and grade tolerances have been exceeded. The tunnel guidance system may be used; however, the General Contractor shall select times to measure and record this information after the air temperatures have stabilized throughout the pipe to ensure accurate readings.

If the General Contractor is unable to maintain these tolerances, he shall bear full responsibility and expense for correction (redesign, easement acquisition, etc.) If these tolerances are exceeded and redesign of structures is required, the General Contractor shall obtain the services of an independent professional engineer registered in the State of Colorado for the redesign. Plans showing the changes shall be submitted to the Construction Project Manager for review.

### 7.2.10 General Contractor Submittals

The Construction Project Manager will base the review of submitted details and data with consideration of requirements for the completed work, utilities, and the possibility of unnecessary details in the execution of the work to be constructed under this Contract. Review of the General Contractor submittals by the Construction Project Manager shall not be construed in any way as relieving the General Contractor of his responsibilities under this Contract.

The General Contractor shall submit the following to the Construction Project Manager for approval and/or examination:

1. **Working Drawings**

   Complete working drawings showing details of the proposed method of construction and the sequence of operations to be performed during construction shall be submitted. Working drawings shall show the method of micro-tunneling, including the micro-tunneling system to be used, location of access pits including method of excavation, shoring and bracing appurtenance installation, and dewatering techniques that are proposed to be used. The following shall be included as the minimum level of detail required:

   a. A detailed description of the micro tunneling procedure including construction techniques to provide the access required to install pipe in conformance with the Contract Documents.

   b. Manufacturer's literature describing in detail the micro-tunneling system to be used. Detailed description of projects on which this system has been successfully used

including the names, addresses and telephone numbers of owner's representatives for these projects as well as length, diameter, and pipe material used.

c. Calculations and drawings indicating limits of access pits and any ground support to be utilized.

d. Method of spoils disposal.

e. A groundwater stabilization scheme covering the excavations for starter and receiver pits. Verify this plan to stabilize anticipated unstable soil conditions. Such verification shall include all calculations and detail drawings for methods of controlling groundwater.

f. Certification by the machine manufacturer of the thrust, torque, condition, and operational characteristics of all equipment to be used for installing the specified pipes. The micro-tunneling equipment shall employ a spoil removal system with a pressure balance system that is capable of equalizing pressures between the tunnel face and the micro-tunneling machine head in order to prevent caving beyond the outside diameters of the pipe.

g. Layout of tunneling and ancillary equipment at each jacking and receiving (access) pit location.

h. Tunnel machine shop drawings including configuration of cutter head and over cut.

i. Ventilation system details.

j. Pipe lubrication system details.

k. Electrical system and lighting details.

l. Grade and alignment control system details.

m. Tunneling machine groundwater control provisions.

n. Gas monitoring system.

o. Details of mucking system and soil separation methods including proposed slurry formulations and calculations of the system capacity to handle flows at all distances and changes of elevation to and from the tunnel machine.

p. Details of jacking system, intermediate jacking stations and their proposed spacing, method of operation, and thrust capacity. Include calculations of anticipated jacking forces required to advance the pipe. Include sleeve details and supporting gasket compression calculations for joints and gaskets used with intermediate jacking stations. Describe controls to prevent the maximum jacking force from being exceeded.

q. Details of grouting the annulus space after pipe has been installed including injection pressure and method of controlling grout pressures.

r. Grouting techniques to be used for over excavation if any, including equipment, pumping procedures, pressure grout types and mixtures.

s. Procedures for measuring excavation quantities versus forward progress during the tunneling operation.

t. Calculations demonstrating that the pipe selected has been designed to support the maximum anticipated earth loads and superimposed live loads, both static and dynamic, which may be imposed on the pipe. Determine the additional stresses imposed on the pipe during jacking operations and upgrade the quality and strength of the pipe and pipe joints to the extent necessary to withstand the additional stresses imposed by the jacking operation. The details shall be submitted for approval.

u. Complete information on General Contractor's safety plan for personnel conducting the micro-tunneling operations and appurtenance installation. The plan shall include provisions for lighting, ventilation, and electrical safeguards.

v. Keep and maintain at the construction site a complete set of field drawings for recording as-built conditions. It shall have marked or noted thereon all field information, properly dated, recording as-built conditions. This set of field drawings shall be kept up to date.

w. Pipe certification of compliance.

x. Pipe jointing methods and details.

y. All General Contractor submittals requiring structural design shall be signed by a professional civil or structural engineer registered in the State of Colorado.

z. Written documentation summarizing the qualifications of the project superintendent, machine operators, and site safety representative.

**2. Log of the Jacking Operations**

The General Contractor shall submit a log of jacking operations; the log shall be taken at intervals of no more than 10 minutes apart and a minimum of four readings per pushed 10 foot and accomplished by digital video recording of the TV image at the operator's console. Video shall show a real-time clock that matches the time scale used in the log. Indicators in the tunneling machine being viewed by the digital recorder shall indicate when the tunneling machine is excavating and the number of the pipe joint that is being pushed. The log shall be submitted to the Construction Project Manager each day. The digital video shall be submitted to the Construction Project Manager each week. As a minimum, the log shall consist of the following:

a. The position of the tunneling machine in relation to the design line and grade.

b. The jacking forces exerted on the pipe at each jacking station.

c. The date, the starting time, and the finish time.

d. The position of the steering jacks.

e. Inclination.

f. Cutter head torque.

g. Slurry flow rates in both the supply and return lines (if slurry is used).

h. Face pressure.

i. Hydraulic pressure (on hydraulic motor machines).

j. LEL gas readings.

**3. Pipe Lubricant**

Submit a separate log tracking pipe lubricant used in gallons, its viscosity, and pumping pressure. Log shall be submitted to the Construction Project Manager each day

**4. Muck Removal**

Submit a separate log tracking the volume of muck removed from the site. Log shall be submitted to the Construction Project Manager each day.

**5. Survey Records**

Submit survey records of the horizontal and vertical positions of surface control points and other instrumentation within 24 hours of measurements as required herein."

**6. Inclinometer Data**

Inclinometer data shall be plotted on a cumulative time-deflection plot, using commercial software from the manufacturer, with past readings shown together with most current so that trends can easily and quickly be established by the Construction Project Manager and General Contractor.

## 7.2.11 Products

### 7.2.11.1 Equipment

No gasoline powered equipment shall be permitted in the tunnel operation. Diesel, electrical or air-powered equipment will be acceptable, subject to applicable federal and state regulations. Diesel engines equipped with scrubbers are acceptable only when jacking in free air. Provide compressed air and electricity for General Contractor's operations from a source outside the pipe.

**1. Micro Tunnel Boring Machine (MTBM)**

The General Contractor shall employ MTBM that is capable of handling the various anticipated ground conditions. In addition, the MTBM shall:

a. Have a "closed" face which is capable of minimizing loss of ground ahead of and around the machine and providing satisfactory support of the excavated face at all times and shall have the capability of setting a calculated earth balancing pressure and positively measuring the earth pressure at the face.

b. Provide a system to indicate whether the amount of earth material removed is equivalent to that displaced by the advance of the machine such that the advance rate may be controlled accordingly.

c. Conform to the shape of the tunnel with a uniform perimeter that is free of projections that could produce over excavation or voids.

d. Be articulated to enable remote steering of the system.

e. Have a display available to the operator, at an operation console, showing the position of the shield in relation to a design reference together with other information such as face pressure, roll, pitch, steering attitude and valve positions.

f. Incorporate a seal in the tail of each MTBM shield to prevent leakage of lubricating liquid or grout, into the tunnel space, between the MTBM shield and lining.

g. Have a cutter head powered by electric or hydraulic motors and have motors and operating controls protected against water inflows.

h. Provide a bi-directional drive on the cutter head wheel.

i. Provide means for maintaining the tunnel face under wet and adverse soil conditions. Use closure doors on the cutter wheel or other means acceptable to the Construction Project Manager.

**2. Automated Spoil Transportation**

The General Contractor shall provide a MTBM which includes an automated spoil transportation system which shall:

a. Match the excavation rate to the rate of spoil removal thereby maintaining settlement or heave within tolerances specified.

b. Balance ground water pressures by the use of a slurry pressure balance system which shall be capable of any adjustment required to maintain face stability for the particular soil condition encountered on the Project and shall monitor and continuously balance the ground water pressure to prevent loss of slurry and or ground water.

- In a slurry spoil transportation system the ground water pressure shall be managed by use of the slurry pumps, pressure control valves, and a flow meter.
- A slurry bypass unit shall be included in the system to allow the direction of flow to be changed and isolated, as necessary.
- A separation process shall be provided when using the slurry transportation system which shall be designed to provide adequate separation of the spoil from the slurry so that the clean slurry can be returned to the cutting face for reuse. Spoil shall be appropriately contained at the site prior to disposal.
- The type of separation process used shall be dependent upon the size of the tunnel being constructed, the soil type being excavated, and the work space available at each work area for erecting the plant.
- The composition of the slurry shall be carefully monitored for specific gravity and viscosity.

c. Balance ground water pressures by the use of an auger earth pressure balance system which shall be capable of any adjustment required to maintain face stability for the particular soil condition to be encountered on the Project and shall monitor and continuously balance the ground water pressure to prevent loss of ground water.

- If an auger spoil transportation system is utilized, the ground water pressures shall be managed by controlling the volume of spoil removal with respect to the advance rate (Earth Pressure Balance Method) and the application of compressed air. The speed of rotation of the auger flight, the addition of water, and/or compressed air shall be monitored.
- The Construction Project Manager's approval will be required where an auger soil transportation system is proposed for use by the General Contractor in the presence of ground water. Such approval will be based on an evaluation of the equipment's ability to balance soil and water pressures at the face, stability of the soils, and the significance of the ground water present.

**3. Pipe Jacking Equipment**

The General Contractor shall provide a MTBM which includes a pipe jacking system which shall:

a. Have the main jacks mounted in a jacking frame located in the starting pit.

b. Have a jacking frame which shall successively push the MTBM along with a string of connected pipes toward a receiving pit.

c. Have sufficient jacking capacity to push the MTBM and the string of pipe through the ground.
   - Calculations shall be made to determine the face excavation forces, frictional factor, and weight of the MTBM and pipes.
   - The jacking equipment installed must have a capacity at least 20 percent greater than the calculated theoretical jacking load.

d. Have hydraulic cylinder extension rates which are synchronized with the excavation rate of the MTBM, which shall be determined by the soil conditions.

e. Have intermediate jacking stations which shall be provided when the calculation of the total jacking force needed to complete the installation exceeds 80 percent of the capacity of the main jacks or the designed working compressive loads (including safety factor) allowed for the pipe.

f. Develop a uniform distribution of jacking forces on the end of the pipe by use of spreader rings and packing.

g. Provide for a pipe lubrication system which shall be used if the calculated jacking forces are expected to exceed the pipe design strength (including the 2.5 to 1 safety factor) or if the actual jacking forces encountered exceed 80 percent of the pipe design strength (including the 2.5 to 1 safety factor). Should either of these conditions occur, an approved lubricant shall be injected to lower the friction developed on the surface of the pipe during jacking.

**4. Remote Control System**

The General Contractor shall provide a MTBM which includes a remote control system which shall:

a. Allow for the operation of the system without the need for personnel to enter the micro-tunnel. In man entry sized pipes, intermittent entry of personnel will be permitted for maintenance and removal of equipment once the pipe installation is complete, provided that all safety precautions specified elsewhere and required by law are in place and functional.

b. Integrate the system of excavation and removal of soil and its simultaneous replacement by pipe. As each pipe section is jacked forward, the control system shall synchronize all of the operational functions of the system.

c. Provide complete and adequate ground support at all times.

**5. Active Direction Control**

The General Contractor shall provide a MTBM which includes an active direction control system which shall:

a. Control line and grade by a guidance system that relates the actual position of the MTBM to a design reference (e.g., by a laser beam transmitted from the jacking pit along the center line of the pipe to a target mounted in the shield).

b. Be capable of maintaining grade to within plus or minus one inch and line to within plus or minus 1.5 inches.

c. Provide active steering information which shall be monitored and transmitted to the operation console.

d. Provide minimum steering information available to the operator on the control console which includes the position relative to the reference, role, inclination, attitude, rate of advance, installed length, thrust force, and cutter head torque.

**6. Ventilation and Monitoring**

Equipment shall be provided to adequately ventilate the entire micro-tunneling operation at all times during construction.

a. Portable testing equipment shall be provided for carbon monoxide gas, hydrogen sulfide gas, oxygen deficiency and explosive gases.

b. An automatic gas alarm to detect explosive gases shall be provided on the Micro-Tunnel Boring Machine. The audible alarm shall be located in the jacking pit and shall be active at all times.

**7. Electrical Systems**

All electrical systems utilized on the Micro-Tunnel Boring Machine shall be equipped with appropriate ground fault systems. All electrical systems are to be insulated, not permitting any bare wire exposures. Motors and controls shall be equipped with an automatic shutoff such as MSA Methane Monitoring System VI or equal.

**8. Additional Safety Equipment**

Necessary equipment for tunnel excavation shall include signal systems, fire extinguishers, safety equipment, and other equipment required by the General Contractor's method of construction. Such equipment shall be maintained in good repair.

#### 7.2.11.2 Jacked Pipe

Pipe for jacking shall be designed to carry all jacking loads. Refer to individual pipe specification sections.

#### 7.2.11.3 Pipe Joints

The outside walls shall be straight without bell modifications. All joints shall be watertight.

### 7.2.12 Design

The General Contractor shall be responsible for the design of the fiberglass reinforced polymer mortar pipe to carry the loads imposed on it during construction, including the jacking forces.

### 7.2.13 Excavation

#### 7.2.13.1 General Tunnel Requirements

Tunnel excavation shall not begin until:

a. The work Plan and all required submittals have been submitted by the General Contractor and reviewed and returned approved by the Construction Project Manager.

b. The required Pre-Construction Surveys have been completed.

c. All instrumentation along the tunnel alignment is in place, stable, and baselines have been established.

d. All pre-job safety meetings required by OSHA and/or General Contractor's Safety Plan have been held.

### 7.2.14 Micro-Tunneling

The General Contractor shall conduct all micro-tunneling operations in accordance with all applicable safety rules and regulations. The following shall apply to micro tunneling operations:

1. No work shall commence until the design and construction procedure has been approved in writing by the Construction Project Manager. The General Contractor is totally responsible for the performance of the equipment and methods selected for this phase. The Construction Project Manager's approval signifies only that the construction process is compatible with the overall objectives of the project.

2. The pipe used for jacking shall be round, have a smooth, even outer surface, and have joints that allow for easy connections between pipes. Pipe ends shall be square and smooth so that jacking loads are evenly distributed around the entire pipe joint and such that point loads will not occur when the pipe is jacked in a reasonably straight alignment. Pipe used for jacking shall be capable of withstanding all forces that will be imposed by the process of installation, as well as the final in place loading conditions. The driving ends of the pipe and intermediate joints shall be protected against damage.

3. The pipe, insofar as practical, shall be micro-tunneled from the downstream end.
4. A jacking frame shall be provided for developing a uniform distribution of jacking forces around the periphery of the pipe. Special care shall be taken by the General Contractor to ensure that the thrust reaction backstop is properly designed and constructed. The backstop shall be square with the proposed pipe alignment and shall be designed to support the maximum obtainable jacking pressure with a factor of safety of at least 2.0. The jacking system shall be capable of continuously monitoring the jacking pressure and rate of advancement. Special care should be taken when setting the pipe guard rails in the pit to ensure correctness of the alignment.
5. The General Contractor shall maintain an envelope of bentonite slurry, or other similar material, around the exterior of the pipe during the jacking and excavation operation to reduce the exterior friction and the possibility of the pipe freezing in place. Water jetting of the pipe bedding or backfill shall not be permitted.
6. The pipe freezes and the General Contractor is unable to move it again, the General Contractor may be permitted to construct an intermediate access pit, with the location subject to review by the Construction Project Manager . The General Contractor shall be solely responsible for making arrangements for such an intermediate pit and shall be solely responsible for any and all costs associated with the location and construction of the pit and for maintaining traffic in the area.
7. In the event a section of pipe is damaged during the jacking and excavation operation, one of the following procedures shall be used to correct the damage, as directed by the Construction Project Manager.
    a. Slightly damaged pipe which passes leakage test and maintains pipe barrel and joint structural integrity shall be repaired in place with a method approved by the manufacturers.
    b. Severely damaged pipe shall be removed from the excavation by jacking it through the excavation and removing it at an access pit.
8. The joints shall be made watertight by using rubber gaskets.
9. The pipe joints shall be cushioned by a plywood ring between the joints, or by other methods, to transmit the jacking forces without damage to the pipe or pipe joints.
10. After the pipe is in place and the jacking and excavation operation is complete from one access pit to the next; any over excavation greater than the pipe outside diameter plus 3/4 inch shall require the pipe to be grouted in place.

### 7.2.15 Grouting

The General Contractor shall furnish and operate suitable equipment for all grouting operations.

After completion of the jacking operation, the lubricate material shall be displaced from between the pipe exterior and surrounding ground by a cement grout. Pressure and the amount of grout shall be controlled by the General Contractor to avoid pipe damage and

displacement of the pipe and soil beyond specified tolerances. Grouting shall be accomplished as soon as possible after pipe installation has been completed to prevent any surface settlement due to movement of soil material into the void space or loosened zone around the pipe.

All voids outside the limits of the excavation created by caving or collapse of earth cover over the excavation, or by other cause shall also be completely filled with pea sized gravel or sand cement grout. Pressure-injected grout shall be placed at the same frequency as required when placing grout behind the pipe.

Pressure-injected grout used in conjunction with pea gravel shall be placed behind the pipe if required to minimize ground loss. General Contractor shall provide seals on the tail of the tunnel boring machine which will prevent the pea gravel or grout from moving into the shield.

### 7.2.16 Jacking Pits

Construction techniques required to provide access for micro-tunneling shall be such as to ensure the safety of the work. Acceptable excavation methods include the use of interlocked steel sheetpiling or open excavation. Final dimensions of access pits selected by the General Contractor shall conform as a minimum with dimensions required to permit installation of the work.

The General Contractor shall be required to properly support all excavations and to prevent all movement of the soil, pavement, utilities or structures outside of the excavation. All pits shall conform to applicable Local Safety Standards, OSHA Standards, trenching, and shoring standards.

If at any time the method being used by the General Contractor for supporting any material or structure adjacent to any excavation is not safe in the opinion of the Construction Project Manager or applicable federal, state or local inspection authorities, the Construction Project Manager may require and the General Contractor shall provide additional bracing and support necessary to furnish the added degree of safety required by the Construction Project Manager. The General Contractor shall provide such added bracing and support by such method approved by the Construction Project Manager as he may elect to use but the taking of such added precautions shall in no way relieve the General Contractor of his sole final responsibility for the safety of lives, work, and structures. The use of such additional bracing and support shall be without additional cost to the City. The absence of an order from the Construction Project Manager for the aforementioned additional bracing shall in no way relieve the General Contractor of his sole final responsibility.

Pits shall be constructed to accommodate the installation of pipe casings, slurry shield, and jacking device. Install thrust block as required and consolidate the ground where the casings enter and exit the ground.

All work of excavating shoring and bracing shall be so executed that settlement is minimized, the in-place casing shall have full bearing against earth, and no voids or pockets are left in any portion of the work.

Before beginning construction, the General Contractor shall adequately protect existing structures and other permanent objects. The repair of or compensation for damage to permanent facilities due to negligence or lack of adequate protection on the part of the General Contractor will be at no cost to the City.

The General Contractor shall provide surface drainage during the period of construction to protect the work. Provide all dewatering and test any groundwater discharges. All discharge limits and reporting requirements shall be the responsibility of the General Contractor.

Size and locate pits and their work areas so as to avoid interference with traffic.

Blasting will not be permitted.

### 7.2.17 Line and Grade

The Construction Project Manager has established the baselines and benchmarks as indicated on the Contract Drawings. The General Contractor shall check these baselines and benchmarks at the beginning of the contract period and report any errors or discrepancies to the Construction Project Manager.

The General Contractor shall use the baselines and benchmarks to furnish and maintain all reference lines and grades for the micro-tunnel construction. These lines and grades shall be used to establish the exact location of all micro-tunneling, excavations and structures.

The General Contractor shall establish and be fully responsible for the accuracy of his own control for the construction of the entire project, including access shaft locations, structures, excavation, pipe alignment and grade. The General Contractor shall submit copies of field notes used to establish all lines and grades.

The General Contractor's control points shall be established sufficiently far from the tunnel operation not to be affected by ground movement.

The General Contractor shall maintain daily surveying records of alignment and grade and shall submit three copies of these records to the Construction Project Manager . The General Contractor, however, remains fully responsible for the accuracy of his work and the correction of it, as required.

The General Contractor shall check his control for his excavation against an above ground undisturbed reference at least once each week and once for each 250 feet of tunnel constructed, or more often as needed or directed by the Construction Project Manager .

After installation of the sewer pipe, the General Contractor shall provide the Construction Project Manager with access to the tunnel for visual inspection of the line and grade of the completed in place sewer pipe.

Guidance laser system shall be mounted in a manner that isolates it from effects of movement by the jacking forces.

### 7.2.17 Earth Movement

The General Contractor shall be responsible for all damages due to settlement from any construction induced activities or occurrences.

The General Contractor is advised of the proximity of buildings, structures, roads, and utilities to the work. Precautions shall be taken to avoid damage or settlement to any of these. Such precautions shall include the use of construction methods and equipment to minimize loss of earth at the excavation face and settlement of earth around the sewer pipe.

In the event any movement of earth is detected, the Construction Project Manager may order the work stopped and secured. Before proceeding, the General Contractor shall correct any problems causing or resulting from such movement.

The General Contractor should be aware that if settlement of the ground surface should occur during construction, which will affect the accuracy of the temporary benchmarks established by the Construction Project Manager**,** it shall be the General Contractor's responsibility to detect and report such movement. The locations of the permanent City monumentation benchmarks (BM) and temporary benchmarks (TBM) are indicated on the Drawings; the General Contractor may use these to verify temporary benchmark accuracy. Advise the Construction Project Manager and the City of any settlement affecting the permanent monumentation benchmarks. Upon completion, the field books pertaining to monitoring of the permanent monumentation benchmarks shall be submitted to the City.

### 7.2.18 Excavated Material

Remove and dispose of all excavated materials from jacking pit and tunnel excavations in accordance with the requirements of State of Colorado.

### 7.2.19 Infiltration Leakage Test

The tests shall be performed by the General Contractor under the observation of the Construction Project Manager. A test section is defined as the length of tunnel between manholes or structures.

Leak testing shall be by television inspection after dewatering operations have been discontinued a minimum of 48 hours and until groundwater has been allowed sufficient time to reach its natural elevation. Any leakage found during this operation shall be corrected.

Each joint shall also be tested in place by exerting a pressure of 11.2 psi absolute on it in accordance with ASTM D 3754. The internal test pressure, which is 3.5 psi lower than normal atmospheric pressure, shall be in addition to the normal external hydrostatic pressure exerted on the pipe by the groundwater above the pipe. Each joint when tested in this manner shall exhibit no infiltration of groundwater into the pipe. The General Contractor may at his option, test sections of the sewer using this method instead of individual joints. If this method is selected each section shall exhibit no infiltration of ground water into the section. The General Contractor shall isolate any joints which are found to leak during this test and jack such joints through until all joints between manholes are found to be watertight under these conditions.

One hundred percent of the sewer and sewer joints shall be tested.

The General Contractor shall repair all visible leaks in manholes, structures, and joints even if the leakage test requirements are met.

Adequate bulkheads, or plugs, shall be installed at each end of the sewer pipe in preparation for testing. The General Contractor shall submit the type of bulkhead, or plug, to be used to the Construction Project Manager for review. After testing, the bulkheads or plugs shall remain in place until the sewer is put into service, at which time the General Contractor shall remove the bulkheads or plugs.

### 7.2.20 Restoration

The General Contractor shall promptly restore to their original condition any streets, curbs, sidewalks, or any other facilities which are damaged, moved or disturbed as a result of tunneling operations or jacking pit construction. Any surface or subsurface settlement shall be restored to pre-construction conditions.

**End of Specification**

# 7.3 SHAFT EXCAVATION AND SUPPORT

## 7.3.1 Definitions

### 7.3.1.1 Geotechnical Data Report (GDR)

A document that presents an interpretation of the known subsurface data for the project.

The purpose of the GDR is to compile all geological, geotechnical, groundwater, and other data obtained from the geotechnical investigations for use by the various participants in the project. If available, this information will be included within the contract documents as specifically applicable to the project.

### 7.3.1.2 Geotechnical Baseline Report (GBR)

The intent of a GBR is to clearly and contractually define the geotechnical conditions through which tunneling will occur in order to evaluate a differing site condition (if encountered) and it is used as a basis of bid for the contractor. By assessing the anticipated geotechnical conditions for a project and providing baselines in the contract, the contractor has a basis from which to prepare their bid and select their means and methods. The baseline conditions do not necessarily reflect the actual conditions; they are not geotechnical fact to be encountered. Rather, they represent the owner's assumption of existing geotechnical conditions for the project. If available, this information will be included within the contract documents as specifically applicable to the project. Regardless of inclusion, this information shall be investigated, interpreted, verified and/or developed by the contractor prior to commencement of the work.

## 7.3.2 Section Includes

The work specified in this section includes requirements for design, excavation, and support of the entry shaft(s), jacking pit(s), exit shaft(s), and receiving pit(s) for all tunneling operations required within the Contract Documents. The Contractor shall design, furnish, install, and maintain a system of supports, including all bracing and associated items, to retain excavations in a safe manner and to control ground movements as specified herein. Acceptable means of shaft support include: pre-fabricated systems such as slide-rail; rib and lagging; sheet pile; or liner plate. The means and methods utilized to accomplish the project scope are the Contractor's responsibility. All costs incurred for completion of this item shall be included within the applicable bid items(s) for construction of the associated facility.

### 7.3.3 Requirements

The Contractor shall have the sole responsibility for maintenance and protection of existing utilities, structures, railroad tracks, and facilities within the zone impacted by shaft construction.

The Contractor shall have the sole responsibility for sizing the shafts within the site boundaries shown on the Construction Drawings. The size of the excavations shall be adequate to construct all structures required and to gain access to tunneling and contact grouting operations.

Shaft support systems shall be in accordance with OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926. Shaft support systems shall also meet the standards and guidelines of all **applicable utility companies, and stakeholders**.

The Contractor shall allow the Engineer, City's Construction Project Manager and City's Project Management Team access to the shafts, and to use the shafts to access tunnel operations**.**

### 7.3.4 Submittals

#### 7.3.4.1 Preconstruction

Submit the following shop drawings and plans a minimum of 8 weeks prior to beginning shaft construction to allow for review by the City's Construction Project Manager, utility owners, and stakeholders:

1. Detailed description of the procedures, equipment, and methods proposed to conduct the shaft excavations.

2. Shop drawings of shafts including locations, dimensions, and support elements.

3. Shop drawings and descriptions of the procedures and methods proposed for the construction shoring system(s), including a minimum: erection scheme; support element descriptions, sizes, spacings, and strengths; design calculations; plan for removal of shoring. Shafts shall be designed and constructed to withstand all imposed loads, including soil conditions, **Cooper E80 loads**, dynamic loads from

4. Equipment and surcharge loads from materials. Calculations shall include loads, methods, assumptions, results, and safety factors. Shop drawings and calculations shall be signed and stamped by a professional engineer registered in the State of Colorado.

### 7.3.5 Materials

#### 7.3.5.1 Structural Steel

Structural steel members, such as fabricated connections and accessories, steel W shapes, and other structural steel shall conform to the requirements of ASTM A 572 or ASTM A 36, unless otherwise approved.

#### 7.3.5.2 Slide-Rail

Pre-engineered system of panels, corner slide-rails, linear slide-rails, and cross braces as manufactured by Speed Shore Corporation or equivalent.

#### 7.3.5.3 Lagging

Timber lagging shall be of construction grade and shall be any species that provides a minimum allowable bending stress of 1,100 psi.

#### 7.3.5.4 Lagging Backfill

Backfill sand shall conform to ASTM C 778 for 20-40 sand. Plugging material such as Excelsior or dry pack shall be used to prevent backfill sand from running.

#### 7.3.5.5 Sheet Piles

Steel sheet piling shall be continuous interlocking made in accordance with ASTM A 328 or ASTM A 857 or from steel meeting the requirements of ASTM A 570 or ASTM A 36.

#### 7.3.5.6 Liner Plate

Steel for liner plate shall be ASTM A 569 with a minimum yield of 28 ksi and a minimum ultimate strength of 42 ksi.

### 7.3.6 General Shaft Requirements

Commence shaft excavations only after submittals have been reviewed and approved by the Engineer, applicable utility companies, and stakeholders, and a pre-construction meeting has been conducted.

Provide all excavations with a gravel pad or concrete working slab equipped with a sump to pump out water.

No gasoline-powered equipment shall be permitted. Diesel, electrical, hydraulic, and air powered equipment is acceptable, subject to applicable City, State, and Federal regulations.

### 7.3.7 Utilities

All utilities shall be preserved without interruption.

Location of utilities shown on the Construction Drawings shall be considered approximate. Field locate each utility potentially impacted by the work to verify location prior to beginning underground construction at each location.

Coordinate with each utility agency as necessary prior to relocation, hanging, or upgrade of utilities in the vicinity of shafts, pits, and excavations.

### 7.3.8 Slide-Rail

The slide-rail system shall be installed simultaneous with soil excavation in accordance with manufacturer recommendations.

### 7.3.9 Soldier Pile and Lagging

Install piles in predrilled holes to the tip elevations shown on approved submittals. Provide casing or drilling mud as needed to prevent caving of holes and loss of ground in predrilled holes.

After soldier pile has been seated plumb in the drill hole, encase it with concrete from the tip to the bottom level of the final excavation. Concrete strength shall be in accordance with approved submittals, and shall be placed by means of a tremie system. Apply vibration through the pile.

Provide timber lagging of sufficient strength to withstand lateral earth pressures. Install lagging with no gap between adjacent boards. As installation progresses perform the following as selected by the excavation and support designer: 1) backfill the voids between the excavation face and the lagging with sand or pea gravel packed into place, 2) pack voids with materials such as straw, burlap, or geotextile fabric, or 3) grout voids with cementitious materials. Where necessary, allow drainage of groundwater without loss of ground due to piping.

### 7.3.10 Steel Sheet Piling

Drive in plumb position with each sheet pile interlocked with adjoining piles for its entire length so as to form a continuous diaphragm throughout the length of each run of wall, bearing tightly against original ground.

Drive to the depth indicated on approved shop drawings; exercise care in driving to avoid damaging adjacent utilities and structures, and so that interlocking members can be extracted without damaging adjacent structures or utilities.

### 7.3.11 Liner Plate

Install liner plate around the full perimeter of the shaft excavation. The unsupported height of soil at the base of the shaft shall be no greater than the height of one course of liner plate. Upon completion of liner plate installation, backfill the annulus between support elements and the ground with excelsior and/or grout as needed to prevent inflow of soil or groundwater.

### 7.3.12 Internal Bracing System

The internal bracing support system shall include wales, struts, and/or shores as applicable.

Provide web stiffeners, plates, angles, and struts with intermediate bracing as needed to prevent rotation, crippling, or buckling of connections and points of bearing between structural steel members. Allow for eccentricities caused by field fabrication and assembly.

Install and maintain all bracing support members in tight contact with each other and with the surface being supported.

### 7.3.13 Disposal of Excess Excavated Material

Excess excavated material shall be disposed of in accordance with the Contract Documents.

### 7.3.14 Removal of Support System

Temporary shoring systems shall be removed completely at the end of the job. If the Contractor intends to leave any portion of the support system in the ground permanently, he must first get the approval of the property owner where the support elements are located. In the event that the support system is not fully removed, all shoring elements within 5 feet (minimum) of the ground surface, including soldier piles, wales, struts, lagging, sheet piles, and shores shall be removed. Removal of the support system shall be performed in a manner that will not disturb or harm adjacent construction or facilities and only after backfill has been fully compacted. All voids created by the removal of the construction shoring system(s) shall be immediately filled with controlled density fill, lean concrete, or cement grout, as approved by the City's Construction Project Manager.

**END OF SPECIFICATION**

# 7.4 PERMEATION GROUTING

## 7.4.1 Definitions

### 7.4.1.1 Geotechnical Data Report (GDR)

A document that presents an interpretation of the known subsurface data for the project. The purpose of the GDR is to compile all geological, geotechnical, groundwater, and other data obtained from the geotechnical investigations for use by the various participants in the project. If available, this information will be included within the contract documents as specifically applicable to the project.

### 7.4.1.2 Geotechnical Baseline Report (GBR)

The intent of a GBR is to clearly and contractually define the geotechnical conditions through which tunneling will occur in order to evaluate a differing site condition (if encountered) and it is used as a basis of bid for the contractor. By assessing the anticipated geotechnical conditions for a project and providing baselines in the contract, the contractor has a basis from which to prepare their bid and select their means and methods. The baseline conditions do not necessarily reflect the actual conditions; they are not geotechnical fact to be encountered. Rather, they represent the owner's assumption of existing geotechnical conditions for the project. If available, this information will be included within the contract documents as specifically applicable to the project. Regardless of inclusion, this information shall be investigated, interpreted, verified and/or developed by the contractor prior to commencement of the work.

### 7.4.1.3 Permeation Grouting

The direct pressure injection of a chemical fluid grout into the ground to fill the spaces between soil particles, without causing excessive movement or fracturing of the soil formation. Permeation grouting is performed prior to commencement of tunneling operations to provide a more consistent and stable soil matrix.

### 7.4.1.4 Chemical Grout

A chemical fluid grout that sets and alters the physical properties of a geologic mass, typically composed of (1) matrix forming base materials, (2) reactants and, (3) accelerators or retarders.

### 7.4.2 Section Includes

This item includes pre-excavation ground stabilization as required within the Contract Documents by permeation grouting. Permeation grouting shall be performed in accordance with these specifications. If applicable, the general extents of permeation grouting for a specific project may be shown in the plans.

### 7.4.3 Requirements

The purpose of the grouting program is to stabilize non-cementitious granular soil and fill as shown on Construction Drawings. The permeation grouting program is to be completed prior to beginning tunnel construction.

The effectiveness of the grouting program shall be verified in accordance with requirements specified herein.

Restricted work hours and permits are as specified in the Contract Documents. The Contractor shall coordinate all work with affected utility companies, and stakeholders and comply with the requirements outlined within any access and/or construction permit obtained by the City.

### 7.4.4 Quality Control

Before the Contractor begins tunnel construction, demonstrate to the City's Construction Project Manager, using either drilling and sampling methods, geophysical methods, data records during grouting operations, or other acceptable means as stated in the approved quality control program, that the grouting zones have been thoroughly impregnated and stabilized with chemical grout. If grouting zones are found to be inadequately treated, the Contractor shall perform additional chemical grouting as needed and at no additional expense to the City.

The Contractor shall obtain samples of grout used for chemical grouting for gel time checks: at least one for every half-hour of pumping or for every 250 gallons of grout, whichever is more frequent. The gel samples shall be labeled and stored in accordance with manufacturer recommendations until completion of the project.

## 7.4.5 Submittals

#### 7.4.5.1 Preconstruction

Submit the following shop drawings and plans a minimum of 8 weeks prior to mobilization of grouting equipment for review by the City's Construction Project Manager, utility owners and stakeholders:

1. Certificates of compliance for materials specified herein. Certificate of origin for reactant materials.

2. Proposed grout mix, gel time, and certified laboratory testing results documenting the required strength of soil samples injected with the proposed chemical grout mix,

at least 45 days prior to beginning grouting operations.

3. Detailed chemical grouting work plans and shop drawings, describing the grouting approach, the chemical grout to be used, grout hole locations and orientations, grout pipe installation procedures, locations and arrangement of injection points, grouting equipment, injection procedures and sequences, proposed injection pressures, recording equipment, data reporting methods, work sequences, schedules, method of monitoring and protecting existing utilities; testing methods to be used to verify the effectiveness of grouting with respect to strength and acceptance criteria; quality assurance program and methods for determining that grouted zones are effectively stabilized; and any other information necessary to demonstrate compliance with the specified purpose of this grouting work. Also show grout target volumes at each proposed grout injection point including assumptions with respect to porosity and target volumes. Indicate cure time required for chemically grouted soil to obtain required strength prior to tunneling.

#### 7.4.5.2 During Construction

Submit records of grouting operations to the City's Construction Project Manager on a daily basis. Include grout mix, gel time, injection date and time, injection pressure and rate, injection volumes and exact injection locations. Provide data in an acceptable chart-type format that facilitates rapid visual evaluation of the results of the work, and update daily.

Submit results of surface monitoring point and settlement monitoring point array monitoring on a daily basis.

Submit test results by the end of the day in which they were taken, and with frequency as specified herein.

Within one week of completion of the grouting program, submit an as-built sketch showing locations, depths and orientations of drilled holes and any grout pipes left in place.

### 7.4.6 Materials

#### 7.4.6.1 Chemical Grout

Chemical grout shall consist of a liquid sodium silicate base, reactant, water, accelerator, and other admixtures as required. The Contractor shall design the chemical grout mix so that when injected into standard medium dense sand (Ottawa 20-30) specimens, the unconfined compressive strength of the grouted test sample is no more than 200 psi and no less than 100 psi. The Contractor shall design the trial mix and conduct laboratory tests to verify trial mix meets strength requirements in accordance with ASTM D4219 and D4320.

#### 7.4.6.2 Base Material

The base material for the grout shall be liquid sodium silicate with a specific gravity of 1.4 to 1.5 and a silicate-to-soda ratio of 3.20 to 3.35. The minimum sodium silicate concentration shall be 50 percent of the mix by volume. Sodium silicate shall be delivered in sealed containers, or a certified tank truck, accompanied by the supplier's certificate of origin.

#### 7.4.6.3 Reactant

The reactant shall be an organic base type which, when properly mixed with other grout components, provides a permanent, irreversible gel with controllable gel times. The resulting gels shall exhibit less than 15 percent syneresis in 30 days when mixed with appropriate amounts of sodium silicate, water and accelerator, and shall not exhibit objectionable odors such as ammonia. Sodium bicarbonate, sodium aluminate and other reactants that produce a temporary grout are not allowed. Reactant shall be delivered in sealed containers, accompanied by the supplier's certificate of origin.

#### 7.4.6.4 Water

Water shall be potable and free of impurities that will deleteriously affect the grout gelling characteristics and strength development of the grouted soil.

#### 7.4.6.5 Accelerator

An accelerator may be utilized if required. It shall be technical grade, water soluble calcium chloride or other approved salt, containing a minimum amount of insolubles.

#### 7.4.6.6 Drilling Equipment

Drilling equipment shall be of the type and capacity suitable for drilling the required hole diameters to the tolerances identified or established by the Contractor through evaluating the potential ground conditions from the Geotechnical Data Report and/or Geotechnical Baseline Report, as applicable. Drilling equipment shall also be able to drill at the approved inclinations and depths for installing grout pipes.

#### 7.4.6.7 Grouting Equipment

Chemical grouting equipment shall have the capacity and mechanical capability to do the work as described herein. The equipment shall be maintained in good operating condition at all times. If grout holes are lost or damaged due to mechanical failure of the equipment, inadequacy of grout supply, or improper injection procedure, the Contractor shall backfill these holes and replace them at no additional cost to the City.

The chemical grout plant shall be a continuous mixing type capable of supplying, proportioning, mixing and pumping the grout with a gel time as specified. Batch-type systems are not permitted. The main pumps shall be equipped with recording, positive displacement meters that will accurately measure the volumes of the various components pumped. Meters shall also be provided at the injection point and at each material line ahead of mixing. The meters shall act independently of the viscosity of the metered fluid. The accuracy of the meters shall be checked at least twice daily.

The pumping unit shall be equipped with piping and/or hoses of adequate capacity to carry the base grout and reactant solutions separately to the point of mixing. The hoses shall be joined using a 'Y' fitting containing check valves to prevent backflow, followed by a baffling chamber. A sampling valve shall be placed beyond the point of mixing and the baffling chamber. The pumping unit shall allow distribution of proportioned grout, under pressure, to the grouting locations monitored by separate, automatic real-time display, flow rate indicators and gauges.

Chemicals shall be stored in metal tanks, suitably protected from accidental discharge. The Contractor shall maintain storage tank capacity sufficient to supply at least one day's worth of grouting materials so as to not interrupt the work if chemical delivery delays occur.

The Contractor shall provide the required chemical quality control testing apparatus on site including, but not limited to: hydrometers, balance scales, graduates, viscometers and other devices required to conduct chemical material acceptance tests, chemical proportioning tests, and grout quality tests for proper quality control of the work.

### 7.4.7 Grout Pipes

Grout pipes shall be installed horizontally, inclined, or vertically to obtain the specified minimum grout coverage. Grout pipes shall be re-groutable sleeve-port type grout pipes, with grout ports at maximum 15-inch centers covered by expandable rubber sleeves. After being placed in a borehole, the sleeve-port grout pipes shall be encased in a continuous brittle mortar sheath. An internal double packer shall be used to inject grout at a specific sleeve-port.

### 7.4.8 Preparation

Permeation grouting operations shall not begin until geotechnical instrumentation has been installed as required in Section 7.1 of these Standard Construction Specifications.

Coordinate with all affected utility companies as applicable. Coordinate the sequence of operations taking into consideration: a) means of access to the area; b) permitted areas of operations; c) time restrictions for the performance of the Work; and d) maintenance and adherence to utility traffic requirements.

### 7.4.9 Installation of Grout Pipes

The Contractor shall locate, protect, support and maintain, without interruption, all utility facilities, equipment and services. Before beginning grout pipe installation from the surface, the proposed grout hole locations shall be marked by the Contractor and cleared by the "on-call" utility notification system. If existing utilities are within 5 feet of proposed grout pipes, the Contractor shall pothole the utilities before installing grout pipes.

Close coordination with the affected utility companies and/or property owners will be necessary when installing grout pipes, in terms of both grout pipe location and the timing of installation.

The minimum extents of the soil zones to be grouted are shown on the Construction Drawings. The intent of the grouting program is to treat granular soil and fill. During drilling, the Contractor should be able to distinguish these granular soils from cohesive soil and fill by drilling action and return of cuttings. Grout pipes shall be installed to the elevations shown on the Construction Drawings or until drilling action indicates that the grout pipes have fully penetrated through the depth of granular soil and fill, whichever is greater.

### 7.4.10 Grouting Procedures

Using double packers or other approved suitable measures, inject chemical grout into the selected zones through ports in the sleeve pipes. The Contractor shall use soils information gained while drilling grout pipes to manage the grout plan accordingly. The grouting pressure for any one pipe shall not be more than 2 psi per foot of overburden. Adjust injection procedures as required to prevent surface heave. Temporary high injection pressures are permitted to crack open sleeve-ports, but these pressures are not allowed for longer than one minute.

The Contractor shall conduct a surface pressure test of sleeve port grout tube from manifold to injection point (equivalent to maximum depth) to ascertain system pressure loss. This measured pressure is used for estimating appropriate grouting pressures for production grouting. Inject grout at rates not greater than 10 gpm.

The Contractor shall survey surface monitoring points and arrays each day after grouting operations are completed. Ground heaving and settlement shall not exceed monitoring criteria as specified in Section 7.1 of these Standard Construction Specifications.

### 7.4.11 Leakage Monitoring

The Contractor shall closely monitor the rate of grout take during grout injection, and ascertain the cause of sudden drops in grout injection pressures following initial start-up pressure adjustments. Regularly monitor the ground surface adjacent to the grouting site for leakage. In the event that serious grout leaks are observed, the Contractor shall temporarily terminate injection and plug leaks before resuming pumping. The City's Construction Project Manager shall be informed immediately of such leakage.

If excessive grout take is experienced that is not attributable to leakage, the Contractor shall adjust injection pressure, pumping rates, gel or setting times, or grout composition, subject to the acceptance of the City's Construction Project Manager, to reduce grout use to acceptable levels.

### 7.4.12 Clean Up and Site Restoration

Remove all equipment, unused materials, and debris from the site at the end of the job. Spilled materials and ground shall be cleaned-up. After tunneling is completed, grout pipes shall be filled with lean cement and cut off within one foot of the ground surface.

Restoration shall follow construction as the work progresses and shall be completed as soon as possible. Restore and repair any damage resulting from heave or spills caused by the work. Any property or improvements damaged or destroyed, shall be restored to a condition equal to or better than existing prior to construction at no additional cost to the City. Restoration shall be completed immediately if a third party or the City is inconvenienced by the damage, and in no case later than thirty (30) days after the damage is discovered. This provision for restoration shall include all property which was affected by the construction operations.

**END OF SPECIFICATION**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management Standard Construction Specification

## 7.5 COMPENSATION GROUTING

### 7.5.1 Definitions

#### 7.5.1.1 Geotechnical Data Report (GDR)

A document that presents an interpretation of the known subsurface data for the project. The purpose of the GDR is to compile all geological, geotechnical, groundwater, and other data obtained from the geotechnical investigations for use by the various participants in the project. If available, this information will be included within the contract documents as specifically applicable to the project.

#### 7.5.1.2 Geotechnical Baseline Report (GBR)

The intent of a GBR is to clearly and contractually define the geotechnical conditions through which tunneling will occur in order to evaluate a differing site condition (if encountered) and it is used as a basis of bid for the contractor. By assessing the anticipated geotechnical conditions for a project and providing baselines in the contract, the contractor has a basis from which to prepare their bid and select their means and methods. The baseline conditions do not necessarily reflect the actual conditions; they are not geotechnical fact to be encountered. Rather, they represent the owner's assumption of existing geotechnical conditions for the project. If available, this information will be included within the contract documents as specifically applicable to the project. Regardless of inclusion, this information shall be investigated, interpreted, verified and/or developed by the contractor prior to commencement of the work.

#### 7.5.1.3 Compensation Grouting

Compensation grouting is a grouting technique utilized to control ground settlement during soft ground tunneling. Compensation grouting involves the injection of a low slump mortar-like grout under high pressure to compact and displace the adjacent soils. The grout does not penetrate soil pores but displaces the subsurface soils by forming a homogeneous grout bulb near the grout pipe tip. Typically, compensation grouting is done after completion of tunneling to correct for settlement. Compensation grouting may also be performed concurrently with the progress of the tunnel while adjusted grouting parameters continually with reference to measured movements of the ground and/or surface structures, to keep settlement and deformations within specified limits.

### 7.5.2 Section Includes

This item includes settlement mitigation by compensation grouting**.** All costs for compensation grouting shall be included within the cost of the associated pipeline and no separate measurement for payment will be made. Within the compensation grouting plan, the Contractor is responsible for design of controls such that bondage between the tunnel pipeline and the compensation grout does not occur and hinder tunnel progression.

### 7.5.3 Requirements

This work shall consist of installation, monitoring and testing of compensation grouting. It shall be used to mitigate areas of settlement which exceed the limits specified within the Contract Documents.

The Contractor shall provide all labor, materials and equipment to accomplish this work. In addition, the Contractor shall be responsible for all associated costs to comply with City held permits, obtaining additional permits, working within restricted hours and ensuring that all work is coordinated with affected utility companies and stakeholders.

Prior to beginning grout pipe installation, the Contractor shall perform a subsurface investigation to verify the ground conditions above and within the tunnel footprint.

### 7.5.4 Quality Control

The Contractor shall obtain compensation grout cylinders daily or when the mix design changes. Cylinders shall be 3-inch by 6-inch. Three cylinders shall be taken and marked with the date and time of day collected. Cylinders shall be broken at 7 and 28 days with the remaining cylinder held. Testing shall be performed at a certified laboratory.

The Contractor shall perform slump tests on grout and take measurements of grout mix quantities to verify the grout mix at least twice every shift.

Results of these tests shall be submitted in accordance with these specifications.

### 7.5.5 Submittals

#### 7.5.5.1 Preconstruction

Submit the following a minimum of 8 weeks prior to mobilization of grouting equipment to allow for review by the City's Construction Project Manager, utility companies and stakeholders:

1. Description of plant, equipment, and materials, including manufacturer's product data

2. The proposed grout mix design, including: the proposed proportions or range of proportions of each constituent including cement, water, fly ash, sand, bentonite and additives; anticipated characteristics when mixed including density, slump or viscosity as appropriate; expected working time after mixing, time to initial set, and time to achieve 75 percent of design strength; and anticipated properties when set including compressive strength and shrinkage. Include field test data from previous projects

including the compressive strength and slump achieved.

3. Grouting work plan and shop drawings, describing: the grouting approach; the grout mix design; grout pipe locations, spacing, depth, and orientation; grout pipe installation procedures; grouting equipment including pump and pressure capacity; injection procedures and sequences; proposed injection pressures; recording equipment; data reporting methods; work sequence; schedule; method of monitoring and protecting existing utilities; testing methods to be used to verify the effectiveness of grouting with respect to strength and acceptance criteria; and any other information necessary to demonstrate compliance with the specified purpose of this grouting work.

4. Work plan for grouting operations to be performed within affected property owner or utility company corridors.

5. If applicable: Layout and location plan of deep settlement monitoring points used to detect settlement above the crown of the tunnel. Include a description of the instrument type and method of installation. Also, proposed method to monitor the ground surface for heave during grouting.

6. If applicable: Layout and location of boreholes for subsurface investigation.

#### 7.5.5.2 During Construction

Record and maintain accurate daily records of all grout pipe installation and grouting quantities, including:

- type of drill rig and drilling method used;
- grout pipe locations and tip elevations;
- grout mix;
- grout quantity injected per stage;
- rate of pumping; and
- beginning and final grouting pressure obtained in each stage

The Contractor shall perform slump tests on grout and take measurements of grout mix quantities to verify the grout mix at least twice every shift. These records shall be submitted on a daily basis within one day of the work being performed. The grout cylinder break results shall be submitted 5 days after test results are available.

Within one week of completion of the grouting program, the contractor will submit an as-built sketch showing locations, depths and orientations of drilled holes.

## 7.5.6 Materials

#### 7.5.6.1 Cement

Type I or Type II Portland cement (per ASTM C150) free of contamination.

#### 7.5.6.2 Sand
Per ASTM C-33. The fines content shall be greater than 10 percent and less than 30 percent. Natural fines may be supplemented with flyash or bentonite.

#### 7.5.6.3 Flyash
Class C or Class F per ASTM C-618

#### 7.5.6.4 Water
Water shall be potable and free of impurities that will deleteriously affect the grout characteristics.

#### 7.5.6.5 Compensation Grout Mix
A low mobility, viscous grout with a slump between 1-2 inches. Grout shall be a mixture of cement and water, with the potential addition of sand, which will displace soil under pressure but will not penetrate between soil particles. Bentonite, fly ash, and additives may be included. Slump achieved shall be between 1-2 inches.

### 7.5.7 Equipment

#### 7.5.7.1 Grout Pipe Drilling Equipment
Furnish drilling equipment as required to install grout pipes at locations, depths, and inclinations indicated on the approved work plan in the soil conditions as described in the Geotechnical Baseline Report or as determined via subsurface investigation by the contractor. Use duplex rotary (self-casing) drills to install all grout pipes, or other system(s) as approved by the City's Construction Project Manager. The system must prevent flow of water from the top of the borehole and prevent ground losses as a result of installation. The use of wash boring techniques is not acceptable.

#### 7.5.7.2 Subsurface Investigation Drilling Equipment
If necessary, the Contractor shall furnish geotechnical drilling equipment as required to advance soil borings along the tunnel alignment to confirm ground conditions prior to compensation grouting.

The geotechnical rig shall be a CME55 or similar, or other equipment approved by the City's Construction Project Manager, such that Standard Penetration N-values and split spoon barrel soil samples can be obtained by the Engineer. The rig shall be equipped with hollow stem augers to facilitate sampling and maintain borehole stability.

#### 7.5.7.3 Hydraulic Jacking System
Provide suitable hydraulic jacking system for withdrawing grout pipes in a controlled manner after completion of compensation grouting.

#### 7.5.7.4 Grouting Pipes
Grout pipes and connections shall be steel casing of adequate strength to maintain the hole and to withstand the required jacking and pumping pressures. The pipes shall be at least 2-inches inside diameter to adequately transmit the specified low slump material without

plugging. All casing shall be flush joint threaded or a single piece tubing to provide a smooth inner wall and unobstructed inside diameter. It shall be the Contractor's responsibility to install casing that does not detrimentally impact the grouting procedure.

**7.5.7.5 Grouting Equipment**

Equipment used shall be specifically designed for compensation grouting. Because of the high pressure involved, all equipment, including hoses, couplings, gauges and pipes, shall be able to safely operate at the maximum grouting pressures as included in Contractor submittals. The mixing and grout pump system shall be designed to provide continuous flow of the grout mixture at variable flow rates and pressures without interruption during any single hookup or stage due to inadequate batching or pump feed capacity.

**7.5.7.6 Grout Mixers**

The mixer shall be a continuous auger type to ensure complete uniform mixing of the materials used and shall be of sufficient capacity to continuously provide the pumping unit with mixed grout at its normal pumping range. The mixer must be capable of volumetrically proportioning the grout materials. Ready mixed grout is also acceptable with an approved mix design.

**7.5.7.7 Grout Pumps**

Provide positive displacement grout pump(s) capable of continuously delivering grout at pressures of at least 700 psi or at pressures sufficient to penetrate through previously grouted zones, whichever is larger. Pumping rate shall be readily controllable down to 0.2 cfm. Each grout pump shall be capable of displaying both pressure and injection volume.

**7.5.7.8 Grout Delivery System**

The grout delivery system shall consist of hoses, couplings, and pipes compatible with the equipment used for this work and shall be capable of withstanding the pressures delivered by the pump. Pressure gauges shall be provided at the pump discharge and at the top of the injection pipe to monitor pressure.

**7.5.8 Utility and Stakeholder Coordination**

Coordinate with all affected utility companies, stakeholders and property owners within the project limits, as applicable. The Contractor shall locate, protect, support and maintain, without interruption, all utility facilities, equipment and services. Coordinate the sequence of operations taking into consideration: a) means of access to the area; b) permitted areas of operations; c) time restrictions for the performance of the Work; and d) maintenance of traffic requirements.

**7.5.9 Installation of Grout Pipes**

Before beginning grout pipe installation from the surface, the proposed grout hole locations shall be marked by the Contractor and cleared by the utility notification system. If existing utilities are within 3 feet of proposed grout pipes, the Contractor shall expose the utilities by hand excavation before installing grout pipes. Vacuum excavation may be permitted to expose existing utilities, subject to City's Construction Project Manager's approval.

### 7.5.10 Compensation Grouting Procedures

The grouting process shall progress in stages within each pipe starting at the bottom of the pipe, progressing upward at 2-foot intervals. The ground surface and adjacent structures will be monitored by the Contractor during grouting, in accordance with the approved work plan. Heave shall not exceed 1/8 inch. Grout injection shall cease at any given stage when surface heave is detected, when the maximum grouting pressure is reached, or when a sudden drop in pressure is noted.

### 7.5.11 Clean Up and Site Restoration

Remove all equipment, unused materials, and debris from the site at the end of the job. Spilled materials and ground shall be cleaned-up. Grout pipes shall be removed from the ground or filled with lean cement and cut off within one foot of the ground surface in accordance with the requirements of the City, utility owner or stakeholder. Restoration shall follow construction as the work progresses and shall be completed as soon as possible. Restore and repair any damage resulting from heave or spills caused by the work. Any property or improvements damaged or destroyed, shall be restored to a condition equal to or better than existing prior to construction at no additional cost to the City. Restoration shall be completed immediately if a third party or the City is inconvenienced by the damage, and in no case later than thirty (30) days after the damage is discovered. This provision for restoration shall include all property which was affected by the construction operations.

**END OF SPECIFICATION**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management Standard Construction Specification

## 8.0 Structural Excavation

### 8.0.1 General

All excavation for the construction of structures shall be in conformance with the applicable provisions of CDOT Section 206 except as modified herein.

Unless otherwise stipulated in the Contract Documents, no separate payment will be made for structural excavation, except for overexcavation as directed by the Construction Project Manager, and all costs incurred will be considered to be included in the unit price bid for the associated structure or appurtenance. The cost of overexcavation will be paid for as specified below.

### 8.0.2 Over Excavation

In locations where soil with unsuitable bearing characteristics are encountered, the Construction Project Manager may order that the unsuitable material be removed and be replaced with granular and/or rock backfill material to provide suitable bearing for the structure.

The overexcavation will be paid for in accordance with the unit price set forth in the Contract Documents for excavation and replacement with an approved granular material; provided, however, no measurement for payment will be made of any material required to fill overexcavated areas: outside of specified pay limits (if applicable), that were for the Contractor's convenience, beyond the limits required for structural excavation, or where excavations for footings, slabs, etc., are made below the required elevations without specific authorization from the Construction Project Manager. Under these circumstances, the excess excavation and backfill required for over excavated area(s) shall be filled in a manner satisfactory to the Construction Project Manager by the Contractor at their expense.

### 8.0.3 Removal of Water

All water encountered in excavations shall be removed as required within these Specifications.

### 8.0.4 Backfill

Backfill around structures shall be per the requirements set forth within these Standard Construction Specifications.

### 8.0.5 Site Grading

The entire site shall be graded using suitable materials from the excavation. Grading shall be for the purpose of providing a neat and pleasing appearance and for facilitating positive drainage. Compaction of all grading material shall be as specified within these Specifications.

**End of Specification**

# 9.0 Pipe Testing, Inspection and Acceptance

## 9.1 General

In addition to any other testing or inspection requirements set forth elsewhere in these Specifications, all testing, inspection and acceptance of the completed work will be as specified herein.

Test for water-tightness of sanitary sewers shall be conducted by the Contractor at his own expense, except as noted, with the assistance and under the direction of the Construction Project Manager prior to final acceptance.

Unless otherwise specified, storm sewer systems normally will not be required to be tested for leakage. All leakage tests shall be completed and approved prior to placing of permanent resurfacing. Where the difference in elevation between the inverts of adjacent structures (manholes) exceeds 20 feet, no exfiltration leakage tests will be required.

## 9.2 Testing and Inspection

### 9.2.1 Exfiltration Test

Unless otherwise noted on the plans, each section of sewer will be tested between successive manholes by closing the lower end of a sewer reach by plugging the pipe at the inlet to the lower manhole and then by filling the sewer and the upper manhole(s) to the proper level with water. The water level in the upper manhole shall be a minimum of 4 feet above the level of the ground water. The maximum exfiltration rate for any section of sewer line shall not exceed the limits specified below:

| Pipe Material | Maximum Rate of Exfiltration |
|---|---|
| Clay, Concrete | 200 gal per day/inch diam/mile |
| PVC, RPMP | 50 gal per day/inch diam/mile |

For the purposes of exfiltration leakage, manholes shall be considered to be concrete pipe of the same diameter as the manhole i.e. 48, 60 or 72 inch diameter. Air pocket entrapment shall be avoided when filling the line with water. Once filled with water, the system shall be allowed to stabilize for a period of one or two hours before starting the test. Exfiltration leakage rate is determined by measuring the amount of water required to maintain a constant level in the upper manhole. Test duration is to be no less than two hours.

If the leakage, as shown by the test, exceeds the allowable value, the Contractor shall make the necessary corrections at his expense to reduce the exfiltration to within the permissible limits. The Contractor shall furnish all water, material and labor required to perform the test. All tests shall be made in the presence of the Construction Project Manager.

### 9.2.2 Infiltration Test

If the Construction Project Manager determines that excessive ground water is encountered during construction of a sanitary sewer section, the infiltration test for leakage shall be used. The maximum allowable infiltration for sanitary sewers shall not exceed the following limits for the type of projects specified:

| Type of Pipe | Max. Allowable Infiltration |
|---|---|
| Clay, Concrete | 200 gal per day/inch diam/mile (3.8 d/inch/100 ft) |
| PVC, RPMP | 50 gal per day/inch diam/mile (0.95 gpd/inch/100 ft) |

Unless otherwise specified, infiltration will be measured by the Construction Project Manager, using measuring devices furnished by the City.

If the infiltration is found to exceed the prescribed amount, the Contractor shall make the appropriate repairs as approved by the City and shall continue to test the sewer until it meets requirements.

### 9.2.3 Air Pressure Test

When directed by the Construction Project Manager and prior to acceptance of any segment of newly constructed sanitary sewers, the pipe will be subjected to an air pressure test, which will be conducted after densification of the backfill and prior to installation of any sanitary taps. The test shall conform to the recommended practice and calculations established by the ASTM C-828. After a manhole to manhole reach of pipe has been backfilled, the line should be flushed and cleaned with the interior walls moist. Plugs shall be placed in the line at each manhole and low pressure shall be introduced into this sealed line until the internal pressure reaches 4 psig (pounds per square inch gage) greater than the average back pressure of any ground water that may be surrounding the pipe. At least two minutes shall be allowed for the air pressure to stabilize. The test shall then be run with the drop in pressure from 3.5 to 2.5 psig. The calculations generated by ASTM C-828 shall then be used to check the adequacy of the pipe installation. If the installation fails to meet the requirements, the Contractor shall at his own expense determine the source of leakage

and then shall repair or replace all defective materials and/or workmanship at his own expense to the satisfaction of the Construction Project Manager.

Safety precautions shall be used at all times. It is extremely important that the plugs be installed and braced to prevent blowouts. No one shall be allowed into the manholes during testing.

### 9.2.4 Television Inspection

Prior to acceptance of any segment of newly-constructed sewers, all pipes will be televised and physically inspected by the City for any observable defects. This requirement will apply to sanitary sewers and to small storm sewers which are too small to be physically inspected will also be televised. Any defects discovered during this inspection shall be corrected prior to acceptance of the sewer.

The Contractor shall request these televised inspections through the City Construction Project Manager with at least 48 hours advance notification. The cost of initial inspection and the first re-inspection to confirm correction of previously identified deficiencies will be borne by the City. If additional inspections are required due to inadequate or otherwise unacceptable repairs, the costs for such inspections shall be charged to the Contractor.

### 9.2.5 Deflection Test (Flexible Pipe)

The City shall conduct deflection tests of all flexible pipes after completion of the work and again 30 days prior to the end of the guarantee period. The Contractor shall, at his expense, furnish a multiarmed test mandrel having an odd number of arms, nine or more in number. The mandrel will be pulled through the lines to be tested by City personnel using the ASTM testing procedure. The Contractor may witness the tests and may receive a copy of the test logs and reports if desired. All test equipment, calibration data, procedures, etc. shall be subject to approval by the Construction Project Manager.

The maximum allowable deflection after installation and backfilling shall not exceed that specified elsewhere in these Specifications for the particular pipe installed. Any segments of the pipe deemed necessary to be unsatisfactory shall be replaced or reworked by the Contractor in accordance with the requirements of the Construction Project Manager. Such repair shall be at the Contractor's expense.

### 9.2.6 Hydrostatic Test

Cast Iron, Ductile Iron, PVC Pressure Mains and Force Mains

#### 9.2.6.1 Hydrostatic Tests

Hydrostatic tests consisting of a Pressure Test and a Leakage Test shall be performed prior to final backfilling. Thrust blocks, anchors, and partial backfill sufficient to anchor the pipeline in place but leaving joints, valves and fittings exposed for inspection shall be performed before testing.

#### 9.2.6.2 Pressure Test

After the pipe has been laid and partially backfilled, all newly laid pipe, or any valved section thereof, shall be subjected to a pressure test. The test pressure shall be determined by the Engineer. For PVC Pressure mains and Force Mains the test pressure shall be defined in

general accordance with the requirements of AWWA-900 or UNI Bell B-3-77. The duration of the pressure test shall be at least one hour with no discernable loss of pressure.

a. **Procedure**. Each valved section of pipe shall slowly be filled with water to the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation on the test gage. Air shall be applied by means of a pump connected to the pipe in a satisfactory manner satisfactory to the Engineer. The pump, pipe connections, gages and all necessary test equipment shall be furnished by the Contractor who will make all taps into the pipe. The Contractor shall furnish all necessary assistance for conducting the tests.

b. **Air Removal**. Before applying the specified air pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so the air can be expelled as the line is filled with water. After the air has been expelled, the corporation cocks shall be closed and the test pressure applied.

c. **Examination Under Pressure**. All exposed pipe fittings, valves and joints shall be carefully examined prior to placement of backfill. Any cracked or defective pipe, pipe joints, fittings, or valves discovered in consequence of the pressure test shall be removed and replaced by the Contractor, and the test shall be repeated to the satisfaction of the Construction Project Manager.

#### 9.2.6.3 Leakage Tests

A leakage test shall be conducted after the pressure test has been satisfactory completed. The Contractor will furnish the gage, measuring device, pump, and pipe connections, other necessary apparatus and the necessary assistance to conduct the test. The duration of each leakage test shall be two hours with an average test pressure determined by the Engineer being maintained during this period.

Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain the specified leakage test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L=ND\sqrt{P} \text{ divided by } 3700$$

For mechanical joints and push-on joints, where L is the allowable leakage in gallons per hour, N is the number of joints in the length of pipeline tested, D is the nominal diameter of the pipe in inches, and P is the average test pressure applied during the test in pounds per square inch gage.

The allowable leakage for 1,000 feet of 18-foot length of mechanical joint or push-on joint pipe at various pressures and diameters is shown in Table 1 of this section.

a. **Variation from Permissable Leakage**. If any pipe laid discloses leakage greater than that specified above, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified allowance.

b. **Pressure and Leakage Tests after Backfilling**. After the trench has been completely backfilled, the test connections made, and the main filled with water, the pipe shall be subject to a final pressure and leakage test as specified above. If defects are found, the Contractor shall immediately make the repairs and the test repeated until satisfactory to the Engineer.

A final leakage test shall then be conducted after satisfactory completion of the pressure tests. Should any section fail to meet the final leakage test, the Contractor shall make the necessary repairs at his expense.

The duration of the final pressure test and leakage test shall be a minimum of one hour each.

#### 9.2.6.4 Test Report

The Construction Project Manager shall be furnished a written report of the reports of the Hydrostatic Tests performed; identifying the specific length of the pipe tested, the pressure, the duration of the test and the amount of leakage.

## 9.2 Acceptance

Portions of the work completed may be placed in operation after all cleaning, and inspection requirements have been fulfilled. Final acceptance of the work will not be made until all requirements set forth in the Contract documents have been completed. Any items of work which the Contractor considers as extra shall be reported to the Construction Project Manager during the progress of the testing and inspection. No consideration of any work items will be made unless substantiating records of the work exist. Any work which the Contractor considers to be extra shall be considered in accordance with General Condition 1101, “Change Order”.

**END OF SPECIFICATION**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management
# Standard Construction Specification

## 10.1 PRECAST CONCRETE PIPE

### 10.1.1 General

This section covers material requirements, inspection, marking, delivery, installation, field performance and acceptance of reinforced concrete pipe for storm drainage systems. This shall include circular, elliptical and arch pipe along with all associated special pipe sections.

### 10.1.2 Referenced Standards

This section references American Society for Testing and Materials (ASTM) Specifications, which are made a part hereof by such references, and shall be the latest edition and revision thereof. All material, manufacturing, operations, testing, inspection and production of concrete pipe shall conform to the following Referenced Standards:

| | |
|---|---|
| ASTM C14 | Concrete Sewer, Storm Drain and Culvert Pipe |
| ASTM C33 | Specification for Concrete Aggregates |
| ASTM C76 | Reinforced Concrete Culvert, Storm Drain and Sewer Pipe |
| ASTM C150 | Standard Specification for Portland Cement |
| ASTM C361 | Reinforced Concrete Low-Head Pressure Pipe |
| ASTM C443 | Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets |
| ASTM C497 | Standard Test Methods for Concrete Pipe, Manhole Sections or Tile |
| ASTM C506 | Reinforced Concrete Arch Culvert, Storm Drain and Sewer Pipe |
| ASTM C507 | Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe |
| ASTM C655 | Standard Specification for Reinforced Concrete D-Load culvert, Storm Drain and Sewer pipe |
| ASTM C822 | Standard Terminology Relating to Concrete Pipe and Related Products |
| ASTM C985 | Standard Specification for Non-reinforced concrete Specified Strength Culvert, Storm Drain and Sewer pipe |

ASTM C1417 Standard Specification for Manufacture of Reinforced Concrete Sewer, Storm drain and Culvert pipe for Direct Design

### 10.1.3 Diameter of Pipe

The diameter indicated on the Contract Documents shall mean the inside diameter of the pipe.

### 10.1.4 Wall Thickness and Class of Pipe

The wall thickness and reinforcing steel shall comply with the appropriate ASTM Specification and the designated class of pipe as indicated in the Contract Documents. For jacked pipe, the pipe manufacturer shall supply allowable jacking force calculations for each size of pipe supplied for the project. The Contractor is responsible for ensuring that the allowable jacking force is sufficient to install the product based on anticipated site conditions and the forces that the pipe may be subjected to during jacking operations.

### 10.1.5 Submittals

#### 10.1.5.1 Supplier Certification

A letter from the supplier to the Construction Project Manager shall be submitted certifying that all Precast Reinforced Concrete Pipe is manufactured in accordance with the applicable ASTM specification.

#### 10.1.5.2 Design Calculations

All designs shall be per the applicable ASTM designation, except where pipe sizes and or special load conditions are not covered in the specifications. All special designs and load conditions shall require the submittal of design calculations through the Construction Project Manager for approval.

#### 10.1.5.3 Shop Drawings

Shop drawings showing a laying diagram and the location of all closure pieces shall be submitted. Drawings shall include: proposed lifting anchors, lugs and any other features pertinent to the manufacture of special sections.

#### 10.1.5.4 Gasket Deformation

Calculations showing the gasket deformation(s) shall be submitted to the Construction Project Manager.

#### 10.1.5.5 Lifting Anchors

The lifting mechanisms proposed for handling and placement of conduit shall be submitted to the Construction Project Manager for approval.

#### 10.1.5.6 Maximum Allowable Joint Gap

The manufacturer shall provide the Construction Project Manager with the maximum allowable joint gaps on all conduit sizes for the project. The maximum allowable joint gap is determined as that point where the bevel of the bell and the shoulder of the spigot are vertically aligned and the rubber gasket has achieved the minimum compression necessary to ensure a water tight seal per these Standard Construction Specifications.

### 10.1.6 Materials

All precast reinforced concrete pipe shall be manufactured in accordance with the applicable ASTM designation or as specified in the Contract Documents.

The Construction Project Manager shall be provided a production schedule at least three working days in advance of when the various types of pipe will be cast so the casting operation may be inspected and appropriate specimens may be selected for testing in accordance with the Contract Documents.

#### 10.1.6.1 Cement

Unless otherwise specified by the Construction Project Manager, or within the Contract Documents, Type II Portland Cement complying with the requirements of ASTM C150 will be used in the production of concrete pipe.

#### 10.1.6.2 Lifting Anchors

Lifting anchors shall be used on all precast concrete pipe. Lifting holes are <u>only</u> permitted on jack pipe and will require metal sleeves cast through the pipe wall which are capable of accepting threaded caps that are flush with the pipeline interior after installation. Lift hole sleeves shall be filled with a non-shrink grout prior to installing threaded caps.

#### 10.1.6.3 Fittings and Specials

Details of all fittings and specials shall be submitted for approval to the Construction Project Manager prior to construction. Fittings and specials shall be made up of pipe segments having the same structural qualities as the adjoining pipe and shall have the interior treated the same as the pipe, except that epoxy coatings shall be allowed.

#### 10.1.6.4 Joints and Gaskets

Pipe joints for all reinforced concrete pipes shall be formed using rubber gaskets that provide a watertight seal, in accordance with ASTM C443. The joints shall be of such design that they will withstand the forces caused by the compression of the gasket when joined.

- A separate submittal package specific to each pipe size and unique project scenario shall be required for approval by the Construction Project Manager prior to product procurement by the Contractor. At a minimum, this submittal shall include jacking force calculations (see 7.1.4), joint design, and a special pipe detail for each situation.

The joint design of concrete pipe shall be a bell and spigot or a tongue and groove style joint. The spigot or tongue shall be grooved to properly contain and seat the rubber gasket. The joint assemblies shall be accurately formed so that when each pipe section is forced together in the trench the assembled pipe shall form a continuous watertight conduit with a smooth and uniform interior surface, and shall provide for slight movement of any piece of the pipeline due to expansion, contraction, settlement or lateral displacement. The gasket shall be the sole element of the joint providing water tightness. The ends of the pipe shall be perpendicular (90° angle) to the longitudinal centerline of the pipe, except where bevel-end pipe is required. The ends shall be finished so that they are uniform and smooth.

Rubber gaskets for bell and spigot pipe shall consist of an o-ring rubber gasket, rubber profile gasket, or another gasket specifically approved, in writing, by the Construction Project Manager.

Gaskets may be either isoprene or neoprene conforming to ASTM C443. All gaskets shall be stored in a cool place, preferably at a temperature of less than 70 degrees Fahrenheit (F), and in no case shall the gaskets be stored in the open, or exposed to direct sunlight. No gaskets which show signs of deterioration, such as surface cracking or checking, shall be installed in a pipe joint. When the air temperature is 10 degrees F or lower, the gaskets shall be warmed to temperature of 60 degrees Fahrenheit for a period of 30 minutes before being placed on the pipe.

#### 10.1.6.5 Joint Gap

For reinforced concrete pipe 30-inches (or equivalent diameter for arch and elliptical pipes) and larger, if the end face joint gap is greater than or equal to 65% of the maximum allowable joint gap, as submitted by the manufacturer for each specific pipe size and less any factors of safety, the gap shall be grouted with an approved non-shrink grout product around the entire internal joint perimeter. If the end face joint gap is greater than the maximum allowable joint gap submitted by the manufacturer, at any point around the internal joint perimeter, the adjoining pipe sections will be rejected and no payment will be made.

#### 10.1.6.6 Jacking and/or Microtunneling Pipe

All other Requirements set forth in this specification shall apply to reinforced concrete pipe being installed via tunneling, in addition to the following:

2. All RCP shall have a flush joint design.
3. The class of pipe shall be as defined in the drawings:
    - Where steel joint rings are specified, they shall conform to ASTM C361, joint type R-2 and shall include steel joint rings on the bell and spigot
    - Where steel bell bands are specified, the pipe shall include a ¼” thick steel bell band which is at least 12” wide or twice the manufactured pipe joint depth, whichever is greater. A separate submittal package specific to each pipe size and unique project scenario shall be required for approval by the Construction Project Manager prior to product procurement by the Contractor. At a minimum, this submittal shall include jacking force calculations, additional reinforcement required to meet the site conditions, and a special pipe detail for each situation.
4. Concrete used in Pipe production shall have a minimum 28-day compressive strength of 6,000 psi, regardless of the class of pipe specified.
5. Grouting nipples shall be spaced no more than 8 feet apart on the installed pipeline.

### 10.1.7 Acceptance

In addition to any deficiencies not covered by the applicable ASTM specifications, individual concrete pipe sections shall be subject to rejection due to any of the following:

1. Surface defects indicating honeycombed or open texture that would adversely affect the function of pipe sections. Repairs may be made, if approved by the Construction Project Manager.
2. Damaged ends, where such damage would prevent making a satisfactory joint.
3. Pipe which has been excessively patched or repaired. The manufacturer may request that the Construction Project Manager perform an inspection at the plant, prior to delivery, to assess patching and/or repair work on conduits. Pipe damaged during shipment or construction may be repaired with the approval of the Construction Project Manager.
4. Exposure of the reinforcement. The exposure of the ends of longitudinals, stirrups and spacers used to position reinforcement shall not be cause for rejection and may be repaired with the approval of the Construction Project Manager, in writing.
5. Concrete pipe that has been delivered to the jobsite prior to being at least 5 days (120 hours) old, except in cases when evidence that design strengths can be met earlier has been submitted and approved by the Construction Project Manager.
6. Broken bells or spigots on installed pipeline
7. Joint gaps greater than maximum allowable submitted by manufacturer

Acceptance of the pipe at point of delivery will not relieve the Contractor of full responsibility for any defects in materials due to workmanship.

### 10.1.8 Marking

The following shall be clearly marked on both the interior and exterior surface of the pipe:

1. ASTM specification designation
2. Class and size
3. Date of manufacture
4. Name or trademark of manufacturer

### 10.1.9 Protective Coatings

Whenever adverse corrosive conditions warrant additional interior protection, those pipe segments noted in the Contract Documents shall be lined as specified elsewhere in these Standard Construction Specifications.

### 10.1.10 Installation

Reinforced concrete pipe shall be constructed continuously, from downstream to upstream, except when otherwise approved by the Construction Project Manager, in writing. The General Contractor is responsible for matching line and grade as shown within the Contract Documents. Bedding material shall be placed in accordance with these Contract Documents

and all applicable Wastewater Management Division Standard Details to provide uniform and continuous support.

Pipe shall be placed with the grove or bell end upstream. Each conduit section shall be set into position and checked for line and grade prior to continuing placement. The manufacturers' recommendations shall be closely followed during installation.

The General Contractor shall ensure that all reinforced concrete pipe is kept clean and free from gravel, dirt and debris during and after installation. Precautions shall be taken by the General Contractor to eliminate soil and debris from being washed into the sewer prior to completion of the entire system and its appurtenances. The General Contractor shall incur all costs associated with street failures, cave-ins, system washouts and settlements, and conduit cleaning as a result of carelessness during this timeframe.

**End of Specification**

# 10.3 Precast Reinforced Box Conduits

## 10.3.1 General

The work of this section includes furnishing and installing all precast reinforced concrete box conduits for storm drainage systems. This shall include all associated special pieces, except inlets and manholes.

## 10.3.2 Related Sections

Section 4.0, Utility Trenching and Excavation (Wastewater Capital Projects Management Standard Construction Specifications).

## 10.3.3 Referenced Standards

This section references American Society for Testing and Materials (ASTM) Specifications, which are made a part hereof by such references, and shall be the latest edition and revision thereof. All material, manufacturing, operations, testing, inspection and production of precast reinforced box conduits shall conform to the following standards.

| | |
|---|---|
| ASTM C150 | Standard Specification for Portland cement |
| ASTM C497 | Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile |
| ASTM C822 | Terminology Relating to Concrete Pipe and Products |
| ASTM C1433 | Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains and Sewers |
| ASTM C443 | Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets |

## 10.3.4 Submittals

### 10.3.4.1 Supplier Certification

A letter from the supplier to the Construction Project Manager shall be submitted certifying that all Precast Reinforced Box Conduits are manufactured in accordance with ASTM C1433.

### 10.3.4.2 Design Calculations

All designs shall be per the tables of ASTM C1433 except where box sizes and or special load conditions are not covered by these tables. All special designs and load conditions shall

require the submittal of design calculations through the Construction Project Manager for City and County of Denver approval.

#### 10.3.4.3 Shop Drawings

Shop drawings showing laying diagram and location of all closure pieces shall be submitted. Drawings shall include: proposed lifting anchors, lugs and any other features pertinent to the manufacture of special sections.

#### 10.3.4.4 Gasket Deformation

Calculations showing the gasket deformation(s) shall be submitted to the Construction Project Manager.

#### 10.3.4.5 Lifting Anchors

The lifting mechanisms proposed for handling and placement of box conduit shall be submitted to the Construction Project Manager for approval.

#### 10.3.4.6 Maximum Allowable Joint Gap

The manufacturer shall provide the Construction Project Manager with the maximum allowable joint gaps on all box conduit sizes for the project. The maximum allowable joint gap is determined as that point where the bevel of the bell and the shoulder of the spigot are vertically aligned and the rubber gasket has achieved the minimum compression necessary to ensure a water tight seal per these Standard Construction Specifications.

### 10.3.5 Materials

#### 10.3.5.1 Box Conduits

All precast reinforced concrete box conduits shall be manufactured in accordance with ASTM C1433.

The Construction Project Manager shall be provided a schedule at least three working days in advance of when the various types of box conduit will be cast so the casting operation may be inspected and appropriate specimens may be selected for testing in accordance with the Contract Documents.

#### 10.3.5.2 Box Joints

Box joints for reinforced concrete box conduits shall be formed using either o-ring or profile rubber gaskets that provide a watertight seal. The gasket shall be properly placed on the spigot using an adhesive, as necessary along the joint perimeter, to maintain the correct position of the gasket. Joints for box conduits shall comply with the requirements set forth in ASTM C443, with the following revisions.

- A separate submittal package specific to each pipe size and unique project scenario shall be required for approval by the Construction Project Manager prior to product procurement by the Contractor. At a minimum, this submittal shall include jacking force calculations (see 7.1.4), joint design, and a special pipe detail for each situation.

1. **Gasket Deformation**

   The joints shall be of such design that they will withstand the forces caused by the compression of the gasket when the joint is in the assembled and homed position, as well as when the box joint is fully off-centered and the maximum dimensional tolerances are applied.

2. **Hydrostatic Testing and Requirements**

   One box joint per size, for each project, shall be hydrostatically tested at the place of manufacture to verify water tightness and joint integrity. Hydrostatic pressure tests on joints shall be made on an assembly of two sections of box, properly connected in accordance with the joint design. Suitable means shall be provided that allows pressure to be applied to the joint, either external or internal of the two joined box sections. When infiltration is a concern, the joint shall be tested using external pressure only.

   Assembled joints shall pass the following performance tests without leakage at the joints. Moisture or beads of water appearing on the surface of the joint will not be considered as leakage.

   *Box in straight alignment*
   Concrete box conduit shall be subjected to a hydrostatic pressure of 5psi (11.5 ft of pressure head) for 10 minutes in straight alignment. If leakage of joints should initially occur, the manufacturer shall have the option to extend the test period up to 24 hours.

   *Box in maximum deflected position*
   Upon completion of the test for box in straight alignment, the test section shall be deflected to create a position ½ inch wider than the assembled position on one side of the outside perimeter of each joint and shall be subjected to a hydrostatic pressure of 3psi (6.9 ft of pressure head) for 10 minutes.

3. **Joint Gap**

   If the end face joint gap is greater than or equal to 65% of the maximum allowable joint gap, as submitted by the manufacturer for each specific box size and less any factors of safety, the gap shall be grouted with an approved non-shrink grout product around the entire internal joint perimeter.

### 10.3.5.3 Closure Pieces

All pieces required for closure between precast and cast-in-place elements shall be fabricated with protruding dowels or exposed reinforcing steel, as shown in the Contract Documents, and as approved by the Construction Project Manager. All dowels and/or exposed reinforcing shall be fully developed.

### 10.3.5.4 Special Pieces

Special pieces shall be fabricated as shown on the Contract Documents and shall be approved by the Construction Project Manager prior to fabrication.

#### 10.3.5.5 Lifting Anchors

Lifting anchors shall be used on all box conduits. Lifting holes will not be allowed.

### 10.3.6 Acceptance

In addition to deficiencies covered by applicable ASTM specifications, individual precast reinforced concrete box conduits shall be subject to rejection due to any of the following:

1. Surface defects indicating honeycombed or open texture that would adversely affect the function of box sections. Onsite repairs may be made, if approved by the Construction Project Manager.
2. Damaged ends, where such damage would prevent making a satisfactory joint.
3. Conduit which has been excessively patched or repaired. The manufacturer may request that the Construction Project Manager perform an inspection at the plant, prior to delivery, to assess patching and/or repair work on conduits. Conduit damaged during shipment or construction may be repaired with the approval of the Construction Project Manager.
4. Exposure of the reinforcement. The exposure of the ends of longitudinals, stirrups and spacers used to position reinforcement shall not be cause for rejection.
5. Box conduit that has been delivered to the jobsite prior to being at least 5 days (120 hours) old.

Acceptance of the conduit shall not relieve the General Contractor of full responsibility for defects in material or workmanship on the completed boxlines.

### 10.3.7 Marking

The following information shall be legibly marked on each box section by indentation, waterproof paint or other approved means:

1. ASTM specification designation
2. Date of manufacture
3. Name or trademark of manufacturer

### 10.3.8 Testing

The Construction Project Manager or other identified representatives shall be permitted to visit the manufacturing facility of the General Contractor's supplier to observe compliance with all applicable testing provisions. These visits may be scheduled or random.

### 10.3.9 Shipping and Handling Box Conduit and Fittings

All conduits, fittings, and specials shall be hauled, unloaded, stockpiled, distributed, handled and installed as recommended by the manufacturer and in such a manner as to prevent damage to the product.

### 10.3.10 Installation

Box conduit lines shall be constructed continuously, from downstream to upstream, except when otherwise approved by the Construction Project Manager. The General Contractor is responsible for matching line and grade as shown within the Contract Documents. Bedding

material shall be placed in accordance with the Contract Documents and applicable Wastewater Management Division Standard Details to provide uniform and continuous support.

Box conduits shall be placed with the grove end upstream. Each conduit section shall be set into position and checked for line and grade prior to continuing placement. The manufacturers' recommendations shall be closely followed during installation.

The General Contractor shall ensure that all reinforced concrete box conduits are kept clean and free from gravel, dirt and debris during and after installation. Precautions shall be taken by the General Contractor to eliminate soil and debris from being washed into the sewer prior to completion of the entire system and its appurtenances. The General Contractor shall incur all costs associated with street failures, cave-ins, system washouts and settlements, and conduit cleaning as a result of carelessness during this timeframe.

**End of Specification**

# 10.4 Reinforced Polymer Mortar Pipe

## 10.4.1 General

This section covers material requirements, inspection and testing, marking and delivery, installation, and field performance and acceptance tests of Reinforced Polymer Mortar Pipe (RPMP), for use in gravity, storm and sanitary sewer installations.

## 10.4.2 Referenced Standards

This section references American Society for Testing and Materials (ASTM), which are made part hereof by such references, and shall be the latest edition and revision thereof. All material, manufacturing, operations, testing, inspection and production of Reinforced Polymer Mortar Pipe (RPMP) shall conform to the following referenced standards:

ASTM D3262 Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe

ASTM D4161 Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.

ASTM D2412 Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.

ASTM D3681 Standard Test Method for Chemical Resistance of "Fiberglass" Pipe in a Deflected Condition.

ASTM D638 Test Method for Tensile Properties of Plastics.

## 10.4.3 Diameter of Pipe

The diameter indicated on the Contract Documents shall mean the inside diameter of the pipe.

## 10.4.4 Wall Thickness

The wall thickness and reinforcements shall comply with the appropriate ASTM Specification as indicated in the Contract Documents.

## 10.4.5 Submittals

### 10.4.5.1 Supplier Certification

1. A letter from the supplier to the Construction Project Manager shall be submitted certifying that all Reinforced Polymer Mortar Pipe and associated appurtenances are manufactured in accordance with the applicable ASTM specifications.
2. The manufacturer shall provide the Construction Project Manager with the manufacturer's recommended maximum allowable joint gaps and tolerances on all conduit sizes for the project.
3. If the project contains tunneling or boring, please refer to additional submittal requirements elsewhere in this specification.

## 10.4.6 Materials

### 10.4.6.1 Pipe

The pipe shall meet the ASTM D3262 standard specification Cell Limit Type 1, Liner 1 or 2, and Grade 1 or 3, with a minimum SN of 46 psi and PN of 25psi, unless otherwise indicated on the plans.

### 10.4.6.2 Joints

The joints must meet the performance requirements of ASTM D4161. Unless otherwise specified, the pipe shall be field connected with sleeve couplings that utilize elastomeric sealing gaskets made of EPDM rubber compound as the sole means to maintain joint water tightness as otherwise approved by the Construction Project Manager.

The measured pipe joint gap shall not be equal to or larger than 65% of the manufacturer's recommended maximum allowable joint gap.

#### 10.4.6.2.1 Manhole Connection

Unless otherwise specified the connection at the manhole must be a waster stop gasket or approved equal.

- **A separate submittal package specific to each pipe size and unique project scenario shall be required for approval by the Construction Project Manager prior to product procurement by the Contractor. At a minimum, this submittal shall include jacking force calculations (see 7.1.4), joint design, and a special pipe detail for each situation.**

### 10.4.6.3 Fittings

Flanges, elbows, reducers, tees, wyes, laterals and other fittings shall be capable of withstanding all operating conditions when installed. They may be contact molded or manufactured from mitered sections of pipe joined by glass-fiber-reinforced overlays. Properly protected standard ductile iron, fusion-bonded epoxy coated steel and stainless steel fittings may also be used.

### 10.4.6.4 Resin Systems

The manufacturer shall use only polyester resin systems with a proven history of performance in this particular application. The historical data shall have been acquired

from a composite material of similar construction and composition as the proposed product.

#### 10.4.6.5 Glass Reinforcements

The reinforcing glass fibers used to manufacture the components shall be of highest quality commercial grade E-glass filaments with binder and sizing compatible with impregnating resins.

#### 10.4.6.6 Silica Sand

Sand shall be minimum 98% silica with a maximum moisture content of 0.2%.

#### 10.4.6.7 Additives

Resin additives, such as curing agents, pigments, dyes, fillers, thixotropic agents, etc., when used, shall not detrimentally affect the performance of the product.

#### 10.4.6.8 Elastomeric Gaskets

Gaskets shall be supplied by qualified gasket manufacturers and be suitable for the service intended.

### 10.4.7 End Squareness

Pipe ends shall be square to the pipe axis with a maximum tolerance of 1/8”.

### 10.4.8 Packaging, Handling, Shipping

The Contractor shall follow the procedures and recommendations for packaging, handling, and shipping, in accordance with the manufacturer’s instructions.

### 10.4.9 Jacking and/or Microtunneling Pipe

All other Requirements set forth in these specifications shall apply to reinforced polymer mortar pipe being installed via tunneling, in addition to the following:

1. All RPMP utilized for Jacking and or Microtunneling shall have a flush joint design.
2. A separate submittal package specific to each pipe size and unique project scenario shall be required for approval by the Construction Project Manager prior to product procurement by the Contractor. At a minimum, this submittal shall include jacking force calculations, joint design, and a special pipe detail for each situation.
3. The pipe manufacturer shall supply allowable jacking force calculations for each size of pipe supplied for the project.
4. The Contractor is responsible for ensuring that the allowable jacking force is sufficient to install the product based on anticipated site conditions and that the forces the pipe may be subjected to during jacking operations do not damage the product.

#### 10.4.4.9 Testing

1. All pipes shall be manufactured and tested in accordance with ASTM D3262
2. All joints shall meet the requirements of ASTM D4161.
3. Stiffness shall be tested in accordance with the test method of ASTM D2412.

## 10.4.5 Inspection of Product During Manufacturing

### 10.4.5.1 Customer Inspection

The owner or other designated representative shall be entitled to inspect pipes or witness the pipe manufacturing.

### 10.4.5.2 Manufacturers Notification to Customer

Should the Owner request to see specific pipes during any phase of the manufacturing process, the manufacturer must provide the Owner with at least 48-hours advance notice of when and where the production of those pipes will take place.

## 10.4.6 Installation

### 10.4.6.1 Trenching and Excavation

Trenching and excavation shall be performed in accordance with Section 4.0 of these Standard Construction Specifications.

### 10.4.6.2 Bedding and Haunching

The bedding shall be Class B as defined in these Standard Construction Specifications. The bedding material shall conform to ASTM C33 or ASTM D448 gradation No. 67 shall be brought to proper grade and elevation prior to installation of pipe and assembly of joints. Depressions for pipe bell shall be provided. Additional bedding material shall then be placed according to Wastewater Management Division Standard Detail S-301, “Standard Detail for Trenching and Bedding”.

### 10.4.6.3 Pipe Handling

Use textile slings, other suitable materials or a forklift. Use of chains or cables shall not be permitted.

### 10.4.6.4 Jointing

1. Clean ends of pipe and coupling components.
2. Apply joint lubricant to pipe ends and elastomeric seals of coupling. Use only lubricants approved by the pipe manufacturer.
3. Use suitable equipment and end protection to push or pull the pipes together.
4. Do not exceed forces recommended by the manufacturer for coupling pipe.
5. Join pipes in straight alignment then deflect to required angle. Do not allow the deflection angle to exceed the deflection permitted by the manufacturer.

## 10.4.6.5 Minimum Cover

Minimum cover depth of compacted fill above the top of the pipe is three (3) feet. If this minimum cover requirement is not attainable, pipes with higher stiffness (SN 72) shall be used for installation.

## 10.4.7 Field Testing

### 10.4.7.1 Infiltration/Exfiltration Test

Maximum allowable leakage shall be per local specification requirements.

#### 10.4.7.2 Low Pressure Air Test

See section 9.2.3

#### 10.4.7.3 Individual Joint Testing

For pipes large enough to enter, individual joints may be air pressure tested with a single or double bladder tester to 5 psi for 1 minute. If the joint fails then the joint shall be repaired per City approved manufacturer's recommendation.

#### 10.4.7.4 Deflection Testing

A deflection test shall be performed according to section 9.2.5 of these Standard Construction Specifications. The maximum allowable deflection limits after construction shall be 5% of the initial diameter.

**END OF SPECIFICATION**

# 10.5 Ductile Iron Pipe

## 10.5.1 General

This section covers material requirements, fittings, field joints and protective coatings for ductile iron pipe.

## 10.5.2 Referenced Standards

This section references American Society for Testing and Materials (ASTM), American National Standards Institute (ANSI), and American Water Works Association (AWWA), which are made a part hereof by such references, and shall be the latest edition and revision thereof. All material, manufacturing, operations, testing, inspection and production of ductile iron pipe shall conform to the following standards;

| | |
|---|---|
| ASTM A746 | Standard Specification for Ductile Iron Gravity Sewer Pipe |
| AWWA C110/ANSI A21.10 | Standard for Ductile-Iron and Gray Iron Fittings, 3 in. – 48 in |
| AWWA C111/ANSI A21.11 | Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings |
| AWWA C151/ASA A21.51 | Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water |
| AWWA C153/ANSI A21.53 | Standard for Ductile-Iron Compact Fittings |

## 10.5.3 Pipe Diameter

The diameter indicated on the drawings shall represent the nominal diameter of the pipe. The inside diameter of the pipe after protective lining has been applied shall not be less than that required for cast iron pipe.

## 10.5.4 Wall Thickness

The minimum wall thickness and /or pressure class of each section of the pipeline shall conform to that indicated on the Contract Documents, and shall be subject to the approval of the Construction Project Manager.

### 10.5.5 Grade of Iron

The grade of iron shall be 60-42-10 having a minimum tensile strength of 60,000 psi, minimum yield strength of 42,000 psi, and a minimum percent of elongation of 10 percent.

### 10.5.6 Fittings and Specials

Fittings and specials shall be ductile iron at least Class 54 thickness and shall be in accordance to the requirements of either AWWA C153/ANSI A21.53 or AWWA C110/ANSI A21.10. Fittings shall be lined as specified in Section 10.5.7a and coated as specified in Section 10.5.7b below.

### 10.5.7 Field Joints

Mechanical joints shall conform to AWWA C111/ANSI A21.11.

### 10.5.8 Protective Coatings

Unless otherwise specified. The interior and exterior surfaces shall conform to the following.

1. Interior surfaces shall be lined with calcium aluminates mortar made of fused calcium aluminates cement and fused calcium aluminates aggregates. The thickness of the lining shall be a minimum of 0.125” for 6” through 12” and 0.1875” for 14” through 24” diameter pipe.

2. The lining shall be Sewpercoat® as manufactured by Lafarge Calcium Aluminates or approved equal.

3. Exterior coating shall be a minimum of 1 mil bituminous paint according to AWWA C151/ASA A21.51 - Section 51-8.1.

**End of Specification**

# 10.6 Polyvinyl Chloride (PVC) Sewer Pipe

## 10.6.1 General

This section covers material requirements, inspection and testing, marking and delivery, installation, and field performance and acceptance tests of Polyvinyl Chloride (PVC) Sewer Pipe and Fittings for use in gravity, non-pressure, storm or sanitary sewer installations.

## 10.6.2 Referenced Standards

This section references American Society for Testing and Materials (ASTM), American National Standards Institute (ANSI), and American Water Works Association (AWWA), UNI-Bell PVC Pipe Association (UNI), which are made part hereof by such references, and shall be the latest edition and revision thereof. All material, manufacturing, operations, testing, inspection and production of Poly (Vinyl Chloride) (PVC) sewer pipe shall conform to the following referenced standards:

| | |
|---|---|
| ASTM C33 | Standard Specification for Concrete Aggregates |
| ASTM D448 | Standard Classification for Sizes of Aggregate for Road & Bridge Construction. |
| ASTM F477 | Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe. |
| ASTM F679 | Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings. |
| ASTM F789 | Standard Specification for Type PS-46 and Type PS-115 Poly (Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings. |
| ASTM F794 | Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter. |
| ASTM D2321 | Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications. |
| ASTM D3034 | Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings. |

UNI-B-6 Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe.

### 10.6.3 PVC Sewer Materials

The following described materials are approved for use in PVC pipe sewer construction.

#### 10.6.3.1 Pipe and Fittings

Sanitary sewer pipes shall be PVC and conform to: ASTM D3034 SDR 35 for sizes 8 inches to 15 inches in diameter; ASTM F789 for sizes 8 inches to 18 inches (Solid Wall); ASTM F679 for sizes 18 inches to 36 inches (Solid Wall); ASTM F949 for sizes 8 inches to 36 inches (Profile Wall); ASTM F794 for sizes 8 inches to 48 inches (Profile Wall); ASTM F1803 for sizes 18 inches to 60 inches (Profile Wall).

#### 10.6.3.2 Gaskets

Gaskets shall comply with ASTM F477. It shall consist of a properly vulcanized high grade elastomeric compound. The basic polymer shall be natural rubber, synthetic elastomer, or a blend of both. The gasket shall be the only element depended upon to make the joint flexible and water-tight.

#### 10.6.3.3 Lubricant

The lubricant used for assembly shall have no detrimental effect on the gasket or on the pipe. Lubricants shall be in accordance with the manufacturer's recommendations.

### 10.6.4 Acceptance

Acceptance of the pipe, fittings, and other associated sewer material shall be based on full compliance with these Standard Construction Specifications.

#### 10.6.4.1 Certification

A manufacturer's certification that the material was manufactured and tested in accordance with these Standard Construction Specifications together with a report of all test results shall be furnished at the time of shipment.

### 10.6.5 Receiving, Storage and Handling

The Contractor shall follow the procedures and recommendation for receiving, storage, and handling contained in the Uni-Bell Plastic Pipe Association, "Handbook of PVC Pipe", and as recommended by the manufacturer.

#### 10.6.5.1 Receiving

Pipes not conforming to the requirements of these Standard Construction Specifications and pipes damaged in transit shall be rejected by the Construction Project Manager. Acceptance of pipes at the time of delivery does not preclude rejection of the installed sewer pipe which do not conform to these Standard Construction Specifications.

#### 10.6.5.2 Storage

Pipe shall be stored in unit packages provided by the manufacturer. The unit packages shall be supported by racks to prevent damage to the underside of the pipe. Supports shall be spaced to prevent pipe bending. Stored pipe shall be covered with an opaque material to

prevent exposure to direct sunlight while permitting adequate circulation of the air above and around the pipe to prevent excessive heat accumulation. Pipe determined to have been damaged in storage shall be rejected.

#### 10.6.5.3 Handling

Construction equipment shall be operated in a safe and cautious manner so as to prevent damage to the pipe. Blows to the pipe causing impact damage shall be prevented. Pipe and fittings shall not be thrown, dropped, or dragged.

### 10.6.6 Installation

Installation of PVC pipe shall be in conformance with ASTM D2321, except where modified by these Standard Construction Specifications.

#### 10.6.6.1 Trenching and Excavation

Trenching and excavation shall be performed in accordance with Section 4.0 of these Standard Construction Specifications.

#### 10.6.6.2 Bedding and Haunching

The bedding shall be Class B as defined in Section 4.0 of these Standard Construction Specifications. The bedding material shall conform to ASTM C33 or ASTM D448 gradation No. 67 as modified and shall be brought to proper grade and elevation prior to installation of pipe and assembly of joints. Depressions for pipe bell shall be provided. Additional bedding material shall then be placed according to Wastewater Management Division Standard Detail S-301, “Standard Detail for Trenching and Bedding”.

#### 10.6.6.3 Jointing Pipe

Assembly of all joints shall be in accordance with the recommendations of the manufacturer. Proper jointing may be verified by rotation of the spigot or with a strap wrench. If unusual joining resistance is encountered or if the insertion mark does not reach the flush position, the joint shall be disassembled, inspected for damage, the joint components recleaned and the assembly steps repeated.

#### 10.6.6.4 Cutting and Beveling Pipe

For shorter than standard pipe lengths, field cuts may be made with plastic pipe cutters. Ends shall be cut square and perpendicular to the pipe axis. Spigots shall have burrs removed and ends smoothly beveled by a mechanical beveler or by hand with a rasp or file. Field spigots shall be stop-marked with felt tip marker or wax crayon for the proper length of assembly insertion. The angle and depth of field bevels and length to stop-mark shall be comparable to factory pipe spigots.

#### 10.6.6.5 Sanitary Sewer Connections

On all new PVC sewer construction, connections shall be made with Wye’s or Tee’s conforming to ASTM D3034 or F679 whichever is applicable. Only gasketed fittings will be used. Saddle Wye’s and Tee’s with gaskets for the saddle and joints are approved for sanitary sewer service connection to existing PVC sanitary sewers only. Stainless steel straps shall be used to secure the saddle fittings to the main pipe.

#### 10.6.6.6 Water Stops

Whenever the PVC sewer pipe joints a manhole and is encased by the concrete manhole base or a cutout in precast manhole base, waterstops or seals shall be used. See City and County of Denver, Wastewater Management Division Standard Detail No. S-550.

- A separate submittal package specific to each pipe size and unique project scenario shall be required for approval by the Construction Project Manager prior to product procurement by the Contractor. At a minimum, this submittal shall include jacking force calculations (see 7.1.4), joint design, and a special pipe detail for each situation.

#### 10.6.6.7 Trench Backfill

Backfilling of the trench shall as specified in Section 5.0 of these Standard Construction Specifications except that no wheeled vehicles shall be used for compaction or other purpose over the installed pipe until the backfill is at least 30 inches thick measured from the top of the pipe to the backfill surface. Mechanical tampers shall not be used until the backfill is at least 48 inches thick. Direct dumping of material over the top of uncovered pipe will not be allowed.

### 10.6.7 Field Performance and Acceptance Tests

#### 10.6.7.1 Television Inspection

The City will perform a television inspection to verify accuracy of alignment, freedom from debris or obstructions, displacement of gaskets or joints and leaks at joint and service connections. Any of the above discrepancies observed shall be rectified by the Contractor at no cost to the City.

The cost of the initial inspection and the first re-inspection to confirm correction of previously identified deficiencies will be borne by the City. In the event additional inspections are necessary due to inadequate or otherwise unacceptable repairs, the costs for such inspection shall be charged to the Contractor.

#### 10.6.7.2 Air Pressure Test

An air pressure test using the most recent version of UNI-Bell's UNI-B-6 shall be made. The air pressure test outlined in paragraph 9.2.3 of Section 9.0 of these Standard Construction Specifications will not apply to PVC sewer air testing. The Contractor shall secure adequate copies of UNI-B-6, as published by the Uni-Bell Plastic Pipe Association, and provide at least one copy to the Construction Project Manager.

#### 10.6.7.3 Infiltration Test

If the ground water level is above the top of the pipe throughout the length being tested, an infiltration test shall be performed. See paragraph 9.2.2 of Section 9.0 of these Standard Construction Specifications.

#### 10.6.7.4 Deflection Test

A deflection test shall be performed according to paragraph 9.2.5 of Section 9.0 of these Standard Construction Specifications. The allowable deflection limits shall be a maximum of 5% after construction and 6% at the end of the guarantee period. The allowable deflection shall be based on the base inside diameter of the PVC pipe.

#### 10.6.7.5 Reports

Copies of all certified reports and logs of all tests and inspections conducted shall be submitted to the Construction Project Manager.

**End of Specification**

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS, ENGINEERING DIVISION

# Wastewater Capital Projects Management
# Standard Construction Specification

## 10.7 Cured In Place Pipe

### 10.7.1 General

This section outlines the guidelines & requirements for the rehabilitation of pipelines and conduits by the Cured in Place Pipe Method (CIPP). CIPP is the installation of a resin-impregnated flexible tube which is inserted into an existing conduit and cured by the use of pressurized steam or circulated water under a hydrostatic head. When complete, the CIPP is continuous and fits tightly to the existing pipe.

### 10.7.2 Referenced Standards

This section references American Society for Testing and Materials (ASTM) standards, which are made a part of this specification by such reference. All standards shall be the latest edition and revision. The materials, manufacturing, operations, testing, inspection and production of cured in place pipe shall conform to the following standards.

ASTM D638 Standard Test Method for Tensile Properties of Plastics

ASTM D790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

ASTM D2122 Determining Dimensions of Thermoplastic Pipe & Fittings

ASTM D2990 Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastic

ASTM D5813 Standard Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems

ASTM F1216-09 Standard Practice and Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube

ASTM F1743 Practice of Rehabilitation of Existing Pipelines and Conduits by Pulled-In-Place

### 10.7.3 Submittals

Unless otherwise specified, the Contractor is responsible to have all submittals transmitted to the Construction Project Manager in sufficient time to allow two weeks for review and acceptance prior to starting the construction or any work by the Contractor. These include, but are not limited to:

- CIPP Health and Safety Plan
- Confined Space Entry Permits
- Corrosion Testing.
- Employee Certifications (NASSCO, OSHA, etc.)
- Felt Certification
- Fire Department Permit
- Installation Procedures
- Laboratory Designation and Accreditation
- Laboratory Testing Results
- Liner and Resin Long Term Performance Studies in Post-installation
- Service Open Notice
- Pre-cleaning (and TV) Notice
- Pre-lining Notice
- Pulling force gauge
- Structural Requirements
- Technical Supervision
- Tube Compliance
- Unanticipated Cancellation Notice
- Video/log sheet sample

#### 10.7.3.1 Installation

Prior to installation by Inversion or the Pulled-in-Place method, the Contractor shall provide the Construction Project Manager with the following as applicable to the specific installation method:

a. The minimum pressure required to hold the tube tight against the existing conduit and the maximum allowable pressure so as not to damage the tube. A complete log of the pressure (or head level) shall be maintained on the site and be furnished to the Construction Project Manager after each installation.

b. The maximum allowable force that can be used in pulling the tube into the existing pipeline for each size of line. A complete log of the pulling force used for each line shall be maintained on site by the Contractor and be furnished to the Construction Project Manager after each installation.

c. Minimum temperature and time required for cure on each size of line, based on installation method.

d. For CIPP segments which are wet out on site, the Contractor must also submit (in spreadsheet form) information on allowable head pressure, roller spacing and gallons of resin to felt length with respect to diameter so the procedure can be verified on site.

### 10.7.3.2 Health and Safety Plan

Prior to site work, the Contractor shall provide the Construction Project Manager, for review, a Health and Safety Plan which includes (at a minimum) the following:

I) Introduction

a. Provide project description, the work location and summary of key work activities to be performed.

II) Scope and Applicability

a. Describe the scope of work for the General Contractor and 1st tier subcontractors performing the work

b. Detail the planned site activities

c. Describe who must adhere and abide by the Health and Safety plan

d. Detail how site visitors will be addressed

III) Key Personnel, Responsibilities and Authority

a. In relation to Health and Safety, describe the role of project managers, health and safety managers, technical supervisors (10.7.3.4), and other contractor and subcontractor staff.

b. Provide resumes of Key Personnel, including background and training history.

c. Identify the name, title, and contact information (phone, email, address) for key personnel.

d. Identify the name, location, and contact numbers for ambulance, fire, police, hospital, Health and Safety managers (contractor and/or subcontractors), and other key personal or support contacts.

IV) Task/Operation Health and Safety Risk Analysis

a. Identify, on a task specific basis the individual hazard elements that are present including chemical, physical, and biological.

V) Qualifications and Training Requirements for all Personnel

a. Detail specific qualifications and training that are required.

b. Discuss the frequency of safety and training refreshers.

c. Detail the requirement for site personnel to read and acknowledge, in writing, their understanding of the Health and Safety plan.

VI) Engineering and Administrative Controls

a. Describe in detail how engineering and administrative controls will be used to protect worker and public safety by preventing chemical exposure, injury, or illness.

b. List controls in conjunction with each activity identified in the Task/Operation Health and Safety Risk Analysis section above.

VII) Personal Protective Equipment (PPE) Requirements

a. PPE requirements should be listed in conjunction with each activity identified in the Task/Operation Health and Safety Risk Analysis.

b. Detail applicable standards (e.g., ANSI, NIOSH, ACGIH, OSHA etc)

VIII) Health and Safety Monitoring

a. Detail instruments, samples, and monitoring that will occur both on the jobsite and in response to complaint(s) or inquiries.

b. Detail who is responsible for performing monitoring

c. Detail frequency of monitoring

d. Define the appropriate action levels and thresholds

e. Describe standard operating procedures for Health and Safety monitoring

IX) Site control

a. Describe work zones, buddy systems, and site security.

b. Address policies including drug and alcohol policies, personal hygiene requirements, heat and cold stress prevention

c. Describe task specific site control (e.g., confined space entry protocol, worker photo ID program, etc.)

X) Decontamination plan

a. Eye and hand wash (if applicable)

b. Site cleanup

XI) Emergency Contingency Plan

a. Medical services

b. Emergency phone numbers

c. Personnel Injury

d. Fire/Explosion

e. Hazardous Material spill response and onsite location of spill kit

f. Evacuation

g. Emergency signals and communication

h. First aid

i. Emergency equipment list

j. Map(s), addresses, and phone numbers of nearest medical facilities

XII) Appendices

a. Safety forms (as needed)

b. Supporting documentation and information

c. Material safety data sheets (MSDS)

### 10.7.3.3 Weekly Installation Schedule

The Contractor shall submit a weekly construction schedule, 7 calendar days in advance of the work, to the Construction Project Manager and the Denver Fire Department to include the following information:

1. The specific line number and related manhole numbers as designated in the project plans. The line length and service connection count information must also be included from the preliminary video investigation.
2. The specific date and timeframe each installation will occur. Night and weekend work must be approved by the Construction Project Manager a minimum of 10 days prior to the proposed commencement of the work.
3. The Technical Supervisor's name for the crew(s) that will be doing each specific installation.
4. The method of installation planned for each line in accordance with ASTM F1216 or F1743.
5. The location and schedule of the "wet-outs" in order to permit inspection of the materials and procedures. This information may be submitted separately.

### 10.7.3.4 Technical Supervision

Due to the technical aspects and complexity of the products used during the installation of CIPP, the Contractor is required to maintain a full time employee with a minimum of five years experience in the CIPP process of rehabilitation. This employee should be at the superintendent level or higher. This employee must be the direct, first line contact for all aspects of the project construction management. Resume and references, and copies of applicable required NASSCO, OSHA, etc. training certificates of this employee shall be submitted to the Construction Project Manager for review and acceptance prior to the start of the project.

### 10.7.3.5 Test Results and Performance Studies

CIPP sample test results as well as long term performance studies, from an industry recognized independent laboratory, must be submitted for the materials from the specific supplier(s) to be used on the project in accordance with applicable ASTM standards. The CIPP liner material must meet the requirements of ASTM F1216 or F1743 and ASTM D5813 Sections 6 and 8 (Appendix X.1). The resin shall produce CIPP, which will comply with the structural and chemical resistance requirements of ASTM F1216 or F1743. It is required that CIPP samples with and without polyethylene coating meet these chemical testing requirements. The long term performance studies must show the proposed material

consistently meets the required thickness and strength requirements per the Contract Documents.

The Long Term Performance Studies must be submitted and accepted prior to bidding to pre-qualify the prospective bidder. The CIPP liner material used for the project must be the exact same composition of the material used in the Long Term Performance Studies as outlined in this Section. Any deviation in the composition will require that a new Long term Performance Study is completed, submitted and accepted prior to installation.

### 10.7.3.6 Street Occupancy Permits

The Contractor shall submit, to the Construction Project Manager, copies of the street occupancy permits, including the approved traffic control plans prior to beginning work.

### 10.7.3.7 Digital Video and Log Sheets

Prior to commencing any site work, the contractor shall submit video quality samples as well as log sheet samples for review and acceptance by the Construction Project Manager. These samples must be in accordance with the following specifications.

### 10.7.3.8 Digital Video and Log Sheets Specifications

1. After cleaning and lining, the manhole sections shall be visually inspected by means of closed-circuit television. The inspection will be done one manhole section at a time and the flow in the section being inspected will be suitably controlled as specified elsewhere in these Standard Construction Specifications. CCTV inspections shall be performed in accordance with PACP standards including indications of the specific date and time of inspection.

2. The closed-circuit television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the Owner's Representative; and if unsatisfactory, equipment shall be removed and no payment will be made for an unsatisfactory inspection.

3. The camera shall be moved through the line upstream to downstream at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire line section, the Contractor shall set up his equipment so that the inspection can be performed from the opposite manhole. If, again, the camera fails to pass through the entire manhole section, the inspection shall be considered complete noted as Survey Abandoned. The contractor is required to notify the Construction Project Manager and further direction will be provided.

4. When manually operated winches are used to pull the television camera through the line,

telephones or other suitable means of communication shall be set up between the two manholes of the section being inspected to insure good communications between members of the crew.

5. The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be above ground by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device, and the accuracy shall be satisfactory to the Construction Project Manager.

6. Documentation of the television results shall be as follows:

(6.1) Television Inspection Logs: Electronic media location records shall be kept by the Contractor and will clearly show the location, by distance in 1/10 of a foot or nearest cm, from the upstream manhole wall, in relation to an adjacent manhole of each infiltration point observed during inspection.
In addition, other points of significance such as locations of building sewers (taps), unusual conditions, roots, storm sewer connections, cracks, fractures, broken pipe, presence of scale, calcium deposits and corrosion (with estimated thicknesses), and other discernible features, as defined in the PACP defect codes, will be recorded on electronic media, and a copy of such records will be supplied to the Construction Project Manager.

(6.2) Digital photographs of the pipe condition and all defects and service connections (taps) shall be taken by the Contractor. Photographs shall be located by distance in 1/10 of a foot or nearest mm, from the manhole wall, in relation to an upstream manhole.

(6.3) Electronic media recordings: The purpose of electronic media recording shall be to supply a visual and audio record of problem areas of the lines that may be replayed by the Owner. Each original electronic media recording of conditions and defects will be delivered to the Project Construction Manager upon completion of a specific line section.

(6.4) All CCTV Inspection shall be performed by CCTV personnel who are trained and certified in the use of NASSCO's Pipeline Assessment and Certification Program (PACP)©.

### 10.7.3.9 Digital Video and Log Sheets Submittal Naming Convention

The Contractor shall submit all log sheets and digital video files for pre and post installation, together, the week immediately following completion of each work segment. All digital video and log sheets must be submitted electronically, *on a USB Plug and Play device (flash drive or hard drive). Video shall be in MP4 format and logs shall be in .pdf format* All video and logs shall be submitted utilizing the following naming convention:

a. Video Files and Log Sheets
   i. Named using the following items sequentially, followed by a space

1. City of Denver Contract Number
2. Line Number From Plans
3. GIS Facility ID From Plans (for each line segment.)
4. Type Of File ('Pre' or 'Post' for Video, 'Pre Log' or 'Post Log' for applicable log sheets)
5. Extension of file (.mp4 or .pdf)

ii. Examples:

1. 2012XXXXX Line72 31814SAGM Post Log.pdf
2. 2012XXXXX Line72 31814SAGM Post.mp4
3. 2012XXXXX Line72 31814SAGM Pre Log.pdf
4. 2012XXXXX Line72 31814SAGM Pre.mp4
5. 2012XXXXX Line73 31825SAGM Post Log.pdf
6. 2012XXXXX Line73 31825SAGM Post.mp4

## 10.7.4 Materials

### 10.7.4.1 Textile Tube

1. The tube shall meet the requirements of ASTM F1216 or F1743 and ASTM D5813 Sections 6 and 8. The finished CIPP shall be fabricated from materials which when cured will be chemically resistant to withstand internal exposure to to all types of sewage being conveyed. The textile tube shall be continuous in length for the associated run. The wet-out textile tube shall meet ASTM F1216 or F1743, as

   applicable, have sufficient strength to bridge missing pipe segments and have a uniform thickness that when compressed at installation pressure will equal the specified nominal tube thickness, with a -5% manufacturing tolerance allowed. The tube shall be fabricated to a size that when installed will tightly fit the internal circumference and length of the original pipe. Allowance should be made for circumferential stretching during installation. The minimum length shall be that deemed necessary by the Contractor to effectively span the distance between respective access points, unless otherwise specified. It is the Contractor's responsibility to verify the CIPP lengths and diameters in the field before fabricating the tube.

2. Prior to installation the outside layer of the tube shall be coated with a translucent plastic coated flexible material that clearly allows inspection of the resin impregnation, or wet-out procedure. The plastic coating shall not be subject to delamination after curing of the CIPP. The tube shall be homogenous across the entire wall thickness containing no intermediate or encapsulated elastomeric layers. No materials shall be included in the tubes that are subject to delamination from the cured CIPP.

3. The wall color of the interior pipe surface of the CIPP after installation shall be notably colored as seen in the field install to insure that the resin has been fully impregnated so that a clear and detailed examination with closed circuit television inspection equipment may be made.

4. The wet-out textile tube shall meet ASTM F1216 or F1743, as applicable, shall have a uniform thickness and 5% to 10% excess resin distribution that when compressed at installation pressures will meet or exceed the design thickness after the cure.

### 10.7.4.2 Resin

1. The resin/liner system shall conform to ASTM D2990 and ASTM D5813 Section 8.2.2 – 10,000-hour test.
2. The resin shall be a general purpose, unsaturated, styrene-based, thermoset resin and catalyst system or epoxy resin and hardener that are compatible with the inversion or pulled in place process as per the requirements of ASTM F1216 or F1743. The resin shall be tinted so that adequate saturation can be readily observed. Only resin with a minimum long term (50 years) Modulus of Elasticity of 48% of the initial Modulus of Elasticity will be accepted.
3. The tube shall be impregnated with sufficient amount of resin to insure that the resin will be observed on the outer surface of the tube when squeezed. After the tube is cured, it shall show satisfactory evidence of a fully impregnated tube or the existence of excess resin on the outer surface.

### 10.7.4.3 Calibration Hose

If a calibration hose is required to be used during the process of the installation of the CIPP, the hose shall be wet and vacuum impregnated with sufficient amount of resin prior to inversion to prevent delamination after the curing of the CIPP. Delaminating or failure of the calibration hose will be cause for rejection or complete removal of the CIPP section at the discretion of the Construction Project Manager.

### 10.7.4.4 Structural Requirements

1. The CIPP shall be designed as per ASTM F1216, Appendix X.1. The CIPP design shall assume no bonding to the original pipe wall, a fully deteriorated condition, 5% ovality and a conservative groundwater presence over the pipeline. The CIPP cured thickness must meet the required minimum cured nominal thicknesses specified in the table below, or for pipe larger than 18-inches in diameter as specified within the Contract Documents.

| Internal Pipe Diameter (inches) | CIPP Minimum Cured Nominal Thickness (mm) Based on Modulus of Elasticity Values | |
|---|---|---|
| | Modulus of Elasticity (E) 250,000 psi | Modulus of Elasticity (E) 400,000 psi |
| 8 | 6 | 5 |
| 10 | 7.5 | 6 |
| 12 | 9 | 7.5 |
| 15 | 10.5 | 9 |
| 18 | 12.5 | 10.5 |
| For pipe larger than 18-inches in diameter, the CIPP minimum nominal thickness is specified within the Contract Documents | | |

2. The layers of the cured CIPP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly or the probe or knife blade moves freely between the layers; nor shall separation of the layers occur during the required testing.
3. The cured pipe material (CIPP) shall conform to the minimum structural standards, as listed below:

| | | |
|---|---|---|
| Flexural Stress | ASTM D790 | 4,500 psi |
| Modulus of Elasticity | ASTM D790 | 250,000 or 400,000 psi |
| Tensile Strength | Pressure Pipe - ASTM D638 | 3,000 psi |

Either of the listed Modulus of Elasticity values noted may be used as long as minimum nominal thicknesses are adhered to in accordance with the table or as noted within the Contract Documents.

## 10.7.5 Quality Control

It shall be the contractor's responsibility to ensure that the CIPP installed on the project meets all requirements of the Contract Documents and that the final product provided to the City meets all of the City and County of Denver Specifications and is of the highest quality possible.

### 10.7.5.1 Testing

In the event that the results of any tests do not meet the requirements of the Contract Documents and/or referenced ASTM standards, the Contractor may proceed with the work at his/her own risk and will be required to submit to the Construction Project Manager the proposed changes in the process to meet the required properties of the CIPP.

If any lined pipe segment fails to meet the required properties, the Contractor's attention is directed to General Condition 304 – "Substituted Performance". At the discretion of the Construction Project Manager and at the Contractor's own expense, the Contractor will be required to remove and replace any lined pipe segment, without damaging the host pipe, or install another liner inside of the liner that failed in order to meet the specified requirements of the Contract Documents

The City may elect at any time to decrease or increase the frequency of these sample and testing requirements.

#### *10.7.5.1.1 On-Site Thickness Testing*

A minimum of 2 (two) samples will be collected or 2 locations tested using ultrasonic methods, for on-site thickness at each installation by the contractor. All samples collected for testing shall be restrained with equivalent diameter pipe to match the actual field installed liner. A minimum of eight measurements at evenly spaced intervals around the circumference (internal or external based on method) of the pipe will be made to ensure that

minimum and maximum thicknesses have been achieved. For pipe diameters fifteen inches or greater, a minimum of sixteen evenly spaced measurements shall be recorded. Any plastic coatings or CIPP layers not included in the structural design of the CIPP must be deducted from the measured thickness value. The average thickness will be calculated using all measured values and shall meet or exceed the minimum required design thickness. Additionally, the minimum wall thickness measured at any one point around the circumference shall not be less than 87.5% of the specified design thickness as specified within the Contract Documents.

The wall thickness will be measured in accordance with the applicable sections of ASTM D2122 or ASTM E797 and shall incorporate the following, as applicable:

1. For onsite samples collected for testing: A cylindrical anvil tubing micrometer accurate to +0.02 mm (+0.001 inch) will be used. The minimum wall thickness tests will be performed by the Construction Project Manager (or assigned field representative) from the two samples at each installation. All costs associated with providing the required samples shall be borne by the Contractor.
2. For onsite testing using Ultrasonic methods: Testing will be performed by the ultrasonic pulse echo method, in accordance to ASTM E797. Measurements will be taken and calculated at both ends of the pipe run, around the internal circumference of the installed CIPP and at a distance of 12 to 18 inches from the end of pipe, as noted in item 1 above. The ultrasonic method will utilize a flaw detector with A-scan display and a direct thickness readout as defined in 6.1.2 of AST< E797. A calibration block shall be manufactured from the identical materials used in the installed CIPP to calibrate sound velocity through the liner. Calibration of the transducer shall be performed daily in accordance with the equipment manufacture's recommendations.

If the deviation in thickness of any one sample is less than 5% (five percent), no payment adjustment will be required. If the deviation in thickness is measured to be between 5%-10% (five percent and ten percent) an adjustment of 10% (ten percent) reduction of the liner unit bid cost will be applied. If the deviation in thickness is greater than 10% (ten percent), the entire run will be rejected and removed and replaced solely at the Contractor's expense.

#### *10.7.5.1.2 Allowable Pulling Force*

Prior to installation, the Contractor shall submit to the Construction Project Manager the maximum allowable force, per the material manufacturer, that can be used in pulling the tube into the pipe without rupturing or diminishing the diameter and/or the thickness of the tube. Such pulling force shall be monitored at all times during the installation operation with a gauge that is available for viewing by the City and the tube shall be rejected and removed if the allowable pulling force is exceeded.

#### *10.7.5.1.3 Allowable Elongation of Flexible Tube*

Prior to installation, the flexible tube shall be measured and marked equal to the installation run (distance between manholes less one manhole diameter). After the completion of installation, the length of the flexible tube outside of the installation run (face of the manhole to the mark) shall be measured. This length or elongation shall not exceed

3% (three percent) of the original length of measured flexible tube. In the event that this length is exceeded, the entire run length may be rejected and permanently discarded, the Construction Project Manager may order an additional tube to be inserted at no cost to the City, or may accept the elongated tube, but reduce the price paid for the work by 5% (five percent) for every percent elongation above the 3% (three percent) allowable tolerance, as provided by General Condition 304, Substituted Performance. Acceptance will be at the sole discretion of the Construction Project Manager.

#### *10.7.5.1.4 Laboratory Testing*

At the start of construction, at least two restrained CIPP field samples will be taken and submitted for laboratory testing. CIPP samples shall be prepared and tested in accordance with ASTM F1216. These samples will be taken by the approved independent lab, with chain of custody documentation regarding each sample.

A CIPP sample is required to be prepared for each installation segment, using one of the following two methods (depending on the size of the host pipe):

1. For pipe sizes of 18 inches or less: the sample will be cut from a section of cured CIPP at an intermediate manhole or at the termination point. If the sample is taken at a termination point the CIPP must have been inverted through a restrained, like diameter pipe which has been held in place by a suitable heat sink, such as sandbags.

2. For pipe sizes greater than 18 inches and areas with limited access: the sample must be fabricated from material taken from the tube and the resin/catalyst system used. This fabricated sample must be cured in a clamped mold which is placed in the down tube (when curing using circulating hot water) or in the silencer (when curing using steam). If approved by the Construction Project Manager, this method can be used for preparing a test sample on any size of CIPP in situations where preparing samples in accordance with section F1216-09, sec. 8.1.1 is not possible due to physical constraints.

Samples must identify the City contract number, project name, line number, date sample was taken and the specified thickness requirement. Testing for cured liner thickness, modulus of elasticity, flexural stress and tensile strength shall be performed by a Certified Independent laboratory approved by the Construction Project Manager. Test results are to be submitted to the Construction Project Manager and all costs of tests shall be included in the related bid price unless specified elsewhere in the Contract Documents. The Contractor shall take samples from the first week's installation and have the short term tests completed and results to the Construction Project Manager prior to application for the first pay estimate. Additional testing will commence at intervals required by the Construction Project Manager.

Additional laboratory testing, at the City's expense, may be requested as frequently as every CIPP installation, at the discretion of the Construction Project Manager. The Contractor will be reimbursed for additional testing at the Contract unit bid price. At the option of the Construction Project Manager any sample taken by the Contractor may be sent to an independent laboratory for similar testing.

#### *10.7.5.1.5 Infiltration Test*

If the ground water level is above the top of the pipe throughout the length being reconstructed, the Construction Project Manager, at his/her discretion, may order that an infiltration test be performed. The maximum allowable infiltration shall be 50 gal per day/inch dia/mile (.95 gpd/inch/100 ft.). If the infiltration is found to exceed the prescribed amount, the Contractor shall make the appropriate repairs as approved by the Construction Project Manager. Additional infiltration tests will be performed until acceptable results are obtained.

Unless otherwise specified, infiltration will be measured by a subcontractor specializing in CIPP testing who is mutually agreed upon by the City and Contractor. Payment for this testing is at the City's expense and will be handled by change order.

#### *10.7.5.1.6 Exfiltration Test*

In the absence of ground water, the Construction Project Manager, at his/her discretion, may order an exfiltration test be performed in accordance with these specifications. The allowable rate of exfiltration shall be equal to the limits of infiltration stated above. Each section of CIPP will be tested between successive manholes by closing the lower end of a sewer and the upper manhole(s) to the proper level with water. The water level in the upper manhole shall be a minimum of 4 feet above the level of the ground water.

For the purposes of exfiltration leakage, manholes shall be considered to be equivalent length of pipe equal to the diameter of the manhole (i.e. 48, 60 or 72 inch diameter). Air pocket entrapment shall be avoided when filling the line with water. Once filled with water, the system shall be allowed to stabilize for a period of two hours before starting the test. Exfiltration leakage rate is determined by measuring the amount of water required to maintain a constant level in the upper manhole. Test duration is to be no less than two hours.

If the leakage, as shown by the test, exceeds the allowable value, the Contractor shall make the necessary correction at his expense to reduce the exfiltration to within the permissible limits. The Contractor shall furnish all water, material and labor required to perform the test. All tests shall be made in the presence of the Construction Project Manager.

## 10.7.6 Public Information and Notification

All written notices shall be issued on current City and County of Denver letterhead templates, prepared in a professional manner and must be approved by the Construction Project Manager prior to distribution. All contact with the Public shall be executed in a business professional manner, including adhering to professional standards regarding courtesy, grooming and maintaining visible/legible photo identification.

1. The Public Information and Notification program shall at a minimum, require the Contractor to be responsible for contacting each home or business affected by the sewer construction and informing them of the work to be done in all of the following ways: Written notice shall be delivered a minimum of 48 hours in advance of the Pre-clean and Video; and again on the day of installation, to each home or business describing the work, schedule, how the construction affects them, and a local

telephone number of the Contractor they can call to discuss the project or any problems that may arise.

2. Personally contacting each home and business owner on the day of pre-installation inspection of the sewer and coordinating with that owner the verification of their existing service connection. If the owner is unavailable, other arrangements shall be made for existing service connection verification.

3. In the event that a written notice cannot be left at the home or business, the contractor shall personally contacting each home or business owner the day prior to beginning work on the section of sewer to which they are connected.

4. Personally contacting any home or business owner which cannot be reconnected within the time stated in the Written Notice. Anticipated service tap reconnection time shall be noted within another notice.

5. Provide written notice with the time of reactivation posted on the front door of a residence or business.

6. Upon request by residents and businesses affected by the work, portable toilets shall be furnished and serviced by the Contractor. Reimbursement for the costs of these items will be covered through change order with the Construction Project Manager.

7. Businesses which require special accommodations, such as night or weekend work, must be identified at least 10 days prior to the proposed scheduled work. The Construction Project manager shall be notified and kept apprised of the coordination to meet these special accommodations.

## 10.7.7 Installation

### 10.7.7.1 Access Points

The City has shown all existing manhole access points on the Contract Documents, to the best of its knowledge. It is the Contractor's responsibility to fully examine the project site to verify the location of existing manholes and to determine if all manholes are accessible, as necessary for completion of the work. It will be the Contractor's responsibility to notify the Construction Project Manager far enough in advance of the CIPP lining process to allow time for the City to make necessary repairs and provide access to the manholes that are not accessible. The Contractor will reschedule the work as needed so that repair work, either by the City or by the Contractor, can be completed.

### 10.7.7.2 Pre-Installation Inspection

Inspections of pipelines shall be performed by experienced personnel trained in locating and identifying defects, breaks, obstacles, and service connections by closed circuit television. Certification by NASSCO, PACP program is preferred for inspection personnel. The pre-inspection of pipelines shall also determine active service connections, the addresses served (both visible on the digital recording and audible), as well as which service

connections are opened, capped or misaligned. Only active service connection and laterals shall be re-established unless directed otherwise by the Construction Project Manager.

The interior of the pipeline shall be carefully inspected to determine the location of any conditions which may prevent proper installation of the CIPP. It is the Contractor's responsibility to notify the Construction Project Manager of any conditions which may prevent proper installation of the CIPP. These types of conditions shall be recorded and submitted digitally, as described elsewhere in these specifications, to the Construction Project Manager within 5-calendar days of observance, to allow for remedial action and rescheduling of installation for that section of CIPP.

### 10.7.7.3 Bypassing Sewage

The Contractor shall provide for the flow of sewage around the section or sections of pipe designated for reconstruction. All costs incurred for bypass pumping are included within the "Cured-In-Place-Pipe" bid item within the contract, except when otherwise noted. The bypass shall be made by plugging the line at an existing upstream manhole or adjacent system. The pump and bypass lines shall be of adequate capacity and size to handle the flow with backup pumps onsite. Bypass pumps must be monitored at all times. Leaking equipment will not be permitted. Bypass pumping must be provided for all mainline and service line flows affected by construction. Wastewater shall not be allowed to spill into storm drains, street gutters, or open excavations. Any spills that occur must be addressed immediately and in full conformance with local regulations and requirements. The Construction Project Manager shall be notified immediately and the Contractor shall bear all costs associated with any spills.

### 10.7.7.4 Cleaning of the Sewer Line

The Contractor shall be required to remove all existing internal debris from the sewer line with the use of water jet, and/or grinding equipment that is accepted by the Construction Project Manager. The cleaning operation shall remove any and all existing debris so that

each pipe joint can be thoroughly inspected and successfully reconstructed or rehabilitated. Excessively hard deposits that cannot be removed by regular cleaning equipment or grinding which require special tools to remove will be paid for negotiated separately by the City.

All sludge, dirt, sand, rocks, grease, and all other solid or semi-solid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. Passing material from one manhole section to another shall not be permitted.

All such debris resulting from cleaning operations shall be removed from the site and disposed of in a proper manner. The Contractor shall bear all costs associated with testing of debris and proper dumping. Dumping of the debris shall be in accordance with all local, state, and federal regulations. The City will negotiate for costs associated with material disposal if Hazardous Wastes are encountered during testing.

At the end of each work day, all debris shall be removed from the downstream manhole and from the construction site. No debris shall be left at the construction site unattended by the Contractor. Under no circumstances will the Contractor be allowed to accumulate

debris beyond the stated time limit. In the event the Contractor leaves debris unattended at the construction site beyond the stated time, the Contractor will not be allowed to proceed with the work until the debris is properly removed.

During all sewer cleaning operations, precautions shall be taken to protect the sewer lines from damage that might be inflicted by improper use of cleaning equipment. Precautions shall be taken to ensure that the cleaning operation will not cause any damage or flooding to public and/or private property being served by the sewer line section involved. The Contractor shall bear all costs associated with flooding, damage to basements or structures, adjacent utilities and the City's sewer.

#### 10.7.7.5 Line Obstructions

It shall be the responsibility of the Contractor to clear the line of obstructions such as solids and roots that will prevent the installation of the CIPP. If the pre-installation inspection reveals an obstruction such as a protruding service connection, dropped joint, collapse or obstruction that will prevent the rehabilitation process and cannot be removed by conventional sewer cleaning equipment, grinding or extended tap cutting, then the Contractor shall notify the Construction Project Manager immediately. These conditions shall be recorded and a digital video file and log sheet must be submitted to the Construction Project Manager so that the existing conditions are documented and may be reviewed to determine the extent of repair required prior to CIPP installation. The Construction Project Manager will notify the Contractor upon completion of required repair(s), at which time the Contractor shall perform sewer line cleaning and a pre-installation inspection prior to CIPP installation.

#### 10.7.7.6 Methods

All bidders proposing to use the CIPP process for a project must use a method that has been approved by the City prior to bid opening. All approved CIPP methods must meet these Standard Construction Specifications. Any proposed deviation from these Standard Construction Specifications must be submitted in writing for acceptance at least eight calendar days prior to the bid opening. CIPP installation shall be in accordance with ASTM F1216, Section 7 for the Inversion Method, or Section 6 of ASTM F1743 for the Pulled-In-Place Installation Method, with the following requirements:

1. The Contractor shall designate a location where the tube will be impregnated prior to installation. The Contractor shall notify the Construction Project Manager of proposed "wet-outs" in order to inspect the materials and procedure. A resin and catalyst system compatible with the requirements of this method shall be used.
2. Once inversion has started, the pressure shall be maintained between the minimum and maximum pressures, as set by the liner's manufacturer, until cure completion. A continuous, constant pressure must be maintained for all air inversion steam cure (AISC) installations. If pressure is lost at any time during installation/cure (for inversion or pulled in place methods), the City may request that the CIPP product be removed and the line segment re-inspected, at the contractor's expense, prior to allowing re-installation and curing.

3. The Contractor shall pull or invert the flexible tube through the existing sewer line in a method which has been reviewed and approved by the Construction Project Manager. The Contractor will not be allowed to use water to float the inserted flexible tube into the existing sewer line. Immediately after installation of the tube, a heat source will be applied to start the curing process. Constant pressure shall be maintained until the tube has completely cured out with continuous monitoring of the confined space during the curing procedure to ensure that the LEL is not exceeded.

4. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing heat supply. Another such gauge shall be placed at the remote manhole to determine the temperature at that location during cure. The Contractor must maintain an on-site written log during the CIPP curing process for each installation, tracking temperature, pressure (for steam cure) and curing time. This log must be available for review at any time by the Construction Project Manager. If air pressure and steam are used, a Safety Gas Detector shall be used to ensure that it does not reach the explosive limit.

5. As noted within the submittals portion of this specification, before the installation process begins, the Contractor shall submit to the Construction Project Manager, the minimum pressure required to hold the tube tight against the existing conduit (including considerations for external ground water pressure, if present) and the maximum allowable pressure to avoid damaging the tube. This data shall be obtained by the Contractor from the tube manufacturer.

   If the CIPP is installed via inversion, the pressure shall be maintained between the minimum and maximum pressures until the entire operation has been completed (inversion and cure). If the CIPP is installed using the pulled-in-place method, the pressures shall be maintained, after initial inflation, between the minimum and maximum pressures until the entire operation has been completed (inflation and cure).

   If the pressure drops below the recommended minimum at any time during installation or curing of the CIPP, the liner should be removed and the host pipe re-inspected for dislodged pipe fragments or fallen debris which may cause bulging or protrusions within the cured CIPP. In addition, under the above circumstances, the CIPP product should be inspected for lifts or delaminations and evaluated for its ability to fully meet the applicable ASTM F1216 and F1743 requirements. Should the pressure deviate from within the range of minimum and maximum pressures, the installed tube may be rejected and the Contractor will be responsible for the removal of the CIPP without damage to the host pipe and replacement with new CIPP at no additional cost to the City.

   Once the cure has started and dimpling for laterals is completed, the required pressures shall be sustained until the cure has been completed. A complete log of the pressures shall be maintained on the site and furnished to the Construction Project Manager after each installation.

6. The plastic coating of the tube shall be translucent to allow visual proof that the resin has wet out the entire tube and that there are no dry areas.

7. The Contractor shall maintain a log on site for each installation section documenting elongation, thickness and pulling force. These logs shall be submitted weekly to the Construction Project Manager.
8. The finished CIPP shall be continuous over the entire length of an installation run between two manholes and be free, as commercially practicable, from visual defects such as foreign inclusions, dry spots, pinholes, folds and delamination.
9. If the CIPP fails to make a tight seal at each manhole, the Contractor shall apply Hydrophilic Seals. The Contractor shall provide a submittal to the Construction Project Manager for approval on either a gasket or a non cementitious (epoxy) grout.
10. Individual installation runs can be made over one or more manhole sections as determined in the field by the Contractor. The maximum allowed installation run is 1,200 feet. Intermediate manholes will be reopened as directed by the Construction Project Manager.

#### 10.7.7.7 Sewer Service Connection and Reactivation

The Contractor shall determine if a service connection is active prior to rehabilitation of the sewer. Only active service connections and laterals shall be re-established. All costs incurred to verify active service connections are included within the "Cured-In-Place-Pipe" bid item within the contract. No additional payment for verification shall be considered.

After the curing of the CIPP has been completed, the Contractor shall reopen and restore the existing active service connections and branch connections. It is the intent of these Standard Construction Specifications that the active service connections and branch connections be reopened without excavation. When the pipe size is too small to facilitate direct manned reactivation, a remotely controlled cutting device, monitored by a close circuit television camera shall be used. The cutting device is required to re-establish service connections to not greater than 100% (one hundred percent) capacity, and not less than 95% (ninety five percent) capacity, while conforming to the shape of the existing opening. A smooth, or brushed, surface is required to prevent debris or solids from accumulating at the opening. Perforated services connections will be considered damaged and will need to be repaired. The Contractor shall be responsible for completing point repairs of any active service connections that are damaged or misaligned during reactivation procedures. These point repairs shall be completed as directed and approved by the Construction Project Manager and all costs shall be borne by the Contractor.

The Contractor shall certify he/she has a minimum of 2 (two) complete working cutting devices, plus spare key components on the site before each installation.

All solid or semi-solid material resulting from reactivation of the service connection or manhole cut outs shall be removed at the downstream manhole of the section being reactivated. Passing material from one manhole section to another shall not be permitted.

Service connections shall not remain out of service for more than 12 hours at a time, without the Contractor providing some means of temporary facilities or hotel accommodations for the affected residents or property owners.

### 10.7.8 Post Installation Inspection

Post installation video inspection of all CIPP line segments shall be completed by the contractor and recorded using closed circuit television in accordance with ASTM F1216 or F1743. The post inspection of pipelines shall be performed in a manner which allows the invert to be clearly viewed and inspected (i.e. no water flow). The recorded video must show that all active service connections have been reactivated, the addresses served (both visible on the digital recording and audible), as well as any inclusions or visual defects present. All service connections and laterals which are not plugged or capped shall be re-established unless directed otherwise by the Construction Project Manager. The contractor shall review all post inspection videos and notify the City immediately of any visual defects, inclusions, or issues with the installation. Digital video records shall be submitted, as specified elsewhere in these standards.

## 10.7.9 Clean-Up

The Contractor shall reinstate all project areas affected by their operations to an equal or better condition than existing upon completion of the CIPP installation. All restoration must be completed prior to submitting that section of CIPP for consideration for payment.

## 10.7.10 Record Documentation

1. Digital Video and Log Sheets

   The Contractor is required to provide pre and post video files, as well as associated log sheets, for all pipe segments rehabilitated under the contract. All video and log sheets must be submitted to the City and County of Denver. All digital video files shall be submitted in .mp4 format and log sheets shall be submitted in .pdf format. All files will be labeled in accordance with the instructions provided by the Construction Project Manager.

   Pre and post inspection log sheets and digital video should be submitted together the week immediately following completion of each work segment, unless the contractor is submitting pre-inspection results separately to convey potential problem areas to the Construction Project Manager. Log sheets and digital video files not submitted at least 5 business days prior to a pay estimate cut-off date will not be considered for payment until the following month. It is the Contractor's responsibility to submit digital video media and log sheets in a timely fashion and as outlined in these specifications.

2. Redline Drawings

   A final set of red-lined drawings shall be submitted by the Contractor on a clean, full size set of project plans for As-Built creation purposes prior to processing final

payment and releasing remaining retainage. A .pdf copy of a clean set of project plans may be obtained from the Construction Project Manager upon request.

The red-lined drawings shall include the following: location and size of all pipe segments rehabilitated, the location of all restored service connections (showing distances from the downstream manhole), and the field recorded length of each rehabilitated segment (face of manhole to face of manhole). Providing inaccurate or incomplete record information is reason for withholding of progress payment as outlined in the General Contract Conditions.

### 10.7.11 Patents

The Contractor and the Contractor's suppliers shall warrant and save harmless the City against any and all claims, potential litigation involving patent infringement, copyright violations and any loss thereof.

**End of Specification**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management
# Standard Construction Specification

## 10.20 Pipe Bursting

### 10.20.1 Intent

It is the intent of this specification to provide for the replacement of existing pipelines and conduits by bursting or crushing the existing pipeline and replacing it with either the same size or larger diameter pipe.

### 10.20.2 Methods

All bidders on this project must construct the Trenchless Replacement of Sanitary Sewers with a process that has been approved by Wastewater Capital Projects Management prior to bid opening.

All approved methods must meet these Standard Construction Specifications. Any proposed deviation from these Standard Construction Specifications must be submitted in writing for acceptance at last ten (10) calendar days prior to the bid opening. Any and all departures from these Standard Construction Specifications must be pointed out and shown on the material submitted.

Special Condition SC-8, **Substitution** of these Specifications refer to substitution of processes other than herein approved.

### 10.20.3 Inspection of Pipelines

Inspections of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles, and service conditions by closed circuit television. The inspection of pipelines is also to determine active service connections and the addresses which they serve. A videotape and suitable log shall be kept for later reference by Wastewater Capital Projects Management.

### 10.20.4 Public Relations

The Public Information and Notification program shall as a minimum require the Contractor to be responsible for contacting each home or business connected to the sanitary sewer and informing them of the work to be done, and when the sewer will be off-line and the following:

**10.20.4.a**

Written notice to be delivered to each home or business describing work, schedule, how it affects them, and a local telephone number of the Contractor they can call to discuss the project or problems.

**10.20.4.b**

Personal contact on the day of pre-installation inspection of the sewer. Each lateral shall be verified by having the homeowner run water down their drain. If the homeowner is unavailable, other arrangements shall be made to drain water through the lateral.

**10.20.4.c**

Personal contact and written notice the day prior to beginning work on the section of sewer to which they are connected.

**10.20.4.d**

Personal contact with any home or business which cannot be reconnected within the time stated in the written notice.

**10.20.4.e**

If so required by a served business, portable toilets for their use by their employees will be will be furnished and serviced by the Contractor. The costs of these items are considered to be included in the cost of CIPP. No additional payment will be made by the City.

**10.20.4.f**

The Public Information and Notification Program shall include the minimum of the above. A complete program shall be submitted in writing to the Construction Project Manager.

## 10.20.5 Approved Material for Trenchless Replacement of Sanitary Sewers

### 10.20.5.a Materials

High Density Polyethylene Pipe (HDPE) shall conform to requirements of Type III, Class C, Category 5, Grade P34 as defined in the latest revision of ASTM D-1248. All solid wall HDPE pipe and fittings shall be manufactured in accordance with ASTM F-714. Pipe and fittings shall be made from virgin high density plastic compounds, with no rework compound except that obtained from the manufacturer's own production of the same formulation, which comply with the requirements for a minimum cell classification of PE 345434C as defined by ASTM D-3350. HDPE pipe shall have an inside surface in light color (e.g. natural, white, green, etc.) to allow light reflection for television inspection.

### 10.10.5.b Physical Properties

Pipes, fittings and joints shall meet the following minimum requirements at the time of installation:

| | | |
|---|---|---|
| Density | 0.941 gm/cc | ASTM D-1505 |
| Melt Index | < 0.15 gm/10 min. | ASTM D-1238 |
| Initial Flexural Modulus | 110,000 psi | ASTM D-790 |
| Long-Term Flexural Modulus | 28,200 psi | Continuous load duration of 50 years at design load conditions, certified by manufacturer. |
| Initial Flexural Strength | 3,000 psi | ASTM D-790 |
| Long-Term Flexure Strength | 1,500 psi | Continuous load duration of 50 years at design load conditions, certified by manufacturer. |
| Environmental Stress Cracking Resistance | F20=192 | ASTM D-1693, Test Condition C (failure % = hours). |
| Hydrostatic Design Basis | 1,600 psi | ASTM D-2837 |
| Color & Ultraviolet Stabilizer | Black, with 2% carbon black | ASTM D-3350 |

**Certification**

Manufacturer shall provide certification that the pipe and fittings meet the minimum specified physical properties, and has sufficient ultraviolet stabilizer for a minimum two (2) years storage life.

**Workmanship**

The pipe and fittings shall be homogeneous throughout and free of any blemishes, wrinkles, ribs, protrusions, holes, visible cracks, foreign materials, blisters or other deleterious faults or any defects.

### 10.20.5.c Joints

Sections of HDPE pipe shall be assembled and joined on the job site. Jointing shall be accomplished by the heating and butt-fusion method in strict conformance with the manufacturer's printed instructions. It is the sole responsibility of the Contractor to provide an acceptable water-tight butt-fusion joint. Joint strength shall be equal to or greater than the pipe and shall indicate a ductile rather than brittle fracture when tested. If sectional HDPE pipe is used, it shall be joined in accordance with the manufacturer's recommendation for a leakproof, stab joint method using EPDM O-ring synthetic elastomer gaskets.

Where excavations for HDPE pipe installation are made between manholes, pipe ends shall be jointed by butt-fusion joints, or when recommended by the pipe supplier, with a full circle seal clamp made of stainless steel hardware and a rubber sleeve. Seal clamps shall be manufactured by Rockwell, Dresser, or approved equal. The minimum clamp length shall be fifteen inches (15”).

### 10.20.5.d Saddles

Reconnection of service laterals to installed HDPE pipe shall be accomplished using heat fusion saddles. Heat fusion saddles shall be made of polyethylene pipe that meets the minimum specified physical properties and is suitable for fusion welding. Fusion saddles shall be Branch Saddle as manufactured by Driscopipe®, Miller®, Dupont®, or approved equal.

### 10.20.5.e Flexible Couplings

Connections to existing service laterals shall be made using flexible couplings. All flexible couplings shall conform to ASTM C-425 and shall be as manufactured by Fernco® Joint Sealer Co., DFW® Plastics, Inc., or approved equal.

### 10.20.5.f Restrained Joint Polyvinyl Chloride (PVC) Pressure Pipe

### 10.20.5.g Material

Restrained Joint PVC Pressure Pipe shall conform to the requirements of the latest revision of ASTM D-2241. All restrained joint PVC pipe and fittings shall be manufactured from a specially formulated PVC compound which contains impact modifiers and ultraviolet inhibitors. In accordance with ASTM D-1784, all pipe and fittings shall be made from a compound utilizing Type 1, Grade 1, 2000 psi hydrostatic design stress material, Class 12454-B.

### 10.20.5.h Physical Properties

Pipe, fittings and joints shall meet the following minimum requirements at the time of installation:

| | | |
|---|---|---|
| Izod Impact | 1.15 ft-lb./in. of notch | ASTM D-256 |
| Tensile Strength | 7,000 psi | ASTM D-638 |
| Modulus of Elasticity | 40,000 psi | ASTM D-638 |
| Deflection Temperature | 158º F | ASTM D-648 |
| Chemical Resistance | B | ASTM D-543 |
| Elongation | 150% | ASTM D-638 |
| Flammability | Self-Extinguishing | ASTM D-635 |

**Certification**

Manufacturer shall provide certification that the pipe and fittings meet the minimum specified physical properties.

**Workmanship**

The pipe and fittings shall be homogeneous throughout and free of any blemishes, wrinkles, ribs, protrusions, holes, visible cracks, foreign materials, blisters or other deleterious faults or any other defects.

### 10.20.5.i Joints

Sections of PVC pipe shall be assembled and permanently joined on the job site. Jointing shall be accomplished by use of machined grooves on the pipe and in the joining coupling which, when aligned, allow a spline to be inserted, resulting in a fully circumferential restrained joint that locks the pipe and couplings together. A flexible elastomeric seal (O-ring) in the coupling provides a hydraulic pressure seal.

Joints shall meet the requirements of ASTM D-3139, and the O-rings shall meet the requirements of ASTM F-477. Couplings shall be provided with factory installed O-rings.

## 10.20.6 Bypassing Sewage

The Contractor shall provide for the flow of sewage around the section or sections of pipe designated for reconstruction. The bypass shall be made by plugging the line at an existing upstream manhole or adjacent system. The pump and bypass lines shall be of adequate capacity and size to handle the flow. Bypassing includes all mainline and service line bypassing required. Wastewater shall not be allowed to spill into storm drains, street gutters, or open excavations. Any spills that occur must be taken care of properly and immediately. The City shall be notified immediately and the Contractor shall bear all costs associated with any spills.

## 10.20.7 Service Connections

After the trenchless replacement of the pipe has been completed, the Contractor shall reopen / restore the existing active service connections and branch connections. No service connection shall remain out of service for more than twenty-four (24) hours at a time without the Contractor providing some means of temporary facilities or hotel accommodations for the residents.

No additional payment will be made for excavations for the purpose of reopening connections and the Contractor will be responsible for all costs and liability associated with such excavation and restoration work.

## 10.20.8 Reports

The Contractor will provide the Construction Project Manager with a color videotape. The tape will include both the before and after conditions, and restored connections with addresses each connection serves, in audio, and on the videotape. Copies of all certified reports and logs off all tests and inspections conducted shall be submitted to the Construction Project Manager.

### 10.20.9 Clean-up

Upon acceptance of the installation work and testing, the Contractor shall reinstate the project area affected by this operation.

### 10.20.10 Payment

Payment for work included in this section will be in accordance with the prices set forth in the proposal for the quantity of work performed. Progress payments will be made monthly based on the work performed during that period.

### 10.20.11 Patents

The Contractor and the Contractor's supplier shall warrant and save harmless the City and Wastewater Management Division against any and all claims and potential litigation involving patent infringement and copyright violations and any loss thereof.

**End of Specification**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management
# Standard Construction Specification

## 11.0 Structures and Appurtenances

### 11.0.1 General

Except where otherwise indicated in these Standard Construction Specifications, manholes, special structures, box culverts, vaults, storm inlets, and other miscellaneous structures and appurtenances shall conform to the details included in these Specifications or as shown on the drawings. All concrete and reinforcing for structures shall conform to the requirements set forth in the most recent Standard Specifications for Road and Bridge Construction, by the Colorado Department of Transportation, as described below, or otherwise modified herein.

**1. CDOT Section 601 Structural Concrete**

*CDOT Section 601 Structural Concrete shall be utilized and revised as follows:*
Class D Concrete will be utilized for all structural concrete work; using ¾" nominal sized aggregate (100% passing the 1" sieve and 90% to 100% passing the ¾" sieve).
Type II Portland Cement will be used.

*Subsection 601.05 shall be revised to include:*
The concrete used in upper deck slabs shall have a maximum substitution of fly ash for Portland cement of 10% by weight.

*CDOT Subsection 601.19 shall be revised as follows:*
Method of measurement shall be deleted. Method utilized will be as specified elsewhere in the Contract Documents.

*Subsection 601.20 shall be revised as follows:*
Basis of payment will be deleted. Basis of payment utilized will be as specified elsewhere in the Contract Documents.

**2. CDOT Section 602 Reinforcing Steel**

*CDOT Section 602 Reinforcing Steel shall be utilized and revised as follows:*
Subsection 602.02 shall be revised as follows:
Epoxy coated reinforcing steel will not be utilized unless otherwise specified in the Contract Documents.

*Subsection 602.07 shall be revised as follows:*
Method of measurement will be deleted. Method utilized will be as included otherwise in the Contract Documents.

*Subsection 602.08 shall be revised as follows:*
Basis of payment will be deleted. Basis of payment will be as included otherwise in the Contract Documents.

2. *Special Design*

All special structures in the City and County of Denver that deviate from the standard details shall be submitted in writing, to the City Construction Project Manager. This includes items such as inlets, oversize structures, and/or precast vaults. If the Construction Project Manager will allow the special design a structural design is required by a Professional Engineer licensed in the state of Colorado. At a minimum the design loading and load factors shall comply with the following:

Live Load - AASHTO LRFD, HL-93 Tandem, and Colorado Permit Truck

Dead Load - vertical earth load = 120 lbs/cu.ft., horizontal earth load = 60 lbs/cu.ft.

Wearing Surface – 12 in. thick concrete pavement

Live Load Surcharge on Exterior Walls = 2 ft. of Earth (120 psf)

Load Factors - Latest edition of AASHTO Bridge Design Specifications

Environmental engineering durability factor (Sd) per ACI 350-06

## 11.0.2 Manholes

Except where otherwise specified or indicated on the drawings, storm and sanitary sewer manholes shall conform to the requirements as set forth below. Manholes 6' (six foot) in diameter or smaller shall be constructed of precast concrete or cast-in-place concrete as outlined in the Wastewater Management Division Standard Detail Drawings or within the Contract Documents. Type B and Type P manholes shall be cast in place only, unless specified otherwise in the contract documents. All manholes and related component items shall be designed for AASHTO HS20 loading.

### 11.0.2.1 Size

The minimum internal diameter of the manhole barrel shall be as follows for both storm and sanitary sewer installations (please refer to the Wastewater Management Division Standard Detail Drawings).

| Pipe Size | MH Barrel I.D. | Standard Top Section | Standard Detail |
|---|---|---|---|
| 30” dia. and smaller | 4’-0” | Concentric Cone | S501.1 |
| 30” to 36” | 5’-0” | Concentric Cone | S501.1 |
| 42” and larger | Type B or P or Special Detail | As detailed | S503<br>S504 |

***Note***: Standard ring and cover is 24 inch diameter.

### 11.0.2.2 Materials

The materials to be used in the construction of sewer manholes shall conform to the following requirements:

1. **Precast Reinforced Concrete Manhole Sections**

   Precast manhole sections including barrels, cones, flat tops, etc. shall be manufactured in accordance with ASTM C-478, Precast Reinforced Concrete Manhole Sections. All cones furnished shall be concentric except for manholes with less than 4 feet of cover, which shall be flat top. Concrete used in precast manhole bases shall have a minimum 28 day compressive strength of 5000 psi, and shall be constructed of Type II, Portland cement. Welded wire fabric used in precast manhole sections shall be as specified in ASTM C-478. These precast manhole elements are intended to be utilized as components of non-pressurized sewer and manhole systems only. Pressure systems were warranted and authorized by the Division will require special design pressure manholes, joints, and other appurtenant items.

2. **Cast-in-Place Concrete Manholes**

   All concrete used in construction of cast-in-place manholes and bases shall be CDOT Class D. Construction shall be in conformance with the Wastewater Management Division Standard Detail Drawings.

3. **Structural Reinforcement**

   All structural reinforcement shall be placed in accordance with the Wastewater Management Division Standard Detail drawings and in conformance with this specification.

4. **Frame and Cover**

   Unless otherwise noted on the drawings, frame and covers for manholes and special structures shall be the current Denver Standard pattern, manufactured by an approved foundry. Castings shall, at the minimum, meet the requirements of ASTM A48, Class 35B, and other Agency requirements as a condition of approval. Horizontal bearing surfaces of all rings and covers shall be machined to eliminate any rocking action or non-uniform bearing. Castings shall not be dipped or painted prior to field inspection and acceptance. Refer to the Wastewater Management Division Standard Detail Drawings for additional requirements.

5. **Manhole Steps**

   Manhole steps shall be required for all new manholes greater than 4 feet in depth, from the rim to the top of the bench, unless otherwise specified within the Contract Documents.

6. **Flexible Plastic Joint Sealing Compound**

   All joints in the manhole barrel, cone and/or flat top sections including the joint between the cast-in-place base and the bottom barrel section, shall be sealed with an approved preformed, flexible plastic gasket conforming to the following requirements:

   a. The flexible plastic gasket shall be in conformance with ASTM C-990-91, AASHTO M198-B, and ASTM C-990, latest versions.

   b. The plastic sealing compound shall be packaged in extruded pre-formed rope-like shapes of proper size to completely fill the joint when completely compressed, as per the pipe manufacturer's recommendations. The material shall be protected by a suitable, removable two-piece wrapper that may be removed as the compound is applied to the joint surface without disturbing the other wrapper, which remains attached to the compound for protection. The sealing compound shall be impermeable to water, have high immediate bonding strength to the concrete surface and shall maintain permanent plasticity, as well as resistance to water, acids, and alkalis inherent in sewer systems.

   c. All lifting holes shall be permanently and properly sealed with the plastic sealing compound or an approved concrete grout.

7. **Adjustment**

   Grade rings shall be used to adjust and set final rim elevations, brick is not allowed. A 3-inch cast iron riser shall be used in conjunction with grade rings on all construction within streets. Cast iron shall conform to ASTM C62, Grade SW [AASHTO M114].

8. **Mortar and Grout**

   Mortar and grout used in the shaping of inverts, grade ring gaps, setting and anchoring cast iron street fabrications, etc., shall consist of one part Type II Portland Cement and two parts of fine, clean sand. Only sufficient water shall be added to provide a stiff, workable cement mixture for proper troweling. Hydrate lime or masonry cement shall not be used. Where relatively thin portions of grout are to be applied to the flow channel, top of bench, etc., and approved epoxy bonding coat shall be applied to the exposed concrete surfaces prior to grouting.

#### 11.0.2.3 Bases and Inverts

Except as otherwise shown on the drawings, manhole bases shall be constructed of cast-in-place or precast concrete, as shown in the Wastewater Management Division Standard Detail Drawings, and as otherwise described in these Standard Construction Specifications. Inverts may be cast separately, but shall be constructed of cast-in-place concrete. All concrete used for these applications shall be meet the requirements set forth in section 11.0.2.2 of these Standard Construction Specifications.

1. **Sanitary Sewer Manholes**

   Sanitary Sewer manholes are normally designed and constructed such that inverts of the influent and effluent sewers are at the same relative elevation with sufficient drop to compensate for pressure head losses occurring in the manhole. Therefore except for special cases, the bench around the flow channel shall be constructed to the outside top of the largest pipe in the manhole. The top of the bench shall be poured with a slope towards the flow channel with an overall cross slope not exceeding ½ inch. Flow channels shall have smooth, rounded inverts shaped to match the lower half of the pipe. Proper shaping shall be accomplished by forming or shaping with a proper cement grout mixture. Changes in direction of flow through the manhole shall be made with a smooth continuously-curved channel utilizing the maximum radius possible. Changes in the size of channels, multiple flow channels, or changes in invert slopes, shall be made gradually and evenly, and shall be formed directly in the concrete.

   a. Outside Drops. Whenever specified on the Drawings, directed by the Construction Project Manager, or where the elevation difference between the incoming sewer inverts and the outgoing invert is 18 inches or greater, an outside drop shall be constructed. The diameter of the drop shall not be less than the diameter of the incoming sewer pipe to be dropped. A concrete encasement will be required around the drop pipe as shown and detailed within the Wastewater Management Division Standard Details, S-530.

      Quantities and costs for the outside drop configuration shall be measured and paid for separately from the manhole unless otherwise specified.

2. **Storm Sewer Manholes**

   Flow channels in storm sewer manholes shall be as shown in the Wastewater Management Division Standard Detail Drawings for the particular type of manhole base utilized. Except for special situations, and where specifically noted, outside manhole drops will not be required. All exposed channel edges and cut pipe edges shall be grouted smooth. The minimum thickness of the cast-in-place concrete at any point shall not be less than 6-inches. The construction of the manhole base and shaping of inverts, including all pipes within the dimensions of the manhole, will be considered to be incidental to the construction of the manhole and all costs shall be included in the unit price bid for the manhole structure.

### 11.0.2.4 Stub-Outs and Block-Outs

Block-outs are the preferred method of construction for future connections. These shall be constructed as specified within the Contract Documents.

Where stub-outs are specifically indicated on the drawings and where a specified pipe size for future connections is to be constructed, the pipe used for stubbing shall extend a nominal 2 feet beyond the outside of the manhole barrel, unless otherwise noted, and shall terminate with a bell end [or spigot end if applicable]. The pipe end shall be sealed with an approved, pre-fabricated plug or cap conforming to the joint detail of the pipe supplied. For

pipe greater than or equal to 30-inches in diameter, a full section of pipe shall be installed as the manhole stub. Shop drawings shall be submitted for approval.

The use of brick or concrete fill as a means of plugging will only be permitted on sewers that are to be abandoned. Unless otherwise stated in the contract documents, stub-outs and plugs or caps will be considered to be incidental to the construction of the associated manholes, and all costs incurred shall be included in the unit price bid for the manhole structure.

#### 11.0.2.5 Flexible Booted Connections

Flexible watertight rubber boots for the jointing of any sewer pipe to any precast manhole base, barrel section, inlet box, or vault shall conform to the Specifications contained herein and to the Wastewater Management Division Standard Detail Drawings. Flexible connectors shall meet the requirements of ASTM C923.

- A separate submittal package specific to each pipe size and unique project scenario shall be required for approval by the Construction Project Manager prior to product procurement by the Contractor. At a minimum, this submittal shall include jacking force calculations (see 7.1.4), joint design, and a special pipe detail for each situation.

### 11.0.3 Structures

#### 11.0.3.1 Concrete

All structural concrete shall be CDOT Class D, with the revisions noted within this section.

#### 11.0.3.2 Reinforcement

All structures shall be reinforced as shown on the Drawings or within the Wastewater Management Division Standard Details. All reinforcing steel shall be ASTM A-615, Grade 60 with deformed bars.

### 11.0.4 Concrete Flatwork

#### 11.0.4.1 Concrete

All flatwork shall be CDOT Class D, unless otherwise approved by the Project Engineer.

#### 11.0.4.2 Reinforcement

All required reinforcement shall be in accordance with the Contract Documents.

### 11.0.5 Storm Inlets

The work under this subsection shall consist of furnishing all materials and constructing concrete catch basins, including excavation, concrete removal and backfill. Work shall be done at the locations designated on the project plans and in accordance with the Wastewater Management Division Standard Detail Drawings and other requirements of the Contract Documents. All inlet structures and related components shall be designed for AASHTO HS20 loading conditions.

#### 11.0.5.1 Concrete

Concrete shall be Class D, with a minimum 28-day strength of 4500 psi. Cement used in concrete shall conform to ASTM Designation C-150 Type II cement. All concrete used for these applications shall be meet the requirements set forth within these Standard Construction Specifications.

#### 11.0.5.2 Masonry Mortar

Masonry mortar (grout) shall be composed by volume of one part Portland cement, two parts fine aggregate, one fifth part hydrated lime and sufficient water to provide a plastic mixture. Mortar in concrete fill shall obtain a 28 day strength of 2000 psi.

#### 11.0.5.3 Reinforcement

All inlets shall be reinforced as shown on the Drawings or Wastewater Management Division Standard Details. All reinforcing steel shall be ASTM A-615, Grade 60 with deformed bars. The diameter of bend measured on the inside of the bar shall be 6 bar diameters. All reinforcing steel shall be 2" clear minimum from formed surfaces and 3" clear against earth unless otherwise noted. Splicing of reinforcing steel shall be permitted only where detailed on the Drawings.

#### 11.0.5.4 Connectors

Connectors for single inlets shall be 15" diameter (min.) with desired slope of 1 percent, for double inlets connectors shall be 18" diameter with desired slope of 1.8 percent and for triple inlets connectors shall be 21" with a desired slope of 1.8 percent. All connections to main line storm sewers shall be cored and collared in accordance with the Wastewater Management Division Standard Detail Drawings. Saw cutting and/or jack hammering will not be permitted.

#### 11.0.5.5 Castings (No. 16 Inlets)

Frame shall be Denver Standard Pattern and grate where required shall be No. 16 Grate (Wastewater Management Division Standard Detail-S-716).All castings shall conform to ASTM A-48 (Class 35b) with a minimum tensile strength of 35 ksi. Castings shall not be dipped or painted prior to field inspection; once castings are approved by the Division for project usage, they shall be coated with an approved material. All castings shall be heavy duty and capable of withstanding AASHTO H-20 loadings. Horizontal bearing surfaces of all frames and grates shall be machined to eliminate any rocking action or non-uniform bearing.

#### 11.0.5.6 Steps

Manhole steps shall be required for all new inlets greater than 4’ in depth, , unless otherwise specified within the Contract Documents. Single Type 16 inlets are exempt from this requirement.

#### 11.0.5.7 Construction Requirements

All storm inlets shall be constructed of cast-in-place concrete, unless specifically approved for precast construction by the City. Precast inlets shall meet the requirements of 11.0.1 (revised 602.08 Special Design)

1. **Bedding and Backfill**

   All catch basins/inlets shall be cast in place. Subgrade shall be Class B Bedding compacted to 90% maximum dry density (AASHTO designation T-180). Backfill shall be hand tamped in 6" lifts, Backfill Method B.

2. **Inlet Depths**

   Desired depths for single inlets shall be 3.5 feet (flow line to floor), for double inlets depth shall be 4 feet and for triple inlets depth shall be 4.5 feet. Inlets are designed to allow for 6 foot depth maximum; for depths greater than 6 feet, shop drawings and design analysis shall be submitted for approval by the Construction Project Manager.

3. **Forming**

   Inlets shall be formed both inside and out; casting of sidewalls against earth walls or other structures is not permitted. No formwork shall remain inside structure when complete.

### 11.0.6 Backfill Requirements

The following outlines backfill requirements around manholes, structures, inlets, utilities and appurtenances. Structures shall include but not be limited to: type B manholes, type P manholes, box culvert and special structures noted within the Contract Documents. All structures shall be constructed in accordance with the most recent addition of the Wastewater Management Division Standard Detail drawings, and/or in conjunction with special details provided within the Contract Documents.

Method B backfilling, as described within these Standard Construction Specifications, is required around manholes, structures, inlets, utilities and appurtenances, unless otherwise specified or directed by the Construction Project Manager. The following backfilling constraints and requirements shall apply for all such facilities:

1. **Cast-in-place: Inlets (≤ 6’ deep), Manhole Bases and Structure Bases**

   May be backfilled and compacted around, once the concrete has achieved 80% of the required 28-day compressive strength indicated in the Contract Documents.

   For inlet depths larger than six (6) feet, from top of base slab to the top of wall at flow line of the lip, shop drawings and a design analysis must be submitted to the Construction Project Manager for approval. These submittals shall address the backfilling constraints during and after inlet placement.

2. **Cast-in-place: Structure Walls**

   Shall not be backfilled or compacted against until the deck (top) slab has been placed, the walls have attained 80% of the required 28-day compressive strength, and the deck (top) slab has attained 80% of its required 28-day compressive strength as indicated in the Contract Documents.

3. **Cast-in-place: Structure Decks or Top Slabs**

May only be backfilled and compacted over once the concrete has attained the required 28-day compressive strength indicated in the Contract Documents.

4. **Precast: Structures, Manhole Bases, Barrels, Cone Sections and Inlets**

   All precast components may be backfilled and compacted against, if manufactured a minimum of 28-days prior to placement, or if concrete test results demonstrate that the required 28-day compressive strength indicated in the Contract Documents has been achieved.

   Precast barrels and cone sections may only be placed on cast-in-place manhole bases after 80% of the required 28 day compressive strength indicated in the Contract Documents has been attained.

   Alterations and special allowances to these criteria may be granted at the discretion of the Construction Project Manager on a case by case basis.

**End of Specification**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management
# Standard Construction Specification

## 12.0 Riprap, Boulders and Slope/Channel Protection

### 12.1 General

This work consists of furnishing all labor, equipment and materials necessary to place riprap, soil riprap, grouted riprap, and erosion resistant materials where detailed on the Plans or as directed by the Construction Project Manager. The work includes water control, excavation and backfill, grading, sub-grade preparation, materials and installation of bedding, rock, riprap, boulders and grout as indicated herein and in the Contract Documents.

### 12.2 Submittals and Testing

In accordance with the Special Conditions submit documentation indicating source of stone and certifying materials for all types of rock will meet the requirements of this section. Include test results for specific gravity, abrasion, gradation and freeze thaw on samples of rock to be supplied on this project. Submit design mix for grout. In advance of delivery of rock to the work site an inspection of the quarry shall be arranged by the Contractor and shall include the Contractor, Construction Project Manager, and Quarry Representative. The quarry will identify the rock source and procedures that will be used to stockpile, mix and grade the types of riprap and boulders specified. The Construction Project Manager, following receipt and review of current gradation test results, may waive the requirement for field gradation tests at his discretion. If gradation tests are determined to be necessary by the Construction Project Manager, the following procedures shall be used.

For each type of riprap specified a random sample will be selected by the Construction Project Manager. The objective is to obtain a sample as it would be handled for normal delivery to the work site. It will then be placed in an approved area at the quarry and sized and sorted to identify and weigh the individual pieces as directed by the Construction Project Manager. The Contractor and Quarry Representative shall apply all labor and equipment to sort and weigh the riprap. Submit weight data of individual pieces and summary gradation curve. The approved sample shall then be hauled to the work site and stockpiled for comparison of future riprap deliveries. If the riprap being delivered appears to be outside of the specified gradation, or does not resemble the same stockpiles, the Contractor shall make appropriate adjustments at the quarry to ensure riprap meets the requirement of the Specification.

Boulders shall be visually checked by the Contractor at the quarry or work site as required for size, elongation, cracks, deterioration and other defects visible on the entire surface of the stone. If cracks are observed, the Contractor shall notify the Construction Project Manager to re-inspect and retest the rock. Stone with cracks or defects that are detrimental to a long lasting product shall not be shipped to the work site.

## 12.3 Riprap and Boulders

Only quarry rock that is sound and durable against disintegration under conditions to be met in handling and placing, and is hard and tenacious and otherwise of suitable quality to ensure permanency in the specified kind of work, shall be used.

All rock shall be angular, each piece having its greatest dimensions greater than 3 times its least dimensions and shall conform to the following requirements and testing standards:

1. The riprap designation and total thickness of riprap shall be as shown in the contract documents. The maximum stone size shall not be larger than the thickness of the riprap.
2. The specific gravity of the riprap shall be two and one-half (2.5) or greater.
3. Neither width nor thickness of a single stone of riprap shall be less than one-third (⅓) of its length.
4. Broken concrete or asphalt pavement shall not be acceptable for use in any portion of the Project.
5. Rounded riprap (river rock) is not acceptable unless specifically designated in the Contract Documents.
6. The color of the riprap shall be gray with gray/blue hues or other acceptable colors approved by Construction Project Manager prior to delivery to the Project site. Color shall be consistent on the entire Project and shall match the color of rock to be used for all other portions of the Project Scope.
7. Minimum density for acceptable riprap shall be one hundred sixty five (165) pounds per cubic foot. The specific gravity shall be according to the bulk-saturated, surface-dry basis, AASHTO T85.
8. The riprap shall have a percentage loss of not more than forty percent (40%) after five hundred (500) revolutions when tested in the Los Angeles machine in accordance with AASHTO Test T96.
9. The riprap shall have a percentage loss of not more than ten percent (10%) after five (5) cycles when tested in accordance with AASHTO Test T104 for ledge rock using sodium sulfate.
10. The riprap shall have a percentage loss of not more than ten percent (10%) after twelve (12) cycles of freezing and thawing when tested in accordance with AASHTO Test T103 for ledge rock, procedure A.

11. Rock shall be free of calcite intrusions.
12. Each load of riprap shall be reasonably well graded from the smallest to the largest size specified. Stones smaller than the two-to-ten percent (2-10%) size will not be permitted in an amount exceeding ten percent (10%) by weight of each load. Control of gradation shall be by visual inspection. However in the event Construction Project Manager determines the riprap to be unacceptable, the Construction Project Manager shall pick two (2) random truckloads to be dumped and checked for gradation. Mechanical equipment and labor needed to assist in checking gradation shall be provided by Contractor at no additional cost.

### 12.3.1 Types, Sizes and Classifications

The types, size, or classification of riprap to be placed will be noted on the Plans. Unless otherwise specified in the Plans or the Contract Documents riprap placed in accordance with the requirements for "dumped riprap" will be considered satisfactory. All riprap shall be placed on a prepared slope on a prepared filter media consisting of either a heavy duty plastic filter cloth or a free draining granular bedding media as described in the materials section of this specification. If the existing soils conditions meet the requirements for filter media the filter media will not be required.

Riprap used shall be the type designated within the contract documents and shall conform to **the table on the following page:**

| Riprap Designation | % Smaller Than Given Size By Weight | Intermediate Rock Dimension (inches) | $d_{50}$ * (inches) |
|---|---|---|---|
| Type VL | 70 - 100 | 12 | 6 |
| | 50 - 70 | 9 | |
| | 35 - 50 | 6 | |
| | 2 - 10 | 2 | |
| Type L | 70 - 100 | 15 | 9 |
| | 50 - 70 | 12 | |
| | 35 - 50 | 9 | |
| | 2 - 10 | 3 | |
| Type M | 70 - 100 | 21 | 12 |
| | 50 - 70 | 18 | |
| | 35 - 50 | 12 | |
| | 2 - 10 | 4 | |
| Type H | 70 - 100 | 30 | 18 |
| | 50 - 70 | 24 | |
| | 35 - 50 | 18 | |
| | 2 - 10 | 6 | |
| Type VH | 70 – 100 | 41 | 24 |
| | 50 - 70 | 33 | |
| | 35 - 50 | 24 | |
| | 2 - 10 | 9 | |

* $d_{50}$ = Mean Particle Size

#### 12.3.1.1 Dumped Riprap

This type of riprap shall consist of angular or fractured rock dumped in place on a prepared slope and filter media to form a well graded mass with a minimum of voids. Asphalt, broken concrete and other materials not classified as rock will not be allowed for use as riprap.

#### 12.3.1.2 Soil Riprap

The soil material shall be native or topsoil and mixed with sixty five percent (65%) riprap and thirty five percent (35%) soil by volume. Soil riprap shall consist of a uniform mixture of soil and riprap without voids. Bedding material is not required for soil riprap. This type of riprap shall consist of angular or fractured rock mixed with 35% soil by volume dumped in place on a prepared slope to form a uniform mixture of soil and riprap without voids per Section 12.2.1C.

#### 12.3.1.3 Grouted Riprap

This type of riprap shall consist of rock with all parts of the interstices filled with Portland cement mortar. The finished product shall be aesthetically pleasing resembling hand placed stone or fireplace rockwork. Colored concrete grout may be specified as defined elsewhere within these Standard Construction Specifications.

#### 12.3.1.4 Feature Boulders

Feature Boulders shall consist of the same material as riprap, differing only by size. Feature Boulders shall have a minimum dimension of four (4) feet, or as shown on the Plans.

#### 12.3.1.5 Boulders

Boulders shall consist of the same material as riprap, differing only by size. Boulders shall have a minimum dimension of two (2) feet, or as shown on the Plans.

### 12.3.2 Bedding

The granular bedding designation and total thickness of bedding shall be as shown in the Contract Documents. Granular bedding shall meet the same requirements for specific gravity, absorption, abrasion, sodium sulfate soundness, and freeze-thaw durability as required for riprap and as follows:

1. Broken concrete asphalt pavement or sledge, shall not be acceptable for use in any project. Rounded river rock is not acceptable unless specifically designated in the Contract Documents.
2. Shall conform to the quality requirements of AASHTO M197.
3. The requirements for the wear test in AASHTO T96 shall not apply.

4. Gradation for Granular Bedding:

| U.S. Standard | Percent by Weight Passing | Square Mesh Sieves |
|---|---|---|
| Sieve Size | Type I | Type II |
| 3 inch | | 90 - 100 |
| 1-½ inch | | |
| ¾ inch | | 20 - 90 |
| ⅜ inch | 100 | |
| No. 4 | 95 – 100 | 0 - 20 |
| No. 16 | 45 - 80 | |
| No. 50 | 10 - 30 | |
| No. 100 | 2 - 10 | |
| No. 200 | 0 - 2 | 0 - 3 |

## 12.4 Excavation

The excavations shall be finished to smooth and uniform surfaces conforming to the line and grade specified. Variation from the finished grade elevations specified shall not be more than 1.0 inch. Materials shall not be wasted without written permission of the Construction Project Manager. Excavation operations shall be conducted so material outside of the slope limits will not be disturbed. Prior to beginning grading operations, all necessary clearing and grubbing in that area shall have been performed. The top six (6) inches of material from all areas to be excavated shall be designated as topsoil and shall be removed and stockpiled in the designated location on the plans. Following removal of topsoil, in the designated excavation areas, the remaining material shall be removed and stockpiled separately for use as sub-grade material in the designated location on the plans. Unclassified excavation shall consist of the excavation of all materials of whatever character required for the work, obtained within the project limits, including surface boulders, masonry, organics, muck, and slag that are not removed under some other item. The work will also include hauling of unsuitable unclassified excavation materials off the site.

### 12.4.1 Unclassified Excavation

All excavation from six (6) inches below existing grade to the top of sub-grade for the associated boulders and/or riprap shall be designated as Unclassified Excavation.

Unless otherwise stipulated in the Contract Documents, no separate payment will be made for unclassified excavation and all costs incurred will be considered to be included within the unit price bid for the associated work.

### 12.4.2 Overexcavation

In locations where soil with unsuitable bearing characteristics are encountered, the Construction Project Manager may order that the unsuitable material be removed and be replaced with granular and/or rock backfill material to provide suitable bearing for the structure. At least eight (8) inches of acceptable material must be present below the proposed riprap, soil riprap, grouted riprap or boulders within two (2) feet of existing grade.

The overexcavation will be paid for in accordance with the bid items included within the Contract Documents, regardless of soil classification. No measurement for payment will be made of any material removed or necessary to fill overexcavated areas: outside of the limits for structure excavation, outside of limits defined within the Contract Documents, beyond the limits required for structure excavation performed for the Contractor's convenience or, where excavations for footings, slabs, etc., are made below the required elevations without specific authorization from the Construction Project Manager. In these situations, excess excavation and backfill shall be at the Contractor's expense and the areas shall be filled in a manner satisfactory to the Construction Project Manager.

### 12.4.3 Removal of Water

During construction, the Contractor shall provide and maintain adequate equipment to properly remove and dispose of all water entering the work area. In water bearing strata, well points, sub drains or any other method approved by the Construction Project Manager may be required to provide a dry trench.

The discharge from any dewatering operations shall be conducted to natural drainage channels or other structures as approved by the Construction Project Manager and in accordance with applicable permits. Ground water shall not be discharged into sanitary sewers.

Excavation work areas shall be kept free from water during excavation, fine grading, pipe laying and grouting. Dewatering, sufficient to provide a completely dry work area, shall be maintained during all excavation, construction and grouting operations. The Contractor shall be responsible for damage of any nature resulting from the dewatering operations.

Unless provided for in the Contract Documents, dewatering shall be considered as incidental to construction and all costs incurred will be considered to be included in the unit price bid for the construction of each section of sewer line, associated structures, laterals and appurtenances.

## 12.5 Backfill

Backfill around riprap or boulder structures shall be performed in accordance with these Standard Construction Specifications. Backfill shall be placed only after walls or other constructed items have been inspected and the approval of the Construction Project Manager to commence backfilling has been obtained. Backfilling against riprap or boulder structures is allowed only after the concrete has properly cured for not less than seven days, or until other testing procedures (concrete test cylinders) indicate that the concrete has attained sufficient strength so as not to be damaged by the backfilling operation.

## 12.6 Topsoil

Top soil material shall be taken from the topsoil stockpile and placed to a minimum depth of six (6) inches to the limits shown on the plans. Additional topsoil material, if necessary, shall be obtained from the sub-grade stockpile as approved by the Construction Project Manager. The topsoil shall be placed uniformly and compacted to a minimum of 85% Standard Proctor density ASHTO T-99. The intent is to provide a suitable medium for revegetation activities.

## 12.7 Unsuitable Materials

Materials encountered during construction that are deemed by the Construction Project Manager to be unsatisfactory as structure sub-grade shall be removed to a maximum depth as approved by the Construction Project Manager, and replaced with stabilization material including, rock, or other materials approved by the Construction Project Manager. The source of stabilization material shall be approved by the Construction Project Manager prior to placement. Excavated muck shall be removed and hauled off the site.

## 12.8 Construction Requirements

Channel slopes, bottoms, or other areas that are to be protected with riprap, soil riprap, or boulders shall be free of brush, trees, stumps, and other objectionable material and be graded to a smooth compacted surface. Contractor shall excavate areas to receive riprap or boulders to the sub-grade for granular bedding or for soil riprap to the specified depth (bedding material is not required for soil riprap). The sub-grade materials shall be stable. If unsuitable materials are encountered, they shall be removed and replaced in accordance with these Standard Construction Specifications for sub-grade that has been excavated in undisturbed soil. Additional compaction shall not be required unless specified by Construction Project Manager. When sub-grade is built up with embankment material it shall be compacted to ninety five percent (95%) optimum density (ASTM D698). After an acceptable sub-grade is established, the soil riprap or bedding shall be immediately placed and leveled to the specified elevation. Immediately following the placement of the bedding material, the riprap shall be placed. If bedding material is disturbed for any reason, it shall be replaced and graded at Contractor's expense. In-place bedding materials shall not be contaminated with soils, debris or vegetation before the riprap is placed. If contaminated, the bedding material shall be removed and replaced at Contractor's expense.

### 12.8.1 Placement

For the purposes of the following, boulders, riprap and rock are used interchangeably.

When riprap is placed on slopes, placement shall commence at the bottom of the slopes working up the slope. Place the riprap in a stepped fashion with the bottom of the uphill riprap below the top of the downhill riprap by one half (½) of the height of the riprap minimum.

The entire mass of riprap shall be placed on either channel slopes or bottoms so as to be in conformance with the required gradation mixtures and to lines, grades, and thickness shown on the plan set. Riprap shall be placed to its full course thickness at one operation and in such a manner as to avoid displacing the underlying bedding material. Placing of riprap in layers, or by dumping into chutes, or by similar methods shall not be permitted.

All material going into riprap protection for channel slopes or bottoms shall be so placed and distributed that there shall be no large accumulations of either the larger or smaller sizes of stone. Some hand placement may be required to achieve this distribution.

It is the intent of these Standard Construction Specifications to produce a fairly compact riprap protection in which all sizes of material are placed in their proper proportions. Unless otherwise authorized by Construction Project Manager, the riprap protection shall be placed in conjunction with the construction of embankments or channel bottoms with only sufficient delay in construction of the riprap protection, as may be necessary, to allow for proper construction of the portion of the embankment and channel bottom which is to be protected. Contractor shall maintain the riprap protection until accepted. Any material displaced for any reason shall be replaced to the lines and grades shown in the Contract Documents at no additional cost to City and County of Denver. If the bedding materials are removed or disturbed, such material shall be replaced prior to replacing the displaced riprap.

The basic procedure shall result in larger materials flush to the top surface with faces and shapes arranged to minimize voids, and smaller material below and between larger materials. Surface grades shall be a plane or as indicated, but projections above or depressions under the finished design grade more than ten percent (10%) of the rock layer thickness shall not be allowed. Smaller rock shall be securely locked between the larger stone. It is essential that the material between the larger stones not be loose or easily displaced by flow or by vandalism. The stone shall be consolidated by the bucket of the backhoe or other means that will cause interlocking of the material. All rock is to be placed in a dewatered condition beginning at the toe of the slope or other lowest point.

Riprap shall be rejected, which is either delivered to the job site or placed, that does not conform to this section. Rejected riprap shall be removed from the Project site by the Contractor at his/her expense.

Following acceptable placement of granular bedding, riprap placement shall commence using one of the following methods:

**Machine Placed Riprap**

Riprap shall be placed using appropriate construction equipment on the prepared slope or channel bottom areas in a manner which will produce a reasonably well-graded mass of stone with the minimum practicable percentage of voids. Riprap shall be machine placed, unless otherwise stipulated in the Contract Documents.

**Hand Placed Riprap**

Hand placed riprap shall be performed during machine placement of riprap and shall conform to all the requirements outlined above. Hand placed riprap shall also be required when the depth of riprap is less than two (2) times the nominal stone size, or when required by the Contract Documents.

After the riprap has been placed, hand placing or rearranging of individual stones by mechanical equipment shall be required to the extent necessary to secure a flat uniform surface and the specified depth of riprap, to the lines and grades as shown in the Contract Documents.

#### 12.8.1.1 Types

**Buried Riprap**

Where riprap is designated to be buried, place onsite excavated material that is free from trash and organic matter in riprap voids by washing and rodding. Prevent excessive washing of material into stream. When voids are filled and the surface accepted by the Construction Project Manager, place a nominal six (6) inches of soil over the area, or as designated in the Contract Documents. Fine grade, seed, and mulch per the Contract Documents.

**Soil Riprap**

Adjacent stockpiles of riprap and soil shall be created and mixing done at the stockpile location, not at the location where soil riprap is to be placed. Mix thirty five percent (35%) soil by volume with stockpiled riprap, using additional moisture and control procedures that assure a homogenous mixture, where the soil fills the inherent voids in the riprap without displacing riprap.

Place a first layer of smaller soil riprap of approximate $d_{50}$ thickness. Then place the top layer with surface rocks that are largely $d_{50}$ or greater, filling voids as necessary with smaller planted riprap. Create a smooth plane as described in Paragraph A. The mixture shall be consolidated by large vibratory equipment or backhoe bucket to create a tight, dense interlocking mass. The soil shall be further wetted to encourage void filling with soil. Any large voids shall be filled with rock and small voids filled with soil. Excessively thick zones of soil prone to washing away shall not be created (e.g., no thicknesses greater than six (6) inches). For buried soil riprap, the top surface shall be covered with four (4) inches of topsoil such that no rock points are protruding. The final surface shall be thoroughly wetted for good compaction, smoothed and compacted by vibrating equipment; the surface shall then be hand raked to receive planting or seeding. With prior approval of Construction Project Manager, layering the riprap and soil instead of premixing may be allowed if the native soil is granular.

**Feature Boulders**

Feature Boulders serve an aesthetic function and as such shall be placed and rotated into final position as directed by the Construction Project Manager in order to achieve the desired result.

**Grouted Boulders**

Grouted riprap and boulder lined channel edge shall be placed at the locations as shown in the Construction Documents and installed with the following requirements:

1. The sub-grade to receive each boulder shall be excavated and any unstable material shall be removed. Approved material shall be placed and compacted in a maximum of four-inch (4") lifts to ninety five percent (95%) of Maximum Standard Proctor Density (ASTM D698) to re-establish the sub-grade of each boulder. Unstable material shall be removed from the Project site and disposed of by Contractor. Removal and replacement of unstable material shall only be completed at the direction of Construction Project Manager and shall be paid for under Muck Excavation. Backfill behind boulders shall be compacted to ninety five percent (95%) Maximum Standard Proctor Density (ASTM D698). Care shall be taken during compaction to avoid disturbing and/or damaging the integrity of the boulder channel edge.

   The top of all boulders shall be as indicated in the Construction Documents. Finished grades and sub-grades for boulders will be determined from the height of each boulder used.

2. The boulders shall be carefully picked and arranged so that adjacent rock surfaces match within two (2) inches in top elevation and two (2) inches along the vertical exposed face or channel side of rock. Boulders shall be placed such that adjacent boulders "touch" each other and voids do not exceed four (4) inches. It is the intent of construction to minimize voids and grout placed between boulders.

3. Smaller rocks shall be "chinked in" to fill all voids behind the boulders. Placement shall be approved by Construction Project Manager prior to grouting.

4. Prior to placing the grout, any type of debris, fines, smaller rock, or silt shall be removed from around or under the boulders.

5. Dewatering shall be implemented to guarantee that the grout will not be placed in water and for a period of twenty four (24) hours after the grout has been placed.

6. Keep boulders receiving grout wet at all times prior to receiving grout. The concrete grout shall be placed by injection methods by pumping under low pressure, through a two-inch (2") maximum diameter hose to ensure complete penetration of the grout into the void area as detailed in the Contract Documents. Grout will be placed up to eight (8) inches from the top of boulders, or as directed by the Construction Project Manager. The Operator shall be able to stop the flow and will place grout in the voids and not on the surface of the rocks.

7. Grout shall be troweled out and finished to minimize visibility. Clean and wash any spillage before the grout sets. The visual surfaces of boulders will be free

of grout to provide a clean, natural appearance. If washing does not clean off grout residue, Contractor shall wash off any grout residue with muriatic acid and water, using a brush to scrub off the residue. A "pencil" vibrator shall be used to make sure all voids are filled between the boulders. The intent is to fill all voids from the sub-grade level around the boulders to a depth as shown in the Contract Documents. The "pencil" vibrator may be used to smooth the appearance of the surface, but Contractor shall use a wood float to smooth and grade the grout around the boulders. The grout mix shall be stiffened and other measures taken to retain the grout between the boulders.

8. Contractor shall, if deemed necessary, support the boulders from falling over before and during the placement of rock, grout, backfill, and compaction work on either side of the boulder.

9. Grout shall receive cold weather protection and curing in accordance with the most recent version of CDOT Standard Specifications for Road and Bridge Construction (section 601.13) as applicable.

## 12.9 Grouted Rock Retaining Walls

Grouted rock retaining walls shall be placed at locations as shown in the Contract Documents and installed with the following requirements:

1. The grouted rock walls shall be constructed to the dimensions in the locations shown in the Contract Documents. The walls shall be constructed with a one (1) horizontal to four (4) vertical batter on the front and back face, with a minimum width of one (1) foot at the top of the wall.

2. The stone of the wall shall be laid to form substantial masonry, presenting a neat, finished appearance. Headers shall hold the heart of the wall to the face. Headers shall occupy at least twenty percent (20%) of the area and they shall be evenly distributed. The length of stretchers shall not exceed three (3) times their rise. Face stones shall be laid to break joint. Rock shall be hand graded so that only the larger stones are used in the face. Face stones shall be laid to break joint so that each rock laid rests on two beneath it. Spalls and pinners will not be allowed in the face and shall be used in the backing only where necessary.

3. All face stones shall be pitched to a string line on straight walls or laid to batter stakes for curved walls. The batter shall be consistent with respect to all parts of the wall and shall meet the minimum requirements set forth in the detail. The degree of roughness on the exposed face shall be measured with a six-foot (6') straightedge supported between adjacent projections and stone face. Variations in excess of 3 inches, measured from the straight edge to the extreme depression in the stone, will not be permitted. Rear faces shall present approximately plane surfaces and shall in general conform to the detail.

4. Grout shall be placed to fill all voids between the rocks throughout the walls. Any "loose" rocks shall be re-grouted by machine or hand methods. Grout shall

be recessed approximately two (2) inches from the face of the wall in order to give a "dry stacked" appearance.

5. Prior to placing the grout, any type of debris, fines, smaller rock, or silt shall be removed from around the rocks.

   Dewatering shall be implemented to guarantee that the grout will not be placed in water and the area will remain dewatered for a period of ten (10) hours after the grout has been placed.

   The surface of the rocks receiving grout shall be wet at all times prior to receiving grout.

6. Clean and wash any spillage before the grout sets on the outside face and top of walls. The visual surfaces of the rocks will be free of grout to provide a clean natural appearance. If washing does not clean off grout residue, then Contractor shall wash off any grout residue with muriatic acid and water, using a brush to scrub off the residue.

7. Grout shall receive cold weather protection and curing in accordance with the CDOT Standard Specifications for Road and Bridge Construction (section 601.13) as applicable.

**End of Specification**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management
# Standard Construction Specification

## 13.0 Fencing

### 13.1 Description

This item shall consist of furnishing and installing new fencing and/or removing and salvaging the existing fencing and restoring the same in conformance with the lines, grades and/or alignment shown on the Plans. Wherever the materials to be removed are not in good condition, as judged by the Construction Project Manager, or wherever the Contractor has damaged the materials during the process of removal, equal or better quality fencing materials than the existing will be furnished and installed by the Contractor. Relocated and/or new fencing will be chain link, heavy construction type. The fence heights shall be as noted on the Plans.

#### 13.1.1 Chain Link Fence

Where specified on the plans or directed by the Construction Project Manager, chain link fencing shall be constructed as detailed on the drawings and as specified herein.

#### 13.1.2 Security Fence

Where specified on the plans or directed by the Construction Project Manager, security fencing shall be constructed as detailed on the drawings and as specified herein. The fencing shall be topped with 3-strand barbed wire which will extend the overall height of the fence by one (1) foot.

#### 13.1.3 Shop Drawings and Data

Complete detail drawings and specifications for the fence, gates and accessories shall be submitted in accordance with the procedure set forth in the Special Contract Conditions.

#### 13.2.4 Removal of Existing Fencing

All ties and clamps shall be removed to free the fabric from posts, rails, braces, tension bars and the like. The fabric shall be removed and stored appropriately to be reused. All rails, braces, barbed wire, tension bars and the like shall be removed from posts to a sufficient degree that will allow the removal of the posts.

The post footings shall be excavated and the concrete shall be broken until the post is free. Posts higher than ten (10) feet may be cut in segments or left intact for relocation at the option of the Contractor and as approved by the Construction Project Manager.

## 13.3 Materials

Materials for all fencing shall conform to the standards of the existing fence or to the minimum standards as outlined herein. All new steel or malleable iron parts and accessories shall be hot dip galvanized after fabrication.

### 13.3.1 Posts

All posts shall be steel pipe, ASTM A120, standard weight, Schedule 40. Post diameters shall be as follows.

a. **Line Posts**

(1) Up to ten (10) foot high fence inclusive, line posts shall be 2-1/2 inch O.D. pipe, 3.65 lbs. per ft.

(2) Over ten (10) foot to eighteen (18) foot high fence inclusive, line posts shall be 3 inch O.D. pipe, 5.79 lbs. per ft.

(3) Over eighteen (18) foot to thirty (30) foot high backstop fence inclusive, line posts shall be 4 inch O.D. pipe 9.1 lbs. per ft.

b. **Terminal End. Corner and Pull Posts**

(1) Up to eighteen (18) foot high fence inclusive; terminal, end, corner and pull posts shall be 3 inch O.D. pipe, 5.79 lbs. pr ft.

(2) Over eighteen (18) foot to thirty (30) foot high backstop fence inclusive; terminal, end, corner and pull posts shall be 4 inch O.D. pipe, 9.1 lbs. Per ft.

c. **Gate Posts.** Pipe, 9.1 lbs. per ft. and 4 inch O.D.

(1) **Top Rail** shall be 1-5/8 inch O.D. pipe, 2.27 lbs.

(2) **Post Tops** shall be pressed steel or malleable iron designed to prevent entry of moisture into tubular posts and/or for barbed wire installation.

(3) **Stretcher Bars** shall be steel, 3/16 inch by 3/4 inch, or equivalent area.

(4) **Fabric** shall be No.9 wire woven into a 2" mesh; galvanized AS~M A392, Class II.

(5) **Fabric Ties** shall be No.7 aluminum wire or 12 gauge galvanized steel wire.

(6) **Concrete Collars** around posts: f'c -2000 psi, 5 sack mix, with Type r or Type II cement conforming to ASTM C-150.

### 13.3.8 Gates

Materials for gates shall conform to the

a. **Fabric** shall be the same as fence fabric.

b. **Frames** shall be 2 inch O.D. pipe, 2.72 lbs. per ft.

c. **Hinges** shall be heavy pattern with large bearing surfaces and shall not twist or turn under the action of the gate.

d. **Latches** shall be forked type and shall be arranged for padlocking, with the padlock accessible from both sides of the gate.

e. **Stops** shall consist of a roadway plate with anchor set in concrete and arranged to engage the plunger.

### 13.3.9 Security Fence

Materials for security fencing shall conform to the contract specific specifications and the following special items.

a. **Barbed Wire Support Arms** shall be galvanized steel and shall extend at an angle of approximately 45°, and shall be fitted with clips or other means for attaching three strands of barbed wire. The top wire shall be approximately twelve inches horizontally from the fence line and the other wires spaced uniformly between the top of the fence fabric and the outside strand. The barbed wire support arm shall be of sufficient strength to withstand a weight of 200 lbs. applied at the outside strand of barbed wire.

b. **Barbed Wire** shall consist of two strands of 12-1/2 gage steel wire with 14 gag; 4 point barbs spaced not more than 5 inches apart. All wire shall be zinc coated with a minimum coating of .80 ounces per square foot of surface area on 12-1/2 gage wire and .60 ounces per square foot of surface area on 14 gage wire.

## 13.4 Installation or Replacement of Fence

### 13.4.1 General Constructions

The Contractor shall perform such clearing and grubbing as may be necessary to construct or replace the fence to the required grade and alignment as shown on the Plans. Where specified on the plans or ordered by the Construction Project Manager, a one (1) foot wide concrete mowing strip shall be provided for the entire length of the fence. The fence shall be located along the center line of the mowing strip.

At locations where breaks in a run of fencing are required, appropriate adjustments in fence alignment and/or post spacing shall be made to satisfy requirements of conditions encountered.

### 13.4.2 Posts

Posts shall be held in proper position by secure bracing until such time as the concrete has set sufficiently to hold the posts. Materials shall not be installed on posts, or stress placed on guys nor bracing set in concrete until the concrete has developed enough strength to withstand the stress.

All line, terminal, corner and gate posts shall be of the size specified. Posts shall be of the proper length to accommodate full height of fabric as shown on the Plans and provide for footing to the depth required. All posts shall be set plumb and firmly in concrete footings with a maximum spacing of 10 feet between posts. Concrete footings shall be domed to shed water. All terminal, corner and gate posts shall be braced with horizontal braces and diagonal truss rods.

All posts shall have a post cap of heavy galvanized malleable iron or pressed steel.

The tops of all posts shall be set to the required grade and alignment.

### 13.4.3 Fabric

Fabric shall be firmly attached to the posts and braces. All wire shall be stretched taut and be installed to the required spacing. The completed fence shall be plumb and in straight alignment, firmly wired to prevent sag or looseness.

The fabric shall be the full height as shown on the Plans. Fabric shall be attached to the inside of posts with the wires or fabric clips, spaced at one (1) foot intervals on all posts and six (6) ties to each horizontal rail. Top and bottom selvages shall be knuckled for residential chain link fences and security fences.

### 13.4.4 Top Rails, Braces, Fittings, Ties, Tension Wire, Tension Bars

These items shall be the same lengths, dimensions and quantities as those of the existing fence or as shown on the Plans. The existing items shall be removed and replaced and where new items need to be purchased, the quality shall be equal to or better than the existing. The top rail shall extend through all line posts to form a continuous brace from end to end of each stretch of fence, be securely fastened at the end of each run, and have joints made with expansion sleeve couplings not less than 5 inches long.

### 13.4.5 Gates

Gates hall be constructed at or relocated to locations shown on the plans. Any materials not up to standard shall be replaced with materials of equal or better quality than the existing. Gates shall be installed to swing horizontally in true vertical plane and shall be provided with offset hinges to permit 180 degree swing.

Gates shall be installed so that they cannot be removed without disassembly of the hardware. Hardware attachment bolts shall be preened so that removal will be difficult.

Gates shall have all necessary latches, straps, locking bars and locking devices. Fabric shall be tightly stretched and securely fastened to gate frame with the proper number of bands, clips or tie wires and stretch bars shall be installed one (1) inch shorter than the full height of the fabric. Gates shall be free from sag or twist. Joints between frame members shall be made by welding or by means of heavy fittings and shall be rigid and water tight.

If welding is employed, it shall conform to the requirements of the American Welding Society. A1l welds shall be ground smooth. When the spelter coating has been burned by welding, the surface of the welded connection shall be thoroughly cleaned by wire brushing and all traces of the welding flux and loose or cracked spelter removed. The cleaned areas shall then be painted with two coats of zinc oxide-zinc dust paint conforming to the requirements of Federal Specification MIL-P-15145, latest revisions. The paint shall be properly compounded in a suitable vehicle in the ratio of one part zinc oxide to four parts zinc dust, by weight.

A method to padlock all gates shall be provided. Each padlock shall be provided with two keys.

**End of Specification**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management Standard Construction Specification

## 14.0 Removal and Disposal of Construction Debris and Contaminated Materials

### 14.0.1 General

The Contractor shall be required to transport all non-hazardous solid waste and construction debris to the Denver Arapahoe Disposal Site (DADS) landfill, in accordance with Executive Order 115. Only approved haul routes around DADS may be used (Contractor must contact landfill directly for these routes). Landfill fees, gate fees and applicable State surcharges will be paid for by the City and County of Denver, Wastewater Capital Projects Management. The Contractor is responsible for any special handling charges imposed by Waste Management at DADS.

All costs associated with loading, hauling, and disposal of construction debris and/or contaminated soils at DADS shall be considered included within the unit price bid for construction of each section of sewer, the associated structures, laterals and appurtenances unless provided for elsewhere in the Contract Documents. The City and County of Denver, Wastewater Capital Projects Management will not provide hauling tickets nor cover the fees associated with disposal of recyclable materials at the DADS landfill. Recyclable materials shall include: concrete, asphalt, clean soil, and any other materials generated onsite with a monetary value. No payment will be made for the loading, hauling and/or processing of recyclable materials.

If the excavated soil appears to be re-usable, and the Contractor wishes to dispose of this material at a location other than DADS, then the Contractor shall obtain City Project Manager approval, obtain an environmental consultant approved by the City and County of Denver Department of Environmental Health at the Contractor's expense, and follow the minimum recommendations below or as required by the City Project Manager.

The Contractor shall analyze the following list of constituents as a means of determining whether the soil is suitable for re-use: Volatile Organic Constituents (VOCs), Semi-Volatile Organic Constituents (SVOCs), Pesticides, Herbicides, PCBs, Total Petroleum Hydrocarbons (TPH), 8 RCRA Metals, and Asbestos. Depending on the location of the project, additional constituents may be required for testing.

Soil samples shall be collected from the stockpiles every 500 cubic yards. Samples shall be collected by environmental professionals, evaluating the results with respect to

residential standards, and only re-using soil that meets residential standards. Depending on the location of the project, a more strict sampling/testing frequency may be required. If the soil is determined to be re-usable, the Contractor transferring the soil and the non-City entity which takes possession of the soil must sign an agreement, approved by the City Attorney's Office which will release the City from liability.

If the waste material cannot be accepted at DADS, the Department of Environmental Health has contact information regarding landfills which may accept the waste material. Landfill fees at these facilities will be paid for by the Contractor.

The work required for this section shall consist of exploratory investigation, testing, identification, removal and disposal of construction debris and contaminated materials associated with the construction of pipelines, box culverts, gulches, open channels, ponds and associated structures and appurtenances.

### 14.0.2 Contaminants

The contaminants required to be removed or treated may or may not be known at the time of award of the work. Contaminated soils may be encountered and have to be identified on the job site. Potentially and/or suspected contaminated sites of known and unknown origin may be listed at the end of the Contract Documents and are identified on the plans.

### 14.0.3 Environmental Consultant

The City and County of Denver, Wastewater Capital Projects Management will provide an Environmental Consultant to help identify, monitor and document and provide other assistance as required.

### 14.0.4 Contaminated Soil Identification

1. Remediation of soils with unknown contaminants will be performed by the Contractor as described herein or as directed by the Construction Project Manager with recommendations by the Environmental Consultant. Materials visibly contaminated or having field instrument (e.g. PID, FID, OVA, etc.) readings above established action levels will be excavated, or otherwise loaded for transport to an approved disposal facility or to a temporary storage area designated by the Construction Project Manager. Appropriate safeguards will be utilized to prevent or limit exposures to stored materials.

2. The stored material will be tested at the contractor's expense for contaminants. As dictated by the proposed disposal facility the parameters to be tested for will be based on the historical use of the area and the requirements of the facility used for disposal. The material will not be stored for more than 90 days.

3. Material identified as hazardous or non-hazardous will be disposed of in a manner consistent with current established federal, state and local regulations for waste material. A hazardous waste contractor shall be required for handling of hazardous material.

4. Materials with contaminants below action levels may be used for fill on-site or transported off-site. Materials with contaminants not specifically regulated will be disposed of as directed by the Construction Project Manager.
5. The owner of any contaminated material will be the City and County of Denver, for the purposes of permits and disposal only.

### 14.0.5 Submittals

The Contractor will submit the following information for approval prior to beginning work or as otherwise specified:

1. ***Health and Safety Plan*** meeting OSHA requirements of CFR 1910.120. The Health and Safety Plan for remediation work shall address the protection of health, safety and response to contingencies which could occur during remediation. It shall describe known and potential hazards related to remediation work activities. It shall include descriptions of construction and decontamination procedures for personnel and equipment. The plan will only be implemented if contaminated materials are encountered.

   The contractor shall provide a project Health and Safety Officer. The project Health and Safety Officer shall be qualified by certification or training in the area of Industrial Hygiene or Hazardous Waste Health and Safety. The officer will have the authority and knowledge to design and implement a site-specific Health and Safety Plan and Hazardous Communication Program and to verify compliance with applicable safety and health requirements.

   All persons working in and entering the areas designated by the Health and Safety Officer to be hazardous due to the presence or potential of contacting hazardous substances shall have previously received training according to the requirements in the Hazardous Waste Operation Regulations (OSHA 1910.120).

   General site workers involved in construction activities in the designated areas shall receive 40 hours minimum training in the health and safety of hazardous waste; site workers and workers who are on-site occasionally to perform a single specified task shall receive 24 hours minimum of training. Personnel overseeing the health and safety of other workers shall receive an additional eight hours of supervisor training in that capacity. Documents certifying that the training requirements have been met and that all personnel are current on their refresher training shall be present at the project office or trailer or otherwise be made available to the project Health and Safety Officer and/or the Construction Project Manager.

   In addition to the personnel working in the designated hazardous waste sites, all personnel working on this construction project shall be involved in the communication and understanding of potential hazards through a Hazardous Communication Program in accordance with the provisions of OSHA regulation 29 CFR 1910.12. This program shall include all elements of the regulations including training of personnel, compilation of Material Safety Data Sheets (MSDS), labeling, and placarding of hazardous chemicals, hazard identification of the construction area and monitoring of all activities to determine if new hazards are posed to the employees.

Reduced levels of training are to be identified for persons performing short duration or non-intrusive activities in areas in which the concentrations of or the potential for exposures to hazardous chemicals are reduced or shown to be minimal in the designated areas.

The training of employees in the non-designated areas are covered in the Hazard Communication Program for this phase of construction activities. This training shall include the following elements:

1. Methods of detecting hazardous chemicals.
2. Physical and health hazards of chemicals in the area.
3. Personal protective measures that are implemented to protect the employees.
4. Details of the Hazardous Communication Program such as emergency response procedures and location of the Material Safety Data Sheet.

2. Material Management Plan

***A. Sampling and Analysis Plan*** (SAP) which describes methods of sampling, testing and analysis to obtain additional data on chemical constituents of the various materials. The Environmental Consultant will prepare this plan which shall be reviewed by all parties prior to the commencement of this aspect of construction. The purpose of the SAP will be to provide a basis for classifying a material as hazardous or non-hazardous and to provide confirmation and documentation of completed remediation work as it relates to project construction.

***B. Product Data:*** Submit the following as part of a Pre-Construction Submittal Package.

1. Material list for items proposed to be provided under this section.
2. Certificates signed by the materials producer and the subcontractor stating that all material, meet or exceed the specified requirements.

3. ***Materials Samples***: Submit adequate and representative samples of the backfill material to the Testing Laboratory for pre-construction tests.
4. ***Test Reports***: Submit at least one week prior to beginning of the work of this section the test reports for the pre-construction testing performed by the Testing Laboratory.
5. ***Disposal Profile Sampling***: If contaminated soil is known or believed to exist in the project alignment, the contractor shall be responsible for waste classification, profiling and manifesting. This shall be done in advance of the construction phase.

The material management plan is a dynamic document. It shall be the contractor's responsibility to coordinate revisions as necessary based upon changing site conditions.

## 14.0.6 Materials

### 14.0.6.1 Backfill Materials

Materials generated on-site or if imported shall be predominantly granular non-expansive soil free from roots and other unsuitable material meeting the requirements of Section 5.0 of these Standard Construction Specifications. The Contractor shall try to generate all backfill materials on-site. Imported fill materials will only be allowed in cases where sufficient quantities of suitable backfill material cannot be generated on-site.

### 14.0.6.2 Backfill of Excavated Areas

Excavated areas outside the vertical limits of construction will be backfilled and regraded using uncontaminated soils. Compaction requirements are described in Section 5.0. The fill materials will be from on-site stockpiles as described above. The surface will be regraded to match natural contours and drainage patterns and the areas to be reseeded or otherwise restored to match existing conditions prior to the contaminated material excavation.

## 14.0.7 Execution

### 14.0.7.1 Removal

1. Contaminated materials will be removed to a depth of 3 feet below construction within the horizontal limits of construction at the direction of the Construction Project Manager. If the contamination extends less than three (3) feet, a minimum thickness of three (3) inches of soils below the contaminated materials will be removed, loaded, transported, and disposed of.

2. Upon completion of initial contaminated material removal, the excavated area will be inspected by the Construction Project Manager and or the Environmental Consultant and additional materials will be removed as deemed necessary based on visual observations, instrument readings, and the results of initial and confirmatory laboratory testing.

### 14.0.7.2 Disposal

The contaminated soils requiring disposal will be transported to a land fill approved to accept the waste. The landfill will be approved by the Construction Project Manager prior to transport and landfill fees will be paid for by the Contractor. A payment item is provided for this in the Bid Form and Submittal Package. The Denver Arapahoe Disposal Site (DADS) and the Conservation Services Inc. facilities are licensed to accept non-hazardous waste. Facilities in Utah and Texas are licensed to accept hazardous waste.

### 14.0.7.3 Confirmation Sampling

1. Upon completion of the contaminated material removal in each area, a confirmation soil sample will be collected by the Environmental Consultant in accordance with a Sampling and Analysis Plan (SAP) and the samples shipped to an approved testing laboratory for analysis.

2. The SAP will be prepared by the Environmental Consultant prior to construction and should contain methods of sampling and analysis to confirm if a material is hazardous or non-hazardous and that remediation work has been completed. The sampling will either be from a discrete location or composited, if appropriate. Duplicate and blank samples will be collected for laboratory quality assurance at the frequency described in the SAP. All samples will be labeled and sealed and appropriate chain-of-custody and shipping procedures followed.

**14.0.7.4 Field Testing**

1. The Testing Laboratory as designated by the Environmental Consultant, will perform tests and report results as approved by City'sDepartment of Environmental Health (DEH) and the City and County of Denver, Wastewater Capital Projects Management on soil samples obtained by the Construction Project Manager. The City's Department of Environmental Health may act as internal consultant to the City and County of Denver, Wastewater Capital Projects Management as needed.
2. Obtain the Construction Project Manager's approval of subgrade materials with respect to the City and County of Denver, Wastewater Capital Projects Management requirements before subsequent construction is performed.
3. Notify the City and County of Denver, Wastewater Capital Projects Management and the Environmental Consultant of conditions contrary to accepted requirements.
4. The Colorado Department of Hazardous Wastes Management Division (CDHWMD) is the state's agency for reviewing cleanup measures. Since the contaminants and their levels are unknown and the Colorado Department of Hazardous Wastes Management Division does not have specific regulations for cleanup of materials that may be found, they will only "suggest" or review cleanup measures. They will in some cases provide a letter suggesting that they concur with the levels selected but make no commitments regarding long-term liabilities. They will maintain a file on each project if the information is provided to them. The following cleanup levels will be used for the site, but may be modified by CDEVS or CDHWMD.
   - ❑ Petroleum Product – 100 ppm TPH, 20 ppm BTEX (RACI)
   - ❑ Metals (CERCLA, Ep-Tox or TCLP levels)
   - ❑ Volatile and semi-volatile organics – 10 ppm total
   - ❑ PCB's – 10 ppm (TSCA regulation)

Cleanup levels are determined on a case-by-case basis for contaminants not specifically regulated under Resource Conservation Recovery Act or Toxic Substances Control Act. The cleanup will be implemented using visual observation of stained areas and an established action level for PID readings in a headspace test of 50 ppm for petroleum contaminated soils and 10 ppm for organic contaminants. If either of these conditions are met, the material will be considered contaminated and stockpiled for sampling, analysis and appropriation of disposal or potential reuse.

5. Test Report: At least once a week prior to the work of this Section, submit test reports for the pre-construction testing performed by the Testing Laboratory.

**14.0.7.5 Protection of Storm and Sanitary Sewers**

1. Concrete Cut-off Walls as shown in figure 2of the City and County of Denver, Wastewater Management Division, Standard Detail for Trenching and Bedding (S-301.1) shall be constructed upstream and downstream of the contaminated area to prevent migration of hazardous material from off-site areas.

**End of Specification**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management
# Standard Construction Specification

## 20.0 Grass Sodding

### 20.0.1 General

This item shall consist of placing grass sodding and fertilizing in conformity with the lines, grades and cross sections shown on the plans, stakes established by the Construction Project Manager, and in accordance with these Standard Construction Specifications.

The equipment and methods described in these Standard Construction Specifications may be modified where it is established to the satisfaction of the Construction Project Manager that the resultant product is equivalent to that specified herein.

### 20.0.2 Materials

#### 20.0.2.1 Sod

Sod shall be Kentucky bluegrass and shall be approved by the Parks and Recreation Department before placement. At least 99% of the plants in the sod shall be of the variety specified. The sod shall be materially free from weeds or undesirable plants and stones larger than 1 inch in diameter. Sod shall be nursery grown and shall be mowed to a height not to exceed 2 inches before lifting and shall be of a uniform thickness with not over 1-1/2 inches soil or less than 1 inch of soil.

Delivered sod shall not contain more than 5% broken rolls. Sod shall be laid within 24 hours from the time it is lifted from the field.

Sod that has become moldy, withered, or yellow from storage or white from drying will be rejected at the time of planting. Rejected sod will not be counted for payment.

#### 20.0.2.2 Fertilizers

The area to be sodded shall be fertilized as follows:

a. Well rotted cow manure shall be roto-tilled into the topsoil prior to sod placement.

b. In general commercial fertilizer consisting of 20% nitrogen, 20% available phosphoric acid and 10% water soluble potash is acceptable. Commercial fertilizers shall be applied after the sod is laid and shall be a complete formulation or organic base, granular and free flowing.

#### 20.0.2.3 Topsoil

Topsoil may be selected from the material excavated at the job site by the Construction Project Manager and placed where needed to provide a 4inch minimum friable, fertile loam root-moisture zone. During the excavation operation, the acceptable on-site topsoil shall be removed and stockpiled in the area. Upon completion of the construction, the topsoil shall be placed to the correct line and grade in all areas requiring sodding and seeding. Topsoil will not be required in areas of special slope protection noted on the plans, in paving areas or other structures.

In the event the topsoil available from project excavation is insufficient, in the judgement of the Construction Project Manager, the Contractor shall import suitable topsoil in conformance with the select material requirements in section 5.0 of these Standard Construction Specifications. Payment for on-site or imported topsoil shall be as noted in the Measurement and Payment Section of these Standard Construction Specifications.

### 20.0.3 Construction

#### 20.0.3.1 Time

The Contractor shall place the sod between March 1 and November 1 of the Calendar year of construction. No sod shall be laid on frozen soil.

#### 20.0.3.2 Site Preparation

The area to be sodded shall be cleared of all stones, roots, wood, weeds, and any other materials that may hinder proper grading, tilling, sodding, or subsequent maintenance, operations and shall be smooth before any sod is laid.

After the cow manure has been roto-tilled into the topsoil as specified in Subsection 20.3.4 below, fine grading shall be performed to insure reasonable grades and alignments per the grade stakes. Where no grade stakes are shown, areas shall be smooth and of continual grade between control points, such as walks and curbs. Areas of settlement shall be filled with topsoil and properly rolled to insure a firm bed true to the proposed grades. Areas of compacted soil, which are, in the judgment of the Construction Project Manager, too hard to serve as suitable subgrade, shall be scarified to a depth of six inches, and leveled and rolled.

After the fine grading operations have been completed, the entire area to be sodded shall be rolled with a 100 pound roller prior to sod placement.

#### 20.0.3.3 Sod Placement

Sod shall be laid on a smooth, firm earth bed with staggered, tight joints. Care should be" exercised to avoid air voids along the joints and at end sections. Sections of sod that leave more than 1/2 inch joints opening shall be filled with a screened topsoil. Exposed edges shall be mounded with topsoil.

The sod shall be laid with staggered joints and shall run parallel to a 90-degree angle to the slope of the ground. If the slope is steeper than 2:1, the prepared sod bed shall be lightly and sufficiently watered prior to placement of the sod.

All sod laid slopes within 4 vertical feet of the flow line of open channels, gulches, etc. shall be held in place with 12 gauge u-shaped metal pins, minimum one inch in width, eight inches long driven flush with the top of the root zone. Prior to pinning, a 12" wide strip of 20 gauge 2" galvanized wire netting shall be placed at each corner and one in the center of each perpendicular edge (3 pins/le" wide roll). Care shall be taken to insure that each pin will secure the wire netting to the sod. Pins shall be driven at intervals not greater than one foot from beginning to end of the roll and at each grade change in the slope. All sod shall be laid parallel to the center line of the channel.

#### 20.0.3.4 Fertilizer Placement

Fertilizing accomplished in a two step operation as follows:

a. Cow manure shall be spread over the surface of the ground of the areas to be covered at the minimum rate of one (1) cubic yard per thousand (1,000) square feet. The areas shall then be thoroughly roto-tilled to a depth of from a minimum of 4 inches to a maximum of 6 inches until no manure appears on the surface.

b. Commercial Fertilizer shall be uniformly applied after the sod has been laid at the rate of 10-pounds per 1,000 square feet of coverage or as recommended by the fertilizer manufacturer. The method of application shall be subject to approval by the Construction Project Manager.

#### 20.0.3.5 Maintenance

The Contractor shall be responsible for watering and mowing the sodded areas. Watering shall be performed periodically to insure a uniform root extension into the bed root--moisture zone. Mowing shall be performed to limit maximum grass height to three (3) inches and cut length of one and one-half (1-1/2) inches.

The maintenance period for sod shall continue for 90 days after notification in writing to the Construction Project Manager of the completion of sodding and the owner’s initial approval. During this 90-day period the sod shall be kept growing and in place, and any movement or dead grass shall be replaced to the satisfaction of the Construction Project Manager. During this period, the sod's condition shall show normal to good progress so as to constitute an acceptable planting by the owner's representative. Watering shall be as required. If the planting within the reasonable care of the contractor does not show acceptable progress during this period, the areas affected shall be resodded, fertilized as required and growth progress repeated until results are obtained. This reworking shall be at the contractor's expense. If the planting is damaged or otherwise hindered due to causes beyond the contractor's control such as inclement weather or vandalism, the contractor shall rework the planting according to the item in the Measurement and Payment Section of these Standard Construction Specifications.

**End of Specification**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management
# Standard Construction Specification

## 21.0 Sprinkler Systems

### 21.0.1 General

This section outlines the guidelines and requirements required to construct irrigation distribution lines and sprinkler systems required to complete construction per the Contract Documents.

The work shall include the installation of all line pipes, fittings, valves, and blow-offs, drain valves, controllers, electrical control and supply wires, all fittings and tapped couplings necessary for the connection of the lateral sprinkling system lines to the distribution system lines, etc. Also included will be the plugging and blocking of the cut ends of disconnected existing lines if any, connection to existing park water lines and/or city water mains, meter installation, and all fittings, valves, accessories, etc. necessary for these connections.

The pipe shall be installed to the prescribed lines and grades. All work required for the construction of the water lines, accessories and appurtenances thereto, including excavation, trenching, concrete work, pressure tests and miscellaneous items of work covered by the Plans and these Standard Construction Specifications shall be preformed.

### 21.0.2 Proposed Substitutions

Substitutions which will result in any changes in layout, installation, or coverage as designed and shown on the Plans and specified herein shall be accompanied by plans clearly showing the proposed installation including but not limited to materials, spacing, precipitation and scheduling. Such plans must be approved by the Construction Project Manager before work is to start.

### 21.0.3 Qualifications of Installers

The sprinkler system contractor shall have had considerable experience and demonstrated ability in the installation of sprinkler irrigation systems of this type. All work shall be installed by skilled persons proficient in the trades as required, in a neat, orderly and responsible manner with recognized standards of workmanship. At least one person shall be present at all times during the execution of this work who shall be thoroughly familiar with the type of materials being installed and the material manufacturers' recommended methods of installation and who shall direct work performed under this section.

## 21.0.4 Staking

All necessary staking for construction of the sprinkler system shall be done by the Contractor and checked by the City before excavation or installation is begun.

## 21.0.5 Material

Unless otherwise noted or approved, all materials shall be of the type as shown on the Plans and shall conform to the following specifications. Asbestos Cement Pipe shall not be used.

### 21.0.5.1 Plastic Pipe

**1. Rigid Plastic Pipe**

Shall be polyvinyl chloride (PVC) and shall conform to all requirements of Product Standard PS-22 or ASTM D-2241 or PVC 1120 (Type I), SDR-21 (Class 200). Pipe shall be National Sanitation Foundation (NSF) approved. Fittings shall be socket type PVC schedule 40 meeting all requirements of ASTM D-2466 and D-1784. Solvent used for joining pipe & fittings shall meet all requirements of ASTM D-2564 Rigid plastic pipe shall not be threaded except as noted below.

**2. Riser and Swing Joint Nipples**

Shall be PVC Schedule 80 threaded pipe and shall conform to all requirements of Product Standard PS-21 or ASTM D-1785. Fittings shall be threaded PVC Schedule 40 meeting all requirements of ASTM D-2466 and D-1784. Use Teflon tape on all threaded joints.

**3. Flexible Plastic Pipe**

Shall be polyethylene (PE), 80 psi rated and shall conform to all requirements of Product Standard PS-11 or ASTM D-2239 or PE-2306, SDR-15. Pipe shall be National Sanitation Foundation (NSF) approved. Fittings shall be insert type PVC meeting requirements of ASTM D-2609. Clamps shall be all stainless steel. Flexible plastic pipe shall not be used in any continuous pressure application.

**4. Markings**

All plastic pipe shall be continuously & permanently marked with the manufacturers name, pipe size, schedule number or SDR number, type of material and code number.

### 21.0.5.2 Copper Pipe

Copper pipe shall be type K copper, ASTM B-88. Fittings for copper pipe shall be wrought copper or cast bronze, 150 psi class. Joints shall be solder joints with
95-5 tin-antimony.

### 21.0.5.3 Galvanized Steel Pipe

Galvanized Steel Pipe shall be schedule 40 steel. Fittings shall be malleable galvanized iron, screwed pattern, 150 psi class. Galvanized pipe and fittings shall conform to ASTM A-120. Buried galvanized pipe except risers and casing shall be wrapped with heavy craft paper applied with hot asphalt. Wrap on fittings shall be glass cloth. Use Teflon tape on all threaded joints.

#### 21.0.5.4 Gate Valves

Gate Valves shall be Class 125 (200 psi w.o.g.), shall open by turning to the left, shall have non-rising stems and shall have a clear waterway equal to the full nominal diameter of the valve. Gate valves (not buried) shall have solid wedges, union bonnets and shall comply with the following materials specifications: Handwheel Nut -Bronze ASTH B-16. Stem -Silicon Bronze ASTH B-371 Alloy A (Rod) or ASTH B-198 Alloy 13B; Packing -Teflon impregnated Asbestos; Packing Gland -Bronze ASTM B-62 or B16 ; Packing Nut, Stuffing Box, Bonnet, Union Nut, Body Wedge and Wedge Holder- Bronze ASTH B-62. These valves shall conform to Federal Specification WW-V-54C Class A, Type I. Buried gate valves 2 and larger shall conform to AWWA C-500, with double-disk wedges and 0-ring seals.

#### 21.0.5.5 Valve Boxes

Unless shown or noted otherwise, all underground valves not located in pits shall have cast iron boxes with flared bases. Valve boxes shall be 2 piece screw type.

#### 21.0.5.6 Angle Valves

Angle Valves shall be rated at 150 psi or more, and shall open by turning to the left. Angle valves shall be designed for above or below ground installation with suitable cross wheel for operation with key. Valves shall have removable bonnet and stem assembly with packing gland nut and with replaceable seat washers. Angle valves shall be heavy pattern brass construction of the make and size shown on Plans or approved equal.

#### 21.0.5.7 Drain Valves

Drain Valves shall be rated at 150 w.o.g. or more, shall open by turning to the left, and shall be the make and size as shown on Plans or approved equal. Unless shown or noted otherwise, drain valves shall be 3/4". If valve discharge is not downward, valves shall be provided with elbow for downward discharge.

#### 21.0.5.8 Quick Coupler Valves

Quick Coupler Valves shall be 2 piece all brass construction of the make and size as shown on Plans or approved equal. Quick coupler keys and hose swivels shall be provided as shown on the Drawings.

#### 21.0.5.9 Manual Control Valves

Manual Control Valves shall be either angle valves as described herein or Class 125 bronze globe valves meeting requirements of Federal Specification
WW-V-5ld Class A, Type I. They shall be of the make and size as shown on Plans or approved equal. Valves shall be key operated.

#### 21.0.5.10 Electric Control Valves

Electric Control Valves shall be brass construction, normally closed, 24 volt AC electrically operated globe valves with slow-opening and slow-closing devices. They shall be of the make, model numbers, and size as shown on the Plans or approved equal.

#### 21.0.5.11 Valve Keys

Two valve keys shall be provided for each type key operated valve installed.

#### 21.0.5.12 Unions

Brass unions shall be provided where shown and/or required to allow removal of all control valves.

#### 21.0.5.13 Valve Pits

Valve Pits shall be constructed as shown in the Valve Pit and Piping Detail. of these Standard Construction Specifications. Concrete shall conform to the requirements of Item 12 of the Standard Construction Specifications. Precast concrete rings or fiberglass pits and their respective covers may be submitted for approval by the Construction Project Manager.

#### 21.0.5.14 Automatic Controllers

Automatic Controllers shall be 110 volt input, 24 volt AC value output with both controller and control valves of the same manufacturer, designed to operate as a unit or as otherwise shown on the Plans. Controllers shall be capable of operating the number of valves shown on the Plan and shall be pedestal mounted unless shown otherwise on the Plans. Controllers shall have a 2 hour clock, 14 day calendar wheel and individual station timers from 0 to 30 minutes. Manufacturer and model numbers shall be as shown on the Plans or approved equal. Unless located inside of a building, the controller shall be enclosed in an approved separate weatherproof, vandal resistant cabinet. A lock and 3 keys shall be furnished with each unit.

#### 21.0.5.15 Sprinkler Heads

Sprinkler Heads of the type and size as shown on the Plans shall be furnished and installed as herein specified.

#### 21.0.5.16 Electric Control Wiring

Electric Control Wiring shall be No.14 direct burial type U.F. cable or larger if required to operate the system as designed. Follow the recommendations of the controller manufacturer for sizing wire.

### 21.0.6 Installation

#### 21.0.6.1 General

Prior to any work described in this section, the Contractor shall carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. The Contractor shall verify that the irrigation system can be installed in strict accordance with all pertinent Permits, codes and regulations, the original design, the referenced standards and the manufacturer recommendations. All necessary field measurements shall be made by the Contractor to ensure precise fit of items in accordance with the original design.

#### 21.0.6.2 Excavation

Plastic pipe up to 2" in diameter may be direct bore if approved by the Construction Project Manager. All other lines shall be installed in open cut trenches. The width of the trench in which the pipe will be placed shall be sufficient to allow thorough tamping of suitable backfill material under, around and over the pipe. All excavated material shall be deposited at least two feet away from any trench side. Tunneling will be permitted only where pipe

must pass under any obstruction which cannot be removed. In backfilling the tunnel, the final density of the backfill must match that of the surrounding soil. It shall be acceptable to use a casing of suitable diameter which shall be installed first by tunneling or jacking, and the pipe shall then be laid through the casing, observing the same precautions as though it were installed in open trench. Any trench deeper than 6 feet shall be adequately shored and/or braced for safety considerations. If ground water is encountered during trench excavation above the elevation of the bottom of the pipe bell, such water shall be removed until the pipe has been installed and the trench backfield. The Contractor shall take all necessary measures to insure that no ground water enters the pipe.

#### 21.0.6.3 Piping and Control Wiring Depth

All lines shall be installed with the following minimum depths of cover unless noted otherwise on the drawings:

a. Pressure Lines 30”

b. Distribution Lines (Laterals) 6” to 18”

c. Lines to Drinking Fountains 30”

d. Lines to Quick Couplers 30”

e. Electrical Lines 24”

#### 21.0.6.4 Piping

All pipes shall be installed according to the following specifications.

**1. Rigid Plastic Pipe**

Exercise care in handling, loading unloading and storing plastic pipe and fittings; store plastic pipe and fittings under cover until ready to be installed; transport plastic pipe only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load. Repair all dented and damaged pipe by cutting out the dented or damaged section and rejoining with a coupling. In jointing, use only the specified solvent and make all joints in strict accordance with the manufacturer's recommended methods; give solvent welds at least 15 minutes set-up time before moving or handling; and 24 hours curing time before filling with water. If manufacturer’s recommendations do not cover all aspects of jointing, the recommendations of Plastics Pipe Institute Technical Report TR10 shall be followed. Piping shall be snaked in the trench, centerload the pipe with a small amount of backfill to prevent arching and deflection under pressure. All piping shall be sloped to drain and shall not be installed when air temperature is below freezing.

**2. Flexible Plastic Pipe**

Shall be installed in strict accordance with the manufacturer’s recommendation. If the manufacturer’s recommendation does not cover all aspects of installation the recommendations of the Plastics Pipe Institute Technical Report TR8 shall be followed. Piping shall be sloped to drain. Saddle tee connections shall not be used. Pipe shall not be installed when air temperature is below freezing.

**3. Copper Pipe**

Shall be installed according to manufacturer's recommendations. When copper pipe is jointed to any metal pipe or equipment other than copper it shall be by means of dielectric unions. Pipe shall be sloped to drain.

**4. Galvanized Steel Pipe**

Make all cuts in galvanized pipe square. Cuts shall be thoroughly reamed with all rough edges and burrs removed. Use joint tape on male threads only. Pipe shall be sloped to drain.

### 21.0.6.5 Valves and Valve Boxes

Installation of Valves and Valve Boxes shall be in accordance with the following:

**1. Gate Valves**

Shall be installed where shown on the Plans and shall be set plumb. Gate valves 6. and larger shall be anchored to a block of concrete to insure stability of the valve in an upright position. Anchor valve in such a manner that it may be removed and re-installed without breaking the concrete block.

**2. Valve Boxes**

Shall be installed where shown on the Plans and shall be set plumb. Gate valves 6” and larger shall be anchored to a block of concrete to insure stability of the valve in an upright position. Anchor valve in such a manner that it may be removed and re-installed without breaking the concrete block.

**3. Angle Valves and Drain Valves**

Shall be installed where shown on the Plans and also at other low points in the system as necessary to insure complete drainage of the system. Each valve not in a valve pit shall be provided with a C.I. Valve box with the lid set flush with the ground. Drain valves set below valve pits shall have PVC sleeves for key operation. Sleeves shall project a minimum of 12" from the pit bottom and shall have removable caps. A drainage sump shall be provided for each drain valve and shall contain a minimum of 4 cubic feet of gravel. See 'Valve & Pit Piping Detail" of these Standard Construction Specifications.

**4. Quick Coupler Valves**

Shall be installed where shown on the plans and as shown in "Valve Pit & Piping Detail". Risers for quick couplers shall be schedule 40 galvanized. In lawn areas install quick coupling valves using a double swing joint top flush to final grade. In planting areas install with top 2" above grade.

**5. Manual Control Valves**

Shall be installed where shown on the Plans and in accordance with manufacturer's recommendations. All manual control valves shall be in valve pits or valve boxes.

**6. Electric Control Valves**

Shall be installed as shown in "Valve Pit & Piping Detail”. Valves shall be installed in such a way that they are accessible for repairs and/or removal.

#### 21.0.6.6 Valve Pits

Install valve pits where shown on the Plans and as shown in “Valve Pit & Piping Detail”.

#### 21.0.6.7 Automatic Controllers

Install controllers where shown on the Plans and in accordance with the manufacturer’s recommendations and, if pedestal type, as shown on "Controller Pedestal Detail” of these Standard Construction Specifications.

### 21.0.7 Flushing

Before sprinkler heads are set, the lines shall be thoroughly flushed in order to make sure that there is no foreign matter in lines which could cause stoppage of the sprinklers. When the system has been fully completed, it shall be tested and the operation thereof demonstrated to the City.

### 21.0.8 Inspection

No work shall be covered up or enclosed until it has been inspected, tested and approved by the City. The Contractor shall thoroughly clean, adjust and balance all systems. The Contractor shall demonstrate the entire system to the City proving that all remote control valves are properly balanced, that all heads are properly adjusted for radius and arc of coverage and that the installed system is workable, clean and efficient.

### 21.0.9 Testing

The Contractor shall furnish all necessary testing equipment and personnel and test the system as follows:

a. make all necessary provisions for thoroughly bleeding the line of air.

b. Before testing, fill the line with water for a period of at least 24 hours.

c. After valves have been installed, test all live water lines for leaks at a hydrostatic pressure of 150 psi for a period of two hours with all couplings exposed and with all pipe sections center loaded.

d. Correct all leaks, and replace damaged or faulty pipe and retest until accepted by the City.

### 21.0.10 Backfilling

Trenches shall be carefully backfilled with suitable materials free from clods of soil or stones larger than three inches (3.) in maximum dimension. Deposit the backfill materials equally on both sides of the pipe in 6" layers and compact thoroughly. Puddling or "ponding" shall be required. An excess of water shall be avoided in order to prevent disturbance of the earth under and around the pipe and also to prevent undue pressure upon the pipe. Likewise, the amount of water used shall be controlled so as not to risk “floating" the pipe out of position. Adequate dikes shall be constructed along the trench to retain and guide the water.

When jetting is used, jets shall be of an approved design and of sufficient length to reach the bottom of each layer and the water supply shall be continuous. All costs incurred in

getting the water to the point of use for the above purposes shall be borne by the Contractor. Excavated material will generally be considered satisfactory for backfill purposes. All backfill material shall be free from rubbish, vegetable matter, frozen materials, or stones larger than three inches (3.) in maximum dimension. Any material not suitable for backfill or not used shall be removed from site by the Contractor. Backfill shall not be done in freezing weather except with written approval from the City. All trenches shall be left slightly mounded to allow for settlement after the backfilling is completed. The site of the work shall be continuously cleaned up of excess and/or waste materials as the backfilling progresses and shall be left in a neat and workmanlike condition to the satisfaction of the City. Any undue settling which results within one year after final acceptance of work shall be corrected by the Contractor and at the Contractor's expense including resurfacing as required.

## 21.0.11 Area Restoration

Where trenches and lines cross existing roadways, paths, curbing, etc., damage to these shall be kept to a minimum and they shall be restored to as near original condition as possible. Match existing road section for blacktop paving thoroughly compacted sub-base, base course, bituminous course matching grades of existing paving. Blacktop curbs hot mix bituminous course material tamped and shaped to match adjoining curbs. Concrete paving or curbs concrete to match adjoining concrete work. The quality of the materials used in this restoration shall be equal to or better than the material which was removed, or as shown on the Plans or specified

## 21.0.12 Water Service

### 21.0.12.1 Scope

This work consists of providing water service for the sprinkler system by connecting the system to existing park water lines and/or city water mains. The work includes the furnishing of all labor, supervision, construction equipment and materials including piping, valves, meters, meter pits and backflow prevention devices. All work required to complete the water service in conformance to the Plans and Specifications including excavation, trenching, concrete work pressure tests, and miscellaneous items of related work shall be preformed.

### 21.0.12.2 Workmanship

All materials and equipment shall be installed in a first class, workmanlike manner using workmen who are skilled and certified in their respective trades.

### 21.0.12.3 Building Code

All work shall be in accordance with the Denver Building Code, latest revision.

### 21.0.12.4 Connection to Existing Park Water Lines

Connection to Existing Park Water Lines shall be made by tapping sleeves, tees or crosses. All fittings shall have a design working pressure of 150 psi; all material shall conform to the requirements herein specified

### 21.0.12.5 Connections to City Water Mains

Connections to City Water Mains shall be done in accordance with Denver Water Board Requirements and regulations.

### 21.0.12.6 Materials

Unless otherwise noted or approved, all material shall conform to the following Specifications .

**1. Copper Pipe**

Shall be Type k copper, ASTM B-88. Fittings for copper pipe shall be wrought copper or cast bronze, 150 psi class. Joints shall be solder joints with
95-5 tin -antimony.

**2. Cast Iron Pipe**

Shall meet the requirements of AWWA Standards C-101 and C-I06 for 150 psi working pressure. Unless otherwise noted, cast iron pipe shall have push on type joints approved by the Construction Project Manager and installed in strict accordance with manufacturers recommendations. Cement lining shall conform to AWWA Standard C-104. Rubber gasket joints shall conform to AWWA Standard
C-111.

**3. Curb Valves**

All curb valves between the main and the meter shall be rated at 175 psi w.o.g., and shall open by turning to the right. Curb valves shall be all bronze with "0" ring seals. Curb valves shall have cast iron curb boxes complete with lid and foot piece designed for use with the curb valve. Make and size shall be as shown on the Plans. Curb valves must be approved by the Denver Water Board.

**4. Gate Valves**

All gate valves used in conjunction with water meters shall be as approved by the Denver Water Board.

**5. Water Meter**

The size shall be as shown on the Meter and shall be of the type approved by the Denver Water Board.

**6. Backflow Preventer Device**

Shall be of the type as shown on the Plans. The backflow prevention device must be approved by the Denver Water Board and shall be furnished with inlet and discharge shut-off valves.

**7. Pit for Water Meter**

Shall be as per Denver Water Board requirements. Water Service installation shall conform to the following specifications.

**a**. **Excavation**. The width of the trench in which the pipe will be placed shall be sufficient to allow thorough tamping of suitable backfill material under, around and over the pipe. All excavated materials shall be deposited at least two feet away from any trench side.

Any trench deeper than 6 feet shall be adequately shored and/or braced for safety considerations. If ground water is encountered during trench excavation above the elevation of the bottom of the pipe bell all water shall be removed until the pipe has been installed and the trench backfilled.

**b. Cast Iron Pipe** shall be installed in accordance with the recommendations of the manufacturer. Unless noted otherwise or approved by the Construction Project Manager, cast iron pipe shall be embedded in and covered by a minimum of 6 inches of pea gravel; max. 3/8" dia.

**c. Copper Pipe** shall be installed in accordance with the manufacturer's recommendations. When copper pipe is jointed to any metal pipe or equipment other than copper, brass or bronze, it shall be by means of dielectric unions.

**d. Testing** required for this portion of the system shall be the same as that described in Section 21.3 of these Standard Construction Specifications.

**e. Backfilling** requirements shall be the same as those described in Section 21.3 of these Standard Construction Specifications.

**f. Restoration**. Requirements for restoring area shall be the same as those described in Section 21.3 of these Standard Construction Specifications.

## 21.0.13 Electrical Service

### 21.0.13.1 Scope

This work consists of providing electrical service to the automatic sprinkler controllers. The work includes the furnishing of all labor, supervision, construction equipment and materials including wire, conduit, devices and appurtenances. All work required to complete the electrical service in conformity with the Plans and specifications including excavation, trenching and miscellaneous items of related work shall be performed.

### 21.0.13.2 Workmanship

All materials and equipment shall be installed in a first class, workmanlike manner, using workmen who are skilled and certified in their respective trades.

### 21.0.13.3 Code

All work shall be done in accordance with the Denver Building Code and the National Electrical Code, latest edition.

### 21.0.13.4 Materials and Installation

Material and Installation shall conform to the following specifications.

**1. Wire**

Shall be as shown on the Plans.

**2. Sleeves**

Shall be Schedule 40 galvanized steel. All wires buried in roadways shall have sleeves.

### 3. Service Connections

Coordinate with Public Service Company, Street Lighting Division for electrical service connection.

**End of Specification**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management
# Standard Construction Specification

## 22.0 Seeding

### 22.1.1 General

This work shall consist of furnishing and drilling in seed or hydromulch seeding in accordance with these Standard Construction Specifications and as shown on the Plans. The work shall also include soil preparation, furnishing and spreading fertilizer and installation of mulch and erosion control blanket.

All areas shall be seeded by drilling. In areas where access is a problem, seeding shall be conducted by hydromulch seeding as directed by the Construction Project Manager. Mulch shall be required in all areas that are drilled.

Seeding and the installation of erosion control in certain areas designated by the Construction Project Manager may be permitted before the construction of certain areas to take advantage of growing conditions.

Seeding shall not be accomplished when the ground is frozen or otherwise untillable.

Seeded areas damaged due to circumstances beyond the Contractor's control shall be repaired and reseeded as ordered. Payment for this corrective work shall be at the contract price.

### 22.1.2 Grading

All areas requiring seeding shall be cleared of vegetation, roots, oversized materials and all other material which is objectionable in the opinion of the Resident Engineer and shall be disposed of as specified in Section 2.0, Site Preparation.

## 22.2 Materials

### 22.2.1 Seed

All seed shall be furnished in bags or containers clearly labeled to show the name and address of the supplier, the seed name, the lot number, net weight, the percentage of purity and germination. All brands furnished shall be free from such noxious seeds such as Russian or Canadian Thistle, European Bindweed, Johnson Grass and Leafy Spurge. All seed furnished shall be from a lot that has been tested by a recognized laboratory for seed

testing within six months prior to the date of delivery. Seed which has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable.

Seed Type. The seeds acceptable for drilling and hydromulch seeding are: (1) White Dutch Clover, (2) Fairway Wheatgrass, (3) Perennial Rye, (4) "Sodar" Streambank Wheatgrass, and (5) Luna Pubescent or Western Wheatgrass.

Seeding Mixture. The seeding mixture shall be applied at a bulk rate per acre as follows for hydromulch seeding:

| | Pounds | Purity | Germination |
|---|---|---|---|
| (1) White Dutch Clover | 1.1 | 96% | 90% |
| (2) Fairway Wheatgrass | 2.9 | 95% | 85% |
| (3) Perennial Rye | 3.5 | 98% | 90% |
| (4) Sodar Streambank Wheatgrass | 5.2 | 97% | 92% |
| (5) Luna Pubescent Wheatgrass | 8.9 | 93% | 85% |
| (6) Western Wheatgrass | 10 | 80% | 80% |

The seeding rate per acre for drilling shall be one-half the rate of hydromulch seeding.

c. Seed Purity. Seed and seed labels shall conform to all current State and Federal regulations and will be subject to the testing provisions of the Association of Official Seed Analysis.

   If seed available on the market does not meet the minimum purity and germination percentages specified, the Contractor must compensate for a lesser percentage of purity of germination by furnishing sufficient additional seed to equal the specified product. Product comparison shall be made on the basis of pure live seed in pounds. The formula used for determining the quantity of pure live seed (PLS) shall be:

   Pounds of Seed x (Purity & Germination) = Pounds of Live Seed (PLS)

### 21.2.2 Fertilizers

Fertilizers shall consist of a standard brand fertilizer having a minimum content of 18% available nitrogen. The percentage of nitrogen content shall be certified at the time of use.

Super Phosphate (45% minimum Phosphate when called for on the Plans) will be used on subsoil where all topsoil has been removed. The rate of application shall be approximately 250 pounds per acre.

### 22.2.3 Erosion Control Blanket

Erosion Control Blanket. The blanket shall consist of a material or combination of materials that are biodegradable after a sufficiently long enough period of time to insure germination and rooting of grass seeds. The blanket shall have uniform openings and consist of knitted

yarn in a material that has enough strength and flexibility that allows it to be placed over uneven ground surfaces. The erosion control blanket shall be furnished in rolls that have a width of 4' minimum to 10' minimum. Length and weight of the rolls may vary depending on the manufacturer and the blanket material.

Pins and Staples. Pins or staples shall be made of wire .091" or larger in diameter. "U" shaped staples shall have legs 6" long and 1" crown." T" shaped pins shall have a minimum length of 8" after bending. The bar of the "T" shall be at least 4" long with the single wire end bent downward approximately ¾".

### 22.2.4 Tackifier

A tackifier will be required with all hydromulch seeding.

### 22.2.5 Hydromulch

Wood cellulose fiber for hydromulch seeding shall not contain any substance or factor, which might inhibit germination or growth of grass seed. It shall be dyed an appropriate color to allow metering of its application.

The wood cellulose fibers shall have the property of becoming evenly dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil, the fibers shall form a blotterlike ground cover, which readily absorbs water, and allows infiltration to the underlying soil. Weight specifications from suppliers, and for all applications, shall refer only to air dry weight of the fiber, a standard equivalent to ten (10%) percent moisture. The mulch material shall be supplied in packages having a gross weight not in excess of one hundred (100) pounds, and shall be marked by the manufacturer to show the air dry weight content. Suppliers shall certify that the laboratory and field testing of their product has been accomplished and that it meets all of the foregoing requirements pertaining to wood cellulose fiber mulch.

### 22.2.6 Mulch

Materials for straw mulch shall consist of straw of oats, barley, wheat, or rye and shall not contain seed of noxious weeds.

Straw or hay in such an advanced stage of decomposition as to smother or retard the normal growth of grass will not be accepted. Old dry straw which breaks in the crimping process in lieu of bending will not be accepted.

## 22.3 Construction

### 22.3.1 Grade Preparation

Prior to seeding, the top 4 inches of the surface shall be tilled and brought to the desired line and grade, except where seeding follows so closely behind the initial grading as to make special seeding preparation unnecessary. Areas to be seeded shall be tilled or handworked into a reasonably even and loose sandbed immediately in advance of the seeding.

### 22.3.2 Seeding

Hydromulch Seeding. As required, cellulose fiber mulch shall be added with the proportionate quantities of water and other approved materials in the slurry tank. All ingredients shall be mixed to form a homogeneous slurry. Using the color of the mulch as a metering agent, the operator shall spray-apply the slurry mixture uniformly over the designated seeded area. Unless otherwise ordered for specific areas, wood cellulose fiber mulch shall be applied at the rate of 1500 pounds per acre or 35 pounds per 1,000 square feet.

Hydromulch seeding shall not be done in the presence of free surface water resulting from rains, melting snow or other causes.

Drilling. Seeding shall be accomplished by means of an approved mechanical power drawn drill, followed by packer wheels or drag chains. Seed shall not be drilled during windy weather or when the ground is frozen or otherwise untillable.

Mechanical power drawn drills shall have depth bands set to maintain a planting depth recommended for the type of seed being drilled and shall be set to space the rows not more than 7 inches apart.

If the inspections indicate the stripe wider than the specified space between the rows planted have been left or other areas skipped, the Construction Project Manager shall require immediate re-sowing of seed in such areas at the Contractor's expense.

All seeding shall be done between September 1 to September 15 and March 2 to April 15 of the Calendar year of construction.

The Contractor shall be responsible for maintaining and watering areas seeded for a period of 7 weeks after the time of seeding. Areas in which there is not a satisfactory stand at the expiration of this 7-week period shall be re-seeded. Sprinkling of the seeded areas shall be carefully done in such a manner as to avoid standing water, surface wash or scour. Areas seeded and so maintained shall be protected against damage by vehicle or pedestrian traffic by the use of barriers and appropriate warning signs. Areas shall be re-seeded as many times as is required to establish a significant growth of grass seedlings (a minimum of 25 plants per square feet).

### 22.3.3 Mulch

After seeding has been completed, a rate of 11/2 tons of hay or straw per acre, or as directed, shall be applied uniformly, crimped in with a crimper or other approved equipment. The Construction Project Manager may order the employment of hand crimping operations on such areas where excessive ground slopes or confined areas would cause unsatisfactory crimping by mechanical methods.

The seeded area shall be mulched and crimped within 24 hours after seeding. Areas not mulched and crimped within this 24-hour period must be reseeded with the specified seed mix at the Contractor's expense prior to mulching or crimping.

On steep slopes or other specific areas as shown on the plans, which are difficult to mulch or crimp by conventional methods, burlap or other blanketing materials properly anchored or secured may be used when approved by the Construction Project Manager.

### 22.3.4 Fertilizer

Fertilizer shall be spread uniformly at the rate specified and washed into the soil by the application of water or tilled into the top two inches of soil. Sufficient fertilizer shall be evenly distributed to provide 50 pounds of free nitrogen per acre.

### 22.3.5 Erosion Control Blanket (Channels, Etc.)

Erosion control blanket shall be installed on each side and bottom of the low flow channel as shown on the drawings and as directed by the Construction Project Manager. An additional row of blanket (approximately 4’ to 5’ wide) may be required in areas of steep slopes or southern exposures.

The area to be covered shall be properly prepared, fertilized and seeded before the erosion control blanket is applied. The blanket shall be placed in accordance with the manufacturer’s recommendations and in such a manner to insure contact with the ground creating maximum protection for the newly planted seed. In the low flow channel, the erosion control blanket shall be applied in the direction of the flow of the water, butted snugly at the sides and lapped approximately one foot. On slopes the blankets may be applied either horizontally or vertically to the slope as directed by the Construction Project Manager. Ends and sides shall be butted snugly. The blanket shall be stapled down at intervals in accordance with the manufacturer’s specifications.

The Contractor shall also be responsible for maintaining and caring for the erosion control blanket for a 7-week period. All blankets that are disturbed during this period will be replaced and restapled by the Contractor.

**End of Specification**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management
# Standard Construction Specification

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# 23.0 Storm Water Management

## 23.0.1 Definitions

Definitions used for this Section shall consist of those listed in Title 1 of the City and County of Denver "Standard Specifications for Construction, General Contract Conditions" as referenced within the Contract Documents, those listed within the City and County of Denver Construction Activities Stormwater Manual (CASM), and the following:

**23.0.1.1 Basis of Payment**
The terms under which Work is paid, as a designated Pay Item, in accordance with the quantity measured and based upon the associated Measurement and Payment description.

**23.0.1.2 Best Management Practices (BMPs)**
Schedules of activities, prohibitions of practices, installation of devices, maintenance procedures, and other management practices deployed to stabilize the construction site to prevent or reduce the pollution of State Waters (see definition below). Stormwater BMPs can be classified as "structural" (i.e., devices installed or constructed on a site) or "non-structural" (procedures, such as modified landscaping practices).

**23.0.1.3 Colorado Department of Health and Environment (CDPHE)**
State of Colorado, Water Quality Control Division responsible for issuance of State Construction Stormwater Permit.

**23.0.1.4 Construction Activities Stormwater Discharge Permit (CASDP)**
Permit issued by the City for compliance with City & County of Denver Revised Municipal Code and Department of Public Works Rules & Regulations concerning the discharge of pollutants in storm generated runoff from construction sites to Municipal Separate Storm Sewer System (MS4, see definition below) or State Waters, via the Municipal Separate Storm Sewer System (MS4).

**23.0.1.5 Construction Activities Stormwater Manual (CASM):** City and County of Denver Construction Activities Stormwater Manual (CASM), current edition.

**23.0.1.6 Colorado Department of Transportation (CDOT)**
State agency that has published standards for Erosion Control with accompanying Erosion Control Supervisor certification courses.

**23.0.1.7 Erosion Control Supervisor (ECS)**
The Contractor's Erosion Control Supervisor, to perform duties as described in this Section. The ECS shall be properly trained in BMPs per requirements of Part V below, and shall be under the direction of a Professional Engineer licensed in the State of Colorado when performing any modifications to the Project Stormwater Management Plan (SWMP).

**23.0.1.8 Final Stabilization**
Point of construction when all ground surface disturbing activities at the site have been completed and uniform vegetative cover has reached 70% of pre-disturbance vegetative cover, or equivalent permanent features have been employed. At this point, all temporary BMPs can be removed, all construction and equipment maintenance wastes have been disposed of properly; and all elements of the Stormwater Management Plan have been completed.

**23.0.1.9 Major SWMP Modification**
Changes to the original SWMP that removes or adds additional area to the Project, or modifies the final hydrology or drainage of the Project. A Major SWMP Modification requires the submission of revised Storm water Management Plan (SWMP) elements to the Permit Authority for review and approval. Any adjustments to a SWMP must be performed either by or under the direction of a Professional Engineer licensed in the State of Colorado.

**23.0.1.10 Minor SWMP Modification**
Modification to the SWMP that does NOT increase the scope or change hydrology of the Project but: modifies/improves specific BMPs in use at site, indicates progression in phasing of the Project, or specifies relocation of previously approved BMPs within the Project. Any adjustments to a SWMP must be performed either by or under the direction of a Professional Engineer licensed in the State of Colorado.

**23.0.1.11 Municipal Separate Storm Sewer System (MS4):** A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

a) owned or operated by a State, city, town, county, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of storm water or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or a designated and approved management agency under Section 208 of the Federal Clean Water Act that discharges to State Waters;

b) designed or used for collecting or conveying storm water;

c) which is not a combined sewer; and
d) which is not part of a Publicly Owned Treatment Works (POTW).

**23.0.1.12 Permit Authority**
The Department authorized by the City to review and process CASDP Applications for Capital and/ or governmental sponsored Projects. The responsible City department serving as the Permit Authority is the Public Works Project Controls Office. As a clarification, the Development Services Department of the City serves as the point of intake and permit processing center.

**23.0.1.13 Permit Enforcement Authority**
The Department authorized by the City to inspect and enforce CASDP Rules and Conditions for all construction Projects within the City's MS4 Boundary. The responsible City department serving as the Permit Enforcement Authority is the Wastewater Management Division of the Department of Public Works.

**23.0.1.14 State Construction Stormwater Permit**
Colorado Revised Statues require that all construction sites/development Projects, which, by definition, disturb one or more acres in area, shall be covered by a State issued general permit for construction activities. Information on the application requirements for the State permit can be obtained by phone at 303-692-3500; or by visiting their offices located at 4300 Cherry Creek Drive South, Denver, CO 80246 – 1530 or on the Web at: www.cdphe.state.co.us

**23.0.1.15 State Waters**
Any and all surface waters which are contained in or flow in or through this State, not to include waters in sewage systems, waters in treatment works of disposal systems, waters in potable water distribution systems, and all water withdrawn for use until use and treatment have been completed. Examples of State Waters include, but are not limited to, perennial streams, intermittent or ephemeral gulches and arroyos, ponds, lakes, reservoirs, irrigation canals or ditches, wetlands, stormwater conveyances (when they discharge to a surface water), and groundwater.

**23.0.1.16 Substantial Completion of Erosion Control**
Point of construction when permanent BMPs have been installed, initial growth is in place, and the site is waiting for vegetative cover to reach 70% of pre-disturbance vegetative cover.

**23.0.1.17 Stormwater Management Plan (SWMP)**
A SWMP establishes a minimum standard to construct, install, maintain, and remove required BMPs during the life of the Contract to prevent or minimize pollution of stormwater due to erosion, sediment transport, and construction related pollutant generated during all phases of the Project.

## 23.0.2 General

This Work shall consist of constructing, installing, maintaining, and removing when required, BMPs during the life of the Contract until Final Stabilization to prevent or minimize erosion, sedimentation, and pollution of any waters including storm, drainageways, MS4, State Waters, and/ or wetlands. Work under this Section includes the Contractor obtaining required Permits, utilizing SWMP elements provided in the Contract, and/ or SWMP elements specifically prepared by the Contractor as defined herein. The work shall also consist of providing on-going maintenance and monitoring of the SWMP as may be necessary due to the specific and/or dynamic needs of the Project as well as meet all requirements set forth within the CASM.

The Contractor shall coordinate the construction of temporary BMPs with the construction of permanent BMPs to assure economical, effective, and continuous erosion and sediment control and water pollution prevention throughout the construction period until Final Stabilization is achieved

When a provision of this Section or an order by the Permit Enforcement Authority requires that an action be immediate or taken immediately, it shall be understood that the Contractor will at once begin effecting completion of the action and pursue it to completion in a manner acceptable to the Permit Enforcement Authority, and in accordance with applicable Permitting requirements.

A SWMP consists of the following elements:

(i) CASDP Narrative Worksheet with Narrative Report. The Narrative Report and supporting documents should fully address the methods to be used to prevent sediment, debris, and other pollutants from entering the MS4 and/ or State Waters in and around the Project area. Proposed structural and non-structural BMPs should be described with sufficient implementation detail to insure that the logical phases of the proposed construction Project meet the performance standards listed in the CASM.

(ii) Proposed site drawings and Best Management Practice (BMP) installation details as they apply to the site conforming to the Urban Storm Drainage Criteria Manual, Vol. 3, "Best Management Practices", most current version as issued by the Urban Drainage and Flood Control District (UDFCD), or those established by the City's Department of Public Works. If erosion control drawings were included within the bid documents for the Project, they shall be used for bid purposes and initial planning/ deployment of BMPs on the Project. If provided drawings are signed/ sealed by a Professional Engineer, they have been pre-approved by the Permit Authority and may be used without revision for purposes of submitting for CASDP. If provided drawings do not have signature/ seal of Professional Engineer licensed by the State of Colorado, they will require revision by the Contractor with

Professional Engineer signature/ seal prior to submission to the City and County of Denver for CASDP.

(iii) Supporting documentation related to proposed BMPs that are not currently identified in UDFCD Vol. 3 or as otherwise published by the City.

Any preparation of or adjustments to a SWMP must be performed either by or under the supervision of a Professional Engineer licensed in the State of Colorado. SWMP elements submitted to the City shall also meet currently established criteria of the CDPHE as the SWMP must meet all local, State and Federal requirements.

## 23.0.3 Materials

Materials to be used for BMPs shall conform to each specific detail as set forth within the approved project SWMP or as noted within the Contract Documents.

## 23.0.4 Erosion Control Permit

The applicable storm water management bid item included within the contract documents will indicate which of the following scenarios applies for the project.

### 23.0.4.1 Scenario 1: CASDP is not required.

A SWMP is currently not required for this project as the proposed disturbed area and/ or proximity to stream does not meet the minimum criteria for requiring a CASDP. All portions of this specification following this subsection are hereby deleted and shall not be made part of the Project. However, the responsibilities for minimizing sediment pollution from the Project have not been waived, and as such, the City hereby requires the Contractor to perform as specified within this subsection. All costs for performance of the following are included within the associated Storm Water Management bid item included within the contract and shall not be paid for separately.

a) A CASDP Permit will not be required for this project, however, the Contractor and/or their authorized agents shall ensure that all potential pollutants generated during demolition, excavation, trenching, boring, grading, or other construction Work associated with this permit, be prevented from discharge to stormwater conveyance systems in the vicinity of the Project.

b) The Contractor shall remove all sediment, mud, construction debris, or other potential pollutants that may have been discharged to or, accumulate in the flow lines of storm drainage appurtenances and public rights of ways of the City and County of Denver as a result of construction activities associated with this Project. All removals shall be conducted in a timely manner.

c) The Contractor shall be held responsible for remediation of any adverse impacts to the MS4, State Waters, waterways, wetlands, and or other public or private properties, resulting from work done as part of this Project.

d) The Contractor shall insure that all loads of cut and fill material imported to or exported from the Project shall be properly covered to prevent loss of the material during transport on public rights of way." (Sec.49-552; Revised Municipal Code)

e) Approved erosion and sediment control 'Best Management Practices' shall be maintained and kept in good repair for the duration of the Project. All necessary maintenance and repair shall be completed immediately upon discovery of any deficiency or defect.

f) The Contractor shall implement the following Best Management Practices (BMPs) on site during construction:
   i. VEHICLE TRACKING CONTROL**:** This BMP is required at all access points to a construction site that are used by vehicular traffic or construction equipment.
   ii. INLET PROTECTION**:** This BMP is required on all existing or proposed storm sewer inlets in the vicinity of the construction site that may receive site runoff. The BMP must be appropriate to the type of storm inlet and appropriate for the ground surface at the inlet.
   iii. INTERIM SITE STABILIZATION: This BMP is required to provide a measure for preventing the discharge of sediment from construction sites where overlot grading or other site disturbance has occurred. This BMP is particularly necessary on sites where construction activities/disturbance will be limited to small areas of the project site. Acceptable BMPs include:
      - Preserving existing vegetation
      - Seeding and planting
      - Mulching
      - Mulching and seeding
      - Temporary/Permanent re-vegetation operations
      - Chemical soil stabilizer application (requires Permit Enforcement Authority approval)
   iv. WASTE MANAGEMENT/CONTAINMENT: This BMP requires that all construction wastes, fuels, lubricants, chemical wastes, trash, sanitary wastes, contaminated soils or debris shall be contained on site, protected from contact with precipitation or surface runoff, periodically removed from the construction site, and properly disposed of.
   v. SPILL PREVENTION /CONTAINMENT**:** This BMP defines the measures proposed for preventing, controlling, or containing spills of fuel, lubricants, or other pollutants; and protecting potential pollutants from contact with precipitation or runoff.
   vi. CHUTE WASHOUT CONTAINMENT**:** Water used in the cleaning of ready mixed concrete truck delivery chutes shall be discharged into a predefined, bermed containment area on the job site. The required

containment area is to be bermed so that wash water is totally contained. Wash water discharged into the containment area shall be allowed to infiltrate or evaporate. Dried concrete waste shall be removed from the containment area and properly disposed of.

vii. Should a predefined bermed containment area not be available due to the project size, or lack of an area with a suitable ground surface for establishing a containment area, proper disposal of ready mix washout and rinse off water at the job site shall conform to the approved techniques and practices identified in the Colorado Department of Public Health & Environment's training video entitled "Building For a Cleaner Environment, Ready Mix Washout Training", and its accompanying manual entitled, "Ready Mix Washout Guidebook, Vehicle and Equipment Washout at Construction Sites."

viii. The direct or indirect discharge of water containing waste concrete to the storm sewer system is prohibited (Sec.56-102a, c; Revised Municipal Code, City and County of Denver).

ix. Information about, or copies of the video and training manual are available from the Water Quality Control Division, Colorado Department of Public Health & Environment, 4300 Cherry Creek Drive South, Denver, Colorado 80222-1530, (303) 692-3555.

x. STREET SWEEPING**:** This BMP requires that paved surfaces which are adjacent to construction sites be swept in a timely manner when sediment and other materials are tracked or discharged on to them. Either sweeping by hand or use of street sweepers is acceptable. Street sweepers using water while sweeping is preferred in order to minimize dust. Flushing off paved surfaces with water is prohibited.

xi. PERIMETER CONTROL: This BMP requires that a construction site install a perimeter control measure along the edge of the construction site, to prevent, or filter the discharge of surface runoff from the construction site. The type of perimeter control used shall be determined based on site conditions and location. Maintenance and repair of the control measure shall occur as needed, in a timely manner.

xii. STOCK PILES: Soils that will be stockpiled for more than thirty (30) days shall be protected from wind and water erosion within fourteen (14) days of stockpile construction. Stabilization of stockpiles located within 100 feet of an MS4 or State Waters, or with slopes 3 to 1 or greater shall be completed within seven (7) days following stockpile construction. Stabilization and protection of the stockpile may be accomplished by any of the following: Mulching, Temporary/Permanent Revegetation Operations, Chemical Soil Stabilizer Application (requires Permit Enforcement Authority approval), or erosion control matting/Geotextiles. If stockpiles are located within 100 feet of an MS4 or State Waters, a drainageway or the site perimeter, additional sediment controls shall be required.

xiii. SAW CUTTING OPERATIONS: The Contractor shall protect all storm sewer facilities adjacent to any location where pavement cutting operations involving wheel cutting, saw cutting, or abrasive water jet cutting are to occur. The Contractor shall remove and properly dispose of all waste products generated by said cutting operations on a daily basis or as needed throughout the work day. The discharge of any water contaminated by waste products from cutting operations to the storm sewer system is prohibited. (Sec.56-102a, c; Revised Municipal Code, City and County of Denver)."

**23.0.4.2 Scenario 2: CASDP and State Construction Storm Water Permit(s) are required. No SWMP element(s) are included. The City has not provided SWMP elements nor obtained required CASDP or State Construction Stormwater Permit(s) in advance of bid.**

SWMP elements have not been included in the Contract Documents. The Contractor shall plan and coordinate with the Permit Authority to prepare all required SWMP elements and obtain required CASDP. Per CASDP requirements, the Contractor shall obtain the endorsement of a Professional Engineer licensed in the State of Colorado for preparation of the initial SWMP and/ or any proposed Major or Minor SWMP Amendments. This will require the Contractor to provide or retain a Professional Engineer or subcontract with the original Professional Engineer that prepared the Bid Documents.

The Contractor is hereby made aware that the Permit Authority allots up to 3 weeks per review cycle for CASDP Permit applications (2 review cycles are not uncommon).

Per definition, a Major SWMP Modification requires the submission of revised SWMP elements to the Permit Authority for review and approval.

Prior to issuance of a Notice to Proceed, the Contractor shall obtain required State Construction Stormwater Permit(s) as applicable.

**23.0.4.3 Scenario 3: CASDP and State Construction Storm Water Permit(s) are required and "For reference only" SWMP erosion control drawings have been provided. The City has not obtained required CASDP or State Construction Stormwater Permit(s) in advance of bid.**

The Contractor shall submit a complete SWMP and application to the Permit Authority to obtain the required CASDP. The Contractor shall use the provided "For reference only" erosion control drawings provided in the Contract as a starting point for preparation of required SWMP elements (as required for CASDP) and for general information as to the origin of pay items included in the Bid Documents. The included erosion control drawings have been previously reviewed by the Permit Authority, and the BMPs shown therein have been found to be generally acceptable by the Permit Authority.

It shall be the responsibility of the Contractor to prepare and acquire approval of a complete SWMP and obtain a CASDP from the Permit Authority prior to beginning construction. The

Contractor is hereby made aware that the Permit Authority allots up to 3 weeks per review cycle for CASDP applications (2 review cycles are not uncommon).

Per CASDP requirements, the Contractor shall obtain the endorsement of a Professional Engineer licensed in the State of Colorado for preparation of the initial SWMP and/ or any proposed Major or Minor SWMP Amendments. This will require the Contractor to provide or retain a Professional Engineer or subcontract with the original Professional Engineer of the "For reference only" erosion control drawings.

Per definition, a Major SWMP Modification requires the submission of revised SWMP elements to the Permit Authority for review and approval.

Prior to construction, the Contractor shall obtain the required State Construction Stormwater Permit(s) as applicable.

**23.0.4.4 Scenario 4: CASDP and State Construction Storm Water Permit(s) are required and completed SWMP has been included. The City has obtained CASDP in advance of bid. The City has not obtained State Construction Stormwater Permit prior to bid.**

An approved SWMP has been prepared and CASDP obtained by the City prior to bidding of the Project and as such must be properly transferred to the Contractor prior to the start of construction. The SWMP has been provided within the Bid Documents and shall be made a part of the Contract. The Contractor shall coordinate with the Construction Project Manager and Permit Authority to perform the necessary transfer of CASDP from City to Contractor prior to the start of construction. The Permit transfer will be performed at no cost to the Contractor.

Prior to transfer of CASDP, additional elements shall be completed by the Contractor before the CASDP will be transferred from City to Contractor:

a) Complete Sections B&E (Permittee & Site Supervisor) of the CASDP "Narrative Report Information Worksheet".
b) Prepare a complete SWMP including any required adjustments for proposed construction phasing, staging areas, or additional items necessary to address applicable project specific Permit requirements. This will require the Contractor to provide or retain a Professional Engineer or subcontract with the original Professional Engineer that prepared the Bid Documents.
c) Complete the "Construction Scheduling" section of the "Narrative Report Information Worksheet".
d) Include specific methods and/or BMPs that the Contractor will implement to address hazardous spill prevention/ containment response.
e) Provide any "Additional Documentation and Correspondence" applicable to the Contractor as stated in the CASM. This will require the Contractor to provide or retain a Professional Engineer or subcontract with the original Professional Engineer that prepared the Bid Documents.

If deemed necessary, the Contractor may propose modifications to the approved SWMP once the CASDP has been transferred to the Contractor. Per CASDP requirements, the Contractor shall obtain the endorsement of a Professional Engineer licensed in the State of Colorado for any proposed Major or Minor SWMP Amendments. This may require the Contractor to provide or retain a Professional Engineer or subcontract with the original Professional Engineer of the "For reference only" erosion control drawings.

Per definition, a Major SWMP Modification requires the submission of revised SWMP elements to the Permit Authority for review and approval.

Prior to construction, the Contractor shall obtain the required State Construction Stormwater Permit(s) as applicable.

## 23.0.5 Construction Requirements

### 23.0.5.1 Construction Implementation

The Contractor shall incorporate into the Project all BMPs as outlined in the accepted Critical Path Method Construction schedule.

### 23.0.5.2 Alterations to Project BMPs

The Contractor shall design and implement BMPs for correcting potential conditions unforeseen during design of the Project, or as possible for emergency situations, which arise during construction. The Project's SWMP, UDFCD Vol 3 standards and details, and CDOTs "Erosion Control and Storm-Water Quality Guide," and any approved modification to these documents as proposed by the Contractor, shall be used as reference documents for the purpose of designing appropriate BMPs. Measures and methods proposed by the Contractor to deal with unforeseen conditions shall be reviewed and approved in writing by the Permit Enforcement Authority and the Project Construction Engineer prior to implementation and construction.

In an emergency situation, the Contractor shall use best judgment for immediately responding to the emergency situation as it arises.

All costs associated with revising the BMPs utilized throughout the project, for its duration, shall be included within the applicable Storm Water Management bid item. No separate or additional payment shall be made.

### 23.0.5.3 Permits

The Contractor shall obtain all required permits for the Project including those required by federal, state, and local agencies. The Contractor shall obtain (or transfer from the City when specified) required erosion control and water quality permits and shall be responsible for compliance with all requirements under any such permits.

### 23.0.5.4 Erosion Control Supervisor

Contractor shall assign to the Project an employee or subcontractor to serve as Erosion Control Supervisor (ECS). The ECS shall be a person other than the Contractor's superintendent, foreman, or equivalent supervisory position. The ECS shall be experienced in aspects of BMP construction and have satisfactorily completed a Colorado DOT or equivalent ECS training program authorized by the City. Proof that this requirement has been met shall be submitted to the City's Construction Project Manager at least ten working days prior to the beginning of any soil disturbance work. A list of authorized ECS training programs is available from the City upon request. Additionally, per definition, the ECS shall be under the direction of a Professional Engineer licensed in the State of Colorado when performing any modifications to the Project Stormwater Management Plan (SWMP).

The ECS shall be responsible for oversight of the implementation, maintenance, and revision of the SWMP for the duration of the Project. The ECS's responsibilities shall be as follows:

a) Ensure compliance with all water quality permits or certifications in effect during the construction work.
b) Supervise the installation, construction, and maintenance of all BMPs specified in the Contract and coordinate the construction of BMPs with all other construction operations.
c) Direct the implementation of suitable BMPs as necessary to correct unforeseen conditions or emergency situations. Direct the dismantling of those features when their purpose has been fulfilled due to completion of each Project phase unless the Permit Enforcement Authority agrees that the features be left in place.
d) Inspect the construction site and document inspection activities at least every seven (7) days and immediately following any precipitation or snowmelt event with the potential to cause surface erosion. If no land disturbing construction activities are present during a storm event, post-storm event inspections shall be conducted prior to commencing any new land disturbing construction activities, but no later than seventy-two (72) hours following the storm event.
e) Attend the preconstruction conference, erosion control preconstruction inspection, Project scheduling meetings, weekly construction/ field meetings, substantial completion and final stabilization inspections, and other meetings regarding construction that could impact water quality.
f) Evaluate all non-stormwater coming onto the site, such as springs, seeps, and landscape irrigation return flow. If such flow is identified, the ECS shall propose appropriate SWMP modifications to the Contractor to protect off-site water from becoming contaminated with sediment or other pollutants.
g) Coordinate with the Contractor to implement necessary actions to reduce anticipated or presently existing water quality or erosion problems resulting from construction activities.
h) Coordinate with the Contractor to ensure all labor, material, and equipment deployed to meet SWMP requirements is judged appropriately.
i) During construction, update and record the following items in the SWMP as changes occur:

i. Construction boundaries (may require Major SWMP Modification)
ii. Areas of disturbance (may require Major SWMP Modification)
iii. Areas used for storage of construction materials, equipment, soils, or wastes.
iv. Location of any dedicated asphalt or concrete batch plants.
v. Location of construction offices and staging areas.
vi. Location of work access routes during construction.
vii. Location of borrow and waste.
viii. Location of temporary and permanent stabilization
ix. The ECS shall start a new site map before the current one becomes illegible. All site maps shall remain with the SWMP paperwork.

j) Amend the SWMP whenever there are: additions, deletions, or changes in locations of BMPs. SWMP revisions shall be recorded immediately. Items shall be dated and signed at time of occurrence. Specifically, amendments shall include the following:
   i. A change in design, construction, operation, or maintenance of the site which would require the implementation of new or revised BMPs; or
   ii. Changes when the SWMP proves to be ineffective in achieving the general objectives of controlling pollutants in stormwater discharges associated with construction activity.
   iii. Changes when temporary BMPs are no longer necessary from changes in Project phase and are removed. All inspection and maintenance activities or other repairs shall be documented.

k) All inspection and maintenance activities or other repairs shall be documented. The SWMP and documentation shall be kept on the Project site at all times.

l) Modify the site map with arrows to indicate direction of surface and storm water flowing across the Project site.

m) When adding or revising BMPs in the SWMP, amend the narrative to explain what, when, where, why, and how the BMP is being used, and add a detail to the SWMP.

n) If using existing topography, vegetation, etc. as a BMP, label it as such in the SWMP site map; amend the Narrative to explain when, why, and how the BMP is being used to the SWMP.

o) Record on the SWMP, and implement the approved plan for concrete and asphalt saw cutting, grinding, and milling containment and removal.

p) Update the potential pollutants list in the SWMP throughout construction meeting CASDP requirements.

q) Spills, leaks, or overflows that result in the discharge of pollutants shall be documented on the inspection form. The ECS shall record the time and date, weather conditions, reasons for spill, and how it was remediated. The ECS shall immediately report to the Contractor and Construction Project Manager the following instances of noncompliance:
   i. Noncompliance which may endanger health or environment.

ii. Spills or discharge of hazardous substance or oil which may cause pollution of the City MS4 or State Waters.

iii. Discharge of stormwater which may cause an exceedance of a water quality standard.

r) Perform a thorough inspection of the stormwater management system at least every seven (7) days and within 24 hours after any precipitation or snowmelt event with the potential to cause surface erosion. The inspection records shall be kept on-site in a written or previously approved format. Inspections shall be conducted during the progress of the work, during work suspensions, or until Final Stabilization of all disturbed areas is approved by Permit Enforcement Authority and shall include the following services at a minimum:

i. The construction site perimeter, disturbed areas, and areas used for material storage that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. BMPs identified in the SWMP shall be observed to ensure that they are operating correctly.

ii. The description of potential pollutant sources, and the BMPs identified in the SWMP, shall be revised and modified as appropriate based on the results of the inspection as soon as practicable after such inspection. Modification to the SWMP shall be implemented in a timely manner and in accordance with applicable Permit requirements.

iii. The operator shall keep a record of inspections. Uncontrolled releases of sediment or polluted storm water or measurable quantities of sediment found off the site shall be recorded with a brief explanation as to the measures taken to prevent future releases as well as any measures taken to clean up the sediment that has left the site. Inspection records shall be made available to the City upon request. Note: documentation of uncontrolled releases at site DOES NOT alleviate any State or Federal requirements for reporting of discharges or upset conditions. Care should be taken to ensure compliance with all regulatory requirements at site.

iv. Seven (7) day inspections are required during construction and at all times until Final Stabilization has been achieved. Seeding and mulching of disturbed areas does NOT count as final stabilization until such time as 70% pre disturbed vegetative cover has been achieved. Sites with growth in place sufficient to deter erosion that have not yet achieved final stabilization may petition the City to grant an alternative inspection schedule while awaiting additional growth for final stabilization. These inspections must be conducted in accordance with the above paragraphs.

### 23.0.5.5 Applying BMPs

The duration of the exposure of uncompleted construction to the effects of weather shall be as short as practicable. BMPs such as: seeding, surface roughening, mulching, applying

tackifier, use of geotextiles and matting, permanent landscaping, or other selected BMPs shall be applied within fourteen (14) calendar days of completion of grading/soil disturbance activities to stabilize the construction site unless disturbed area is within 100 feet of an MS4 or State Waters or has slopes of 3 to 1 or greater in which case BMPs shall be implemented within seven (7) calendar days of completion of grading activities. Disturbed areas where work is temporarily halted shall be temporarily stabilized within seven (7) days after the activity ceased unless work is to be resumed within thirty (30) calendar days after the activity ceased.

Clearing and grubbing operations shall be scheduled and performed to minimize both the area of the Project disturbed at a given time and the amount of time that disturbed areas remain open. BMPs such as temporary seeding are required between successive construction stages when disturbed areas will not be stable or active for thirty (30) calendar days or more. No payment will be made for additional work required because the Contractor has failed to properly coordinate the BMP schedule, thus causing previously stabilized areas to be disturbed by operations that could have been performed prior to the stabilization. Upon failure of the Contractor to coordinate the permanent BMPs with the grading operations in a manner to effectively control erosion and prevent water pollution, the Permit Enforcement Authority can suspend the Contractor's grading operations and the Construction Project Manager can withhold monies due to the Contractor on current estimates until such time that all aspects of the work are coordinated in an acceptable manner.

#### 23.0.5.6 Work Outside Limits of Construction

Non-contiguous areas outside the limits of construction that are used by the Contractor that include, but are not limited to, borrow pits, haul routes, storage and disposal areas, field offices, maintenance, batching areas, etc., shall have appropriate BMPs implemented by the Contractor at the Contractor's expense. Should said areas meet applicable CASDP Permit criteria, the Contractor shall obtain a separate CASDP for each area as applicable at no additional expense to the City.

#### 23.0.5.7 Maintenance

The Contractor shall continuously maintain erosion and sediment control BMPs on a daily basis or as directed by the ECS so that they function properly during and after construction (including work suspensions) until Final Stabilization has been approved by the Permit Enforcement Authority. Maintenance includes, but is not limited to, the following items:

a) From the time seeding and mulching work begins until the date the Project has reached Substantial Completion of Erosion Control, the Contractor shall keep all seeded areas stabilized at all times. Any damage to seeded areas or to mulch materials shall be promptly repaired.
b) All inspection sediment removal, and BMP maintenance activities to comply with all Federal, State & Local erosion control permit requirements until Final Stabilization is reached.

c) All removal and replacement of existing BMPs due to damage to same suffered either by the contractor, outside agencies, the public, or acts of God.
d) All required mechanical and/ or manual street sweeping.
e) Discretionary changes required of any regulatory enforcement officer.

If the Contractor fails to maintain the BMPs in accordance with the Contract, or as directed, the City may at the expiration of a period of 48 hours, after having given the Contractor written notice, proceed to maintain BMPs as deemed necessary. The cost thereof will be deducted from any compensation due, or which may become due to the Contractor under this Contract.

### 23.0.5.8 Minor SWMP Modifications

These shall be made in the field by the Contractor and thoroughly documented in the Contractor's SWMP narrative and drawings. Should the Permit Enforcement Authority deem minor field modifications inadequate, the Contractor may be required to a) make specific modifications as requested by the Permit Enforcement Authority or b) return to the original approved design specifications. Minor SWMP Modifications are allowed, covered under the original CASDP, and required as part of standard maintenance and operation.

### 23.0.5.9 Major SWMP Modifications

The City reserves the right to require changes in the Work or Project Limits that may require a Major Modification to the SWMP and/ or CASDP due to unforeseen circumstances. Should this occur, the Contractor will be responsible for the following (as applicable):

a) Make required revisions to comply with changing federal or state rulemaking if occurs within timeframe of Project
b) Make required revisions due to unforeseen or unplanned conditions leading to deficient Drawings/ SWMP (hazardous materials encountered, landfills, expansion of work limits, etc.)
c) Prepare revised SWMP elements endorsed by a Professional Engineer licensed in the State of Colorado.

### 23.0.5.10 Substantial Completion of Erosion Control

When a CASDP is required for the Project, Substantial Completion of the Project as defined by the City and County of Denver General Contract Conditions cannot be reached until Substantial Completion of Erosion Control has been granted. Granting of Substantial Completion of Erosion Control must be requested by the Contractor and be approved by the Permit Enforcement Authority in the form of a "Certificate of Substantial Completion of Erosion Control".

### 23.0.5.11 Final Stabilization

Granting of Final Stabilization must be requested by the Contractor and be approved by the Permit Enforcement Authority. Other permanent soil stabilization techniques may be proposed, in writing, by the Contractor and used upon approval, in writing, by the Construction Project Manager and Permit Enforcement Authority.

The Contractor may reach Final Stabilization via the following procedures:

a) The Contractor shall file Inactivation Request for Construction Activities Stormwater Discharge Permit (available within CASDP guidance documents) with the Permit Enforcement Authority.
b) The Contractor shall coordinate with the Permit Enforcement Authority to hold a Final Inactivation Inspection.
c) If passing, the Permit Enforcement Authority transmits a letter of approval for Final Stabilization.
d) If not passing, the Permit Enforcement Authority transmits a letter of denial for Final Stabilization with associated inspection report to Contractor.
e) Stabilization, inspection and maintenance requirements shall continue until confirmation of having met final closure requirements have been granted in writing by the Permit Enforcement Authority. When Final Stabilization has been reached, the Permit Enforcement Authority shall issue a "Certificate of Final Stabilization".

#### 23.0.5.12 Final Acceptance

CASDP obligations (including reaching Final Stabilization) may hinder the ability to reach Final Acceptance for the overall Project as defined in the City General Contract Conditions.

## 23.0.6 Construction of BMPs

BMPs shall be constructed so that they conform to all requirements as set forth within the Project SWMP. They shall meet all requirements set forth within each BMP detail and shall be installed and maintained so that they function in an effective and operable manner.

**End of Specification**

CITY AND COUNTY OF DENVER
ENGINEERING DIVISION

# Wastewater Capital Projects Management
# Standard Construction Specification

## 25.0 Hot Mix Asphalt Pavement

### 25.1 Design Intent

These specifications include general requirements applicable to all types of plant mixed hot mix asphalt pavements (HMAP). This work consists of one or more courses of asphalt mixture constructed on a prepared foundation in accordance with specifications. The design intent is to provide pavement with adequate thickness and quality to provide a service life of 20 years. It is also the intent to provide construction in accordance with these specifications and with a high standard of practice. This item shall include all labor, equipment, and materials to manufacture, place and compact asphalt cement concrete for pavement purposes.

| TEST PROCEDURE DEFINITIONS | |
|---|---|
| CP-## | Colorado Department of Transportation: Field Materials Manual (Colorado Testing Procedures) |
| ASTM | American Society for Testing & Materials |
| AASHTO | American Association of State Highway & Transportation Officials |
| CP-L #### | Colorado Department of Transportation: Laboratory Manual of Test Procedures (Lab Testing Procedures) |

### 25.2 Materials

The hot mix asphalt shall be composed of a mixture of aggregate, filler, hydrated lime and asphalt cement. Some mixes may require polymer modified asphalt cement. Some mixes may allow up to 25% reclaimed asphalt pavement (RAP). All RAP shall meet the requirements of section 25.2.5

### 25.2.1 Aggregate

Aggregates for HMAP shall be of uniform quality, composed of clean, hard, durable particles of crushed stone, crushed gravel, or crushed slag. Excess of fine material shall be wasted before crushing. The material shall not contain clay balls, vegetable matter, or other deleterious substances and shall meet the requirements in Table 25.2.1.1.

**Table 25.2.1.1**

**Aggregate Requirements**

| Aggregate Test Property | Coarse: Retained on #4 | Fine: Passing the #4 |
|---|---|---|
| Fine Aggregate Angularity, CP-L 5113 Method A or AASHTO T 304<br>Note: Fine aggregate angularity does not apply to RAP aggregates | | 45% Min |
| Two Fractured Faces, CP-45 or ASTM D 5821<br>SG Mixtures<br>Top and Middle Lifts<br>Bottom Lifts<br>SMA Mixtures | <br><br>90% Min.<br>80% Min.<br>70% Min.<br>100% required | |
| LA Abrasion, AASHTO T 96 | 45% Max. | |
| Flat and Elongated (Ratio 5:1) %, AASHTO M 283 | 10% Max. | |
| Adherent Coating (Dry Sieving) ASTM D 5711 | 0.5% Max. | |
| Sand Equivalent. AASHTO-T 176 | | 45% Min. |
| Micro Deval CP-L 4211 or AASHTO T 327 | 18% Max | |

Reclaimed Asphalt Pavement material (RAP) shall be used only where specifically allowed as shown on the plans and shall be of uniform quality and gradation with a maximum size no greater than the nominal aggregate size of the mix. Mixes shall not contain more than 25 percent RAP.

The HMAP gradation for the proposed design job mix gradation shall be wholly within the control point gradation range set forth in Table 25.2.1.2. The allowable job mix gradation for production shall be the design job mix gradation with the tolerances of Section 25.13.2 applied. The proposed design job mix and the final allowable job mix gradation for production shall report all sieve sizes listed in table 25.2.1.2

**Table 25.2.1.2**

**Dense Graded HMA Gradation Range**

**(Percent by Weight Passing Square Mesh Sieves, CP-31, AASHTO 11 & T27)**

| Mixture Grading | SX (1/2" nominal) | | S (3/4" nominal) | | SG (1" nominal) | |
|---|---|---|---|---|---|---|
| Sieve Size | Control Points | Caution Zone* | Control Points | Caution Zone* | Control Points | Caution Zone* |
| 1 1/2" | | | | | 100 | |
| 1" | | | 100 | | 90-100 | |
| 3/4" | 100 | | 90-100 | | @ | |
| 1/2" | 90-100 | | @ | | @ | |
| 3/8" | @ | | @ | | @ | |
| #4 | @ | | @ | | @ | 39.5 |
| #8 | 28-58 | 39.1 | 23-49 | 34.6 | 19-45 | 26.8-30.8 |
| #16 | @ | 25.6-31.6 | @ | 22.3-28.3 | @ | 18.1-24.1 |
| #30 | @ | 19.1-23.1 | @ | 16.7-20.7 | @ | 13.6-17.6 |
| #50 | @ | 15.5 | @ | 13.7 | @ | 11.4 |
| #200** | 2.0-8.0 | | 2.0-7.0 | | 1.0-7.0 | |

* The caution zone is guideline only. It is recommended that mix design gradations go above the caution zone boundaries, on the "fine" side

** These limits shall include the weight of lime at 1.0%

@ These sieve sizes used only to determine the final Allowable Job Mix Formula (JMF) in accordance with 25.13.

## 25.2.2 Performance Graded Asphalt Binders

The Contractor shall provide to the Construction Project Manager acceptable 'Certifications of Compliance' of each applicable asphalt binder grade from the supplier. Upon non-conformance with specifications, the asphalt binder may be rejected as directed by the Construction Project Manager. When production begins the Contractor shall, upon request, provide to the Construction Project Manager a one quart can of each specified asphalt binder. Additionally, when requested, the Contractor shall provide the refinery test results that pertain to the asphalt binders used during production.

Asphalt binder shall meet the requirements of the Superpave Performance-Graded Binders (PG) as presented in table 25.2.2

**TABLE 25.2.2. -PROPERTIES OF PERFORMANCE GRADED BINDERS**

| Usage for each Binder Grade | PG 58-28 | PG 64-22 | PG 76-28 |
|---|---|---|---|
| Traffic Loading, Total 18 kip ESALs Over Design Life (Usually 20 Years)*** | Low Volume (0-100,000) | 100,000 to <10.0 Million | 3.0 Million to <10 Million |
| Superpave Compactor Design gyrations Recommended (alternate) Usage | $N_{design}$ = 50 (75) | $N_{design}$ = 75 (100) | $N_{design}$ = 100 |
| **Property of Binder Grade** | **PG 58-28** | **PG 64-22** | **PG 76-28** |
| Flash Point Temperature, ºC, AASHTO T 48 | 230 Min. | 230 Min. | 230 Min. |
| Viscosity at 135 ºC, Pas, ASTM D 4402 | 3 Max. | 3 Max. | 3 Max. |
| Dynamic Shear, Temperature ºC, where C*/Sin δ @ 10 rad/sec. ≥ 1.00 Kpa, AASHTO TP 5 | 58 º C | 64 º C | 76 º C |
| ***Rolling Thin Film Oven Residue Properties, AASHTO T 240*** | | | |
| Mass Loss, %, AASHTO T 240 | 1.00 Max. | 1.00 Max. | 1.00 Max. |
| Dynamic Shear, Temperature ºC, where G*/Sin δ @ 10 rad/sec. ≥ 2.20 Kpa, AASHTO TP 5 | 58 º C | 64 º C | 76 º C |
| Elastic Recovery1, 25°C, % Min.* | N/A | N/A | 50 Min. |
| **TABLE 25.2.2. -PROPERTIES OF PERFORMANCE GRADED BINDERS continued** | | | |
| ***Pressure Aging Vessel Residue Properties, Aging Temperature 100 ºC AASHTO PP1*** | | | |
| Dynamic Shear, Temperature ºC, where G*/Sin δ @ 10 rad/sec. ≤ 5,000 Kpa, AASHTO TP 5 | 19 º C | 25 º C | 28 º C |
| Creep Stiffness, @ 60 sec. Test Temperature in ºC, | -18 º C | -12 º C | -18 º C |

| | | | |
|---|---|---|---|
| AASHTO TP 1 | | | |
| S, Mpa, AASHTO TP 1 | 300 Max. | 300 Max. | 300 Max. |
| m-value, AASHTO TP 1 | 0.300 Min. | 0.300 Min. | 0.300 Min. |
| **Direct Tension Temperature in ºC, @ 1.0 mm/min., Where Failure Strain >1.0%, AASHTO TP 3 | -18 º C | -12 º C | -18 º C |

* Elastic Recovery by Task Force 31, Appendix B Method

** Direct tension measurements are required when needed to show conformance to AASHTO MP.1

*** Project Design Engineer is to determine PG Binder

### 25.2.3 Additives – Hydrated Lime

Lime shall be added at the rate of 1% by dry weight of the aggregate and shall be included in the amount of material passing the No. 200 sieve. Hydrated lime for aggregate pretreatment shall conform to the requirements of ASTM C 207, Type N. In addition, the residue retained on a 200-mesh sieve shall not exceed 10% when determined in accordance with ASTM C 110. Drying of the residue in an atmosphere free from carbon dioxide will not be required.

### 25.2.4 Tack Coat

The emulsified asphalt, for Tack Coat shall be CSS-1h or SS-1h and conform to AASHTO M208 or M140, respectively.

### 25.2.5 Reclaimed Asphalt Pavement

Reclaimed Asphalt Pavement (RAP) may be allowed in the HMA mixture by the **Project Design Engineer**. It shall be of uniform quality and gradation with a maximum size particle no greater than the maximum size allowed in the HMA mixture. HMA mixtures containing RAP shall meet the same gradation requirements as a virgin HMA mix. The Project Design Engineer may allow mixtures with a maximum of 20% RAP may be allowed in the top lift of any asphalt pavement, and a maximum of 25% RAP may be allowed in layers below the top lift, RAP is not allowed in Stone Mastic Asphalt Mixtures, except by agreement by the **Project Design Engineer.**

The reclaimed asphalt pavement shall meet all the requirements for HMA pavement, as contained herein. The **General Contractor** shall have an approved mix design for the amount of RAP to be used prior to placement.

The **Construction Project Manager** may require the **General Contractor** to maintain separate stockpiles for each type of RAP material. All processed material shall be free of foreign materials and segregation shall be minimized. Any RAP material that cannot be readily broken down in the mixing process, and/or affects the paving operation, shall be processed prior to mixing with the virgin material.

Fine Aggregate Angularity requirements shall not apply to any RAP aggregate. The RAP will not contain clay balls, vegetable matter, or other deleterious substances.

Verification testing for asphalt content and gradation will be performed on RAP at the frequencies listed in section 25.5.2, below. The **Construction Project Manager** may request the mix supplier's testing results on RAP at any time. In addition, the mixture shall be tested for properties as listed in Table 25.15
**When the use RAP is allowed, the following additional conditions shall apply:**

25.2.5.1. The processed RAP must be 100 percent passing the 1¼" sieve. The aggregate obtained from the processed RAP shall be 100% passing the 1" sieve. The aggregate and binder obtained from the processed RAP shall be uniform in all the measured parameters in accordance with the following schedule:

**Table 25.2.5.1 RAP AGGREGATE UNIFORMITY TOLERANCES**

| Element | Uniformity* |
|---|---|
| Binder Content | 0.5 |
| % Passing ¾" | 4.0 |
| % Passing ½" | 4.0 |
| % Passing 3/8" | 4.0 |
| %Passing #4 | 4.0 |
| % Passing #8 | 4.0 |
| % Passing #30 | 3.0 |
| % Passing #200 | 1.5 |

* Uniformity is the Maximum allowable Standard Deviation of test results of processed RAP.

25.2.5.2. The **General Contractor** shall have an **approved RAP Quality Control (QC) Plan** that details how the RAP will be processed and controlled. The QC plan must address the following:

25.2.5.2. A. RAP Processing Techniques. This requires a schematic diagram and narrative that explains the processing (crushing, screening, and rejecting) and stockpile operation for normal plant operation or a specific project.

25.2.5.2. B. Control of RAP Asphalt Binder Content: - Minimum Testing Frequency: 1/1,000 tons of processed RAP material (minimum 3 tests) for recent production of the mix type.

25.2.5.2. C. Control of RAP Gradation (CP31 or AASHTO T-30): Minimum Testing Frequency: 1/1,000 tons of processed RAP material (minimum 3 tests) for recent production of the mix type.

25.2.5.2. D. Process Control Charts shall be maintained for binder content and each screen listed, during addition of any RAP material to the stockpile. The **General Contractor** shall maintain separate control charts for each RAP stockpile. The control charts shall be displayed and shall be made available to the **Construction Project Manager** upon request.

**25.2.5.3** Example of **RAP QUALITY CONTROL PLAN**

**25.2.5.3. A** Initial quality control of the reclaimed asphalt pavement shall be performed prior to and during crushing. Material for reclamation shall be separated by quality and source before being accepted for processing. Reclaimed asphalt must be free of concrete, dirt and organic materials... These stockpiles shall be built from the ground up, completely mixing all loads as they come in.

**25.2.5.3. B** Crushing of the reclaimed asphalt pavement shall be accomplished by means of a cone crusher and a screen deck. Oversize material shall be to be rejected on a ¾" scalping material, which reprocesses the material through the cone additional times. The processed material shall be stockpiled at the crushing facility and kept in separate piles and separate from other products to prevent intermingling of products, as well as the feed bins to prevent intermingling of the aggregates.

**25.2.5.3. C** The reclaimed asphalt pavement material shall be sampled during the crushing operations according to AASHTO T 2 at frequencies greater than 1/1000 tons and tested for gradation and asphalt content in accordance with AASHTO T 27 AND T11, and AASHTO T 308. Testing shall be done randomly on a daily basis to ensure conformance to specifications.

**25.2.5.3. D** The reclaimed asphalt pavement material at the asphalt plant shall be again sampled and tested according to the appropriate procedures to ensure that the asphalt content and gradation meet specifications and represent

initial quality control data. Once data is collected, a statistical analysis shall be performed to determine the blend for the asphalt mixture design. This analysis shall be provided with the Asphalt Mixture Design submittal. The RAP will meet the Uniformity Specification of Table 25.2.5.1 above.

**25.2.5.3. E** The RAP system at the asphalt plant consists of a feed bin with a variable speed motor controlled by the plant computer, which ensures the proper quantity of RAP material called for by the mix design. Material is delivered to the asphalt-mixing chamber of the asphalt plant by means of conveyor belts. The RAP material falls from one conveyor to another through a shaker screen that serves to break up any RAP material that has recompacted. Any oversize material shall be rejected at the shaker screen. While in production, the front-end loader shall works the full face of the stockpile, to ensure a representative batch is being produced.

**25.2.5.3. F** Prior to starting a project and at any other time necessary, the RAP feed system shall be calibrated by placing an amount of RAP measured by certified external scales into the feed bin. That measured material is fed from the RAP bin across the belt scales. The weights are compared and, if outside of accepted tolerances for the blending system, adjustments are made by the plant-blending computer. This process is the same as for all other components of the mix design.

## 25.3 Mix Design and Plant Produced Mixture Requirements

The mix design materials shall be those listed in Section 25.2 and used for the project. No substitutions are allowed during production, unless approved by the **Construction Project Manager**.

The **Project Design Engineer** shall indicate on MGPEC Form #9 the project specific criteria concerning mix design method, traffic level, asphalt binder type, mixture grading, and maximum amount of RAP allowed. This information shall be provided on MGPEC Form #9, "Requirements for Hot Mix Asphalt (HMA)", or other Contract bidding documents.
Grading SG (1-inch nominal aggregate) shall only be designed using the 150 mm Superpave molds. Hveem Stability and Lottman test are not required for Grading SG mixtures. Grading S and SX shall be designed using 100 mm Superpave molds.

### 25.3.1 Superpave Mixture Design Method

The **General Contractor** shall submit a Proposed Design Job Mix Formula (PDJMF) for each mixture required by the Contract. The mixture design shall be determined using AASHTO T-312 or Colorado Procedure CP-L 5115 for the Superpave Method of Mixture Design. Guidance is provided in "Superpave Level 1 Mix Design" SP-2 published by the Asphalt Institute. Mixture design and field control testing shall meet the following requirements of Table 25.3.1a (located on the following page) for Dense Graded HMA.
Mixture design and field control testing of SMA shall meet the following requirements of Table 25.3.1b.

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**TABLE 25.3.1a SUPERPAVE MIXTURE PROPERTIES FOR DENSE GRADED HMA**

| Property or Test | Traffic Levels (ESALs) | | |
|---|---|---|---|
| Traffic Loading, Total 18 kip ESALs Over Design Life (Usually 20 Years) | Low (0-100,000) | Medium (100,000 to <3.0 Million) | High (3.0 Million to <30 Million) |
| Design gyrations, $N_{design}$ (Air Void: 3.5% to 4.5%) (See Note 1,2) | 50 | 75 | 100 |
| Air Voids in Total Mix ( VTM) CPL 5115 or AASHTO T 312 | (See Note 1) | (See Note 1) | (See Note 1) |
| Hveem Stability CP-L 5106 or AASHTO T 246 (Grading S & SX only) (See Note 3) | N/A | 28 Min. | 30 Min. |
| Voids Filled with Asphalt (VFA), MS-2 | 70-80 | 65-78 | 65-75 |
| Lottman, Tensile Strength Ratio, % Retained, CP-L 5109 or AASHTO T 283, Method B | 80 Min. | 80 Min. | 80 Min. |
| Lottman, CP-L 5109 or AASHTO T 283 Dry Tensile Strength, psi | 30 Min. | 30 Min. | 30 Min. |
| VMA %. CP-48 or AASHTO PP 19 (See notes 2,3,4) | Minimum VMA criteria applies to the mix design only (Table 25.2.1.2). The minimum VMA criteria shall be linearly interpolated based on actual air voids. See 25.13 for production tolerances | | |

Note 1: Select the target Job Mix Optimum Binder Content for HMA gradings as close to 4.0% air voids as possible (3.5% to 4.5% air voids).
VTM is also referred to as Pax in CPL 5115, and %Gmmx in T 312

Note 2: Maximum Theoretical Specific Gravity of mix by CP-51 or AASHTO T 209.
Note 3: Refer to Section 25.13 for production tolerances.

Note 4: VMA shall be based on tests of the Bulk Specific Gravity of the Compacted Mix (CP-L 5103 or AASHTO T 166) and Aggregate (AASHTO T 84 & T 85), and calculated according to CP-48 or AASHTO PP 19. All mixes shall meet the minimum VMA specified in Table 25.3.2, below.

**Table 25.3.1b SUPERPAVE MIXTURE PROPERTIES FOR OPEN GRADED SMA**

| Property | Test Method | Value for SMA |
|---|---|---|
| Lab compaction (Revolutions) $N_{Design}$ | CPL 5115 or AASHTO T 312 | 100 |
| Air Voids, percent at: $N_{Design}$ (See Note 1) | AASHTO T 312 | 3.0 – 4.0 |
| Hveem Stability | CP-L 5106 or AASHTO T 246 | 30 Min. |
| Accelerated Moisture Susceptibility, tensile strength Ratio, (Lottman) | CPL 5109 or AASHTO T 283, Method B | 80 Min. |
| Dry Split Tensile Strength, psi | CPL 5109 or AASHTO T 283, Method B | 30 Min. |
| Grade of Asphalt Binder | n/a | PG 76-28 |
| Voids in the Mineral Aggregate (VMA) %, minimum (see note 2) | CP 48 or AASHTO PP 19 | 17 |
| Draindown at Production Temperature | AASHTO T 305 | 0.3 maximum |
| % $VCA_{MIX}$ (See Note 3) | AASHTO PP 41-02 | Less than $VCA_{DRC}$ (See Note 4) |

General Note: Copies of AASHTO PP 41-02 and MP 8-02 (for designing SMA mixes) can be obtained from the CDOT Region Materials or the Project Design Engineer

Note 1: Select the target Job Mix Optimum Binder Content for SMA grading at 3.0% to 4.0% air voids

Note 2: VMA shall be based on tests of the Bulk Specific Gravity of the Compacted Mix (CP-L 5103 or AASHTO T-166) and Aggregate (AASHTO T 84 & T 85), and calculated according to CP-48 or AASHTO PP 19. All mixes shall meet the minimum VMA specified in Table 25.3.2, below

Note 3: VCA = Voids in the Coarse Aggregate

Note 4: DRC = Dry-Rodded Condition

**TABLE 25.3.2 MINIMUM VOIDS IN MINERAL AGGREGATE (VMA) for Dense Graded HMA & Open Graded SMA, %**

| Nominal Maximum* Particle Size | Air Voids ++ | | |
|---|---|---|---|
| | 3.5% | 4.0% | 4.5% |
| 1" | 12.2 | 12.7 | 13.2 |
| ¾" | 13.2 | 13.7 | 14.2 |
| ½" | 14.2 | 14.7 | 15.2 |
| SMA | 17.0 | 17.0 | 17.0 |

* Nominal Maximum Particle Size is defined as one sieve size larger than the first sieve to retain more than 10%, but shall not exceed the 100% passing size. The Nominal Maximum Particle Size can vary during mix production even when the 100% passing size is constant.

++ Minimum VMA criteria apply to the mix design only. The minimum VMA criteria shall be linearly interpolated based on actual air voids. See Section 25.13 for tolerances.

## 25.4 Mixture Design Submittals

### 25.4.1 General Requirements

The General Contractor shall submit all mixture designs, certificates, refinery reports, and laboratory data to the Construction Project Manager for approval at least 7 days before construction is to begin. The job mix formula may be rejected as directed by the Construction Project Manager on the basis of incompleteness, timeliness or changes in materials. Submittals shall be in a timely fashion such that rejection will not delay completion of the project.

Proposed Design Job Mix testing shall be performed in a materials laboratory under the direct supervision of; and shall be stamped and signed by a Professional Engineer licensed in the State of Colorado practicing in this field. In addition, the General Contractor shall submit as part of the Proposed Design Job Mix, documents to verify the following:

1. Source of materials.
2. Gradation, specific gravity, source and description of individual aggregates and the final blend.
3. Aggregate physical properties.
4. Source and Grade of the Performance Graded Binder (PG Binder)

5. Proposed Design Job Mix – aggregate and additive blending, final gradation shown on 0.45 power graph, optimum asphalt content.
6. Mixing and compaction temperatures used.
7. Mixture properties determined at a minimum of four asphalt contents and interpolated at optimum and graphs showing mixture properties versus asphalt content.

The Construction Project Manager reserves the right to test the General Contractor's mix for each hot asphalt pavement grading utilizing materials actually produced and stockpiled. General Contractor shall provide a sufficient quantity of each aggregate, mineral filler, RAP, and additive for the required laboratory tests, if required by the Construction Project Manager.

The Contractor shall not place any materials without acceptance and approval of the Construction Project Manager.

### 25.4.2 Change in source or grade

Should a change in the source of Asphalt Cement (AC) or Lime occur, a one point verification test (at optimum asphalt content) of the mix must be performed to verify that the applicable Table 25.3.1a(Dense Graded HMA) or 25.3.1b (SMA) or 25.3.2 (VMA), is still met. If this testing shows noncompliance, a new design job mix shall be established before the new AC or Lime source is used. Any change in aggregate type or source will require a new mix design.

### 25.4.3 Mix Production Verification

Production verification shall occur prior to the start of the project. The production verification shall be performed by LABCAT Level C certified technicians with current Certification to verify the volumetric properties of the mix. If the mix has been produced for another project within the last 90 days, data from that project can be submitted for this verification. Volumetric properties of the mix verification testing shall be within the following tolerances compared to the Proposed Design Job Mix. The mix verification test reports shall be submitted to the Construction Project Manager prior to mix placement.

**TABLE 25.4.3.1 MIX DESIGN VERIFICATION TOLERANCES**

| | |
|---|---|
| Air Voids | +/- 1.2% |
| VMA | +/- 1.2% |
| Asphalt Binder Content | +/-0.3% |
| Stability | Applicable minimum |

The tolerances in this table are for mix design verification only. See section 25.13 for production tolerances.

### 25.4.4 Pre-paving Meeting

The Construction Project Manager may require a pre-paving meeting of all parties involved in supply, haul, laydown inspection, quality control and quality acceptance of HMA. Areas of responsibility and contact names and numbers should be shared. A construction (joint) plan will be submitted at the pre-paving meeting, see section 25.9 for joint requirements. Form 25.1 provided at the end of this specification is an example of a pre-paving meeting agenda.

## 25.5 Equipment

### 25.5.1 Mixing Plant

The mixing plant shall be capable of producing a uniform material, have adequate capacity, and be maintained in good mechanical condition. Defective parts shall be replaced or repaired immediately if they adversely affect the proper functioning of the plant or plant units, or adversely affect the quality of the hot bituminous plant mix.

Dust, smoke, or other contaminants shall be controlled at the plant site to meet all air quality requirements in the "Colorado Air Quality Control Act," Title 25, Article 7, CRS and regulations promulgated there under.

Acceptable safety equipment, approved by the Construction Project Manager, shall be provided by the General Contractor to accommodate sampling and testing.

### 25.5.2 Hauling Equipment

Trucks used for hauling HMAP shall have tight, clean, smooth metal beds thinly coated with a minimum amount of paraffin oil, lime solution, or other approved release agent. Petroleum distillates such as kerosene or fuel oil will not be permitted. Each truck shall have and use a cover of canvas or other suitable material to protect the mixture from the weather and excessive temperature loss or cooled layers of mix in truck.

### 25.5.3 Bituminous Pavers

Self-propelled pavers shall be provided for full lane width paving capable of spreading and finishing the HMA, material in full lane widths applicable to the typical section and thicknesses shown in the Contract and shall be equipped with:

1. anti-segregation devices,
2. A vibratory screed assembly capable of being heated.

Pavers used for shoulders, patching and similar construction, not requiring fine grade control, shall be capable of spreading and finishing courses of HMA material in widths shown in the Contract without segregation.

The paver's receiving hopper shall have sufficient capacity for a uniform spreading operation and shall have an automatic distribution system that will place and spread the mixture uniformly in front of the screed.

The paver shall be capable of operating at forward speeds consistent with uniform and continuous laying of the mixture. Stop and go operations of the paver shall be avoided. The screed or strike-off assembly shall produce the specified finished surface without tearing, shoving, or gouging the mixture. Self-propelled pavers shall be equipped with automatic screed controls with sensors capable of sensing grade from an outside reference line, and maintaining the screed at the specified longitudinal grade and transverse slope. The sensors may be contact or non-contact type devises. The sensor shall be constructed to operate from either or both sides of the paver and shall be capable of working with the following devices when they are required for the situation:

1. Grade control device at least 30 feet in length.
2. Joint matching device
3. Adequate length of control line and stakes, if no other type of geometric control is present
4. A straight edge at least 10 feet in length will be available to verify the crown on the screed, at the request of the Construction Project Manager

The controls shall be capable of maintaining the screed at the specified transverse slope within plus or minus 0.1 percent. Automatic mode should be used where possible. If the automatic controls fail or malfunction, the equipment may be operated manually for the remainder of the normal working day, provided specified results are obtained.

If the Contractor fails to obtain and maintain the specified surface tolerances, the paving operations shall be suspended until satisfactory corrections, repairs, or equipment replacements are made.
Placement of HMA on a waterproofed bridge deck shall be accomplished with equipment that will not damage the membrane or protective covering.

## 25.6 Manufacture

### 25.6.1 Preparation of Aggregates

Heating and drying of the aggregates shall be accomplished without damaging the aggregate. Lime shall be added to achieve complete and uniform coating of the aggregate. When hydrated lime is used it shall be added to the aggregate in accordance with one of the following methods:

a. Lime Slurry Added to Aggregate: The hydrated lime shall be added to the aggregate in the form of a slurry and then thoroughly mixed in an approved pugmill. The slurry shall contain a minimum of 70 percent water by weight.

b. Dry Lime Added to Wet Aggregate: The dry hydrated lime shall be added to wet aggregate (a minimum of three percent above saturated surface dry) and then thoroughly mixed in an approved pugmill.

The lime-aggregate mixture may be fed directly into the hot plant after mixing or it may be stockpiled for not more than 90 days before introduction into the plant for mixing with the asphalt cement. The hydrated lime may be added to different sized aggregates and stockpiled, by adding 75 percent of the lime to the aggregate passing the No. 4 sieve and 25 percent to the aggregate retained on the No. 4 sieve.

### 25.6.2 Mixing

The dried aggregates and asphalt cement shall be combined in the mixer in the quantities required to meet the design job mix. The materials shall be mixed until the aggregate is completely and uniformly coated, and the asphalt cement is uniformly distributed throughout the aggregate. The output rate shall not exceed the manufacturer's capacity rating.

Baghouse fines shall be fed to the mixing plant in a uniform and continuous manner so as to maintain uniformity in the mixture. The Baghouse, fines feeder, auger, and related equipment, shall be in good working condition and operated in accordance with manufacturer's recommendation. If the Construction Project Manager determines that non-uniform operation of the equipment is detrimental to the mixture, he may halt all construction until the General Contractor takes appropriate action.

The minimum temperature of the mixture when discharged from the mixer shall be as shown in the following table:

**Table 25.6.2.1**
**Mixture Discharge Temperatures**

| Asphalt Grade | Minimum Discharge Temperature | Maximum Discharge Temperature |
|---|---|---|
| PG 58-28 | 275° F | 310° F |
| PG 64-22 | 290° F | 325° F |
| PG 76-28* | 318° F | 326° F |

* Contractor or Binder supplier must supply production temperature as require by their product

The General Contractor may provide refinery information that recommends revised

discharge temperatures depending on the base binder grade or source being used. HMA mix shall be produced at the lowest temperature within the specified temperature range that produces a workable mix and provides for uniform coating of aggregates (95 percent minimum in accordance with AASHTO T 195), and that allows the required compaction to be achieved.

HMA mix may be stored provided that any and all characteristics of the mixture are not altered by such storage. If storing or holding of the mixture causes segregation, excessive heat loss, or adversely affects the quality of the finished product, corrective action shall be taken. Unsuitable mixture shall be disposed of at the **General Contractor's** expense.

When placing hot mix asphalt over bridge decks covered by waterproofing membrane, the minimum temperature of the mixture, when rolling operations begin, shall be 250 ° F. The job mix temperature may be increased up to 30 ° F to obtain this temperature.

The mineral filler for SMA shall be stored in a separate silo and added automatically in the correct proportion. The mineral filler addition equipment shall be electronically or mechanically interlocked to the aggregate feed sensors so that the proper amount of mineral filler is added whenever SMA is produced.
The SMA mineral filler shall be added at the same point the asphalt binder is added to the aggregate.

### 25.6.3 Hauling

Each truck shall use covers (tarps) to protect the mix during transport. The Construction Project Manager can reject mix, which is hauled without a cover. Should the mixture show an excess or deficiency of asphalt cement, damage due to burning or overheating, an improper gradation, or thermal segregation with cold areas 10° F below the minimum discharge temperature, the truck shall be rejected.

## 25.7 Tack Coat

Prior to placement of HMA, a tack coat shall be applied. The material shall be in accordance with 25.2.4. The emulsified asphalt shall be diluted 1:1 with water and applied at 0.10 ± 0.01 gallons per square yard of diluted material. The Construction Project Manager may direct other application rates to match the age of condition of the surface.

All work shall be done at locations and with the grade and quantities of material designated on the plans. The surface to receive the tack coat shall be dry and cleaned by sweeping or other approved method until dust, debris, and foreign matter are removed. The tack coat shall then be applied uniformly by squeegee, brooms, or distributor. Prior to placement of SMA, tack coat between the existing pavement and Stone Matrix Asphalt pavement shall be placed at a rate between 0.03 and 0.05 gallons per square yard

## 25.8 Placement

Hot mix asphalt shall be placed only on approved, properly constructed surfaces that are

free from loose material, water, frost, snow or ice. The hot mix asphalt and tack coat shall be placed in accordance with the temperature limitations of Table 25.8 and only when weather conditions permit the pavement to be properly placed and finished as determined by the Construction Project Manager. Placement temperature as stated shall be increased by 5° F for each 10 miles per hour wind velocity to a maximum increased minimum placement temperature of 70° F.

**Table 25.8**
**Placement Air and Surface Temperature Limitations**

| Compacted Layer Thickness | Top Layer of Pavement* | | Lower Layers* | |
|---|---|---|---|---|
| | PG 58-28<br>PG 64-22 | PG 76-28 | PG 58-28<br>PG 64-22 | PG 76-28 |
| <2 inches not permitted | N/A | N/A | N/A | N/A |
| 2 inches to <3 inches | 50° F | 65° F | 40° F | 50° F |
| 3 inches or more | 50° F | 60° F | 40° F | 40° F |
| SG mix only | N/A | N/A | 38º F | 38º F |

* Air temperature is taken in the shade. Surface temperature is taken on the subgrade or base.
The Construction Project Manager may not waive the above temperature limitations for PG 76-28.

The mixture shall not be placed at a temperature lower than 245° F for mixes containing PG 58-28 or PG 64-22 asphalt, and 290° F for mixes containing polymer modified asphalt. Mix, which is too cold or damaged by weather, will be rejected.

The mixture shall be laid upon an approved surface, spread and struck off to obtain the required grade and elevation after compaction. The minimum lift thickness shall be **at least three times (preferably four times)** the normal particle size. The mixture shall be placed approximately 10-25 percent thicker than the existing surrounding mat thickness to account for compaction based on the materials being placed. Raking is not permitted and will not be allowed. Casting that causes any segregation will not be permitted.

On areas where the use of mechanical spreading and finishing equipment is impracticable, the mixture shall be carefully dumped, spread, raked, screeded, and luted by hand tools to the required compacted thickness plus 25 percent based on the materials being placed.. Carefully move or minimally work the HMA mix with the use of rakes, lutes, or shovels to avoid segregation. Mixtures made with modified asphalt cement require more rapid completion of handwork areas than for normal mixtures. Hauling and placement sequences shall be coordinated so that the paver is in constant motion. Starting and stopping shall not be allowed. A construction joint shall be placed at anytime the power stops, and the screed

drops enough to cause a surface dip in violation of Section 25.13.1, “Surface Tolerances”; or the mat temperature falls below that allowed in Section 25.12, “Compaction”. Bituminous pavers shall be used to distribute the mixture either over the entire width or over such partial width as may be practicable. Echelon paving will be permitted.

If an unsatisfactory mix has been placed, it shall be removed, disposed of and replaced as directed. No compensation will be allowed for rejected material.

### 25.8.1 SMA PLACEMENT & Compaction

A Roller Pass Study (RPS) for Density and 1000 foot demonstration control strip are required for placement of lifts less than or equal to 1.5 inch thick, optional for thicker lifts.

**25.8.1.A For Thin Lift SMA less than or equal to 1.5 inch thick.**

In-place density shall be determined through the completion of a Roller Pass Study (RPS) to be conducted during placement of the required 1000-foot demonstration control strip. The RPS will determine the necessary roller compaction process needed to produce a minimum pavement density of 94 percent of theoretical maximum density (RICE). During the RPS, a minimum of three sets of three 4-inch diameter cores each shall be taken to measure SMA mat density for the various sections of the RPS. All coring shall be completed by the **General Contractor** and submitted to the **Construction Project Manager**. The densities of the three cores will be averaged to produce the density for each RPS section tested.

Full production of the thin SMA shall not begin until density test results are determined and the project compaction process is established by the **General Contractor** and approved by the **Construction Project Manager**. The approved compaction process established from the RPS shall be used for the duration of the thin SMA paving. Changes to the thin SMA mixture will be reviewed and a new RPS may be required.

Using the same method for determining density during the RPS, density will be determined daily for each day of full production and tested to confirm pavement density. If a daily density check shows density below 92 percent of RICE, the **General Contractor** shall stop production and the **General Contractor** will again complete a RPS to establish the necessary compaction process. The **General Contractor** will be allowed two daily density checks below 92 percent of RICE to be addressed in this manner during the project. All subsequent daily checks that identify locations having density below 92 percent of RICE shall be removed and replaced and a new RPS shall be completed and approved prior to again beginning production. Thin SMA density requirements will be enforced when the SMA mix design gradation and specified lift thickness are in accordance with or exceed the 3:1 requirements for the ratio of nominal maximum aggregate size to lift thickness.

The **General Contractor** shall submit a plan for a Roller Pass Study (RPS) to the **Construction Project Manager** for approval. Upon approval by the **Construction Project Manager**, the **General Contractor** shall perform a RPS. The plan for the RPS shall include, but is not limited to the following:

Number, size, and type of rollers.
Amplitude, frequency, size and speed of vibratory rollers.
Temperature of mixture being compacted.
Roller patterns.

The method of measuring density will be by roller passes. If a density element is based on a RPS, the Pay Factor shall be as shown in section 25.14.3.

**25.8.1.B For SMA lifts greater than 1.5 inch thick.**

If in the opinion of the **Construction Project Manager**, the roller pass study presented by the **General Contractor** is inadequate, then the **General Contractor** shall modify the compaction procedures as directed.

**25.8.1.C Before Proceeding with SMA placement,**

The General Contractor shall demonstrate the ability to produce and place a satisfactory mix. The actual work may proceed when a full lane width demonstration control strip, having a minimum length of 1000 feet has been successfully placed. The **GENERAL CONTRACTOR** shall determine properties (Superpave Air voids, VMA, in-place density, and Hveem Stability) of the project produced mix that is used in the demonstration control strip and provide the results to the **Construction Project Manager**. No other SMA production or placement will be allowed until densities are determined. If the material in the demonstration control strip is not in close conformity with the specifications, the demonstration control strip will be removed and replaced at the **General Contractor's** expense. The **Construction Project Manager** will designate the location of the control strip.

SMA mixture shall be transported and placed on the roadway without drain-down or flushing. All flushed areas behind the paver shall be removed immediately upon discovery. If more than 50 square feet of flushed SMA pavement is ordered removed and replaced in any continuous 500 linear feet of paver width laydown, operations shall be discontinued until the source of the flushing has been found and corrected. The **Construction Project Manager** will designate the depth and area of all flushed areas requiring removal and replacement. All costs associated with the removal and replacement of the flushed areas shall be at the **General Contractor's** expense.

Stone Matrix Asphalt Pavement shall be placed and compacted in accordance with the temperatures listed in table 25.8 or as revised for the project.

The relative compaction for all SMA mixtures will be measured from roadway cores in accordance with CDOT-CP 44 or AASHTO T-166, Method B, unless the SMA mixture is being placed on a structure (bridge deck) in which case the **Construction Project Manager** may specify that nuclear gauge measurements be used.

When cores are used, the **General Contractor** shall provide all labor and equipment for the coring operation and filling the core holes. When nuclear density gauges are used, the tests will be performed in accordance with CDOT-CP 81 or ASTM D 2950 and CDOT-CP 82 or AASHTO T 230.

In-place density for SMA shall be 95 ± 2 percent of the SMA Mix maximum specific gravity as measured according to Maximum theoretical value (Rice) (CDOT-CP 51 or AASHTO T 209).

## 25.9 Longitudinal Joints

### 25.9.1 Joint Placement

The longitudinal joints in both a new pavement and an overlay pavement layer shall offset the joint in the layer immediately below by 6 inches. The joints in any pavement layer shall not fall in a wheel track. The joints in the top layer of new pavement not built on top of an existing pavement shall be located on lane lines or as shown on the plans. Longitudinal joints shall be minimized, where feasible, with wide paving pulls or echelon paving. Joints shall be parallel to the flow of traffic and shall not cross any centerline, lane line, or edge line unless approved by the **Construction Project Manager**. The **General Contractor** shall submit, prior to paving, a joint plan and pavement marking plan showing locations and the methods to establish a field control line. The **Construction Project Manager** must approve such plans prior to paving. The **General Contractor** shall use a continuous string line to delineate longitudinal joints during paving as shown on the joint plan. All string lines shall be removed at the end of each day's paving.

The free edge of the paved pass shall be laid as straight as possible, to the satisfaction of the **Construction Project Manager.** This joint, if cold, shall be tack coated prior to placement of adjacent paving.

The new compacted mat shall overlap the previously placed mat no more than 1.5 inches. Excess overlap or thickness shall not be raked or cast onto the new mat, but shall be wasted by pulling back and removing. The hot edge shall be blocked or bumped in a smooth line consistent with the previous longitudinal edge. Minor raking will only be allowed to correct major grade problems or provide mix around manholes and meter covers. The longitudinal joint shall be rolled from the hot side and overlap the joint by approximately 6 inches on the cold side.

## 25.10 Transverse Joints

The **General Contractor** shall submit, prior to paving, a joint plan showing locations and the methods to be used to construct transverse joints. The **Construction Project Manager** must approve such plans prior to paving. Placing of the HMA shall be continuous with a minimum of transverse joints, and rollers shall not pass over the unprotected end of a freshly laid mixture. Transverse joints shall be formed by cutting back on the previous run to expose the full depth of the course. Tack coat material shall be applied to contact surfaces of all joints just before additional mixture is placed against the previously compacted material.

The end of transverse joints shall be located so they will be constructed with a full head of mix in front of the screed. When butt joints are constructed, runoff boards shall be used to support the roller on the downstream side of the joint. All tapered sections, rounded edges and segregated areas shall be removed to achieve a vertical face at the butt joint before paving is restarted.

When a temporary tapered joint is required for temporary traffic access, the ramp shall be removed back to a full depth section before paving is restarted.

When restarting paving operations, the paver screed shall be placed on the starter block on the completed side of the transverse joint. The starter block should be approximately 25% greater than the thickness of the existing completed mat, so that adequate grade and compaction can be achieved on starting the paving operation. The screed should be nulled (angle removed) when on starting blocks and an up angle of attack set. Proper head of mix should be introduced into the paver prior to starting. The new compacted (downstream) side of the joint may be up to 3/16 inches higher than the old (upstream) side. Raking of this joint shall not be allowed except to correct major grade problems. The surface tolerance at the transverse joint must be verified by the **General Contractor** with a 10-foot straight edge before the paver is more than 100 feet from the joint. If the surface tolerance is not within the 3/16", the **General Contractor** shall make corrections before proceeding

## 25.11 Segregation

The asphalt mixture shall be transported and placed on the roadway without segregation. All segregated areas shall be removed immediately and replaced with specification material before the initial rolling. If more than 50 square feet of segregated pavement is removed and replaced in any continuous 500 linear feet of paver width laydown, operations shall be discontinued until the source of the segregation has been determined and corrected.

The Construction Project Manager will visually determine areas, which are segregated, and may also use density and gradation measures to help in this determination. The Construction Project Manager will visually determine the extent of the segregation. The General Contractor will not be allowed additional compensation for correction of segregated areas.

## 25.12 Compaction

The temperature of the mixture immediately behind the screed shall be sufficient to allow for proper compaction of the HMA layer and at least 245 °F for PG 58-28 or PG 64-22 binder and between 297°F and 305 °F for PG 76-28 binder. The breakdown compaction should be completed as quickly as possible after placement occurs.

The HMA shall be compacted by rolling. The number, weight, and type of rollers furnished shall be sufficient to obtain the required density and surface texture while the mixture is in a workable condition. Compaction shall begin immediately after the mixture is placed and be continued until the required density is obtained. Final compaction shall be obtained using steel wheel rollers.

Pavement operations shall be suspended when density requirements are not met and the surface temperature falls below 185 °F, or there is obvious surface distress or breakage, the problem shall be resolved prior to continuing paving operations. The criteria for mixtures containing PG 76-28

asphalt cements shall be 235 °F. The minimum compaction temperatures may be adjusted according to the asphalt binder supplier recommendations. Adjusted minimum compaction temperatures must be shown on the approved mix design or on other asphalt binder supplier documents, and be available on the job site. Pay Reduction criteria in Section 25.14 shall still apply in such cases.

All roller marks shall be removed with the finish rolling. Use of vibratory rollers with the vibrator on will not be permitted on bridge decks.

The **General Contractor** shall establish a rolling pattern or procedure during the beginning of paving operations, which will achieve the required compaction and surface tolerances. This procedure may be re-evaluated by the **General Contractor** and **Construction Project Manager** throughout the paving operations.
All HMA paving shall be compacted to 94.0 ± 2 percent of Maximum Theoretical (RICE) Density, (CP-51 or AASHTO T-209: Maximum Specific Gravity of Bituminous Paving Mixtures) as determined by ASTM D 2950. RICE values shall be used in calculating Relative Compaction according to CP-44 or .AASHTO T 166. The **General Contractor** shall determine the proper RICE value to use for the initial day's placement. Subsequent day's RICE value(s) will be based on the current day's production. The **General Contractor** shall provide the producer's RICE value, which shall be used for production until the actual day's RICE value is determined by the testing firm of record for the project as approved by the **Construction Project Manager**.

All joints shall be compacted to 92.0 ± 2 percent of RICE, taken fully on each side of joint, every 200 Linear Feet. RICE values shall be used in calculating Relative Compaction according to AASHTO T 166, Cores if need will be used to verify compaction results.

The **General Contractor** shall core the pavement, as required by the **Construction Project Manager,** for field density tests in accordance with Colorado Procedure 44 or AASHTO T 230, Method B, or for field calibration of nuclear density equipment in accordance with the ASTM D 2950 or Appendix of Colorado Procedure 81. At a minimum, cores for nuclear density equipment calibration shall be taken at the beginning of placement of each pavement layer or change of mixture materials or gradation. Untested areas during placement will also require cores to be taken to verify compaction.

Along forms, curbs, headers, walls, and all other places not accessible to the rollers, the mixture shall be thoroughly compacted with mechanical tampers.

Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective, shall be immediately removed and replaced with fresh hot mixture and compacted to conform to the surrounding area.

Compaction requirements for SMA are covered in section 25.8.1. Rollers shall not be used in a vibratory mode on SMA unless they are first used successfully in the demonstration control strip. Pneumatic wheel rollers shall not be used on SMA Mix.

## 25.13 Production Tolerances

### 25.13.1 Top Lift Surface Tolerances

The variation between any two contacts with the surface shall not exceed 3/16 inch in 10 feet. For patching surface tolerances, the variation shall not exceed 3/8 inch in 10 feet. Irregularities exceeding the specified tolerance shall be corrected at the General Contractor's expense. Transverse measurements for variations shall exclude breaks in the crown sections.

### 25.13.2 Job Mix Formula Tolerances

Production test results that deviate from the design job mix by more than shown in the following table are subject to Section 25.14:

**Table 25.13.2.**
**Gradation Tolerances**

| Item | |
|---|---|
| Passing No. 3/8" and Larger (note 1) | ± 6% |
| Passing No. 4 and No.8 | ± 5% |
| Passing No. 30 to No. 50 | ± 4% |
| Passing No. 200 (note 2) | ± 2% |
| Air Voids | ± 1.2% |
| VMA (note 4) | ± 1.2% |
| Hveem Stability | (note 3) |
| Asphalt Content | ± 0. 3% |

(Note 1) There is 1.0 percent tolerance for the maximum sieve size.

(Note 2) Mixes with passing No. 200 sieve material produced over 7.0 percent are allowed only when the above Air Voids and VMA tolerances are still met.

(Note 3) Hveem Stability must meet the minimum value specified in table 25.3.2.

(Note 4) When calculating VMA, use the most current aggregate specific gravity $G_{sb}$,

When disagreements concerning determination of specification compliance occur, only valid tests from the Construction Project Manager will be considered. The Construction Project Manager shall determine validity. Generally, valid tests are those in which sampling and test have been performed according to referenced procedures and the results are within stated precision statements. When disagreements occur with Asphalt Content and gradation tests results, solvent extracted aggregate testing shall take precedence over burn off oven extracted aggregate, which shall take precedent over cold feed belt testing.

## 25.14 CONFORMITY WITH PLANS AND SPECIFICATION

**25.14.1 General**

All work performed and all materials furnished shall conform to the lines, grades, cross sections, dimensions, and material requirements, including tolerances, shown in the contract.

For those items of work where working tolerances are not specified, the **General Contractor** shall perform the work in a manner consistent with reasonable and customary manufacturing and construction practices.

When the **Construction Project Manager** determines that the material furnished, work performed, or the finished product is not in conformity with the contract and has resulted in inferior or unsatisfactory product, the finished product or materials shall be removed and replaced or otherwise corrected by, and at the expense of, the **General Contractor**.

Materials shall be sampled and tested by a qualified testing laboratory in accordance with the sampling, testing schedules, and procedures contained in the Section 25.15 Testing and Inspection. The approximate maximum quantity represented by each sample shall be as set forth in the testing schedule. An additional number of samples, in relation to the quantity of materials represented, may be selected and tested at the **Construction Project Manager's** discretion. The quantity represented by five consecutive random samples shall constitute a lot, whenever production schedules and material continuity permits. When it is necessary to represent short production runs, significant material changes, or other unusual characteristics of the work, the **Construction Project Manager** may establish a lot consisting of the quantity represented by any number of consecutive random samples from one to seven inclusive. Testing results that are determined to have sampling or testing errors, as determined by the **Construction Project Manager**, shall not be used.

## 25.15 Testing and Inspection

If any materials furnished or work performed by the **General Contractor** fails to fulfill the specification requirements, such deficiencies shall be reported to the **Construction Project Manager** and the **General Contractor** immediately. Preliminary written field reports of all tests taken and observation results shall be given to the **General Contractor** and **Construction Project Manager,** <u>within 1 business day</u> after samples were obtained or density testing performed. Field reports shall be forwarded to the Project Manager no later than 1 week following the testing.

Reports of all tests taken, including failing tests, shall be reported to the **Construction Project Manager** and to the **General Contractor** no later than 1 week following the sampling. Density test results will be given in writing at the time the testing occurs.

Testing of Hot Mix Asphalt Pavement shall be performed in accordance with Table 25.15. The tests shall be performed under the general supervision of and signed by a **Professional Engineer** registered in the State of Colorado. Laboratories shall be inspected by either AASHTO or accredited A2LA or equivalent in the elements listed below. Technicians taking samples and conducting compaction tests must have a LABCAT Level A certification or equivalent. Technicians conducting tests of asphalt content and gradation must have a LABCAT Level B certification or equivalent. Technicians performing volumetric testing must have a LABCAT Level C certification or equivalent.

**Table 25.15.1**
**Schedule for Minimum Materials Sampling and Testing**

| Test | Standard* | Minimum Frequency |
|---|---|---|
| Sampling | AASHTO T 168, ASTM D 979 and ASTM D3665 | One test for each day |
| Density | AASHTO T 166, T 238, T 230 Or CP-44, CP-81, CP-82 | One test for each 250 lineal feet per Lane |
| Thickness (Core) | ASTM D 3549 | One test for each 1000 lineal feet per Lane, |
| Air Voids & VMA | AASHTO T 166 & AASHTO PP 19 or CP-48 | One test for each day (See note 4, Table 25.13.2) |
| Gradation | AASHTO T 27, T 11 or CP-31A, CP-31B | One test for each day |
| Asphalt (AC) Content | AASHTO T 164 or CP-L 5120 or other methods agreed upon between **Construction Project Manager** and **General Contractor** | One test for each day |
| Maximum Theoretical Specific Gravity (Rice) | AASHTO T 209 or CP-51 | One test for each day |
| Lottman Stripping, TSR & Dry Density | AASHTO T 283 or CP-L 5109, Method B | As requested by the **Construction Project Manager** . |
| Micro Deval | AASHTO T 327 or CP-L 4211 | One per 5000 tons or 1 per project minimum |

Construction Project Manager or designee shall be responsible for checking temperatures of mix in truck and on pavement, segregation, rolling patterns and other construction means and method that affect the performance of the pavement system. The General Contractor shall provide assistance in sampling and testing at all facilities and at the job site.

**End of Specification**

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## 26.0 Excavation and Embankment

### 26.0.1 General

This work pertains to construction and consists of excavation, hauling, disposal, placement, and compaction of all material encountered on-site within the limits identified in the plans. All excavation and embankment for construction will be classified as "unclassified excavation" as hereafter described.

### 26.0.2 Referenced Standards

| | |
|---|---|
| AASHTO M 145 | Classification of soils and soil-aggregate mixtures |
| AASHTO T 99 | Moisture-Density Relations of Soils using a 5.5-lb Rammer and a 12-inch Drop |
| AASHTO T 180 | Moisture-Density Relations of Soils using a 10-lb Rammer and a 18-inch Drop |

### 26.0.3 Excavation

*Unclassified Excavation.* Unclassified excavation shall consist of the excavation of all materials of whatever character required for the work, obtained within the construction project site, including surface boulders, masonry, organics, rocks, muck material, miscellaneous debris and slag that are not removed under some other item. The work also includes excavation for the ditches, channels, and placement, water and compaction of the material to construction embankments in accordance with the plans.

### 26.0.4 Embankment

*Embankment:* Embankment material shall consist of approved material acquired from excavations, hauled and placed in embankments. Approval of the embankment material will be contingent on the material having a maximum dry density of not less than 90 pounds per cubic foot. Soil embankment shall consist of materials obtained on-site and approved by the Engineer.

## 26.0.5 Construction Requirements

### 26.0.5.1 General

The excavations and embankments shall be finished to a smooth and uniform surface conforming to the line and grade specified. Variation from the subgrade plan elevations specified shall not be more than 1.0 inch. Excavation operations shall be conducted so material outside of the slope limits will not be disturbed. Prior to beginning grading operations, all necessary clearing and grubbing and site demolition in that area shall be performed.

The Contractor shall notify the Engineer not less than ten working days prior to beginning excavation so the necessary cross sections may be taken. Baseline survey for purposes of payment of the unclassified excavation work item will be obtained by the CCD Survey Group. The baseline survey will be taken once all building and site demolition, including removal of the buildings, parking lots, driveways is complete. The baseline survey is intended to set the topography of the existing native soil below the pavements and building elevations. Once the construction is complete a second survey will be completed to determine the final quantity of unclassified excavation. The Contractor shall not excavate beyond the dimensions and elevations established.

### 26.0.5.2 Unclassified Excavation

All material to be excavated shall be stockpiled as subgrade material or removed from the site. Materials excavated beneath the top twenty six (26) inches shall, at the discretion of the Engineer, either be placed in the subgrade stockpile or removed from the site and disposed of at Denver Arapahoe Disposal Site (DADS). It shall be the responsibility of the Contractor to determine the amount of subgrade material to be stockpiled and necessary for completion of the work. All stockpiled material not used shall be disposed of per Contract requirements.

### 26.0.5.3 Embankment

Embankment construction shall include preparation of the areas upon which embankments are to be constructed, placing, moisture conditioning and compacting of approved material to the limits shown on the plans or as directed. Only approved materials shall be used in the construction of embankments and fills. The type of relative compaction required shall be a minimum of 95% of Standard Proctor density AASHTO T-99 within 2% of optimum moisture content.

The soil upon which the embankments are to be constructed shall be scarified to a depth of eight (8) inches and compacted with moisture and density control. The moisture content of the soil at the time of compaction shall be as specified or directed.

Embankment shall be placed in horizontal layers not to exceed six (6) inches loose measurement and shall be compacted as specified before the next layer is placed. Spreading equipment shall be used to obtain uniform thickness prior to compaction. As the compaction progresses, continuous mixing, leveling and manipulating shall be done to assure uniform moisture and density.

Embankments shall be constructed with moisture and density control. The moisture content of the soil at the time of compaction shall be as specified or directed. Maximum dry density of all soil types encountered or used will be determined in accordance with AASHTO T-99. The amount of water to be used in compacting A-2-6, A-2-7, A-4 and A-6 through A-7 soils shall not deviate from optimum on the dry side by more than two percentage points as determined by AASHTO T-99. A-4 soils, which are unstable at the above moisture content, shall be compacted at lower moisture content to the specified density.

Additional work involved in drying embankment material to the required moisture content shall be included in the work.

### 26.0.6 Finished Grade

Finished grade as shown on the plans or as directed shall be achieved by placement of a minimum of twelve (12) inches of compacted subgrade followed by placement of six (6) inches of topsoil. Materials, compaction, moisture and density requirements for the subgrade are as specified above.

**End of Specification**

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# 31-3223.12 Soil Improvement by Compaction Grouting

## Part 1 - General

### 1.01 Introduction

A. Compaction grouting involves the injection under high pressure of a low-slump, mortar-like grout to compact and displace the adjacent soils. The grout does not penetrate soil pores but displaces the subsurface soils by forming a homogeneous grout bulb near the grout pipe tip.

B. In situ soil types: Refer to the project specific geotechnical report for soil types.

C. Applications: Loose fill stabilization; remediation of settling structures and utilities; sinkhole remediation; building/utility protection during tunneling; soil densification for site improvement; liquefaction mitigation. In certain cases, procedures can be designed to intentionally lift structures and/or utilities.

### 1.02 Intent

The intent of the compaction grouting specified herein is to provide soil improvement within the limits indicated on the Project Drawings to achieve the required degree of improvement detailed in these specifications.

### 1.03 Standards and References

A. The most recent version of the following testing methods or standards shall be employed:

1. ASTM D1586 Standard Penetration Testing (SPT) and Split-Barrel Sampling of Soils
2. ASTM C1019 Sampling and Testing Grout
3. ASTM C150/C150M Portland Cement
4. ASTM C143/C143M Slump of Hydraulic-Cement Concrete

B. Reference documents as provided to the grouting contractor shall include:

1. This specification.
2. Construction Drawings.
3. Project specific geotechnical report.
4. Bid Documents.

## 1.04 Definitions

A. *Compaction Grout*: A material blend of fine aggregate, fines and water to achieve a pumpable, thixotropic, viscous grout of a low slump to enable pumping at high pressure and remain intact after injection.

B. *Field Quality Control Representative (FQCR)*: The Contractor's representative given specific inspection tasks identified in this specification.

C. *Treated Zone* – the area requiring subgrade stabilization (compaction grouting) as measured between bedrock (or depth of refusal) and the subgrade of the facility to be supported

D. *Overburden/untreated zone* – the area as measured between the existing ground surface and the subgrade of the facility to be supported.

E. *Refusal* – **This definition relies on information provided by the approved contractor and is required as a submittal. In general Refusal is the point at which pipe advancement has stopped.** We agree that Refusal is based upon the physical limitations of the machine being used to advance the pipe. There is a point, based upon different mechanical limits, at which advancement ceases and may not be within the anticipated limits of bedrock.

F. *Geotechnical Data Report (GDR)* - A document that presents an interpretation of the known subsurface data for the project. The purpose of the GDR is to compile all geological, geotechnical, groundwater, and other data obtained from the geotechnical investigations for use by the various participants in the project. If available, this information will be included within the contract documents as specifically applicable to the project.

G. *Geotechnical Baseline Report (GBR)*- The intent of a GBR is to clearly and contractually define the geotechnical conditions through which tunneling will occur in order to evaluate a differing site condition (if encountered) and it is used as a basis of bid for the contractor. By assessing the anticipated geotechnical conditions for a project and providing baselines in the contract, the contractor has a basis from which to prepare their bid and select their means and methods. The baseline conditions do not necessarily reflect the actual conditions; they are not geotechnical fact to be encountered. Rather, they represent the owner's assumption of existing geotechnical conditions for the project. If available, this information will be included

within the contract documents as specifically applicable to the project. Regardless of inclusion, this information shall be investigated, interpreted, verified and/or developed by the contractor prior to commencement of the work.

## 1.05 SCOPE OF WORK

A. The work shall consist of installation, monitoring and testing of compaction grouting within the limits indicated on the Drawings to meet the acceptance criteria presented in within these specifications.

B. In connection with the compaction grouting program, as shown on the drawings, the grouting contractor shall provide all labor, materials and equipment as detailed in the contract documents and within the Measurement and Payment to accomplish the work:

## 1.06 SUBMITTALS

A. The following shall be submitted to the Construction Project Manager by the General Contractor a minimum of two (2) weeks *prior to the start of the work:*

1. A ground movement monitoring plan, as detailed in this specification, if structures are located within a horizontal distance equal to the depth of treatment.

2. A mix design for the project indicating sources and types of grout materials, with volumetric proportions, and field test data from previous projects indicating compressive strength and slump of 1 inch or less achieved. If the grouting contractor intends to deviate from the gradation provided in this specification, the contractor shall submit evidence of satisfactory use of the proposed material from past projects with similar geotechnical conditions.

3. Work procedures and control criteria (including volumes and pressures for each stage).

4. A general Work Procedures Plan outlining the spacing as shown on the Drawings, location, depth and estimated quantity of grout to achieve the specified criteria detailed in this specification. Grout hole locations shall be dimensionally referenced to the facility foundation as shown on the Drawings.

B. The following shall be submitted to the Construction Project Manager by the General Contractor *during construction:*

1. Accurate daily records of all grout pipe installation, compaction grouting quantities, including stage data, volume, pressure and depth for each grout pipe location.
2. Any change in the predetermined grouting program necessitated by a change in the subsurface conditions.

# Part 2 – Equipment and Materials

## 2.01 GROUTING EQUIPMENT

A. The grouting contractor shall supply equipment capable of advancing the grout pipe through overburden, soils and other obstructions to the specified depth or as is required to meet the project objectives.

B. The grouting contractor shall supply all equipment required to operate a compaction grouting system capable of supplying the specified grout at variable flow rates and pressures, measured at the pump, up to 250 psi and at rates of 0.5 to 12 cubic feet per minute, as required to suit the application.

C. The mixer shall be a continuous auger type to ensure complete uniform mixing of the materials used and shall be of sufficient capacity to continuously provide the pumping unit with mixed grout at its normal pumping range. The mixer must be capable of volumetrically proportioning the grout materials.

D. The grouting contractor shall provide gauges or other instrumentation (measuring devices) to measure:

1. Continuous grout pressure close to the top of the injection casing
2. Flow rate of grout.
3. Volume or grout injected.

E. The grouting contractor shall supply and install structural monitoring equipment in accordance with these specifications.

F. A communication system shall be maintained between the pumping and batching plant and the injection location. As an alternate, the grouting contractor may furnish a remote control system to allow full control (start, stop, flow rate, reversing) of the pump directly by the contractor's personnel from the injection point).

## 2.02 GROUT PIPES

A. Grout pipes and connections shall be steel casing of adequate strength to maintain the hole and to withstand the required jacking and pumping pressures. The pipes shall be at least 2.0 inches inside diameter in order to adequately handle the specified low slump material without plugging. All casing shall be flush joint threaded or a single piece tubing to provide a smooth inner wall and unobstructed inside diameter. It shall be the contractor's responsibility to install casing that does not detrimentally impact the grouting procedure.

B. Pipes shall be installed such that grout material will not travel in the annular space between the pipe and adjacent ground and escape at the surface when pumped.

## 2.03 GROUT MATERIALS

A. Portland Cement (ASTM C150)

B. Fine aggregate shall be sand with fines content (percent passing No. 200 sieve) of not less than 10 percent and not more than 30 percent. Natural fines may be supplemented with Fly/ash, a minimal amount of bentonite, or aggregate washings.

C. Proportions of the mixture shall be as required to achieve a pumpable mix with not more than 1 inch slump.

D. Upon discharge into the pump hopper or holding tank, the grout must be continuously agitated. Mixed grout may not be held in the agitator for more than 1.5 hours unless a set retarder, approved by the Owner's representative, is used.

# Part 3 – Execution

## 3.01 Site Examination

A. If adjacent buildings are involved, a building survey shall be performed.

## 3.02 Compaction Grouting

A. Compaction grouting shall be performed in accordance with the approved grout injection point layout scheme to achieve the following acceptance criteria in the in situ soil between the injection points:

1. Post-grouting average, corrected Standard Penetration values exceeding 15 in typical site soils. Locations of the tests shall be agreed upon between the grouting contractor, Construction Project Manager and FQCR and will be spaced at no greater than100 foot intervals. At each location, the Standard Penetration tests will begin at the approximate bottom of the facility to be supported and will be taken at 3 to 5-ft intervals in the treated zone.

B. Compaction grouting shall extend from bedrock up to the subgrade of the facility to be supported.

C. The grout shall be injected in stages until one of the following occurs:

1. Grout flow ceases at a gauge pressure reading of 50 to 150 psi (250 psi maximum) or,

2. Surface ground heave of 1 inch as measured via survey or,

3. An injected grout volume equal to approximately 2 to 6 cubic feet per 1 vertical linear foot of the material being treated.

D. Compaction grouting shall be sequenced so that grouting does not take place within 4 feet of locations grouted within the previous 12 hours.

E. As compaction grouting is completed at each location, the grouting contractor shall completely fill the grout hole to the ground surface with an approved granular material.

F. Should the contractor reach refusal, at an elevation other than that which is expected, the FQCR shall notify the Construction Project Inspector immediately.

## 3.03 Field Quality Control

The General Contractor's FQCR will ensure that procedures and documentation conform to these specifications.

A. All compaction grouting shall be performed under the inspection of the FQCR.

B. Monitoring and logging of compaction grouting operations for both test areas and production work shall be done by the grouting contractor and the FQCR.

C. The FQCR will perform slump tests of grout and take measurements of grout mix quantities to verify the grouting contractor's grout mix, as follows:

1. Slump tests will be performed a minimum of twice during each grout shift.

2. Grout mix proportions will be checked a minimum of once daily.

D. The FQCR will cast minimum size 2 inch by 4 inch grout test cylinders or 2 inch by 2 inch cube molds for strength testing (per ASTM C1019). One set of four cylinders or molds will be cast during each slump test.

E. Layout of grout injection points shall be by the grouting contractor and checked by the FQCR and Project Inspector with survey control provided by the General Contractor.

F. As detailed in this specification, daily records shall be maintained by the grouting contractor and submitted to the General Contractor on a daily basis.

G. The grouting contractor shall monitor nearby structures as follows:

1. A level control system will be installed by the contractor for each structure within a horizontal distance equal to the depth of treatment of the grouting operations.

2. Monitoring shall be carried out on a continuing basis whenever compaction grouting is occurring within a horizontal distance equal to the depth of treatment.

3. After completion of the compaction grouting program, the monitoring system and grout pipes will be removed and all holes will be filled with an approved material and the surface shall be restored to match existing materials.

As compaction grouting is completed at each location, the grouting contractor shall completely fill the grout hole to the ground surface with an approved granular material.

## 3.04 Testing and Inspection

A. The effectiveness of the proposed grouting layout scheme shall be verified as follows:

1. The Contractor's FQCR shall perform the in situ Standard Penetration testing as directed by the Construction Project Manager. Two test sections will be performed before and during production work, as follows:

   a. Test section locations will be agreed upon by the FQCR, Project Inspector and Grouting Contractor within the treatment area. A test section shall consist of a single module comprised of at least three grout injection points for isolated footings and sixteen grout injection points for area applications (such as along the alignment of the facility being supported). Tests will be performed at the center of the module prior to and after grouting. Standard Penetration tests will begin at the approximate bottom of the facility being supported and will be taken at 3 to 5-ft intervals in the treated zone below the facility being supported.

   b. All testing to determine specification compliance will be provided by the FQCR. The same test method shall be utilized both before and after the soil improvement work in order to provide the most accurate assessment of the degree of improvement obtained.

   c. The method of installation of the test section shall comply with this specification and shall be performed using the same grout line sizes, grout mix drilling and grouting equipment and procedures as that to be used for production work.

   d. Prior to commencement of production grouting, two (2) test sections shall be performed. If the pre-production test sections indicate that the required ground improvement has not been achieved, the grouting contractor shall revise the Work Procedure Plan and re-test at two (2) test sections.

B. Monitoring and logging of compaction grouting operations in the test areas and for production work shall be done by the grouting contractor and submitted to the FQCR on a daily basis.

**END OF SECTION**

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## 47.0 Construction Survey and Monumentation

### 47.0.1 Description

The Contractor shall be responsible for construction surveying, calculating, and staking necessary for the construction of all elements of the project. The Contractor shall also provide locating, preserving, referencing, installing and restoring of land monuments based upon the project's Land Survey Control drawing(s) as provided in the Contract Documents. Unless otherwise noted, payment for construction surveying and monumentation shall be via separate bid items.

The work shall be done under the supervision of a Professional Land Surveyor (PLS) who is experienced and competent in storm sewer construction, sanitary sewer construction and roadway construction surveying and licensed in the State of Colorado.

The PLS shall be available to review work, resolve problems, and make decisions in a timely manner.

### 47.0.2 Materials and Equipment

The Contractor shall furnish all personnel, survey equipment, safety equipment, materials, and traffic control necessary to perform the required construction surveying and staking. If any survey equipment is found to be functioning outside the manufacturer's specified tolerance, certification from an approved repair facility showing that the instruments have been repaired, properly adjusted, or both if necessary shall be included in the survey records and submitted to the City Surveyor's Office before being used.

### 47.0.3 Construction Requirements

A Construction Survey Conference shall be held with the City Surveyor's Office prior to performing any surveying work under this section. The Contractor's Surveyor (PLS) and Party Chief shall attend. A Construction Survey Checklist shall be completed and signed by the City Surveyor's Office and the contractor.

The Contractor shall check and verify all established Primary horizontal and vertical control points.

All survey records generated shall be the property of the City and shall be available to the City Surveyor's Office for inspection or reproduction at all times. All survey records shall be transmitted to the City Surveyor's Office for inclusion into the project records before final project acceptance.

Electronic formats may be acceptable, please coordinate with the City Surveyor's Office.

## Copies of any new Monument Records filed by the PLS with the State Board of Registration shall be submitted to the City Surveyor prior to filing.

### 47.0.4 Construction Surveying

The Contractor's PLS shall perform all construction surveying and staking that is necessary for construction of the project. Additionally, the contractor shall establish and maintain control points and stationing during construction to allow the City's Project Manager or designee a reference to determine contract pay quantities.

### 47.0.5 Staking

It is the responsibility of the Contractor's PLS to adhere to industry standards and acceptable practices in regards to staking. Any re-staking will be the responsibility of the Contractor at no cost to the City.

### 47.0.6 Accuracy and Tolerances

It is the responsibility of the Contractor's PLS to adhere to industry standards and applicable standards with regard to horizontal and vertical accuracy tolerances.

### 47.0.7 Responsibility and Inspections

Supervision and coordination of construction surveying and staking is the Contractor's responsibility. The City Surveyor may inspect the Contractor's surveying; however such inspection will not relieve the Contractor of any responsibility for accuracy or completeness of work. The Contractor shall check the work to verify the accuracy and include documentation of this check in the Survey Records. All Contractor surveying inaccuracies, errors, or omissions shall be corrected at the Contractor's expense. The City Surveyor's inspection or the Contractor's corrections shall not entitle the Contractor to additional payment or contract time extension.

Survey control, benchmarks, and other significant stakes that are damaged, destroyed, or made inaccessible by the progress of construction shall be replaced, transferred or reestablished at the Contractor's expense.

### 47.0.8 Changes

All changes in lines and grades required by the field conditions and all discrepancies in grades, alignments, locations or dimensions detected by the Contractor shall be immediately submitted to the City Project Manager in writing. No changes in given data or

plans will be allowed unless approved by the City Project Manager in writing. All changes shall be documented in the survey records.

### 47.0.9 Traffic Control

Traffic control necessary for surveying and monumentation work shall not be measured and paid for separately. All traffic control costs incurred due to this work shall be included within the associated bid item(s).

### 47.0.10 Survey Records

Survey records shall be completed as the work is done. Field survey notes for construction surveying and checking by the Contractor shall be recorded in survey records in conformance with industry standards and acceptable practices.

All survey records generated shall be the property of the City and shall be available to the City Surveyor's Office or the City Construction Project Manager for inspection or reproduction at all times. All survey records shall be transmitted to the City Surveyor's Office for inclusion into the project records before final project acceptance. All survey records shall be stamped with the seal of, and signed by, the responsible PLS.

"As-built" and "Red-lined" drawings and prints necessary for the construction and preparation of record drawings for all elements of the project shall be the responsibility of the Contractor.

All "As-built" and "Red-lined" drawings generated shall be the property of the City and shall be submitted to the Construction Project Manager upon completion. In addition to red-lined prints, the Contractor shall supply the Construction Project Manager with electronic survey data information in the form ".asc", ".txt", and/or ".dwg" files upon request.

### 47.0.11 Survey Monumentation

This work consists of locating, preserving, referencing, installing and restoring land monuments as indicated in the Land Survey Control drawing(s) for the specific contract. Survey Monumentation includes but is not limited to: City of Denver Range Points and accessories, Primary Control monuments from which the Right of Way or any land boundary will be calculated, described or monumented, Public Land Survey System (PLSS) monuments, Right of Way (ROW) monuments, General Land Office (GLO) monuments, Bureau of Land Management (BLM) monuments, Mineral Survey (MS) monuments, property boundary monuments and offsets, benchmarks, easement monuments, and other monuments that are required by law or regulation to be established and recorded by a Professional Land Surveyor (PLS).

At the close out of the project the following Survey documents shall be submitted to the City Surveyor for review and acceptance:

1. City and County of Denver Monument Tie Out Sheets for all range points within the project influence.
2. A survey of all project monumentation per State Statute.

The production of additional documentation may be required by the City Surveyors' Office. All such work included in this section shall be under the supervision of a PLS who is licensed in the State of Colorado.

### 47.0.12 Reset Monuments

Survey monuments, benchmarks, and other significant monuments that are damaged, destroyed, or made inaccessible by the progress of construction shall be replaced, transferred or reestablished at the Contractor's expense.

Locating, preserving, referencing, installing and restoring land monuments as described in this specification shall be done under the supervision of a PLS who is experienced and competent in Right of Way and boundary surveying and licensed in the State of Colorado

### 47.0.13 Locating Monuments

This work consists of field locating all survey monumentation as discussed in 47.0.11 which is in place within the project limits. A diligent search of construction zones and project limits shall be performed by the PLS.

### 47.0.14 Preserving and Referencing Monuments

All monuments as described in this specification shall be preserved, referenced and reset by the Contractor's PLS within the project limits.

### 47.0.15 Installing Monuments

All monuments as described in the contract documents shall be preserved through construction. If any monuments are to be disturbed/removed during construction, it will be the contractor's responsibility to have all monuments reset to current City of Denver standards. Appropriate documentation will be required for all reset monuments.

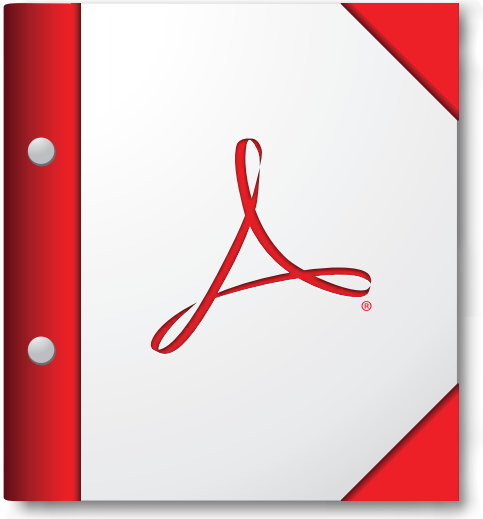
### 47.0.16 Monument Box

This survey work shall consist of installing or adjusting monument boxes to current City or State requirements.

### 47.0.17 Method of Measurement

All survey work will be paid for via the associated bid item(s) and in accordance with the respective Measurement and Payment portions of the Contract Documents.

**End of Specification**



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**Denver Parks and Recreation**
Office of the City Forester

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www.denvergov.org/forestry

# Required Tree Protection and Associated Penalties

## City & County of Denver, Office of the City Forester

Updated April 2018

The General Contractor (GC) is expected to install required tree protection for evaluation and approval by Office of the City Forester (OCF) prior to any demolition or construction activity. Contractor is required to obtain Tree Protection Zone (TPZ) approval from the OCF. After approval has been obtained, contact the OCF a minimum of five (5) business days before commencement of construction activity. See contact information on OCF website, www.denvergov.org/Forestry.

1. When Notifying Office of The City Forester of Project Commencement:
   Include the following information:
   - Project number
   - Project address/location
   - GC and main contact information (if main contact is not GC)

2. Existing Public Right of Way, Public Place, or Setback Trees Approved for Removal:
   Existing ROW trees approved for removal by the OCF must be protected in place per Forestry standards & specifications until removed by an OCF-licensed tree contractor. A tree removal permit is required from the OCF prior to removal. Failure to protect such trees until removal, or removing ROW trees without an OCF-issued permit will result in notice of violation and may include citations/fines.
   - A tree removal permit must be obtained from the OCF prior to removal. ***Tree removal permits are not included with plan or permit approvals and must be obtained separately from the Office of the City Forester.***

3. Existing Public Right of Way, Public Place, or Setback Trees Requiring Protection:
   Existing trees to be preserved in public right of way shall be protected per OCF standards & practices – Refer to tree retention and protection specifications as well as tree preservation detail on OCF website (https://www.denvergov.org/content/denvergov/en/denver-parks-and-recreation/trees-natural-resources/forestry-trees-/land-developer-resources.html).
   - Tree protection zone (TPZ) shall be installed prior to commencement of demolition and/or construction activities, inspected and approved by OCF staff, and tree protection shall remain in place as approved until Certificate of Occupancy is issued.
     ***NOTE: Unless otherwise approved by OCF, 6' chain link fencing shall be installed per OCF tree protection detail and specifications. Install fencing prior to commencement of site construction (including excavation).***

        - Tree lawn within boundary of tree dripline shall not be rototilled at any time. Rototilling is only permitted in areas outside ex. tree dripline where concrete & hardscape are removed.
        - Installation of any irrigation under driplines of existing trees must be performed by directional bore. Irrigation line trenching within TPZ is strictly prohibited.
        - Any work/access within the TPZ must be approved by the OCF prior to activity.
4. Tree Maintenance
    - Responsibilities of GC on project duration of or exceeding 5 days
        - Watering - while tree protection fencing is in place, trees shall be deep-root watered at an interval of once per week when temperatures are at or above 40-degrees F. Trees shall be watered at the rate of 20 gallons per inch caliper.
        - Insect and disease treatments shall be applied when necessary

5. Tree Protection Ordinance Violations:
    - Violations include, but not limited to:
        - Lack of tree protection
        - Insufficient tree protection
        - Approved tree protection not maintained as approved
        - Tree protection has been altered from originally approved condition
        - Access to TPZ has been violated, including storage of construction-associated materials and/or equipment
        - Trunk damage
        - Root damage, including trenching, fraying, compaction
        - Crown damage, including clearance pruning, topping, broken limbs
        - Unauthorized removal of tree(s)

6. Tree Protection Associated Penalties
    - Violations
        - May be subject to penalties/fines up to $999.00 per occurrence
    - Tree Appraisal - If damage has occurred:
        - Damage will be appraised and assessed to responsible party, along with above mentioned penalties.
        - OCF may require removal of tree to mitigate safety concerns.
        - Tree removal, and any required replacement, shall be at expense of responsible party.

**For further information, including tree retention and protection specifications, visit Office of the City Forester website: www.denvergov.org/forestry.**

ENVIRONMENTAL QUALITY
DENVER PUBLIC HEALTH & ENVIRONMENT

# Regulated Asbestos Contaminated Soil Standard Operating Procedure

For City and County of Denver

Prepared by the Denver Department of Public Health and Environment

Environmental Quality Division

May 2, 2019

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# Acronyms

| Acronym | Definition |
|---|---|
| ACM | Asbestos-containing Material |
| AHERA | Asbestos Hazard Emergency Response Act |
| AMS | Air Monitoring Specialist |
| AOC | Area of Contamination |
| AQCD | Air Quality Control Division |
| BDL | Below Detection Limits |
| BMP | Best Management Practice |
| CABI | Certified Asbestos Building Inspector |
| CCOD | City and County of Denver |
| CCR | Code of Colorado Regulation |
| CDPHE | Colorado Department of Public Health and Environment |
| CFR | Code of Federal Regulation |
| CMU | Concrete Masonry Unit |
| CSWR | Colorado Solid Waste Regulations |
| DDPHE | Denver Department of Public Health and Environment |
| GPS | Global Position System |
| HEPA | High-efficiency Particulate Air |
| HVAC | Heating, Venting and Air Conditioning |
| IDW | Investigation-derived Waste |
| MMP | Materials Management Plan |
| mph | Miles Per Hour |

| Acronym | Definition |
|---|---|
| NIOSH | National Institute for Occupational Safety and Health |
| NIST | National Institute of Standards and Technology |
| NVLAP | National Voluntary Laboratory Accreditation Program |
| OSHA | Occupational Safety and Health Administration |
| PCM | Phase Contrast Microscopy |
| PLM | Polarized Light Microscopy |
| Poly | Polyethylene |
| PPE | Personal Protection Equipment |
| PSRMP | Project-Specific Regulated Asbestos Contaminated Soil Management Plan |
| RACS | Regulated Asbestos Contaminated Soil |
| RWA | Regulated Work Area |
| TEM | Transmission Electron Microscopy |

# Definitions

"**Adequately wet**" means sufficiently wet to minimize visible emissions of dust and/or debris within the regulated work area (RWA) and to prevent the release of visible emissions from leaving the RWA. The observance of visible emissions, outside of the RWA, of dust and/or debris may be an indication that soils are not adequately wet.

"**Adjacent Receptor Zone**" means an area of uncontrolled access at a distance of 150 feet or less from the nearest RWA boundary during active Regulated Asbestos Contaminated Soil (RACS) disturbance. For the purpose of this definition, highways, streets, and roads without sidewalks, where only vehicles are permitted, are considered to be areas of controlled access and therefore not adjacent receptor zones. For the purpose of this definition "vehicle" means a device that is capable of moving itself, or of being moved, from place to place upon wheels, including bicycles and electrical assisted bicycles. For the purpose of this definition, an area for which access is not ordinarily controlled that is closed to the public during soil disturbing activities in the adjacent RWA is considered to be an area of controlled access and therefore not an adjacent receptor zone.

"**Amended water**" means water containing a wetting agent, such as a 50:50 mixture of polyoxyethylene ester and polyoxyethylene ether, or the equivalent, in a 0.16 percent solution (1 ounce to 5 gallons) of water, or as per manufacturer recommendations for the wetting of asbestos.

"**Air Monitoring Specialist**" (AMS) means a person trained and certified, in accordance with the requirements of Air Quality Control Commission Regulation No. 8 (5 Code of Colorado Regulation [CCR] 1001-10, Part B) (CDPHE, 2008), for the collection of air samples to determine airborne particulate and/or asbestos concentrations.

"**Asbestos**" means the asbestiform varieties of serpentine (chrysotile) and amphibole minerals, riebeckite (crocidolite), amosite (cummingtonite-grunerite), anthophyllite, actinolite, and tremolite.

"**Asbestos-containing material**" (ACM) means any material that contains more than one percent (1%) asbestos by weight, area or volume. It is during a CABI's RACS/Non-RACS Determination that ACM will be analyzed for.

"**Asbestos Worker**" means an individual trained and certified under the Colorado State Regulation No. 8, Part B to disturb, enclose, remove, and abate friable and non-friable asbestos containing material.

"**Certified Asbestos Building Inspector**" (CABI) means a person trained and certified in accordance with Air Quality Control Commission Regulation No. 8, (5 CCR 1001-10, Part B), for the identification of asbestos containing materials and the collection of samples to determine asbestos content inspection and sampling, and who has forty (40) verifiable hours of on the job asbestos in soils experience on a minimum of three (3) different asbestos in soils projects, conducted under either AQCC Regulation No. 8 or CSWR §5.5. The CABI shall be independent of the general contractor (GC) and/or abatement

contractor unless the CABI and the GC or abatement contractor are both direct employees of the property owner. However, the GC or abatement contractor may hire a subcontractor CABI, but the CABI shall not be a direct employee of the GC or abatement contractor.

"**Consultant**" refers to the entity contracted to perform all oversight actions in the form of training, inspections, field directions, air monitoring and documentation related to soil disturbing activities in accordance with this standard operating procedure.

"**CSWR**" refers to the Colorado Solid Waste Regulations (6 CCR 1007-2). The sections most applicable to this standard operating procedure are Section 5 "Asbestos Waste Management", and specifically Section 5.5 "Management of Regulated Asbestos Contaminated Soil (RACS)".

"**Debris**" means any discarded material that contains or consists of any of the following: construction, renovation and demolition debris (regardless of how it was generated), building or facility components, components of building systems (heating, venting, air condition [HVAC], plumbing, electrical, control, fire protection, roofing), components of pavement or drainage systems, industrial or machinery components, and/or mechanical components from motorized vehicles.

**"Debris Determination"** for the purpose of this standard operating procedure, means a determination, conducted in the field by the contractor and/or their sub-contractors for the possibility of visible debris to be either Non-Suspect for ACM or Suspect for ACM. Determinations of Non-Suspect/Suspect shall be based on the requirements set forth in Section 4.1 & 4.2 of this standard operating procedure.

"**Facility Component**" - for purposes of this standard operating procedure, means any part of a facility including equipment. For the purpose of this definition, "facility" means (as defined in Air Quality Control Commission Regulation No. 8 (5 CCR 1001-10, Part B): "any institutional, commercial, public, industrial, or residential structure, installation, or building (including any structure, installation, or building containing condominiums or individual dwelling units operated as a residential cooperative, but excluding: residential buildings having four or fewer dwelling units); any ship; and any active or inactive waste disposal site. For purposes of the definition, any building, structure, or installation that contains a loft used as a dwelling is not considered a residential structure, installation, or building. Any structure, installation or building that was previously subject to this subpart is not excluded, regardless of its current use or function."

"**Friable ACM**" means any material that contains more than one percent asbestos by weight, area, or volume, and when dry can be crumbled, pulverized, or reduced to powder by hand pressure. The term includes non-friable forms of asbestos after such previously non-friable material becomes damaged to the extent that when dry it can be crumbled, pulverized, or reduced to powder by hand pressure as determined in the field by a CABI.

"**General Abatement Contractor**" refers to State-certified entity contracted to perform asbestos contaminated soil disturbing activities in accordance with the standard operating procedure.

"**Geofabric**" means a permeable fabric or synthetic material used for both visual and physical separation.

"**Green Waste**" biodegradable waste that can be composed of garden or park waste, such as grass or flower cuttings and hedge trimmings, as well as domestic and commercial food waste.

"**Mechanical**" means operated or produced by mechanism, tool or machine. This may include but shall not be limited to, an excavator, backhoe, grader, tiller, auger, or hand shovel.

"**Non-regulated Asbestos Contaminated Soil**" **(Non-RACS)** means soil or debris that has been inspected by a CABI to contain only:

- Intact non-damaged, non-friable ACM(s).
- Damaged non-friable ACM(s) that do not have a high probability to release fibers based on the forces expected to act upon the material during disturbance as determined in the field by a CABI(s) through a "RACS Determination". The following ACM(s) are predetermined to be Non-RACS:
    - Resin-based materials including but not limited to phenolic-plastic (Bakelite), used in electrical and mechanical parts
    - Resilient flooring (vinyl, asphalt, rubber) excluding non-tar impregnated friable felt backing on sheet vinyl flooring (linoleum)
    - Tar-impregnated or asphaltic materials in good condition that have not become brittle
    - Elastic, pliable, or rubberized materials, including but not limited to:
        - Pliable duct sealant
        - Pliable fiberglass insulation sealant
        - Pliable fire-stop caulking /sealants
        - Pliable window and door caulking
    - Extremely hard materials, coatings and sealants including but not limited to:
        - Laboratory countertops and sinks
        - Epoxy-type Concrete Masonry Unit (CMU) coatings
        - Epoxy-type panel adhesive
        - Duct sealant
        - Ceiling tile adhesive
    - Other ACM(s) as approved by the Department at the request of the owner or person disturbing debris, to not have a high probability to release fibers.

**"Suspect Debris"** means non-soil debris that is Suspect, including ash, to contain ACM. This material requires a RACS determination by a CABI, and until the CABI determination is complete, will be assumed to be RACS and managed in accordance with this standard operating procedure. Although this material may not require special management as ACM, it may still require management as a solid waste. Co-mingled Suspect and Non-Suspect debris should be managed as Suspect Debris.

**"Non-soil Debris"** means materials entrained within the soil matrix that are not composed of soil. These may include Non-RACS, RACS, or Non-Suspect. Often associated with uncontrolled fill, or historical urban fill areas.

"**Project-specific Regulated Asbestos Contaminated Soil Management Plan**" (PSRMP) means a RACS management plan for a single project submitted in accordance with CSWR §5.5

"**Regulated Asbestos Contaminated Soil**" (RACS) means soil, ash or debris (plus six inches in all directions of surrounding soil or other matrix material) containing:

- Friable ACM as determined in the field by a CABI through a RACS determination; Previously non-friable ACM(s) that have been rendered friable as determined in the field by a CABI(s) through a RACS determination.
- Non-friable ACM(s) that have a high probability of releasing fibers based on the forces expected to act upon the material during soil disturbance as determined in the field by a CABI(s) through a RACS determination; deteriorated non-friable ACM(s) that are in poor condition resulting in a high probability to release fibers due to weathering, historical mechanical impact, fire damage (by evidence of ACM within an ash layer) or other factors as determined in the field by a CABI(s) through a RACS determination.
- The following broken, resized, or damaged ACM(s) are predetermined to be RACS:
    - Asbestos cement materials
    - Plaster
    - Brittle caulking, glazing and sealants
    - Powdery Concrete Masonry Unit (CMU) sealant
    - Powdery floor leveling compound
    - Drywall/wallboard and associated joint compound material
    - Firebrick
    - Other material as determined by the Department, at the request of the owner or person disturbing debris, to have a high probability to release fibers.
- Soil or ash known to contain non-visible asbestos based on documented evidence.

"**RACS Determination**" for the purpose of this standard operating procedure means a determination, conducted in the field by a Certified Asbestos Building Inspector (CABI), of the friability of Asbestos Containing Material (ACM) and the probability of non-friable ACM to release fibers based on the condition of the material and the forces that are expected to act on it during disturbance. Determinations of friability shall be based on the requirements for such determinations set forth in Air Quality Control Commission Regulation No. 8 (5 CCR 1001-10, Part B). Determinations of the probability for non-friable ACM to release fibers during disturbance shall be based on the following:

1) The condition of the material prior to disturbance, based on observations of weathering, the integrity of the material, historical mechanical impact, or fire damage;

2) The potential for the material to be broken, resized or damaged during planned disturbance;

3) The material shall be considered RACS if the planned disturbance includes any of the following:

a. Augers

b. Rotary style trenchers

c. Driving on ACM lying on the surface (vehicles or equipment)

d. Blasting or other detonation

e. Intentional burning

f. Other types of direct mechanical impact which are:

i. In direct contact with ACM or result in observation of ACM after disturbance, and

ii. Causing damage to the ACM

"**Regulated Work Area**" (RWA) means the portion(s) of a site at which soil disturbing activities involving RACS occur

**"RACS Disturbance**" means activities such as removal, management, or other physical disturbance of RACS

"**Soil-disturbing Activities**" means digging, excavating, staging, loading, stockpiling, backfilling, compacting, grading, tilling, drilling, intrusive sampling, and equipment or vehicle movement or any other mechanical activity, that when used, disturbs the surface and/or subsurface soil. Disturbance or removal of soil, or soil with debris and/or RACS is considered a soil-disturbing activity. Hand disturbance or removal of RACS is subject to the State Regulation and this standard operating procedure but is not considered to be a mechanical disturbance.

**"Staging"** means the accumulation of RACS in the RWA for twelve (12) hours or less.

**"Stockpiling"** means the accumulation of RACS that will exist for more than twelve hours, up to and including ten calendar days

**"Storage"** means the accumulation of RACS greater than ten days but not exceeding six months unless a longer timeframe is approved by the Department and DDPHE.

"**Visible Emissions**" means any airborne or liquid emissions, coming from, or having come into contact with RACS, which are visually detectable without the aid of instruments. Proper disposal of appropriately filtered decontamination water does not constitute a visible emission.

"**Visual Inspection**" means observation with sufficient proximity to identify discrete visible materials, while maintaining the safety of the inspector.

# 1. Introduction

The City and County of Denver (CCOD) recognizes the need for construction activities to have a well-established agreement in place regarding the risks from management of construction projects where soil may be impacted by asbestos-containing materials (ACMs). While these agreements modify traditional construction work practices and required personnel, they do remain consistent with the established Colorado Department of Public Health and Environmental (CDPHE) rules and regulations and current industry standards for the management of regulated asbestos-contaminated soil (RACS). Today's public safety realities are highlighted by the numerous construction projects that encounter RACS, and the need for CCOD and its construction partners to have established field standards that protect public health from exposure to asbestos, and help the projects stay on schedule and on budget. This document has been prepared to be used on CCOD's projects. Implementation of this standard operating procedure on other projects not owned or controlled by the CCOD are in no way the responsibility of the CCOD.

The Denver Department of Public Health and Environmental (DDPHE) and CDPHE have worked cooperatively to develop a solution designed to be followed by any contractor or its sub-contractor when performing soil-disturbing activities (as defined within this standard operating procedure) during excavation at CCOD's construction projects. Initially, the solution establishes standard operating procedures that are intended to be followed during construction projects where activities have disturbed and/or identified non-soil debris within the soil matrix. Additional standard operating procedures are predicated on the type and amount of non-soil debris and coordination with and the approval by the CCOD project manager.

Soil that is not to be disturbed by planned construction on a project will remain in-place. Characterization and remediation of soil not directly disturbed by project activities are beyond the scope of this standard operating procedure, unless specifically directed by DDPHE. If remedial actions are required, additional planning would be conducted under the direction of DDPHE.

## 1.1 Purpose

This standard operating procedure has been prepared to ensure compliance with the Colorado Solid Waste Regulations CCR 1007-2 Part 1, Section 5.5 (Colorado Solid Waste Regulation [CSWR] §5.5; CDPHE, 2014), and provides the procedures for identification, safe handling, transport, and disposal of Non-RACS or RACS that may be encountered during soil-disturbing activities. Provisions of CSWR §5.5, not specifically referenced within this standard operating procedure, must be followed; therefore, any contractor working on CCOD projects must be familiar with both this document, and CSWR §5.5. In the event of any disparity between the two, CSWR §5.5 will supersede provisions included within this document.

This standard operating procedure has been prepared to minimize potential delays, and to develop approved standard procedures that the contractor will implement as needed for future soil-disturbing where Non-RACS and RACS may be encountered. The quick disseminating of critical information to participating parties is key to the proper identification of debris, management of Non-RACS and RACS, and protection of public health and environment.

This standard operating procedure has been approved by the CDPHE (Appendix A) and incorporates by reference CDPHE Regulations Pertaining to Solid Waste Sites and Facilities (6 CCR 1007-2, Part 1), CSWR §5.5 - Management of Regulated Asbestos Contaminated Soils (CSWR §5.5). The Regulation can be found at: https://www.colorado.gov/pacific/cdphe/solid-waste-regulations.

## 1.2 Applicability

The requirements of CSWR §5.5 apply to the owner or operator of any property with RACS at which soil-disturbing activities are occurring or planned. The owner/operator may choose to follow the procedures set forth in CSWR §5.5.1(A) and (B) when debris is exposed or disturbed to determine if the debris is RACS. Soil-disturbing activities involving Non-RACS, where no RACS is present or generated, are not subject to the requirements of CSWR §5.5, but Non-RACS must be disposed as non-friable asbestos waste in accordance with the disposal requirements set forth in Section 5.2 of the CSWR, where applicable.

It is the responsibility of the general contractor (contractor), including the contractor's subcontractors, to incorporate this standard operating procedure into a project's scope for identifying debris or other environmental hazards and the subsequent management of that material according to this standard operating procedure and the Materials Management Plan (MMP) (if applicable). Unless otherwise written, separate from this standard operating procedure, it is the responsibility of the contractor to employ appropriate personnel capable of meeting the requirements of this standard operating procedure and CSWR §5.5 during identification and management of all debris and RACS.

Prior to commencing soil-disturbing activities, if there is no visible or documented evidence, such as construction drawings or analytical reports or environmental investigations, of RACS during a soil-disturbing action, the contractor does not have a duty under this standard operating procedure or CSWR §5.5 to sample or otherwise investigate for RACS. However, if RACS or suspect RACS is discovered, the contractor is obligated to follow this standard operating procedure.

This standard operating procedure may be incorporated within a MMP and/or Health and Safety Plan for site-specific safe work practices. Should either of those plans or other site-specific environmental work plans require changes to this standard operating procedure, the contractor shall present a written draft amendment to be reviewed by the CCOD Project Manager (who will coordinate with DDPHE) prior to submittal for review and approval by CDPHE.

## 1.3 Non-RACS vs. RACS

As described in CSWR §5.5 (and the definitions presented in this standard operating procedure):

- Non-RACS is soil or debris that contains intact, non-damaged ACM, or damaged non-friable ACM that does not have a high probability to release fibers as determined by a Certified Asbestos Building Inspector (CABI) (note, additional description provided in the definitions).
- RACS is soil, ash, or debris (plus 6 inches in all directions) containing friable ACM, non-friable ACM that has been rendered friable, or deteriorated ACM that has a high potential to release fibers due to weathering or other processes (note, additional description provided in the definitions).

Essentially, Non-RACS material contains ACM that is unlikely to release asbestos fibers, and RACS is material that contains ACM that is likely to release asbestos fibers. Although Non-RACS is technically not subject to the provisions of CSWR §5.5, disposal requirements still apply per CSWR §5.2. Further, the presence of Non-RACS still requires special attention during management activities, as there is a high potential that RACS and Non-RACS may be co-located at a project, or that management activities may result in Non-RACS releasing asbestos fibers, and thus transforming into RACS.

## 1.4 Project-specific Regulated Asbestos Contaminated Soil Management Plan

As determined by DDPHE, a Project-specific Regulated Asbestos Contaminated Soil Management Plan (PSRMP) may be prepared for individual projects; the PSRMP would detail project-specific RACS management protocols, amended best management practices (BMPs), or other applicable changes to this standard operating procedure. If DDPHE determines that a PSRMP is necessary, the PSRMP would be reviewed and approved by DDPHE then CDPHE, and management techniques may supplant those presented in this standard operating procedure. At a minimum, this standard operating procedure should be utilized a foundation for the PSRMP.

## 1.5 Key Parties and Responsibilities

The following table provides contact and general responsibility information for key parties. A full contacts list may not be established at the beginning of every project. In cases where RACS management will be needed, contact information shall be amended as required.

*Table 1 Key Parties and Responsibilities*

| Party | Contact | Responsibility |
|---|---|---|
| CDPHE | Brian Long<br>Phone: 303-691-4033<br>Email: briant.long@state.co.us | Regulatory Agency – State of Colorado |
| CCOD – DDPHE | Steve Gonzales<br>Phone: 720-865-5447<br>Email: steve.gonzales@denvergov.org<br><br>If no immediate response, call 720-460-1706 | Environmental Quality Technical Oversight – City and County of Denver |
| CCOD Project Manager | TBD | Overall project management of CCOD Project |
| Contractor | TBD | General Construction; RACS Management |
| Specialized Abatement Contractor (if applicable) | TBD | RACS Management |
| Environmental Consultant (CABI, AMS) | TBD | CABI, RACS Oversight and if necessary Air Monitoring Specialist (AMS); discovery notification to CCOD Project Manager and DDPHE, and to CDPHE if approved by DDPHE |

Responsibilities for key personnel are summarized in Table 2, and discussed in detail in the standard operating procedures. Key personnel will be contacted as required, as described in the text of the standard operating procedure.

*Table 2 Responsibilities*

| Duties per Standard Operation Procedure | Project Personnel | | | | |
|---|---|---|---|---|---|
| | Contractor | Sub-contractors | CABI | Air Monitoring Specialist (AMS) | GAC |
| Provide Awareness Training | | | ☒ | | |
| Receive annual RACS Awareness Training (All Site Personnel) | ☒ | ☒ | | | ☒ |
| Receive Project-Specific Annual Asbestos Awareness Training (to enter any Regulated Work Area [RWA] during RACS disturbance) | ☒ | ☒ | ☒ | ☒ | ☒ |
| Environmental Consultant Responsibilities | | | ☒ | ☒ | |
| Handling, Disturbing, Removing RACS | ☒ | ☒ | ☒ | ☒ | ☒ |
| Decontamination of Equipment, Personal Protective Equipment (PPE) and RWA | | | ☒ | ☒ | ☒ |
| Wind Speed Monitoring | | | ☒ | ☒ | |
| Air Monitoring | | | | ☒ | |
| Documentation | ☒ | ☒ | ☒ | ☒ | ☒ |

# 2. Process Flow and Decision Scenarios

The following process flow and corresponding figures present the more likely scenarios related to the discovery of debris and management of RACS for CCOD's projects, and the decisions to be made for conducting continued soil-disturbing activities under these discovered conditions. Note that these scenarios are general. Each RACS discovery and project is unique, so the actual steps necessary to reasonably respond to a RACS discovery and management may change. Coordination with DDPHE on the most practical management strategy is required when there is reason to believe that RACS is present or is identified.

## 2.1 Scenarios

This standard operating procedure has been prepared to provide guidance for five soil-disturbing scenarios, which are described in detail below.

### 2.1.1 Excavation in Areas with No Debris

This scenario applies when soil disturbance is planned and there are no RACS concerns (e.g., soil that is "clean" with no visible debris) (**Figure 1**). This scenario applies where the contractor has been provided information from the CCOD Project Manager, or has determined for himself, that the project area is not likely to have RACS or Non-RACS present because, through visible inspection or other research, no debris is present. The contractor will then proceed with work as planned, but must be familiar with this standard operating procedure, and must be observant regarding unexpected debris discovery.

### 2.1.2 Excavation in Areas with Non-Suspect Debris

This scenario applies when soil disturbance would occur in areas where Non-Suspect Debris is present [e.g., soil containing pieces of clean concrete (with no associated or attached materials)], but when no Suspect Debris has been identified (**Figure 2**). In this standard operating procedure, the contractor is empowered to make this determination himself. However, if the contractor is unsure of the nature of debris, a CABI should be consulted to provided certainty of the debris identified. Additional information about the classification of debris is presented in detail in Section 4.

### 2.1.3 Discovery of Suspect Debris or Suspect RACS During Excavation

This scenario applies when soil disturbance occurs where Suspect Debris, including RACS, is suspected or encountered unexpectedly (e.g., work within a known historical urban fill area [https://www.denvergov.org/opendata/dataset/city-and-county-of-denver-historical-fill-areas] (**Figure 3**). There are many areas in the CCOD where uncontrolled fill is present in the subsurface, including historical urban fills, areas where buildings once stood but have since been demolished, areas where

channelization along streams and rivers occurred or where floodplains or gravel pits were filled, or where heavy industries were once present. A key component of discovery is to: conduct interim actions that are described in this standard operating procedure in detail; contact a CABI to make a RACS determination; and, coordinate stabilization, removal actions and required documentation.

### 2.1.4 Excavation in Areas with Known RACS

This scenario applies where soil disturbance is planned in an area where known RACS is present (as confirmed through prior investigation or via a RACS determination by a CABI) (**Figure 4**). In this scenario, careful planning would be conducted to perform management actions in accordance with this standard operating procedure and CSWR §5.5.

### 2.1.5 Subsurface Investigations

This scenario applies when soil disturbance is conducted related to subsurface investigations, including environmental, geotechnical or utilities (**Figure 5**). These investigations are generally small in scale, where a drill rig may be used to drill a small-diameter hole to evaluate geologic conditions; a small test pit/trench is excavated to visually assess subsurface conditions (primarily in the investigation of Suspect Debris conditions); or a vacuum truck/water knife is used to locate a utility line. Detailed analysis of the RACS management strategies are presented in Section 5.1.5 of this standard operating procedure. **Note, if a utility investigation utilizing a vacuum truck/water knife is proposed in a <u>known historical urban fill site and/or area with known RACS or Suspect Debris</u>, additional project-specific planning will be necessary BEFORE work is initiated as there is a high potential that equipment may become contaminated. Coordination with DDPHE will be required.**

*Figure 1 Excavation in Areas with No Debris*

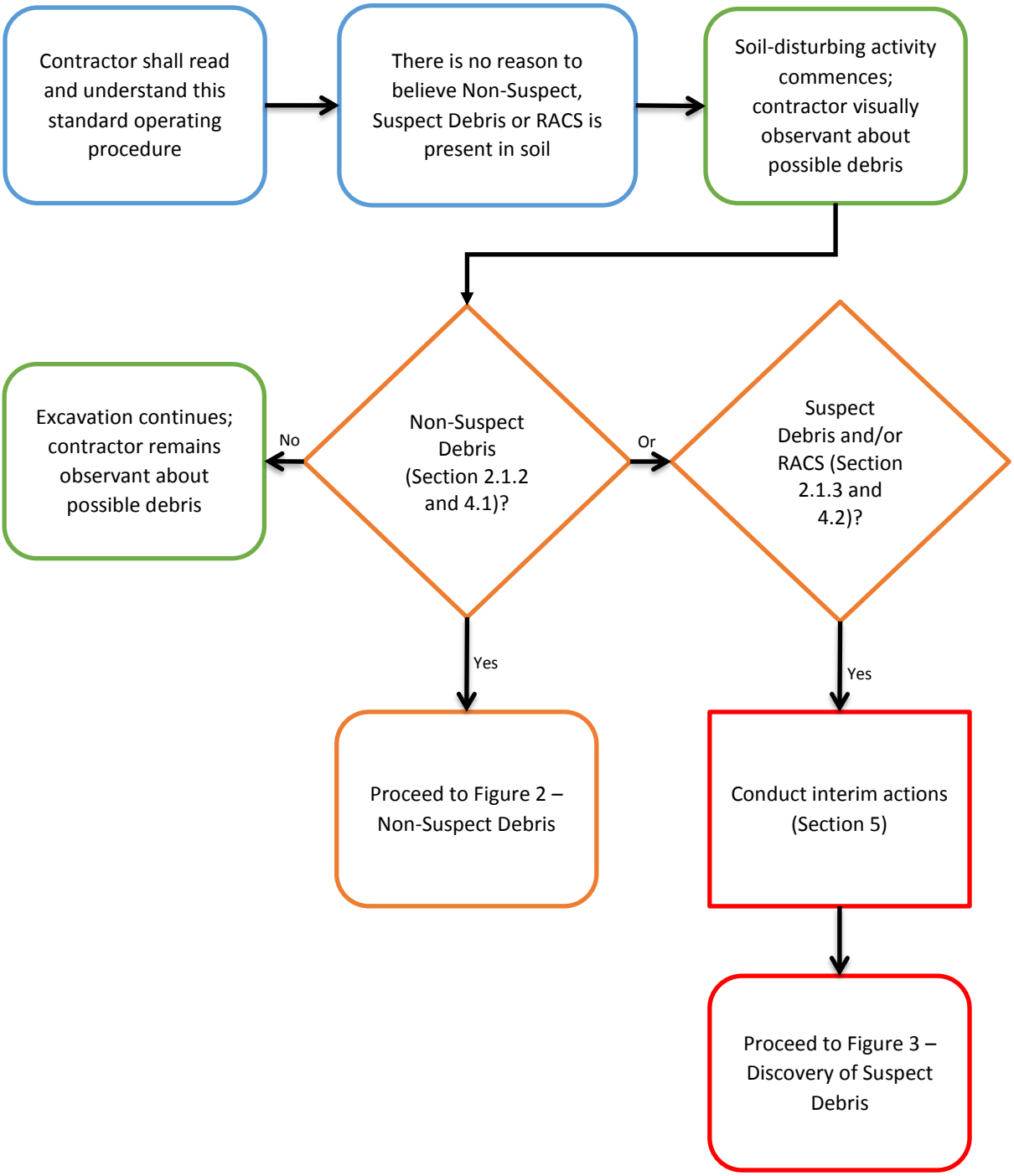


*Figure 2 Excavation in Areas with Non-Suspect Debris*

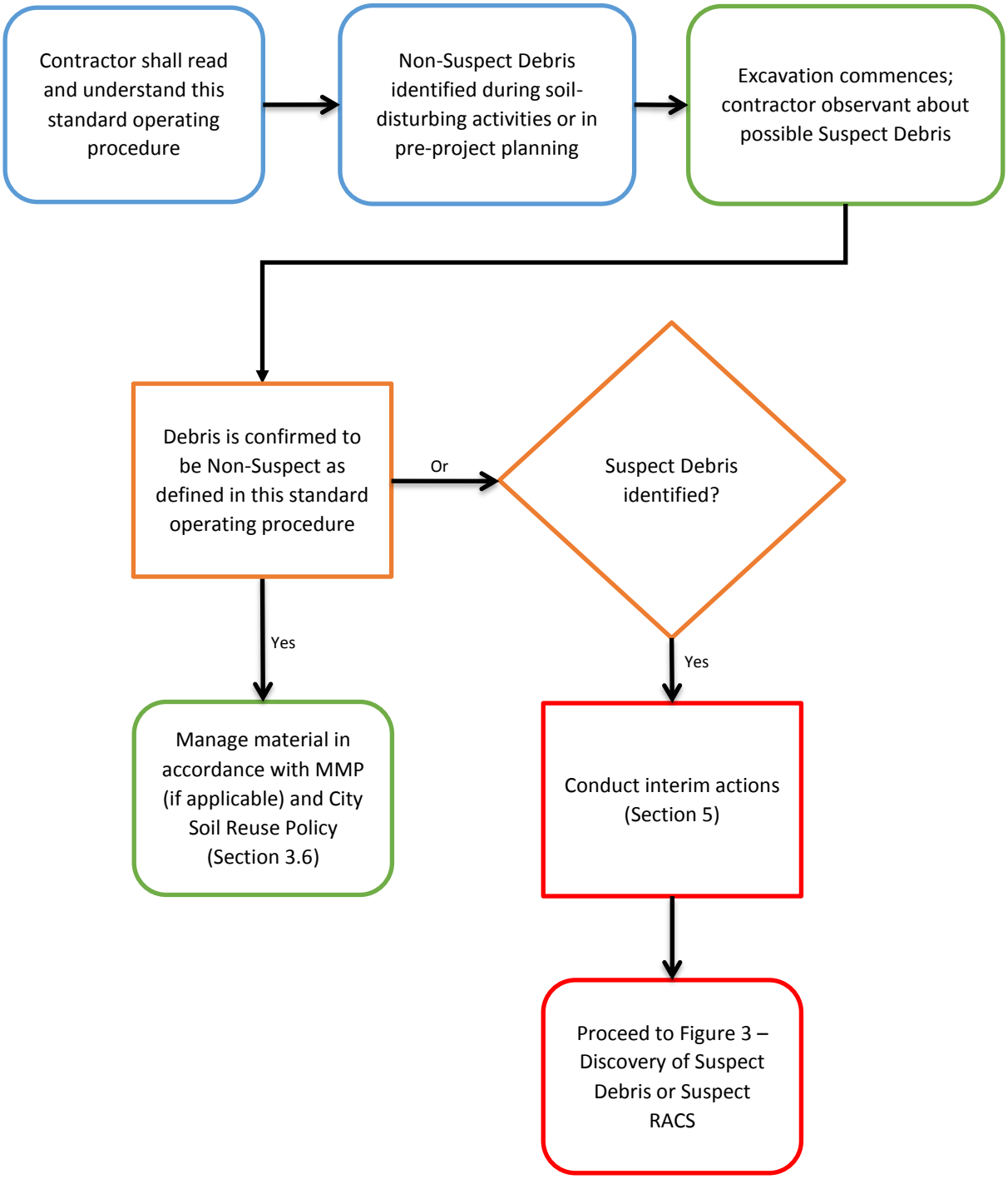


*Figure 3 Discovery of Suspect Debris or Suspect RACS During Excavation*

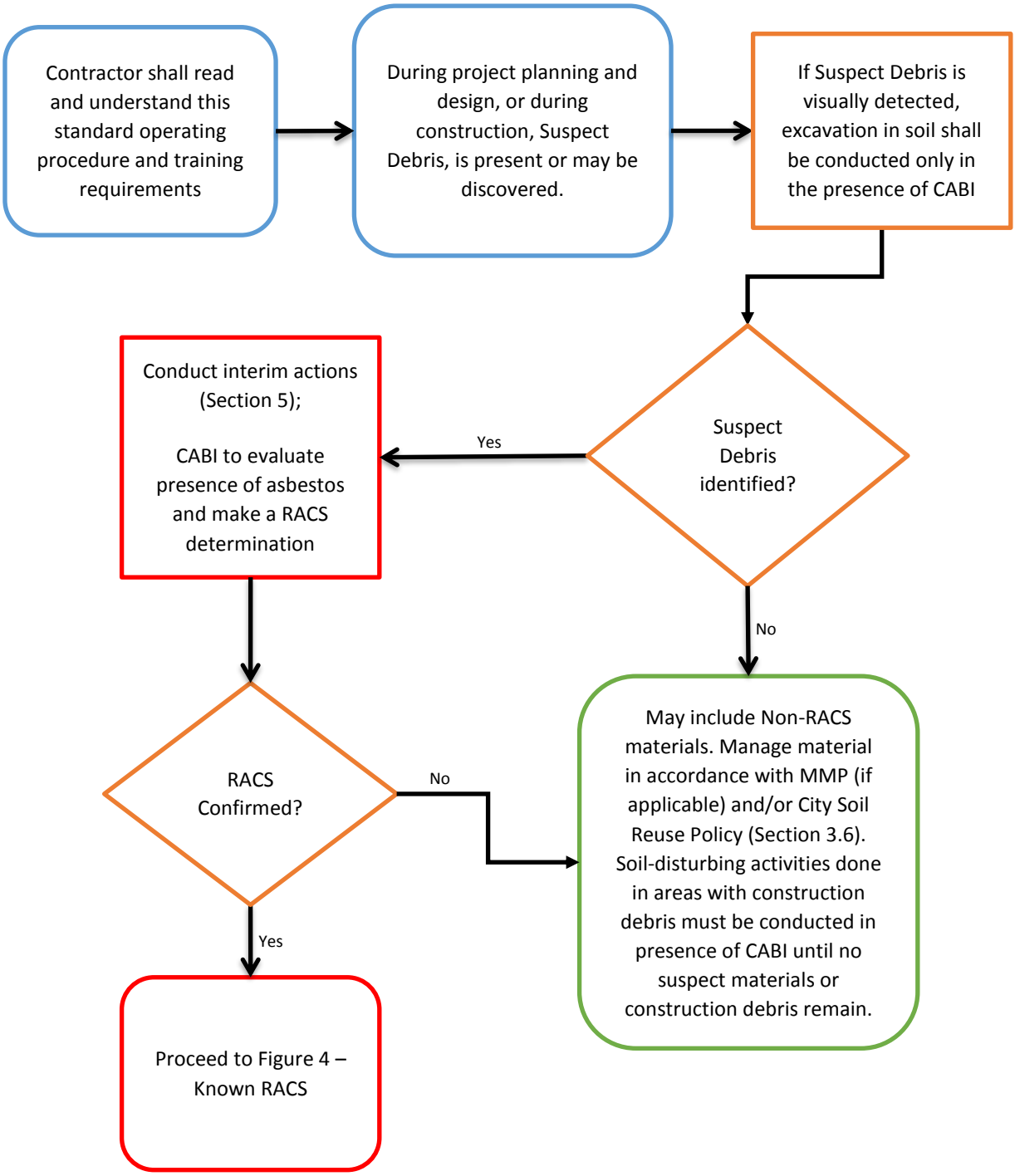


*Figure 4 Excavation in Areas with Known RACS*

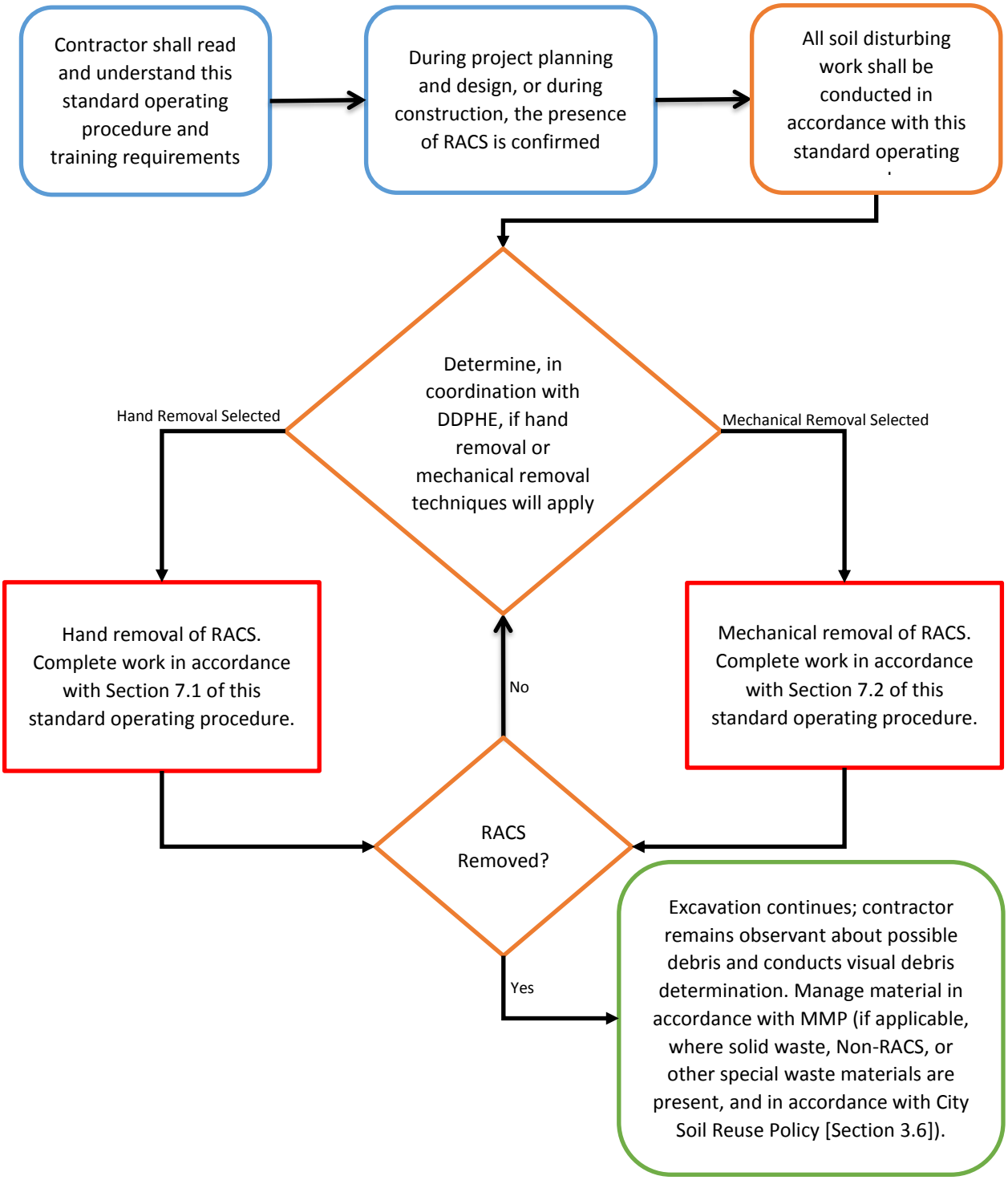
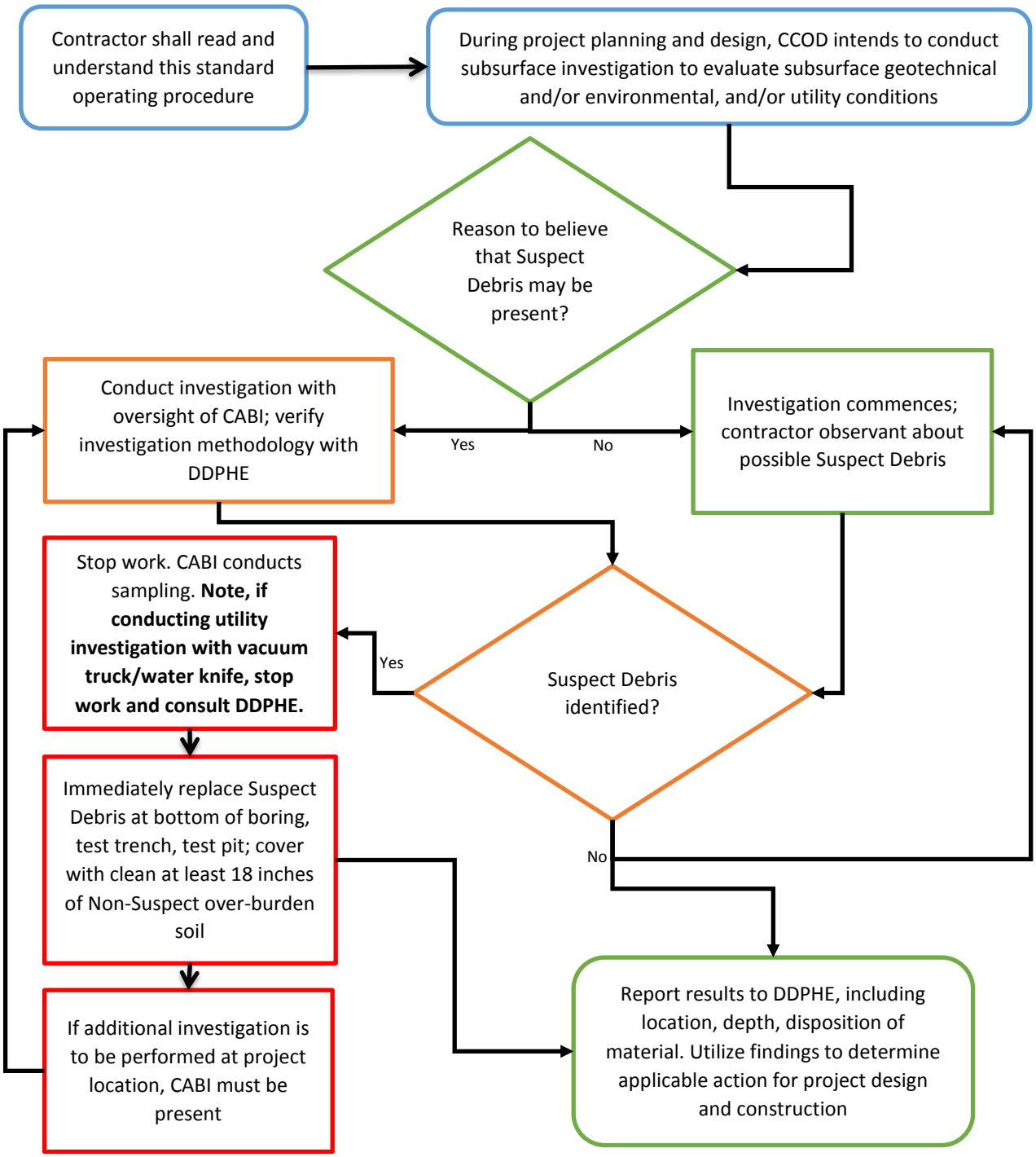


*Figure 5 Subsurface Investigations*



# 3. General Requirements

The following sections describe general requirements for the management of RACS.

## 3.1 Training for Site Personnel

As described in CSWR §5.5.3, personnel overseeing, directing, inspecting, and/or handling RACS (including suspect asbestos) and all personnel inside the Regulated Work Area (RWA) during the disturbance of RACS, shall have annual asbestos awareness training, and provide documentation to the CABI.

Personnel who enter the RWA during disturbance of RACS will receive project-specific training by a CABI familiar with this standard operating procedure and CSWR §5.5, as well as the project. This includes drivers of trucks carrying contaminated material for off-site disposal. The training will cover the provisions of this standard operating procedure, as well as the following:

- Background of asbestos, including health effects
- Overview of the requirements of CSWR §5.5 and this standard operating procedure and its implementation
- Recognition of Suspect Debris that may contain asbestos and which requires further evaluation by a CABI
- Overview of Non-Suspect Debris, Suspect Debris, RACS, and Non-RACS, and standard operating procedure protocols for each
- Controls and notifications to be followed when debris that may contain asbestos is encountered
- The nature of operations that could result in exposure to asbestos fibers
- Spill prevention and contamination reduction techniques
- Proper use, handling, and disposal of PPE
- Respiratory protection levels required for various activities and conditions
- Engineering controls and other measures to prevent contact with contaminants
- Engineering controls to prevent visible emissions from leaving the RWA
- Personnel and equipment decontamination and the establishment of decontamination stations
- Emergency procedures

- Project chain-of command and identification of authorized personnel with stop-work authority
- Hands-on training specific to the soil-disturbing activities the individual will be performing subject to CSWR §5.5.

Records of this training will be retained by the CABI, and will be available for inspection for the duration of the project for which the training is conducted.

## 3.2 Health and Safety

There is a potential for increased risk to the health of workers during disturbance/removal of RACS. Awareness by site personnel of these hazards is of the highest priority. Therefore, a site-specific Health and Safety Plan will be developed by the contractor prior to any RACS management. Site personnel will be provided with a copy of the Health and Safety Plan for review, and will be required to sign a form stating that they are aware of, agree to, and understand the requirements of the plan. The contractor will be required to employ the proper personnel, and PPE, to provide a safe working environment for its employees, consultants and subcontractors.

## 3.3 CABI and AMS Requirements

When a *Discovery of Unknown Suspect Debris or Suspect RACS,* or *Known RACS* is present, a CABI who meets the training, certification, and experience requirements of CSWR § 5.5.3(D) (and an Air Monitoring Specialist [AMS] if a RWA is required) shall be on-site on a full-time basis during all soil-disturbing activities, to physically observe and monitor the air and site conditions and provide information to the contractor to help limit and avoid asbestos fiber release. The CABI and AMS can be the same person if she/he meets the CABI and AMS requirements listed below. Ideally, the CABI and AMS will be the same person. Depending on site conditions and scope, more than one CABI, AMS, or both may be required.

When a *Discovery of Suspect Debris or Suspect RACS,* or *Known RACS,* is present, the CABI(s) will be responsible for the following:

- Have all current applicable training certificates and State of Colorado Certification(s) in accordance with the CDPHE-Air Quality Control Commission (AQCD Reg. 8) and Hazardous Materials and Waste Management (HMWMD) regulations to be a CABI (CSWR § 5.5.3 (D)).
- Be on-site on a full-time basis and continuously observe all soil disturbing, excavation, and loading activities.
- Identify if suspect RACS is present.
- Complete necessary sampling of suspect asbestos, and make RACS determination(s).

- Complete CABI Work Day Documentation Form (Appendix B), thoroughly detailing site activities as presented in Section 8 – Close Out Report.
- Maintain all pertinent documentation related to adherence of the standard operating procedure, including sampling results, air monitoring data, waste manifests, photographs, etc.
- Inspect the RWA and equipment after removal of RACS to evaluate whether remaining ACM is present on the surface or on equipment.
- The CABI will have "Stop Work" authority if it is believed that work is being performed outside the guidelines of this standard operating procedure or of CSWR §5.5, or if actions harmful to life and health, or the environment, are observed; the CABI will not be responsible for consequential damages for any work stoppage, including real or perceived harm, including lost productivity, that may result.
- Notification of RACS disturbance to CDPHE on behalf of the contractor.
- Updates to CCOD Project Manager and CDPHE on contractor decisions regarding RACS management.
- Notification of deviations from this standard operating procedure to the CDPHE (note: deviations from this standard operating procedure and/or CSWR §5.5 will require approval by DDPHE and CDPHE; deviations may be addressed through preparation of an amendment to this standard operating procedure, PSRMP, or other means as approved).
- Monitor and log wind speed and direction during soil disturbing activities.

If RACS management is required by Section 7.2.5 of this standard operating procedure or CSWR §5.5, the AMS(s) will be responsible for the following:

- Have all current applicable training certificates and State of Colorado Certifications in accordance with the CDPHE-AQCD regulations to be an AMS (Air Quality Control Commission Regulation No. 8 (5 CCR 1001-10, Part B).
- Be on site on a full-time basis during disturbance, excavation, and loading of RACS.
- Monitor RWA during removal and disposal of RACS for compliance of this plan.
- Place and monitor air samples on site and around RWA during soil-disturbing activities.
- Monitor and log wind speed and direction during soil disturbing activities.
- The AMS will have "Stop Work" authority if it is believed that work is being performed outside the guidelines of this plan or of CSWR §5.5, or if actions harmful to life and health, or the environment, are observed; the AMS will not be responsible for consequential

damages for any work stoppage, including real or perceived harm, including lost productivity, that may result.

- Submitting an Emission Control Plan for each detection of asbestos by TEM analysis as required by CDPHE in accordance with CSWR § 5.5.7 (E)(2)(f)(i)(ii) & (iii).

## 3.4 Contractor Requirements

The following contains requirements for the contractor performing RACS disturbance/removal:

- The contractor shall provide documentation to the CABI and CCOD that all individuals performing RACS-disturbing activities have completed a project-specific awareness training that provides information necessary to perform their duties in a way that ensures compliance with the requirements of the CSWR §5.5. If the contractor cannot provide this documentation, then the applicable training will be conducted by the CABI.
- The contractor shall ensure that individuals performing RACS-disturbing activities have completed asbestos awareness training in accordance with Occupation, Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1926.1101(k) Communication of Hazards - (9)(10) .
- Records that document the training, experience, or certification requirements in CSWR §5.5. Documents shall be available on-site for review throughout the duration of soil-disturbing activities.
- The contractor will be required to prepare and implement a Health and Safety Plan in accordance with the applicable regulations, including OSHA. The contractor will be responsible for the health and safety of its employees, subcontractors, consultants, etc., as well as provide all necessary training and PPE for completion of work.
- The contractor will be responsible for maintaining all necessary site controls to prevent unauthorized entry into the RWA in accordance with Section 5.2 of this standard operating procedure, and with CSWR § 5.5.7(A) “Establishment and Control of a Regulated Work Area (RWA)”.
- The contractor will be responsible for adherence to this plan at the direction of the CABI/AMS. The CABI/AMS will be completing air monitoring in accordance with Section 7.2.5. Based on the air monitoring results, the CABI/AMS will direct the contractor to institute additional BMPs, if necessary, to eliminate fugitive dust emissions or visible emissions.

The following contains requirements for the contractor performing any soil disturbing activity:

## 3.5 Notifications

The Notification of RACS Disturbance form (Appendix C) must be submitted to CDPHE prior to commencing work in planned RACS management or within twenty-four (24) hours of unexpected discovery of RACS areas. The notification shall indicate which management approach will be utilized per the project's soil-disturbing scenario as presented in Section 2 of this standard operating procedure:

- Use this standard operating procedure (and note what, if any, deviations are proposed [with DDPHE approval]); or
- A project-specific PSRMP (with DDPHE approval); or
- Standard Requirements of CSWR §5.5 (with DDPHE approval).

Planned RACS disturbance shall not commence until approval has been granted by CDPHE. Notification must have the approval of the CCOD Project Manager and DDPHE must be notified before any notification is submitted to CDPHE. Notification is not required when only sampling debris for ACM content by a CABI.

For all soil-disturbing activities where the contractor or subcontractor will perform RACS management:

- Within twenty-four (24) hours of **unplanned** RACS discovery, the contractor or CABI shall submit a Notification of RACS Disturbance form (Appendix C) to CDPHE indicting that the project will be using the RACS management steps as detailed in this standard operating procedure.
- Ten (10) days prior to start of RACS disturbance for **planned** RACS management, the contractor or CABI, shall submit a Notification of RACS Disturbance form (Appendix C) to CDPHE indicting that the project will be using the RACS management steps as detailed in this standard operating procedure.
- Notification of RACS Disturbance form shall be emailed to CDPHE address on the form, and copied to the CCOD Project Manager and DDPHE contact.
- Maps, figures, drawings, or other applicable information shall be included with the Notification of RACS Disturbance form.
- In the event of an emergency (a condition which is immediately dangerous to life or property; e.g., broken water main, broken gas line) in which a soil-disturbing activity must continue or commence at once, notification shall be made as soon as possible, but within 24 hours of identifying or assuming the presence of RACS within the soil-disturbing area. During the initial response to the immediate emergency, the standard requirements of RACS management in accordance this standard operating procedure shall be implemented to the extent possible. Within 48 hours, any disturbed and/or exposed RACS shall be managed in accordance with this standard operating procedure.

- RACS management must be approved by the CCOD Project Manager prior to commencing ongoing soil-disturbing activities involving RACS. Exceptions would be RACS inspection, stabilization, and necessary decontamination activities. Any planned changes to this standard operating procedure must be approved by the CCOD Project Manager, DDPHE, and CDPHE prior to commencing RACS disturbance activity.

## 3.6 Soil Reuse

In some circumstances, an MMP will be prepared for a project. Soil reuse, and management of soil not impacted by RACS, should be followed in accordance with the MMP. If an MMP is not available, coordination with DDPHE, and potentially CDPHE, may be necessary. Regardless, all CCOD projects must follow the DDPHE *Guidance for Reuse of Soil on City Projects*. Some general requirements (but not all requirements) are described as follows:

- If the soil generated at a project would be reused at a third-party property, coordination with DDPHE will be required, as well as other requirements noted in the *Guidance for Reuse of Soil on City Project,* which define soil quality and analytical requirements.
- Soil that is proposed for reuse at a CCOD-owned park must meet the requirements defined for Unrestricted Reuse, and cannot contain any debris (Suspect or Non-Suspect).
- Soil that is not to be disturbed by planned construction on the project will remain in-place, regardless of its reuse classification. Characterization and remediation of soil not directly disturbed by project activities are beyond the scope of this standard operating procedure, unless specifically directed by DDPHE. If remedial actions are required, additional planning would be conducted under the direction of DDPHE.
- No debris (including Non-Suspect), RACS, or impacted soil may be left exposed at final grade surfaces. Depending on the conditions discovered, it may be necessary to over-excavate these materials 12 inches or more (18 inches minimum if RACS is present), and backfill with clean soil to the final grade (see Section 5.1 of this standard operating procedure).
- **No soil containing debris, whether Suspect or Non-Suspect, may be reused onsite or off-site.** There may be certain circumstance where approval may be obtained, but only through coordination with DDPHE, and possibly with CDPHE, in accordance with applicable regulations.
- All soil destined for landfill disposal, including RACS managed according to this standard operating procedure, must be disposed under proper waste characterization and waste profiling procedures at the Denver-Arapahoe Disposal Site.

# 4. Debris Identification

The contractor and/or sub-contractor(s) to the contractor, while performing soil-disturbing activities under this standard operating procedure, shall have the responsibility of inspecting all soil-disturbing activities through continuous visual inspection for the presence of Suspect Debris or Non-Suspect Debris. All visible debris will have a debris determination as **non-suspect for ACM** (Non-Suspect), or **suspect for ACM** (Suspect). The contractor/sub-contractor shall follow the directions given in this standard operating procedure related to findings and debris classifications. If the contractor/sub-contractor is unsure of a classification or unable to make this classification, the contractor/sub-contractor shall contact a CABI to assist in the final classification of soil and/or debris, or contact DDPHE.

The contractor and/or sub-contractor shall evaluate any debris encountered to see if it meets the parameters of Section 4.1 of this SOP and CSWR § 5.5.2 (H) & (I) during all soil-disturbing activities. To ensure an accurate evaluation is made, any contractor and/or sub-contractor performing any soil-disturbing activities while operating under the provisions of this SOP and not identified as a General Abatement Contractor, shall be required to have all project field personnel complete a general RACS awareness training as detailed in CSWR § 5.5.3 (A) annually. This training is required to be presented by a CABI that meets the training and experience requirements of section CSWR § 5.5.3 (D) and will specifically address all necessary protocols and actions for debris identification regarding sections 4.1 and 4.2 of this SOP. Furthermore, the contractor and/or sub-contractor shall document their debris evaluation(s) and debris encounters(s). Debris documentation and training records shall be made available at upon request by CCOD and/or CDPHE.

## 4.1 Debris Classified as Non-Suspect for ACM

Materials will be defined as **non-suspect for ACM** when it meets the following criteria:

- The material is soil only, where there are no visible signs of construction debris at the point of soil disturbance; or
- Soil that contains the following non-suspect debris:
    - Metal - with NO associated materials on it (e.g. sealants, insulation, adhesives, etc.)
    - Glass - with NO associated materials on it (e.g. caulking, glazing, sealants, etc.)
    - Plastic - with NO associated materials on it (e.g. sealants, adhesives, etc.)
    - Wood - with NO associated materials on it (eg. drywall, plaster, adhesives, caulking, etc.)
    - Concrete - bare, with NO associated materials on it (e.g sealants, adhesives, waterproofing, tars, floor tiles, etc.)
    - Plant material, including plant wastes from the food processing industry and vegetative food waste
    - Yard trimmings

- Untreated wood wastes
- Non-industrial and non-insulative paper products (e.g., newspaper, magazines, food wrappers)
- Debris that has been evaluated during a project-specific subsurface investigation, and has been determined by a CABI as Non-Suspect (documentation must be maintained on the project at all times); special caution is recommended, as subsurface conditions in areas where filling has been conducted can be highly variable, and unexpected discoveries may be identified
- Or other material as approved by CDPHE

## 4.2 Debris Classified as Suspect for ACM

The contractor shall classify all other debris types not specifically listed as non-suspect for ACM above, as **suspect for ACM**, and therefore must have a RACS determination completed by a CABI following the definitions sections of this standard operating procedure and CSWR §5.5, or be assumed to be RACS and managed in accordance with this standard operating procedure (with approval from DDPHE).

Soil or ash known to contain non-visible asbestos fibers, based on documented evidence such as construction drawings or analytical reports, is RACS, and if exposed during a soil-disturbing action, shall be managed in accordance with this standard operating procedure.

Because ash can contain burnt building debris that contains asbestos materials, it is automatically assumed to be RACS. However, it can be evaluated by a CABI (including through laboratory analysis), to be non-ACM during the RACS determination.

# 5. Initial Actions and Stabilization for RACS Discovery

This section describes the immediate and interim actions that will be implemented by the contractor if he identifies debris that is classified as **suspect for ACM**. When Suspect Debris is discovered during soil-disturbing activities, the critical requirements are: 1) **avoid generating dust and avoid being in direct contact with airborne soil emissions**, thereby limiting potential exposure to asbestos fibers; and 2) **stabilize the discovery**. Each Suspect Debris encounter scenario will vary; however, the following general processes must be followed:

- Stop all soil-disturbing activities around the discovery until a CABI's RACS determination can be made that has been reviewed by DDPHE.
- Remove all contractor personnel out of the Suspected Debris area.
- Contact DDPHE, and CCOD Project Manager, of the discovery to coordinate next steps.
- A layer of 6-millimeter (mil) polyethylene (poly) sheeting may be used to prevent cross-contamination onto clean soils during initial characterization activities by placing the poly on the ground and then placing the potentially contaminated soil, which has been adequately wetted, directly on the poly.
- Poly will be used to cover the suspect materials to prevent cross-contamination and spreading; care should be taken to make sure the poly will remain attached to the ground, even in high-wind conditions.
- Wet the area immediately surrounding the suspect RACS with water, prior to performing sampling activities that disturb the material (note: visual inspection does not require wetting). Maintain wet conditions throughout sampling activities.
- Isolate the area where the discovery has been made to prevent worker or public exposure and cross-contamination. It may be necessary install fencing or other measures to preclude such access.
- Coordinate with CABI to perform a RACS determination within 24 hours.
- The CABI will evaluate if personnel decontamination is required and advise accordingly.
- The CABI should evaluate equipment for the need for decontamination, and advise accordingly.
- The CABI will collect samples of the suspect RACS according to procedures provided in this standard operating procedure (Section 6).
- If leaving the site unattended, cover the disturbed soil with a layer of 6-mil poly sheeting, or spray with magnesium chloride solution (or equivalent) in sufficient amounts to adequately

wet the soil to prevent dust generation. The contractor shall implement control mechanisms to prevent unauthorized or unintended contact with the material (e.g., install fencing).

- After confirmation of RACS by the CABI, the CABI, in coordination with DDPHE, will direct the contractor on proper implementation of this standard operating procedure.

## 5.1 Temporary Stabilization Procedures

Any contractor who exposes RACS during a soil-disturbing activity, but does not disturb or come into contact with the RACS debris, such as a side-wall or bottom of excavation, and determines to have the RACS remain in place, shall have it covered or stabilized using one of the following methods:

### 5.1.1 Horizontal Excavation Faces (Excavation Floors)

- Cover RACS with geofabric, followed by eighteen (18) inches of fill suitable for unrestricted use, and vegetation; or
- Cover RACS with geofabric, followed by six (6) inches of fill suitable for unrestricted use, and concrete or asphalt.

### 5.1.2 Vertical Excavation Faces (Excavation Side Walls or Trenches)

- Cover RACS with geofabric, followed by fill suitable for unrestricted use to grade or six (6) inches, whichever is greater; or
- Alternate cover designs as approved by the CCOD Project Manager and CDPHE.

### 5.1.3 Standard Requirements for Temporary Sub-Surface Stabilization of RACS.

Any contractor who excavates RACS during a soil-disturbing activity, where it is decided that RACS will be put back into place for a future planned RACS removal not to exceed six (6) months, shall comply with the following

- RACS may only be placed within the Area of Contamination (AOC) that it was originally removed from; and
- Placement and stabilization of RACS shall utilize standard RACS management requirements in accordance with Section 5.1.1 of this standard operating procedure; and
- Provide DDPHE with a plan to coordinate with the CDPHE on how DDPHE/CCOD will track the 6-month time storage of RACS.

### 5.1.4 Standard Requirements for Permanent Stabilization of RACS

Except as provided in Section 5.5.1(D)(5) of CSWR §5.5, a contractor who disturbs or exposes RACS shall make the decision upon the initial discovery of RACS to either manage the RACS in accordance with Section 7 of this standard operating procedure, or cease soil-disturbing activities and permanently stabilize the disturbed or exposed RACS to control the release of asbestos fibers in accordance with one of the following:

- Cover RACS with geofabric, or equivalent visible and physical barrier, and restore the site to pre-disturbance conditions using fill suitable for unrestricted use; or
- Cover RACS with geofabric, or other equivalent visible and physical barrier, followed by eighteen (18) inches of fill suitable for unrestricted use, and vegetation; or
- Cover RACS with geofabric, or other equivalent visible and physical barrier, followed by six (6) inches of fill suitable for unrestricted use, and concrete or asphalt; or
- Cover RACS with geofabric, or other equivalent visible and physical barrier, followed by fill suitable for unrestricted use to grade for vertical excavation faces or trenches; or
- Alternate cover designs as approved by CDPHE.
- Determinations as to what materials would constitute an equivalent visible and physical barrier replacing geofabric shall be made through consultation with DDPHE and CDPHE.

All procedures shall follow standard requirements for RACS management as per Section 7 of this standard operating procedure.

### 5.1.5 Standard Requirements to Stabilize Investigation-Derived Waste

During the process of investigating or examining subsurface conditions during project design, Suspect Debris (debris classified as suspect for ACM) may be found. Investigations may include: geotechnical or environmental investigations (generally using continuous-flight augers advanced by a truck-mounted drill rig); environmental investigations utilizing excavated test pits or test trenches, utilizing an excavator or backhoe; or utility investigations using a water knife and vacuum truck to locate buried utilities. After investigation or examination, the soil generated during the investigation may be placed back into the subsurface area of origination (e.g., soil boring or test pit from which the material came). The following provisions shall apply:

- Subsurface Suspect Debris locations will be documented and can be made available to CDPHE upon request.
- Only soil generated during the subsurface investigation, at the location of origination, may be placed back into the subsurface.

- Upon discovery of Suspect Debris, drilling or excavation activities will cease. If a CABI is present, the material will be sampled, and the remaining Suspect Debris will then be placed directly back into the point of origination, at the deepest depth as practicable.
- Suspect Debris shall be placed at the bottom of the excavation (boring or test pit), and then covered with clean over-burden soil. At least 12 inches of clean soil must cover Suspect Debris. If a CABI is not present when suspect material is first identified, investigation and replacement of soil may not continue until a CABI is present for the remainder of investigation.
- In lieu of stabilization, Suspect Debris and the surrounding 12 inches of soil can be removed, and then managed and disposed as RACS in accordance with this standard operating procedure.
- **If a utility investigation utilizing a vacuum truck/water knife is proposed in a <u>known historical urban fill site and/or area with known RACS or Suspect Debris</u>, additional project-specific planning will be necessary BEFORE work is initiated as there is a high potential that equipment may become contaminated. Coordination with DDPHE will be required.**
- The contractor completing the investigation work must report to DDPHE Suspect Debris discoveries, including the location, depth, and disposition of the material. These findings will be used to determine applicable actions during the implementation/construction of the project.
- No additional stabilization or management of Suspect Debris, including RACS if confirmed, is required after these steps have been completed.
- The CABI will evaluate the need to decontaminate personnel and/or equipment, and advise accordingly.
- Information collected during the investigation shall be made available to the CCOD Project Manager and DDPHE, who will consider design strategies during the project design to avoid, minimize, or mitigate (via this standard operating procedure) RACS during project construction.
- Notification to the CDPHE of an unexpected discovery is required if stabilization procedures and documentation to DDPHE are performed in accordance with this standard operating procedure.

## 5.2 Site Access Control

The contractor will be responsible for maintaining effective project access control by establishing and taking measures to prevent access to the RWA (or areas where discoveries have been made and are being evaluated) by unauthorized persons. A fence should be erected around the perimeter of the project area to limit access to the site. Instances of unauthorized access not under the control of the contractor shall be evaluated to determine if additional access controls are warranted. The unauthorized access, and the response actions taken, shall be documented and provided to the CDPHE within 48 hours of the incident. Access will be limited to individuals that are approved to be on site.

If RACS is encountered/confirmed, the contactor will install proper signage stating the area is a RWA because of the presence of asbestos, and that the area is off-limits to unauthorized personnel. Personnel working on the site shall be advised and directed not to disturb areas where suspected or known asbestos is encountered. Personnel driving onto the site shall be notified of suspect or known asbestos locations and directed to not drive on or disturb those areas. At no time will vehicle traffic be allowed on surfaces where samples have shown positive test results, or where visible asbestos is present, or where untested suspect materials are located. This excludes equipment that is to remain off the road and on the project area for removal operations. Project equipment/vehicles moving across contaminated soils must do so in a way as to not generate visible emissions, and the soil shall be wetted to control visible emissions. Equipment/vehicles that come into contact with RACS will require decontamination as per section 7.2.7 of this standard operating procedure.

# 6. Suspect Asbestos Bulk Sampling

If Suspect Debris (which is suspect for ACM) is visually identified, the following steps will be applied to sample and analyze potential ACM by the CABI (only a CABI who meets the requirements discussed in Section 3.3 of this standard operating procedure may collect samples to determine asbestos content). Additional information is presented in Appendix D (CSWR §5.5 – Appendix 5A). All sampling and analysis shall be conducted in accordance with CSWR §5.5 – Appendix 5A.

- Samples of suspect asbestos material will be placed in appropriate sample containers such as sample bags or jars.
- Care should be taken to ensure that suspect asbestos material is adequately wetted to prevent visible emissions during the sampling process.
- Bulk samples shall be collected by homogenous type based on color, pattern, texture, thickness, associated materials, or by other identifying characteristics.
- The quantity and location of a suspect material shall be used to determine the number of bulk samples required to characterize the asbestos content of each homogeneous suspect material. For the purpose of determining that a homogeneous suspect material does not contain asbestos:
    - A minimum of three bulk samples shall be collected from the homogeneous material, unless there is insufficient material to constitute three samples.
    - If one of the collected samples of a homogeneous bulk material is determined to be ACM, then the homogeneous material shall be considered ACM.
- A field sampling form or log book entry will be maintained for each sample obtained. The form or log book entry will include the location using a hand-held global positioning system (GPS) instrument, date and time of each sample, depth below the ground surface the sample was identified, description of the type of material, assessment of friability of the material, and other observations made.
- Proper chain-of-custody procedures will be followed for all samples collected.
- Samples of newly discovered suspect asbestos materials will be analyzed by a National Voluntary Laboratory Accreditation Program (NVLAP)-accredited laboratory by Polarized Light Microscopy (PLM) methodology to determine if any asbestos fibers are present.
- Suspect materials not sampled according to these procedures must be assumed to be ACM and managed as such.

# 7. RACS Management

Through coordination with the CCOD Project Manager and DDPHE, the contractor may be retained to conduct RACS management. CCOD will require that the contractor, in coordination with the CABI/AMS, utilize management strategies that are protective of human health and the environment, meet the CSWR §5.5 requirements, and provide the best value to the CCOD. A detailed scope of work detailing how this standard operating procedure will be implemented, including costs, will be required prior to initiating RACS management.

A specialized asbestos abatement contractor may also be retained to conduct these services. Any entity who wishes to engage in RACS management must understand the intricacies of the CSWR §5.5 regulation, the materials, the risks, and management of the material. Due to the complexity of the work, it is highly encouraged that only experienced contractors conduct RACS management activities. The CCOD Project Manager and DDPHE will evaluate the experience and qualifications of the contractor conducting RACS management prior to implementing RACS management on a project through review of the detailed scope of work and other qualifications, as requested.

Two standard RACS management strategies are provided in this standard operating procedure, which are described in this following text. The Hand Removal strategy may be effective where small amounts of RACS (or Non-RACS) is likely to be found. The mechanical removal strategy may be effective where large amounts of RACS (or Non-RACS) is likely to be found. Again, the CCOD Project Manager, DDPHE, and the key parties should thoroughly evaluate site conditions before determining the appropriate RACS management strategy. Some projects may use both strategies at different times as the most effective way to manage RACS.

## 7.1 Hand Removal

During this action, the CABI will direct the contractor (or perform themselves) in the removal of these pieces of suspect or confirmed ACM (including RACS and Non-RACS) using the procedures listed below:

- The CABI will conduct a visual inspection of area and surrounding surface for the presence of suspect or confirmed RACS.
- Establish the RWA according to Section 7.2.1 (an RWA is not required if the material is determined to be a Non-RACS).
- Adequately wet the suspect or confirmed RACS and surrounding soil (12 inches) with amended water containing a wetting agent, such as a 50:50 mixture of polyoxyethylene ester and polyoxyethylene ether.
- Gather the RACS and remaining 12 inches of surrounding soil and place into double-bagged, 6-mil poly bags.

- The CABI will then complete a second visual inspection of the area and surrounding surface where minimal material was discovered to safeguard that no further RACS is in the scope area.
- If the CABI encounters further material after removal of the original discovery in which hand removal is not practical or effective, mechanical removal methods inside a RWA should be implemented.
- If RACS remains as part of the scope, it shall be managed according with Section 5.1.4 of this standard operating procedure.
- Dispose of waste in marked, 6-mil poly bags with attached generator labels in accordance with the CSWR §5.
- Hand-removed, bagged RACS waste may be stored in a leak-tight and secure container labeled for asbestos, and disposed in accordance with CSWR §5. Bagged RACS may not be stored for more than 10 days without a CDPHE-approved RACS storage plan.
- Asbestos worker and equipment decontamination shall be performed in accordance with Section 7.2.7.

Where there are minimal amounts of RACS/Non-RACS discovered as described above, the CABI may conduct the removal actions as stated in this standard operating procedure, and the utilization of an abatement contractor is not required (although an abatement contractor may provide trained asbestos workers to complete removal actions under the supervision of the CABI).

This method may also be applicable where other contaminants are present in soil (such as heavy metals or petroleum hydrocarbons), which are being managed in accordance with a MMP. During mechanical removal actions of special solid waste, the CABI must carefully (and safely) observe soil during the excavation process, prior to the material being loaded into trucks, to ensure that RACS is not overlooked. It may be necessary for the contractor to remove soil, carefully spread on the ground where it may be adequately visually inspected by the CABI (wetting as needed so there is no visible dust), and then re-excavate the material and place in dump trucks for landfill disposal. In no event may excavated soil that contains non-soil debris of any kind (Suspect or Non-Suspect) (e.g., non-ACM bricks, concrete, ceramic) be reused at an off-site location, whether if the property is owned by CCOD or not. These soils must be disposed at the Denver-Arapahoe Disposal Site (3500 South Gun Club Road, Aurora, Colorado 80018) as a special solid waste according with the MMP and CCOD's soil reuse policy (Section 3.6).

## 7.2 Mechanical Removal

Mechanical removal of RACS is often the safest and most cost-effective method of RACS management, particularly where large quantities of RACS/ACM is present, or is expected to be present.

### 7.2.1 Establishing a RWA after Confirmed Discovery of RACS

The contractor, under the direction of the CABI, will be responsible for establishing any RWA(s) for discovered RACS the CABI identifies, which will be removed, as follows:

- Establish a visible perimeter around the discovered material, which is identifiable to all persons on site, to prevent cross contamination. Demarcate area suspected of containing RACS with barrier tape, or other means, and provide access control.
- Post-labeling and signage to demarcate RWA(s). The RWA shall be demarcated with a visual means that defines the full extent of the RWA. Labeling and signage shall indicate the potential presence of asbestos, and that the area is off limits to unauthorized personnel.

### 7.2.2 Engineering Controls

#### *7.2.2.1 Initial Minimum Controls*

Minimum engineering controls will be implemented when excavations occur within the footprint of the RWA. The minimum engineering control include, but are not limited to, the following:

- A CABI must observe each area where soil disturbing or loading activities are taking place; therefore, if multiple excavations are occurring simultaneously, a CABI must be available to visually inspect each excavation location (i.e., utilize multiple CABIs).
- The CABI(s) will be on site at all times that RACS is being removed to ensure that no visible emissions are generated at any time during soil-disturbing activities. Additionally, the CABI will verify that the soil moisture is sufficient during removal to suppress dust, and to ensure that the material is adequately wet. If visible emissions are observed, then work practices will be modified.
- Stockpiled soils will be stabilized using the application of water or magnesium chloride, and/or by covering with overlapped poly sheeting or appropriate cover/stabilization.

#### *7.2.2.2 Wind Break Barriers*

As needed, wind break barriers should be constructed prior to commencement of removal activities, and constructed of materials appropriate to site conditions. Ultimately, wind break barriers will be the responsibility of the contractor. It is recommended that the wind break barriers be relatively portable and adequate to minimize soil dispersal from the work area. The wind break barriers will be placed to completely encompass the work area and loading area, as this will assist to prevent uncontrolled access to the work area by unauthorized personnel during and after work shifts.

### 7.2.3 RACS Disposal Procedures

#### *7.2.3.1 Mechanical Removal/Disturbance of RACS from a Regulated Work Area*

- Removal and disturbance of RACS will be conducted utilizing a direct-load system. RACS and its associated required removal quantities will be removed adequately wet and transported directly to DADS. Trucks will be prepared prior to loading by installing at least one leak tight 6-mil layer of poly as a liner (for non-friable RACS), or at least two layers of leak tight 6-mil poly (for friable RACS). The liner(s) will be installed such that under normal conditions, it (they) will not rupture during loading, transportation, and disposal. The poly liners will be sealed at the opened ends for transport with mechanical fasteners (i.e., tie wire, zip-ties, etc.).
- The project will have the option for all loads, based on continuous visual inspection and documentation by a CABI, to be determined to contain less than one percent (by volume of the load or container) of friable RACS, non-friable RACS or assumed ACM debris. In these cases, the loads shall be packaged and disposed of with one leak tight 6-mil layer of poly as a liner. If debris is assumed to be ACM, continuous CABI visual inspection is still required to determine if the amount of RACS remains below 1% of the disposal load.
- An area to load the trucks with RACS will be prepared as close to the RWA as possible, allowing safe access in and out of the site. A layer of 10-mil poly will be placed on the ground as a loading pad to capture potentially spilled RACS and immediately cleaned or replaced if any spillage or damage to the liner occurs.
- Standard erosion control BMPs must be established by the contractor to prevent stormwater run-on/off for the duration of the loading and transportation activities.
- Spill prevention measures, as outlined in CSWR §5.5.7(G), will be incorporated during loading of the RACS to prevent cross-contamination of adjacent areas. Specific measures include;
    - Protect surfaces of loading, transport or container equipment not meant to be in direct contact with RACS materials. Should these surfaces come into contact with RACS, they shall be decontaminated per section 7.2 of this standard operating procedure;
    - Do not overfill the excavator or loader bucket and return the bucket to a closed position prior to moving from the loading point;
    - Replace protective coverings when worn or damaged in order to prevent breaches;
    - Control runoff in order to prevent cross contamination outside of the RWA from water containing asbestos.
- Spilled RACS shall be treated as an RWA and cleaned up immediately in accordance with CSWR § 5.5.7 (J). It will not be allowed to dry out or accumulate on any surface. The

Department's Hazardous Materials and Waste Management Division shall be notified, through the spill reporting hotline, in the event that spills of RACS cannot be cleaned up within 24 hours of spill identification.

- Where there are breaches in ground coverings that have the potential to allow water contaminated with asbestos to impact the material below the covering or surfaces that are contacted by asbestos-contaminated water, a minimum of three (3) inches of soil, or other matrix material, shall be removed.
- If ground coverings are placed on top of a durable surface such as concrete or asphalt, the surface shall be decontaminated using wet methods, followed by CABI inspection that all soil and debris has been removed from the surface.
- Rinsate, runoff, or any other water that has come into contact with RACS shall be considered to be asbestos contaminated water and shall be collected. However it cannot be  for discharge to a sanitary sewer or other Department-approved disposal facility. It may be re-applied to RACS that will be stabilized and managed under this SOP.
- Surfaces that are contacted by asbestos contaminated water can be permanently stabilized as per Section 5.1.4 of this standard operating procedure.

- Trucks carrying friable RACS (friable material over 1% by volume of the disposal load) must be labeled in accordance with the requirements of CSWR §5.5 using one of the following legends in type at least five inches tall:

**CAUTION**
**CONTAINS ASBESTOS**
**AVOID OPENING OR BREAKING CONTAINER**
**BREATHING ASBESTOS IS HAZARDOUS TO YOUR HEALTH**

**DANGER**
**CONTAINS ASBESTOS**
**AVOID CREATING DUST**
**CANCER AND LUNG DISEASE HAZARD**

- Non-friable RACS will be labeled "Asbestos, Danger" along with the name of the generator during transport.
- The contractor will be responsible for Department of Transportation protocols and labeling for transportation of RACS.

- It is likely that an excavator or front-end loader will be utilized for RACS removal, disturbance, management, and loading. During all soil-disturbing activities involving RACS, adequate wetting of soils will be performed. At least one water hose operator is required at each excavation, and other means may be employed to ensure that RACS is adequately wet (e.g., misting bars, additional hose operators).
- The equipment operator(s) will load the RACS directly into the pre-lined truck; the truck drivers will not be allowed to exit the trucks during loading operations and will be required to keep their windows closed and air handling systems off while their trucks are being loaded.
- The excavation bucket will not be filled greater than 2/3 its capacity to avoid overfilling and spilling.
- The CABI will continuously observe excavation and loading operations to verify that adequate wetting has taken place and that no visible emissions occur, and that compliance to this standard operating procedure is adhered to.
- During mechanical removal, if the CABI observes solid waste material (e.g., Non-Suspect material as described in Section 4.1), with no visible evidence of suspect ACM, and there is sufficient quantity, the CABI and contractor may elect to segregate this material for disposal as non-ACM.

#### *7.2.3.2 RACS Removal Quantities*

The extent of removal quantities differs depending on where the RACS disturbance is taking place as follows:

- When RACS is being removed from the **surface** – Wet and remove all RACS and its associated six-inches in all directions, plus a minimum of six inches of soil or other matrix material, in all directions from the last occurrence of visible ACM with CABI confirmation that the visible extent of RACS has been removed (i.e., removal of visible ACM plus a minimum 12-inches of soil in all directions).
- When RACS is being removed from the **subsurface** – Wet and remove all RACS and its associated six-inches plus a minimum of three linear feet of soil or other matrix material, in the direction of planned excavation with CABI confirmation that the visible extent of RACS has been removed.

#### *7.2.3.3 Off-Site Disposal of RACS*

It will be the responsibility of the contractor to direct the schedule of transportation of RACS to DADS. When loaded, each truck will be assigned a waste manifest to serve as the shipping document for that load. Documentation stating that the soil originating from the project shall not be used as a daily cover

or sold as clean fill will accompany each load of RACS removed from the project. DDPHE will coordinate the waste profile and obtain waste manifests if requested.

RACS will be transported to DADS. Disposal of RACS will be conducted while adhering to CSWR §5. The landfill processes will be followed, specifically regarding notification, profiling, and on-site disposal.

Disposal of Non-RACS will require notification to the landfill that the material to be disposed contains Non-RACS, and based on the DADS requirements, the material will be handled accordingly (e.g., unlined trucks, single-lined trucks). Special precautions shall be undertaken during the management of non-RACS to prevent the material from being turned into RACS (i.e. being rendered friable).

### 7.2.4 Wind Speed Monitoring

Periodic wind speed measurements will be taken during RACS disturbance within each RWA by an AMS or CABI at least once per every half hour. This frequency will be increased at the AMS's or CABI's discretion when it has been determined that wind conditions may be approaching threshold limits, and during wind gusts. It will be the responsibility of the AMS or CABI's to take and record all wind speed measurements onto the daily logs. All wind speed measurements will be taken within the work area in a location deemed representative of the area. The following are conditions where work will be shut down and started:

**Shut down Conditions** – RACS disturbance operations should immediately and temporarily cease when one or more of the following conditions have been met:

- Any wind gust reaches or exceeds 20 miles per hour (mph) as determined by hand-held instruments
- Sustained wind speeds reach or exceed 12 mph averaged over a 10-minute period
- Winds produce visible emissions or create movement of dust or debris in or near the work area or loading area
- Winds impact any engineering controls and prevents them from functioning as designed
- During wind-related project shutdowns, other work not related to RACS disturbance may continue

**Startup Conditions** – RACS disturbance operations may resume after all the following conditions have been met:

- All wind gust readings drop below 20 mph for a period of 20 minutes as determined by hand-held instruments
- Sustained wind speeds are below 12 mph averaged over a 20-minute period

- Winds no longer produce visible emissions or create movement of dust or debris in or near the RACS disturbance area
- Winds are not impacting the ability of engineering controls to work as designed

### 7.2.5 Air Monitoring

CDPHE will require minimum air monitoring when suspect or confirmed ACM/RACS is being disturbed within a RWA, after the second consecutive day of RACS management. An appropriately trained and certified AMS must perform the air monitoring activities at the project. The CABI will characterize debris and air monitoring requirements will be made by the AMS based on the CABIs identification of the debris and applicable regulations. The CABI and AMS can be the same person if she/he meets the CABI and AMS requirements in Section 3.3. Ideally, the CABI and AMS will be the same person.

Air monitoring samples will be collected by the AMS using the procedures outlined below. All air samples will be collected and analyzed in accordance with CSWR §5.5 – Appendix 5A.

#### *7.2.5.1 Air Monitoring Matrix Tables*

Personnel Monitoring and RWA Perimeter Sampling shall be performed in accordance with the following air-monitoring matrix tables:

*Table 3 Removal/Disturbance (by hand or hand-held tools) of Non-Friable RACS*

| Monitoring Type | Sample Frequency | Duration | Analysis |
|---|---|---|---|
| RWA Perimeter Monitoring | None | Not Applicable | Not Applicable |

*Table 4 Removal/Disturbance (by hand or hand-held tools) of Friable RACS*

| Monitoring Type | Sample Frequency | Duration | Analysis |
|---|---|---|---|
| RWA Perimeter Monitoring | Four samples at the perimeter of the RWA, at the points of the compass. | Ongoing after the 2nd day of RACS disturbance | PCM and Transmission Electron Microscopy (TEM) sampling around RWA. Any sample with PCM results exceeding 0.01 fibers per cubic centimeter (f/cc) must be analyzed by TEM. |

*Table 5 Removal/Disturbance by Mechanical Means (Heavy Equipment) of Non-Friable RACS*

| Monitoring Type | Sample Frequency | Duration | Analysis |
|---|---|---|---|
| RWA Perimeter Monitoring | Four samples at the perimeter of the RWA, at the points of the compass. | Ongoing after the 2nd day of RACS disturbance | PCM and TEM sampling around RWA. Any sample with PCM results exceeding 0.01 fibers/cc must be analyzed by TEM. |

*Table 6 Removal/Disturbance by Mechanical Means (Heavy Equipment) of Friable RACS*

| Monitoring Type | Sample Frequency | Duration | Analysis |
|---|---|---|---|
| Area of Disturbance Perimeter Monitoring | Four samples at the perimeter of the RWA at the points of the compass, and two downwind floater samples. | Ongoing after the 2nd day of RACS disturbance | PCM and TEM sampling around RWA. Any sample with PCM results exceeding 0.01 fibers/cc must be analyzed by TEM. |

#### *7.2.5.2 Personnel Air Monitoring*

Personnel monitoring will be the responsibility of the contractor, per OSHA requirements, and is not directed by this standard operating procedure.

#### *7.2.5.3 Required Preliminary and Area Air Sampling Protocol*

- **During the first five days of RACS disturbance/removal** – All air samples collected are required to be analyzed by PCM methodology. Additionally, a minimum of 25% of the samples collected from each RWA shall be submitted for TEM analysis. The sample(s) selected for TEM analysis shall have the highest PCM result(s) based on fiber concentration. If all PCM results are Below Detectable Limit (BDL) for fiber concentration, then the sample(s) selected for TEM analysis shall be determined by highest fiber count. If all samples have no fiber counts, then no TEM analysis is required.
- **After five days of RACS removal/disturbance with no asbestos detections by TEM analysis** – the frequency of analysis by TEM, on the highest 25% of PCM results(s), may be reduced to once every five days of RACS removal/disturbance, or portions thereof, using the same selection criteria as above. During the period of reduced frequency of TEM analysis, the first occurrence of high winds, exceeding wind shutdown criteria (Section 7.2.4), or visible

emissions, shall result in that day's samples (25%) being submitted for TEM analysis. In the absence of high-wind events or visible emissions the selected day for TEM analysis may be random, as determined by the AMS.

- If at any time, a sample analyzed by PCM returns results greater than 0.01f/cc, that sample shall then be analyzed by TEM as required by CDPHE.
- If there are any asbestos detections during the random once-every-five-days-analysis by TEM, then TEM analysis shall be conducted for three consecutive days of RACS removal/disturbance, or portions thereof. If there are no additional asbestos detections during the three consecutive days of RACS removal/disturbance with samples submitted for TEM analysis, then the frequency of TEM analysis may return to random, once-every-five-days of RACS removal/disturbance.

#### *7.2.5.4 Area Air Sampling*

- Air samples will be collected continuously during all mechanical removal of RACS.
- Area monitoring shall consist of a minimum of four samples collected on the perimeter of the RWA, at the four-compass points, and at appropriate intervals to provide representative information regarding potential releases of asbestos fibers to the Adjacent Receptor Zone(s).
- Two additional downwind floating samples will be required for mechanical removal/disturbance of friable RACS. The samples shall be moved based on prevailing wind direction and adjacent receptors.
- Additional samples shall be collected for large perimeter RWAs (greater than one (1) acre). RWAs greater than one (1) acre shall require additional perimeter monitoring points be added at a rate of one (1) sample for every 200 linear feet (or approximately each additional ¼ acre).
- Air monitoring is not required where RACS management activities will occur in areas where there is no Adjacent Receptor Zone present according to the definition of an adjacent receptor zone where access to the public can be controlled (i.e., an area of at least 150 feet surrounding the RWA can be controlled allowing no public access).

#### *7.2.5.5 Sampling Media*

Air samples will be collected by drawing air through a 25-millimeter mixed cellulose ester filter, 0.8-micron pore size, with an open-faced, long cowl using low-flow personnel sampling pumps. The flow rate and the volume of the air passed through the filter will be determined based on the National Institute of Occupational Safety and Health (NIOSH) 7400 (NIOSH, 1987) analytical method. Each pump will be calibrated before and after the collection of each sample using a primary standard.

#### *7.2.5.6 Sample Analysis*

Air samples submitted for Phase Contrast Microscopy (PCM) shall be analyzed according to NIOSH Method 7400 by a laboratory showing successful participation in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program or individual(s) certified through the AIHA Asbestos Analysts Registry (AAR) Program. Analysis of TEM air samples will be submitted to a National Institute of Standards and Technology (NIST) accredited laboratory using TEM in accordance with CSWR §5.5 Appendix 5A (Appendix D).

#### *7.2.5.7 Response to Laboratory Results*

If an air sample analyzed by PCM indicates fiber concentrations over 0.01f/cc, that sample is then required to be analyzed by TEM. If an air sample has concentrations of airborne asbestos fibers after TEM analysis of personnel and/or work RWA samples, then the CDPHE will be notified immediately. The work practices and engineering controls, through consultation with CDPHE, will then be modified to reduce emissions. In the event that this should occur, the following actions shall take place:

- Excavation will immediately halt
- The source(s) of fiber release will be identified
- RACS management operations and engineering controls will be reassessed to safeguard that additional fiber releases do not occur
- If asbestos fibers are detected in air samples:
    - All soil-disturbing activities will immediately cease
    - The source of fiber release will be identified
    - An Emission Control Plan in accordance with Section 5.5.7 of the CSWR §5.5 will be derived and submitted to CCOD and the CDPHE for review
    - Soil disturbance shall not continue until the CDPHE provides verbal and/or written authorization to proceed.

### 7.2.6 RACS Stockpiling

#### *7.2.6.1 Stockpiling of RACS*

If RACS, which must be removed from the project, is in a location with limited or no access for direct loading into trucks, the material may be stockpiled on site if the conditions below are met in accordance with CSWR §5.5:

- The accumulation of RACS cannot exist for more than 10 calendar days without the approval of a RACS Storage Plan by CDPHE.

- Stockpiled RACS shall be placed on a minimum of 6-mil poly or a minimum of three-inches of soil, or other matrix material located under the stockpile which must be removed following removal of all stockpiled material.
- Rinsate/runoff shall be collected, filtered to five-microns, and discharged to a sanitary sewer (contractor must have appropriate authorizations) or re-applied to RACS that will be stabilized and managed under this standard operating procedure.
- The RACS must be adequately wet during stockpiling.
- The stockpile shall be stabilized by polyethylene sheeting, geofabric, or a chemical stabilizer demonstrated to be effective in the stabilization of RACS (e.g., magnesium chloride).
- The condition of the stockpile and cover sheeting/geofabric/stabilizer must be inspected daily and no later than 12 hours following storm events.
- All damage to the cover sheeting/geofabric/stabilizer must be repaired or replaced immediately upon discovery.

#### *7.2.6.2 Transporting RACS to Stockpile*

The following directives and RACS handling must take place during on-site transport of RACS to a stockpile location:

- Driving speeds shall not exceed 12 mph while machine is moving RACS.
- Transportation equipment tires shall not contact RACS. If tires do contact RACS, the RACS must be adequately wetted to prevent dust/emissions and all equipment surfaces that have come into contact with RACS shall be decontaminated (Section 7.2.7).
- If the transport equipment tires come in contact with RACS:
    - The haul road shall be managed as RACS and maintained to prevent dust or emissions generation and if any RACS is visibly observed it is to be removed immediately, along with the required six inches of surrounding soil and handled appropriately.
    - Following completion of excavation and grading activities, the material used in construction of the haul road as well as three inches of underlying soil will be removed and managed in the same manner as the RACS.
    - Water and runoff from the haul road shall be collected and filtered to less than five microns (or applicable local requirements) and discharged to a sanitary sewer (contractor must have appropriate authorizations) or re-applied to RACS that will be stabilized and managed under this standard operating procedure.

### 7.2.7 Decontamination Procedures

#### *7.2.7.1 Heavy Equipment or Machinery Decontamination*

Heavy equipment will be decontaminated prior to leaving a RWA in such a manner as to ensure that residual soil and contaminants are removed and other hazards are not present. Heavy equipment decontamination will include the following steps:

- Decontamination will occur within a waste container when possible, and if not will be staged on 6- or 10-mil poly to prevent cross contamination or spills. This will include mechanical removal by asbestos workers using shovels or other hand-held tools while wearing appropriate PPE.
- Next, the equipment will be thoroughly cleaned with amended water and rags.
- All used rags and disposable PPE will be disposed of as asbestos waste and transported to the landfill.
- It will be the responsibility of the CABI to make final visual inspections and a final determination regarding the decontamination of equipment for release to other portions of the project, or off-site.

#### *7.2.7.2 Asbestos Worker Decontamination During RACS Disturbance in a RWA*

A fully functioning decontamination unit or trailer will be utilized at the project whenever RACS disturbance within a RWA takes place. The decontamination unit will be located within 100 feet of the project, and as near the removal area as practical. The decontamination unit will consist of three chambers, should have fully operational hot and cold running water adjustable at the tap, and a functioning water filtration unit that will filter the waste water to five microns or less. Reuse of waste water from personnel decontamination is prohibited. For disposal, waste water may not be discharged to the sanitary sewer within the City and County of Denver. However, it may be added to RACS, generated by the project, as part of RACS disposal procedures if it does not interfere with the requirements of section 7.2.3 (RACS Disposal Procedures) of this SOP, and does not cause the load to fail a paint filter test. Disposal of decontamination water from equipment must also follow the same disposal protocols. In no event may decontamination water be discharged to any sanitary sewer, storm sewer, ditch, gutter, or stream.

To prevent cross-contamination, asbestos workers will wear clean outer protective suits as they exit from the work area(s) to the decontamination area. The asbestos workers will either double suit and remove the exterior suit, or don a second clean suit over the single suit, within the work area prior to moving out of the RWA to get to the decontamination unit. The decontamination unit should be utilized by the asbestos workers each time they exit the work area(s).

#### *7.2.7.3 Decontamination and Personnel Protection During Removal of RACS/ACM*

Asbestos workers and equipment will be decontaminated on site; dirt and debris should not leave the immediate work area. The following procedures can be modified by the CABI based on the potential level of exposure:

- Decontamination of workers can consist of removal of disposable Tyvek® suites, gloves, and boot covers. These PPE will be bagged, labeled, and disposed as asbestos waste.
- Decontaminate non-disposable personal items by removing visible soil and dust with damp wipes or rags, or by use of a high efficiency particulate air (HEPA) filter equipped vacuum. Place wipes and rags in a plastic bag and dispose along with RACS materials. If additional clothing is available, clothes should be changed and potentially contaminated clothing should be bagged separately from wipes and rags.
- Decontaminate hand equipment and tools by removing gross soils and dust, then washing the equipment. Materials used for decontamination should be bagged and disposed along with RACS materials. Equipment decontamination rinsate water should be collected and filtered to five microns prior to disposal, or reused for wetting of asbestos contaminated areas that will be removed.

Based on analytical results of suspect materials, if asbestos is present, decontamination materials should be bagged and disposed of as asbestos waste at the Denver-Arapahoe Disposal Site or with RACS in accordance with this plan. If analytical results indicate that no asbestos is present, bags (non-asbestos waste bags) can be disposed as non-asbestos solid waste.

### 7.2.8 Work Area Clearance

It will be the responsibility of the CABI to provide final visual clearance of the work area following completion of RACS disturbance/removal. The CABI will document locations, and other pertinent information, onto the daily logs for work area clearance.

# 8. Close-Out Report

The CABI will be responsible for maintaining complete documentation of the project in accordance to C.S.W.R 5.5.7 (L). After RACS disturbance/removal actions are completed, a project close-out report will be prepared for CCOD's files. The project close-out report will include at a minimum:

- Property description and description of area(s) with RACS
- Description of soil-disturbing activities
- Description of field operations or submittal of daily logs (Appendix B)
- Air monitoring logs
- Description/results of asbestos sampling events, including sample locations
- Analytical results
- Disposal summaries and manifests
- Details of excavation profiles
- Description of capped material left in place and site plan showing the capped area(s)
- Photographic logs
- Personnel certifications

Copies of the project close-out report will be submitted to the CCOD Project Manager. Project close-out reports for RACS management projects are not required to be submitted to CDPHE.

# 9. References

CDPHE, 2008. "Regulation No. 8, Part B – Asbestos", Colorado Department of Public Health and Environment, Air Quality Control Commission, Denver, Colorado, January 2008.

CDPHE, 2014. "Deletion and Replacement of Existing Section 5.5 Regulations (Management of Asbestos-Contaminated Soil) with New Section 5.5 Regulations (Management of Regulated Asbestos Contaminated Soil (RACS)); the Addition of Appendix 5A (Sample Collection Protocols and Analytical Methodologies) and the Associated Additions and Revision to Section 1.2 Definitions." Colorado Department of Public Health and Environment, dated August 19, 2014.

NIOSH, 1987. National Institute for Occupational Safety and Health (NIOSH) Method 7400 Entitled "Fibers" published in the NIOSH Manual of Analytical Methods, 3rd Edition, second supplement, August 1987.

OSHA, 1987. Occupational Safety and Health Administration (OSHA) Regulation "Asbestos", 29 C.F.R. Part 1910.1001, Appendix B (OSHA 1987)

# Appendices

# Appendix A
# CDPHE Approval Letter

COLORADO
Hazardous Materials
& Waste Management Division
Department of Public Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

May 2, 2019

Mr. Steve Gonzales
City and County of Denver
Department of Public Health and Environment
101 W. Colfax, #800
Denver, CO 80202

RE: **Approval:** *Regulated Asbestos Contaminated Soil Standard Operating Procedure for City and County of Denver* - dated May 2, 2019
SW/DNV/GEN 3.10

Dear Mr. Gonzales:

The Colorado Department of Public Health and Environment ("CDPHE"), Hazardous Materials and Waste Management Division ("Division") has reviewed the following standard operating procedure (SOP) regarding Regulated Asbestos Contaminated Soil (RACS) management activities in Denver, CO:

- *Regulated Asbestos Contaminated Soil Standard Operating Procedure for City and County of Denver* (the SOP)

The SOP was initially received in our office electronically on May 9, 2018. The Division provided comments on the initial version of the plan that were dated June 13, 2018. A revised version of the plan was received electronically on September 5, 2018. The Division provided additional comments in a letter dated November 2, 2018. Another revision to the SOP was dated January 23, 2019. Additional discussion between the Division and the Denver Department of Public Health and Environment resulted in a final version of the SOP that was provided to the Division on May 2, 2019. The SOP was prepared and submitted by The Denver Department of Public Health and Environment.

**The Division has completed its review and is pleased to hereby approve this SOP for RACS Management. Please keep in mind that all soil disturbing activities involving RACS must be performed in accordance with this approved SOP and the Colorado Solid Waste Regulations (6 CCR 1007-2, Part1).**

In closing, the Division is authorized to bill for is review of technical submittals at $125 per hour, pursuant to Section 1.7 of the Solid Waste Regulations, 6 CCR 1007-2. An invoice for the Division's review of the above referenced document will be sent out under separate cover.

The Division contact person for this project is Brian Long, and may be contacted at (303) 691-4033 or briant.long@state.co.us.

Sincerely,

Digitally signed by Brian Long
Date: 2019.05.02 16:37:42 -06'00'

Brian T. Long
Environmental Protection Specialist
Solid Waste Compliance Assurance Unit
Solid Waste and Materials Management Program

ec: Ed Smith, CDPHE HMWMD

# Appendix B
# CABI Work Day Documentation Form

# City and County of Denver
## Certified Asbestos Building Inspector Work Day Documentation
## Project Name_____

DDPHE V1.0

| | | | |
|---|---|---|---|
| Inspector Name: | | Date: | |
| Inspector Certification Number:<br>Inspector's Company/Affiliation: | | Weather: | |
| Location Description: | | | |
| Description of Site Activities : | | | |
| Equipment Used (Model Number): | | | |

### CABI Documentation

**Identify environmental hazards discussed at the safety meeting:**

- ☐ Delineation of Work Area
- ☐ Work Zones
- ☐ Utility Identification
- ☐ Haul Routes / Access
- ☐ Equipment Mobilization
- ☐ Emissions Controls
- ☐ Fencing and Wind Barriers
- ☐ Other:_____

### Description of Encountered Debris Materials and Practices

| | |
|---|---|
| 1A | **Types of Debris Identified (List all materials, clarify depths of piles):** |
| 1B | **Description of Suspect Debris Material (RACS/ Non-RACS):** |
| 1C | **Description of Hand Removals (Assumed RACS or Analyzed To Be RACS):** |
| 1D | **Friability of Suspect Debris Materials:** |
| 1E | **Observation of Non-Earthen Material or the Appearance of Fill:** |
| 1F | **Observation of Any Other Impacted Soils (Non-Asbestos Impacts):** |

### Bulk Sample Log

| Sample ID# | Time Sampled | Depth | Sample Location/Description | Asbestos Content From Analytical |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

# RACS Management Detail

## Decontamination

| No. | Items | YES | NO |
|---|---|---|---|
| 2A | Have all equipment surfaces in contact with RACS been decontaminated? | ○ | ○ |
| | Details: | | |
| 2B | Have workers conducted personal and equipment decontamination in accordance with applicable procedures? | ○ | ○ |
| | Details: | | |

## Engineering and Administrative Controls

| No. | Items | YES | NO |
|---|---|---|---|
| 3 | Onsite Staging, Stockpiling, & Storage of RACS | ○ | ○ |
| | Annual Awareness Training for Regulated Work Area Personnel | ○ | ○ |
| | Annual Awareness Training for Non-Regulated Work Area Personnel | ○ | ○ |
| | Details: (provide detailed description of any deficiencies) | | |

## Spill Response

| No. | Items | YES | NO |
|---|---|---|---|
| 4 | | ○ | ○ |
| | Details (provide information on corrective actions): | | |

## Air Monitoring Information As Applicable

### General Conditions

| No. | Items | YES | NO |
|---|---|---|---|
| 5A | Were work conditions maintained below stoppage requirements? | ○ | ○ |

Daily Wind Speed — Sustained High: ____ Gust Max: ____

Details (Provide Prevailing Wind Direction and 30-Minute Readings):

| Time | Wind Speed | Direction | Time | Wind Speed | Direction |
|---|---|---|---|---|---|
| 7:00 | | | 12:00 | | |
| 7:30 | | | 12:30 | | |
| 8:00 | | | 13:00 | | |
| 8:30 | | | 13:30 | | |
| 9:00 | | | 14:00 | | |
| 9:30 | | | 14:30 | | |
| 10:00 | | | 15:00 | | |
| 10:30 | | | 15:30 | | |
| 11:00 | | | 16:00 | | |
| 11:30 | | | 16:30 | | |

Comments:

Details of Wind Shut Down Event (If Applicable):

| | | | |
|---|---|---|---|
| 5B | Visible emissions observed? | ○ | ○ |
| | If visible emissions were observed, was worked stopped? | ○ | ○ |
| | Details (provide information on corrective actions): | | |

## Perimeter Monitoring

| | | | | |
|---|---|---|---|---|
| 6A | Adequate perimeter sampling points based on test area? | ○ | ○ | |
| | No disturbance to sampling equipment or power source? | ○ | ○ | |
| | Were samples compromised in any way? | ○ | ○ | |
| | Details: | | | |
| 6B | Has the pump been calibrated? | ○ | ○ | |
| | Details (Pump Calibration Method): | | | |
| 6C | Is there an adjacent public receptor zone within 150 ft. of a Regulated Work Area? | ○ | ○ | |
| | Details (Location): | | | |

## Air Sample Log

| Sample ID# | Start Time | Stop Time | Total Minutes: | Flow Rate Start: | Flow Rate Stop: | Sample Location | Volume | f/cc |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
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## Contractor Monitoring

| No. | Items | YES | NO | |
|---|---|---|---|---|
| 7 | Is contractor working in the regulated work area conducting personal monitoring? | ○ | ○ | |
| | Details: | | | |

## Work Practices and Completion

| No. | Items | YES | NO | |
|---|---|---|---|---|
| 8A | Are work practices conducted in accordance with the project MMP and State regulations? | ○ | ○ | |
| | Have excavation and loading activities been conducted in accordance with applicable procedures? | ○ | ○ | |
| | Details: | | | |
| 8B | Have loading and transportation requirements been met? | ○ | ○ | |
| | Details: | | | |
| 8C | Has visible material and associated soils been removed? | ○ | ○ | |
| | Details: | | | |
| 8D | Have appropriate samples been collected to confirm ACS has been removed? | ○ | ○ | |
| | Details: | | | |

| Soils Disposition | |
|---|---|
| 9A | Where did the soil originate (depth, specific area)? |
| 9B | Temporary or final disposition of soil (where on-site or disposed)? |
| 9C | Method of material movement (What type of truck and loading)? |
| How many cubic yards of soil excavated during shift? (0 - 10000 yds.) | |

**Comments:**

Provide at least 4 Photos From Daily Operations Where RACS Management Is Being Done

**During RACS Management Operations, Include a Map of RACS Management Location(s) with this Documentation**

**ASSOCIATED PHOTOS**

Picture 1

Picture 2

Picture 3

Picture 4

CABI Field Inspector Name

Date

# Appendix C
# Notification of Planned Soil Disturbing Activity

COLORADO
Department of Public Health & Environment
Dedicated to protecting and improving the health and environment of the people of Colorado

# NOTIFICATION OF REGULATED ASBESTOS CONTAMINATED SOIL (RACS) DISTURBANCE

**A map, figure, or drawing, to a recognizable engineering scale, depicting the project area(s) must be submitted with this form.**
The form, plan (if applicable), and depiction of the project area, can be emailed to: briant.long@state.co.us; or, mailed to: Colorado Department of Public Health and Environment, HMWMD-B2 Attn: Brian Long, Solid Waste Compliance Assurance Unit, see address below.

| | |
|---|---|
| **Date and time reported:** | |
| ☐ **Planned management**<br>**Start date:**<br>**Estimated duration:** | ☐ **Unexpected discovery (submit within 24 hours of discovery)**<br>**Discovery date and time:**<br>**Estimated duration:** |
| **Description of planned soil-disturbing activities:** | **Description of activities resulting in RACS discovery/disturbance:** |
| **Description of any access and/or emission control measures already implemented at the site:** | **Description of type and quantity of RACS discovered/disturbance:** |
| ☐ **This is an EMERGENCY management event (submit this form within 24 hours of RACS discovery, and comply with the Minimum Standards to the extent possible during initial management, and fully comply within 48 hours)**<br>**Detail the nature of the emergency (e.g., repair to an active utility line):** | |

**Check the box to indicate which management approach will be utilized on this project:**

| | | |
|---|---|---|
| ☐ **Project Specific RACS Mgmt. Plan**<br>**Submit PSRMP for Division review and approval with this form at least 10 working days prior to commencing RACS disturbing activities.**<br>**RACS disturbance shall not commence until the PSRMP is approved. However, the standard requirements from Section 5.5.7 of the Solid Waste Regulation may be used in the interim after the required notice.** | ☐ **Standard Operating Procedures**<br>**Has the Division approved SOPs for this project?**<br>☐ **Yes, include the name of the SOP here:**<br>**Notification shall be submitted to the Division prior to commencing RACS disturbing activities.**<br>☐ **No, submit SOPs for Division review and approval with this form at least 30 calendar days prior to commencing RACS disturbing activities.** | ☐ **Remediation Plan**<br>**Submit remediation plan for Division review and approval at least 45 calendar days prior to commencing RACS disturbing activities. Remediation shall not commence prior to plan approval.** |
| ☐ **Standard Requirements**<br>**The standard requirements of RACS management are found in Section 5.5.7 of the Solid Waste Regulations. Notification shall be submitted to the Division prior to commencing RACS disturbing activities.** | | ☐ **Risk Based Approach**<br>**Submit a site-specific risk assessment work plan for Division review and approval with this form prior to commencing RACS disturbing activities. RACS disturbance shall not commence until the plan is approved.** |

**Please indicate which program this project will take place under:** ☐ **Solid Waste (general)** / ☐ **Voluntary Cleanup Program (VCUP)** / ☐ **Hazardous Waste Corrective Action (RCRA)** / ☐ **Federal Facilities or CERCLA** / ☐ **Don't Know**

| | | |
|---|---|---|
| **Contact person for entity performing soil-disturbing activity:** | | |
| **Organization, company or agency:** | | |
| **Email:** | **Phone:** | |
| **Name of property owner/operator:** | | |
| **Owner/operator contact (if different):** | | |
| **Email:** | **Phone:** | **Ext:** |
| **Location of property:**<br>(Street address or other location description) | **Street Address:** | |
| | **County:** / **City:** | **Zip:** |
| **General site description:** | | |

Received by:_____ Date:_____

# Appendix D
# Sample Collection Protocols and Analytical Methodologies

# CSWR §5.5 – APPENDIX 5A
# SAMPLE COLLECTION PROTOCOLS AND ANALYTICAL METHODOLOGIES

## 1.0 Purpose

(A) The purpose of this appendix is to establish standard sample collection requirements and analytical methods and procedures for use in identifying and quantifying asbestos fibers in air, bulk material, and environmental media such as soil or ash.

## 2.0 Sample Collection Requirements

(A) The following sample collection requirements shall be followed when collecting samples for the purpose of determining the applicability of Section 5.5, and when collecting samples necessary to comply with the requirements of Section 5.5. Remediation plans submitted in accordance with Section 5.5.6 shall include a site specific sampling and analysis plan that incorporates the sample collection methodologies and analytical procedures in this Appendix, or proposes alternatives, and include site specific clearance criteria.

### 2.1 Bulk Samples

(A) Bulk samples shall be collected, in a manner sufficient to determine whether the material is asbestos-containing material (ACM) or not ACM, from each type of suspect ACM. Bulk samples shall be collected by a State of Colorado certified Asbestos Building Inspector (CABI). In the absence of bulk sample collection, any suspect ACMs must be assumed to be ACMs.

(B) Bulk samples shall be collected by homogenous type based on color, pattern, texture, thickness, associated materials, or by other identifying characteristics. Additionally, the quantity and location of a suspect material shall be used to determine the number of bulk samples required to characterize the asbestos content of each homogeneous suspect material. For the purpose of determining that a homogeneous suspect material does not contain asbestos, a minimum of three (3) bulk samples shall be collected from the homogeneous material unless there is insufficient material to constitute three (3) samples. If one of the collected samples of a homogeneous bulk material is determined to be ACM, then the homogeneous material shall be considered ACM.

## 2.2 Soil Samples

(A) Samples collected to determine asbestos content in soil shall be ten (10) point aliquot composite samples collected from a maximum area of 1,250 square feet (representing 0-6 inches beyond the exposed surface) or a maximum volume of forty (40) cubic yards. Individual aliquots shall be approximately 1/10 of the entire sample volume. At each aliquot location approximately one (1) tablespoon of soil shall be collected. The total volume of the ten (10) aliquots should equal roughly a half cup. The total collected sample volume should be greater than one quarter (¼) cup, but should not exceed one cup. Aliquot locations shall be randomly selected but shall be representative of the entire sample area or volume (to be inclusive of the interior of soil piles in addition to the surface). However, aliquots shall be co-located with any areas where friable ACM was formerly present. All samples collected to determine asbestos content shall be collected by a CABI.

(B) Sampling for clearance purposes of any exposed horizontal or vertical surface shall have the following additional requirements:

1) The aliquots of a clearance sample shall not be collected until after the RACS, and the required amount of associated material, has been removed.

2) A visual inspection shall be performed and passed (i.e., no visible ACM present) by a CABI prior to the collection of soil samples. Visual inspections shall include the following:

   a) The area to be cleared shall be designated before the visual inspection; and
   b) Former locations of friable materials shall be designated; and
   c) The surface being inspected shall be dry enough to allow identification of suspect ACM; and
   d) The visual inspection shall be conducted in adequate lighting; and
   e) The area to be cleared shall be free of visual impediments (e.g. snow cover, plastic sheeting, standing water, etc.); and
   f) At a minimum, the area to be cleared shall be inspected in at least two (2) perpendicular directions; and
   g) Single or multiple inspectors may be used to perform a visual inspection and clearance. However, a single inspector shall not

visually inspect more than a five (5) foot width with each pass [i.e. for a clearance area that is 25' x 50' a single inspector would be required to make at least five (5) passes in one direction (25' length) and at least ten (10) passes in the other direction (50' length)]; and

h) Detailed close examination of the area being cleared is required. The inspector(s) should use limited invasive inspection techniques, such as periodically sifting the surface being cleared and closely inspecting the disturbed area.

3) If sidewalls with six (6) inches or greater of vertical height are present, independent ten (10) point aliquot composite samples shall be collected from each of the sidewalls and the floor of the excavation.

## 2.3 Ash Samples

(A) Ash that contains, or is comingled with, suspect ACM and/or construction and demolition debris shall be considered to be RACS unless the ash is sampled, and analysis demonstrates that the ash is not RACS. Representative samples of each type of ash materials shall be sampled and analyzed in the same manner as soil (including area/volumetric limitations of sampling). Ash samples shall be collected by homogenous strata, location, content of other surrounding material, or other observations indicating heterogeneity of the ash present. All samples collected to determine asbestos content shall be collected by a CABI. In the absence of suspect ACM or construction and demolition debris, and in the absence of documented evidence of non-visible asbestos, ash material may be treated as non-RACS.

## 2.4 Cross Contamination Prevention

(A) All sample collection equipment shall be decontaminated in a manner sufficient to prevent cross contamination between individual samples or individual composite samples. Decontamination is not required between the collection of aliquots comprising a single composite sample.

## 2.5 Air Samples for Standard RACS Management

(A) Air samples shall be collected by drawing air through 0.8-micron (µm), 25-millimeter (mm), mixed cellulose ester (MCE) filters, using an open-faced cowl extension oriented face down at an angle of 45°. Sample flow rate shall be between 0.5-10 liters per minute depending on the anticipated duration of sampling and the specified detection sensitivity. The air sampling equipment

shall be run until the minimum volume required is collected for each sample. However, if the minimum air volume required by the method, and/or to reach the required analytical sensitivity, being utilized cannot be met, the State of Colorado trained and certified Air Monitoring Specialist (AMS) shall request that the laboratory prepare the sample using an indirect preparation method, for TEM presence/absence analysis. Air samples shall be collected at a height that is representative of the disturbance activity taking place. However, air samples shall be located at a height between three (3) feet above the ground surface but not to exceed twenty (20) feet above the ground surface. Air samples shall be collected by an AMS.

2.6 Air Samples for Risk-Based Air Threshold Monitoring

(A) Air samples shall be collected by an AMS. Air monitoring shall be conducted during each partial or full day of soil management activities using fixed and mobile monitors as follows:

1) A minimum of four (4) samples shall be collected for each regulated work area (RWA).
2) For the purpose of determining the number of samples necessary, each RWA shall be divided into four (4) equal quadrants. A minimum of one (1) sample shall be collected for each quadrant with an adjacent receptor zone.
3) If an RWA is greater than one (1) acre, one (1) additional sample for each quadrant with an adjacent receptor zone shall be collected and analyzed for each additional one quarter (¼) acre in RWA surface area.
4) Samples shall be located along the RWA perimeter, between the RWA and each adjacent receptor zone. Samples shall be placed between the RWA and any fixed adjacent receptor(s). In the absence of fixed adjacent receptors, sample placement shall be at the AMS's discretion.
5) The sample volume shall be the minimum necessary to meet analytical sensitivity.
6) Samples shall be collected by drawing air through 0.8-micron (µm), 0.25-millimeter (mm), mixed cellulose ester (MCE) filters, using an open-faced cowl extension oriented face down at an angle of 45°.

## 3.0 Analytical Requirements

(A) The following analytical methods shall be used to evaluate the presence of asbestos and/or to determine asbestos content when analyzing samples for the purpose of determining the applicability of Section 5.5, and when analyzing samples collected in accordance with Section 5.5:

## 3.1 Bulk Samples

(A) Samples of suspect ACM shall be analyzed by polarized light microscopy (PLM), according to United States Environmental Protection Agency (USEPA) Method EPA/600/R-93/116 or equivalent method, to determine if any asbestos fibers are present. If the asbestos content of a sample is estimated to be 1% asbestos or less, but greater than 0%, by a method other than point counting (such as visual estimation), the determination shall be repeated using the point counting technique with PLM. Alternatively, the material may be assumed to be ACM. Analysis shall be conducted by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory.

## 3.2 Soil Samples and Ash Samples

(A) Prior to preparation of a soil or ash sample, bulk materials shall be separated from the soil or ash sample for independent analysis. Any bulk materials identified in a soil or ash sample that contain any amount of asbestos shall be reported as independent layers of the whole sample. The samples shall be adequately prepared (crushed and dried) to facilitate stereomicroscopic analysis by the laboratory. The goal of the preparation process should be to produce dried conglomerates of approximately one eighth inch (1/8”) to one quarter inch (¼”) size. Rock and/or stone material does not need to be crushed (this process is not intended to be homogenization). Soil and ash samples shall be analyzed by PLM according to USEPA Method EPA/600/R-93/116 to determine if any asbestos fibers are present. Analysis shall be conducted by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory. During the stereomicroscopic analysis (10X – 50X) of the soil/ash sample the analyst shall sift through the sample at a rate of approximately one (1) tablespoon per minute. At the end of the stereomicroscopic analysis the sample shall be agitated or shaken as a final check for asbestos prior to the preparation of PLM grab mounts. At no time during the stereomicroscopic analysis shall a sub sample be collected. The entire sample shall be analyzed and the results reported. If no asbestos was identified by PLM after the initial stereomicroscopic examination, then three (3) random grab mount preparations shall be analyzed by PLM to determine if the sample is none detected for asbestos content. If any asbestos is found by the laboratory it shall be reported even in the absence of a second detection (i.e. there does not need to be a second detection to qualify a trace level of asbestos in the sample). Quantification of asbestos content shall be based on the entire sample volume, and be reported as such.

## 3.3 Air Samples for Standard RACS Management

(A) Air samples submitted for Phase Contrast Microscopy (PCM) shall be analyzed according to NIOSH Method 7400 by a laboratory showing successful participation in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program or individual(s) certified through the AIHA Asbestos Analysts Registry (AAR) Program.

(B) Air samples submitted for Transmission Electron Microscopy (TEM), for which quantification of asbestos is desired, shall be prepared and analyzed according to the standard Asbestos Hazard Emergency Response Act (AHERA) method (AHERA; 40 CFR Part 763, Subpart E, Appendix A). All TEM analysis shall be performed by a NVLAP accredited laboratory. If a presence/absence analysis is desired, the analysis shall be performed using the AHERA method modified in the following manner:

1) A minimum of two (2) preparations shall be prepared and utilized for each sample.
2) Analysis shall be conducted on a minimum of four (4) grid openings or until three (3) or more structures are identified, whichever comes first.
3) Any structure (adhering to the AHERA counting rules) identified during analysis shall be reported.
   a) Identification of less than three (3) structures shall be reported as present.
   b) Identification of three (3) or greater structures shall be reported as detected.

(C) Any air sample analysis that results in a “cannot be read (CBR)” determination from the analyst, or a “not analyzed (NA) or rejected” due to loose debris or uneven loading, shall be evaluated by the AMS to determine if a cause of the CBR or NA can be ascertained. If it is determined that the CBR is a result of overloading from airborne emissions, then the AMS shall request that the laboratory prepare the sample, using an indirect preparation method, for TEM presence/absence analysis.

## 3.4 Risk-Based Air Threshold Samples

(A) Air samples collected for TEM analysis shall be submitted to a NVLAP accredited laboratory. Samples shall be analyzed by TEM according to ISO Method 10312 with the following modifications for PCM equivalent (PCMe) structures:

1) An aspect ratio of 3:1 shall be used when counting structures greater than 5 µm in length, rather than the 5:1 ratio specified in the method.
2) A width range of 0.25 to 3 µm will be used when counting PCMe structures, rather than the 0.2 to 3 µm specified in the method.
3) A minimum of ten grid openings will be counted, rather than the minimum of four (4) grid openings specified in the method.
4) Calculations shall be made based on total fibers rather than primary fibers.

(B) The maximum number of grid openings (GOs) to be counted to achieve the specified analytical sensitivity shall be estimated as follows:

$$\text{Number of GOs} = \text{EFA} \div (A_{GO} \times V \times S \times CF)$$

where:

EFA = effective filter area (385 for a 25-mm filter)
$A_{GO}$ = area of a grid opening (approximately 0.01 $mm^2$; actual value to be provided by the analytical laboratory)
V = volume of air sampled (in liters [L])
S = analytical sensitivity (structures per cubic centimeter [s/cc])
CF = conversion factor (1000 cc/L)

(C) Any air sample analysis that results in a “cannot be read (CBR)” determination from the analyst, or a “not analyzed (NA) or rejected” due to loose debris or uneven loading, shall be prepared by the laboratory, using an indirect preparation method, for TEM presence/absence analysis.

## 3.5 Data Evaluation for Risk-Based Air Threshold Samples

(A) General requirements:

1) Samples collected for comparison to risk-based air thresholds shall be evaluated based on the average (mean) concentration over the exposure duration.

2) All valid data shall be used to calculate daily and ten (10) day rolling averages.
3) For all projects a minimum of three (3) samples per day must have quantifiable data (not CBR or rejected). If less than three (3) quantifiable analytical results are available then the daily average is invalid.

(B) Project days 1-9:

1) The results of the daily samples must be averaged to calculate a daily average for use in comparing to the risk based air threshold for days 1-9 of monitoring.
2) A ten (10) day average shall be calculated for days 1-9. The ten (10) day average shall be comprised of at least eight (8) valid daily average results. However, all valid data shall be used to calculate the ten (10) day average.
3) If the ten (10) day average exceeds the risk-based air threshold, engineering controls shall be adjusted to reduce the daily average.
4) The Department shall be notified within 24 hours if the calculations in paragraphs 1 and 2 above cannot be completed due to invalid data.

(C) Project days 10 and greater:

1) Starting on day 10, a ten (10) day rolling average shall be calculated and compared to the risk-based threshold.
2) If average concentration trends indicate the risk-based air threshold will be exceeded before project completion, engineering controls shall be adjusted to reduce the daily asbestos emissions.
3) If subsequent evaluation of average concentration trends indicates that the risk-based air threshold will still be exceeded before project completion, additional adjustments to engineering controls shall be made.
4) If changes in engineering controls are not effective in reducing airborne concentration trends such that the risk-based air thresholds can be met, consultation with the Department is required.
5) The Department shall be notified within five (5) working days if the averaged airborne asbestos concentration for the entire project exceeds the risk-based air threshold.

## 4.0 Documentation

(A) All of the following sampling and analytical documentation shall be maintained during a project and available for Department review upon request. This documentation need not be submitted to CDPHE unless requested or as required in a project specific plan.

1) Documentation of bulk, soil, and ash samples shall include:

    a. A description of the material being sampled including friability.
        i. For samples collected for characterization purposes also include an estimate of the quantity of visible suspected RACS present.
        ii. For samples of ash, also include a brief description of the ash layer, and any associated identifiable debris.
    b. Name of person collecting the sample(s).
    c. Date and time of sample collection.
    d. Location of sample collection (a map, drawing, or diagram showing sample locations in relation to the work area and surrounding area).
    e. The boundary/limits that are represented by the collected sample.
    f. Chain of custody documentation.
    g. Laboratory analysis reports.
    h. Log of characterized homogeneous bulk materials including material descriptions, photographic documentation, and asbestos content.

2) Documentation of air samples shall include:

    a. Name of person collecting the sample(s).
    b. Date and time(s) of sample collection.
    c. Locations of air sample collection.
    d. Any relocation of air samples.
    e. A map, drawing, or diagram showing air sample locations (initial and relocations) in relation to the work area and the surrounding area.
    f. Chain of custody documentation.
    g. Laboratory analysis reports.
    h. Explanation of any air sample malfunctions and any voided air samples.
    i. Risk based air threshold concentration calculations.

j. Air sample data (flow rates, time of sampling, volumes, calibration method, etc.).
k. Wind speed measurements.
l. Prevailing wind directions.
m. Wind shut down events.
n. Observations of visible emissions and responses.

## 5.0 Deviations from Sampling and Analysis Procedures

(A) Deviation from this sampling and analysis appendix shall only be allowed upon consultation with, review by, and approval from, the Department.

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**ADDENDUM**

**TO:** City and County of Denver Department Managers

**FROM:** Zachery Clayton, DDPHE Manager – Environmental Land Use and Planning

**DATE:** May 8, 2019

**SUBJECT:** Clarification on Guidance for Reuse of Soil on City Projects

This Addendum clarifies aspects of and shall be attached to and become part of the Guidance for Reuse of Soil on City Project, dated October 5, 2017.

The Guidance applies to excess soil generated from a City project that is intended to be exported to another City site or to a third-party site.

The Guidance does not apply when soil remains on a City project site. In this case, project-specific protocols will be implemented.

The City will not export or import soil that looks bad, smells bad, or that contains debris regardless of analytical results.

The Guidance may be implemented to import soil to a City project from a third-party site. In this instance, in addition to complying with the Guidance, the third party will supply environmental information, such as a Phase I Environmental Assessment and sampling protocol, for the source area of the soil to be imported.

We look forward to continued success of soil reuse options, cost savings and sustainable approaches to environmental issues on your projects.

Please feel free to reach out to Diane DeLillio or myself with any questions, comments or concerns.

CC: Lee Zarzecki, CAO
Gregg Thomas, DDPHE
Diane DeLillio, DDPHE

**Department of Environmental Health**
Division of Environmental Quality
200 W 14th Ave, Suite 310
Denver, CO 80204
p: 720-913-1311
f: 720-865-5534
www.denvergov.org/deh

**INTEROFFICE MEMORANDUM**

**TO:** City and County of Denver Department Executive Directors

**FROM:** Bob McDonald, Executive Director

**DATE:** October 05, 2017

**SUBJECT:** Guidance for Reuse of Soil on City Projects

There is increasing demand in and around the City and County of Denver (City) for soil available for reuse. Such reuse offers several benefits to the City including reduced waste, hauling costs, disposal fees, and vehicle emissions.

As the local public health authority, the City's Department of Environmental Health (DEH) has determined that all reusable soil must be adequately characterized based on the intended reuse to ensure the protection of public health and the environment. If the soil is not suitable for reuse per these guidelines, it must be disposed at the City-owned Denver Arapahoe Disposal Site (DADS) in accordance with the City's Executive Order No. 115.

This guidance provides criteria by which City employees and/or third parties may, or may not, reuse soil from City projects at both City-owned properties and properties owned by others. DEH sign off will be required for any reuse options. As such, to promote safe and sustainable reuse, it is within DEH's purview to implement the following requirements for City soils to be reused:

1. For onsite reuse, City personnel are responsible for contacting DEH[1] when they want to reuse soil or receive a request to reuse soil. DEH is responsible for promptly informing the requestor of City sampling frequency and analysis requirements based on contaminants of concern from recognized environmental conditions, which are designed to promote safe and sustainable reuse.

2. For off-site reuse and/or material to be imported to a site, the person or entity requesting to reuse the soil must adequately characterize the soil by sampling at least every 500 cubic

[1] Diane DeLillio, 720-865-5448, diane.delillio@denvergov.org

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yards to be excavated (or alternative frequency as determined by DEH) and analyze those soil samples for, at a minimum:

a. Volatile organic constituents;
b. Semi-volatile organic constituents;
c. Total petroleum hydrocarbons;
d. Pesticides;
e. Herbicides;
f. Polychlorinated biphenyls (PCBs);
g. Arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver; and
h. Asbestos – if debris is found and if suspect asbestos-containing material is found in the debris (e.g., transite, ash, brick mortar, asphalt shingles, etc.)

3. In general, the person or entity requesting to reuse the soil shall pay all costs associated with the sampling and analysis of the soil.

4. Before the City will release the soil for reuse, the party requesting the excess soil must indicate the land use of the accepting site and demonstrate to DEH's satisfaction that the soil meets the criteria based on the designated land use of the receiving site. See Exhibit 1 for additional guidance.

5. Maintain the documentation for sample collection, analytical results, and the environmental consultant's field notes and evaluation.

6. Any third party will be required to sign a release to accept the soil from the City and to release the City from liability.

Attachments: Exhibit 1 – Soil Reuse Acceptance Criteria Guidance Table
Exhibit 2 - Draft Release for Third Party Acceptance

CC: Jessica Brody, CAO
Lee Zarzecki, CAO
Zachery Clayton, DEH
Gregg Thomas, DEH

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Division of Environmental Quality
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# Exhibit 1 - Soil Reuse Acceptance Criteria Guidance Table

| Land Use | Examples | Applicable Soil Reuse Acceptance Criteria* |
|---|---|---|
| Recreational | Parks, Open Space | All Contaminants except Arsenic (Residential)<br><br>Arsenic Standard |
| Residential | Single Family, Multi-family, Mixed-use with residential component | All Contaminants except Arsenic (Residential)<br><br>Arsenic Standard |
| Right of Ways (not inclusive of utilities) | Roads, sidewalks, bike paths | All Contaminants except Arsenic (Composite Worker)<br><br>Arsenic Standard |
| Utility corridors (underground) | Storm water, Waste water, | All Contaminants except Arsenic (Composite Worker)<br><br>Arsenic Standard |
| City-owned facilities | Maintenance garages, office buildings, safety buildings | All Contaminants except Arsenic (Composite Worker)<br><br>Arsenic Standard |

* Screening values presented in the Regional Screening Levels table are based on human health risk from the combined exposure of direct soil ingestion, dermal contact with soil and inhalation of vapors or particulates associated with soil. Other pathways, such as indoor air or groundwater protection, may need to be considered on a site-specific basis. Some sites in sensitive ecological settings may need to be evaluated for potential ecological risk. These screening levels may not be applicable to sites within and/or subject to other regulatory programs (i.e., RCRA Corrective Action, Leaking Underground Storage Tanks, Superfund Operable Unit, etc.)

In addition, the reuse of any regulated asbestos-containing soil ("RACS") or suspect-RACS must be conducted in accordance with state regulations governing the management of RACS, 6 CCR 1007-2, § 5.5.

DEH is committed to assisting all agencies and projects to perform soil disturbing activities in a cost-effective and sustainable manner while ensuring protection of public health and the environment.

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# AGREEMENT AND RELEASE FOR EXCESS SOIL REUSE

This Agreement and Release ("Agreement") is made by and between _____ (the "Accepting Party") and the City and County of Denver (the "City") (collectively, the "Parties").

## RECITALS

WHEREAS, the City has determined that it has excess soil available; and

WHEREAS, the Accepting Party has requested excess soil from the City for reuse at ___[address of reuse location]___; and

WHEREAS, the Accepting Party has sampled and analyzed the excess soil and determined it to be suitable for the intended reuse; and

NOW, THEREFORE, in consideration of the premises and agreements contained herein, the Parties agree as follows:

1. Recitals Binding. The Parties agree that the Recitals stated above are an integral part of the Agreement and are binding.

2. Conveyance of Ownership. The City agrees to convey to the Accepting Party ownership of up to __[maximum volume]__ cubic yards of excess soil.

3. Acceptance "AS-IS". The Accepting Party acknowledges that the City has made no representations or warranties regarding the environmental or geotechnical suitability of the excess soil. The Accepting Party acknowledges that it is assuming ownership of the excess soil based solely on its analysis of the soil. The Accepting Party accepts the excess soil "AS IS."

4. Payment. The Accepting Party shall pay to the City good and valuable consideration in the amount of TEN DOLLARS ($10.00), the sufficiency of which is hereby acknowledged.

5. Transportation to Receiving Site. The Accepting Party will transport, or arrange to transport, the excess soil from __[address]__ to the reuse location at a time, place, and manner acceptable to the City.

6. Defense and Indemnification

a. The Accepting Party agrees to defend, indemnify, reimburse and hold harmless City, its appointed and elected officials, agents and employees for, from and against all liabilities, claims, judgments, suits or demands for damages to persons or property arising out of, resulting from, or relating to the reuse of the excess soil, unless such Claims have been specifically determined by the trier of fact to be the sole negligence or willful misconduct of the City.

b. Accepting Party's duty to defend and indemnify City shall arise at the time written notice of the Claim is first provided to City regardless of whether Claimant has filed suit

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on the Claim. Accepting Party's duty to defend and indemnify City shall arise even if City is the only party sued by claimant and/or claimant alleges that City's negligence or willful misconduct was the sole cause of claimant's damages.

c. Accepting Party shall defend any and all Claims which may be brought or threatened against City and shall pay on behalf of City any expenses incurred by reason of such Claims including, but not limited to, court costs and attorney fees incurred in defending and investigating such Claims or seeking to enforce this indemnity obligation. Such payments on behalf of City will be in addition to any other legal remedies available to City and will not be the City's exclusive remedy.

7. City Execution of Agreement. The Agreement will not be effective or binding on the City until it has been fully executed by all required signatories of the City and County of Denver, and if required by Charter, approved by the City Council.

8. Authority.

a. The Parties to this Agreement agree that each Party has authority to execute this Agreement.

b. The Parties to this Agreement have carefully read, and know and understand, the full contents of this Agreement and are voluntarily entering into this Agreement.

c. The Parties to this Agreement are competent to enter into this Agreement.

9. Governing Law and Venue. The Agreement will be construed and enforced in accordance with applicable federal law, the laws of the State of Colorado, and the Charter, Revised Municipal Code, ordinances, regulations and Executive Orders of the City and County of Denver, which are expressly incorporated into the Agreement. Unless otherwise specified, any reference to statutes, laws, regulations, charter or code provisions, ordinances, executive orders, or related memoranda, includes amendments or supplements to same. Venue for any legal action relating to the Agreement will be in the District Court of the State of Colorado, Second Judicial District (Denver District Court).

10. Entire Agreement: The Parties to this Agreement have not relied on any statement, representation, omission, inducement or promise of any other Party (or any officer, agent, employee, representative, or attorney for any other Party) in executing this Agreement, or in making the settlement provided for herein, except as expressly stated in this Agreement. The Agreement contains the entire understanding of the Parties relating to the subject matter of the Agreement. No promise, inducement or agreement which is not specifically provided in this Agreement has been made by any party to this Agreement, and no warranties, representations, or undertakings are made by the Parties hereto except as are expressly provided herein.

11. Electronic Signatures and Electronic Records. The Accepting Party consents to the use of electronic signatures by the City. The Agreement, and any other documents requiring a signature under the Agreement, may be signed electronically by the City in the manner specified by the City. The Parties agree not to deny the legal effect or enforceability of the Agreement solely because it is in electronic form or because an electronic record was used in its formation. The

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Parties agree not to object to the admissibility of the Agreement in the form of an electronic record, or a paper copy of an electronic document, or a paper copy of a document bearing an electronic signature, on the ground that it is an electronic record or electronic signature or that it is not in its original form or is not an original.

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[Signature Pages Follow]

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# CITY AND COUNTY OF DENVER

## STATE OF COLORADO

DENVER
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## DEPARTMENT OF PUBLIC WORKS

Plans/Drawings

Contract Number: 201950389

27th Street Storm Interceptor, Phase 2

May 29, 2019

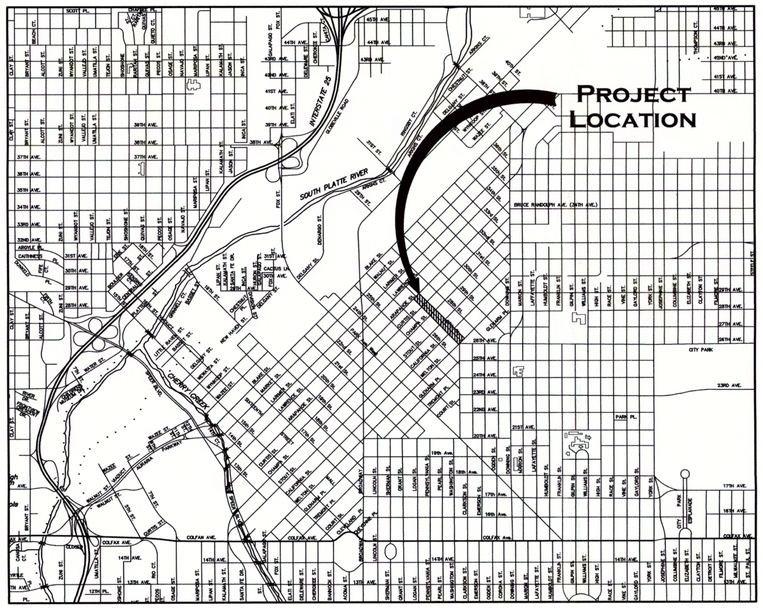
# CITY AND COUNTY OF DENVER

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
WASTEWATER CAPITAL PROJECTS MANAGEMENT

# 27TH STREET STORM INTERCEPTOR PHASE 2

**PROJECT MASTER NO : 2017-PROJMSTR-0000343**
**CONTRACT CONTROL NO : _____**

27TH STREET (ARAPAHOE STREET TO WELTON STREET)
SEC 27 T3S R68W




0 2000' 4000'
SCALE: 1" = 2000'

## BID DOCUMENTS

CITY OF COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS

APPROVED BY:

| | |
|---|---|
| EXECUTIVE DIRECTOR OF PUBLIC WORKS | DATE 4.24.19 |
| CITY ENGINEER | DATE 4.24.19 |
| DIRECTOR OF ENGINEERING CAPITAL PROJECTS | DATE 4/23/19 |
| CITY TRAFFIC ENGINEER | DATE 4/19/19 |

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| NO. | DESCRIPTION OF REVISIONS | DATE | BY |
|---|---|---|---|
| | | | |

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DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
CAPITAL PROJECTS MANAGEMENT
2000 W. 3RD AVE. DENVER, CO 80223
TEL.: (303) 446-3617 FAX: (303) 446-3647


27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343
COVER SHEET

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-CS-GN02.dwg
DATE: APRIL 16, 2019
SHEET NO.: 1

COLORADO LICENSED
43395
PROFESSIONAL ENGINEER


MERRICK®
5970 GREENWOOD PLAZA BLVD
GREENWOOD VILLAGE, CO 80111



PLOT DATE: April 16, 2019
\\MERRICK.COM\CDS\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-CS-GN02.DWG

## GENERAL NOTES:

1. CONTRACTORS PERFORMING WORK ON ANY WASTEWATER FACILITY OR APPURTENANCE MUST BE PROPERLY LICENSED AND HAVE A LICENSED PLUMBER OR DRAINLAYER ON SITE DURING THE WORK. (GENERAL CONTRACT CONDITIONS (G.C.C.) 317.1).
2. THE CURRENT EDITION OF THE WASTEWATER MANAGEMENT DIVISION STANDARD DETAILS SHALL APPLY TO ALL WORK AND WILL BE THE EDITION CURRENT AS OF THE ADVERTISEMENT DATE. THE CONTRACTOR MUST BE IN POSSESSION OF THE STANDARD DETAILS AT THE PRE-CONSTRUCTION CONFERENCE AND A COPY MUST REMAIN ON THE JOB SITE AT ALL TIMES DURING CONSTRUCTION. WASTEWATER MANAGEMENT DIVISION STANDARD DETAILS CAN BE OBTAINED AT WWW.DENVERGOV.ORG(SPECIAL CONTRACT CONDITIONS (SC-1), CONTRACT FORM – 8 (APPLICABLE LAWS)
3. THE CONTRACT SPECIFIED EDITION OF THE CITY AND COUNTY OF DENVER'S TRANSPORTATION STANDARDS AND DETAILS FOR THE ENGINEERING DIVISION SHALL BE FOLLOWED FOR ALL ROADWAY WORK IN THE PLAN SET AND WILL BE THE EDITION CURRENT AS OF THE ADVERTISEMENT DATE. ROADWAY INCLUDES ALL FEATURES IN THE CITY RIGHT-OF-WAY; INCLUDING ANY RESTORATION TO SIDEWALKS, ADA RAMPS, FLATWORK, AND STREET PAVING. THESE STANDARDS AND DETAILS CAN BE OBTAINED AT WWW. DENVERGOV.ORG (SC-1, CONTRACT FORM – 8 (APPLICABLE LAWS))
4. THE CONSTRUCTION ACTIVITIES STORMWATER DISCHARGE PERMITS (STATE AND LOCAL FLOODPLAIN PERMITS), STREET-CUT PERMIT, AND STREET OCCUPANCY PERMIT (INCLUDING THE ASSOCIATED TRAFFIC CONTROL PLANS) MAY BE REQUIRED AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN ALL OF THESE PERMITS. APPROVED COPIES OF ALL REQUIRED PERMITS MUST BE SUBMITTED TO THE CITY CONSTRUCTION PROJECT MANAGER PRIOR TO THE START OF CONSTRUCTION. (G.C.C. 301.2, 317.1 & 317.2& 317.5; CONTRACT FORM – 8 (APPLICABLE LAWS))
5. A PARKS TEMPORARY CONSTRUCTION ACCESS PERMIT (TCAP) WILL BE REQUIRED FOR ANY WORK OR OCCUPANCY OF PARK LAND, THIS INCLUDES BUT IS NOT LIMITED TO: DESIGNATED CITY PARKS, PARKWAYS, OPEN SPACE, TRAILS AND BIKE PATHS. (G.C.C. 301.2, 317.1 & 317.2& 317.5; CONTRACT FORM – 8 (APPLICABLE LAWS)
6. ALL DESIGN DRAWINGS PROVIDED AS PART OF THIS CONTRACT ARE FORMATTED FOR PRINTING FULL SIZE, ON STANDARD 22 X 34 INCH (ANSI D) PAPER SIZE AND TO HALF-SIZE (AND SCALE WHERE APPROPRIATE) ON STANDARD 11 X 17 PAPER SIZE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT HARD COPIES OF PLANS UTILIZED FOR BIDDING OR CONSTRUCTION ARE PRINTED ON THE PROPER MEDIA SIZE AND THAT SCALES PROVIDED WITHIN THE DRAWINGS ARE CORRECTLY INTERPRETED.
7. "RED-LINED" DRAWINGS AND PRINTS ARE TO BE MAINTAINED BY THE CONTRACTOR AND SUBMITTED TO THE CITY CONSTRUCTION PROJECT MANAGER AT THE COMPLETION OF THE PROJECT. ANY AND ALL FIELD CHANGES MADE DURING CONSTRUCTION MUST BE NOTED. THE DRAWINGS WILL STATE "RED LINES" IN LARGE BLOCK LETTERS. THE RED-LINED DRAWINGS MUST BE RECEIVED AND ACCEPTED BY THE CITY CONSTRUCTION PROJECT MANAGER PRIOR TO FINAL ACCEPTANCE AND SETTLEMENT.
8. THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE CITY CONSTRUCTION PROJECT MANAGER IMMEDIATELY OF ANY DISCREPANCIES OR VARIATIONS IN DRAWINGS & SPECIFICATIONS. (G.C.C. 1103)
9. THE CITY AND COUNTY OF DENVER ASSUMES NO RESPONSIBILITY FOR UTILITY LOCATIONS. THE UTILITIES SHOWN ON THESE DRAWINGS HAVE BEEN PLOTTED FROM THE BEST AVAILABLE INFORMATION. ALL UTILITIES MUST BE LOCATED BY THE CONTRACTOR. ALL COSTS ASSOCIATED WITH FIELD VERIFICATION OF LOCATION AND DEPTHS OF UTILITIES AND SHALL BE BORNE BY THE CONTRACTOR AND SHALL BE COMPLETED PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION.(G.C.C. 701, 804)
10. ALL RANGE POINTS OR OTHER SURVEY MONUMENTS WHICH MAY BE DAMAGED OR DESTROYED DURING CONSTRUCTION SHALL BE TIED OUT AND RESET PER CITY SURVEYING STANDARDS. (G.C.C. 318, 319)
11. ALL ELEVATIONS SHOWN ARE NAVD88 DATUM, UNLESS OTHERWISE NOTED.
12. INLETS AND MANHOLES ARE NOT SHOWN TO SCALE ON THE PLAN AND PROFILE SHEETS.
13. INVERT ELEVATIONS AND CALCULATED PIPE SLOPES ON STORM AND SANITARY PROFILES ARE TO THE CENTER OF MANHOLE OR STRUCTURE. PIPE LENGTHS ARE TWO DIMENSIONAL LENGTHS AND ARE CENTER TO CENTER BETWEEN MANHOLES AND TO THE INSIDE EDGE OF INLETS OR SPECIAL STRUCTURES.
14. NORTHING AND EASTING CALLOUTS ON NUMBER 16 AND NUMBER 14 INLETS ARE TO THE CENTER OF THE STRUCTURE. NORTHING AND EASTING CALLOUTS ON MANHOLES ARE TO THE CENTER OF THE MANHOLE.
15. LOCATION OF INLETS AND/OR INLET CONNECTORS MAY BE ADJUSTED IN THE FIELD AT THE DIRECTION OF THE CITY CONSTRUCTION PROJECT MANAGER IN CONJUNCTION WITH DESIGN INTENTION. ALL INLET CONNECTIONS SHOWN IN PLAN AND PROFILE ARE APPROXIMATE LOCATIONS AND DEPTHS. IT SHALL BE THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO ESTABLISH INLET DEPTHS AND COMPLETE CONSTRUCTION IN CONFORMANCE WITH APPLICABLE STANDARD DETAIL DRAWINGS BASED ON CLEARANCES OF ADJACENT UTILITIES WHILE MAINTAINING MINIMUM REQUIRED GRADES ON LATERAL CONNECTIONS.
16. PRIOR TO CONSTRUCTION IT SHALL BE THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO VERIFY THE INVERTS, DEPTHS OR BOTTOM OF EXISTING STRUCTURE ELEVATIONS WITHIN THE PROJECT SCOPE.
17. ALL SEWER MANHOLES MUST BE MAINTAINED AND ACCESSIBLE DURING CONSTRUCTION.
18. ALL MANHOLES BUILT WITHIN THIS PROJECT SHALL INCLUDE A 4" CAST IRON RISER WITH ON 1-1/2" AND ON 2-1/2" CAST IRON ADJUSTING RINGS.

DENVER WATER

19. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO TAKE WHATEVER STEPS NECESSARY TO PROTECT ALL WATER FACILITIES. IF ANY WATER FACILITIES CANNOT BE ADEQUATELY PROTECTED, THEN SAID WATER FACILITIES SHALL BE RELOCATED OR REMOVED IN ACCORDANCE WITH THE DENVER WATER DEPARTMENT REQUIREMENTS, BY A DENVER WATER PREQUALIFIED CONTRACTOR.
20. CONSTRUCTION ACTIVITIES BY ANY PARTY THAT DISTURB, RELOCATE, SEVER, OR IN ANY OTHER WAY IMPACT A SERVICE LINE SHALL BE REQUIRED TO MEET CURRENT DENVER WATER REQUIREMENTS FOR SERVICE LINES AS SPECIFIED IN CHAPTER 3 OF THE LATEST DENVER WATER STANDARDS. IN THE EVENT LEAD WATER LINES ARE ENCOUNTERED, DO NOT DISTURB, IMMEDIATELY STOP WORK, AND NOTIFY THE CITY CONSTRUCTION PROJECT MANAGER.

TREE PROTECTION

21. EXISTING TREES WHICH ARE TO BE REMOVED MUST FIRST BE EVALUATED BY THE CITY AND COUNTY OF DENVER FORESTRY (PARKS) DEPARTMENT AND A PERMIT MUST BE OBTAINED. EXISTING TRESS TO REMAIN MUST HAVE FORESTRY APPROVED TREE PROTECTION SET UP DURING THE CONSTRUCTION AS SHOWN IN THE "INDIVIDUAL TREE PROTECTION DETAIL" IN THE DENVER PARKS DEPARTMENT STANDARD PLANS. THE CONTRACTO MUST FOLLOW ALL OF THE CITY AND COUNTY OF DENVER TREE RETENTION AND PROTECTION GUIDELINES. REFER TO DENVER FORESTRY WEBSITE: HTTPS://WWW.DENVERGOV.ORG/FORESTRY-TREES-.HTML.
22. EXISTING TREES WHICH ARE TO BE PRESERVED IN PUBLIC RIGHT OF WAY SHALL BE PROTECTED PER OFFICE OF THE CITY FORESTER STANDARDS & PRACTICES. TREE PROTECTION SHALL BE INSTALLED PRIOR TO COMMENCEMENT OF DEMOLITION AND/OR CONSTRUCTION ACTIVITIES, INSPECTED & APPROVED BY OFFICE OF THE CITY FORESTER STAFF, AND SHALL REMAIN IN PLACE UNTIL CERTIFICATE OF OCCUPANCY IS ISSUED.
23. IF PRUNING FOR CONSTRUCTION ACTIVITY IS NECESSARY, CONTRACTOR SHALL CONSULT WITH OFFICE OF THE CITY FORESTER STAFF PRIOR TO COMMENCEMENT OF WORK.
24. MINIMUM TREE PROTECTION REQUIREMENTS: TREE PROTECTION SHALL BE INSTALLED AT THE CRITICAL ROOT ZONE (CRZ). THE CRZ IS EQUAL TO THE DRIPLINE, FURTHEST EXTENT OF TREE CANOPY, OR IS EQUAL TO ONE FOOT RADIALLY FROM THE TREE FOR EVERY ONE INCH OF TRUNK DIAMETER AT BREAST HEIGHT (DBH = 4.5' ABOVE SOIL LINE), WHICHEVER IS GREATER.
25. FOR DEMOLITION ACTIVITIES: ORANGE PLASTIC SAFETY FENCING IS ACCEPTABLE. FENCING SHALL BE MIN. 48" IN HEIGHT, TOP SECURED TO METAL T-POSTS WITH 12-GAUGE WIRE WOVEN THROUGH TOP OF FENCING FOR ENTIRE LENGTH. HEAVY DUTY T-POSTS SHALL BE PLACED SO THAT WIRE & FENCE ARE TAUT.
26. FOR CONSTRUCTION ACTIVITIES: USE 6' CHAIN LINK FENCING TO ESTABLISH TREE PROTECTION ZONE (TPZ). ONCE TPZ IS IN PLACE, IT MAY NOT BE MOVED, RESIZED, REMOVED, OR ALTERED IN ANY MANNER WITHOUT PRIOR WRITTEN APPROVAL FROM OFFICE OF THE CITY FORESTER.
27. PLASTIC FENCE TREE PROTECTION IS ONLY ACCEPTABLE FOR DEMOLITION ACTIVITIES. ONCE DEMOLITION IS COMPLETED, 6' CHAIN LINK FENCING MUST BE INSTALLED PER BOUNDARIES SHOWN ON APPROVED SDP DRAWINGS. INSTALL FENCING PRIOR TO COMMENCEMENT OF SITE CONSTRUCTION (INCLUDING EXCAVATION). DUE TO SCOPE OF WORK, WE STRONGLY RECOMMEND INSTALLING 6' CHAIN LINK FENCING PRIOR TO COMMENCEMENT OF DEMOLITION.
28. OFFICE OF THE CITY FORESTER STAFF SHALL INSPECT AND APPROVE BOUNDARIES OF TREE PROTECTION ZONE(S) PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES; INCLUDING WHEN PLASTIC FENCING IS TO BE REPLACED WITH CHAIN LINK FENCING (IF PLASTIC FENCING IS INITIALLY INSTALLED). ONCE APPROVED BY THE OFFICE OF THE CITY FORESTER, THE TREE PROTECTION ZONE SHALL NOT BE RESIZED, MODIFIED, REMOVED, OR ALTERED IN ANY MANNER WITHOUT PRIOR APPROVAL.
29. "TREE PROTECTION ZONE" SIGNS SHALL REMAIN IN PLACE AS POSTED BY OFFICE OF THE CITY FORESTER AND SHALL BE MAINTAINED IN THE CONDITION IN WHICH THEY WERE INSTALLED.
30. CLEAR VISIBILITY INTO TREE PROTECTION ZONE MUST BE MAINTAINED. NO CONSTRUCTION BANNERS, SCREENS, BARRIERS, AND/OR SIGNS (EXCEPT OFFICE OF THE CITY FORESTER-POSTED TREE PROTECTION ZONE SIGNS) MAY BE PLACED TO IMPEDE VIEW INTO TREE PROTECTION ZONE BY OFFICE OF THE CITY FORESTER STAFF.
31. NO ENTRANCE AND/OR ACCESS TO THE TREE PROTECTION ZONE, INCLUDING CONSTRUCTION ACTIVITIES, IS PERMITTED WITHOUT PRIOR APPROVAL FROM THE OFFICE OF THE CITY FORESTER.
32. WHILE TREE PROTECTION FENCING IS IN PLACE, TREES SHALL BE DEEP-ROOT WATERED AT AN INTERVAL OF ONCE PER WEEK WHEN TEMPERATURES ARE AT OR ABOVE 50-DEGREES F. TREES SHALL BE WATERED AT THE RATE OF 10 GALLONS PER INCH CALIPER.
33. TREE LAWN WITHIN BOUNDARY OF TREE DRIPLINE SHALL NOT BE ROTOTILLED AT ANY TIME. ROTOTILING IS ONLY PERMITTED IN AREAS OUTSIDE EX. TREE DRIPLINE WHERE CONCRETE & HARDSCAPE ARE REMOVED.
34. EXISTING ROW TREES APPROVED FOR REMOVAL BY THE OFFICE OF THE CITY FORESTER MUST BE PROTECTED IN PLACE PER FORESTRY STANDARDS & SPECIFICATIONS UNTIL REMOVED BY AN OFFICE OF THE CITY FORESTER-LICENSED TREE CONTRACTOR. A TREE REMOVAL PERMIT IS REQUIRED FROM THE OFFICE OF THE CITY FORESTER PRIOR TO REMOVAL. FAILURE TO PROTECT SUCH TREES UNTIL REMOVAL, OR REMOVING ROW TREES WITHOUT A FORESTRY-ISSUED PERMIT WILL RESULT IN NOTICE OF VIOLATION AND MAY INCLUDE CITATIONS/FINES. TREE REMOVAL PERMITS ARE NOT INCLUDED WITH BUILDING PERMITS AND MUST BE OBTAINED SEPARATELY FROM THE OFFICE OF THE CITY FORESTER.
35. NO CONSTRUCTION ACCESS, ACTIVITY, OR STORAGE OF MATERIALS/DEBRIS/EQUIPMENT IS PERMITTED WITHIN TREE PROTECTION ZONES, INCLUDING GRADING, INSTALLATION OF UNDERGROUND UTILITIES, INSTALLATION OF SITE IMPROVEMENTS, AND/OR GRUBBING/LANDSCAPING. ALL CONSTRUCTION ACTIVITY MUST OCCUR OUTSIDE TREE PROTECTION ZONES (I.E DRIPLINES OF TREES).

METRO WASTEWATER RECLAMATION DISTRICT

36. METRO WASTEWATER RECLAMATION DISTRICT MUST BE NOTIFIED AT LEAST 14 DAYS PRIOR TO CONSTRUCTION ON METRO FACILITIES IN ORDER FOR A DISTRICT INSPECTOR TO BE PRESENT DURING CONSTRUCTION. CONTRACTOR MUST CONTACT METRO WASTEWATER RECLAMATION DISTRICT TO SCHEDULE THE INSPECTION 303-286-3000.

DENVER DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT (DDPHE)

37. THE CONTRACTOR SHALL COMPLY WITH THE DDPHE FINAL REUSE GUIDANCE FOR CITY PROJECTS AND STANDARD ENVIRONMENTAL LANGUAGE DOCUMENTS LOCATED AT: HTTPS://WWW.DENVERGOV.ORG/CONTENT/DENVERGOV/EN/ENVIRONMENTAL-HEALTH/ENVIRONMENTAL-QUALITY/LAND-USE-AND-PLANNING.HTML.

## PROJECT SPECIFIC NOTES:

1. A CERTIFIED ASBESTOS BUILDING INSPECTOR (CABI) MAY BE REQUIRED ONSITE DURING CONSTRUCTION ACTIVITIES IN ACCORDANCE WITH SECTION 5.4 OF THE MATERIALS MANAGEMENT PLAN PROVIDED IN THE BID DOCUMENTS FOR THE 27th St. STORM DRAIN PROJECT LOCATION.
2. HISTORICAL MAPS INDICATE THAT THERE IS A POTENTIAL TO ENCOUNTER TROLLEY TRACKS IN STOUT, CALIFORNIA, AND WELTON. CONTRACTOR TO REMOVE AND DISPOSE OF TRACKS AS NEEDED. THIS WORK WILL BE MEASURED AND PAID FOR UNDER ITEM 20-2a, REMOVE TROLLEY TRACKS.

## BORING HOLE LEGEND:

(6) CONCRETE, THICKNESS IN INCHES SHOWN IN PARENTHESES TO LEFT OF THE LOG.

(4.5) ASPHALT, THICKNESS IN INCHES SHOWN IN PARENTHESES TO LEFT OF THE LOG.

(3.5) AGGREGATE BASECOURSE, THICKNESS IN INCHES SHOWN IN PARENTHESES TO LEFT OF THE LOG.

FILL: SILTY CLAYEY SAND (SC-SM) AND SILTY CLAY WITH SAND (CL-ML), FINE TO COARSE-GRAINED WITH OCCASIONAL GRAVELS, MOIST, BROWN.

SANDY LEAN CLAY TO LEAN CLAY WITH SAND (CL), STIFF TO VERY STIFF, MOIST, BROWN.

SILTY SAND (SM), WITH OCCASIONAL POORLY-GRADED SAND WITH SILT (SP-SM), OCCASIONAL GRAVELS, LOOSE TO VERY DENSE, SLIGHTLY MOIST TO MOIST, LIGHT BROWN.

POORLY-TO WELL-GRADED SAND (SP TO SW), SILTY, OCCASIONAL GRAVELS, MEDIUM DENSE TO VERY DENSE, SLIGHTLY MOIST, LIGHT BROWN.

POORLY-GRADED GRAVEL WITH SILT AND SAND (GP-GM), DENSE, DRY TO SLIGHTLY MOIST, LIGHT BROWN.

DRIVE SAMPLE, 2-INCH I.D. CALIFORNIA LINER SAMPLE.

DRIVE SAMPLE, 1 3/8-INCH I.D. SPLIT SPOON SAMPLE.

21/12 DRIVE SAMPLE BLOW COUNT. INDICATES THAT 21 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

BORING COMPLETED AS MONITORING WELL.

42 DEPTH TO WATER LEVEL AND NUMBER OF DAYS AFTER DRILLING MEASUREMENT WAS MADE.

## BORING HOLE NOTES:

1. THE EXPLORATORY BORINGS WERE DRILLED ON FEBRUARY 20, 21, 22, 23, 27, AND 28, 2017 WITH 4-INCH DIAMETER CONTINUOUS FLIGHT, AND 7.75-INCH HOLLOW STEM POWER AUGERS.
2. THE LOCATIONS OF THE EXPLORATORY BORINGS WERE MEASURED APPROXIMATELY BY PACING FROM FEATURES SHOWN ON THE SITE PLAN PROVIDED.
3. THE ELEVATIONS OF THE EXPLORATORY BORINGS WERE OBTAINED BY INTERPOLATION USING PLAN AND PROFILE INFORMATION ON THE DRAWINGS PROVIDED.
4. THE EXPLORATORY BORING LOCATIONS AND ELEVATIONS SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.
5. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
6. GROUNDWATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE UNDER CONDITIONS INDICATED. FLUCTUATIONS IN THE WATER LEVEL WITH TIME.
7. LABORATORY TEST RESULTS:
   - WC = WATER CONTENT (%) (ASTM D 2216);
   - DD = DRY DENSITY (pcf) (ASTM D 2216);
   - +4 = PERCENTAGE RETAINED ON NO. 4 SIEVE (ASTM D 422);
   - −200 = PERCENTAGE PASSING NO. 200 SIEVE (ASTM D 1140);
   - LL = LIQUID LIMIT (ASTM D 4318);
   - PI = PLASTICITY INDEX (ASTM D 4318);
   - NV = NO LIQUID LIMIT VALUE (ASTM D 4318);
   - NP = NON-PLASTIC (ASTM D 4318);
   - WSS = WATER SOLUBLE SULFATES (%) (CP-L 2103);
   - RES = MINIMUM LABORATORY RESISTIVITY (ohm-cm.) (ASTM G 57).

## ABBREVIATIONS

APPROX - APPROXIMATELY
CL - CENTER LINE
CCD - CITY AND COUNTY OF DENVER
CFS - CUBIC FEET PER SECOND
C & G - CURB AND GUTTER
C G & SW - CURB, GUTTER, & SIDEWALK
CH - CURB HEAD
CIP- CORRUGATED IRON PIPE (WATER)
CPM. - CAPITAL PROJECTS MANAGEMENT
DIP - DUCTILE IRON PIPE (WATER)
DT- DECIDUOUS TREE
DWD - DENVER WATER DEPARTMENT
E - EAST
EF - EACH FACE
E.G.L. - ENERGY GRADE LINE
EOA - EDGE OF ASPHALT
ES - EACH SIDE
EX- EXISTING
EW - EACH WAY
FG - FINAL GRADE
FL - FLOW LINE
FO - FIBER OPTIC LINE
G - GAS
H.G.L. - HYDRAULIC GRADE LINE
I - INLET
INV. - INVERT
LF- LINEAR FEET
MH - MANHOLE
MJ- MECHANICAL JOINT
N - NORTH
NTS - NOT TO SCALE
OHE - OVERHEAD ELECTRIC LINE
PL - PROPERTY LINE
PVC - POLY VINYL CHLORIDE
q - DESIGN FLOW
Qfull - FULL FLOW CAPACITY
RCBC - REINFORCED CONCRETE BOX CULVERT
RCP - REINFORCED CONCRETE PIPE
R.L. - RANGE LINE
S - SOUTH
STM - STORM SEWER
SS - SANITARY SEWER
SW - SIDEWALK
TELE- TELEPHONE LINE
TOC - TOP OF CONCRETE
T.O.P. - TOP OF PIPE
T.O.W. - TOP OF WALL
TYP. - TYPICAL
UE - UNDERGROUND ELECTRIC LINE
U.N.O. - UNLESS NOTED OTHERWISE
VCP - VITRIFIED CLAY PIPE
W - WEST
WAT - WATER
WMD - WASTEWATER MANAGEMENT DIVISION

## SURVEY FEATURES LEGEND

BENCHMARK
CHISELED 'X'
TRAVERSE POINT
RANGE POINT
LAND CORNER
PIN & CAP
REBAR
EASEMENT LINE
SECTION LINE
PROPERTY LINE (NOT R.O.W.)
RANGELINE
R.O.W. LINE

## EXISTING FEATURES LEGEND *

EXISTING STREET LIGHT
EXISTING UTILITY/POWER POLE
EXISTING GUY WIRE
EXISTING TRAFFIC POLE
EXISTING TRAFFIC CONTROL BOX
EXISTING TRAFFIC CONTROL SWITCH BOX
EXISTING ELECTRIC METER
EXISTING ELECTRIC BOX
EXISTING FIRE HYDRANT
EXISTING WATER VALVE
EXISTING WATER MH
EXISTING WATER METER
EXISTING GAS MANHOLE
EXISTING STORM INLETS
EXISTING STREET SIGN
EXISTING POST
EXISTING TRASH RECEPTACLE
EXISTING TRASH DUMPSTER
EXISTING BUS BENCH
EXISTING MAIL BOX
EXISTING NEWSPAPER BOX
EXISTING TELEPHONE MH
EXISTING TELEPHONE BOX
EXISTING TELEPHONE BOOTH
EXISTING IRRIGATION BOX
EXISTING TREE
EXISTING SHRUB
EXISTING WATER LINE
EXISTING GAS LINE
EXISTING STORM LINE W/MANHOLE
EXISTING SANITARY LINE W/MANHOLE
EXISTING UNDERGROUND TELEPHONE LINE
EXISTING OVERHEAD TELEPHONE LINE
EXISTING TRAFFIC CONTROL LINE
EXISTING UNDERGROUND ELECTRIC
EXISTING OVERHEAD ELECTRIC
EXISTING FENCE WOOD
EXISTING FENCE METAL
EXISTING FENCE BARBED WIRE
EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR

## PROPOSED FEATURES LEGEND

PROPOSED STORM INLET
PROPOSED STORM SEWER W/MANHOLE
FUTURE STORM SEWER W/MANHOLE
PROPOSED SANITARY SEWER W/MANHOLE
PROPOSED MAJOR CONTOUR
PROPOSED MINOR CONTOUR
PROPOSED CURB & GUTTER
PROPOSED FH
PROPOSED WATER
PROPOSED WATER VALVE
PROPOSED WATER REDUCER
PROPOSED WATER BENDS AND/OR TEES
PROPOSED GRASS AND/OR MULCH-REPLACE EXISTING LANDSCAPING MATERIAL
PROPOSED CONCRETE UNLESS SPECIFIED OTHERWISE
PROPOSED CURB RAMP
PROPOSED DRAINAGE FLOW ARROW
BORE/TEST HOLE LOCATION

* SEE SHEET 9 FOR UTILITY LEGEND WITH SUBSURFACE UTILITY ENGINEERING QUALITY LEVELS

COLORADO LICENSED 43395 CHRISTIAN WISLEDER PROFESSIONAL ENGINEER 05/02/2019


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GREENWOOD VILLAGE, CO 80111


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CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
CAPITAL PROJECTS MANAGEMENT
2000 W. 3RD AVE. DENVER, CO 80223
TEL.: (303) 446-3617 FAX: (303) 446-3647


27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

GENERAL NOTES & LEGEND

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-CS-GN02.dwg
DATE: APRIL 16, 2019
SHEET NO.: 2

PLOT DATE: May 2, 2019

\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-CS-GN02.DWG

## TRANSPORTATION ENGINEERING STD. DRAWINGS

| STD. DWG. NO. | DESCRIPTION |
|---|---|
| 1.0 | INDEX OF STANDARD DRAWINGS |
| 1.1 | LEGEND |
| 2.0 | LOCAL STREET CROSS-SECTION AND STANDARD UTILITY PLACEMENT DETAIL |
| 3.0 | COLLECTOR - 2 OR 3 LANE CROSS-SECTION |
| 4.0 | ARTERIAL - 4 LANE WITH MEDIAN AND NO PARKING CROSS-SECTION |
| 4.1 | ARTERIAL - 4 LANE WITH MEDIAN AND PARKING CROSS-SECTION |
| 4.2 | ARTERIAL - 6 LANE CROSS-SECTION |
| 5.0 | CURB & GUTTER AND DETACHED SIDEWALK |
| 5.1 | CURB & GUTTER AND ATTACHED SIDEWALK |
| 5.2 | TYPICAL CURB & GUTTER SECTIONS |
| 5.3 | SPECIAL USE CURB & GUTTER SECTIONS |
| 5.4 | CONCRETE GUTTER OVERLAY |
| 5.5 | CURB BULB EXTENSION |
| 5.6 | MONOLITHIC MEDIAN CURB NOSE |
| 6.0 | STANDARD RESIDENTIAL CURB CUT |
| 6.1 | STANDARD COMMERCIAL & MULTI-FAMILY CURB CUT |
| 6.2 | CURB CUT CROSS-SECTIONS |
| 6.3 | CORNER CLEARANCES & MINIMUM DISTANCES BETWEEN CURB CUTS |
| 7.0a,b | GENERAL NOTES FOR CURB RAMPS |
| 7.1 | CURB RAMP TYPE 1 |
| 7.2a | CURB RAMP TYPE 2 |
| 7.2b | CURB RAMP TYPE 2 MODIFIED (FOR COMBINATION CURB, GUTTER AND SIDEWALK) |
| 7.3 | CURB RAMP TYPE 3 |
| 7.4 | CURB RAMP TYPE 4 |
| 7.5 | DOWNTOWN SIGNALIZED CORNER BLENDED TRANSITION |
| 7.6a,b | CURB RAMP TRUNCATED DOME PLACEMENT OPTIONS |
| 7.7 | CURB RAMP TYPICAL SECTION |
| 7.8 | TYPICAL SIDEWALK TRANSITIONS TO CURB RAMP LANDING |
| 7.9 | SIGNAL EQUIPMENT CLEAR ZONE |
| 8.0 | INTERSECTION VALLEY GUTTER |
| 8.1 | SIDEWALK CHASE DRAIN AND TREAD PLATE |
| 9.0 | TYPICAL CONCRETE BUS PULLOUT |
| 9.1 | TYPICAL CONCRETE BUS PAD IN ASPHALT ROADWAY |
| 10.0 | TYPICAL ALLEY LAYOUT |
| 10.1 | ALLEY CUT |
| 10.2 | ALLEY CUT (HISTORIC DISTRICT) |
| 10.3 | TYPICAL ALLEY CROSS-SECTION |
| 10.4 | ALLEY CURB HEAD |
| 10.5 | "L" TYPE ALLEY CONFIGURATIONS |
| 11.0a,b,c | GENERAL NOTES FOR CONCRETE PAVEMENT AND PAVEMENT JOINTS |
| 11.1 | CONCRETE NON-ROADWAY JOINTS H AND Z |
| 11.2 | CONCRETE ROADWAY JOINTS AND TRANSITIONS A-DA |
| 11.3 | CONCRETE ROADWAY JOINTS AND TRANSITIONS DC-L |
| 11.4 | CONCRETE ROADWAY JOINTS AND TRANSITIONS SA-X |
| 11.5 | CONCRETE ROADWAY JOINT SEALANTS |
| 11.6 | CONCRETE ROADWAY JOINTING AT NEW MANHOLES AND ALL INLETS |
| 11.7 | CONCRETE ROADWAY JOINTING AT EXISTING MANHOLES |
| 11.8 | CONCRETE ROADWAY TYPICAL JOINT LAYOUT |
| 11.9 | CONCRETE ROADWAY PANEL REPLACEMENT |
| 11.10 | CONCRETE STREET EXPLORATORY HOLES (POTHOLES) TYPICAL REPAIR |
| 12.0 | ASPHALT PATCH |
| 12.1 | TRENCH PATCH THROUGH EXISTING GRAVEL OR LANDSCAPE MATERIALS |
| 12.2 | TRENCH VERTICAL PATCH (ASPHALT) IN MORATORIUM STREET |
| 12.3 | TRENCH ("T") PATCH (CONCRETE) |
| 12.4 | TRENCH BACKFILL MATERIAL REQUIREMENTS |
| 12.5 | TYPICAL ASPHALT PAVEMENT DETAIL |
| 12.6 | TYPICAL ASPHALT PAVEMENT DETAIL LIFT THICKNESS CRITERIA |
| 12.7 | TYPICAL ASPHALT MIX DETAILS BY TRAFFIC USE OR LIFT POSITION |
| 13.0 | TREE PLANTER (RAISED CURB) |
| 13.1 | TREE PLANTER (GRATES) |
| 13.2 | SIDEWALK CLEAR ZONES |
| 13.3 | AMENITY ZONE PERMEABLE PAVERS |
| 14.0 | STANDARD CUL-DE-SAC |
| 15.0 | RIGHT-OF-WAY SURVEY CONTROL-RANGE POINTS |

## DRAINAGE STANDARD DRAWINGS

| STD. DWG. NO. | DESCRIPTION |
|---|---|
| S-301.1 | TRENCHING AND BEDDING - PART I |
| S-301.2 | TRENCHING AND BEDDING - PART II |
| S-350 | ENCASEMENT OF SANITARY SEWERS |
| S-401 | SHIPLAP JOINTS/TYPE R JOINTS |
| S-450 | INLET CONNECTIONS AND PIPELINE CLOSURES |
| S-501.1 | PRECAST MANHOLE BARRELS AND TOP SECTIONS |
| S-502 | MANHOLE BASE CONSTRUCTION-TYPE A/C |
| S-503 | TYPE B MANHOLE |
| S-504.1 | TYPE P MANHOLE |
| S-504.2 | TYPE B MANHOLE BASE SECTIONS |
| S-520 | TYPICAL MANHOLE BASE CHANNELIZATION |
| S-530 | MANHOLE OUTSIDE DROP |
| S-550 | WATER STOP GASKET |
| S-616.1 | SINGLE NO. 16 INLET |
| S-616.2 | DOUBLE NO. 16 INLET |
| S-616.3 | TRIPLE NO. 16 INLET |
| S-616V | SINGLE, DOUBLE, TRIPLE VALLEY INLET |
| S-620.1 | NO. 14 INLET (SHEET 1) |
| S-620.2 | NO. 14 INLET (SHEET 2) |
| S-701 | 24" DIAMETER RING & COVER |
| S-716 | GRATE & FRAME, ADJUSTABLE CURB BOX |
| S-750 | MANHOLE STEPS |

## TRAFFIC STANDARD DRAWINGS

| STD. DWG. NO. | DESCRIPTION |
|---|---|
| 16.1.0 | 2011 TRAFFIC ENGINEERING SERVICES |
| 16.1.1 | TRAFFIC SIGNAL NOTES |
| 16.1.2 | LEGEND/KEY NOTES |
| 16.1.3 | SPAN WIRE SIGNAL DESIGN |
| 16.1.4 | MOUNTING HARDWARE |
| 16.1.5 | LOOP DETECTION |
| 16.1.6 | CONDUIT DETAILS |
| 16.1.7 | PULL BOXES |
| 16.1.8 | SIGNAL POLE FOUNDATION |
| 16.1.9 | MAST ARM POLE LOADS |
| 16.1.10 | MOUNTING DETAILS |
| 16.1.11 | TABLE DATA |
| 16.1.12 | LUMINAIRE DETAILS |
| 16.1.13 | PEDESTAL POLE DETAILS |
| 16.1.14 | POLE FOUNDATION DETAIL |
| 16.1.15 | FOUNDATION FOR XCEL FACILITIES |
| 16.1.16 | "P" CABINET BASE |
| 16.1.17 | "P" CABINET & BASE |
| 16.1.18 | "M" CABINET BASE |
| 16.1.19 | METER PEDESTAL CABINET DETAILS |
| 16.1.20 | METER PEDESTAL CABINET FOUNDATION AND BASE |
| 16.1.21 | FLASHING BEACON DETAILS |
| 16.1.22 | DRIVER'S FEEDBACK SIGN DETAILS |
| 16.1.23 | FLASHING BEACON & SIGN SHEET 1 |
| 16.1.24 | FLASHING BEACON & SIGN SHEET 2 |
| 16.2.1 | CROSSWALK LAYOUT DETAILS |
| 16.2.2 | PAVEMENT MARKING DETAILS SHEET 1 |
| 16.2.3 | PAVEMENT MARKING DETAILS SHEET 2 |
| 16.2.4 | BIKE LANE TYPICAL MARKING DETAILS |
| 16.2.5 | CENTRAL BUSINESS DISTRICT PAVEMENT MARKING DETAILS |
| 16.2.6 | SINGLE SIGN POST MOUNTING DETAILS |
| 16.2.7 | MULTIPLE SIGN POST MOUNTING DETAILS |
| 16.2.8 | ONE-WAY SIGN PLACEMENT DETAILS |
| 16.2.9 | TRAFFIC SIGN UTILITY POLE MOUNTING DETAIL |
| 16.2.10 | GROUND MOUNT STREET SIGN INSTALLATION DETAIL |
| 16.2.11 | GROUND MOUNT STREET SIGN DETAILS |
| 16.2.12 | OVERHEAD STREET NAME SIGNS (INSTALLED PRIOR APRIL, 2011) |
| 16.2.13 | OVERHEAD STREET NAME SIGNS (INSTALLED AFTER APRIL, 2011) |
| 16.2.14 | PARKING METER POST INSTALLATION |
| 16.2.15 | BARRICADE DETAILS |

CITY AND COUNTY OF DENVER

STANDARDS PLANS LIST

THE STANDARDS PLAN SHEETS INDICATED HEREON BY A MARKED BOX ARE TO BE USED TO CONSTRUCT THIS PROJECT. ■

ALL OF THE STANDARD PLANS, AS SUPPLEMENTED AND REVISED, APPLY TO THIS PROJECT WHEN USED BY DESIGNATED PAY ITEM OR SUBSIDIARY ITEM.

COLORADO LICENSED
CHRISTIAN ANN WISLEDER
43395
PROFESSIONAL ENGINEER
05/02/2019

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27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

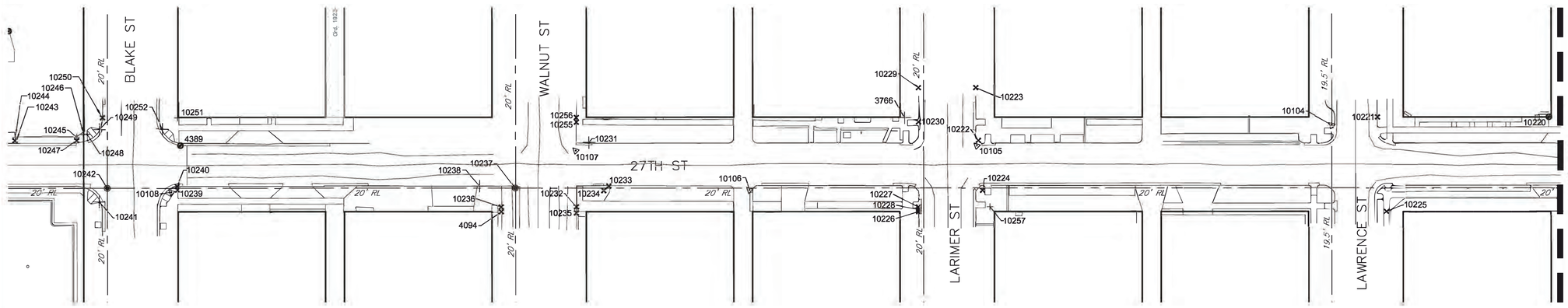
DENVER STANDARD DRAWING LIST

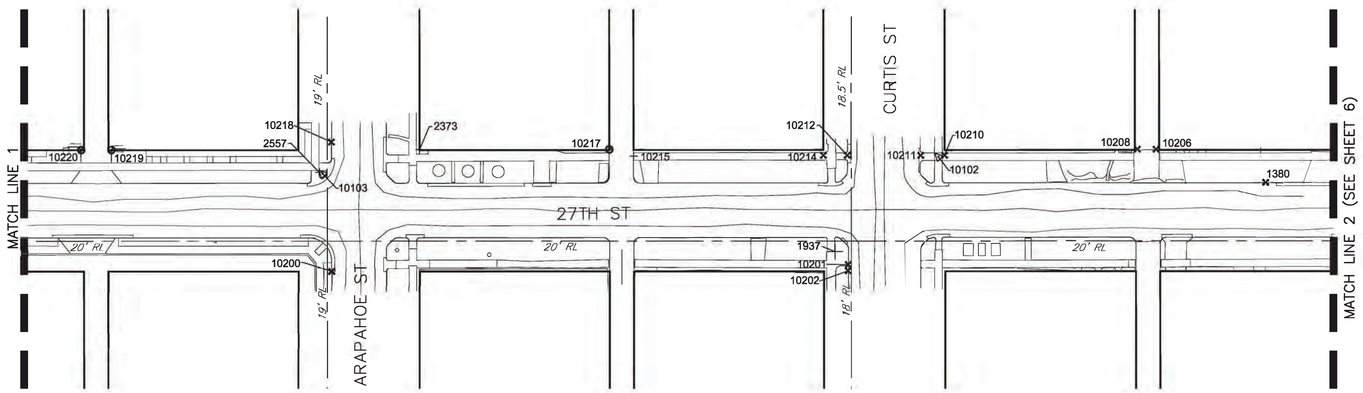
DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-CS-GN02.dwg
DATE: APRIL 16, 2019
SHEET NO.: 3

PLOT DATE: May 2, 2019

\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-CS-GN02.DWG

# SURVEY CONTROL DIAGRAM




0 50' 100'

SCALE: 1" = 50'

| Point Table | | | | |
|---|---|---|---|---|
| Point # | Northing | Easting | Elevation | Raw Description |
| 10102 | 400811.34 | 576578.10 | 5211.72 | TVP102 SET CUTX CL WALK INTERSECTIONS |
| 10103 | 401090.69 | 576282.82 | 5205.03 | TVP103 SET CUTX BETWEEN RAMPS |
| 10104 | 401339.57 | 576046.23 | 5204.06 | TVP104 SET CUTX SIDEWALK |
| 10105 | 401539.99 | 575821.36 | 5202.97 | TVP105 SET MAG ASPHALT |
| 10106 | 401649.73 | 575658.19 | 5201.97 | TVP106 SET MAG ASPHALT |
| 10107 | 401777.56 | 575577.74 | 5202.07 | TVP107 SET MAG ASPHALT |
| 10108 | 401995.17 | 575310.25 | 5186.98 | TVP108 SET MAG CONCRETE JOINT |
| 10200 | 401041.22 | 576241.49 | 0.00 | CH+ ON TOC |
| 10201 | 400803.18 | 576485.72 | 0.00 | CH+ ON TOC |
| 10202 | 400800.31 | 576482.80 | 0.00 | CH+ ON TOC |
| 10206 | 400713.40 | 576683.07 | 0.00 | CH+ ON CONC |
| 10208 | 400722.14 | 576674.34 | 0.00 | CH+ ON CONC |
| 10210 | 400809.20 | 576581.59 | 0.00 | CH+ ON WALK |
| 10211 | 400820.30 | 576570.43 | 0.00 | CH+ ON WALK AT HCR |
| 10212 | 400854.63 | 576536.14 | 0.00 | CH+ ON WALK AT HCR |
| 10214 | 400865.73 | 576525.04 | 0.00 | CH+ ON WALK |
| 10215 | 400953.83 | 576436.11 | 0.00 | MAG IN WALK |
| 10217 | 400968.36 | 576427.88 | 0.00 | P&C AT EDGE OF ALLEY |
| 10218 | 401101.39 | 576301.70 | 0.00 | CH+ ON TOC |
| 10219 | 401200.35 | 576195.35 | 0.00 | P&C 32430 IN CONC |
| 10220 | 401214.40 | 576181.24 | 0.00 | P&C 32430 IN CONC |
| 10221 | 401317.04 | 576078.48 | 0.00 | CH+ ON TOC |

| Point Table | | | | |
|---|---|---|---|---|
| Point # | Northing | Easting | Elevation | Raw Description |
| 10222 | 401542.29 | 575825.48 | 0.00 | CH+ ON TOC |
| 10223 | 401575.33 | 575855.35 | 0.00 | CH+ ON TOC |
| 10224 | 401509.80 | 575797.94 | 0.00 | CH+ ON CONCRETE |
| 10225 | 401255.15 | 576027.45 | 0.00 | CH+ ON WALK |
| 10226 | 401535.38 | 575746.80 | 0.00 | CH+ ON TOC |
| 10227 | 401538.29 | 575749.51 | 0.00 | CH+ ON CONCRETE IN HCR |
| 10228 | 401536.64 | 575748.20 | 0.00 | CH+ ON TOC |
| 10229 | 401609.78 | 575820.91 | 0.00 | CH+ ON TOC |
| 10230 | 401589.19 | 575800.49 | 0.00 | CH+ ON CONCRETE IN HCR |
| 10231 | 401774.49 | 575590.39 | 0.00 | CHX ON CONCRETE INLET |
| 10232 | 401743.32 | 575544.25 | 0.00 | CH+ ON TOC |
| 10233 | 401736.42 | 575576.14 | 0.00 | CH+ ON CONCRETE INLET |
| 10234 | 401736.72 | 575570.58 | 0.00 | CH+ ON CONCRETE INLET |
| 10235 | 401739.72 | 575540.68 | 0.00 | CH+ ON CONCRETE INLET |
| 10236 | 401788.28 | 575499.15 | 0.00 | CH+ ON CONCRETE INLET |
| 10237 | 401791.26 | 575518.92 | 0.00 | RP 34977 2IN AL. CAP |
| 10238 | 401813.78 | 575498.75 | 0.00 | CHX ON TOC |
| 10239 | 401992.74 | 575315.25 | 0.00 | CH+ ON CONCRETE INLET |
| 10240 | 401995.07 | 575317.16 | 0.00 | CH+ ON CONCRETE INLET |
| 10241 | 402032.38 | 575261.22 | 0.00 | CHX ON CONCRETE HCR |
| 10242 | 402035.75 | 575274.13 | 0.00 | RP 25384 3INCH AL. CAP |
| 10243 | 402119.68 | 575247.38 | 0.00 | CH+ ON WALK |

| Point Table | | | | |
|---|---|---|---|---|
| Point # | Northing | Easting | Elevation | Raw Description |
| 10244 | 402121.49 | 575249.78 | 0.00 | N&S ON WALK |
| 10245 | 402084.71 | 575286.54 | 0.00 | N&S ON WALK |
| 10246 | 402081.91 | 575292.33 | 0.00 | N&S ON WALK |
| 10247 | 402082.75 | 575284.42 | 0.00 | CH+ ON WALK |
| 10248 | 402080.14 | 575294.48 | 0.00 | N&S IN CONCRETE HCR |
| 10249 | 402075.63 | 575304.58 | 0.00 | CHX ON CONCRETE HCR |
| 10250 | 402080.92 | 575313.48 | 0.00 | CH+ ON TOC |
| 10251 | 402035.81 | 575358.47 | 0.00 | N&S ON WALK |
| 10252 | 402038.45 | 575342.80 | 0.00 | CHX ON CONCRETE HCR |
| 10255 | 401794.19 | 575595.17 | 0.00 | CH+ ON TOC |
| 10256 | 401797.04 | 575597.91 | 0.00 | CH+ ON TOC |
| 10257 | 401495.53 | 575792.22 | 0.00 | N&S IN WALK |
| 1380 | 400646.78 | 576719.02 | 5218.49 | CH+ |
| 1937 | 400815.42 | 576485.50 | 5211.62 | CHX ON CONC |
| 2373 | 401056.76 | 576339.30 | 5205.68 | N&S IN CONCRETE |
| 2557 | 401092.89 | 576281.93 | 5205.12 | MAG ON TOC |
| 3766 | 401600.12 | 575794.69 | 5203.29 | CHX |
| 4094 | 401785.47 | 575496.31 | 5202.12 | CH+ |
| 4389 | 402017.45 | 575343.57 | 5186.85 | RBR No.8 |

NOTE

ALL RANGE POINTS OR OTHER SURVEY MONUMENTS WHICH MAY BE DESTROYED DURING CONSTRUCTION SHALL BE TIED OUT AND RESET BY THE CONTRACTOR'S SURVEYOR. THIS WORK CONSISTS OF LOCATING, PRESERVING, REFERENCING, INSTALLING AND RESTORING LAND MONUMENTS, SUCH AS PRIMARY CONTROL MONUMENTS FROM WHICH THE RIGHT OF WAY OR ANY LAND BOUNDARY WILL BE CALCULATED, DESCRIBED OR MONUMENTED, PUBLIC LAND SURVEY SYSTEM (PLSS) MONUMENTS, GENERAL LAND OFFICE (GLO) MONUMENTS, BUREAU OF LAND MANAGEMENT (BLM) MONUMENTS, RIGHT OF WAY (ROW) MONUMENTS, PROPERTY BOUNDARY MONUMENTS AND OFFSETS, RANGE POINTS, BENCHMARKS, EASEMENT MONUMENTS, AND OTHER MONUMENTS THAT ARE REQUIRED BY LAW OR REGULATION TO BE ESTABLISHED AND RECORDED BY A PROFESSIONAL LAND SURVEYOR (PLS), ALONG WITH INSTALLING OR ADJUSTING MONUMENT BOXES.

THE PRODUCTION OF ADDITIONAL DOCUMENTATION MAY BE REQUIRED BY THE CITY SURVEYORS' OFFICE. ALL SUCH WORK INCLUDED IN THIS SECTION SHALL BE UNDER THE SUPERVISION OF A PLS WHO IS LICENSED IN THE STATE OF COLORADO.

BENCHMARK

CCD BM 371, A BRASS CAP AT THE SE CORNER OF DOWNING ST. AND 24TH AVE., ELEVATION 5252.14'.

PROJECT MAPPING PROJECTION:

TRANSVERSE MERCATOR ZONE: CCD_LOCAL
DATUM: NAD83-1992
CENTRAL POINT FALSE NORTHING = 400000.0000
CENTRAL POINT FALSE EASTING = 600000.0000
LATITUDE OF ORIGIN = N39°45'19.00000"
CENTRAL MERIDIAN = W104°53'53.00000"
ZONE WIDTH = 6°0'00.0"
SCALE FACTOR AT ORIGIN = 1.00025403000
UNITS ARE US SURVEY FEET.

LEGEND:

- SURVEY MONUMENT (SEE POINT LIST)
- RANGE POINT (SEE POINT LIST)
- CHISELED "+"
- FOUND POINT AS DESCRIBED (SEE POINT LIST)
- LAND LINE
- RANGE LINE
- R.O.W. LINE
- IMPROVEMENTS

| NO. | DESCRIPTION OF REVISIONS | DATE | BY |
|---|---|---|---|
| | | | |

CALL UNCC TWO WORKING DAYS BEFORE YOU DIG 1-800-922-1987 UNITED NOTIFICATION CENTER OF COLORADO

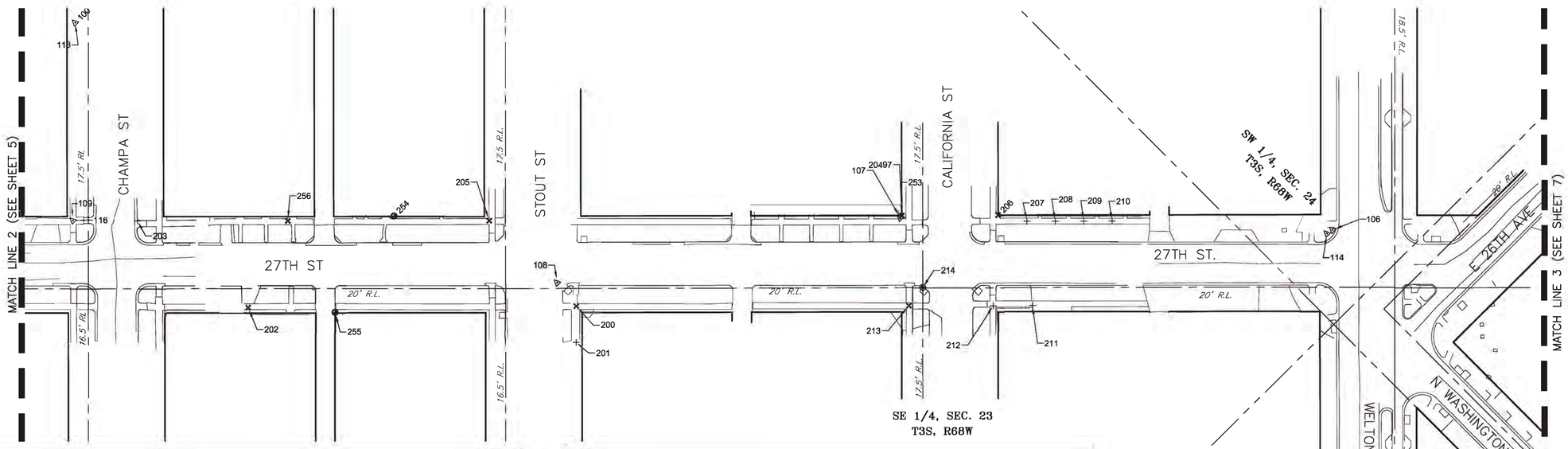
CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
CITY SURVEYOR'S OFFICE
201 WEST COLFAX AVE. DENVER, CO 80202

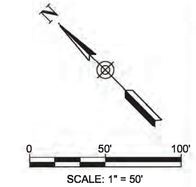
27TH STREET STORM INTERCEPTOR
PWWW2017-012
PRO TRACKING NO.
PROJECT MASTER NO. 2017-PROJMSTR-0000343

LAND SURVEY CONTROL DIAGRAM

DESIGNED BY: JL
APPROVED BY: WLR
CONTRACT NUMBER: XXXXXX
DENVER PCO NUMBER: 2011-XXXX-XX
DATE: 10/10/2017
SHEET NO.: 4

# SURVEY CONTROL DIAGRAM




| POINT TABLE | | | | |
|---|---|---|---|---|
| Point # | Northing | Easting | Elevation | Raw Description |
| 100 | 397203.78 | 577498.84 | 5259.87 | TVP 100 SET CUT X |
| 101 | 397521.18 | 577497.83 | 5253.32 | TVP 101 SET CUT X |
| 102 | 397933.27 | 577454.27 | 5246.81 | TVP 102 SET CUT X |
| 103 | 398273.43 | 577450.45 | 5243.02 | TVP 103 FOUND RP CAP |
| 104 | 398761.00 | 577462.32 | 5238.20 | TVP 104 SET MAG |
| 105 | 399301.67 | 577505.60 | 5233.79 | TVP 105 SET CUT X |
| 106 | 399873.10 | 577507.29 | 5225.85 | TVP 106 SET CUT X |
| 107 | 400133.79 | 577260.61 | 5223.46 | TVP 107 SET CUT X |
| 108 | 400297.08 | 577021.62 | 5222.32 | TVP 108 SET MAG |
| 109 | 400617.13 | 576774.04 | 5220.59 | TVP 109 SET CUT X |
| 110 | 399503.48 | 577505.12 | 5230.15 | TVP 110 SS INK DOT |
| 111 | 399025.40 | 577452.69 | 5236.44 | TVP 111 SS SET CUT X |
| 112 | 398493.30 | 577504.45 | 5241.25 | TVP112 N&S T726 |
| 113 | 400731.81 | 576891.24 | 5220.14 | TVP 113 FORMERLY 100 PER 27TH & BLAKE SET CUTX ON WALK |
| 114 | 399874.21 | 577501.87 | 5225.74 | TVP 114 FORMERLY 101 PER 27TH&WELTON SET CUT X |
| 116 | 400617.13 | 576774.04 | 5220.59 | TVP 116 SS SET CUT X |
| 200 | 400271.84 | 577018.92 | 0.00 | CH+ |
| 201 | 400250.65 | 576997.70 | 0.00 | N&S 16116 |
| 202 | 400463.53 | 576825.72 | 0.00 | CH+ |
| 203 | 400579.26 | 576811.65 | 0.00 | RECROSS 1IN 24313 |
| 205 | 400373.18 | 577018.00 | 0.00 | CH+ |
| 206 | 400077.94 | 577319.63 | 0.00 | CH+ WITH NAIL |
| 207 | 400057.36 | 577332.96 | 0.00 | N&S 269X8 |
| 208 | 400040.72 | 577349.53 | 0.00 | N&S 269X8 |
| 209 | 400024.08 | 577366.26 | 0.00 | N&S 269X8 |
| 210 | 400007.48 | 577382.98 | 0.00 | N&S 269X8 |
| 211 | 400004.79 | 577286.84 | 0.00 | N&W 9655 |
| 212 | 400027.84 | 577263.74 | 0.00 | N&W 9655 |
| 213 | 400077.08 | 577214.20 | 0.00 | CH+ |
| 214 | 400079.79 | 577233.23 | 0.00 | RANGE POINT 2.5IN ALUM CAP PLS26298 W/ CENTER PUNCH |
| 215 | 397207.02 | 577499.01 | 0.00 | MAG |
| 216 | 397197.53 | 577502.93 | 0.00 | MAG |
| 218 | 397851.45 | 577497.86 | 0.00 | CH+ |
| 219 | 398290.44 | 577503.76 | 0.00 | CH+ |
| 220 | 398391.58 | 577504.24 | 0.00 | N&S 20699 |
| 221 | 398395.50 | 577508.00 | 0.00 | 2IN BRASS CAP 12083 |
| 222 | 398493.28 | 577504.45 | 0.00 | N&S 2726X |
| 223 | 398530.79 | 577504.48 | 0.00 | N&S 20699 |

| POINT TABLE | | | | |
|---|---|---|---|---|
| Point # | Northing | Easting | Elevation | Raw Description |
| 224 | 398630.58 | 577504.73 | 0.00 | N&S WC 27268 |
| 225 | 398668.08 | 577504.82 | 0.00 | N&S 20699 |
| 226 | 398773.95 | 577505.01 | 0.00 | N&S WC 2726X |
| 227 | 398777.91 | 577505.05 | 0.00 | N&S 20699 |
| 228 | 399154.77 | 577495.91 | 0.00 | CH+ |
| 229 | 399241.56 | 577503.54 | 0.00 | MAG |
| 230 | 399289.62 | 577490.06 | 0.00 | RANGE POINT 2.5 IN ALUM CAP 3792X |
| 231 | 399436.42 | 577496.16 | 0.00 | N&W WC 14.75 20660 |
| 232 | 399517.95 | 577452.38 | 0.00 | N&W NO WRITING |
| 233 | 399518.06 | 577456.30 | 0.00 | N&S 26958 |
| 234 | 399306.65 | 577454.47 | 0.00 | MAG |
| 235 | 399248.24 | 577458.90 | 0.00 | MAG |
| 236 | 399025.76 | 577451.39 | 0.00 | PK |
| 237 | 398845.93 | 577454.23 | 0.00 | N&S 12346 |
| 238 | 398820.97 | 577429.26 | 0.00 | N&S 12346 |
| 239 | 398390.33 | 577463.82 | 0.00 | MONUMENT STEM |
| 240 | 398240.37 | 577445.77 | 0.00 | N&S 36062 |
| 241 | 398016.63 | 577450.14 | 0.00 | YELLOW 1IN CAP 14112 |
| 242 | 397926.06 | 577444.91 | 0.00 | N&S 36062 |
| 243 | 397919.98 | 577409.58 | 0.00 | N&S 36062 |
| 244 | 398843.23 | 577451.34 | 0.00 | CH+ |
| 245 | 397231.69 | 577449.84 | 0.00 | CH+ |
| 246 | 397231.12 | 577441.86 | 0.00 | CH+ |
| 247 | 397222.78 | 577441.04 | 0.00 | MAG |
| 248 | 398830.92 | 577488.35 | 0.00 | RANGE POINT BROKEN STONE |
| 249 | 398398.07 | 577453.17 | 0.00 | CH+ MALTESE |
| 250 | 399337.91 | 577450.56 | 0.00 | P&C YELLOW PLS 15321 |
| 251 | 399302.52 | 577415.26 | 0.00 | P&C YELLOW PLS 15321 |
| 252 | 397481.61 | 577496.78 | 0.00 | CH+ |
| 253 | 400134.00 | 577262.94 | 0.00 | CH+ |
| 254 | 400431.68 | 576964.89 | 0.00 | P&C RED PLS 26958 |
| 255 | 400409.84 | 576873.86 | 0.00 | P&C ORANGE PLS 9489 |
| 256 | 400491.12 | 576899.86 | 0.00 | CH+ |
| 257 | 397902.67 | 577412.78 | 0.00 | RP 3.25 IN AL CAP TO GRADE PLS 17488 |
| 258 | 397871.08 | 577351.69 | 0.00 | RP 3.25 IN AL CAP TO GRADE PLS 17488 |
| 1118 | 399474.08 | 577456.34 | 5231.18 | N&S 26958 |
| 1170 | 399446.23 | 577456.32 | 5231.70 | N&S 26958 |
| 2549 | 398502.29 | 577450.77 | 5240.31 | RANGE POINT 2.5IN ALUM CAP PLS 38073 W/ CENTER PUNCH |
| 20497 | 400134.16 | 577263.02 | 5223.47 | CH+ |

NOTE

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BENCHMARK

CCD BM 371, A BRASS CAP AT THE SE CORNER OF DOWNING ST. AND 24TH AVE., ELEVATION 5252.14'.

PROJECT MAPPING PROJECTION:

TRANSVERSE MERCATOR ZONE: CCD_LOCAL
DATUM: NAD83-1992
CENTRAL POINT FALSE NORTHING = 400000.0000
CENTRAL POINT FALSE EASTING = 600000.0000
LATITUDE OF ORIGIN = N39°45'19.00000"
CENTRAL MERIDIAN = W104°53'53.00000"
ZONE WIDTH = 6°0'00.0"
SCALE FACTOR AT ORIGIN = 1.00025403000
UNITS ARE US SURVEY FEET.

LEGEND:

- SURVEY MONUMENT (SEE POINT LIST)
- RANGE POINT (SEE POINT LIST)
- CHISELED "+"
- FOUND POINT AS DESCRIBED (SEE POINT LIST)
- LAND LINE
- RANGE LINE
- R.O.W. LINE
- IMPROVEMENTS

| NO. | DESCRIPTION OF REVISIONS | DATE | BY |
|---|---|---|---|
| | | | |

CALL UNCC TWO WORKING DAYS BEFORE YOU DIG 1-800-922-1987 UNITED NOTIFICATION CENTER OF COLORADO

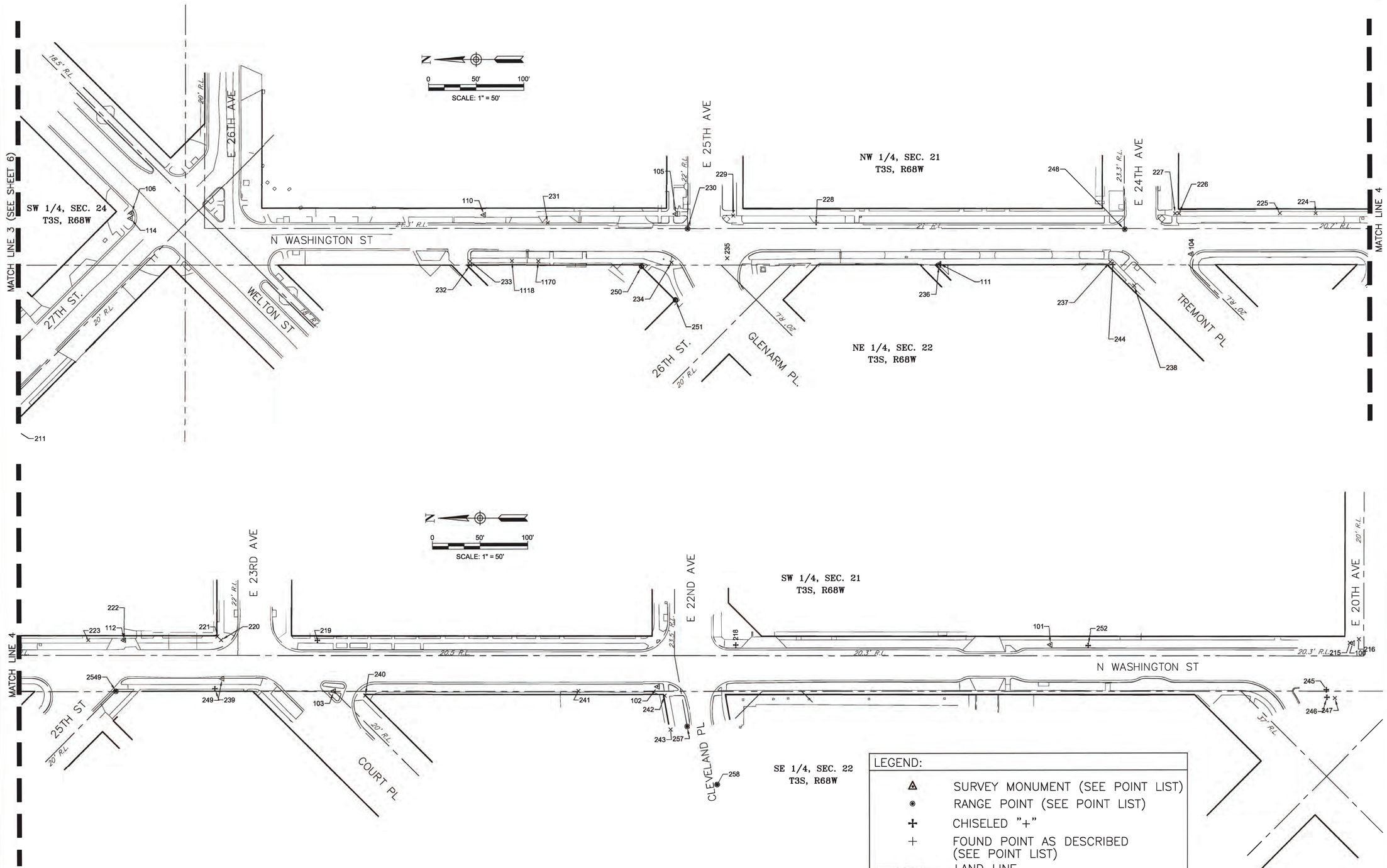
CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
CITY SURVEYOR'S OFFICE
201 WEST COLFAX AVE. DENVER, CO 80202

27TH STREET STORM INTERCEPTOR
PWWW2017-012
PRO TRACKING NO.
PROJECT MASTER NO. 2017-PROJMSTR-0000343

LAND SURVEY CONTROL DIAGRAM

DESIGNED BY: JL
APPROVED BY: WLR
CONTRACT NUMBER: XXXXXX
DENVER PCO NUMBER: 2011-XXXX-XX
DATE: 10/10/2017
SHEET NO.: 5

# SURVEY CONTROL DIAGRAM




| NO. | DESCRIPTION OF REVISIONS | DATE | BY |
|---|---|---|---|
| | | | |

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27TH STREET STORM INTERCEPTOR
PWWW2017-012
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LAND SURVEY CONTROL DIAGRAM

DESIGNED BY: JL
APPROVED BY: WLR
CONTRACT NUMBER: XXXXXX
DENVER PCO NUMBER: 2011-XXXX-XX
DATE: 10/10/2017
SHEET NO.: 6

REVEGETATION NOTES

1. VEGETATION REPLACED AT INTERSECTIONS MUST COMPLY WITH SIGHT TRIANGLE. SHRUBS THAT EXCEED 30" IN HEIGHT AT MATURITY ARE NOT ALLOWED.

FORESTRY NOTES

1. EXISTING TREES TO BE PRESERVED IN PUBLIC RIGHT OF WAY SHALL BE PROTECTED PER FORESTRY STANDARDS AND PRACTICES. TREE PROTECTION SHALL INSTALLED PRIOR TO ISSUE OF DEMOLITION PERMIT, APPROVED BY FORESTRY, AND SHALL REMAIN IN PLACE THROUGHOUT CONSTRUCTION. NO CONSTRUCTION ACTIVITIES OR STORAGE OF MATERIALS SHALL TAKE PLACE WITHIN TREE PROTECTION ZONES WITHOUT PRIOR WRITTEN AUTHORIZATION FROM THE OFFICE OF THE CITY FORESTER.

2. CONTRACTOR SHALL VERIFY FINAL BOUNDARIES OF TREE PROTECTION ZONE WITH FORESTRY STAFF PRIOR TO COMMENCEMENT OF CONSTRUCTION/DEMOLITION ACTIVITIES.

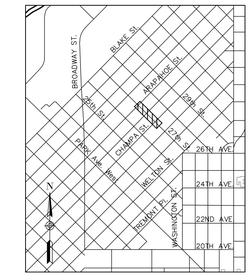
UTILITY NOTES

1. SEE UTILITY PLAN FOR REMOVALS, RESETS, RELOCATIONS, AND ADJUSTMENTS OF UTILITIES BY UTILITY OWNERS.

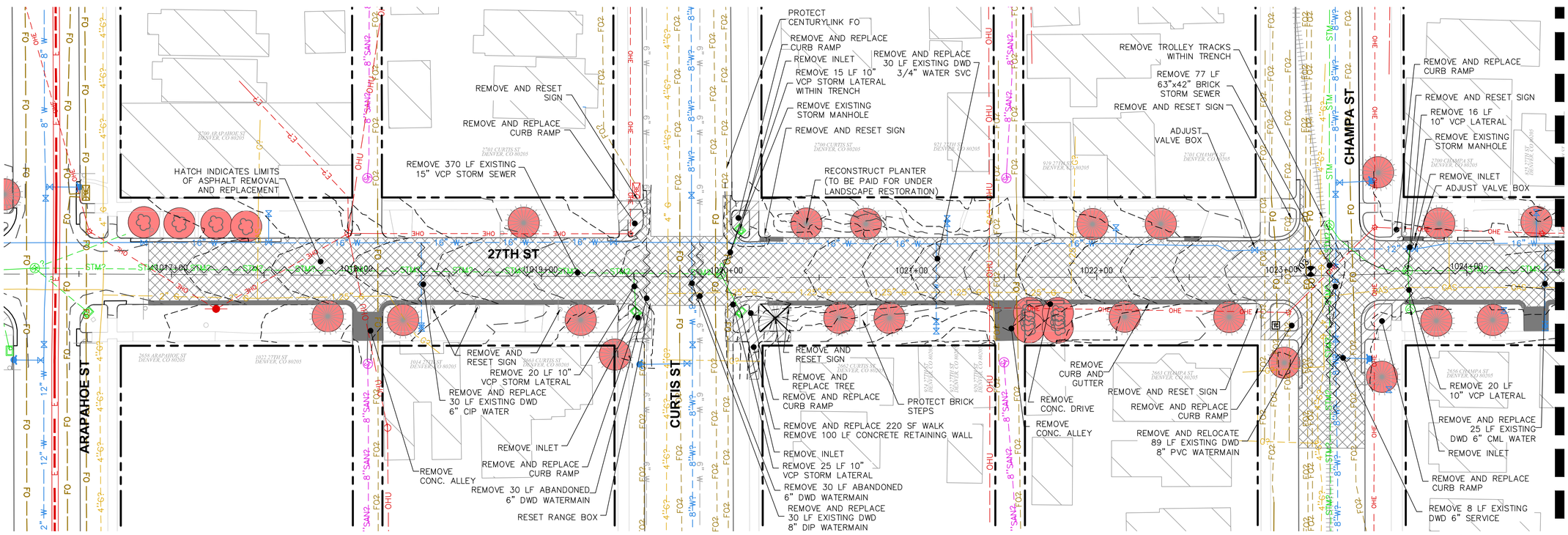
2. SEE DENVER WATER DISTRIBUTION WATER PLANS FOR ALL WATER LINE WORK.

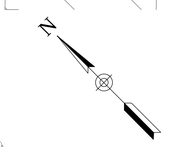
LEGEND

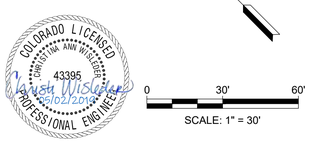
- PROTECT EX. ROW TREES PER FORESTRY STANDARDS & SPECIFICATIONS
- REMOVE AND REPLACE EXISTING ASPHALT PAVEMENT (FULL DEPTH)
- REMOVE AND REPLACE EXISTING CONCRETE OR FLATWORK
- REMOVE AND REPLACE CURB RAMP/SIDEWALK
- EXISTING BUILDING
- REMOVE OR REMOVE/REPLACE PIPE




KEY MAP
SCALE: 1"=2000'




0 30' 60'
SCALE: 1" = 30'

MERRICK®
5970 GREENWOOD PLAZA BLVD
GREENWOOD VILLAGE, CO 80111

| NO. | DESCRIPTION OF REVISIONS | DATE | BY |
|---|---|---|---|
| | | | |

CALL UNCC
TWO WORKING DAYS
BEFORE YOU DIG
1-800-922-1987
UTILITY NOTIFICATION CENTER OF COLORADO

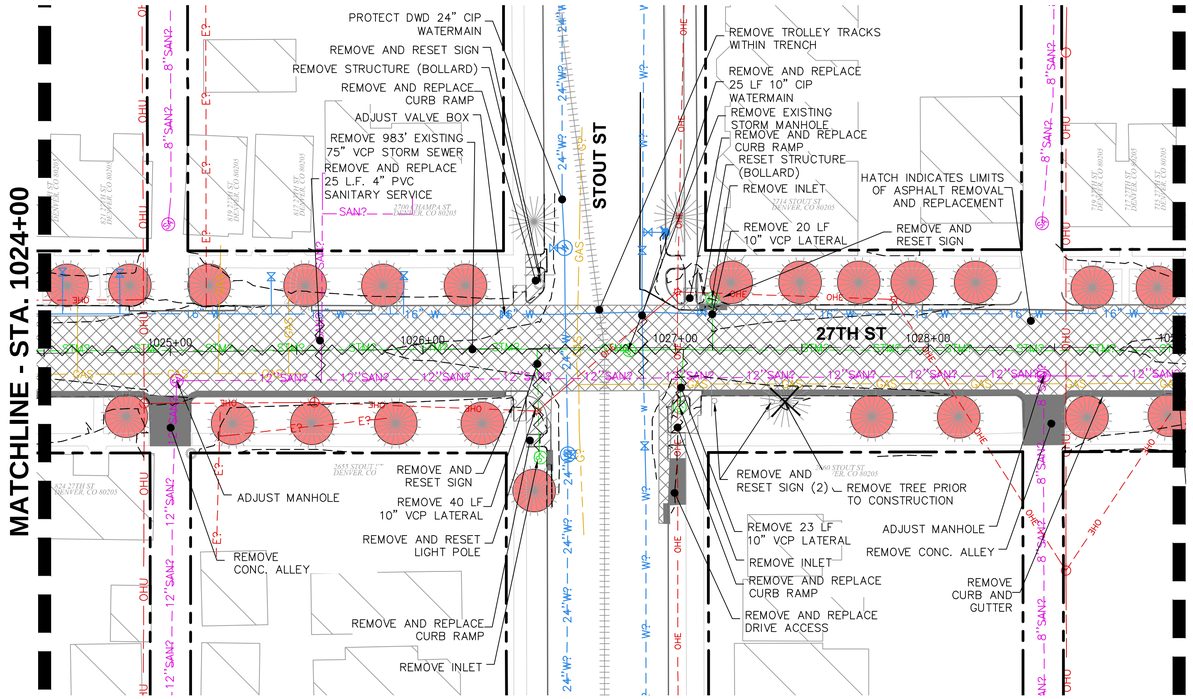

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
CAPITAL PROJECTS MANAGEMENT
2000 W. 3RD AVE. DENVER, CO 80223
TEL.: (303) 446-3617 FAX: (303) 446-3647

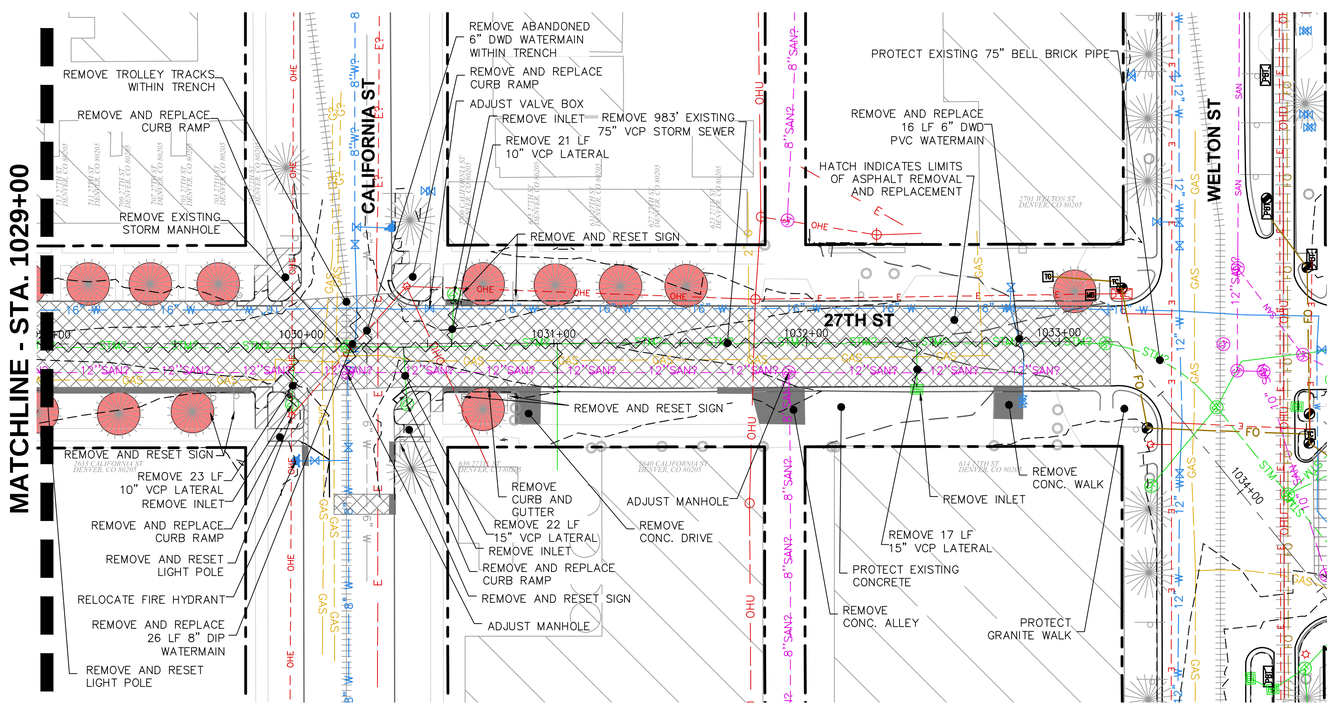

27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343
DEMOLITION AND SURFACE RESTORATION PLAN

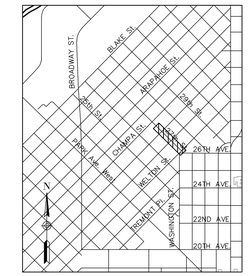
DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-DEMO2.dwg
DATE: APRIL 16, 2019
SHEET NO.: 7

PLOT DATE: May 2, 2019

\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-DEMO2.DWG




KEY MAP
SCALE: 1"=2000'

REVEGETATION NOTES

1. VEGETATION REPLACED AT INTERSECTIONS MUST COMPLY WITH SIGHT TRIANGLE. SHRUBS THAT EXCEED 30" IN HEIGHT AT MATURITY ARE NOT ALLOWED.

FORESTRY NOTES

1. EXISTING TREES TO BE PRESERVED IN PUBLIC RIGHT OF WAY SHALL BE PROTECTED PER FORESTRY STANDARDS AND PRACTICES. TREE PROTECTION SHALL INSTALLED PRIOR TO ISSUE OF DEMOLITION PERMIT, APPROVED BY FORESTRY, AND SHALL REMAIN IN PLACE THROUGHOUT CONSTRUCTION. NO CONSTRUCTION ACTIVITIES OR STORAGE OF MATERIALS SHALL TAKE PLACE WITHIN TREE PROTECTION ZONES WITHOUT PRIOR WRITTEN AUTHORIZATION FROM THE OFFICE OF THE CITY FORESTER.

2. CONTRACTOR SHALL VERIFY FINAL BOUNDARIES OF TREE PROTECTION ZONE WITH FORESTRY STAFF PRIOR TO COMMENCEMENT OF CONSTRUCTION/DEMOLITION ACTIVITIES.

LEGEND

- PROTECT EX. ROW TREES PER FORESTRY STANDARDS & SPECIFICATIONS
- REMOVE AND REPLACE EXISTING ASPHALT PAVEMENT (FULL DEPTH)
- REMOVE AND REPLACE EXISTING CONCRETE OR FLATWORK
- REMOVE AND REPLACE CURB RAMP/SIDEWALK
- EXISTING BUILDING
- REMOVE OR REMOVE/REPLACE PIPE

UTILITY NOTES

1. SEE UTILITY PLAN FOR REMOVALS, RESETS, RELOCATIONS, AND ADJUSTMENTS OF UTILITIES BY UTILITY OWNERS.

2. SEE DENVER WATER DISTRIBUTION WATER PLANS FOR ALL WATER LINE WORK.

COLORADO LICENSED 43395 PROFESSIONAL ENGINEER
10/02/2019

0 30' 60'
SCALE: 1" = 30'

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GREENWOOD VILLAGE, CO 80111

| NO. | DESCRIPTION OF REVISIONS | DATE | BY |
|---|---|---|---|
| | | | |

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UTILITY NOTIFICATION CENTER OF COLORADO

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
CAPITAL PROJECTS MANAGEMENT
2000 W. 3RD AVE. DENVER, CO 80223
TEL.: (303) 446-3617 FAX: (303) 446-3647

27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

DEMOLITION AND SURFACE RESTORATION PLAN

DRAWN BY: MMILLER/AWOLFF
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DRAWING NAME: 9412-DEMO2.dwg
DATE: APRIL 16, 2019
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\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-DEMO2.DWG

## UTILITY LEGEND

### QUALITY LEVEL D UTILITIES (QL D)

| | |
|---|---|
| FO? | EXISTING FIBER OPTIC LINE |
| G? | EXISTING GAS LINE |
| E? | EXISTING ELECTRIC LINE |
| 8"W? | EXISTING WATER LINE |
| SA | EXISTING SANITARY SEWER MANHOLE |
| ST | EXISTING STORM SEWER MANHOLE |
| | EXISTING STORM INLET |
| FBE | EXISTING FIBER OPTIC BOX |
| E | EXISTING ELECTRIC BOX |

### QUALTIY LEVEL C UTILITIES (QL C)

| | |
|---|---|
| 8"SAN? | EXISTING SANITARY SEWER |
| STM? | EXISTING STORM SEWER |
| OHE | EXISTING OVERHEAD ELECTRIC |
| | EXISTING LIGHT POLE |
| | EXISTING FIRE HYDRANT |
| | EXISTING WATER VALVE |

### QUALTIY LEVEL B UTILITIES (QL B)

| | |
|---|---|
| 16" W | EXISTING WATER LINE |
| 2" G | EXISTING GAS LINE |
| E | EXISTING UNDERGROUND ELECTRIC LINE |
| FO | EXISTING FIBER OPTIC LINE |

### QUALTIY LEVEL A UTILITIES (QL A)

| | |
|---|---|
| | UTILITY TEST HOLE |

## UTILITIES NOTES:

1. UTILITY LINES AS SHOWN ON THE PLANS ARE PLOTTED FROM THE BEST AVAILABLE INFORMATION. SUBSECTION 105.10 OF THE CDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, 2017 (AS REVISED) SHALL APPLY FOR THIS CONTRACT.

2. THE INFORMATION SHOWN ON THESE PLANS CONCERNING TYPE AND LOCATION OF UTILITIES IS NOT GUARANTEED TO BE ACCURATE OR ALL INCLUSIVE. SERVICES TO INDIVIDUAL RESIDENCES, PLACES OF BUSINESS, AND OTHER PRIVATELY-OWNED UTILITY LINES ARE NORMALLY NOT SHOWN ON THE DRAWINGS. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY ALL LOCATIONS OF EXISTING STRUCTURES AND UTILITIES SHOWN ON THE DRAWINGS AND TO ASCERTAIN WHETHER ANY OTHER STRUCTURES AND UTILITIES MAY EXIST. EVERY REASONABLE MEANS SHALL BE USED, INCLUDING FIELD LOCATION OF THE UTILITY. THE CONTRACTOR ASSUMES RESPONSIBILITY FOR THE PROTECTION OF ALL UTILITIES DURING THE WORK. REPAIR OF DAMAGE TO EXISTING UTILITIES DURING CONSTRUCTION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. PRIOR TO ANY EXCAVATION, CONTACT THE UTILITY NOTIFICATION CENTER OF COLORADO (UNCC) AT: 1 (800) 922-1987 AT LEAST TWO WORKING DAYS PRIOR TO DIGGING.

3. THE CONTRACTOR SHALL VERIFY AND DOCUMENT THE CONDITION OF EXISTING UTILITIES (VISIBLE FACILITIES) WITH THE ENGINEER AND REPRESENTATIVES FROM THE UTILITY COMPANIES PRIOR TO COMMENCEMENT OF CONSTRUCTION.

4. IT IS SUGGESTED THAT THE CONTRACTOR INITIATE A REQUEST TO XCEL ENERGY FOR ANY CONSTRUCTION-RELATED TEMPORARY ELECTRICAL POWER SOURCES AS SOON AS POSSIBLE. IN SOME INSTANCES UP TO 30 DAYS MAY BE REQUIRED TO PROVIDE THE SOURCES.

## DISCLAIMER REGARDING UNDERGROUND UTILITIES:

EXISTING UTILITIES ARE DEPICTED IN THIS REPORT AND IN ACCORDANCE WITH THE ACHIEVED "QUALITY LEVELS" FOR EACH UTILITY AS DEFINED IN THE AMERICAN SOCIETY OF CIVIL ENGINEERS' DOCUMENT ASCE 38" STANDARD GUIDELINE FOR THE COLLECTION AND DEPICTION OF EXISTING SUBSURFACE UTILITY DATA" AND AS REQUIRED BY C.R.S. 9-1.5-101 ET. SEQ.

AS IT APPLIES TO THE DEPICTION OF EXISTING UNDERGROUND UTILITY INFORMATION, THE STAMP AND SEAL ON THIS UTILITY PLAN REFLECT ONLY THAT DEPICTION OF THE EXISTING UNDERGROUND UTILITY MEETS THE NOTED ASCE 38 QUALITY LEVEL, AND DOES NOT SERVE AS A GUARANTY, REPRESENTATION, OR WARRANTY THAT THE DEPICTED UTILITIES EXIST IN THE NOTED LOCATIONS.

RELIANCE UPON THIS DATA FOR RISK MANAGEMENT PURPOSES DURING BIDDING DOES NOT RELIEVE THE EXCAVATOR OR UTILITY OWNER FROM FOLLOWING ALL APPLICABLE UTILITY DAMAGE PREVENTION STATUTES, POLICIES, AND/OR PROCEDURES DURING EXCAVATION. IT IS IMPORTANT THAT THE CONTRACTOR INVESTIGATES AND UNDERSTAND THE SCOPE OF WORK AND CONSULTS WITH THAT PROJECT OWNER AND THE ENGINEER REGARDING THE SCOPE AND LIMITS OF THE INVESTIGATIONS LEADING TO THESE UTILITY DEPICTIONS.

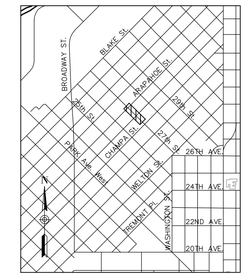
## UTILITY QUALITY LEVEL DESCRIPTIONS:

QUALITY LEVEL A: PRECISE HORIZONTAL AND VERTICAL LOCATION OF UTILITIES OBTAINED BY THE ACTUAL EXPOSURE (OR VERIFICATION OF PREVIOUSLY EXPOSED AND SURVEYED UTILITIES) AND SUBSEQUENT MEASUREMENT OF SUBSURFACE UTILITIES, USUALLY AT A SPECIFIC POINT. MINIMALLY INTRUSIVE EXCAVATION EQUIPMENT IS TYPICALLY USED TO MINIMIZE THE POTENTIAL FOR UTILITY DAMAGE. A PRECISE HORIZONTAL AND VERTICAL LOCATION, AS WELL AS OTHER UTILITY ATTRIBUTES, IS SHOWN PLAN DOCUMENTS. ACCURACY IS USUALLY SET TO 15-MM VERTICAL AND TO APPLICABLE HORIZONTAL SURVEY AND MAPPING ACCURACY AS DEFINED OR EXPECTED BY THE PROJECT OWNER.

QUALITY LEVEL B: INFORMATION OBTAINED THROUGH THE APPLICATION OF APPROPRIATE SURFACE GEOPHYSICAL METHODS TO DETERMINE THE EXISTENCE AND APPROXIMATE HORIZONTAL POSITION OF SUBSURFACE UTILITIES. QUALITY LEVEL B DATA SHOULD BE REPRODUCIBLE BY SURFACE GEOPHYSICS AT ANY POINT OF THEIR DEPICTION. THIS INFORMATION IS SURVEYED TO APPLICABLE TOLERANCES DEFINED BY THE PROJECT AND REDUCED ONTO PLAN DOCUMENTS.

QUALITY LEVEL C: INFORMATION OBTAINED BY SURVEYING AND PLOTTING VISIBLE ABOVE-GROUND UTILITY FEATURES AND BY USING PROFESSIONAL JUDGMENT IN CORRELATING THIS INFORMATION TO QUALITY LEVEL D INFORMATION.

QUALITY LEVEL D: INFORMATION DERIVED FROM EXISTING RECORDS OR ORAL RECOLLECTIONS.




## KEY MAP

SCALE: 1"=2000'

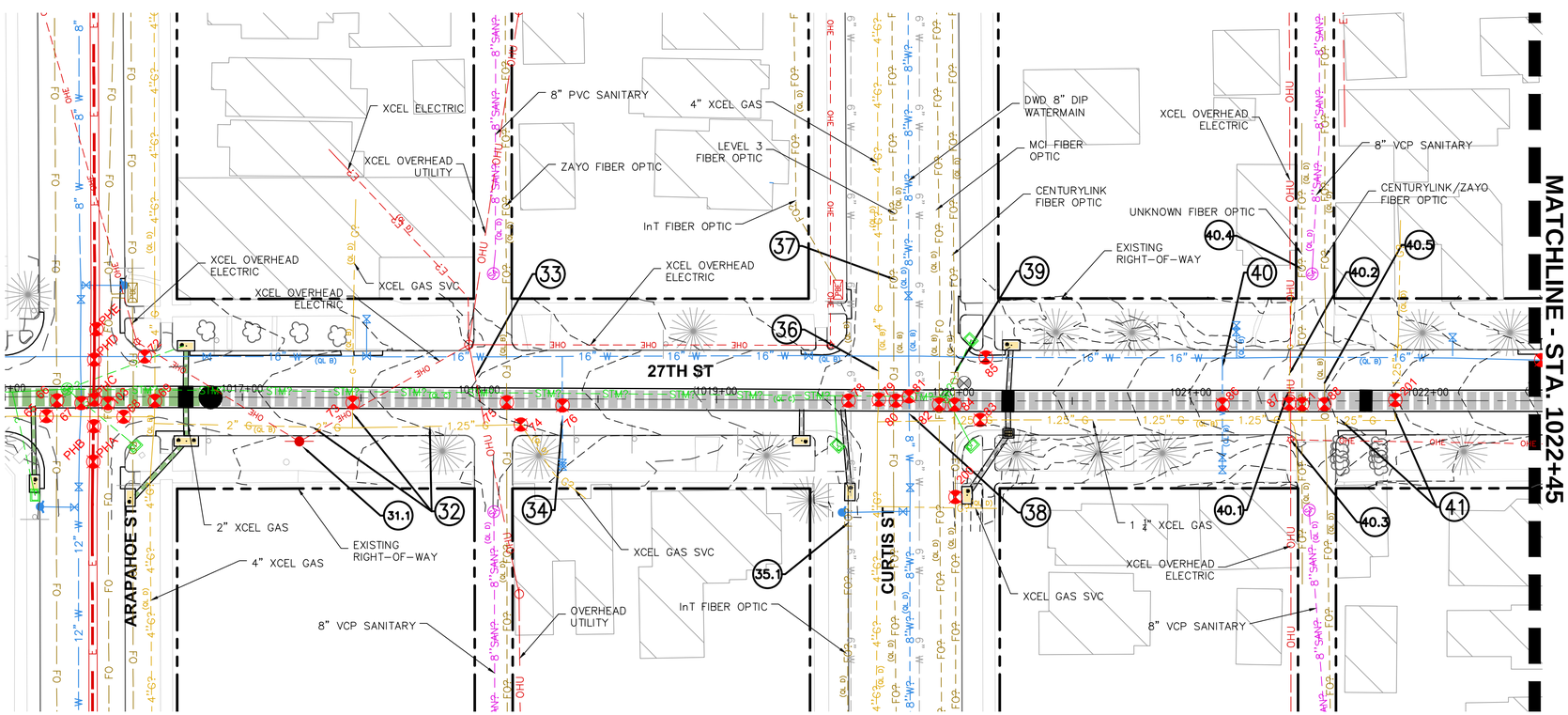
| Pothole # | Utility | Description | Station | Depth to TOP (ft) | TOP Elev (ft) | Comments |
|---|---|---|---|---|---|---|
| 1 | Unknown | 6" Steel FO | 1021+46.75 | 11.45 | 5203.94 | WMD Potholed. Owner Unknown. To be Relocated. |
| 73 | Xcel | 2" Gas | 1017+46.46 | 2.90 | 5203.82 | |
| 74 | Xcel | 3/4" Gas | 1018+17.42 | 2.93 | 5205.09 | |
| 75 | INT (Zayo) | FO | 1018+11.46 | 2.90 | 5205.52 | 4 - 2" Conduits |
| 76 | Denver Water | 2" Water service | 1018+34.94 | 4.20 | 5204.59 | |
| 78 | INT | 2" FO | 1019+55.51 | 2.55 | 5208.74 | |
| 79 | Xcel | 4" Gas | 1019+68.31 | 2.60 | 5208.97 | |
| 80 | Level 3 | FO | 1019+75.57 | 9.85 | 5201.75 | 3 - 2" Conduits |
| 81 | Denver Water | 8" Pipe | 1019+81.10 | 4.35 | 5207.43 | Top of Concrete Cap |
| 82 | MCI | FO | 1019+93.78 | 1.03 | 5206.43 | 5210.68 Top of Concrete Cap. WMD Exposed Utility. Found Bottom at 5204.72 |
| 83 | Xcel | 1-1/4" Gas | 1020+11.10 | 2.00 | 5208.99 | |
| 84 | CenturyLink | FO | 1020+00.30 | 5.70 | 5206.32 | Top of Concrete Cap. WMD Exposed Uitlity. Found Bottom of Fiber at 5203.82 |
| 85 | Denver Water | 16" Pipe | 1020+13.35 | 2.90 | 5208.67 | |
| 86 | Denver Water | 1" service | 1021+13.24 | 3.80 | 5210.92 | |
| 87 | Xcel | 2" Gas | 1021+41.35 | 3.25 | 5212.27 | |
| 88 | CenturyLink/ Zayo | FO | 1021+56.27 | 2.50 | 5208.40 | 5213.58 Top of Concrete Cap. WMD Exposed Utility. Found Bottom at 5206.90 |
| 200 | CenturyLink | FO | 1020+00.00 | 2.90 | 5208.10 | |
| 201 | Xcel | 1-1/4" Gas | 1021+85.50 | 2.80 | 5214.15 | |

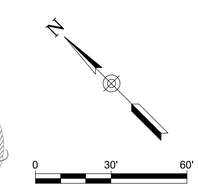
## KEY NOTES

31.1. REMOVE AND RESET UTILITY POLE (BY XCEL)
32. RELOCATE GAS (BY XCEL)
33. RAISE OVERHEAD CABLE LINE (BY COMCAST, TEMPORARY)
34. REMOVE AND REPLACE DWD 2" SVC
35.1. RELOCATE FIBER OPTIC (BY InT)
36. PROTECT 4" GAS (BY XCEL)
37. RAISE OR LOWER FIBER OPTIC (BY LEVEL 3)
38. REMOVE AND REPLACE DWD 8" DIP WATERMAIN
39. PROTECT FIBER OPTIC (BY CENTURYLINK)
40. REMOVE AND REPLACE DWD 1" SVC
40.1. RAISE OVERHEAD CABLE LINE (BY COMCAST, TEMPORARY)
40.2. REMOVE AND REPLACE GAS SVC (BY XCEL)
40.3. REMOVE AND RESET LIGHT (BY XCEL)
40.4. RELOCATE FIBER OPTIC (UNKNOWN)
40.5. PROTECT FIBER OPTIC (CENTURLINK)
41. RELOCATE 1 ¼" GAS (BY XCEL)

## GENERAL NOTES

1. SEE DENVER WATER DISTRIBUTION WATER PLANS FOR ALL WATER LINE WORK.
2. POTHOLE NUMBER / POTHOLE LOCATION — MEASURE DOWN NUMBER / MEASURE DOWN LOCATION
   SEE POTHOLE TABULATION FOR UTILITY OWNER, FACILITY DESCRIPTION AND DEPTH TO UTILITY.
3. PROTECT ALL EXISTING UTILITIES NOT IDENTIFIED TO BE REMOVED, RESET, OR RELOCATED. PROTECT ALL UTILITIES THAT HAVE BEEN RESET OR RELOCATED.




COLORADO LICENSED PROFESSIONAL ENGINEER 43395 — 04/02/2019

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| NO. | DESCRIPTION OF REVISIONS | DATE | BY |
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| | | | |

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CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
CAPITAL PROJECTS MANAGEMENT
2000 W. 3RD AVE. DENVER, CO 80223
TEL.: (303) 446-3617 FAX: (303) 446-3647


27TH STREET STORM INTERCEPTOR PHASE 2

PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

UTILITY PLAN, STA. 1016+00 - STA. 1022+45

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-UT-PP02.dwg
DATE: APRIL 16, 2019
SHEET NO.: 9

PLOT DATE: May 2, 2019

\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-UT-PP02.DWG

# TRAFFIC FIBER OPTIC NOTES

A. THE CONTRACTOR SHALL PROVIDE LABOR, EQUIPMENT, AND MATERIALS FOR THE TEMPORARY RELOCATION OF THE CITY TRAFFIC FIBER OPTIC CABLE AS FOLLOWS:

1. TWO TEMPORARY UTILITY POLES SHALL BE PROVIDED – ONE ON EACH SIDE OF 27TH STREET ON THE NORTHWEST SIDE OF CHAMPA– CONNECTED BY A SPAN WIRE WITH D RINGS. REQUIRED POLE HEIGHT SHALL SUPPORT THE SPAN WIRE AT A HEIGHT EQUAL TO OR HIGHER THAN THE ELEVATION OF THE ADJACENT OVERHEAD POWER LINES

2. A NEW DENVER COMMUNICATIONS VAULT SHALL BE INSTALLED AT THE NORTHEAST CORNER OF 27TH STREET AND CHAMPA STREET ON THE EXISTING 3" CONDUIT. COORDINATE LOCATION WITH CCD PRIOR TO CONSTRUCTION. THE EXISTING 3" CONDUIT CONTAINS A SINGLE 72 STRAND FIBER OPTIC CABLE. THE 3" CONDUIT SHALL BE INTERCEPTED UTILIZING TWO 3" SPLIT DUCT SWEEPS THAT WILL BRING ACCESS TO THE CONDUIT INTO THE NEW VAULT FROM THE NORTHEAST AND SOUTHWEST. THE FIBER OPTIC CABLE SHALL NOT BE DAMAGED DURING THIS CONSTRUCTION PROCCESS. SLACK CABLE FROM THE OPPOSITE CORNER OF THE INTERSECTION WILL BE UTILIZIED TO ALLOW FOR THE SPLIT DUCT SWEEPS INSTALLATION AND THE NEW ACCESS VAULT.

3. INSTALL 2" CONDUITS FROM THE COMMUNICATIONS VAULT TO THE TEMPORARY WOOD POLE AT BOTH VAULTS. INSTALL VERTICAL RACEWAY FROM GROUND LEVEL UP THE SIDES OF EACH POLE ON EACH SIDE OF 27TH STREET. INSTALL THE 175' PIECE OF FIBER CABLE PROVIDED BY CCD FROM VAULT TO VAULT INSIDE THE VERTICAL RACEWAYS AND ACROSS THE TEMPORARY SPAN INSIDE THE D RINGS. NOTIFY DENVER OF COMPLETION OF THE TEMPORARY PATHWAY CONSTRUCTION AND CABLING. SPLICING WILL BE SCHEDULED BY DENVER FOLLOWING THE TEMPORARY PATHWAY AND CABLING CONSTRUCTION. DENVER WILL REMOVE THE UNDERGROUND FIBER CABLE FROM THE CONDUIT CROSSING THE STORM SEWER CONSTRUCTION ZONE.

4. UPON COMPLETION OF THE STORM SEWER THROUGH THE CHAMPA STREET INTERSECTION, THE CONTRACTOR SHALL RESTORE THE EXISTING 3" CONDUIT FROM VAULT TO VAULT, PROOF THE CONDUIT WITH AIR AND INSTALL PULL STRING FROM VAULT TO VAULT. NOTIFY CCD OF THE 3" UNDERGROUND CONDUIT RESTORATION AND DENVER WILL SCHEDULE THE UNDERGROUND CABLING RESTORATION.

5. UPON COMPLETION OF THE RESTORATION OF THE UNDERGROUND BACKBONE CABLE BY CCD CREWS, THE CONTRACTOR SHALL REMOVE ALL TEMPORARILY CABLES, CONDUITS, POLES, SPANWIRE, AND RELATED ITEMS AND RESTORE THE EXISTING SURFACE CONDITIONS.

6. THE FOLLOWING SHALL BE PROVIDED BY THE CCD:

   a. ONE NEW COMMUNICATIONS VAULT FOR THE NORTH CORNER.

   b. 175' FIBER OPTIC CABLE REQUIRED FOR THE TEMPORARY BYPASS LINE.

   c. REMOVAL OF UNDERGROUND FIBER CABLE ACROSS THE STORM SEWER CONSTRUCTION ZONE.

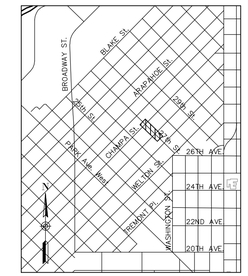
   d. TEMPORARY SPLICE AT BOTH VAULTS.

   e. RE–INSTALLATION OF UNDERGROUND FIBER CABLE AFTER ORIGINAL STORM SEWER CONSTRUCTION IS COMPLETE AND AFTER CCD'S 3" UNDERGROUND CONDUIT PATHWAY IS RESTORED TO ITS ORIGINAL CONDITION.

   f. RESTORATION SPLICE OF THE BACKBONE FIBER.

7. ALL WORK SHALL BE COORDINATED WITH CHAD TAVELLI, SR ENGINEERING ASSOCIATE, PHONE: 720.448.6700, EMAIL: chad.tavelli@denvergov.org

| Pothole # | Utility | Description | Station | Depth to TOP (ft) | TOP Elev (ft) | Comments |
|---|---|---|---|---|---|---|
| 3 | Unknown | FO | 1022+90.84 | - | - | No utility Found. WMD potholed to 20 |
| 5 | Unknown | 3" PVC FO | 1023+04.11 | | 5213.14 | WMD Potholed. Owner Unknown. |
| 89 | Xcel | 4" Gas | 1023+21.41 | 3.00 | 5218.13 | |
| 90 | Denver Water | 8" Pipe | 1023+28.85 | 4.37 | 5216.82 | Measure down at valve |
| 91 | | | | | | Not Potholed |
| 92 | Traffic | 3" FO | 1022+95.23 | 6.65 | 5213.98 | |
| 93 | CenturyLink | FO | 1023+03.10 | 3.15 | 5217.13 | Top of Concrete Cap |
| 94 | CenturyLink | FO | 1023+05.52 | 3.01 | 5217.48 | Top of Concrete Cap |
| 95 | Xcel | 4" Gas | 1023+11.86 | 2.95 | 5217.81 | |
| 96 | Denver Water | 8" Pipe | 1023+20.38 | 4.4 | 5216.31 | |
| 97 | CenturyLink | FO | 1023+30.23 | 2.55 | 5217.78 | Top of Concrete Cap |
| 98 | Xcel | 2" Gas | 1023+66.98 | 2.6 | 5218.1 | |
| 99 | CenturyLink | FO | 1023+31.19 | 1.7 | 5214.32 | 5219.37 Top of Concrete Cap. WMD Exposed Utility. Found Bottom at 5212.71 |
| 100 | Denver Water | 12" Pipe | 1023+69.72 | 3.08 | 5217.24 | Concrete Encountered |
| 101 | Xcel | 1" Gas service | 1023+90.47 | 2.05 | 5218.94 | |
| 102 | CenturyLink | FO | 1023+13.42 | 0.53 | 5213.24 | 5220.56 Top of Concrete Cap. WMD Exposed Utility. Found Bottom of 2 vertically stacked Duct Banks at 5210.40. |
| 103 | | | | | | |
| 105 | Traffic | 2" FO | 1022+96.93 | 4.5 | 5217.51 | WMD potholed seperately. Found Top of 3" steel pipe at 5212.45. |
| 106 | Water | 1" Water Service | 1024+42.05 | 4.45 | 5216.95 | |
| 107 | Xcel | 2" Gas service | 1024+63.17 | 2.93 | 5218.49 | |
| PH2 | Water | 24" Pipe | 1026+58.80 | 5.45 | 5216.74 | Does not meet Quality Level A |
| 109 | Xcel | 4" Gas | 1026+60.70 | 3.49 | 5219.27 | |
| 110 | Water | 8" Pipe | 1026+87.08 | 6.04 | 5216.52 | |
| 111 | Xcel | 4" Gas | 1027+02.60 | 2.05 | 5221.14 | |
| 112 | Water | 16" Pipe | 1027+16.18 | 4.12 | 5217.19 | |
| 202 | Water | 6" Pipe | 1022+51.15 | 4.30 | 5214.63 | |
| 203 | CeturyLink | FO | 1023+12.85 | 0.80 | 5219.69 | Top of Concrete Cap |
| 204 | CeturyLink | FO | 1023+15.20 | 0.90 | 5219.68 | Top of Concrete Cap |
| 205 | Xcel | 2" Gas | 1025+32.00 | 2.80 | 5218.90 | |
| 206 | Sanitary Sewer | | 1025+59.30 | 2.00 | 5219.88 | |
| 208 | Water | 24" Pipe | 1026+56.60 | 5.65 | 5216.81 | |




KEY MAP

SCALE: 1"=2000'

# KEY NOTES

42. RELOCATE OVERHEAD FROM 26TH ST JUNCTION BOX TO JUNCTION BOX ON NW CORNER OF INTERSECTION. CONTRACTOR TO PROVIDE SUPPORT POLES
42.1. REMOVE AND RESET LIGHT (BY XCEL)
42.2. PROTECT FIBER OPTIC
43. RELOCATE HYDRANT
43.1. RELOCATE 4" GAS (BY XCEL)
43.2. RELOCATE DWD 8" PVC WATERMAIN
44. PROTECT–IN–PLACE DWD 8" WATERMAIN
44.1 ABANDON BRICK STORM SEWER
45. PROTECT FIBER OPTIC (BY CENTURYLINK)
46. RELOCATE 1" GAS SVC (BY XCEL)
47. REMOVE AND REPLACE DWD 1" SVC
48. RELOCATE 2" GAS SVC (BY XCEL)
48.1. RELOCATE 2" GAS (BY XCEL)
49. RAISE OVERHEAD CABLE LINE (BY COMCAST, TEMPORARY)
50. RELOCATE 2" GAS SVC (BY XCEL)
50.1. REMOVE AND REPLACE 4" PVC SANITARY SVC.
50.2. LINE SANITARY SEWER (BY OTHERS)
51. EMPTY 24" WATER BY DENVER WATER. CONTRACTOR TO SUPPORT AND PROTECT IN PLACE. (WORK TO BE DONE DURING OCTOBER TO APRIL AFTER DENVER WATER BOARD HAS DRAINED THE LINE)
51.1. REMOVE AND RESET UTILITY POLE (BY XCEL)
52. PROTECT 4" GAS (BY XCEL)
53. REMOVE AND REPLACE DWD 8" WATERMAIN

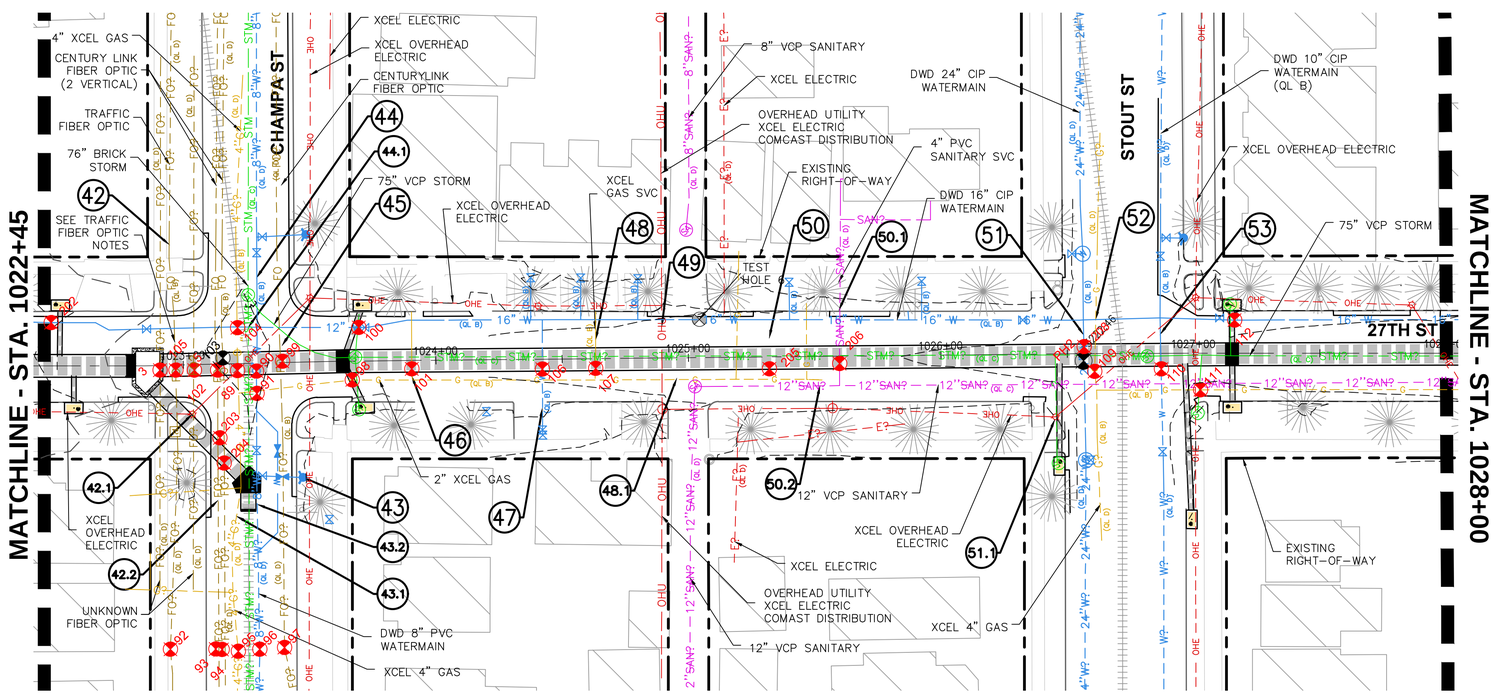
# GENERAL NOTES

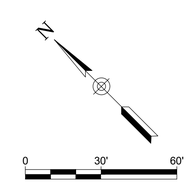
1. SEE DENVER WATER DISTRIBUTION WATER PLANS FOR ALL WATER LINE WORK.

2. POTHOLE NUMBER — POTHOLE LOCATION — MEASURE DOWN NUMBER — MEASURE DOWN LOCATION

   SEE POTHOLE TABULATION FOR UTILITY OWNER, FACILITY DESCRIPTION AND DEPTH TO UTILITY.

3. PROTECT ALL EXISTING UTILITIES NOT IDENTIFIED TO BE REMOVED, RESET, OR RELOCATED. PROTECT ALL UTILITIES THAT HAVE BEEN RESET OR RELOCATED.




COLORADO LICENSED CIVIL, STRUCTURAL AND MUNICIPAL PROFESSIONAL ENGINEER 43395 10/02/2019

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|---|---|---|---|
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CAPITAL PROJECTS MANAGEMENT
2000 W. 3RD AVE. DENVER, CO 80223
TEL.: (303) 446-3617 FAX: (303) 446-3647

27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

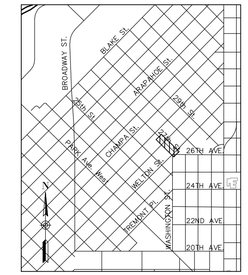
UTILITY PLAN, STA. 1022+45 - STA. 1028+00

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-UT-PP02.dwg
DATE: APRIL 16, 2019
SHEET NO.: 10

PLOT DATE: May 2, 2019

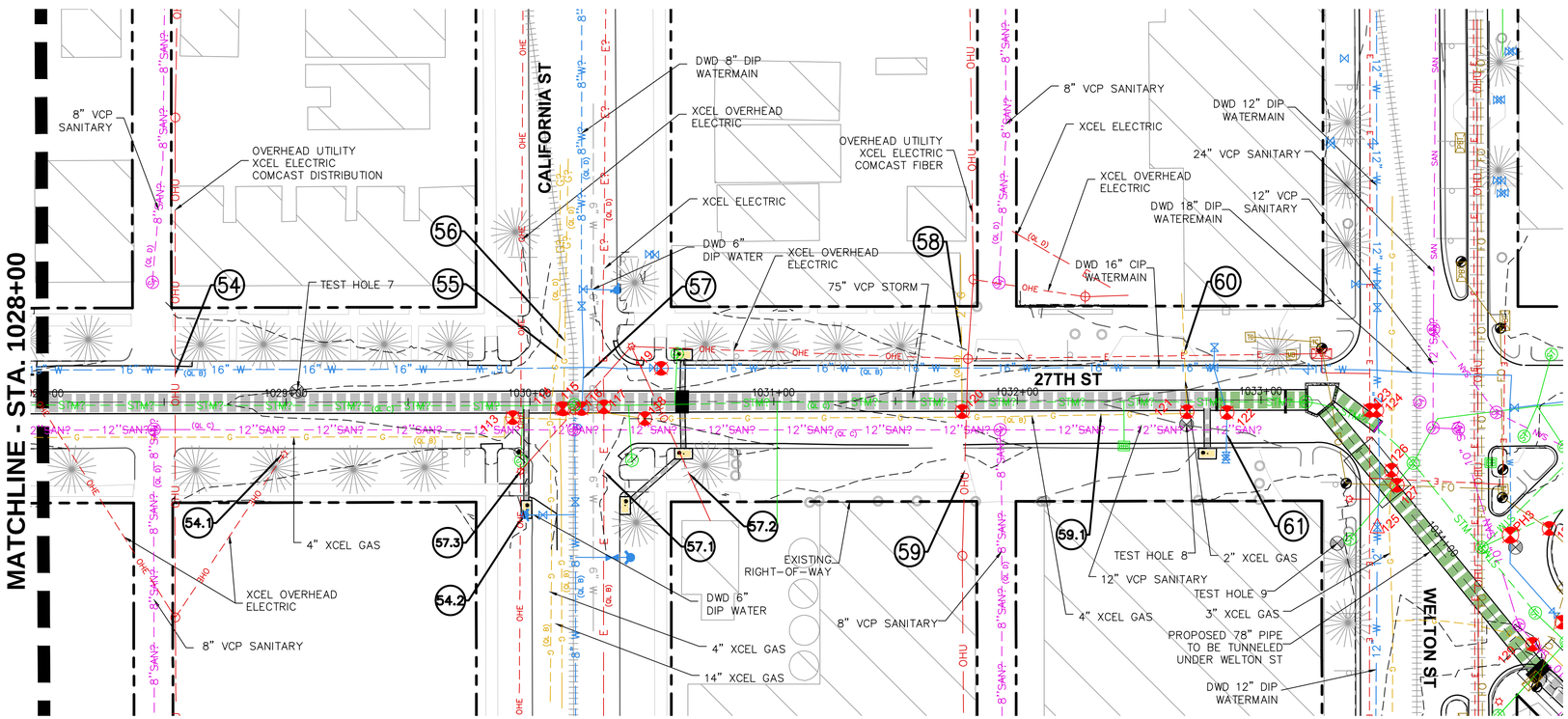
\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-UT-PP02.DWG

| Pothole # | Utility | Description | Station | Depth to TOP (ft) | TOP Elev (ft) | Comments |
|---|---|---|---|---|---|---|
| 113 | Xcel | 4" Gas | 1029+92.88 | 3.10 | 5220.31 | |
| 114 | Xcel | 14" Gas | 1030+12.95 | 3.37 | 5220.29 | |
| 115 | Xcel | 4" Gas | 1030+13.69 | 3.37 | 5220.29 | |
| 116 | Water | 8" Pipe | 1030+21.18 | 4.95 | 5218.89 | |
| 117 | Xcel | 6" Electric | 1030+30.28 | 7.81 | 5215.69 | |
| 118 | Xcel | 4" Gas | 1030+47.04 | 2.60 | 5220.51 | |
| 119 | Water | 16" Pipe | 1030+53.79 | 3.00 | 5219.78 | |
| 120 | Xcel | 2" Gas service | 1031+77.22 | 3.40 | 5222.00 | |
| 121 | Xcel | 2" Gas service | 1032+69.50 | 2.90 | 5222.38 | |
| 122 | Water | 1" Water Service | 1032+85.95 | 4.05 | 5221.40 | |
| 123 | Xcel | Electric | 1033+43.30 | 2.55 | 5223.29 | |




KEY MAP

SCALE: 1"=2000'




## KEY NOTES

54. RAISE OVERHEAD CABLE LINE (BY COMCAST, TEMPORARY)
54.1. REMOVE AND RESET LIGHT (BY XCEL)
54.2. RELOCATE HYDRANT
55. PROTECT 14" GAS
56. PROTECT 4" GAS
57. REMOVE AND REPLACE DWD 8" WATERMAIN
57.1. PROTECT ELECTRIC
57.2. RAISE OVERHEAD UTILITY (BY COMCAST, TEMPORARY)
57.3. REMOVE AND RESET UTILITY POLE (BY XCEL)
58. RELOCATE 2" GAS SVC (BY XCEL)
59. RAISE OVERHEAD CABLE LINE (BY COMCAST, TEMPORARY)
59.1. RELOCATE 4" GAS (BY XCEL)
60. RELOCATE 2" GAS SVC (BY XCEL)
61. REMOVE AND REPLACE DWD 1" SVC

## GENERAL NOTES

1. SEE DENVER WATER DISTRIBUTION WATER PLANS FOR ALL WATER LINE WORK.
2. POTHOLE NUMBER / POTHOLE LOCATION — MEASURE DOWN NUMBER / MEASURE DOWN LOCATION
   SEE POTHOLE TABULATION FOR UTILITY OWNER, FACILITY DESCRIPTION AND DEPTH TO UTILITY.
3. PROTECT ALL EXISTING UTILITIES NOT IDENTIFIED TO BE REMOVED, RESET, OR RELOCATED. PROTECT ALL UTILITIES THAT HAVE BEEN RESET OR RELOCATED.

N

0 30' 60'

SCALE: 1" = 30'

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4/16/2019

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27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343
UTILITY PLAN, STA. 1028+00 - STA. 1033+50

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-UT-PP02.dwg
DATE: APRIL 16, 2019
SHEET NO.: 11

PLOT DATE: May 2, 2019

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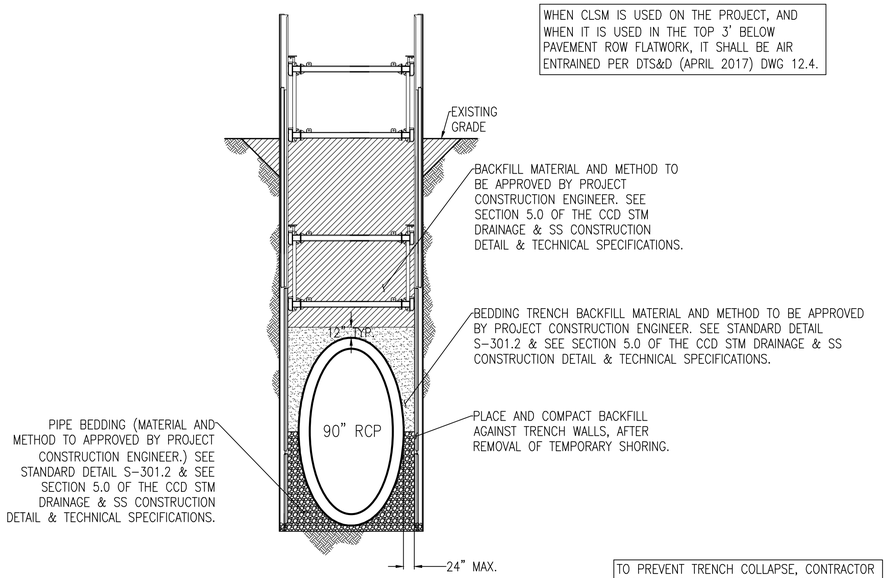
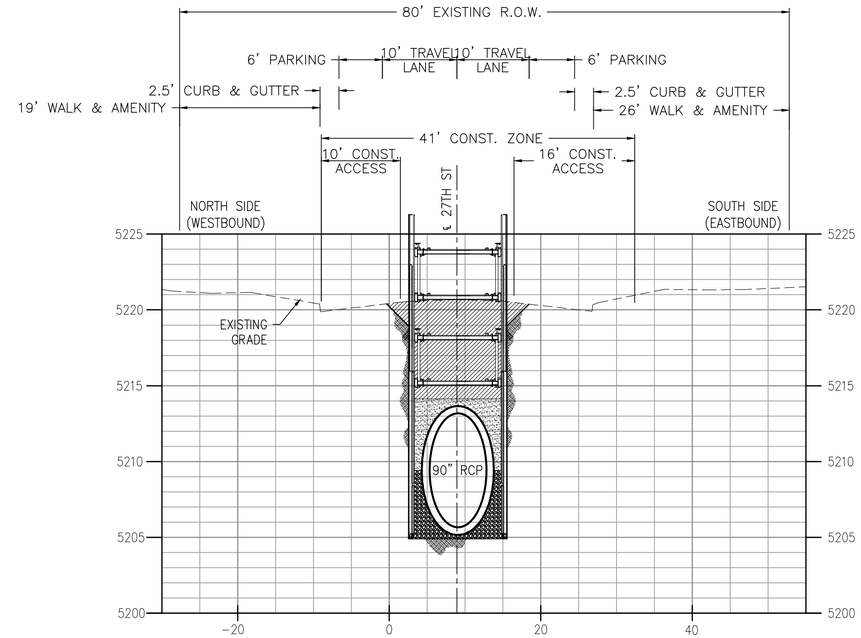


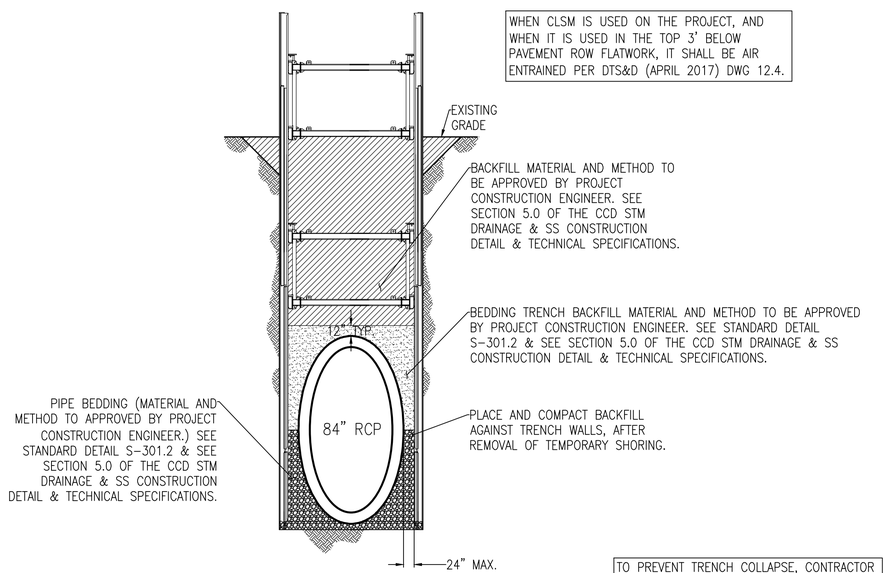

## TYPICAL TRENCH DETAIL FOR 90" RCP

NOT TO SCALE



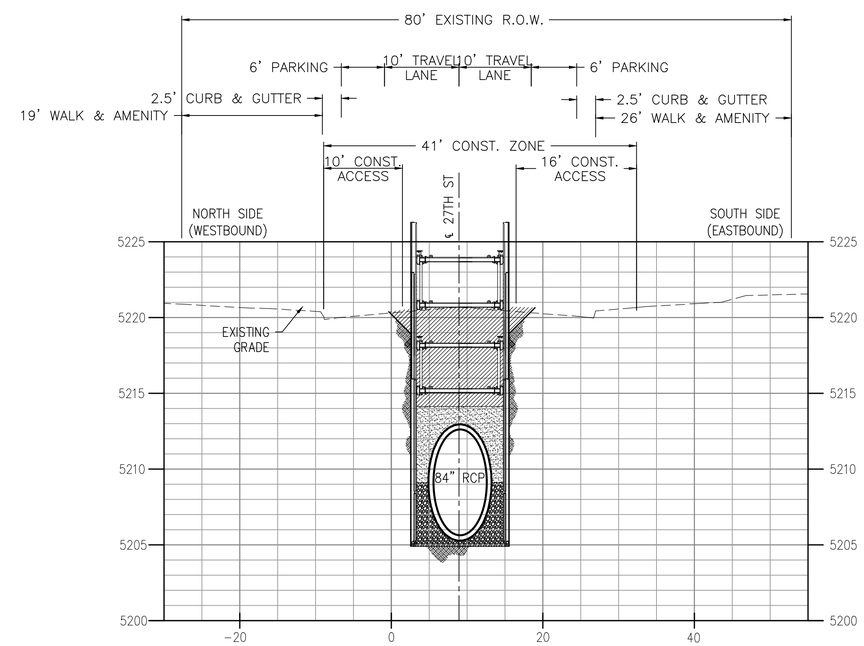

## TYPICAL SECTION 90" DIA. PIPE 27TH STREET

HOR. SCALE: 1"=10'
VERT. SCALE: 1"=5'




## TYPICAL TRENCH DETAIL FOR 84" RCP

NOT TO SCALE




## TYPICAL SECTION 84" DIA. PIPE 27TH STREET

HOR. SCALE: 1"=10'
VERT. SCALE: 1"=5'

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27TH STREET STORM INTERCEPTOR
PHASE 2

PRO TRACKING NO: PWWW2017-012
PROJECT MASTER NO: 2017-PROJMSTR-0000343

TYPICAL TRENCH DETAIL - 27TH STREET

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-DR-TYP02.dwg
DATE: APRIL 16, 2019
SHEET NO.: 12

PLOT DATE: May 2, 2019

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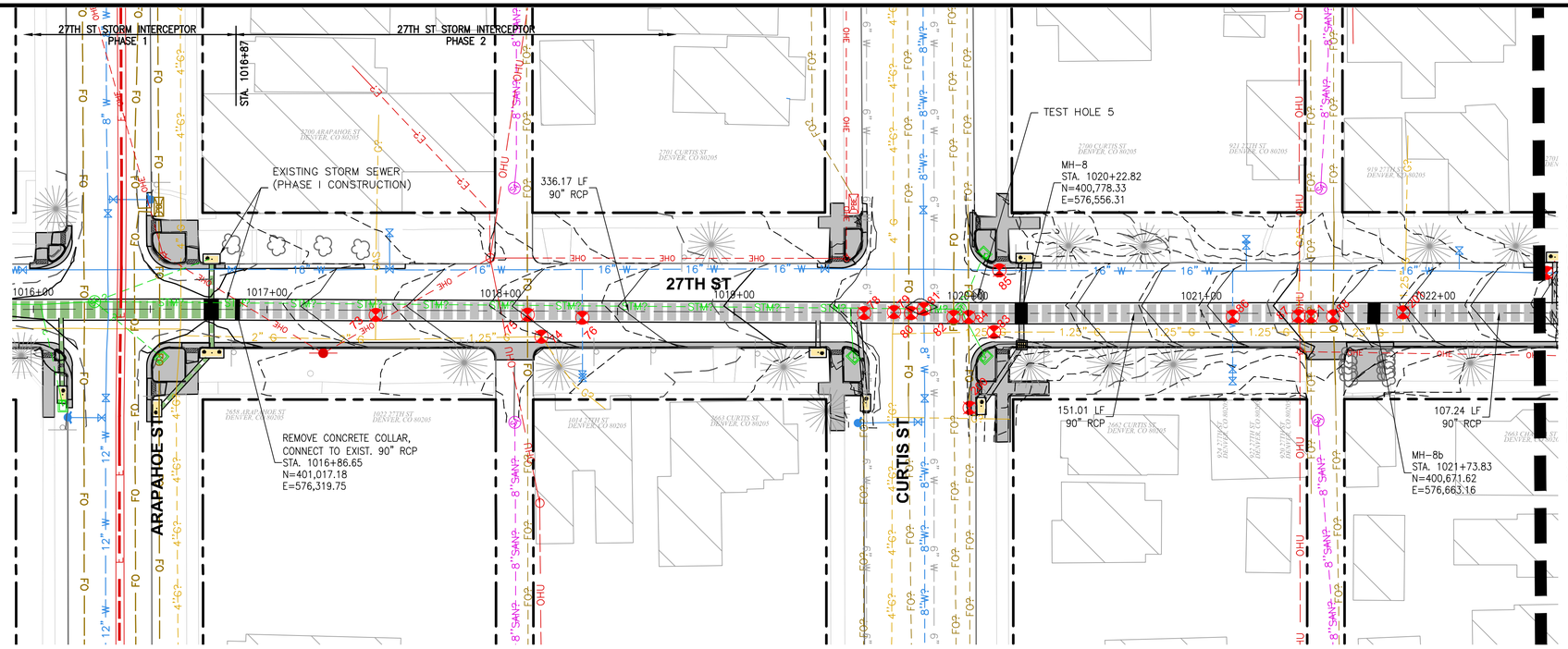
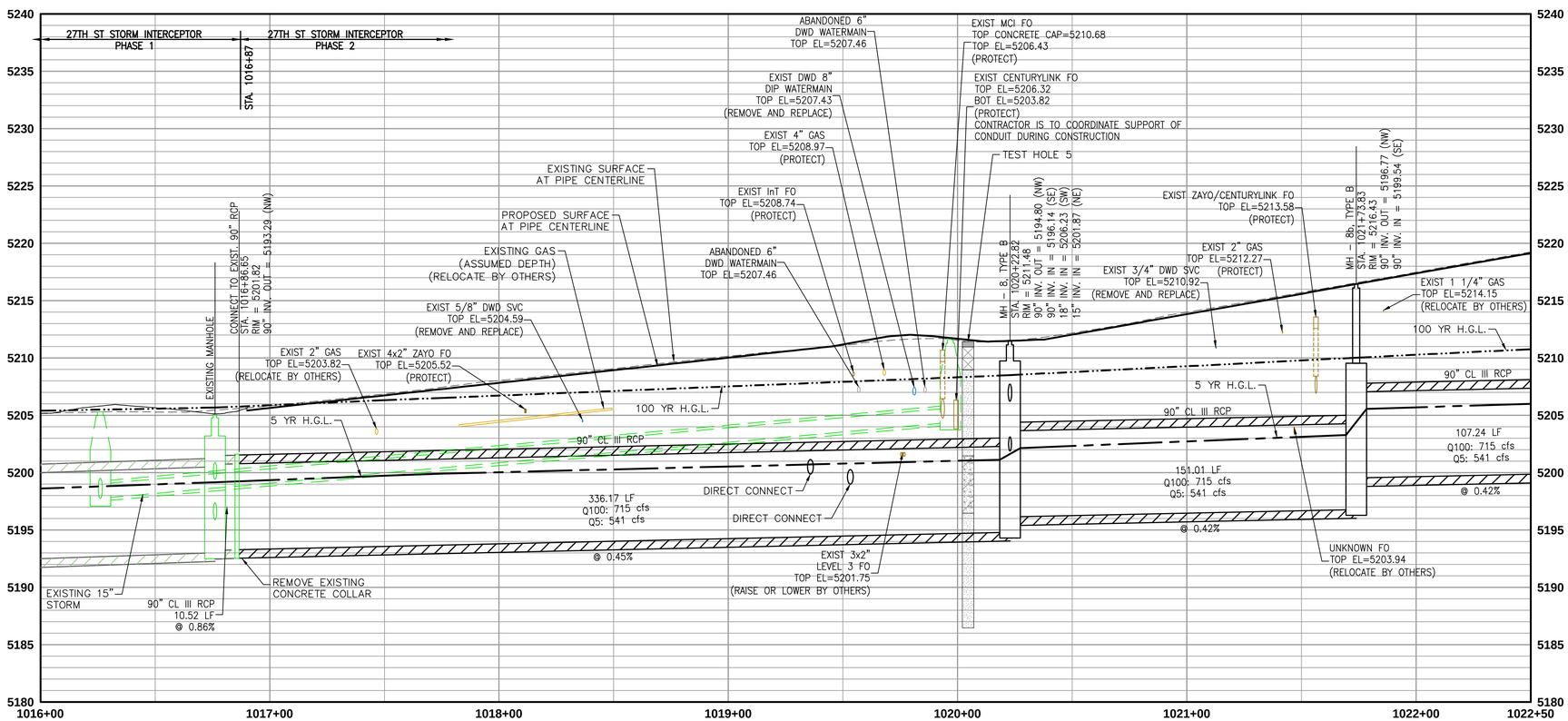
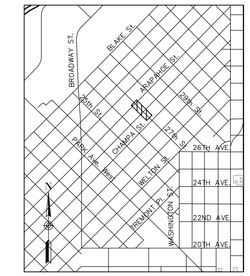



KEY MAP
SCALE: 1"=2000'

GENERAL NOTES

1. SEE STORM LATERAL PLAN AND PROFILE SHEETS 16–19 FOR ALL INLET AND STORM LATERALS.

2. REFER TO SHEETS 9–11 FOR UTILITY INFORMATION.

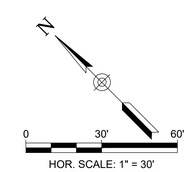
SOIL BORING NOTES

1. SOIL BORINGS INFORMATION TAKEN FROM REPORT TITLED "GEOTECHNICAL ENGINEERING STUDY, 27TH STREET STORM DRAIN INTERCEPTOR PROJECT, 27TH STREET/WELTON STREET/WASHINGTON STREET, DENVER, COLORADO" BY KUMAR & ASSOCIATES, INC.

2. NO GROUNDWATER WAS ENCOUNTERED DURING THIS SUBSURFACE INVESTIGATION.

FORESTRY NOTES

1. EXISTING TREES TO BE PRESERVED IN PUBLIC RIGHT OF WAY SHALL BE PROTECTED PER FORESTRY STANDARDS AND PRACTICES. TREE PROTECTION SHALL INSTALLED PRIOR TO ISSUE OF DEMOLITION PERMIT, APPROVED BY FORESTRY, AND SHALL REMAIN IN PLACE THROUGHOUT CONSTRUCTION. NO CONSTRUCTION ACTIVITIES OR STORAGE OF MATERIALS SHALL TAKE PLACE WITHIN TREE PROTECTION ZONES WITHOUT PRIOR WRITTEN AUTHORIZATION FROM THE OFFICE OF THE CITY FORESTER.




HOR. SCALE: 1" = 30'
VERT. SCALE: 1" = 5'

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05/02/2019

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27TH STREET STORM INTERCEPTOR
PHASE 2

PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

STORM PLAN AND PROFILE, STA. 1016+00 - STA. 1022+50

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-DR-PP02.dwg
DATE: APRIL 16, 2019
SHEET NO.: 13

PLOT DATE: May 2, 2019

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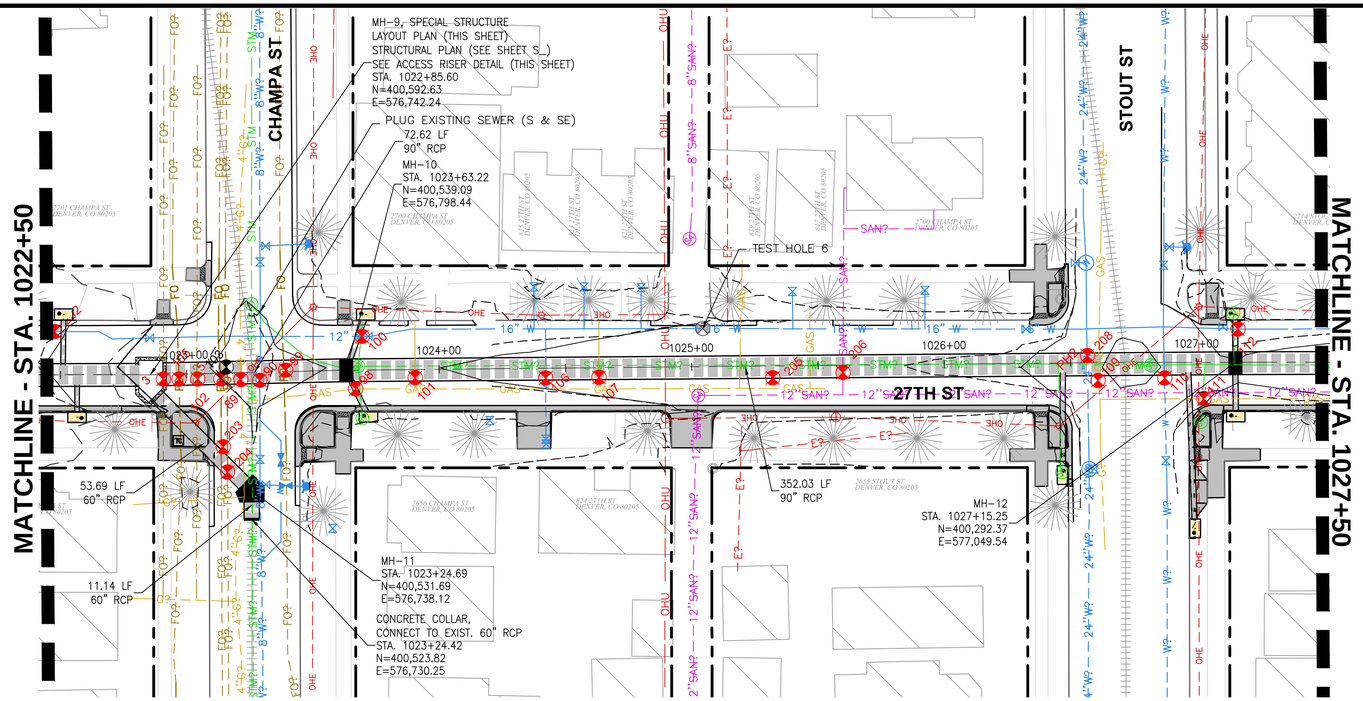
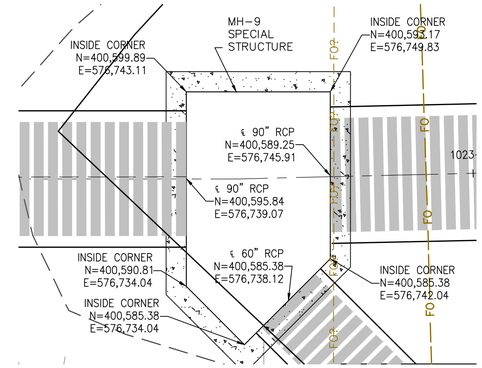
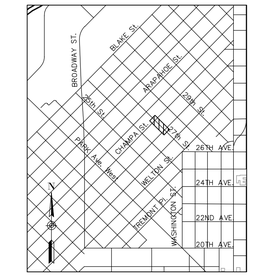


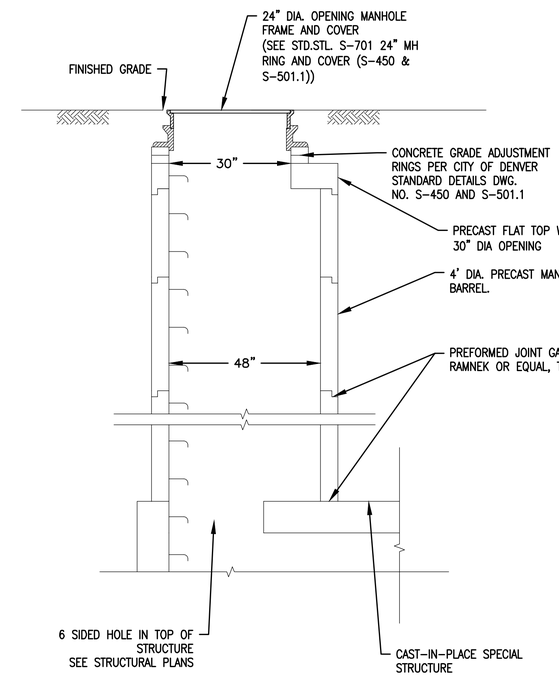

## MH-9 PLAN

SCALE: 1"=5'



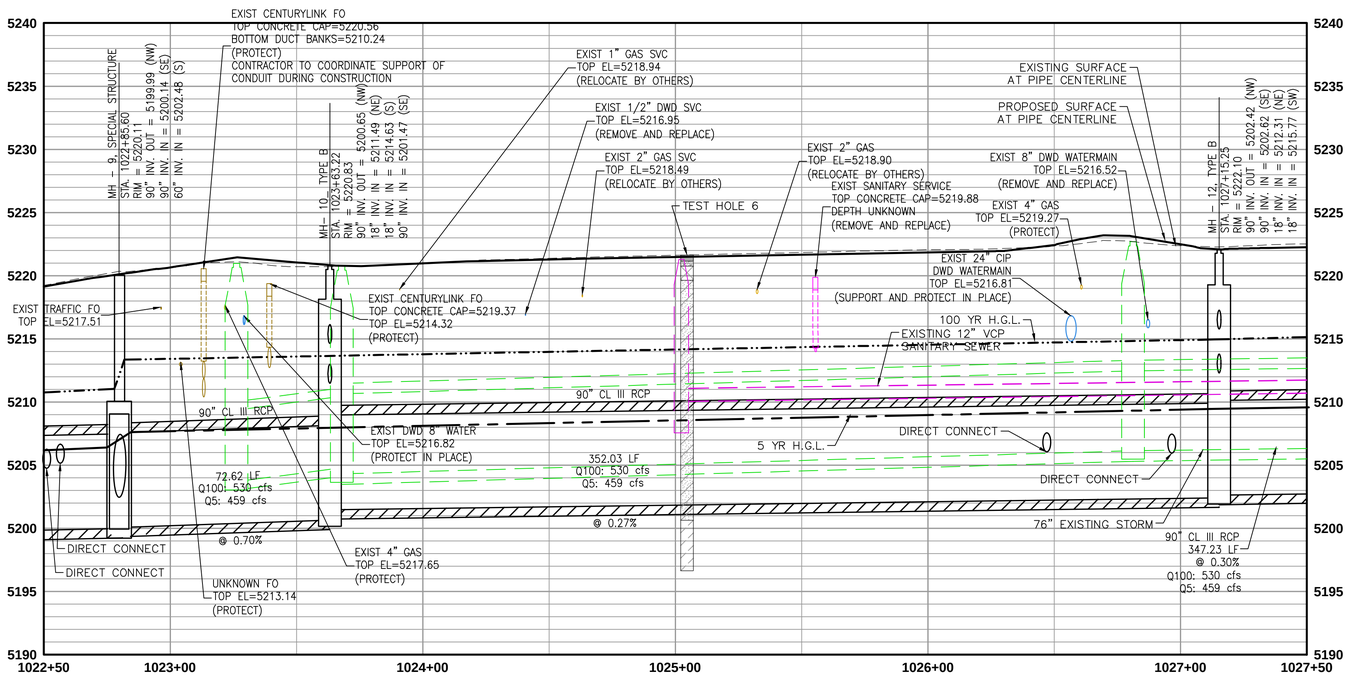

## KEY MAP

SCALE: 1"=2000'




## TYPICAL ACCESS RISER FOR SPECIAL STRUCTURES

NOT TO SCALE




### GENERAL NOTES

1. SEE STORM LATERAL PLAN AND PROFILE SHEETS 16–19 FOR ALL INLET AND STORM LATERALS.

2. REFER TO SHEETS 9–11 FOR UTILITY INFORMATION.

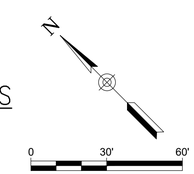
### SOIL BORING NOTES

1. SOIL BORINGS INFORMATION TAKEN FROM REPORT TITLED "GEOTECHNICAL ENGINEERING STUDY, 27TH STREET STORM DRAIN INTERCEPTOR PROJECT, 27TH STREET/WELTON STREET/WASHINGTON STREET, DENVER, COLORADO" BY KUMAR & ASSOCIATES, INC.

2. NO GROUNDWATER WAS ENCOUNTERED DURING THIS SUBSURFACE INVESTIGATION.

### FORESTRY NOTES

1. EXISTING TREES TO BE PRESERVED IN PUBLIC RIGHT OF WAY SHALL BE PROTECTED PER FORESTRY STANDARDS AND PRACTICES. TREE PROTECTION SHALL INSTALLED PRIOR TO ISSUE OF DEMOLITION PERMIT, APPROVED BY FORESTRY, AND SHALL REMAIN IN PLACE THROUGHOUT CONSTRUCTION. NO CONSTRUCTION ACTIVITIES OR STORAGE OF MATERIALS SHALL TAKE PLACE WITHIN TREE PROTECTION ZONES WITHOUT PRIOR WRITTEN AUTHORIZATION FROM THE OFFICE OF THE CITY FORESTER.




HOR. SCALE: 1" = 30'
VERT. SCALE: 1" = 5'

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4/16/2019

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27TH STREET STORM INTERCEPTOR
PHASE 2

PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

STORM PLAN AND PROFILE, STA. 1022+50 - STA. 1027+50

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-DR-PP02.dwg
DATE: APRIL 16, 2019
SHEET NO.: 14

PLOT DATE: May 2, 2019

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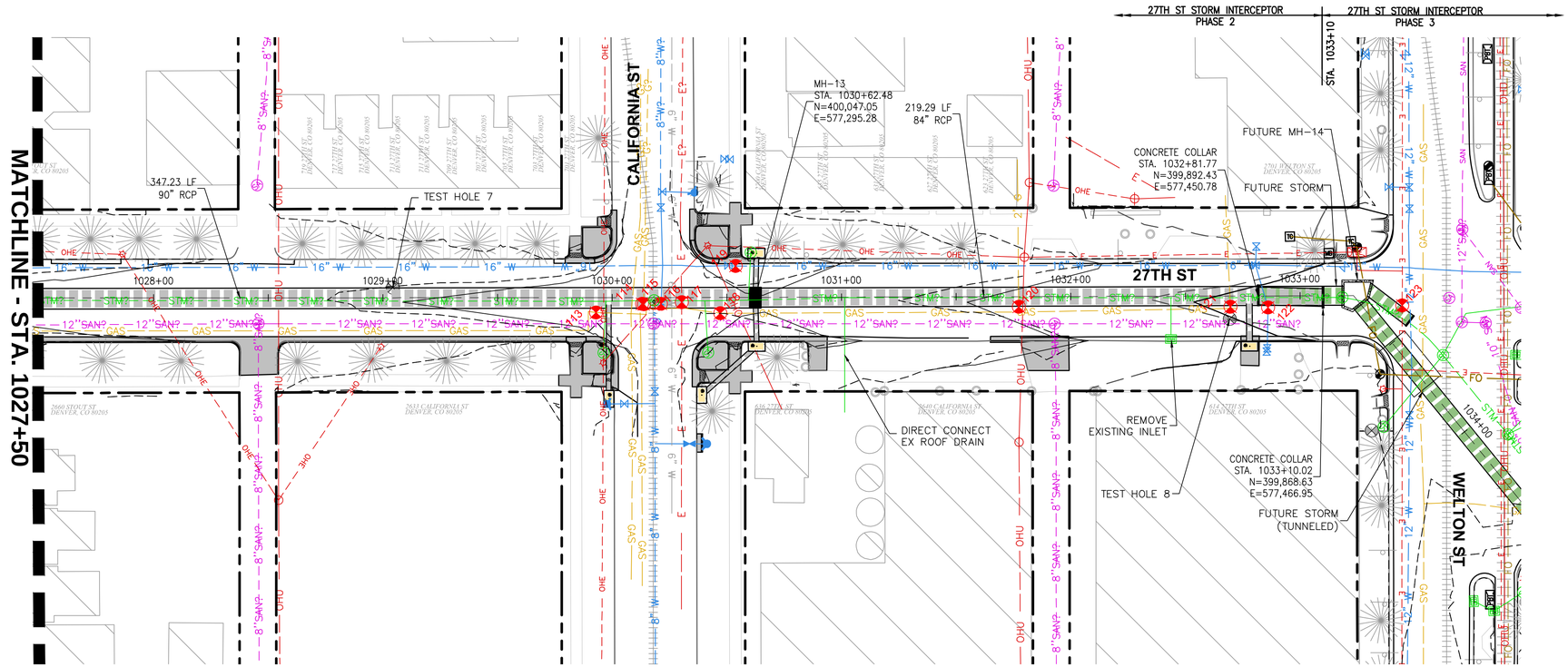


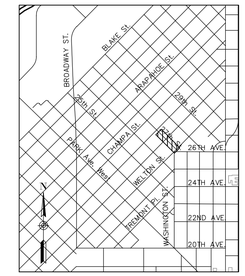


KEY MAP

SCALE: 1"=2000'

GENERAL NOTES

1. SEE STORM LATERAL PLAN AND PROFILE SHEETS 16–19 FOR ALL INLET AND STORM LATERALS.

2. REFER TO SHEETS 9–11 FOR UTILITY INFORMATION.

SOIL BORING NOTES

1. SOIL BORINGS INFORMATION TAKEN FROM REPORT TITLED "GEOTECHNICAL ENGINEERING STUDY, 27TH STREET STORM DRAIN INTERCEPTOR PROJECT, 27TH STREET/WELTON STREET/WASHINGTON STREET, DENVER, COLORADO" BY KUMAR & ASSOCIATES, INC.

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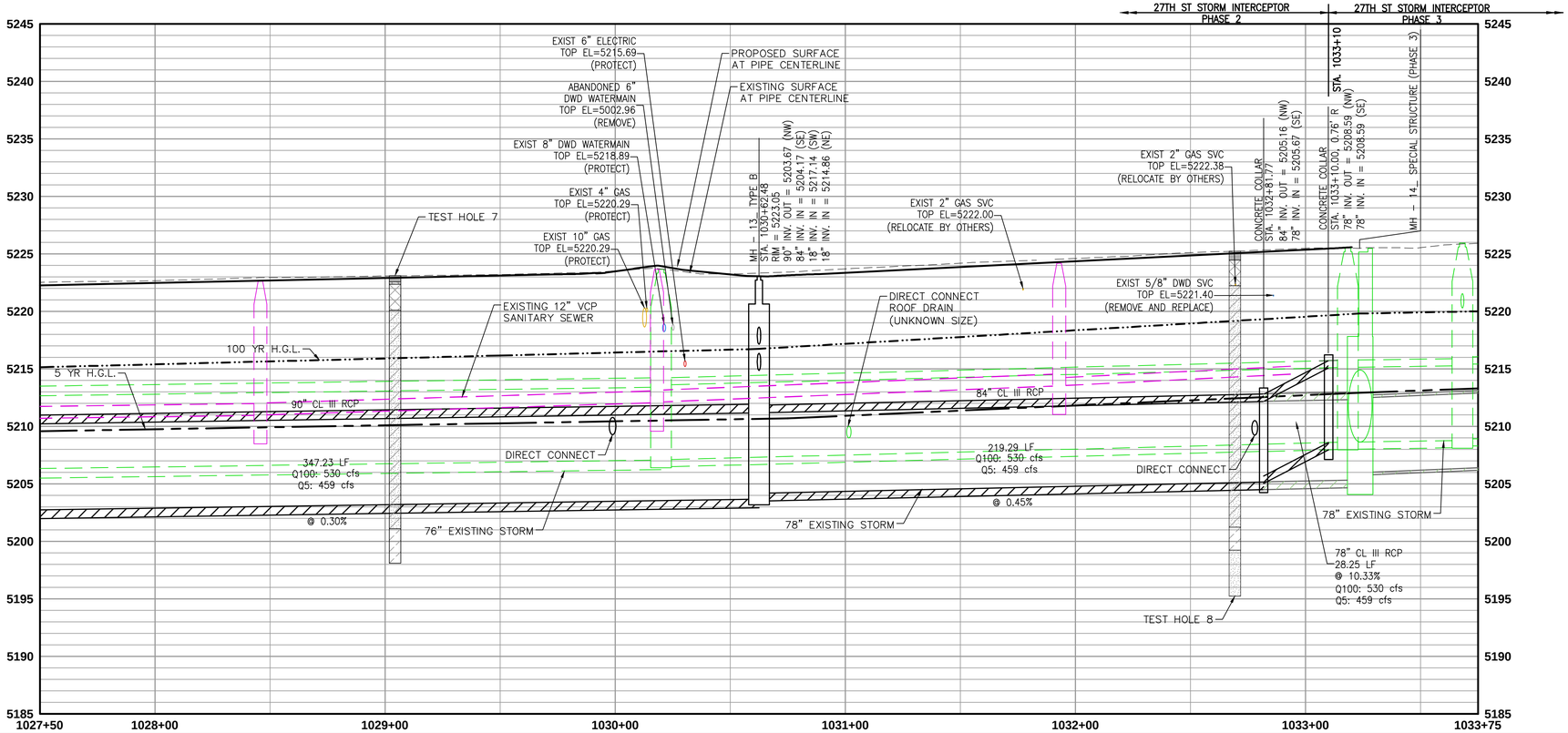


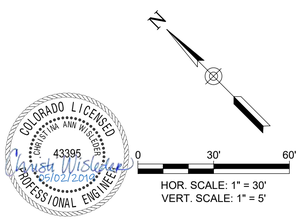


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27TH STREET STORM INTERCEPTOR PHASE 2

PRO TRACKING NO:

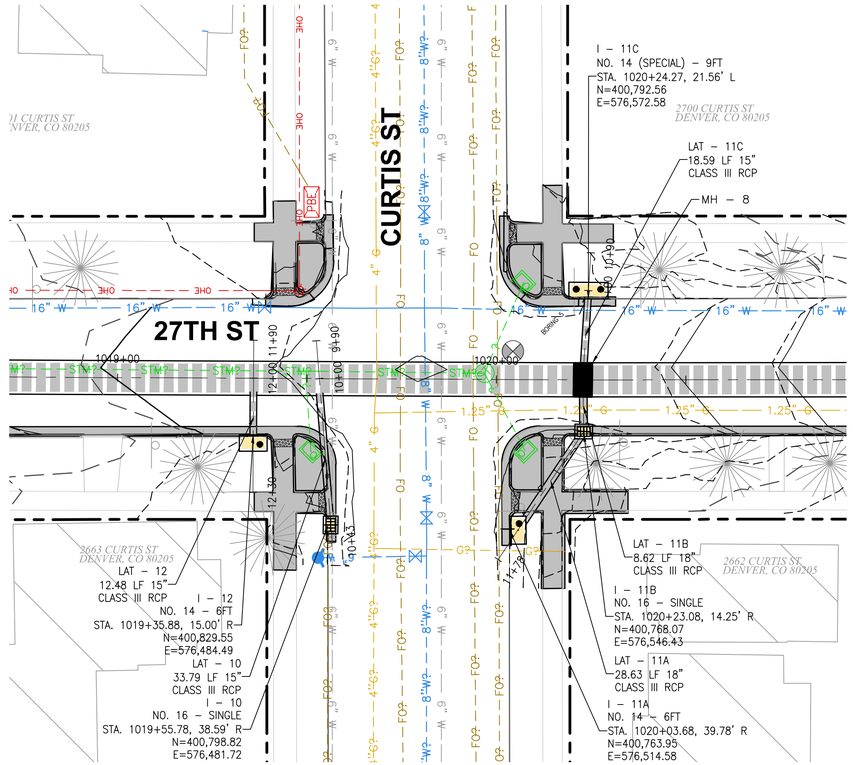
PROJECT MASTER NO: 2017-PROJMSTR-0000343

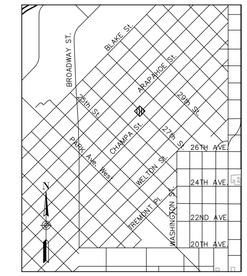
STORM PLAN AND PROFILE, STA. 1027+50 - STA. 1033+50

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-DR-PP02.dwg
DATE: APRIL 16, 2019
SHEET NO.: 15

PLOT DATE: May 2, 2019

\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-DR-PP02.DWG



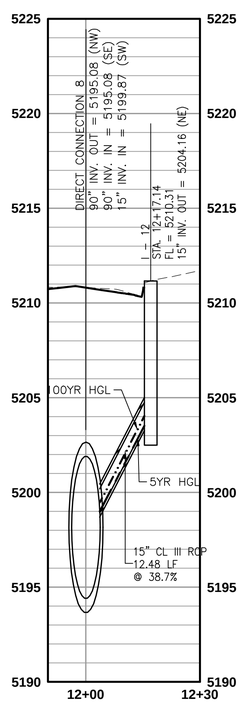




KEY MAP

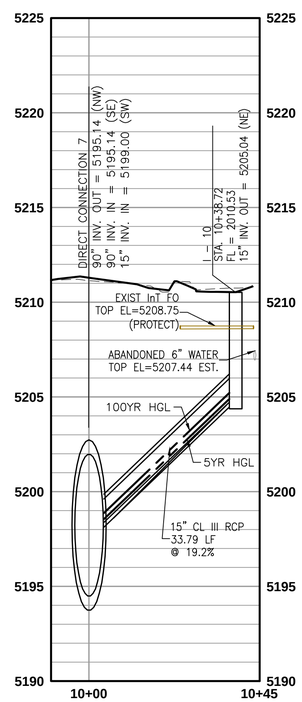
SCALE: 1"=2000'

GENERAL NOTES

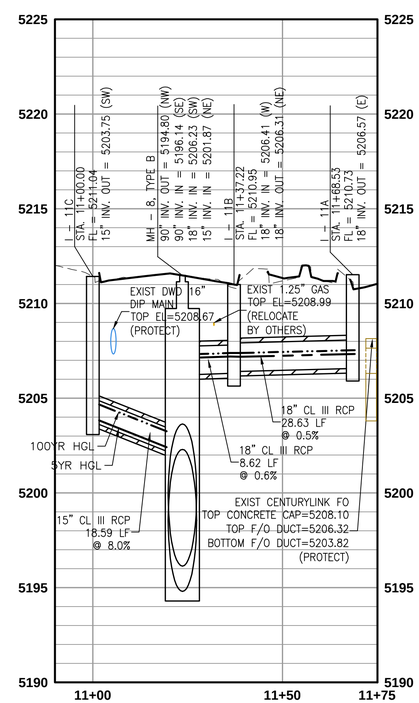
1. REFER TO SHEETS 9–11 FOR UTILITY DETAIL INFORMATION.
2. REFER TO SHEETS 30–31 FOR CURB RAMP CONSTRUCTION.
3. EXISTING STORM SEWER TO BE REMOVED IS NOT SHOWN IN PROFILES FOR CLARITY.




LATERAL 12 PROFILE




LATERAL 10 PROFILE




LATERAL 11 PROFILE

COLORADO LICENSED
CHRISTIAN ANN WOLFF
43395
PROFESSIONAL ENGINEER
4/16/2019

HOR. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'

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TEL.: (303) 446-3617 FAX: (303) 446-3647

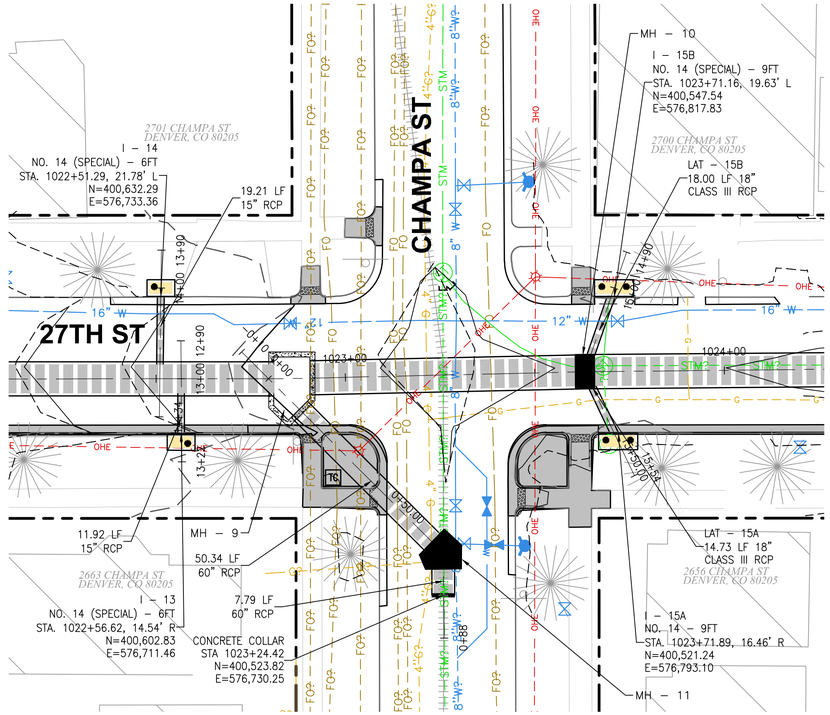
27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

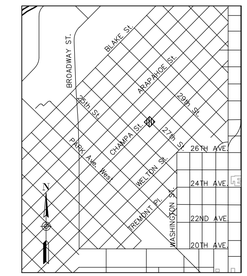
STORM LATERAL PLAN AND PROFILE

DRAWN BY: MMIKS / AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-DR-INLETS_PH2.dwg
DATE: APRIL 16, 2019
SHEET NO.: 16

PLOT DATE: May 2, 2019

\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-DR-INLETS_PH2.DWG



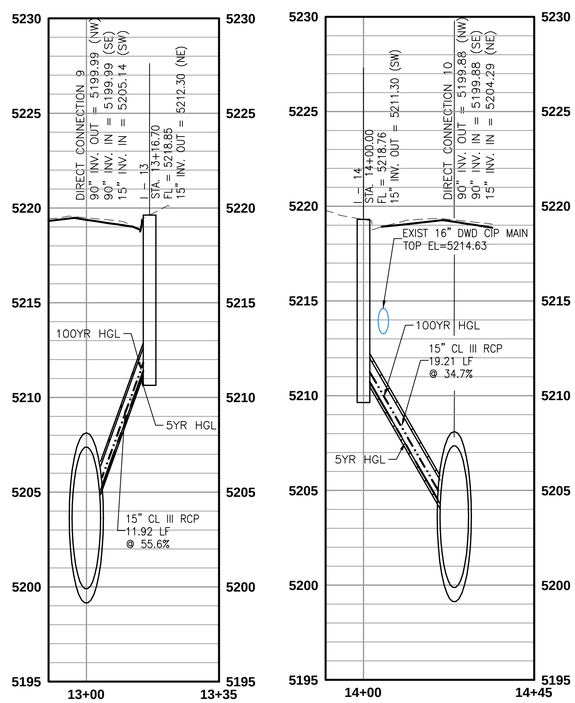




KEY MAP

SCALE: 1"=2000'

GENERAL NOTES

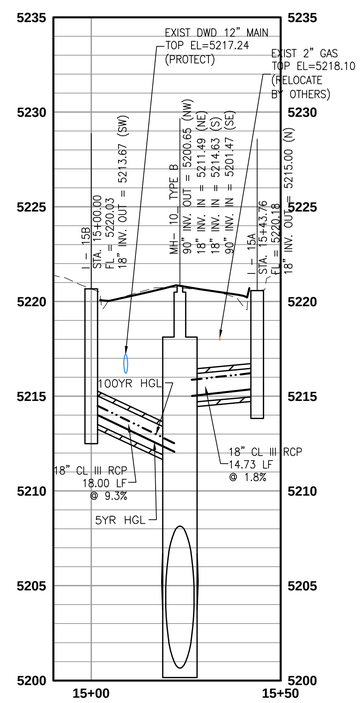
1. REFER TO SHEETS 9–11 FOR UTILITY DETAIL INFORMATION.
2. REFER TO SHEETS 30–31 FOR CURB RAMP CONSTRUCTION.
3. EXISTING STORM SEWER TO BE REMOVED IS NOT SHOWN IN PROFILES FOR CLARITY.



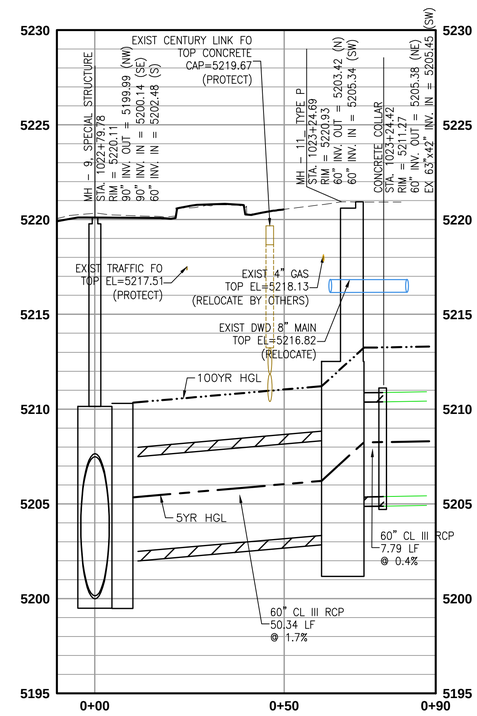

LATERAL 13 PROFILE



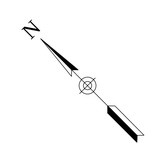

LATERAL 14 PROFILE




LATERAL 15 PROFILE




CHAMPA CONNECTION PROFILE



0 20' 40'

HOR. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'

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27TH STREET STORM INTERCEPTOR
PHASE 2

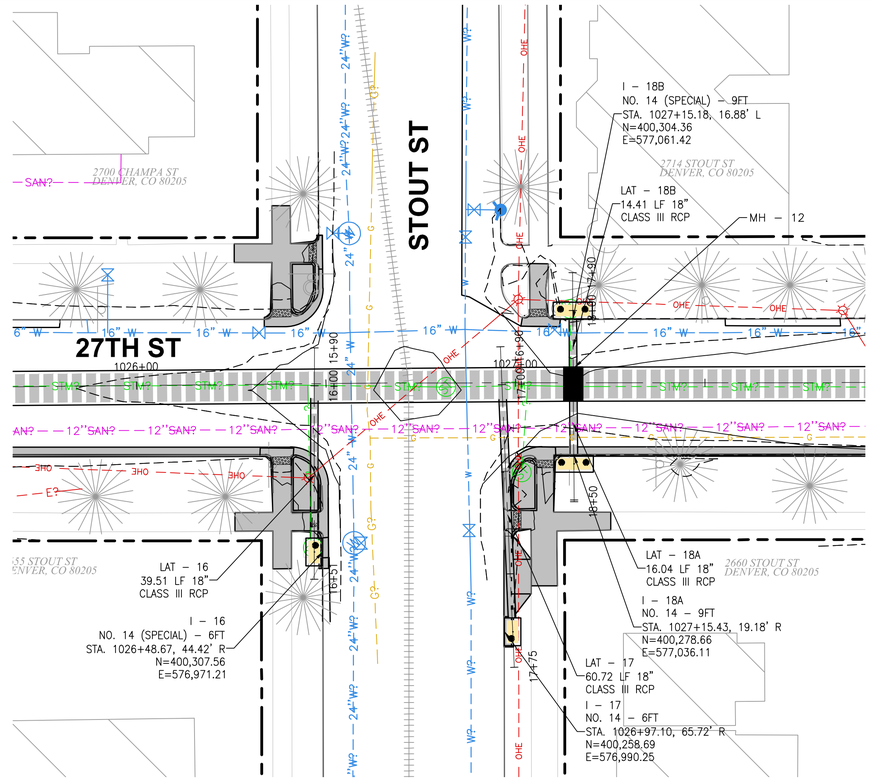
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

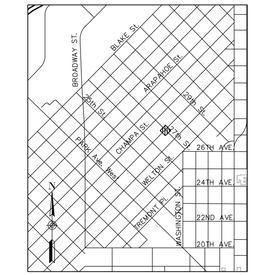
STORM LATERAL PLAN AND PROFILE

DRAWN BY: NMMIKS / AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-DR-INLETS_PH2.dwg
DATE: APRIL 16, 2019
SHEET NO.: 17

PLOT DATE: May 2, 2019

\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-DR-INLETS_PH2.DWG



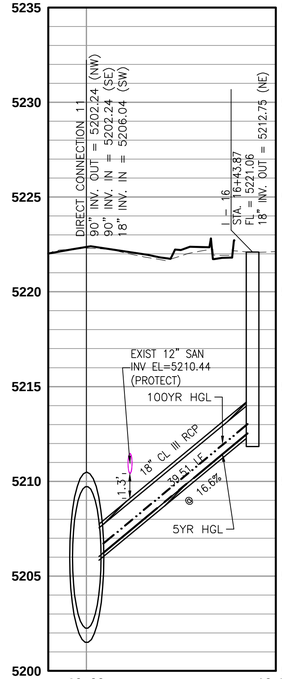




KEY MAP

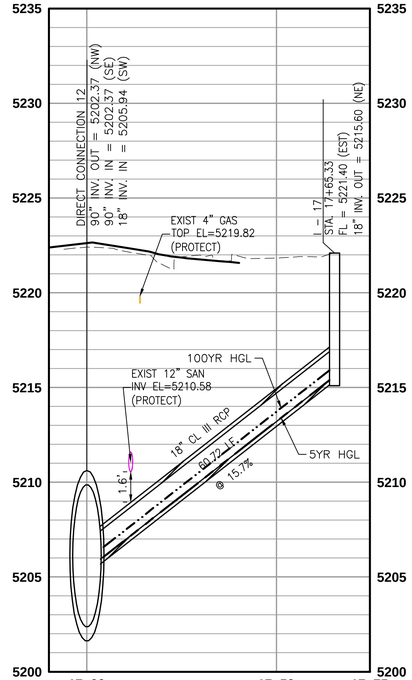
SCALE: 1"=2000'

GENERAL NOTES

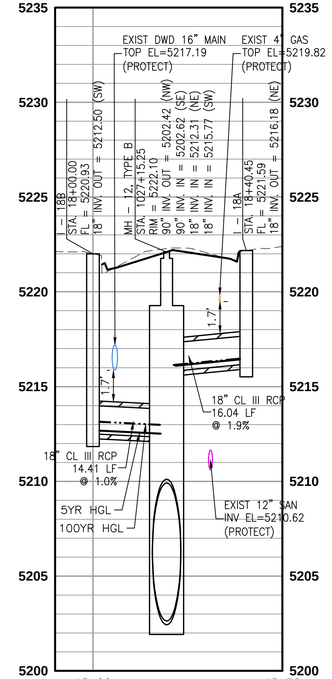
1. REFER TO SHEETS 9–11 FOR UTILITY DETAIL INFORMATION.
2. REFER TO SHEETS 30–31 FOR CURB RAMP CONSTRUCTION.
3. EXISTING STORM SEWER TO BE REMOVED IS NOT SHOWN IN PROFILES FOR CLARITY.




LATERAL 16 PROFILE




LATERAL 17 PROFILE




LATERAL 18 PROFILE

N

0 20' 40'

HOR. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'

COLORADO LICENSED PROFESSIONAL ENGINEER
CHRISTINA ANN WISLEDER
43395
05/02/2019

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27TH STREET STORM INTERCEPTOR
PHASE 2

PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

STORM LATERAL PLAN AND PROFILE

DRAWN BY: MMIKS / AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-DR-INLETS_PH2.dwg
DATE: APRIL 16, 2019
SHEET NO.: 18

PLOT DATE: May 2, 2019

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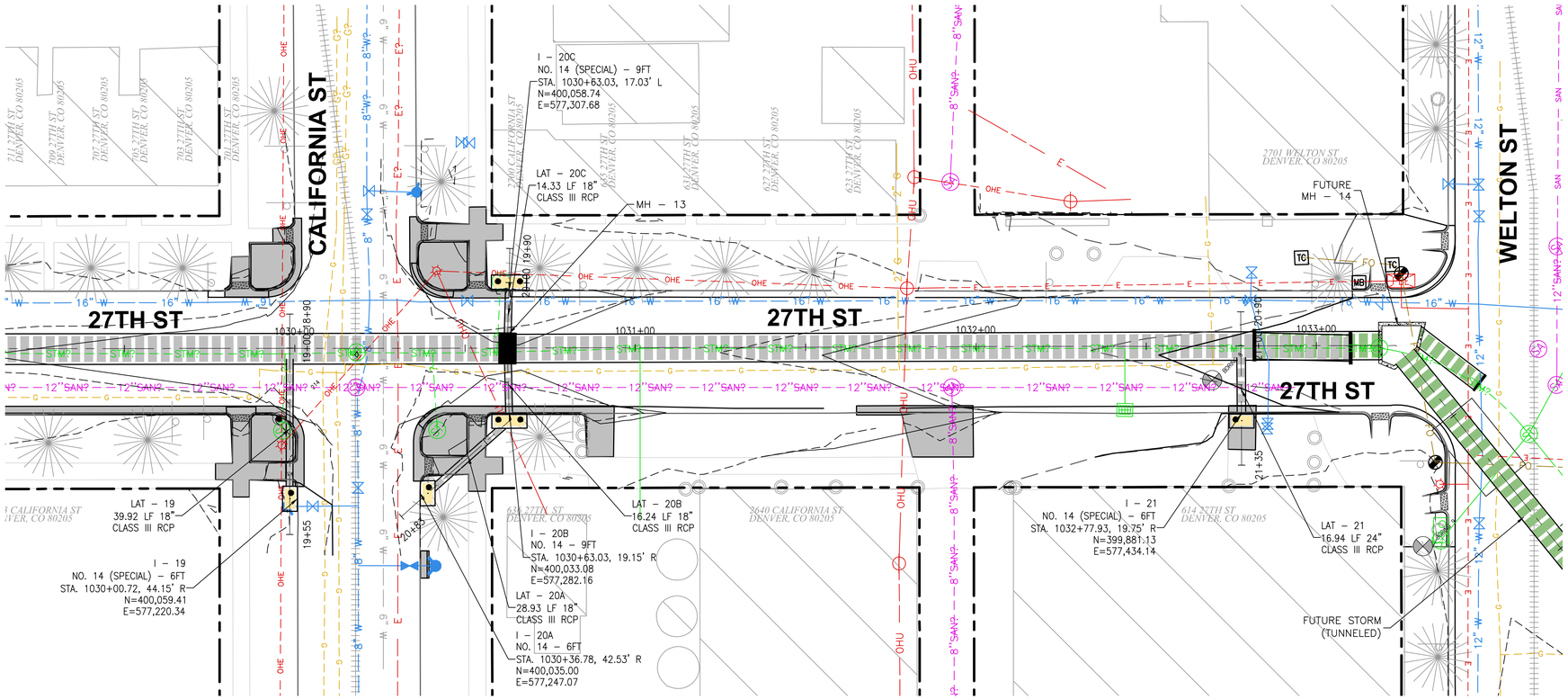
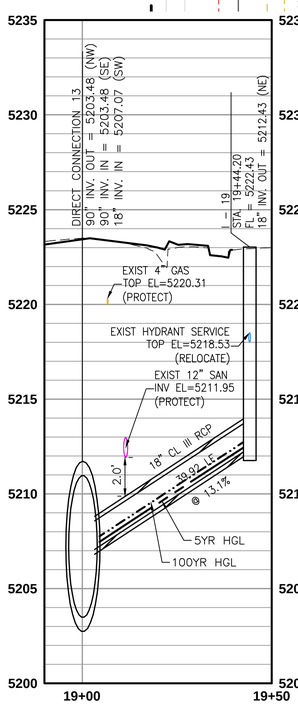
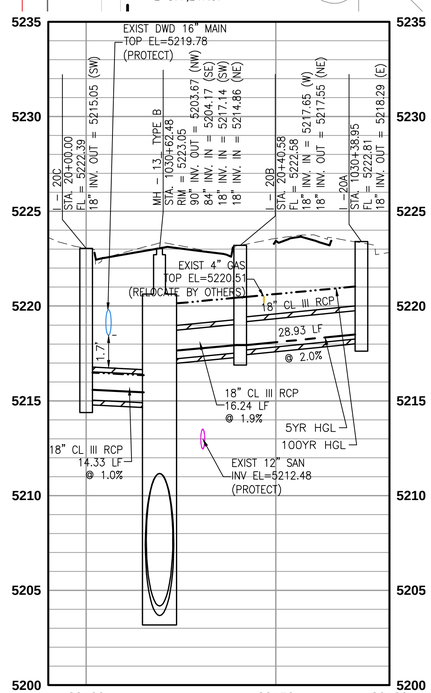



LATERAL 19 PROFILE

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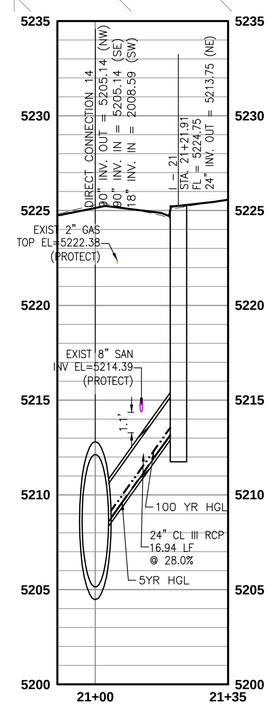
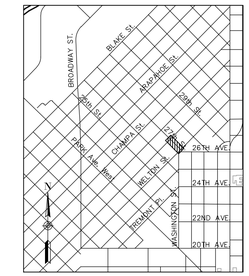



LATERAL 21 PROFILE




KEY MAP
SCALE: 1"=2000'

GENERAL NOTES

1. REFER TO SHEETS 9–11 FOR UTILITY DETAIL INFORMATION.

2. REFER TO SHEETS 30–31 FOR CURB RAMP CONSTRUCTION.

3. EXISTING STORM SEWER TO BE REMOVED IS NOT SHOWN IN PROFILES FOR CLARITY.

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27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

STORM LATERAL PLAN AND PROFILE

COLORADO LICENSED
CHRISTINA ANN WISLEDER
43395
PROFESSIONAL ENGINEER
5/02/2019

0 20' 40'
HOR. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'

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DRAWN BY: MMIKS / AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-DR-INLETS_PH2.dwg
DATE: APRIL 16, 2019
SHEET NO.: 19

PLOT DATE: May 2, 2019
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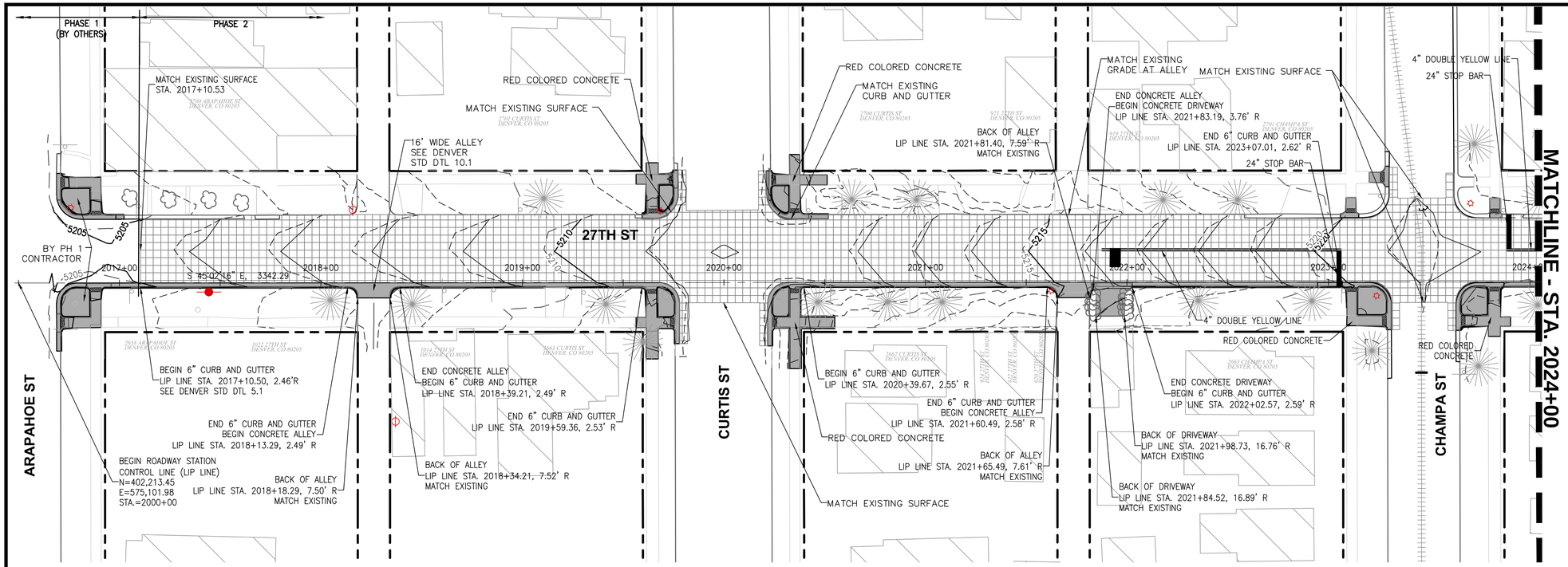



## LEGEND

- NEW ASPHALT FULL DEPTH PAVING
- NEW CONCRETE PAVING
- NEW CONCRETE FLATWORK
- EXISTING BUILDING

## NOTES:

1. SEE SHEETS 30–31 FOR CURB RAMPS, CURB RETURNS, AND INTERSECTION DETAILS.

2. WHEN MATCHING NEW CURB AND GUTTER TO EXISTING CURB AND GUTTER, MATCH AT TOP OF CURB. IF NEEDED, USE CONCRETE GUTTER OVERLAY PER DENVER STANDARD DETAIL 5.4 TO MATCH LIP AND FLOWLINE ELEVATIONS. COORDINATE WITH CITY INSPECTOR.

3. CONCRETE PAVEMENT AND CONCRETE FLATWORK SHALL BE CDOT CLASS B WITH CLASS F FLY ASH. CONCRETE FLATWORK AND STRUCTURES EXPOSED TO SURFACE SHALL MEET CDOT 601.04 CLASS 2 SULFATE MITIGATION CRITERIA.

4. TOP LIFT OF ASPHALT SHALL BE PAVED AS ONE CONTINUOUS OPERATION.

## PAVEMENT DESIGN

PAVEMENT DESIGN FROM GEOTECHNICAL ENGINEERING STUDY
27TH STREET STORM DRAIN INTERCEPTOR PROJECT
27TH STREET/WELTON STREET/WASHINGTON STREET
DENVER, COLORADO
BY KUMAR & ASSOCIATES, INC.
DATED NOVEMBER 2017

27TH STREET, ARAPAHOE STREET, CURTIS STREET, CHAMPA STREET

5.5" ASPHALT BASE COURSE

| | |
|---|---|
| AGGREGATE GRADING | S |
| SUPERPAVE LAB DESIGN GYRATIONS | N=75 |
| ASPHALT BINDER | PG 64–22 |

2" ASPHALT SURFACE COURSE

| | |
|---|---|
| AGGREGATE GRADING | SX |
| SUPERPAVE LAB DESIGN GYRATIONS | N=75 |
| ASPHALT BINDER | PG 64–22 |

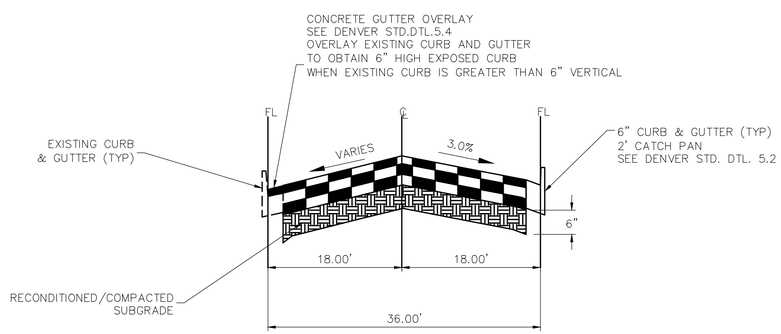
BUS ROUTES
STOUT STREET, CALIFORNIA STREET

8.5" ASPHALT BASE COURSE

| | |
|---|---|
| AGGREGATE GRADING | S |
| SUPERPAVE LAB DESIGN GYRATIONS | N=75 |
| ASPHALT BINDER | PG 64–22 |

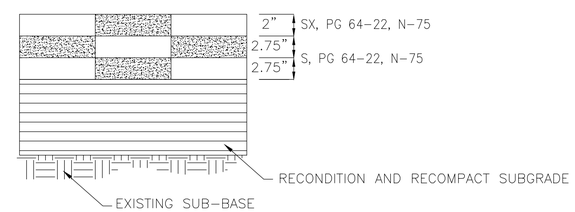
2" ASPHALT SURFACE COURSE

| | |
|---|---|
| AGGREGATE GRADING | SX |
| SUPERPAVE LAB DESIGN GYRATIONS | N=75 |
| ASPHALT BINDER | PG 64–22 |

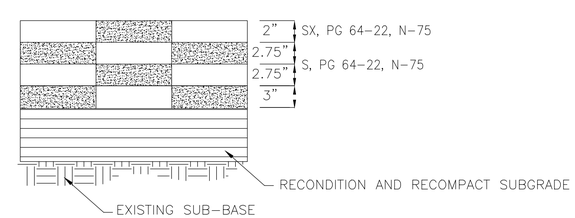



27TH STREET TYPICAL SECTION

CL STA. 2017+11 – STA. 2018+13, STA. 2018+39 – STA. 2019+59, STA. 2020+40 – STA 2021+60, STA. 2022+03 – STA. 2023+07, STA. 2023+87 – STA. 2024+50, STA. 2024+65 – STA. 2025+07, STA. 2025+33 – STA. 2026+54, STA. 2027+32 – STA. 2028+53, STA. 2028+79 – STA. 2030+00,
(NTS)




FULL–DEPTH ASPHALT SECTION
NOT TO SCALE




FULL–DEPTH ASPHALT SECTION
NOT TO SCALE
FOR STOUT ST AND INTERSECTION (STA. 2026+54.3 – STA. 2027+32.4)
AND CALIFORNIA ST AND INTERSECTION (STA. 2030+00 – STA. 2030+78.2)

COLORADO LICENSED CHRISTINA ANN WISLEDER 43395 PROFESSIONAL ENGINEER 05/02/2019

N

0 30' 60'
SCALE: 1" = 30'

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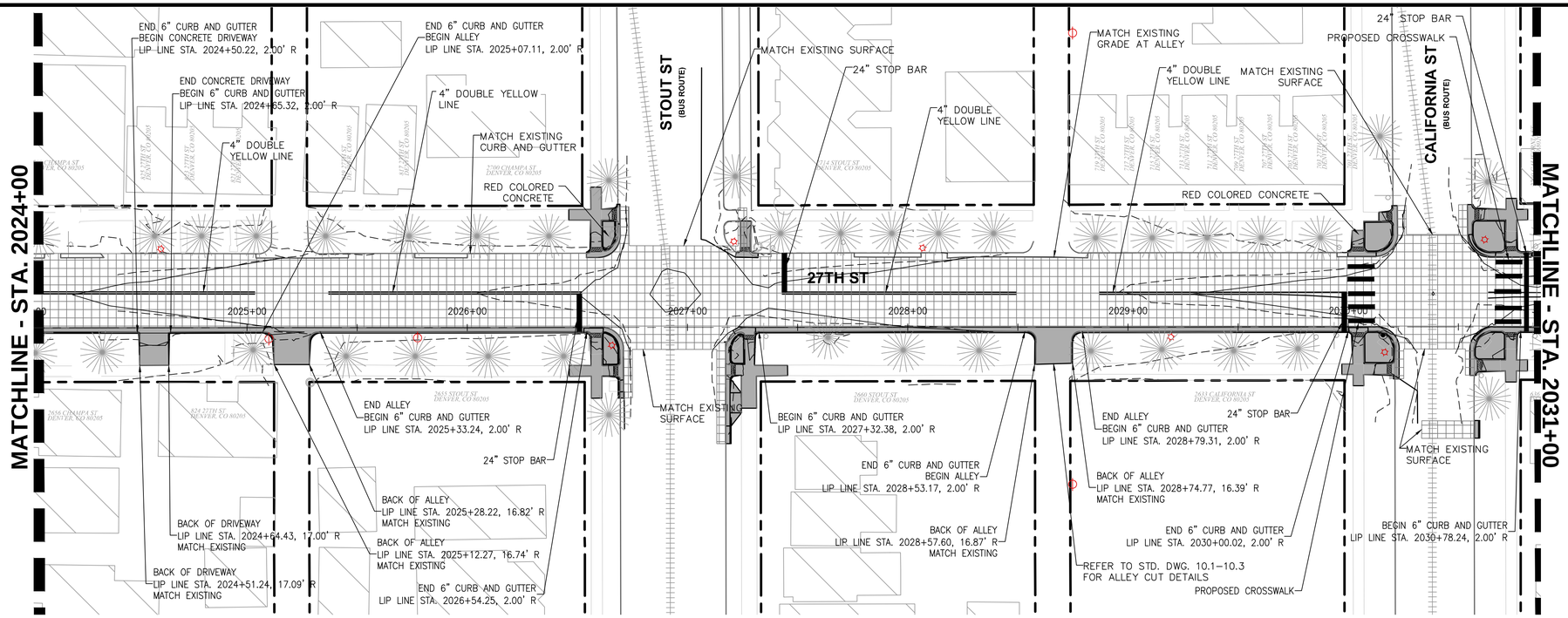
# 27TH STREET STORM INTERCEPTOR PHASE 2

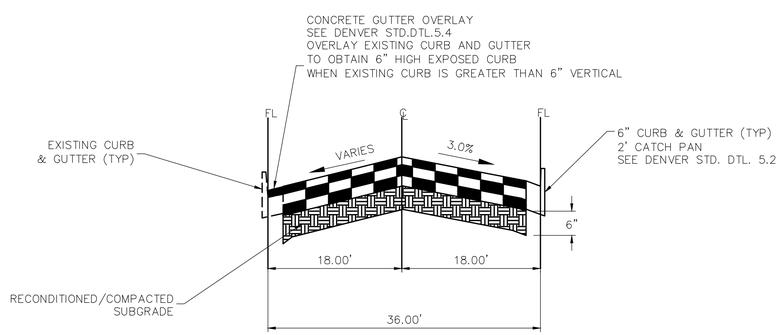
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

ROADWAY RECONSTRUCTION PLAN

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-PAVE_02.dwg
DATE: APRIL 16, 2019
SHEET NO.: 20

PLOT DATE: May 2, 2019
\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-PAVE_02.DWG




27TH STREET TYPICAL SECTION

CL STA. 2017+11 – STA. 2018+13, STA. 2018+39 – STA. 2019+59, STA. 2020+40 – STA 2021+60, STA. 2022+03 – STA. 2023+07, STA. 2023+87 – STA. 2024+50, STA. 2024+65 – STA. 2025+07, STA. 2025+33 – STA. 2026+54, STA. 2027+32 – STA. 2028+53, STA. 2028+79 – STA. 2030+00,
(NTS)

LEGEND

- NEW ASPHALT FULL DEPTH PAVING
- NEW CONCRETE PAVING
- NEW CONCRETE FLATWORK
- EXISTING BUILDING

## NOTES:

1. SEE SHEETS 30–31 FOR CURB RAMPS, CURB RETURNS, AND INTERSECTION DETAILS.

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PAVEMENT DESIGN FROM GEOTECHNICAL ENGINEERING STUDY
27TH STREET STORM DRAIN INTERCEPTOR PROJECT
27TH STREET/WELTON STREET/WASHINGTON STREET
DENVER, COLORADO
BY KUMAR & ASSOCIATES, INC.
DATED NOVEMBER 2017

27TH STREET, ARAPAHOE STREET, CURTIS STREET, CHAMPA STREET

5.5" ASPHALT BASE COURSE

| | |
|---|---|
| AGGREGATE GRADING | S |
| SUPERPAVE LAB DESIGN GYRATIONS | N=75 |
| ASPHALT BINDER | PG 64–22 |

2" ASPHALT SURFACE COURSE

| | |
|---|---|
| AGGREGATE GRADING | SX |
| SUPERPAVE LAB DESIGN GYRATIONS | N=75 |
| ASPHALT BINDER | PG 64–22 |

BUS ROUTES
STOUT STREET, CALIFORNIA STREET

8.5" ASPHALT BASE COURSE

| | |
|---|---|
| AGGREGATE GRADING | S |
| SUPERPAVE LAB DESIGN GYRATIONS | N=75 |
| ASPHALT BINDER | PG 64–22 |

2" ASPHALT SURFACE COURSE

| | |
|---|---|
| AGGREGATE GRADING | SX |
| SUPERPAVE LAB DESIGN GYRATIONS | N= 75 |
| ASPHALT BINDER | PG 64–22 |

N

0 30' 60'
SCALE: 1" = 30'

COLORADO LICENSED
CHRISTIAN ANN WISLEDER
43395
PROFESSIONAL ENGINEER
5/02/2019

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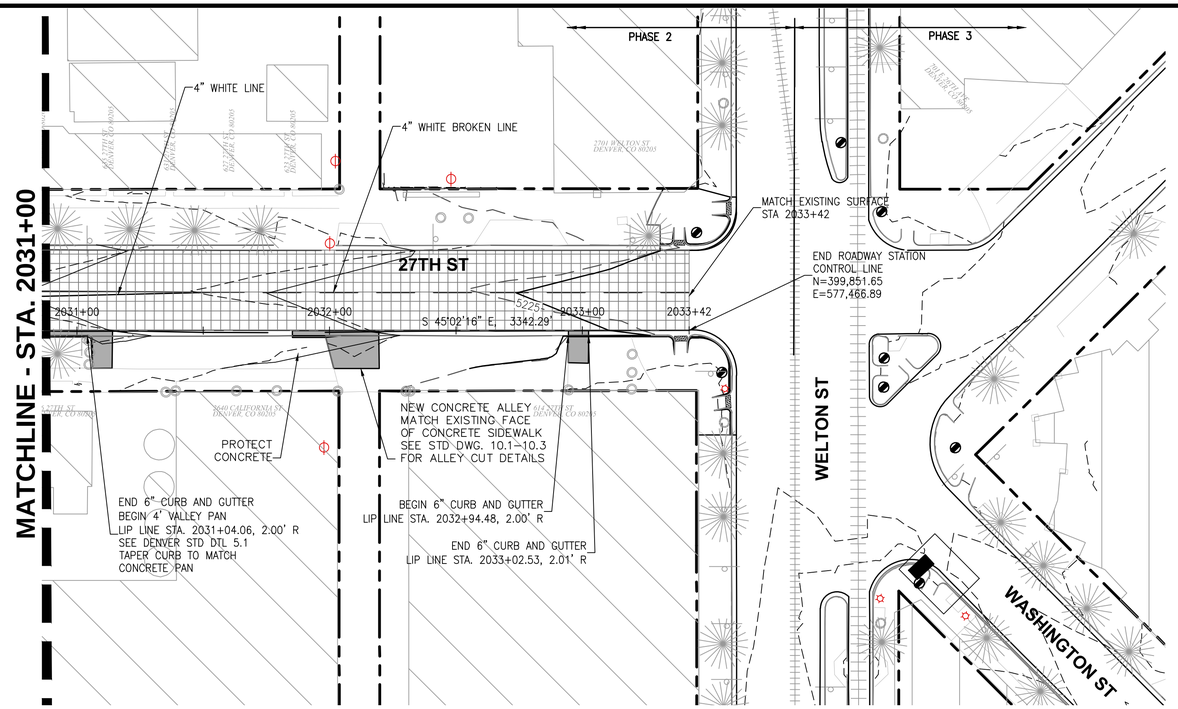
TEL.: (303) 446-3617 FAX: (303) 446-3647

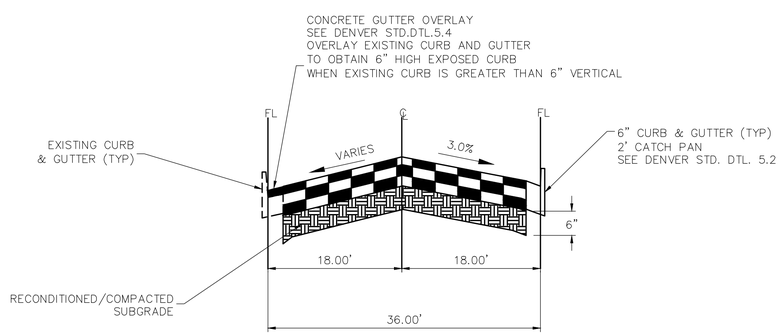
27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343
ROADWAY RECONSTRUCTION PLAN

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-PAVE_02.dwg
DATE: APRIL 16, 2019
SHEET NO.: 21

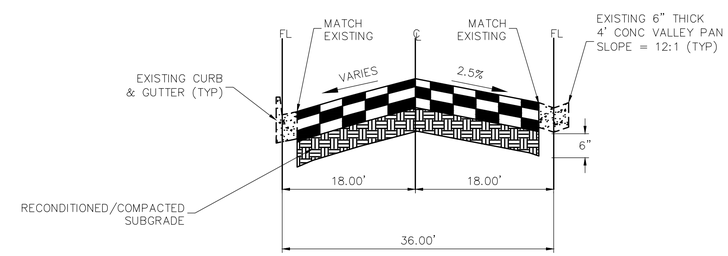
PLOT DATE: May 2, 2019

\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-PAVE_02.DWG




27TH STREET TYPICAL SECTION
CL STA. 2017+11 – STA. 2018+13, STA. 2018+39 – STA. 2019+59, STA. 2020+40 – STA 2021+60, STA. 2022+03 – STA. 2023+07, STA. 2023+87 – STA. 2024+50, STA. 2024+65 – STA. 2025+07, STA. 2025+33 – STA. 2026+54, STA. 2027+32 – STA. 2028+53, STA. 2028+79 – STA. 2030+00,
(NTS)




27TH STREET TYPICAL SECTION
CL STA. 2030+68 – STA. 2033+42
(NTS)

LEGEND

- NEW ASPHALT FULL DEPTH PAVING
- NEW CONCRETE PAVING
- NEW CONCRETE FLATWORK
- EXISTING BUILDING

## NOTES:

1. SEE SHEETS 30–31 FOR CURB RAMPS, CURB RETURNS, AND INTERSECTION DETAILS.

2. WHEN MATCHING NEW CURB AND GUTTER TO EXISTING CURB AND GUTTER, MATCH AT TOP OF CURB. IF NEEDED, USE CONCRETE GUTTER OVERLAY PER DENVER STANDARD DETAIL 5.4 TO MATCH LIP AND FLOWLINE ELEVATIONS. COORDINATE WITH CITY INSPECTOR.

3. CONCRETE PAVEMENT AND CONCRETE FLATWORK SHALL BE CDOT CLASS B WITH CLASS F FLY ASH.

4. TOP LIFT OF ASPHALT SHALL BE PAVED AS ONE CONTINUOUS OPERATION.

## PAVEMENT DESIGN

PAVEMENT DESIGN FROM GEOTECHNICAL ENGINEERING STUDY
27TH STREET STORM DRAIN INTERCEPTOR PROJECT
27TH STREET/WELTON STREET/WASHINGTON STREET
DENVER, COLORADO
BY KUMAR & ASSOCIATES, INC.
DATED NOVEMBER 2017

27TH STREET, ARAPAHOE STREET, CURTIS STREET, CHAMPA STREET

5.5" ASPHALT BASE COURSE

| | |
|---|---|
| AGGREGATE GRADING | S |
| SUPERPAVE LAB DESIGN GYRATIONS | N=75 |
| ASPHALT BINDER | PG 64–22 |

2" ASPHALT SURFACE COURSE

| | |
|---|---|
| AGGREGATE GRADING | SX |
| SUPERPAVE LAB DESIGN GYRATIONS | N=75 |
| ASPHALT BINDER | PG 64–22 |

BUS ROUTES
STOUT STREET, CALIFORNIA STREET

8.5" ASPHALT BASE COURSE

| | |
|---|---|
| AGGREGATE GRADING | S |
| SUPERPAVE LAB DESIGN GYRATIONS | N=75 |
| ASPHALT BINDER | PG 64–22 |

2" ASPHALT SURFACE COURSE

| | |
|---|---|
| AGGREGATE GRADING | SX |
| SUPERPAVE LAB DESIGN GYRATIONS | N=75 |
| ASPHALT BINDER | PG 64–22 |

N

0 30' 60'
SCALE: 1" = 30'

COLORADO LICENSED
CHRISTINA ANN WISLEDER
43395
PROFESSIONAL ENGINEER
Christina Wisleder 6/02/2019

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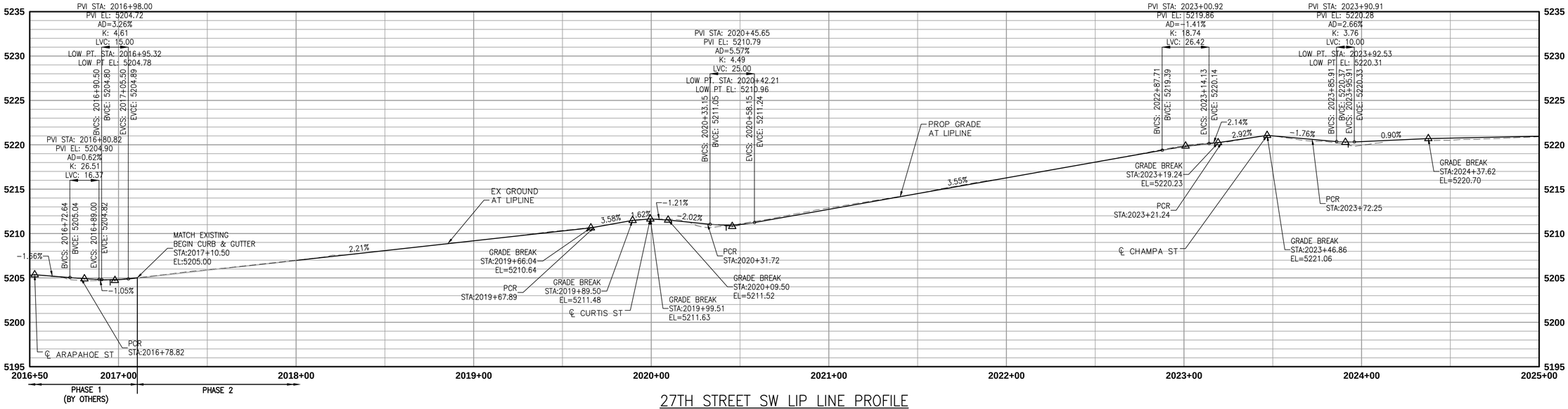
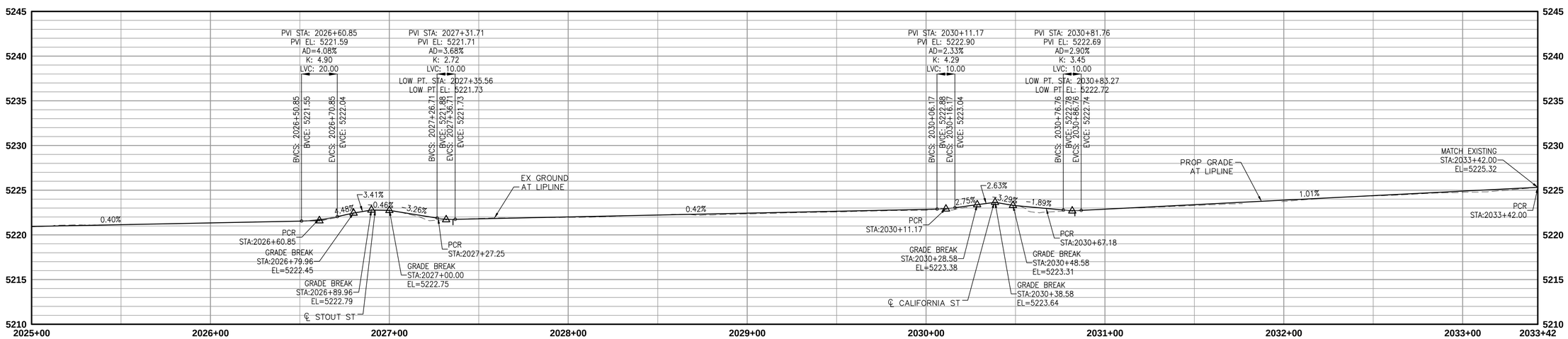
27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343
ROADWAY RECONSTRUCTION PLAN

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-PAVE_02.dwg
DATE: APRIL 16, 2019
SHEET NO.: 22

PLOT DATE: May 2, 2019
\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-PAVE_02.DWG




27TH STREET SW LIP LINE PROFILE
STA. 2016+50 – STA. 2024+50




27TH STREET SW LIP LINE PROFILE
STA. 2024+50 – STA. 2033+00

N

0 30' 60'
HOR. SCALE: 1" = 30'
VERT. SCALE: 1" = 5'

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43395
PROFESSIONAL ENGINEER
05/02/2019

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27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343
ROADWAY PROFILE

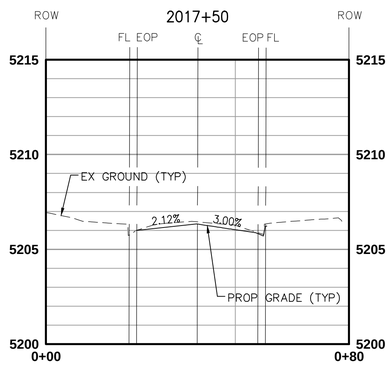
DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-TC-TYP_PH2.dwg
DATE: APRIL 16, 2019
SHEET NO.: 23

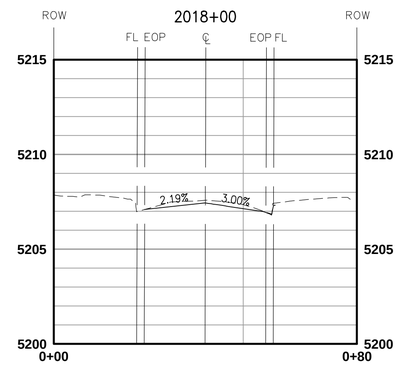
PLOT DATE: May 2, 2019
\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-TC-TYP_PH2.DWG

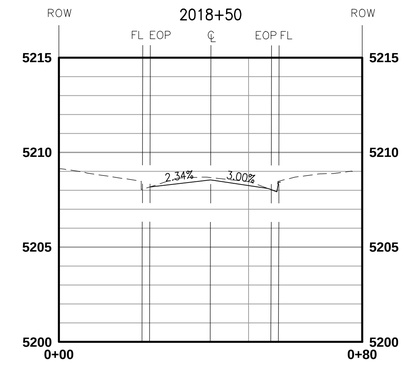
## GENERAL NOTES:

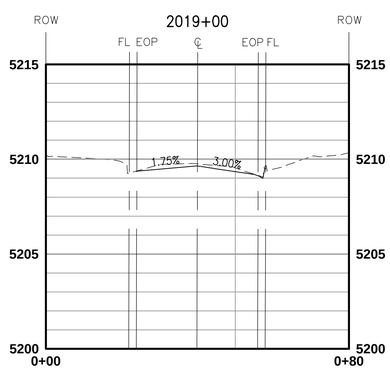
1. CROSS-SECTIONS ARE PERPENDICULAR TO THE SECTION/STATION LINE.

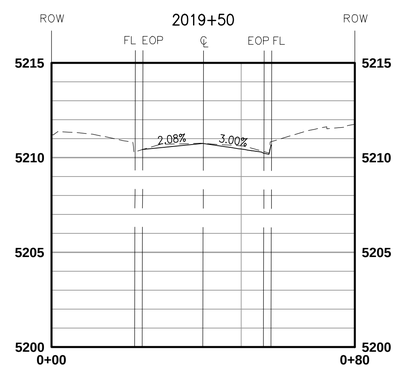
2. CROSS-SECTIONS ARE PROVIDED FOR INFORMATION ONLY. ROADWAY SHALL BE CONSTRUCTED PER ROADWAY PLAN AND PROFILES. CONTRACTOR SHALL NOTIFY DESIGN ENGINEER IMMEDIATELY IF THERE IS A DISCREPANCY BETWEEN THE ROADWAY PLAN AND PROFILES AND THE CROSS-SECTIONS.

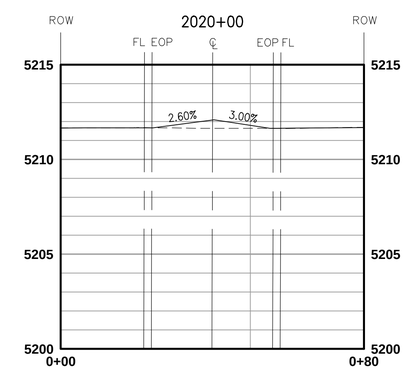



COLORADO LICENSED PROFESSIONAL ENGINEER
43395
CHRISTINA ANN WISLEDER
05/02/2019

0 20' 40'
HOR. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'

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27TH STREET STORM INTERCEPTOR
PHASE 2

PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

ROADWAY CROSS SECTIONS

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-ROAD-XS_PH2.dwg
DATE: APRIL 16, 2019
SHEET NO.: 24

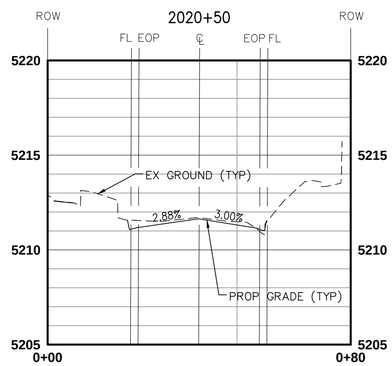
PLOT DATE: May 2, 2019

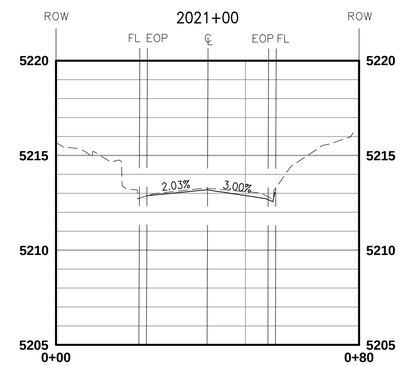
\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-ROAD-XS_PH2.DWG

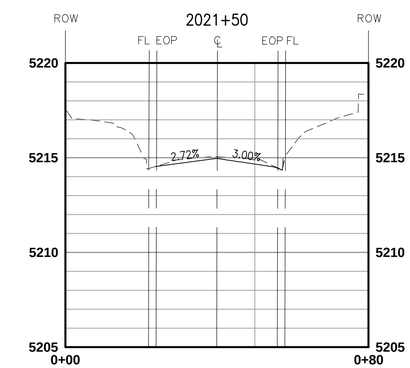
## GENERAL NOTES:

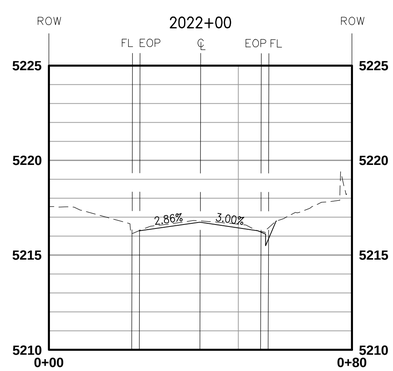
1. CROSS-SECTIONS ARE PERPENDICULAR TO THE SECTION/STATION LINE.

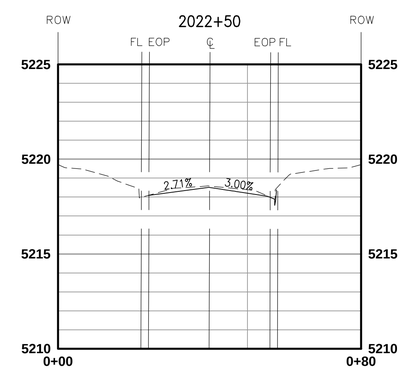
2. CROSS-SECTIONS ARE PROVIDED FOR INFORMATION ONLY. ROADWAY SHALL BE CONSTRUCTED PER ROADWAY PLAN AND PROFILES. CONTRACTOR SHALL NOTIFY DESIGN ENGINEER IMMEDIATELY IF THERE IS A DISCREPANCY BETWEEN THE ROADWAY PLAN AND PROFILES AND THE CROSS-SECTIONS.

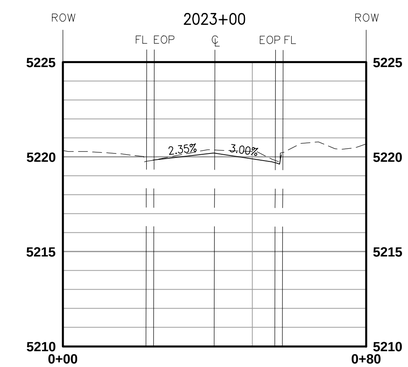



COLORADO LICENSED
CHRISTIAN ANN WISLEDER
43395
PROFESSIONAL ENGINEER
05/02/2019

0 20' 40'
HOR. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'

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# 27TH STREET STORM INTERCEPTOR PHASE 2

PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

**ROADWAY CROSS SECTIONS**

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-ROAD-XS_PH2.dwg
DATE: APRIL 16, 2019
SHEET NO.: 25

PLOT DATE: May 2, 2019

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## GENERAL NOTES:

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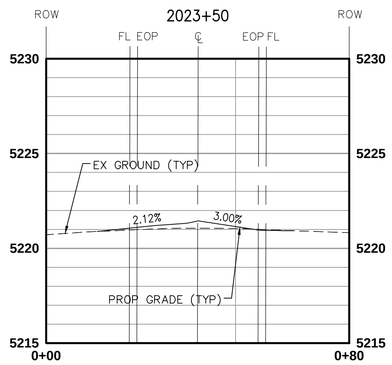
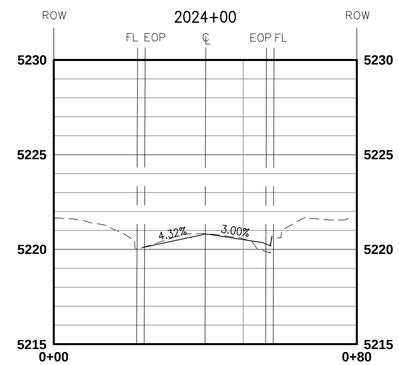
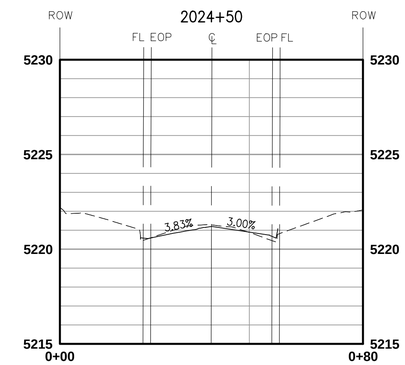
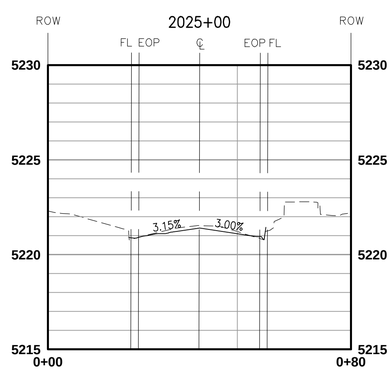
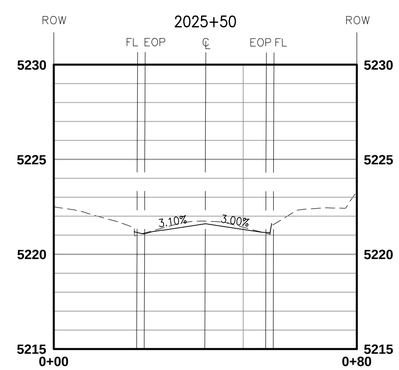
2. CROSS-SECTIONS ARE PROVIDED FOR INFORMATION ONLY. ROADWAY SHALL BE CONSTRUCTED PER ROADWAY PLAN AND PROFILES. CONTRACTOR SHALL NOTIFY DESIGN ENGINEER IMMEDIATELY IF THERE IS A DISCREPANCY BETWEEN THE ROADWAY PLAN AND PROFILES AND THE CROSS-SECTIONS.

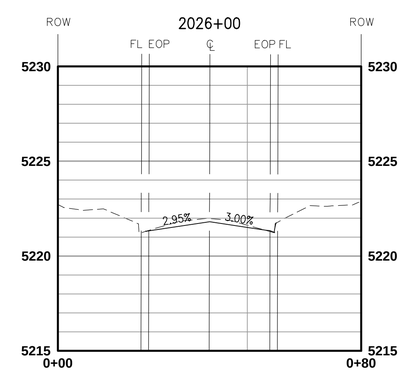



COLORADO LICENSED
CHRISTINA ANN WISLEDER
43395
PROFESSIONAL ENGINEER
4/16/2019

0 20' 40'
HOR. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'

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# 27TH STREET STORM INTERCEPTOR PHASE 2

PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

**ROADWAY CROSS SECTIONS**

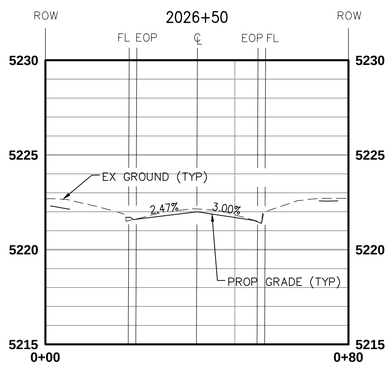
DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-ROAD-XS_PH2.dwg
DATE: APRIL 16, 2019
SHEET NO.: 26

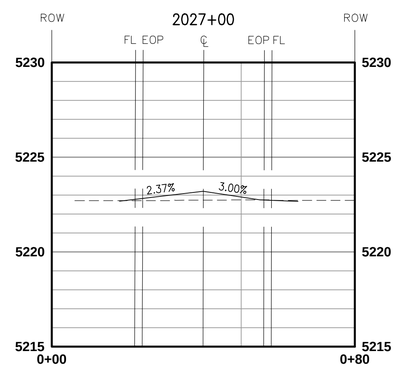
PLOT DATE: May 2, 2019
\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-ROAD-XS_PH2.DWG

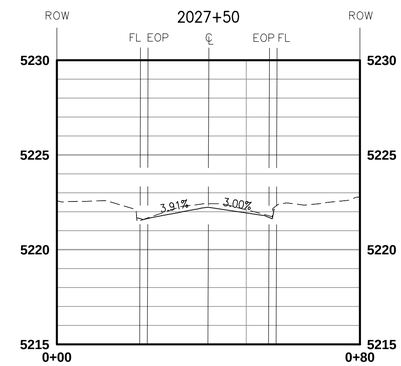
## GENERAL NOTES:

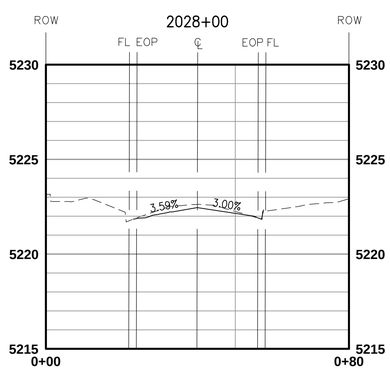
1. CROSS-SECTIONS ARE PERPENDICULAR TO THE SECTION/STATION LINE.

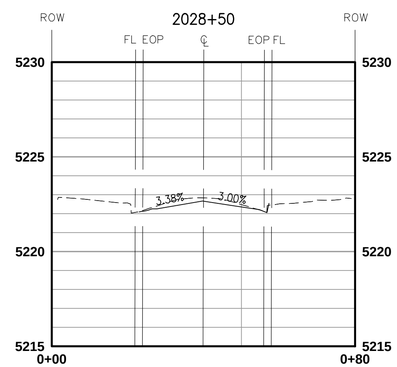
2. CROSS-SECTIONS ARE PROVIDED FOR INFORMATION ONLY. ROADWAY SHALL BE CONSTRUCTED PER ROADWAY PLAN AND PROFILES. CONTRACTOR SHALL NOTIFY DESIGN ENGINEER IMMEDIATELY IF THERE IS A DISCREPANCY BETWEEN THE ROADWAY PLAN AND PROFILES AND THE CROSS-SECTIONS.

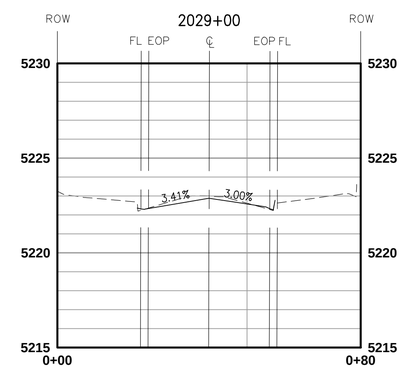



COLORADO LICENSED
43395
CHRISTIAN ANDY WISLEDER
PROFESSIONAL ENGINEER
05/02/2019

0 20' 40'
HOR. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'

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# 27TH STREET STORM INTERCEPTOR PHASE 2

PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

**ROADWAY CROSS SECTIONS**

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-ROAD-XS_PH2.dwg
DATE: APRIL 16, 2019
SHEET NO.: 27

PLOT DATE: May 2, 2019
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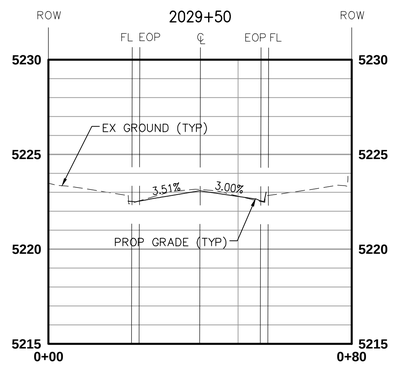
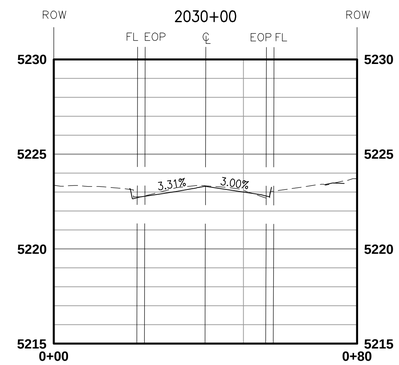
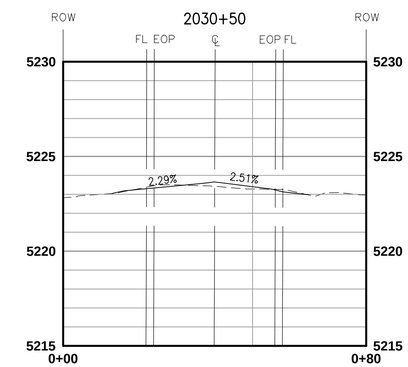
## GENERAL NOTES:

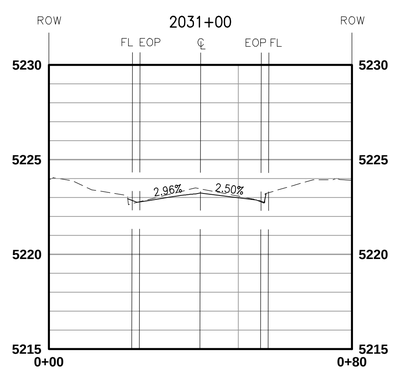
1. CROSS-SECTIONS ARE PERPENDICULAR TO THE SECTION/STATION LINE.

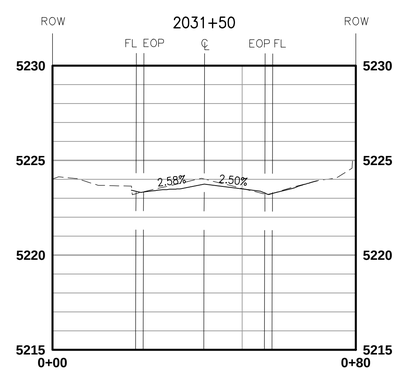
2. CROSS-SECTIONS ARE PROVIDED FOR INFORMATION ONLY. ROADWAY SHALL BE CONSTRUCTED PER ROADWAY PLAN AND PROFILES. CONTRACTOR SHALL NOTIFY DESIGN ENGINEER IMMEDIATELY IF THERE IS A DISCREPANCY BETWEEN THE ROADWAY PLAN AND PROFILES AND THE CROSS-SECTIONS.

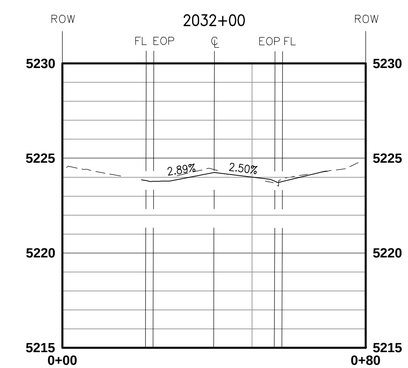
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PROFESSIONAL ENGINEER

0 20' 40'
HOR. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'

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TEL.: (303) 446-3617 FAX: (303) 446-3647


# 27TH STREET STORM INTERCEPTOR PHASE 2

PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

**ROADWAY CROSS SECTIONS**

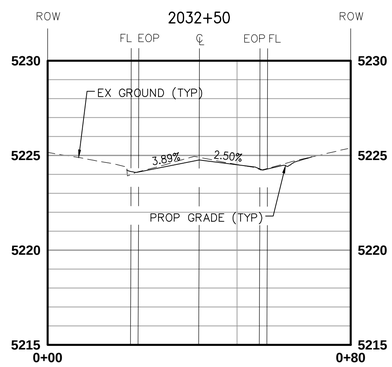
DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-ROAD-XS_PH2.dwg
DATE: APRIL 16, 2019
SHEET NO.: 28

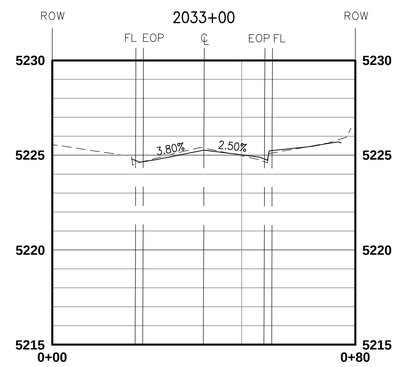
PLOT DATE: May 2, 2019
\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-ROAD-XS_PH2.DWG

## GENERAL NOTES:

1. CROSS-SECTIONS ARE PERPENDICULAR TO THE SECTION/STATION LINE.

2. CROSS-SECTIONS ARE PROVIDED FOR INFORMATION ONLY. ROADWAY SHALL BE CONSTRUCTED PER ROADWAY PLAN AND PROFILES. CONTRACTOR SHALL NOTIFY DESIGN ENGINEER IMMEDIATELY IF THERE IS A DISCREPANCY BETWEEN THE ROADWAY PLAN AND PROFILES AND THE CROSS-SECTIONS.




COLORADO LICENSED
CHRISTIAN ANN WISLEDER
43395
PROFESSIONAL ENGINEER
5/10/2019

0 20' 40'
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VERT. SCALE: 1" = 4'

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27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

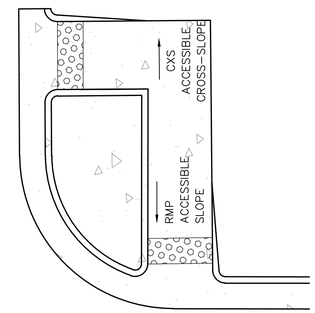
ROADWAY CROSS SECTIONS

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-ROAD-XS_PH2.dwg
DATE: APRIL 16, 2019
SHEET NO.: 29

PLOT DATE: May 2, 2019
\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-ROAD-XS_PH2.DWG

## KEY – RAMP SLOPE LABELS

REFER TO DENVER STD.DWG.7.7.



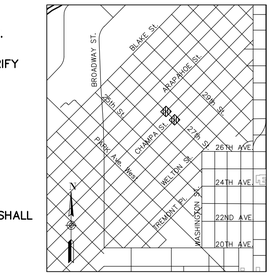

## GENERAL NOTES

1. SEE DENVER STD DTLS 7.0–7.9 FOR CURB RAMP DETAILS.

2. PRIOR TO POURING CURB RAMP, CONTRACTOR SHALL VERIFY SLOPES DO NOT EXCEED THE MAXIMUM ALLOWABLE SLOPE.
ACCESSIBLE FLARE SLOPE = 10.0% MAX
ACCESSIBLE RAMP SLOPE = 8.3% MAX
ACCESSIBLE CROSS SLOPE = 2.0% MAX
ACCESSIBLE RUNNING SLOPE = 5.0% MAX

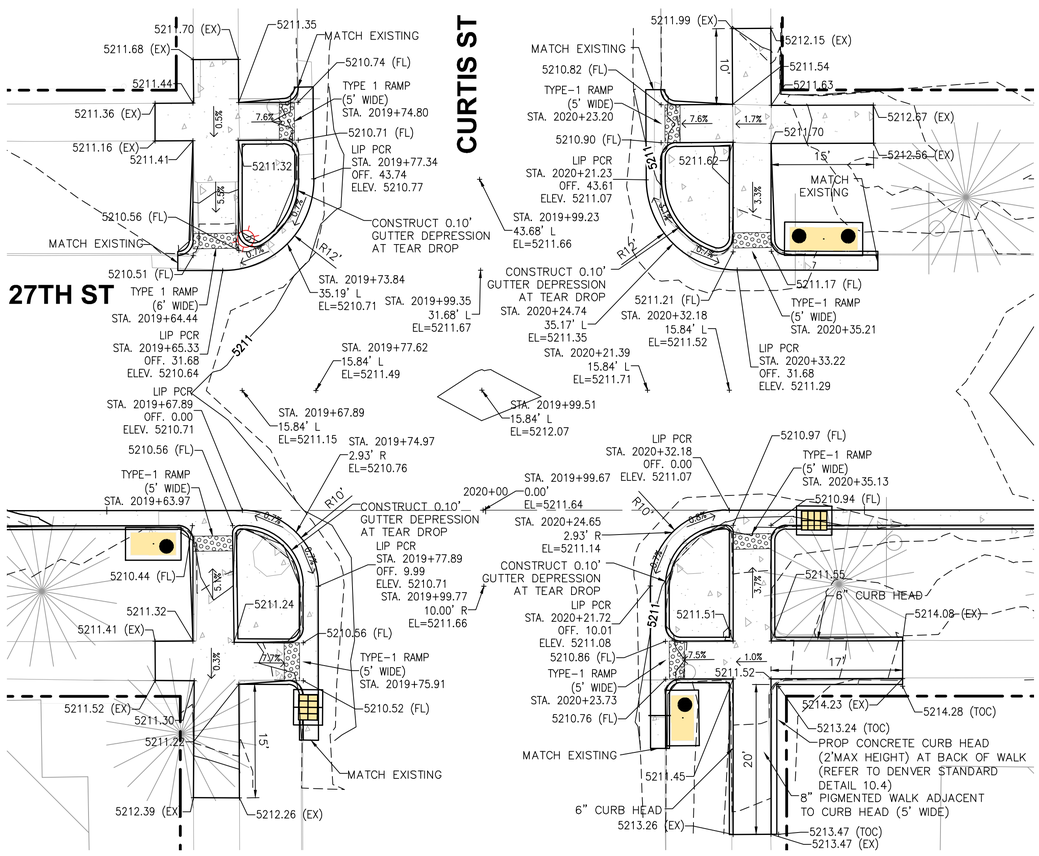
3. SEE ROADWAY RECONSTRUCTION PLANS FOR LIMITS OF PAVEMENT REMOVAL AND REPLACEMENT.

4. SIDEWALK REPLACEMENT BEYOND CURB RAMP LANDINGS SHALL BE 5' UNLESS OTHERWISE NOTED ON PLANS.

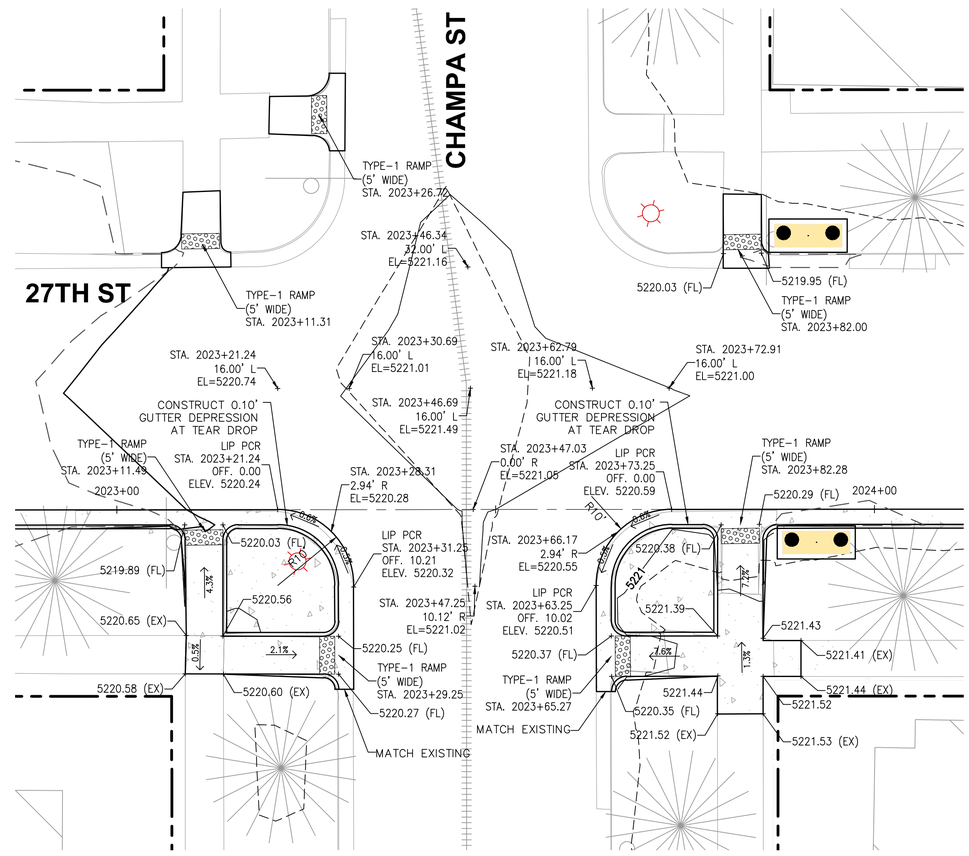



## KEY MAP

SCALE: 1"=2000'




27TH AND CURTIS INTERSECTION

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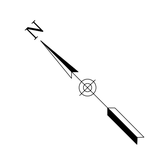


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0 10' 20'
SCALE: 1" = 10'

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27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

INTERSECTION DETAILS

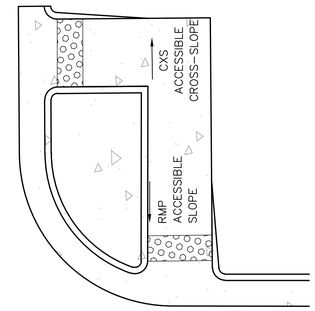
DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-INTERSECTIONS_02.dwg
DATE: APRIL 16, 2019
SHEET NO.: 30

PLOT DATE: May 2, 2019

\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-INTERSECTIONS_02.DWG

## KEY – RAMP SLOPE LABELS

REFER TO DENVER STD.DWG.7.7.




## GENERAL NOTES

1. SEE DENVER STD DTLS 7.0–7.9 FOR CURB RAMP DETAILS.

2. PRIOR TO POURING CURB RAMP, CONTRACTOR SHALL VERIFY SLOPES DO NOT EXCEED THE MAXIMUM ALLOWABLE SLOPE.
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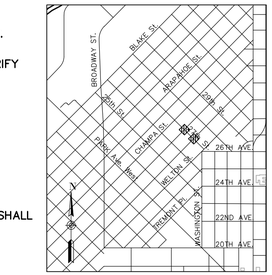
ACCESSIBLE RAMP SLOPE = 8.3% MAX
ACCESSIBLE CROSS SLOPE = 2.0% MAX
ACCESSIBLE RUNNING SLOPE = 5.0% MAX

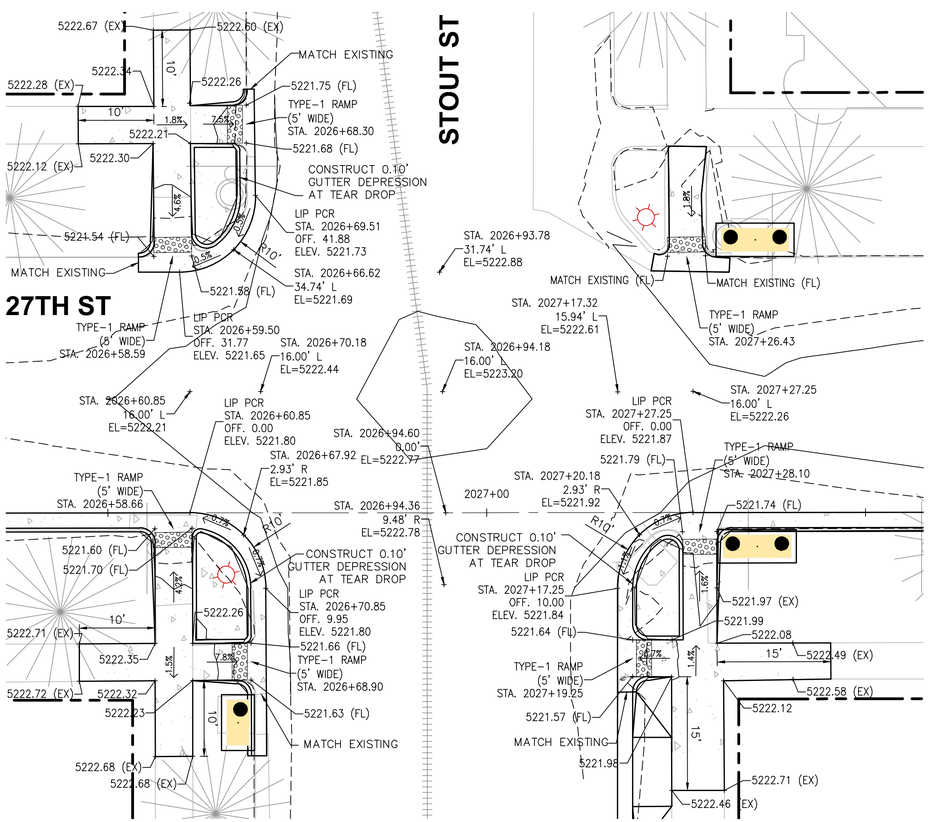
3. SEE ROADWAY RECONSTRUCTION PLANS FOR LIMITS OF PAVEMENT REMOVAL AND REPLACEMENT.

4. SIDEWALK REPLACEMENT BEYOND CURB RAMP LANDINGS SHALL BE 5' UNLESS OTHERWISE NOTED ON PLANS.

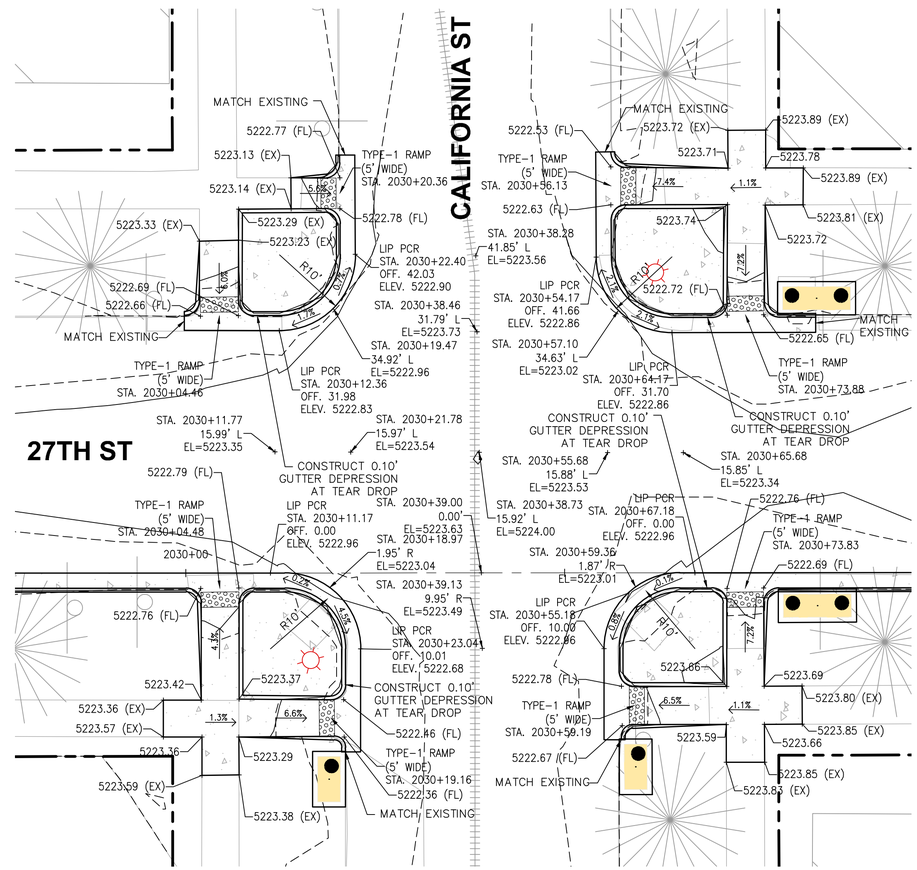



## KEY MAP

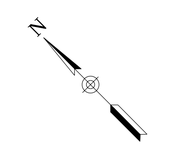
SCALE: 1"=2000'




27TH AND STOUT INTERSECTION




27TH AND CALIFORNIA INTERSECTION



0 10' 20'
SCALE: 1" = 10'

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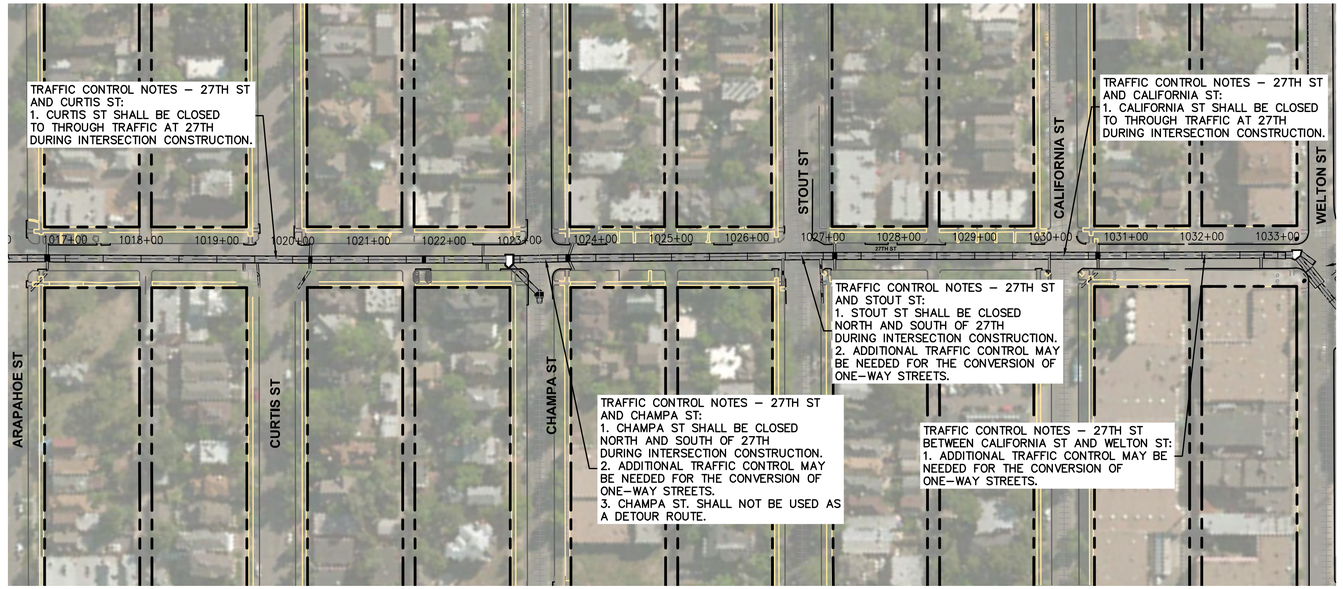
27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

INTERSECTION DETAILS

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-INTERSECTIONS_02.dwg
DATE: APRIL 16, 2019
SHEET NO.: 31

PLOT DATE: May 2, 2019

\\MERRICK.COM\CDS\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-INTERSECTIONS_02.DWG




## GENERAL TRAFFIC CONTROL NOTES

1. THE CONTRACTOR SHALL SUBMIT TO THE CITY AND COUNTY OF DENVER FOR REVIEW AND APPROVAL, A TRAFFIC CONTROL PLAN (TCP) CONFORMING TO THE REQUIREMENTS OF CDOT'S STANDARD SPECIFICATION FOR ROAD AND BRIDGE CONSTRUCTION, SPECIAL PROVISIONS 630 – CONSTRUCTION ZONE TRAFFIC CONTROL AND THE M&S STANDARDS 2 WEEKS PRIOR TO RELATED CONSTRUCTION ACTIVITY. ALL STANDS AND DEVICES MUST MEET NCHRP 350 REQUIREMENTS.

2. ALL TRAFFIC CONTROL DEVICES SHALL BE PLACED PER THE PROJECT MANGER'S REQUEST AND IN ACCORDANCE WITH CDOT M&S STANDARD PLAN S–630–1 AND THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

3. REFER TO CDOT M&S STANDARD PLAN S–630–1 FOR STANDARD TRAFFIC CONTROL CASES THAT MAY BE REQUIRED TO IMPLEMENT PHASES AND OTHER TRAFFIC CONTROL CONDITIONS.

4. EXISTING SIGNS SHALL BE RESET AS CONDITIONS REQUIRE FOR EACH CONSTRUCTION PHASE, AND AS DIRECTED BY THE PROJECT MANAGER.

6. APPROPRIATE ADVANCE WARNING SIGNS SHALL BE PLACED AS NEEDED. ALL SIGNS SHALL BE SHOWN IN THE TCP TO BE APPROVED BY THE PROJECT MANAGER.

7. MAXIMUM SLOPE ADJACENT TO TRAVELED WAY SHALL BE 3:1, UNLESS PROTECTED BY TEMPORARY CONCRETE BARRIER.

8. ALL CONSTRUCTION SHALL CONFORM TO THE APPLICABLE STANDARDS IN THE MANUAL ON UNIFORM CONTROL DEVICES, THE COLORADO DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION (AS REVISED) AND COLORADO DEPARTMENT OF TRANSPORTATION STANDARD PLANS M&S STANDARDS.

9. IF END OF CONCRETE BARRIER (TEMP) IS WITHIN CLEAR ZONE, IT SHALL BE SHIELDED BY EXISTING GUARDRAIL, PROTECTED BY AN IMPACT ATTENUATOR (TEMPORARY) OR TAPERED TO OUTSIDE OF CLEAR ZONE PER THE AASHTO ROADSIDE DESIGN GUIDE.

10. THE CONTRACTOR SHALL BEAR ALL RESPONSIBILITY AND EXPENSE FOR PROVIDING TEMPORARY DITCHES AND PIPES TO ENSURE ADEQUATE DRAINAGE AND SAFE DRIVING CONDITIONS AT ALL TIMES. THIS WORK SHALL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF RELATED WORK.

11. CONTRACTOR SHALL REMOVE ANY CONFLICTING PAVEMENT MARKINGS AND SHALL INSTALL TEMPORARY PAVEMENT MARKINGS IN ACCORDANCE WITH M.U.T.C.D. GUIDELINES.

12. THE TRAFFIC CONTROL PLAN MUST BE COORDINATED WITH THE LOCAL FIRE DEPARTMENT.

13. ACCESS TO ALL RESIDENCES, BUSINESSES, COMMERCIAL PROPERTIES, AND PEDESTRIAN CROSSINGS SHALL BE MAINTAINED AT ALL TIMES.

14. SEE PROJECT SPECIAL PROVISIONS FOR MORE INFORMATION AND RESTRICTIONS.

## TRAFFIC CONTROL NOTES – 27TH ST

1. 27TH ST SHALL BE CLOSED DURING CONSTRUCTION. STREET CLOSURE IS LIMITED TO ONE BLOCK OF 27TH ST AND ONE INTERSECTION AT ANY GIVEN TIME. CONTRACTOR SHALL DEVELOP A TRAFFIC DETOUR PLAN FOR ALL ROAD CLOSURES.

2. ADDITIONAL CLOSURES WILL BE ALLOWED FOR PAVING THE TOP LIFT OF THE ASPHALT. COORDINATE WITH THE CITY INSPECTOR.

3. ADDITIONAL TRAFFIC CONTROL MAY BE NEEDED FOR THE CONVERSION OF ONE–WAY STREETS TO BE TEMPORARY TWO–WAY TRAFFIC ALONG CHAMPA ST., STOUT ST., AND 27TH ST. BETWEEN CALIFORNIA ST AND WELTON ST.

4. CHAMPA ST. SHALL NOT BE USED AS A DETOUR ROUTE. ROUTE ALL DETOUR TRAFFIC ON CURTIS STREET OR STOUT STREET.

## PEDESTRIAN TRAFFIC CONTROL NOTES

1. THE CONTRACTOR SHALL SUBMIT A METHOD FOR HANDLING PEDESTRIAN TRAFFIC CONTROL.

2. CONTRACTOR SHALL DEVELOP A PEDESTRIAN DETOUR PLAN FOR ALL SIDEWALK AND ROAD CLOSURES.

3. CONTRACTOR SHALL INCLUDE A WORKER'S ON FOOT PLAN AS PART OF THE TRAFFIC CONTROL PLAN.

## DENVER TRAFFIC CONTROL NOTES

1. CONSTRUCTION PHASING PLANS ARE "FOR INFORMATION ONLY," THE CONTRACTOR WILL BE REQUIRED TO SUBMIT THE METHOD OF HANDLING TRAFFIC FOR REVIEW AND APPROVAL PRIOR TO WORK.

2. THE CONTRACTOR WILL BE REQUIRED TO COORDINATE WITH OTHER ONGOING CONSTRUCTION IN THE AREA. THE PROJECT MANAGER WILL HAVE FULL AUTHORITY TO STOP CONSTRUCTION ACTIVITIES AT ANY TIME THAT ARE IN CONFLICT WITH OTHER CONSTRUCTION OR TRAFFIC CONTROL IN THE AREA.

3. TEMPORARY EASEMENTS FOR ACCESS TO PRIVATE PROPERTIES INCLUDE SPECIFIC REQUIREMENTS, NOTIFICATIONS AND DURATION OF ACCESS REQUIREMENTS. SEE PROJECT SPECIFICATIONS FOR DETAILS.

4. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING AND MAINTAINING ADEQUATE TRAFFIC CONTROL THROUGHOUT THE PROJECT, INCLUDING PROPER TRAFFIC CONTROL DEVICES AND/OR PERSONNEL AS REQUIRED. A COPY OF APPROVED TCPS MUST BE AVAILABLE ON SITE DURING WORK. TRAFFIC CONTROL IS TO BE IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), SECTION VI.

5. THERE WILL BE PUBLIC OUTREACH AND COMMUNICATIONS WITH THE BUSINESS DISTRICT ABOUT THE PROJECT CLOSURES BY THE CONTRACTOR OR THE PROJECT MANAGER.

COLORADO LICENSED
43395
CHRISTOPHER A. WISLEDER
PROFESSIONAL ENGINEER
Christopher A. Wisleder
4/16/2019

N

0 100' 200'
SCALE: 1" = 100'

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GREENWOOD VILLAGE, CO 80111

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27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343
TRAFFIC CONTROL PLAN

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-TC-EA.dwg
DATE: APRIL 16, 2019
SHEET NO.: 32

PLOT DATE: May 2, 2019

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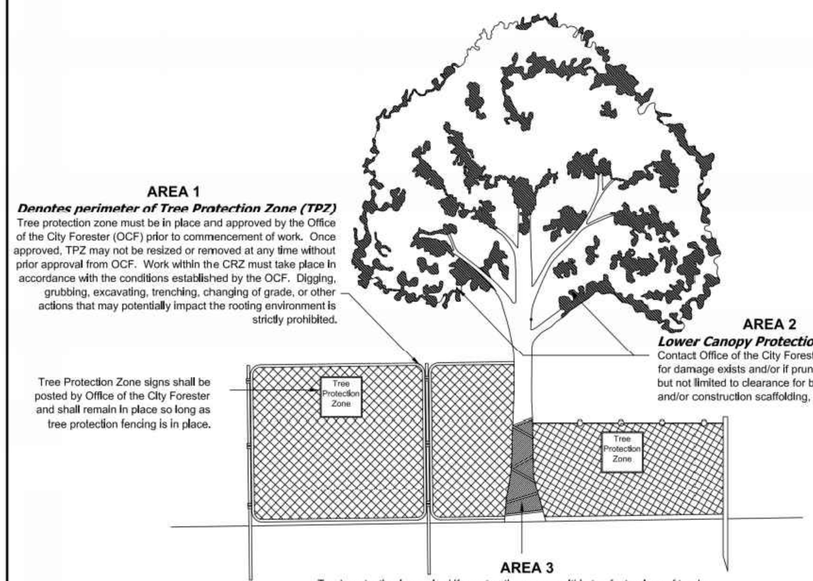
## TREE PROTECTION ZONES

***The Tree Protection Zone (TPZ) shall be equal to eighteen inches (18") radially from the tree for every one inch of trunk diameter at breast height (DBH = 4.5' above soil line).***

***The Critical Root Zone (CRZ) shall be equal to twelve inches (12") radially from the tree for every one inch of trunk diameter at breast height (DBH = 4.5' above soil line).***

***The Structural Root Zone (SRZ) shall be equal to 0.9' (10.8") radially from the tree for every one inch of trunk diameter at breast height (DBH = 4.5' above soil line).***




**NOTES**

1. Office of the City Forester Tree Retention and Protection Specifications shall be followed throughout duration of project.
2. Damage to protected trees is subject to penalty per City Ordinance.
3. Tree protection shall be installed prior to commencement of demolition/construction activities, approved by Office of the City Forester staff, and shall remain in place until Certificate of Occupancy is issued by the City & County of Denver.
4. Once approved by the Office of the City Forester, the Tree Protection Zone shall not be resized, modified, removed, or altered in any manner without prior written approval.
5. Entrance/access to the Tree Protection Zone is not permitted without prior written approval from the Office of the City Forester.
6. No materials, debris, equipment, or site amenities shall be stored within the Tree Protection Zone without prior written approval from the Office of the City Forester.
7. While tree protection fencing is in place, trees shall be deep-root watered at an interval of once per week when temperatures are at or above 50-degrees F. Trees shall be watered at the rate of 10 gallons per inch caliper.
8. Minimum Tree Protection Zone, Area 1 fencing shall be "orange plastic safety fencing," min. 48" in height, top secured to metal T-posts with 12-gauge wire woven through top of fencing for entire length.
   - Heavy duty T-posts shall be placed so that wire & fence are taut.
   - Chain link fencing is recommended and may be required by the Office of the City Forester where heavy construction activity is adjacent to existing trees.
   - "Tree Protection Zone" signs shall remain in place as posted by Office of the City Forester and shall be maintained in the condition in which they were installed.

| REVISIONS | MARK | BULLETIN | DATE | PREPARED BY OFFICE OF THE CITY FORESTER (OCF) PARKS AND RECREATION DEPARTMENT | CITY AND COUNTY OF DENVER 201 W. COLFAX AVE. DENVER, COLORADO 80202 | STANDARD TREE DETAIL FOR TREE PROTECTION ZONE | NOT TO SCALE |
|---|---|---|---|---|---|---|---|
| | | | | | | | DATE: Oct. 2017 |
| | | | | | | | DIAGRAM P-3 |

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TEL.: (303) 446-3617 FAX: (303) 446-3647


27TH STREET STORM INTERCEPTOR
PHASE 2

PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

**TREE PROTECTION DETAIL**

COLORADO LICENSED CHRISTOPHER AND WISLEDER 43395 PROFESSIONAL ENGINEER
5/02/2019


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| | |
|---|---|
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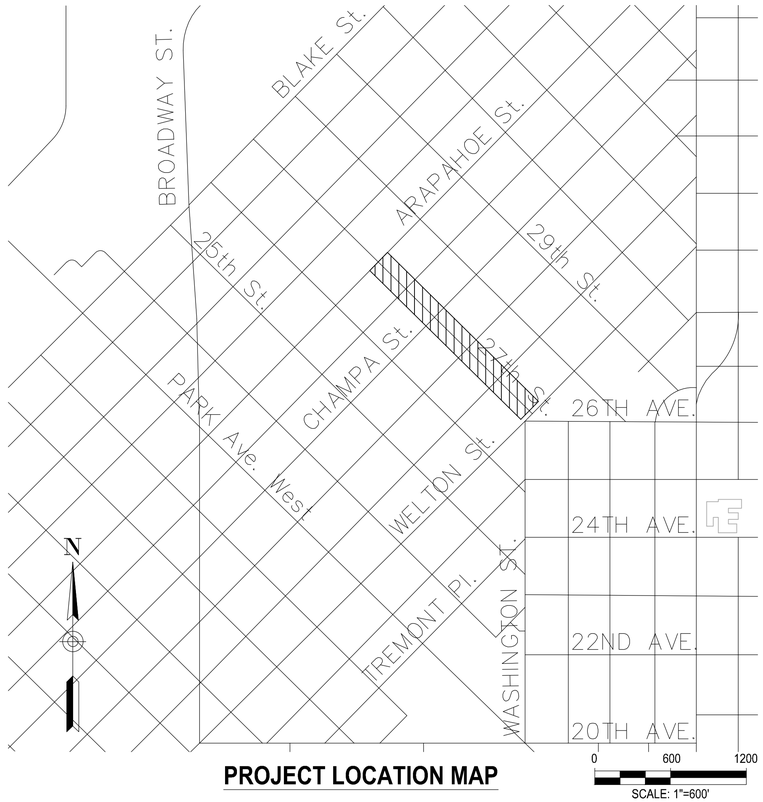
| DESIGNED BY: | CWISLEDER |
| APPROVED BY: | CWISLEDER |
| DRAWING NAME: | 9412-DEMO2.dwg |
| DATE: | APRIL 16, 2019 |
| SHEET NO.: | 33 |


\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\9412-DEMO2.DWG
PLOT DATE: May 2, 2019

# 27TH STREET STORM INTERCEPTOR PHASE 2

## IN THE SOUTHEAST ¼ OF SECTION 27, TOWNSHIP 3 SOUTH, RANGE 68 WEST OF 6TH PRINCIPAL MERIDIAN

DENVER®
THE MILE HIGH CITY




**PROJECT LOCATION MAP**

## UDFCD BMP STANDARD DRAWINGS

| STD. DWG. NO. | DESCRIPTION |
|---|---|
| EC-01 | SURFACE ROUGHENING |
| EC-02 | TEMPORARY AND PERMANENT SEEDING |
| EC-03 | SOIL BINDERS |
| EC-04 | MULCHING |
| EC-05 | COMPOST BLANKET AND FILTER BERM |
| EC-06 | ROLLED EROSION CONTROL PRODUCTS |
| EC-07 | TEMPORARY SLOPE DRAINS |
| EC-08 | TEMPORARY OUTLET PROTECTION |
| EC-09 | ROUGH CUT STREET CONTROL |
| EC-10 | EARTH DIKES AND DRAINAGE SWALES |
| EC-11 | TERRACING |
| EC-12 | CHECK DAM |

| STD. DWG. NO. | DESCRIPTION |
|---|---|
| EC-13 | STREAMBANK STABILIZATION |
| EC-14 | WIND EROSION-DUST CONTROL |
| MM-1 | CONCRETE WASHOUT AREA |
| MM-2 | STOCKPILE MANAGEMENT |
| MM-3 | GOOD HOUSEKEEPING PRACTICES |
| SC-01 | SILT FENCE |
| SC-02 | SEDIMENT CONTROL LOG |
| SC-03 | STRAW BALE BARRIER |
| SC-04 | BRUSH BARRIER |
| SC-5 | ROCK SOCK |
| SC-06 | INLET PROTECTION |
| SC-07 | SEDIMENT BASIN |
| SC-08 | SEDIMENT TRAP |
| SC-09 | VEGETATIVE BUFFERS |

| STD. DWG. NO. | DESCRIPTION |
|---|---|
| SC-10 | CHEMICAL TREATMENT |
| SM-01 | CONSTRUCTION PHASING-SCHEDULING |
| SM-02 | PROTECTION OF EXISTING VEGETATION |
| SM-03 | CONSTRUCTION FENCE |
| SM-04 | VEHICLE TRACKING CONTROL |
| SM-05 | STABILIZED CONSTRUCTION ROADWAY |
| SM-06 | STABILIZED STAGING AREA |
| SM-07 | STREET SWEEPING AND VACUUMING |
| SM-08 | TEMPORARY DIVERSION METHODS |
| SM-09 | DEWATERING OPERATIONS |
| SM-10 | TEMPORARY STREAM CROSSING |
| SM-11 | TEMPORARY BATCH PLANT |
| SM-12 | PAVING AND GRINDING OPERATIONS |

## CCD STORM WATER MANAGEMENT PLAN STANDARD NOTES

1. THE PERMITTEE AND/OR CONTRACTOR SHALL REMOVE ALL SEDIMENT, MUD, CONSTRUCTION DEBRIS, OR OTHER POTENTIAL POLLUTANTS THAT MAY HAVE BEEN DISCHARGED TO OR, ACCUMULATE IN, THE FLOWLINES, STORM DRAINAGE APPURTENANCES, AND PUBLIC RIGHTS OF WAYS OF THE CITY AND COUNTY OF DENVER AS A RESULT OF CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS SITE DEVELOPMENT OR CONSTRUCTION PROJECT. SAID REMOVAL SHALL BE CONDUCTED IN A TIMELY MANNER.

2. THE CONTRACTOR SHALL PREVENT SEDIMENT, DEBRIS AND ALL OTHER POLLUTANTS FROM ENTERING THE STORM SEWER SYSTEM DURING ALL DEMOLITION, EXCAVATION, TRENCHING, BORING, GRADING, OR OTHER CONSTRUCTION OPERATIONS THAT ARE PART OF THIS PROJECT. THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR REMEDIATION OF ANY ADVERSE IMPACTS TO THE MUNICIPAL SEPARATE STORM SEWER SYSTEM, RECEIVING WATERS, WATERWAYS, WETLANDS, AND OR OTHER PUBLIC OR PRIVATE PROPERTIES, RESULTING FROM WORK DONE AS PART OF THIS PROJECT.

3. SOIL STABILIZATION MEASURES SHALL BE IMPLEMENTED WITHIN FOURTEEN (14) DAYS FOLLOWING COMPLETION OF GRADING ACTIVITIES. STABILIZATION OF DISTURBED AREAS ADJACENT TO RECEIVING WATERS OR WITH SLOPES 3 TO 1 OR GREATER SHALL BE COMPLETED WITHIN SEVEN (7) DAYS FOLLOWING COMPLETION OF GRADING ACTIVITIES. NOTE: FEDERAL AND STATE REGULATIONS MAY SOON REQUIRE STABILIZATION WITHIN SEVEN (7) DAYS OF COMPLETION OF GRADING ACTIVITIES. IN SUCH CASES, THE SHORTER TIMEFRAME SHALL APPLY TO PROJECTS WITHIN DENVER AS WELL.

4. THE DEVELOPER, GENERAL CONTRACTOR, GRADING CONTRACTOR AND/OR THEIR AUTHORIZED AGENTS SHALL INSURE THAT ALL LOADS OF CUT AND FILL MATERIAL IMPORTED TO OR EXPORTED FROM THIS SITE SHALL BE PROPERLY COVERED TO PREVENT LOSS OF THE MATERIAL DURING TRANSPORT ON PUBLIC RIGHTS OF WAY. (SEC.49-552; REVISED MUNICIPAL CODE)

5. THE USE OF REBAR TO ANCHOR BEST MANAGEMENT PRACTICES IS PROHIBITED. STEEL FENCE POSTS MAY BE USED ON A CASE BY CASE BASIS AND REQUIRES APPROVAL FROM THE CITY AND COUNTY OF DENVER SWMP REVIEWER OR THE STORMWATER ENFORCEMENT INVESTIGATOR PRIOR TO INSTALLATION.

6. SOILS THAT WILL BE STOCKPILED FOR MORE THAN THIRTY (30) DAYS SHALL BE PROTECTED FROM WIND AND WATER EROSION WITHIN FOURTEEN (14) DAYS OF STOCKPILE CONSTRUCTION. STABILIZATION OF STOCKPILES LOCATED WITHIN 100 FEET OF RECEIVING WATERS, OR WITH SLOPES 3 TO 1 OR GREATER SHALL BE COMPLETED WITHIN SEVEN (7) DAYS FOLLOWING STOCKPILE CONSTRUCTION. STABILIZATION AND PROTECTION OF THE STOCKPILE MAY BE ACCOMPLISHED BY ANY OF THE FOLLOWING: MULCHING, TEMPORARY/PERMANENT REVEGETATION OPERATIONS, CHEMICAL SOIL STABILIZER APPLICATION (REQUIRES DENVER PUBLIC WORKS APPROVAL), OR EROSION CONTROL MATTING/GEOTEXTILES. IF STOCKPILES ARE LOCATED WITHIN 100 FEET OF RECEIVING WATERS, A DRAINAGEWAY OR THE SITE PERIMETER, ADDITIONAL SEDIMENT CONTROLS SHALL BE REQUIRED.

7. APPROVED EROSION AND SEDIMENT CONTROL 'BEST MANAGEMENT PRACTICES' SHALL BE MAINTAINED AND KEPT IN GOOD REPAIR FOR THE DURATION OF THIS PROJECT. AT A MINIMUM, THE PERMITTEE OR CONTRACTOR SHALL PRODUCE AND RETAIN WEEKLY WRITTEN INSPECTION RECORDS FOR ALL BMPS AND AFTER SIGNIFICANT PRECIPITATION EVENTS. ALL NECESSARY MAINTENANCE AND REPAIR SHALL BE COMPLETED IMMEDIATELY. ADDITIONALLY, STREET SWEEPING IS TO BE COMPLETED BY THE CLOSE OF THE BUSINESS DAY OR (AND) ON AN AS NEEDED BASIS THROUGHOUT THE DAY.

8. WATER USED IN THE CLEANING OF CEMENT TRUCK DELIVERY CHUTES SHALL BE DISCHARGED INTO A PREDEFINED, CONCRETE WASHOUT AREA ON THE JOB SITE. BERMED CONTAINMENT OR COMMERCIALLY AVAILABLE CONCRETE WASHOUT DEVICES THAT FULLY CONTAIN ALL WASH WATER ARE ACCEPTABLE. WASH WATER DISCHARGED INTO THE CONTAINMENT AREA OR DEVICE SHALL BE ALLOWED TO INFILTRATE, EVAPORATE, AND OR BE DISPOSED OF IN ACCORDANCE WITH ALL APPLICABLE REGULATIONS. DRIED CEMENT WASTE IS TO BE REMOVED FROM THE CONTAINMENT AREA AND PROPERLY DISPOSED.

   SHOULD THE USE OF A PREDEFINED BERMED CONTAINMENT AREA OR APPROVED WASHOUT DEVICE BE TECHNICALLY INFEASIBLE DUE TO THE PROJECT SIZE, OR LACK OF AN AREA WITH A SUITABLE GROUND SURFACE FOR ESTABLISHING CONTAINMENT, PROPER DISPOSAL OF CONCRETE WASHOUT AND WASH WATER AT THE JOB SITE SHALL CONFORM TO THE APPROVED TECHNIQUES AND PRACTICES IDENTIFIED IN THE COLORADO DEPARTMENT OF PUBLIC HEALTH & ENVIRONMENT'S TRAINING VIDEO ENTITLED 'BUILDING FOR A CLEANER ENVIRONMENT, READY MIX WASHOUT TRAINING' AND ITS ACCOMPANYING MANUAL ENTITLED, 'READY MIX WASHOUT GUIDEBOOK, VEHICLE AND EQUIPMENT WASHOUT AT CONSTRUCTION SITES.

   THE DIRECT OR INDIRECT DISCHARGE OF WATER CONTAINING WASTE CEMENT TO THE STORM SEWER SYSTEM IS PROHIBITED. (SEC.56-102A, C; REVISED MUNICIPAL CODE, CITY AND COUNTY OF DENVER).

9. THE CONTRACTOR SHALL PROTECT ALL STORM SEWER FACILITIES ADJACENT TO ANY LOCATION WHERE PAVEMENT CUTTING OPERATIONS INVOLVING WHEEL CUTTING, SAW CUTTING, OR ABRASIVE WATER JET CUTTING ARE TO TAKE PLACE.

   THE CONTRACTOR SHALL REMOVE AND PROPERLY DISPOSE OF ALL WASTE PRODUCTS GENERATED BY SAID CUTTING OPERATIONS ON A DAILY BASIS OR AS NEEDED THROUGHOUT THE WORK DAY.

   THE DISCHARGE OF ANY WATER CONTAMINATED BY WASTE PRODUCTS FROM CUTTING OPERATIONS TO THE STORM SEWER SYSTEM IS PROHIBITED. (SEC.56-102A, C; REVISED MUNICIPAL CODE, CITY AND COUNTY OF DENVER)

10. PAVED AND IMPERVIOUS SURFACES WHICH ARE ADJACENT TO CONSTRUCTION SITES MUST BE SWEPT ON A DAILY BASIS AND AS NEEDED DURING THE DAY WHEN SEDIMENT AND OTHER MATERIALS ARE TRACKED OR DISCHARGED ONTO THEM. EITHER SWEEPING BY HAND OR USE OF STREET SWEEPERS IS ACCEPTABLE. STREET SWEEPERS USING WATER WHILE SWEEPING IS PREFERRED IN ORDER TO MINIMIZE DUST. FLUSHING OFF PAVED SURFACES WITH WATER IS PROHIBITED. (SEC.56-102A, C; REVISED MUNICIPAL CODE, CITY AND COUNTY OF DENVER)

11. THE FOLLOWING SEED TYPES AND RATES SHALL BE USED:

| Seed Mixture | Growth Season | Growth Form | Mature Height | PLS lbs/ac | % of Seed Mix by Wgt | PLS/sq ft |
|---|---|---|---|---|---|---|
| (1) Sideoats Grama | Warm | Rhizomatous | 8-24" | 1.50 | 7.50 | 7 |
| (2) Buffalograss | Warm | Rhizomatous | 4-8" | 5.00 | 25.00 | 6 |
| (3) Blue Grama | Warm | Rhizomatous | 6-24" | 2.00 | 10.00 | 34 |
| (4) Inland Saltgrass | Warm | Rhizomatous | 13-35" | 1.00 | 5.00 | 12 |
| (5) Slender Wheatgrass | Cool | Bunch | 18-24" | 2.00 | 10.00 | 6 |
| (6) Indian Ricegrass | Cool | Bunch | 8-30" | 4.00 | 20.00 | 15 |
| (7) Western Wheatgrass | Cool | Rhizomatous | 12-24" | 4.50 | 22.50 | 11 |

12. INITIAL BMPS SHALL BE INSTALLED AND APPROVED BY CITY AND COUNTY OF DENVER INSPECTOR PRIOR TO ANY SITE DISTURBANCE ACTIVITIES.

13. UDFCD BMP STANDARD DRAWINGS ARE AT (HTTPS://UDFCD.ORG/VOLUME-THREE) UNDER CHAPTER 7.

COLORADO LICENSED
CHRISTIAN ANN WISLEDER
43395
PROFESSIONAL ENGINEER
05/02/2019

EROSION CONTROL NUMBER
EC-2017-EC-0000XXX

MERRICK®
5970 GREENWOOD PLAZA BLVD
GREENWOOD VILLAGE, CO 80111

| NO. | DESCRIPTION OF REVISIONS | DATE | BY |
|---|---|---|---|
| | | | |

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ENGINEERING DIVISION
CAPITAL PROJECTS MANAGEMENT
2000 W. 3RD AVE. DENVER, CO 80223
TEL.: (303) 446-3617 FAX: (303) 446-3647


27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343
STORMWATER MANAGEMENT PLAN

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-EC-PH2.dwg
DATE: APRIL 16, 2019
SHEET NO.: 34

PLOT DATE: May 2, 2019

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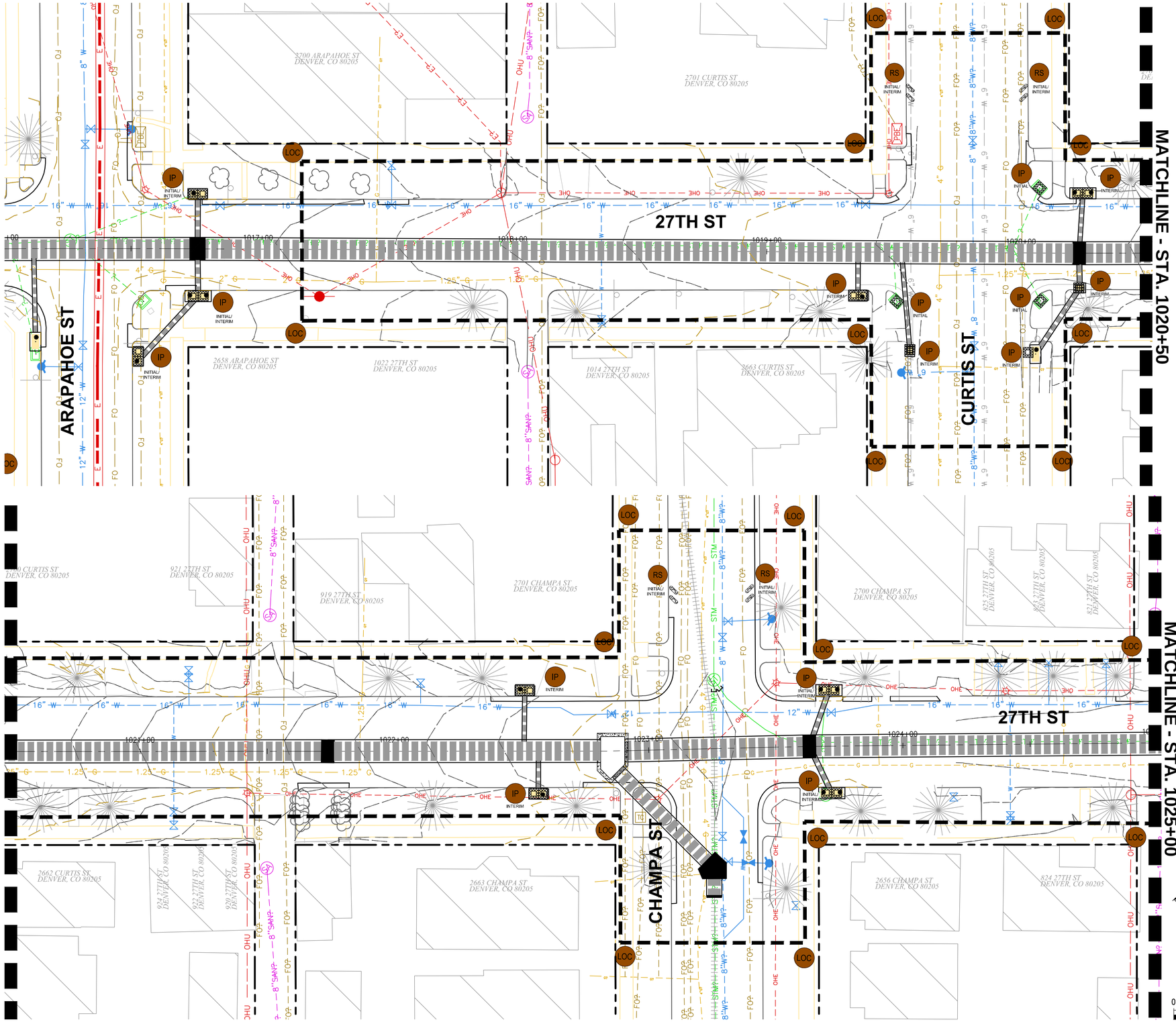


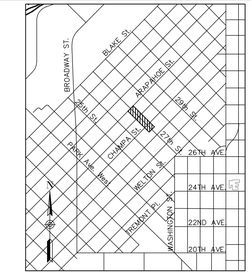


KEY MAP
SCALE: 1"=2000'

## DRAWING LEGEND

| | |
|---|---|
| CWA | CONCRETE WASHOUT AREA |
| VTC | VEHICLE TRACKING CONTROL |
| SM | SEEDING AND MULCHING |
| SF | SILT FENCE |
| IP | INLET PROTECTION |
| RS | ROCK SOCK |
| PT | PORTABLE TOILET |
| ECB | EROSION CONTROL BLANKET WITH SEEDING |
| SSA | STABILIZED STAGING AREA |
| | FLOW ARROW (HISTORIC) |
| | FLOW ARROW (PROPOSED) |
| LOC | LIMITS OF CONSTRUCTION |
| CF | CHAINLINK CONST. FENCE |
| SCL | SEDIMENT CONTROL LOG |

NOTES

1. ALL EROSION CONTROL IS TO BE INSTALLED PRIOR TO WORK COMMENCING IN THE PHASE FOR WHICH IT IS TO BE INSTALLED, AS DISTURBANCE OCCURS.
2. CONCRETE WASHOUT STRUCTURES SHALL BE PORTABLE. LOCATION OF WASHOUT STRUCTURES SHALL BE DETERMINED DURING CONSTRUCTION.
3. ALL AREAS USED FOR STAGING SHALL BE RE-ESTABLISHED TO FINAL STABILIZATION.
4. LOCATE PORTABLE TOILETS ON A FLAT SLOPE AWAY FROM ANY DRAINAGE STRUCTURES OR WATERWAYS AND PROVIDE TIE-DOWNS.
5. CONTRACTOR SHALL USE CONSTRUCTION FENCE AROUND LIMITS AS NECESSARY TO KEEP PEDESTRIANS OUT OF WORK AREA.
6. CONTRACTOR SHALL SWEEP UP SAWCUT SLURRY AFTER SAWCUTTING OPERATIONS TO KEEP IT FROM BEING TRANSPORTED TO THE STORM SEWER SYSTEM.
7. STABILIZED STAGING AREA, VEHICLE TRACKING CONTROL AND CONCRETE WASHOUT LOCATIONS SHALL BE DETERMINED BY THE CONTRACTOR PRIOR TO CONSTRUCTION AND APPROVED BY THE CITY.
8. ROCK SOCKS SHALL BE INSTALLED IN THE INITIAL PHASE AND THEN REINSTALLED AFTER THE NEW CURB AND GUTTER IS IN PLACE.

COLORADO LICENSED
43395
CHRISTIAN WINSLEDER
PROFESSIONAL ENGINEER
Christian Winsleder
05/02/2019

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27TH STREET STORM INTERCEPTOR
PHASE 2

PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

EROSION CONTROL PLAN

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412-EC-PH2.dwg
DATE: APRIL 16, 2019
SHEET NO.: 35

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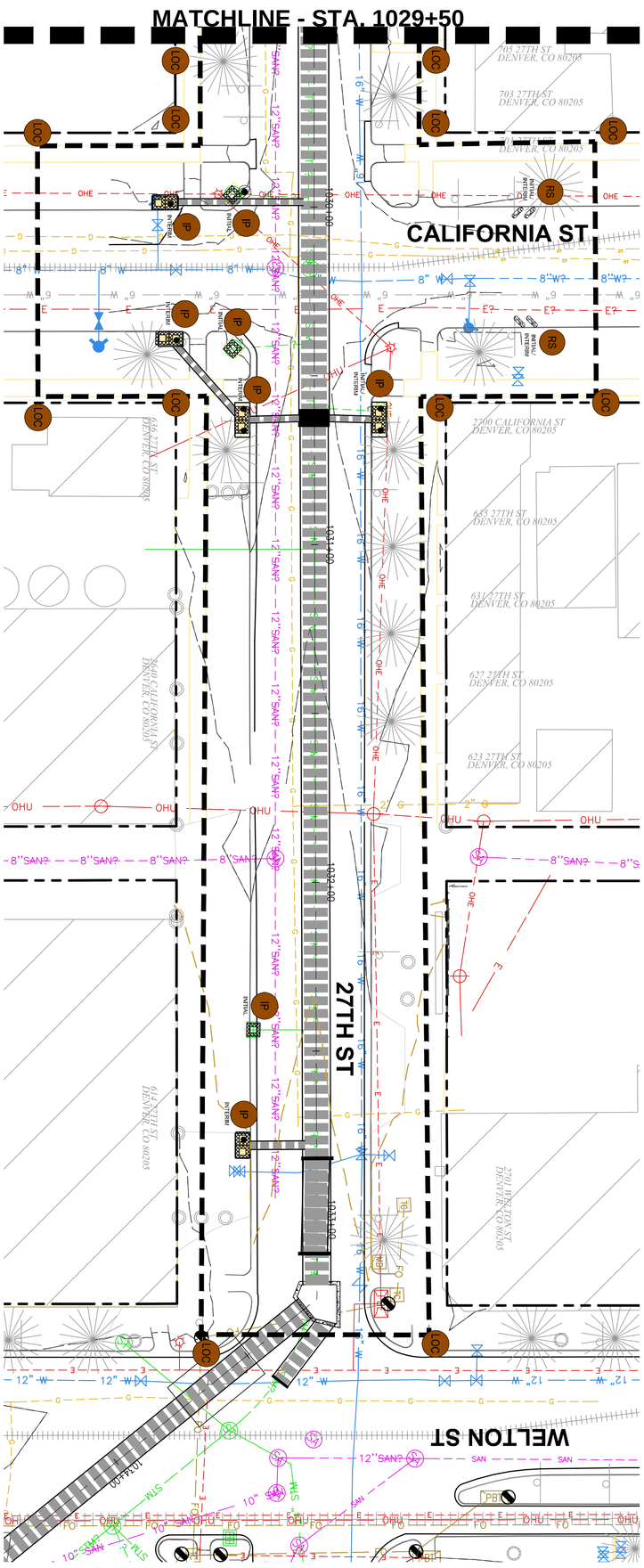


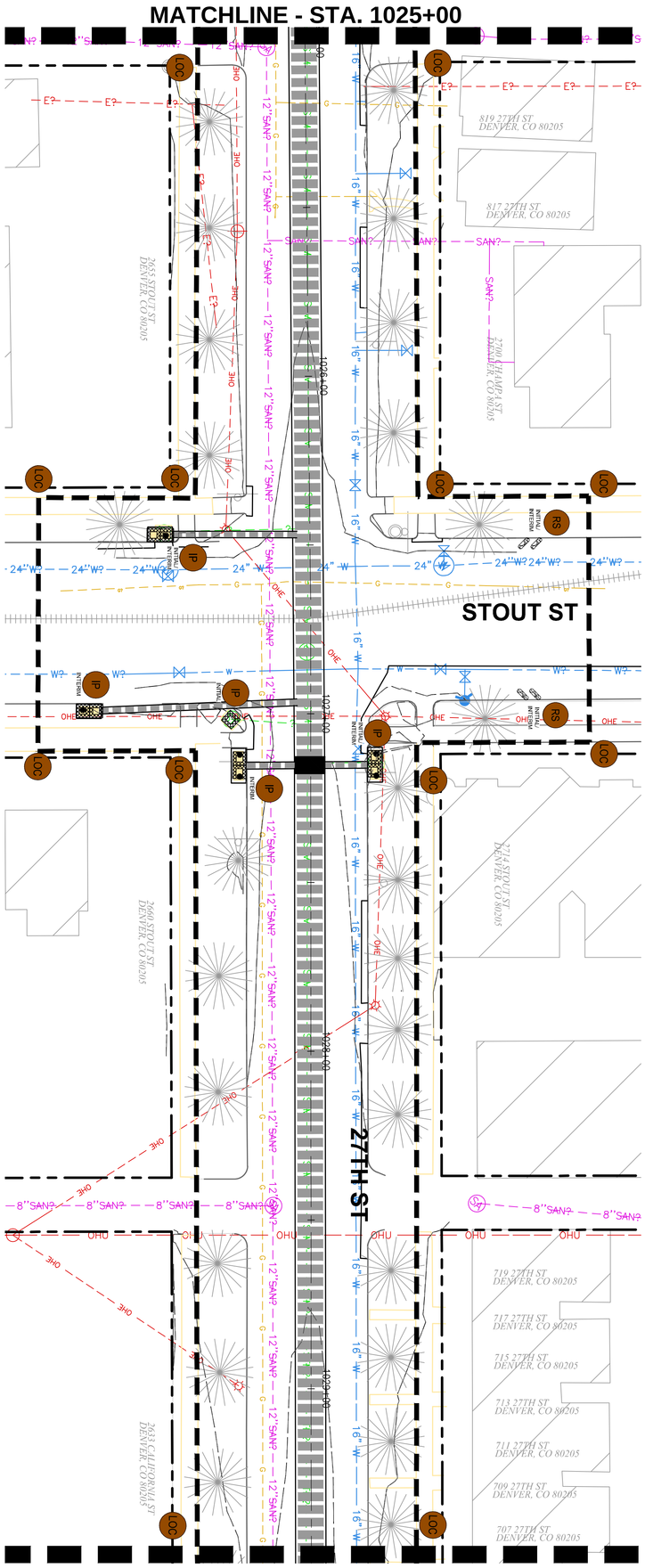


SCALE: 1"=20'

NOTES

1. ALL EROSION CONTROL IS TO BE INSTALLED PRIOR TO WORK COMMENCING IN THE PHASE FOR WHICH IT IS TO BE INSTALLED, AS DISTURBANCE OCCURS.
2. CONCRETE WASHOUT STRUCTURES SHALL BE PORTABLE. LOCATION OF WASHOUT STRUCTURES SHALL BE DETERMINED DURING CONSTRUCTION.
3. ALL AREAS USED FOR STAGING SHALL BE RE-ESTABLISHED TO FINAL STABILIZATION.
4. LOCATE PORTABLE TOILETS ON A FLAT SLOPE AWAY FROM ANY DRAINAGE STRUCTURES OR WATERWAYS AND PROVIDE TIE-DOWNS.
5. CONTRACTOR SHALL USE CONSTRUCTION FENCE AROUND LIMITS AS NECESSARY TO KEEP PEDESTRIANS OUT OF WORK AREA.
6. CONTRACTOR SHALL SWEEP UP SAWCUT SLURRY AFTER SAWCUTTING OPERATIONS TO KEEP IT FROM BEING TRANSPORTED TO THE STORM SEWER SYSTEM.
7. STABILIZED STAGING AREA, VEHICLE TRACKING CONTROL AND CONCRETE WASHOUT LOCATIONS SHALL BE DETERMINED BY THE CONTRACTOR PRIOR TO CONSTRUCTION AND APPROVED BY THE CITY.
8. ROCK SOCKS SHALL BE INSTALLED IN THE INITIAL PHASE AND THEN REINSTALLED AFTER THE NEW CURB AND GUTTER IS IN PLACE.

## DRAWING LEGEND

- CWA — CONCRETE WASHOUT AREA
- VTC — VEHICLE TRACKING CONTROL
- SM — SEEDING AND MULCHING
- SF — SILT FENCE
- IP — INLET PROTECTION
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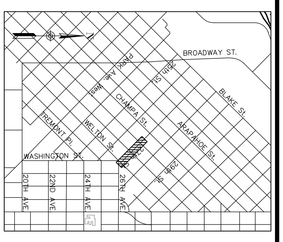
- FLOW ARROW (PROPOSED)
- LOC — LIMITS OF CONSTRUCTION
- CF — CHAINLINK CONST. FENCE
- SCL — SEDIMENT CONTROL LOG

## KEY MAP

SCALE: 1"=2000'

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COLORADO LICENSED PROFESSIONAL ENGINEER 43395 Nick Wisleder

| | |
|---|---|
| DRAWN BY: | MMILLER/AWOLFF |
| DESIGNED BY: | CWISLEDER |
| APPROVED BY: | CWISLEDER |
| DRAWING NAME: | 9412-EC-PH2.dwg |
| DATE: | APRIL 16, 2019 |
| SHEET NO.: | 36 |

# 27TH STREET STORM INTERCEPTOR PHASE 2

PRO TRACKING NO:

PROJECT MASTER NO: 2017-PROJMSTR-0000343

EROSION CONTROL PLAN

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
CAPITAL PROJECTS MANAGEMENT
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|---|---|---|---|
| | | | |

## GENERAL NOTES

ALL WORK SHALL BE DONE IN ACCORDANCE WITH CITY AND COUNTY OF DENVER (CCD) STANDARD CONSTRUCTION SPECIFICATIONS.

EXCEPT AS SHOWN IN THE PLANS, STRUCTURE EXCAVATION AND BACKFILL SHALL BE IN ACCORDANCE WITH M-206-2.

EXPANSION JOINT MATERIAL SHALL MEET AASHTO SPECIFICATION M-213.

GRADE 60 REINFORCING STEEL IS REQUIRED.

ALL REINFORCING STEEL SHALL BE NON-EPOXY COATED UNLESS OTHERWISE NOTED.

(E) DENOTES EPOXY COATED REINFORCING STEEL.

THE FOLLOWING TABLE GIVES THE MINIMUM CLASS B (STAGGERED) LAP SPLICE LENGTH FOR EPOXY COATED REINFORCING BARS PLACED IN ACCORDANCE WITH SUBSECTION 602.06. THESE SPLICE LENGTHS SHALL BE INCREASED BY 25% FOR BARS SPACED AT LESS THAN 6" ON CENTER, INCREASED BY 40% FOR HORIZONTAL BARS WITH MORE THAN 12" OF CONCRETE BELOW (TOP BARS), AND INCREASED BY 75% IF BOTH CONDITIONS EXIST. THE INCREASES ABOVE FOR #6 THRU #11 BARS MAY BE 25%, 13%, AND 42% RESPECTIVELY.

| BAR SIZE | #4 | #5 | #6 | #7 | #8 | #9 | #10 | #11 |
|---|---|---|---|---|---|---|---|---|
| SPLICE LENGTH FOR CLASS D CONCRETE | 1'-3" | 1'-7" | 2'-5" | 2'-10" | 3'-8" | 4'-8" | 5'-11" | 7'-3" |

WHEN THE CONTRACTOR ELECTS TO SUBSTITUTE EPOXY COATED REINFORCEMENT FOR BLACK REINFORCING BARS, THE MINIMUM LAP SPLICE SHALL BE AS DESCRIBED ABOVE.

THE FOLLOWING TABLE GIVES THE MINIMUM CLASS B (STAGGERED) LAP SPLICE LENGTH FOR BLACK REINFORCING BARS PLACED IN ACCORDANCE WITH SUBSECTION 602.06. THESE SPLICE LENGTHS SHALL BE INCREASED BY 25% FOR BARS SPACED AT LESS THAN 6" ON CENTER, INCREASED BY 40% FOR HORIZONTAL BARS WITH MORE THAN 12" OF CONCRETE B ELOW (TOP BARS), AND INCREASED BY 75% IF BOTH CONDITIONS EXIST.

| BAR SIZE | #4 | #5 | #6 | #7 | #8 | #9 | #10 | #11 |
|---|---|---|---|---|---|---|---|---|
| SPLICE LENGTH FOR CLASS D CONCRETE | 1'-1" | 1'-4" | 1'-7" | 1'-11" | 2'-6" | 3'-1" | 3'-11" | 4'-10" |

THE ABOVE SPLICE LENGTHS SHALL BE INCREASED BY 30 PERCENT FOR NON-STAGGERED SPLICES.

THE ABOVE SPLICE LENGTHS SHALL BE INCREASED BY 20 PERCENT FOR 3 BAR BUNDLES AND 33 PERCENT FOR 4 BAR BUNDLES.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.

| | | | |
|---|---|---|---|
| E.F. = | EACH FACE | O.F. = | OUTSIDE FACE |
| F.F. = | FAR FACE | T.&B. = | TOP AND BOTTOM |
| N.F. = | NEAR FACE | T.F. = | TOP FACE |
| I.F. = | INSIDE FACE | B.F. = | BOTTOM FACE |

FOR STRUCTURE NUMBER INSTALLATION, SEE STANDARD S-614-12.

STATIONS, ELEVATIONS, AND DIMENSIONS CONTAINED IN THESE PLANS ARE CALCULATED FROM A RECENT FIELD SURVEY. THE CONTRACTOR SHALL VERIFY ALL DEPENDENT DIMENSIONS IN THE FIELD BEFORE ORDERING OR FABRICATING ANY MATERIAL.

THE INFORMATION SHOWN ON THESE PLANS CONCERNING THE TYPE AND LOCATION OF UNDERGROUND UTILITIES IS NOT GUARANTEED TO BE ACCURATE OR ALL INCLUSIVE. THE CONTRACTOR IS RESPONSIBLE FOR MAKING HIS OWN DETERMINATION AS TO THE TYPE AND LOCATION OF UNDERGROUND UTILITIES AS MAY BE NECESSARY TO AVOID DAMAGE THERETO. THE CONTRACTOR SHALL CONTACT THE UTILITY NOTIFICATION CENTER OF COLORADO AT 1-800-922-1987 AT LEAST 2 DAYS (NOT INCLUDING THE DAY OF NOTIFICATION) PRIOR TO ANY EXCAVATION OR OTHER EARTHWORK.

ALL CAST-IN-PLACE CONCRETE SHALL BE CLASS D UNLESS NOTED OTHERWISE.

## DESIGN DATA

AASHTO, 7th EDITION LRFD

DESIGN METHOD: LOAD AND RESISTANCE FACTOR DESIGN.

LIVE LOAD: HL-93.

LATERAL EARTH PRESSURE: 60 P.C.F (AT-REST E.F.P.)

REINFORCED CONCRETE:
CLASS D CONCRETE: f'c = 4,500 psi
REINFORCING STEEL: f'y = 60,000 psi

## ADDITIONAL REQUIREMENTS

1. CHANNELIZATION CONCRETE IS ONLY SHOWN SCHEMATICALLY FOR CLARITY. ALL TRANSITION STRUCTURES SHALL BE PROVIDED WITH CHANNELIZING CONCRETE PER CDOT STANDARD PLAN M-604-20.
2. STEP RUNGS AT 16" ON CENTER MAXIMUM SHALL BE PROVIDED AT ALL TRANSITION STRUTURES, AND SHALL CONFORM TO AASHTO M199.
3. SLOPES OF MANHOLE COVERS SHALL MATCH ROADWAY PROFILE AND CROSS-SLOPE.
5. ALL STRUCTURES SHALL BEAR ON UNDISTURBED SUBGRADE OR COMPACTED CLASS 6 GRAVEL BEDDING MATERIAL OVER UNDISTURBED SUBGRADE.
6. THE FOLLOWING MINIMUM COVER SHALL PROVIDED FOR REINFORCEMENT (UNLESS OTHERWISE NOTED):

   CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH: 3"

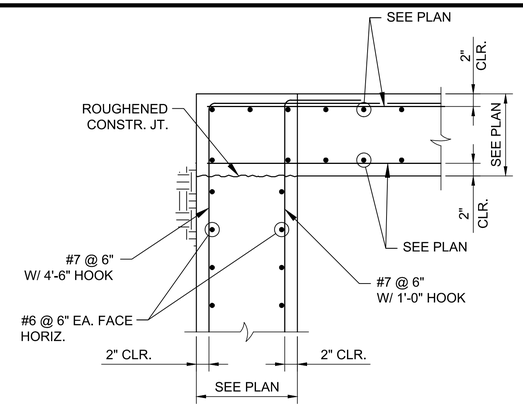
   ALL OTHER CONCRETE LOCATIONS: 2"
7. REFER TO GEOTECHNICAL REPORT NO. 17-1-117 BY KUMAR & ASSOCIATES, INC. FOR ADDITIONAL REQUIREMENTS REGARDING EXCAVATION, AND BACKFILLING.

## STRUCTURE DESCRIPTION

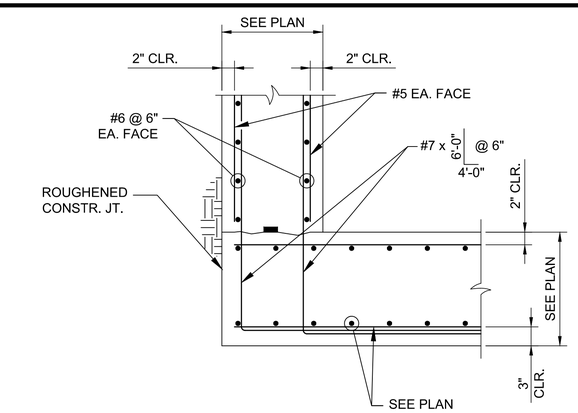
CAST-IN-PLACE STRUCTURES FOR TRANSITIONS BETWEEN VARIOUS PRECAST, RPMP, AND BRICK PIPES. DIMENSIONS VARY PER STRUCTURE.

## STRUCTURE DRAWING INDEX

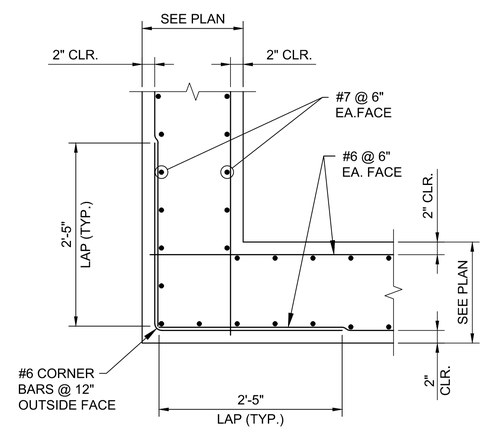

| | |
|---|---|
| S0 | GENERAL NOTES AND SPECIFICATIONS |
| S1 | MH-9 (SPECIAL) TOP SLAB REINFORCEMENT PLAN |
| S2 | MH-9 (SPECIAL) REINFORCEMENT SECTIONS |
| S3 | 84"/78" RCP CONCRETE COLLAR DETAILS |
| S4 | RCP/BRICK PIPE CONCRETE COLLAR DETAILS |

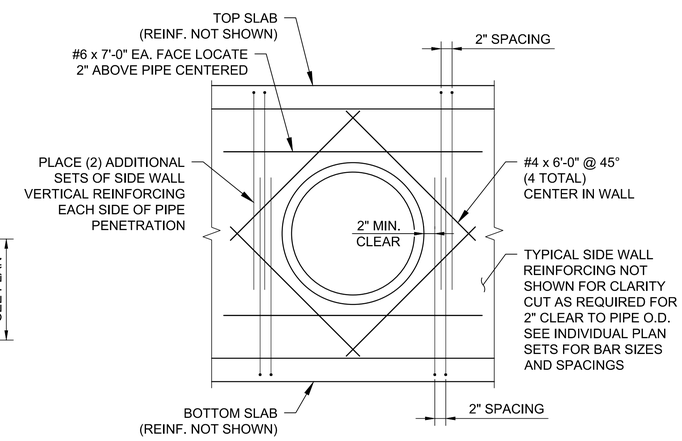

1 - TYPICAL TOP OF WALL DETAIL




2 - TYPICAL BOTTOM OF WALL DETAIL




3 - TYPICAL WALL CORNER DETAIL




4 - SIDEWALL PIPE PENETRATION

SEE SHEET S2 FOR LOCATIONS

A / XX — SECTION OR DETAIL IDENTIFICATION; CROSS-REFERENCE SHEET NUMBER ( -- = SAME SHEET)

**NOTE:**
USE CDOT 601.04 CLASS 2 SULFATE MITIGATION STRATEGIES, THUS NO CLASS C FLYASH IN ANY NEW CONCRETE IN CONTACT WITH SOILS (INLETS, PIPES, STRUCTURES), NOR IN CONTACT OR IN SPLASH ZONE OF STREET OR ROW, THUS CURB & GUTTER, SIDEWALKS, ADA RAMPS ETC.

COLORADO REGISTERED PROFESSIONAL ENGINEER — 05/02/19

San Engineering LLC
Civil and Structural Engineering

| NO. | DESCRIPTION OF REVISIONS | DATE | BY |
|---|---|---|---|

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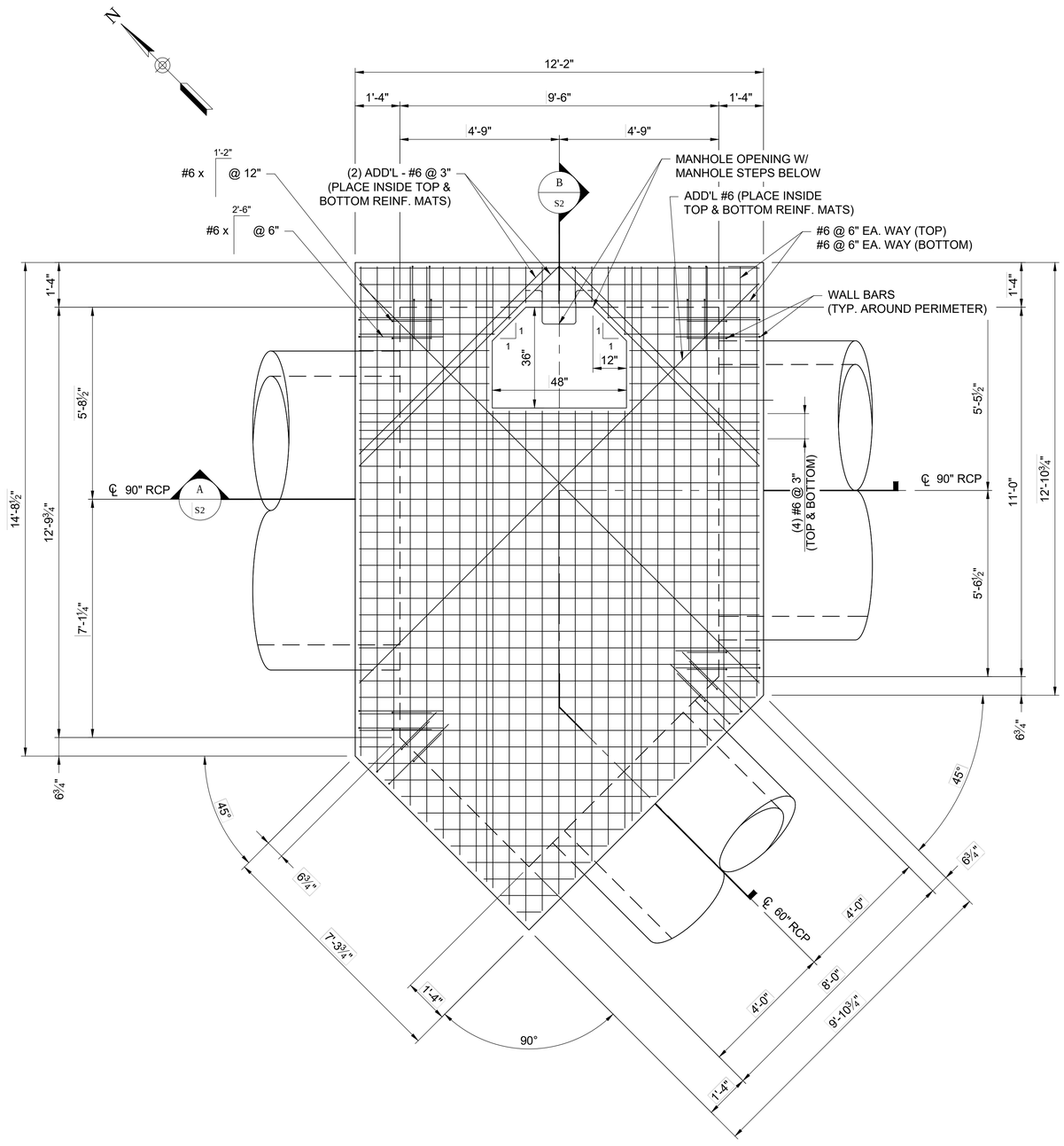
ENGINEERING DIVISION
CAPITAL PROJECTS MANAGEMENT
2000 W. 3RD AVE. DENVER, CO 80223
TEL.: (303) 446-3617 FAX: (303) 446-3647


27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

GENERAL NOTES AND SPECIFICATIONS

DRAWN BY: KB
DESIGNED BY: JKH
APPROVED BY: JJM
DRAWING NAME:
DATE: APRIL 16, 2019
SHEET NO.: S0


PLOT DATE: May 1, 2019
F:\PROJECTS\27TH STREET STORM DRAIN INTERCEPTOR\CAD\27TH STREET STORM INTERCEPTOR - STRUCTURAL_PHASE2.DWG




1 MH-9, SPECIAL STRUCTURE
TOP SLAB REINFORCEMENT PLAN
SCALE: 1/2" = 1'-0"

| NO. | DESCRIPTION OF REVISIONS | DATE | BY |
|---|---|---|---|

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27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

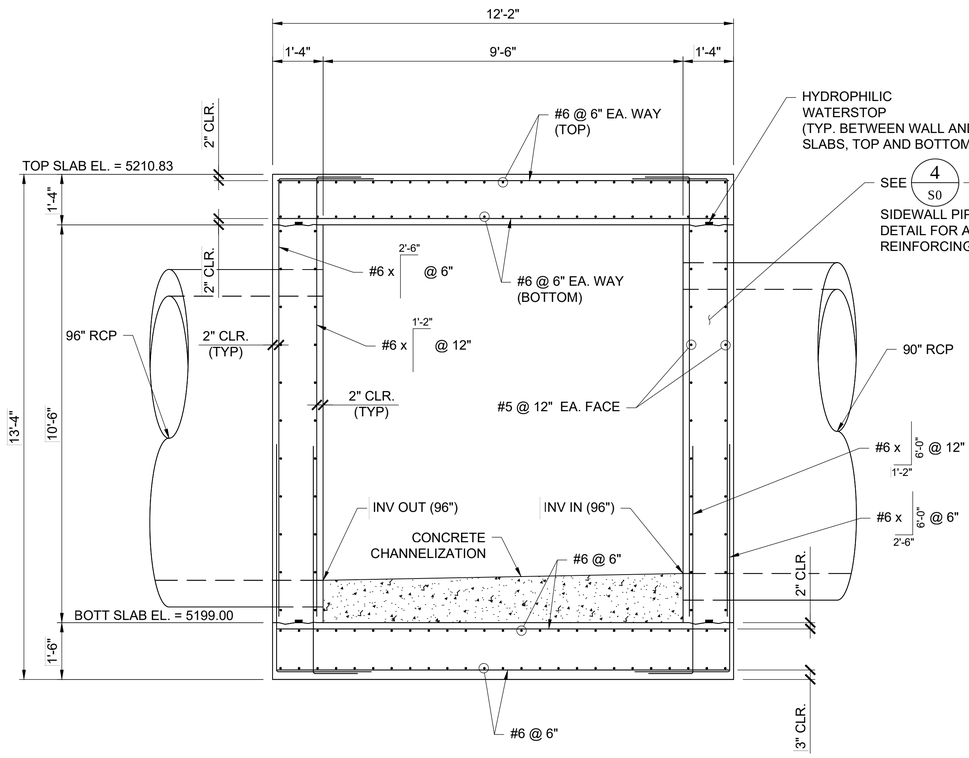
MH-9 (SPECIAL) TOP SLAB REINFORCEMENT PLAN

DRAWN BY: KB
DESIGNED BY: JKH
APPROVED BY: JJM
DRAWING NAME:
DATE: APRIL 16, 2019
SHEET NO.: S1

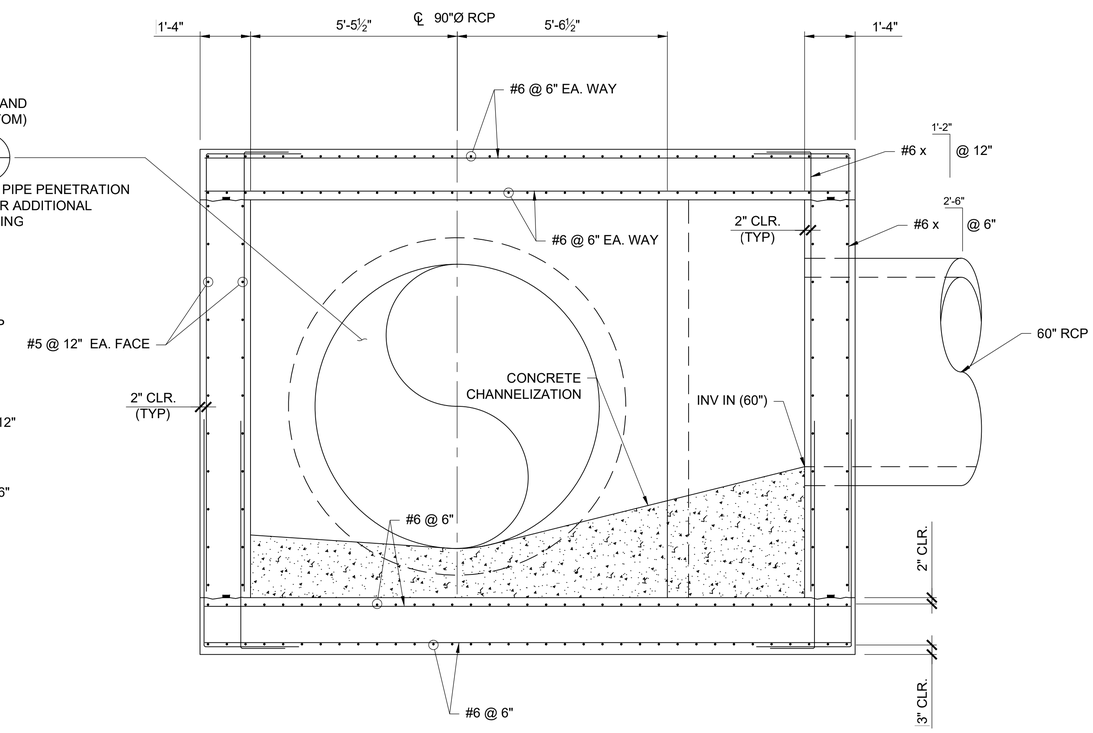
COLORADO REGISTERED PROFESSIONAL ENGINEER
05/02/19

San Engineering LLC
Civil and Structural Engineering

F:\PROJECTS\27TH STREET STORM DRAIN INTERCEPTOR\CAD\27TH STREET STORM INTERCEPTOR - STRUCTURAL_PHASE2.DWG
PLOT DATE: May 1, 2019




A / S2 MH-9, SPECIAL STRUCTURE
TYPICAL REINFORCING SECTION
SCALE: 1/2" = 1'-0"




B / S2 MH-9, SPECIAL STRUCTURE
TYPICAL REINFORCING SECTION
SCALE: 1/2" = 1'-0"

| NO. | DESCRIPTION OF REVISIONS | DATE | BY |
|---|---|---|---|

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# 27TH STREET STORM INTERCEPTOR
## PHASE 2

PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

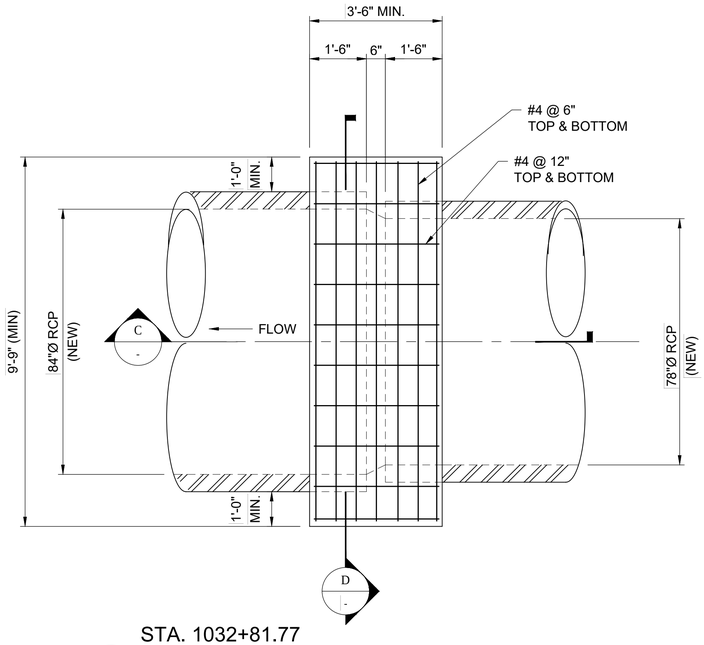
MH-9 (SPECIAL) REINFORCEMENT SECTIONS

COLORADO REGISTERED PROFESSIONAL ENGINEER
05/02/19

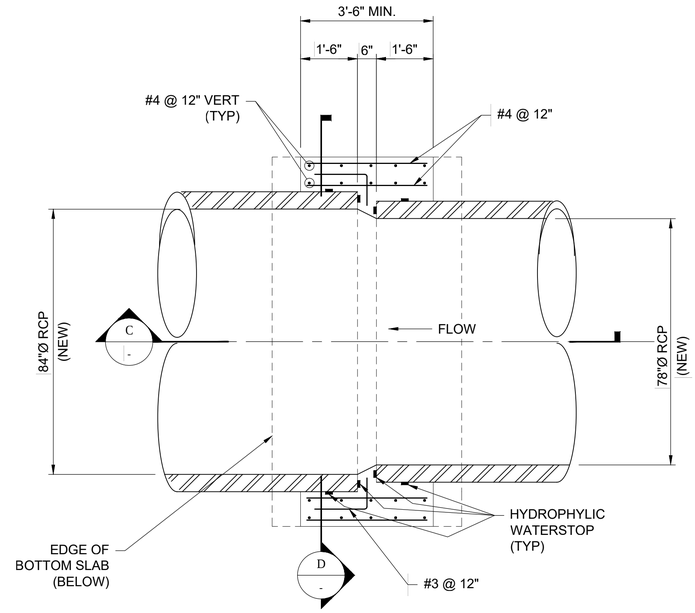
San Engineering LLC
Civil and Structural Engineering

DRAWN BY: KB
DESIGNED BY: JKH
APPROVED BY: JJM
DRAWING NAME:
DATE: APRIL 16, 2019
SHEET NO.: S2

PLOT DATE: May 1, 2019
F:\PROJECTS\27TH STREET STORM DRAIN INTERCEPTOR\CAD\27TH STREET STORM INTERCEPTOR - STRUCTURAL_PHASE2.DWG




STA. 1032+81.77
A - CONCRETE COLLAR - TOP & BOTTOM SLAB PLAN
SCALE: 1/2" = 1'-0"

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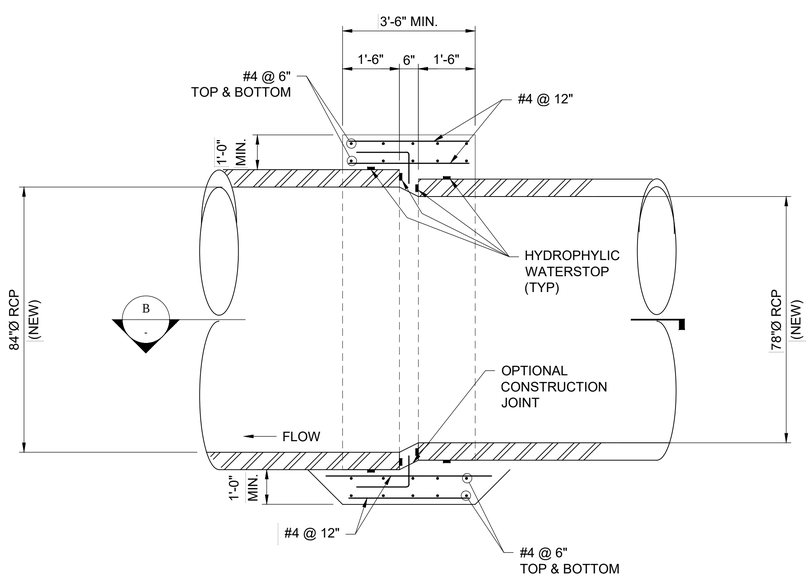
B - CONCRETE COLLAR - SECTION (HORIZ.)
SCALE: 1/2" = 1'-0"

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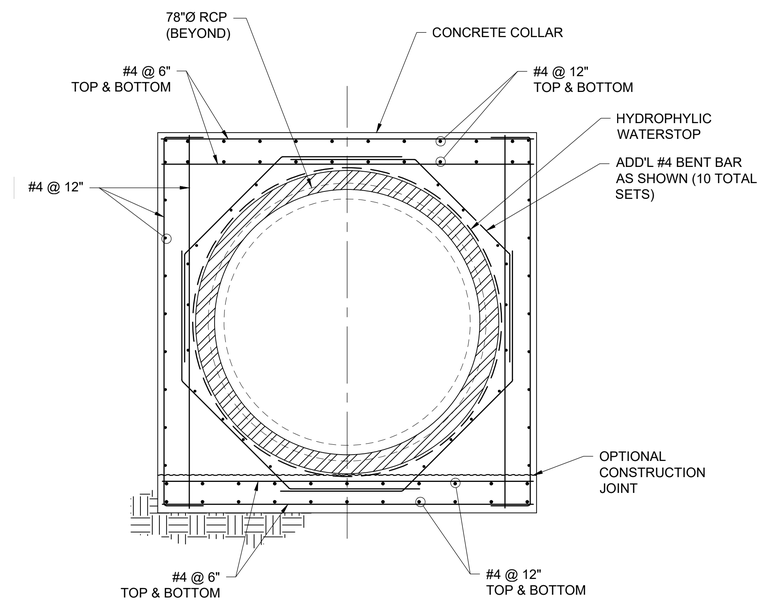
C - CONCRETE COLLAR - SECTION (VERT.)
SCALE: 1/2" = 1'-0"




STA. 1032+81.77
D - CONCRETE COLLAR - SECTION
SCALE: 1/2" = 1'-0"

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|---|---|---|---|

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# 27TH STREET STORM INTERCEPTOR PHASE 2

PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343

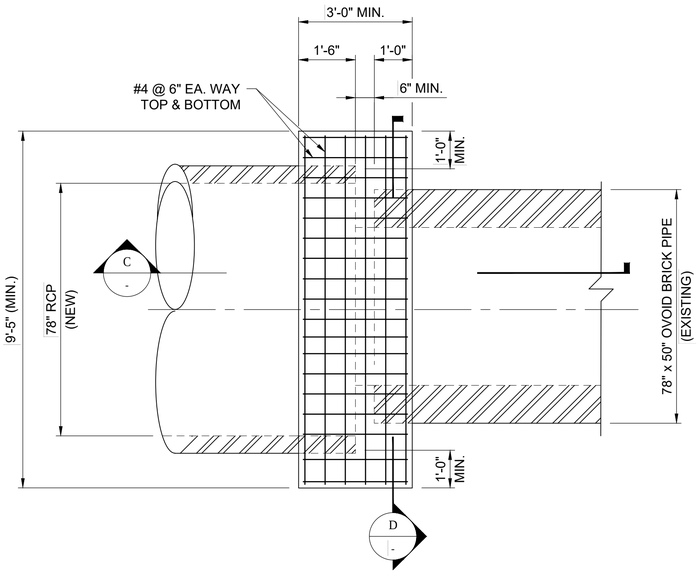
84"/78" RCP CONCRETE COLLAR DETAIL

COLORADO REGISTERED PROFESSIONAL ENGINEER
05/02/19

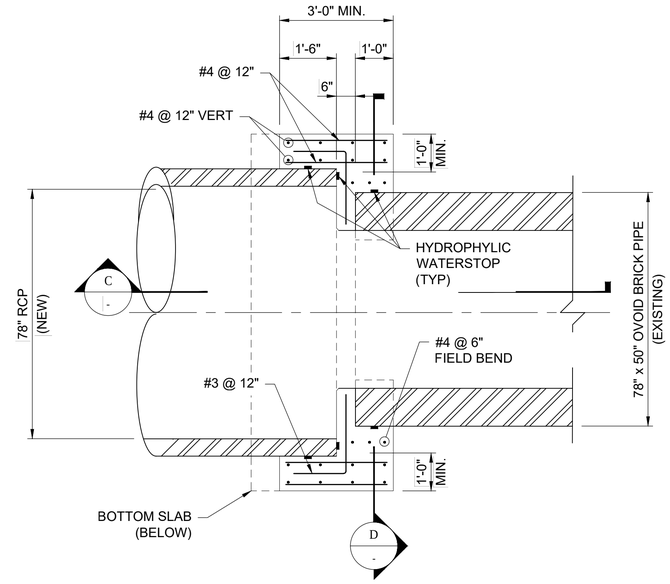
San Engineering LLC
Civil and Structural Engineering

DRAWN BY: KB
DESIGNED BY: JKH
APPROVED BY: JJM
DRAWING NAME:
DATE: APRIL 16, 2019
SHEET NO.: S3

PLOT DATE: May 1, 2019
F:\PROJECTS\27TH STREET STORM DRAIN INTERCEPTOR\CAD\27TH STREET STORM INTERCEPTOR - STRUCTURAL_PHASE2.DWG



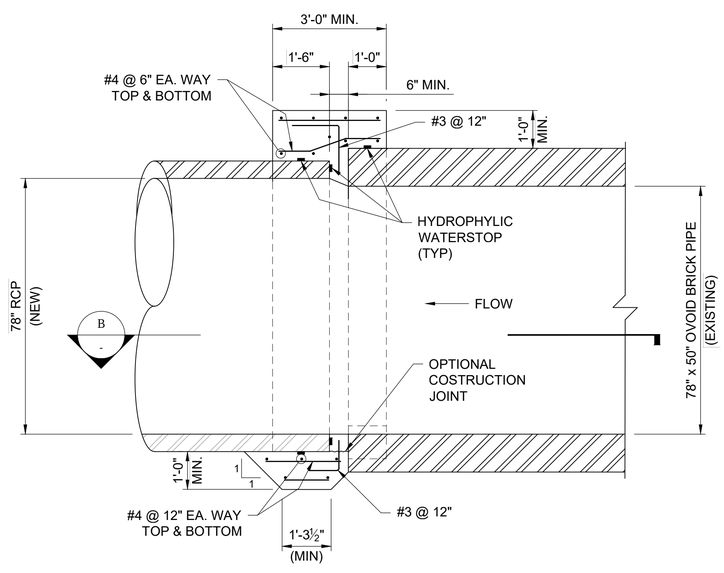

STA. 1033+10.00
A
-
CONCRETE COLLAR - TOP SLAB PLAN
SCALE: 1/2" = 1'-0"



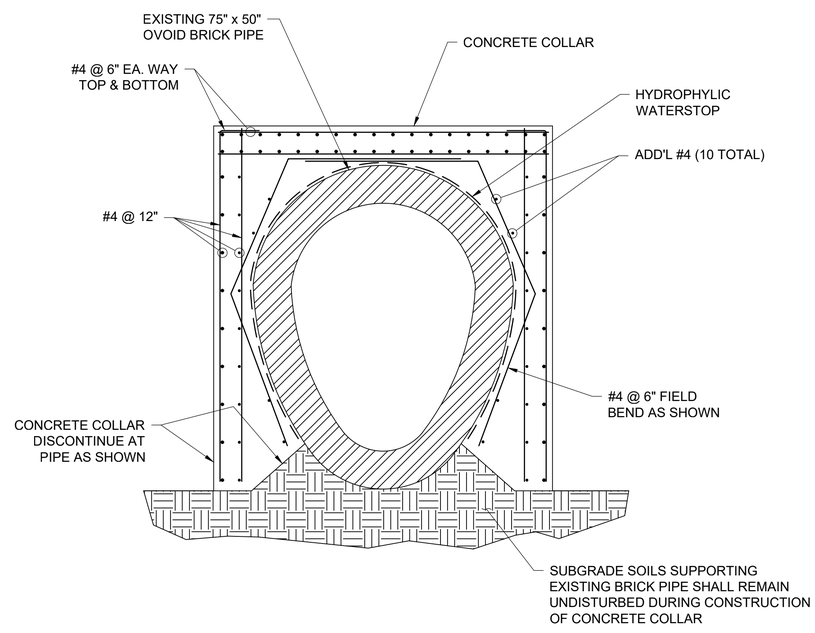

STA. 1033+10.00
B
-
CONCRETE COLLAR - SECTION (HORIZ.)
SCALE: 1/2" = 1'-0"

## BRICK PIPE CONNECTION NOTES

1. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE STABILITY AND INTEGRITY OF THE EXISTING BRICK PIPE THROUGHOUT CONSTRUCTION.
2. THE BRICK PIPE CONNECTION DETAILS HEREIN DEPICT ONLY ONE POTENTIAL SCHEME FOR CONNECTING THE PROPOSED ELEMENTS TO THE EXISTING BRICK PIPE. THE CONTRACTOR IS NOT BOUND TO THESE DETAILS, AND MAY PROPOSE ALTERNATE METHODS FOR CONNECTING TO THE EXISTING PIPE.
3. DRILLING AND/OR DOWELING INTO EXISTING BRICK IS NOT RECOMMENDED.
4. METHODS OF CONSTRUCTION AND ASSOCIATED DETAILS FOR MAKING CONNECTIONS TO THE EXISTING PIPE AND ENSURING ITS INTEGRITY SHALL BE SUBMITTED FOR REVIEW PRIOR TO EXCAVATION.
5. THE PIPE WILL BE INSPECTED UPON EXCAVATION AND PRIOR TO BACKFILLING. SHOULD DAMAGE OR DISTRESS TO THE EXISTING PIPE BE OBSERVED AT ANY POINT, THE CONTRACTOR SHALL REMOVE THE DAMAGED SEGMENTS OF PIPE, REPLACE WITH NEW PIPE, AND CONSTRUCT NEW CONNECTIONS TO THE SATISFACTION OF THE OWNER AND ENGINEER




STA. 1033+10.00
C
-
CONCRETE COLLAR - SECTION (VERT.)
SCALE: 1/2" = 1'-0"




STA. 1033+10.00
D
-
CONCRETE COLLAR - SECTION
SCALE: 1/2" = 1'-0"

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27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO:
PROJECT MASTER NO: 2017-PROJMSTR-0000343
RCP/BRICK PIPE CONCRETE COLLAR DETAIL

COLORADO REGISTERED PROFESSIONAL ENGINEER
05/02/19

San Engineering LLC
Civil and Structural Engineering

DRAWN BY: KB
DESIGNED BY: JKH
APPROVED BY: JJM
DRAWING NAME:
DATE: APRIL 16, 2019
SHEET NO.: S4


PLOT DATE: May 2, 2019
F:\PROJECTS\27TH STREET STORM DRAIN INTERCEPTOR\CAD\27TH STREET STORM INTERCEPTOR - STRUCTURAL_PHASE2.DWG

# CITY AND COUNTY OF DENVER

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
WASTEWATER CAPITAL PROJECTS MANAGEMENT

# 27TH STREET STORM INTERCEPTOR PHASE 2

**PROJECT MASTER NO : 2017-PROJMSTR-0000343**
**CONTRACT CONTROL NO : _____**
**DENVER WATER DISTRIBUTION SYSTEM IMPROVEMENTS**
**WATER SERVICE, FIRE LINE, AND FIRE HYDRANT RELOCATION**
**27TH STREET - CHAMPA STREET TO WELTON STREET**
**WASHINGTON STREET - 26TH AVE TO 20TH AVE**

DENVER®
THE MILE HIGH CITY

## Materials List

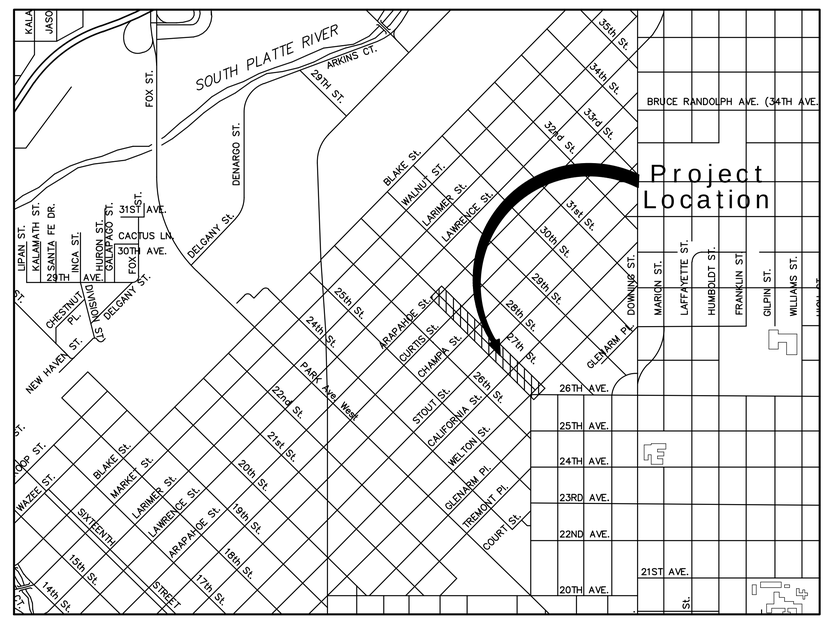
| Description | Qty | Unit |
|---|---|---|
| Fire Hydrant Assemblies (Adjust) | 1 | EA |
| Fire Hydrant Assemblies (Remove & Reset) | 1 | EA |
| 10" Class 52 DIP | 30 | LF |
| 8" Class 52 DIP | 158 | LF |
| 6" Class 52 DIP | 28 | LF |
| 3/4" Copper Service | 177 | LF |
| 8" Gate Valve | 3 | EA |
| 6" Gate Valve | 2 | EA |
| 8"x6" Swivel Tee | 2 | EA |

## LEGEND

| EXISTING | PROPOSED |
|---|---|
| CONDUIT | 12" WATER |
| 20" WATER | 10" WATER |
| 16" WATER | 8" WATER |
| 14" WATER | DOMESTIC WATER |
| 12" WATER | FIRE HYDRANT LINE |
| 10" WATER | ABANDON WATER |
| 8" WATER | FIRE HYDRANT |
| DOMESTIC WATER | VALVE |
| FIRE HYDRANT LINE | WATER METER IN MANHOLE |
| FIRE HYDRANT | FDC |
| CURB STOP | PLUG |
| VALVE | CROSS |
| WATER METER IN MANHOLE | TEE |
| PROPERTY LINE | WATER METER IN VAULT |
| FDC | REDUCER |
| BEND 90° | TAPPING SLEEVE AND VALVE |
| CROSS | BUTTERFLY VALVE |
| TEE | |
| WATER MANHOLE | |
| CLOSED GATE VALVE | |
| AIR VALVE WITH ACCESS MANHOLE | |
| BUTTERFLY VALVE IN MANHOLE | |

## STANDARD ABBREVIATIONS

| | | | |
|---|---|---|---|
| BFV | BUTTERFLY VALVE | FH | FIRE HYDRANT |
| CAV | COMBINATION AIR VALVE | FO | FIBER OPTICS |
| C&G | CURB AND GUTTER | G | GAS |
| CIP | CAST IRON PIPE | GUY | GUY WIRE |
| CL | CENTERLINE | GV | GATE VALVE |
| CO | CLEAN OUT | IRRIG | IRRIGATION |
| COMM | COMMUNICATION | KB | KICK BLOCK |
| CONC | CONCRETE | LF | LINEAL FEET |
| Cu | COPPER | MH | MANHOLE |
| DIP | DUCTILE IRON PIPE | OE | OVERHEAD ELECTRIC |
| DWD/DW | DENVER WATER DEPARTMENT | PP | POWER POLE |
| E | ELECTRIC | PVC | POLYVINYL CHLORIDE |
| EXIST | EXISTING | ROW | RIGHT-OF-WAY |
| F&G | FARMERS AND GARDENERS | S | SANITARY |
| FDC | FIRE DEPARTMENT CONNECTION | SAN | SANITARY |
| | | SVC | SERVICE |
| | | T.BLK | THRUST BLOCK |
| | | TYP | TYPICAL |
| | | UT | UNDERGROUND TELEPHONE |
| | | W/ | WITH |




Fire hydrants shall be installed according to Denver Water Standards. The number and location(s) of fire hydrants(s) and fire flow as shown on this water main installation is correct as specified by the _____ Fire Department.

_____
Signature of Fire Chief or Designated Representative

_____ _____ gpm fire flow
Date Signed

## Sheet List Table

| Sheet Number | Sheet Title |
|---|---|
| 1 | COVER SHEET |
| 2 | DENVER WATER DEPARTMENT NOTES |
| 3 | DENVER WATER - WATER ONLY PLAN |
| 4 | DENVER WATER - WATER ONLY PLAN |
| 5 | DENVER WATER - UTILITY PLAN |
| 6 | DENVER WATER - UTILITY PLAN |

NOTE:

1. **ALL PIPE 3" AND LARGER INSTALLED WITH THIS PROJECT SHALL BE DIP w/ NITRILE GASKETS.**
2. ALL CHANGE OVER TAPS SHALL BE MADE WITH THIS PROJECT, #19968.

MERRICK®
5970 GREENWOOD PLAZA BLVD
GREENWOOD VILLAGE, CO 80111

| NO. | DESCRIPTION OF REVISIONS | DATE | BY |
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27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO: PWWW2017-012
PROJECT MASTER NO: 2017-PROJMSTR-0000343
COVER SHEET

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412_DEN_WAT_CS.dwg
DATE: APRIL 16, 2019
SHEET NO.: 1


PLOT DATE: April 16, 2019
\\MERRICK.COM\DES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\WATER\9412_DEN_WAT_CS.DWG

Revision Date: October 17, 2018

**General Construction and Water Notes:**

1. Projects located in Distributor Contract Areas shall require the District to contact Denver Water prior to the pre-construction meeting.
2. All materials and workmanship shall be in accordance with Denver Water's Engineering Standards, Materials Specifications, and Drawings. All main installations/system modifications will be approved and inspected by Denver Water. Field change directives made by Distribution Inspection shall be made within 24 hours by the contractor.
3. Contractors shall maintain a copy of the current Engineering Standards on-site at all times during construction. See the chart below for a quick reference to the frequently used material specifications.

**Material Specification Quick References:**

| Material Specification | Description |
|---|---|
| MS 01 | Ductile Iron Pipe |
| MS 02 | Polyvinyl Chloride Pressure Pipe |
| MS 03 | Ductile Iron Waterworks Fittings |
| MS 5 | Resilient Seated Gate Valves |
| MS 6 | Rubber Seated Butterfly Valves |
| MS 8 | Tapping Valves - Mechanical Joint Type |
| MS 9 | Fabricated Carbon Steel and Stainless Steel Tapping Sleeves |
| MS 12 | Cast Iron Valve Boxes |
| MS 13 | Dry-Barrel Fire Hydrants |
| MS 14 | Polyethylene Encasement Material |
| MS 23 | Brass and Bronze Goods |
| MS 28 | Concrete Vaults |
| MS 29 | Mechanical Joint Restraint |
| MS 30 | Bolted Sleeve-Type Couplings |
| MS 36 | Flanged Joint Accessories |

4. AWG 12 solid copper wire shall be installed on all non-metallic water mains.
5. The depth of cover over the pipe, measured from official street grade to the top of the pipe, shall be a minimum of 4-1/2 feet and shall be known as the *cover over the pipe*. If difficulties arise when crossing interference, and where specifically approved by Denver Water, deviations from 4-1/2 feet of cover will be permitted. The cover over the pipe shall be a minimum of 4-1/2 feet and a maximum of 10 feet with Denver Water approval.
6. Any changes in alignment and grade shall be authorized by Denver Water and shall be accomplished by the installation of additional fittings. The deflection of joints is permitted only when installing pipe on horizontal or vertical curves.
7. Prior to the installation of water mains, road construction must have progressed to at least the sub-grade state. Sub-grade is defined as an elevation of no more than 7 inches below the finished street grade.
8. The Contractor shall adjust all valve boxes and fire hydrants to the final finished grade.
9. Bends, tees, fire hydrants, blow-offs, and plugs at dead-end mains shall be protected from thrust with mechanical restraint and concrete kick blocks in accordance with Denver Water's Engineering Standards.
10. Valves shall be located on property line extensions, except for tapping tees where an additional valve shall be placed on the tapping tee. Other valve locations may be required as shown on the plans.
11. Utility crossings shall maintain a minimum clearance of 18-inches from the outside of the pipes.
12. Only one point of connection is allowed until the testing of the new main installations is complete.
13. Newly installed water mains and fire service lines shall be hydrostatically tested in accordance with Denver Water Engineering Standards, Section 8.25.
14. The trench shall be excavated and the pipe exposed for inspection at any location on the project, when requested by Denver Water.
15. The sterilization and flushing of mains shall be inspected and certified by the Health Department having jurisdiction; one copy of the certification shall be provided to Denver Water. The certification shall note the location of the main and state the main has been inspected by a representative of the Health Department having jurisdiction and complies with the procedures set forth by that department.
16. The Contractor is responsible for:
    a. Notifying customers verbally or in writing who may be affected by a water outage during construction.
    b. Obtaining, at the Contractor's expense, applicable licenses, permits, bonds, etc., that are required for the main installation/system modification.
    c. Contacting Denver Water's Construction Engineering personnel for the Pre-construction Meeting and Inspection, at 303-628-6671, at least 48 hours prior to beginning construction.
    d. In the event of an emergency in Denver or in a Total Service Area after working hours, call Denver Water's Westside Dispatcher: 303-628-6801. In a Master Meter or Read & Bill District, please contact the representative of the district in which the Project is taking place.
    e. Paying all additional charges for inspection outside normal work hours.

    *Note: Be advised that on occasion valves in our system may be inoperable. On such occasions, it may become necessary to back up an additional block for the shut out. If that occurs, make additional notifications verbally or in writing to customers with the mandatory 24 hours advance notice. When valve maintenance is required, a delay of several days should be expected.*

**Tap and Meter Notes (for Denver, Total Service, and Read and Bill Areas only. In Master Meter Districts please refer to the Specification for that District).**

1. Before any taps are made on mains, tap applications and payment must be received and approved by the Distributor and Denver Water, and the water main has passed water quality testing.
2. Denver Water will make all taps that are 2 inches and smaller.
3. Individual service line PRVs shall be installed by the licensee when area pressure exceeds 80 psi.
4. Services and Meters:
    a. The Contractor may request an on-site pre-construction conference with the Meter Inspector for all taps, service lines, and meters larger than one-inch, and for projects involving more than one tap and service. To schedule a pre-construction conference, call Meter Inspection at 303-628-6145.
    b. A copy of the approved plans with Denver Water's approval sticker must be present on-site at the time the tap is made and the meter is inspected or installed.
    c. Prior to the tap being made, the service address shall be posted, and the curb valve shall be installed. Upon tap installation, the contractor may request the meter inspection after the first pour of concrete foundation has occurred. The service address shall remain posted until the meter setting passes inspection.
    d. Meters cannot be set, inspected, or services activated, until the requirements for backflow prevention have been completed. Contact the Backflow Prevention Program personnel at 303-628-5969 for further information.
    e. Meter pits and vaults must be set flush with the final grade of the landscape, including the proper depth for soil amendment. If final grading has not been completed at the time of meter inspection, the Owner will be required to raise or lower the meter pit/vault when final grade is established. Adjustment of the pit may require adjustment of the meter setting within the pit.
    f. Meter setting, valves, and service lines from the main to the Backflow Preventer Assembly, if present, or to 5 feet after the meter vault, must meet all applicable Engineering Standards in effect at the time of activation. Modifications may be required from the details on these plans to comply with the current engineering standards.
    g. No present or future fences or walls are permitted between the Right-Of-Way (ROW) or easement and the meter setting. There shall be no permanent obstructions within 5 feet of the outside wall of the meter pit or vault.
    h. Inside the City of Denver, all multi-family dwellings with a single tap, service line, and meter are required to sub-meter each individual unit (Sec 401.3.2 of Denver modifications to the International Plumbing Code, Ordinance Number 576, Series of 2004). Call the City and County of Denver Plumbing Inspector for information at 720-865-2625.
    i. Inside the City of Denver, all service lines must be installed to avoid existing or proposed street trees. Contact the City and County of Denver's Forester at 720-913-0647 for information.

**Cross-Connection Control Requirements:**

The licensees listed below shall be in conformance with Denver Water's Engineering Standards, Chapter 5.05, *Cross-Connection Control and Backflow Prevention*. Backflow prevention assemblies are required to be installed on the following water service lines:

1. Commercial domestic service lines
2. Multi-Family domestic service lines (depending on potential hazard)
3. Fire service lines
4. Irrigation service lines
5. Single family residential domestic service lines with an auxiliary water source (Dual Water Service Agreement required)
6. Recycled Water service lines, if system design includes chemical injection or pumps.
    a. Backflow prevention assemblies installed on recycled water service lines shall be identified as "Recycled Water".
7. It is at the sole discretion of Denver Water's Cross-Connection Control section to approve or deny a variance request related to a proposed backflow prevention assembly installation.
    a. Backflow prevention assemblies shall be a model manufactured in accordance with AWWA C510 and C511 and shall have met the specifications by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research.
    b. The licensee is required to have a certified American Backflow Prevention Association (ABPA) or American Society of Sanitary Engineering (ASSE) tester inspect and test the existing and/or newly installed containment backflow prevention assemblies on dedicated domestic, irrigation, fire and recycle water service lines upon installation and annually thereafter.
    c. Within 48 hours of Denver Water setting the meter and turning on the water service, the ABPA or ASSE tester is required to submit the containment backflow assembly test report(s) to the Cross-Connection Control Office:

        Fax: 303-794-8325
        E-Mail: CrossConnectionControl@denverwater.org

    d. There shall be no unprotected takeoffs from the service line ahead of any meter or backflow prevention assembly located at the point of delivery to the customer's water system.
    e. No branch line or taps are allowed on dedicated irrigation water service lines or recycled water service line for domestic (potable) use (e.g., drinking fountains, water play features, swimming pool, restroom facilities, etc.)

**DEN Requirements:**

1. Contractors shall maintain a copy of the current Engineering Standards and Capital Project Construction Standards, when applicable, on site at all times during construction.
2. Wax tape, metallic fittings, and appurtenances shall be in accordance with Denver Water Capital Projects Construction Standards, 3rd Edition SECTION 09 97 13.04.
3. An AMI endpoint is required to be purchased by the contractor at the time of meter installation.
4. Contact the following Denver Water personnel prior to construction for project coordination and inspection services at DEN:

    DEN Airside Construction Inspection

    a. Minimum of 30 days prior to construction
    b. Denver Water Construction Management - Jeff Slankard 303-628-6165

    DEN Landside Construction Inspection

    c. Minimum of 48 hours prior to construction
    d. Denver Water Construction Engineering - 303-628-6671

    DEN Cathodic Protection Inspection

    a. Minimum of 48 hours prior to construction
    b. Denver Water Construction Management - Lee Burke 303-628-6293

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27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO: PWWW2017-012
PROJECT MASTER NO: 2017-PROJMSTR-0000343
DENVER WATER DEPARTMENT NOTES

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412_DEN_WAT_CS.dwg
DATE: APRIL 16, 2019
SHEET NO.: 2

PLOT DATE: April 16, 2019
\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\DDS\WATER\9412_DEN_WAT_CS.DWG

NOTE:

1. **ALL PIPE 3" AND LARGER INSTALLED WITH THIS PROJECT SHALL BE DIP w/ NITRILE GASKETS.**
2. ALL CHANGE OVER TAPS SHALL BE MADE WITH THIS PROJECT, #19968.
3. THE EXISTING MAIN IS LEAD JOINT IN SOME AREAS; ANY DISTURBANCES OF CUT PIPE WITHIN A FEW FEET OF A LEAD JOINT WILL CAUSE THE PACKING OF LEAD TO LOOSEN WHICH MAY CAUSE LEAKAGE. THE CONTRACTOR SHOULD EXERCISE CAUTION WHEN CUTTING OLD PIPE SO NOT TO LOOSEN ANY LEAD JOINTS NEARBY. IT IS ADVISABLE TO BLOCK THE PIPE FOR SUPPORT PRIOR TO CUTTING THE PIPE; THIS WILL REDUCE THE MOVEMENT OF THE PIPE PROTRUDING OUT OF THE LEAD JOINT BELL NEARBY. THE CONTRACTOR WILL BE HELD RESPONSIBLE FOR ANY LEAD AT OR NEAR THE EXCAVATION. SOME OF THE VALVES REQUIRED TO MANIPULATE FLOW ARE OVER 100 YEARS OLD AND MAY NOT FUNCTION PROPERLY. THE CONTRACTOR SHOULD EXPECT DELAYS AND RE-MOBILIZATION IF THE SHUTOUT EXPANDS TO ALTERNATE VALVES RESULTING IN ADDITIONAL 24-HOUR PRIOR NOTIFICATION TO CUSTOMERS. IN MOST CASES THE INSPECTOR WILL TEST THE SHUTOUT PRIOR TO THE SCHEDULED CONSTRUCTION.
4. ALL SERVICE LINES TO BE REPLACED SHALL BE REPLACED FROM MAIN TO CURB STOP.
5. ALL TAPS TO BE ABANDONED: BACKFLOW PREVENTERS (IF EXISTING) MAY NOT BE REPLACED WITHOUT APPROVAL FROM DENVER WATER.

DWD STANDARD DRAWING INDEX

THE FOLLOWING DWD STANDARD DETAILS SHALL BE APPLIED ACCORDINGLY TO THE WORK DEPICTED WITHIN THIS DRAWING SET:

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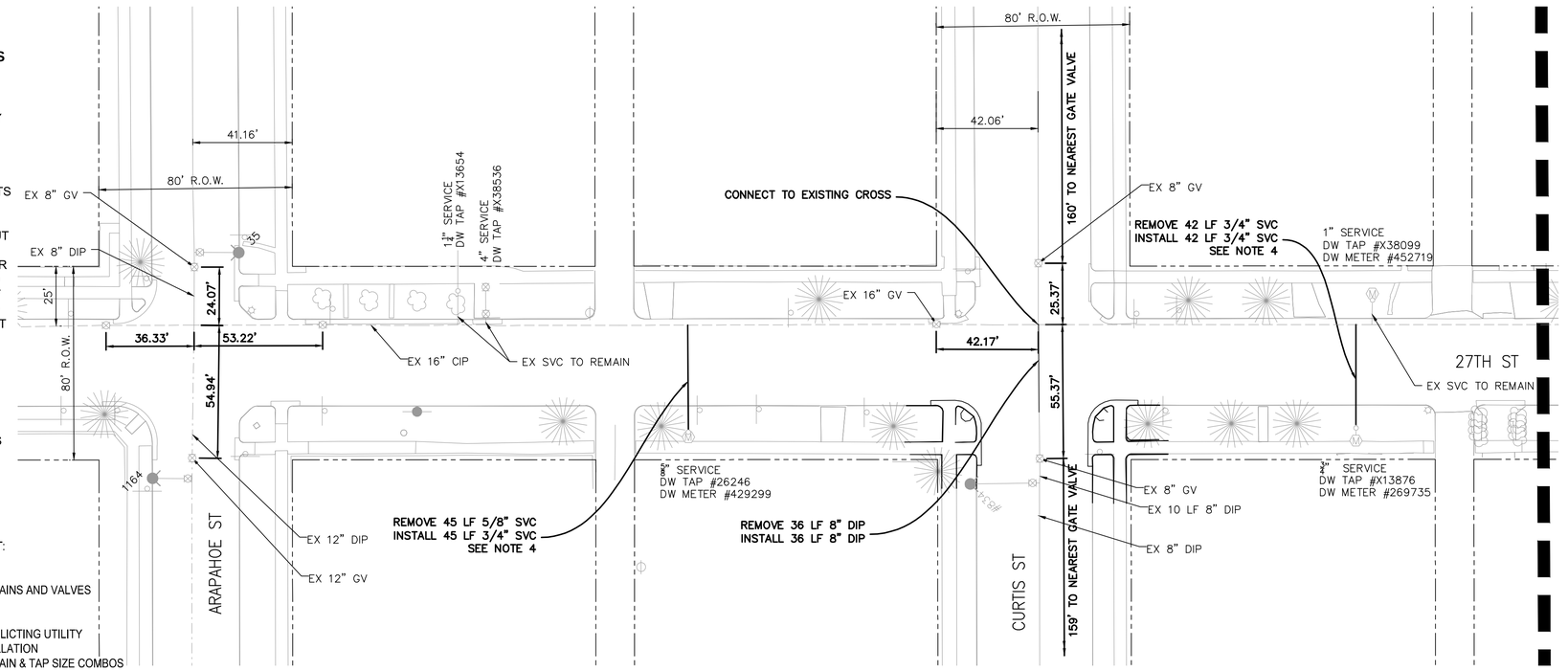
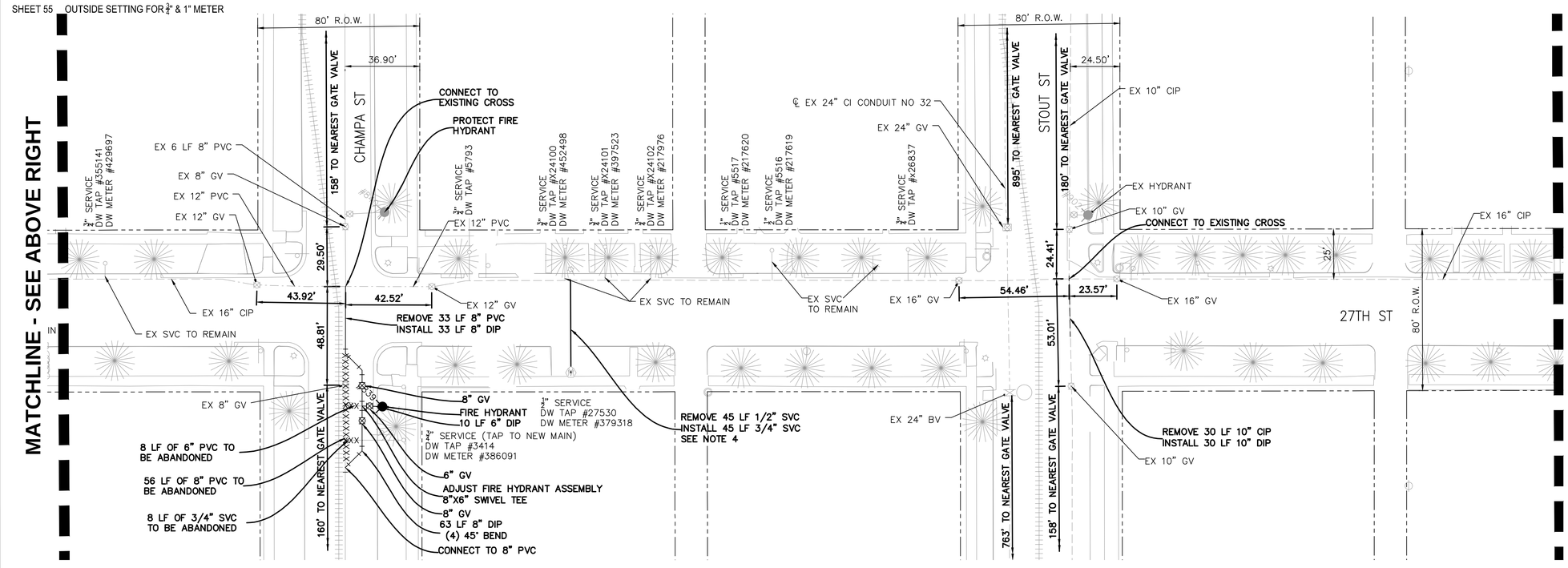
| SHEET 11 | TRACER WIRE INSTALLATION FOR PVC WATERMAIN |
| SHEET 14 | STORM & SANITARY SEWER CROSSING |
| SHEET 15 | OPEN CUT CROSSING OVER OR UNDER CONDUIT CONFLICTING UTILITY |
| SHEET 18 | CONCRETE KICKBLOCKS BEARING SURFACES & INSTALLATION |
| SHEET 19 | CONCRETE KICKBLOCK REQUIREMENTS FOR WATER MAIN & TAP SIZE COMBOS |
| SHEET 40 | VALVE OPERATION |
| SHEET 46 | GENERAL METER & SERVICE NOTES |
| SHEET 47 | 3" & LARGER DOMESTIC & FIRELINE CONNECTIONS |
| SHEET 50 | ¾" & 1" SERVICE LINE, STOP BOX & OUTSIDE METER INSTALLATION |
| SHEET 51 | 2" & SMALLER NON-COPPER SERVICE LINE REPLACEMENT |
| SHEET 55 | OUTSIDE SETTING FOR ¾" & 1" METER |

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0 30' 60'

SCALE: 1" = 30'

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27TH STREET STORM INTERCEPTOR
PHASE 2

PRO TRACKING NO: PWWW2017-012
PROJECT MASTER NO: 2017-PROJMSTR-0000343

DENVER WATER - WATER ONLY PLAN

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412_DEN_WAT_WATER_PLAN(2).dwg
DATE: APRIL 16, 2019
SHEET NO.: 3

\\MERRICK.COM\CES\DEN\PROJECTS\9412-00 27TH STREET STORM DRAIN\DESIGN\CDS\WATER\9412_DEN_WAT_WATER_PLAN(2).DWG PLOT DATE: April 16, 2019

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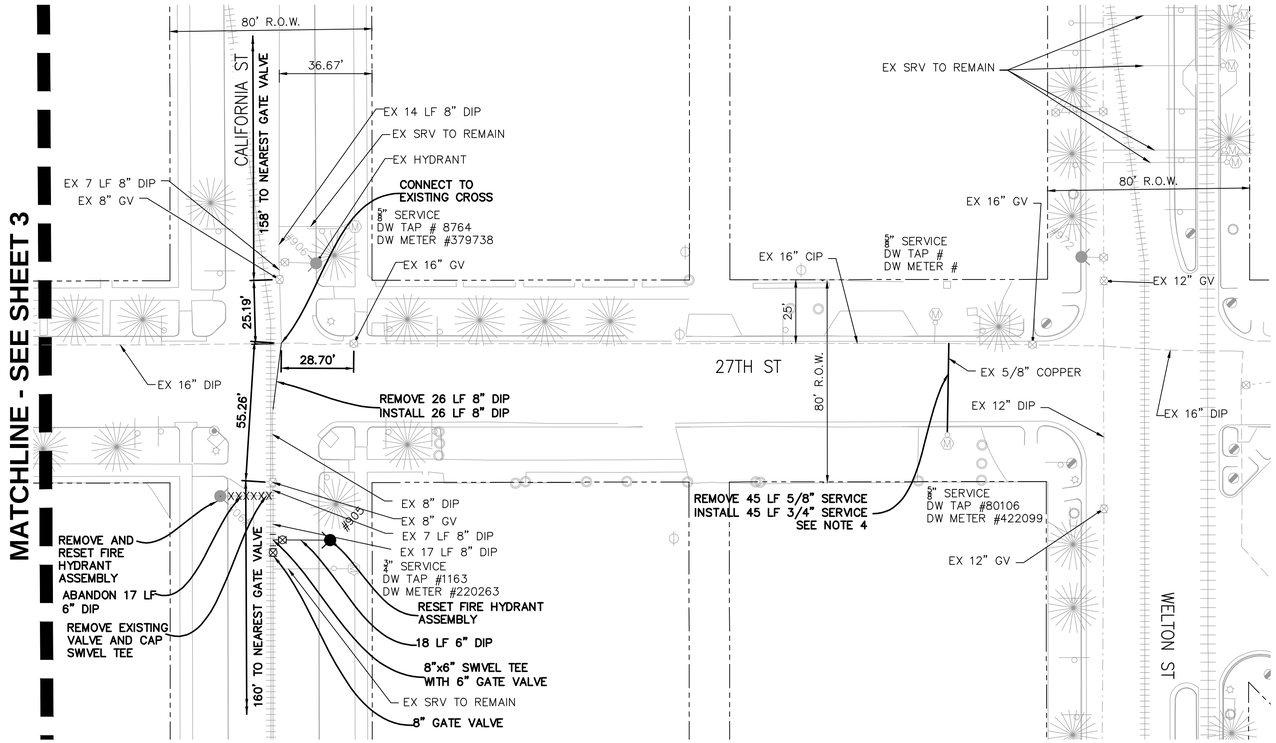


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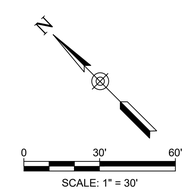


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27TH STREET STORM INTERCEPTOR
PHASE 2
PRO TRACKING NO: PWWW2017-012
PROJECT MASTER NO: 2017-PROJMSTR-0000343
DENVER WATER - WATER ONLY PLAN

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412_DEN_WAT_WATER_PLAN(2).dwg
DATE: APRIL 16, 2019
SHEET NO.: 4

PLOT DATE: April 16, 2019
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# 27TH STREET STORM INTERCEPTOR PHASE 2

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PROJECT MASTER NO: 2017-PROJMSTR-0000343

DENVER WATER - UTILITY PLAN

DRAWN BY: MMILLER/AWOLFF
DESIGNED BY: CWISLEDER
APPROVED BY: CWISLEDER
DRAWING NAME: 9412_DEN_WAT_UTIL_PLAN(2).dwg
DATE: APRIL 16, 2019
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PLOT DATE: April 16, 2019

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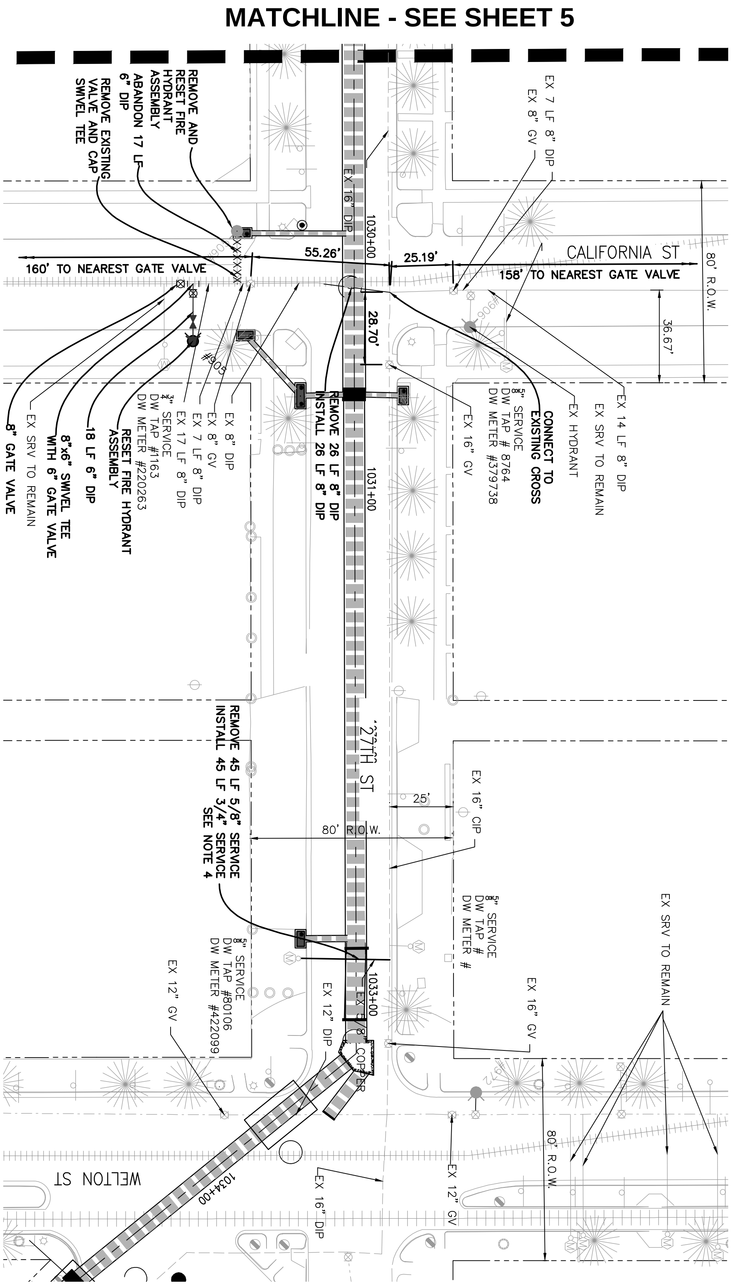


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| DRAWING NAME: | 9412_DEN_WAT_UTIL_PLAN(2).dwg |
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