



Denver Public Works

Engineering Division
Capital Projects Management - Dept. 506
Right-of-Way Services - Dept. 507
Traffic Engineering Services - Dept. 508
Policy and Planning - Dept. 509

201 West Colfax Avenue
Denver, CO 80202
www.Work4Denver.com

NOTICE OF APPARENT LOW BIDDER

**Interlock Construction Corp.
2492 W. 2nd Ave.
Denver, CO 80223**

The MANAGER OF PUBLIC WORKS has considered the Bids submitted on **July 10, 2014**, for work to be done and materials to be furnished in and for:

CONTRACT NO. 201416785 678 S. Jason St. Maintenance Facility

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 lump sum bid the total estimated cost thereof being: **Seven Hundred Forty Nine Thousand, Five Hundred Sixty Five Dollars and Forty Two Cents (\$749,565.42).**

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 B1.12.2 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

CONTRACT NO. 201416785


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 28th day of July 2014.

CITY AND COUNTY OF DENVER

By



Jose M. Cornejo, P.E.

Manager of Public Works

**CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
Parks and Recreation**

**TABLE OF CONTENTS
FOR
BID FORM AND SUBMITTAL PACKAGE**

Table of Contents	BF-1
Bidder's Checklist	BF-2 through BF-3
Bid Form and Submittal Package Acknowledgment Form	BF-4 through BF-5
Bid Form	BF-6 through BF-8
List of Proposed Minority/Woman Business Enterprise(s)	BF-9 through BF-12
Commitment to Minority/Woman Business Enterprise Participation	BF-13
Minority/Woman Business Enterprise Letter(s) of Intent & Checklist	BF-14 through BF-15
Joint Venture Affidavit	BF-16
Joint Venture Eligibility Form	BF-17 through BF-19
Bid Bond	BF-20
Diversity and Inclusiveness in City Solicitations Form	BF-21 through BF-24

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.)	<input type="checkbox"/>
BF-6+	a.) Fill in individual bid item dollars and totals in Numerical figures only b.) Complete all blanks c.) Legal name required	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
BF-7	a.) Write out bid total or bid totals in words and figures in the blank form space(s) provided b.) Calculate Textura® Construction Payment Management System Fee from chart on pg. BF-3 and write % and fee in the space provided	<input type="checkbox"/>
BF-8	a.) List all subcontractors who are performing work on this project	<input type="checkbox"/>
BF-9 – BF-10	a.) Fully complete List of Proposed Minority /Woman Business Enterprise Bidders, Subcontractors, Suppliers, Manufacturers, or Brokers – check appropriate boxes.	<input type="checkbox"/>
BF-11	a.) Complete all blanks b.) If Addenda have been issued, complete bottom section.	<input type="checkbox"/> <input type="checkbox"/>
BF-12	a.) Complete appropriate sections - signature(s) required. b.) If corporation, then corporate seal required.	<input type="checkbox"/> <input type="checkbox"/>
BF-13	a.) Fully complete Commitment to Participation	<input type="checkbox"/>
BF-16	a.) If applicable, fully complete Joint Venture Affidavit (Submit 10 days prior to Bid Opening date)	<input type="checkbox"/>
BF-17 – BF-19	a.) If applicable, fully complete Joint Venture Eligibility Form (Submit 10 days prior to Bid Opening date)	<input type="checkbox"/>
BF-20	a.) Fill in all Bid Bond blanks b.) Signatures required c.) Corporate Seal if required d.) Dated e.) Attach Surety Agents Power of Attorney or Certified or cashier's check made out to the Manager of Revenue referencing Bidder's Company and Contract Number.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
BF-21- BF-24	a.) Each bidder, as a condition of responsiveness to this solicitation, shall <u>complete and return</u> the "Diversity and Inclusiveness in City Solicitations Information Request Form" with their Bid.	<input type="checkbox"/>

Textura ® Construction Payment Management System (CPM System)

Contractor recognizes and agrees that it shall be required to use the Textura® Construction Payment Management System (CPM System) for this Project. All fees associated with the CPM System are to be paid by the Contractor for billings for work performed. Bidders are required, when preparing a bid, to enter the price of the CPM service on the line provided for the service. The fee is all inclusive of all subcontractor, project and subscription fees associated with the CPM system. The bidder will calculate the fee based on a percentage of their overall base bid, and then should 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. Textura will invoice the awarded contractor directly.

PROJECT SIZE	FEE (% OF BID)
< \$1,000,000	0.22% (.0022)
\$1,000,001 - \$5,000,000	0.17% (.0017)
\$5,000,001 - \$20,000,000	0.12% (.0012)
\$20,000,001 - \$50,000,000	0.10% (.0010)
\$50,000,001 - \$100,000,000	0.08% (.0008)
\$100,000,001 - \$500,000,000	0.05% (.0005)
> \$500,000,000	CONTACT TEXTURA FOR PROGRAM PRICING

For more information:

<http://www.denvergov.org/constructioncontracts/ContractAdministration/BiddingProcess/TexturaPaymentSystem/tabid/443165/Default.aspx>

**CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
Parks and Recreation**

BID FORM AND SUBMITTAL PACKAGE ACKNOWLEDGMENT

CONTRACT NO. 201416785

678 S. JASON ST.

BIDDER: INTERLOCK CONSTRUCTION CORP.
(Legal Name per Colorado Secretary of State)

ADDRESS: 2492 W. 2ND AVE.
DENVER, CO 80223

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. 201416785, 678 S. JASON ST.**, made available to the undersigned bidder pursuant to Notice of Invitation for Bids dated June 13, 2014.

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: ROBERT J. SARLO

By: *Robert J. Sarlo*

Title: PRESIDENT

ATTEST:

By: *James Fournier*
JAMES FOURNIER

[SEAL]



**CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
Parks and Recreation**

BID FORM

**CONTRACT NO. 201416785
678 S. JASON ST.**

BIDDER INTERLOCK CONSTRUCTION CORP.
(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 **June 13, 2014**, to furnish all required materials, tools, appliances, equipment and plant; to perform all necessary labor and to undertake and complete: **CONTRACT NO. 201416785, 678 S. JASON ST.**, 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

Lump Sum Bid Amount:

Seven hundred forty seven thousand nine hundred twenty dollars
Dollars (\$ 747,920)

In accordance with the Bidder's Checklist on Page BF-3:

Textura® Construction Payment Management System Fee Amount applicable to Lump Sum amount above:

.22 % of Lump Sum Bid Amount
one thousand six hundred forty five dollars
Dollars (\$ 1,645)

Total Bid Amount equals the Lump Sum Bid Amount and the Textura® Construction Payment Management System Fee:

Seven hundred forty nine thousand five hundred sixty five dollars
Dollars (\$ 749,565)

Alternate 1 - Site work and paving Six hundred ninety nine thousand dollars
Dollars (\$ 699,000)

Alternate 2 - Planting Sixty five thousand one hundred forty one dollars
Dollars (\$ 65,141)

Alternate 3 - Exterior painting Nine thousand nine hundred forty eight dollars
Dollars (\$ 9,948)

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 WESTERN SURETY COMPANY, a corporation of the State of SD, 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 BID AMOUNT. 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: N/A Name: N/A

Address: N/A Address: N/A

If there are no such persons, firms, or corporations, please so state in the following space:
NO SUCH PERSONS, FIRMS, OR CORPORATIONS.

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
Millwork	1.2%	JK Concepts Inc. Denver, CO
MB Roofing	1%	MB Roofing Denver, CO
Acoustic	1.4%	SRB Acoustics Denver, CO
Painting	1.9%	Tribun Benton Denver, CO
HVAC	11.1%	Walrath Heating Denver, CO
Electric	10.8%	Noble Electric Denver, CO

(Copy this page if additional room is required.)



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

Office of Economic Development
Division of Small Business Opportunity
Compliance Unit
201 West Colfax Avenue, Dept. 907
Denver, CO 80202
Phone: 720-913-1999
Fax: 720-913-1803
DSBO@denvergov.org

City and County of Denver Contract No.: 201416785

The undersigned Bidder proposes to utilize the following MWBE for the project. All listed firms 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 commissions 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: <u>INTERLOCK CONSTRUCTION CORP.</u>		
Address: <u>2492 W. 2ND AVE.</u>	Contact Person: <u>ROBERT J. SARLO</u>	
Type of Service: <u>GENERAL CONDITIONS, SUPERVISION, SELECT DEMOLITION, SELECT ROUGH CARPENTRY</u>	Dollar Amount: \$: <u>109,233.00</u>	Percent of Project: <u>14.5</u>

MWBE Prime Bidder

Business Name: <u>N/A</u>		
Address: <u>N/A</u>	Contact Person: <u>N/A</u>	
Type of Service: <u>N/A</u>	Dollar Amount: \$: <u>N/A</u>	Percent of Project: <u>N/A</u>

Subcontractors, Suppliers Manufacturers or Brokers (check one box)

<input checked="" type="checkbox"/>	Subcontractor (✓)	<input type="checkbox"/>	Supplier (✓)	<input type="checkbox"/>	Manufacturer (✓)	<input type="checkbox"/>	Broker (✓)
Business Name: <u>Diamond Plumbing</u>							
Address: <u>Denver</u>		Type of Service: <u>Plumbing</u>					
Contact Person: <u>Gene Juarez</u>		Dollar Amount: \$: <u>121,096</u>		Percent of Project: <u>16.1</u>			
<input checked="" type="checkbox"/>	Subcontractor (✓)	<input type="checkbox"/>	Supplier (✓)	<input type="checkbox"/>	Manufacturer (✓)	<input type="checkbox"/>	Broker (✓)

Business Name: <u>Independent Construction</u>							
Address: <u>Littleton</u>		Type of Service: <u>Drumwall</u>					
Contact Person: <u>Francisco</u>		Dollar Amount: \$: <u>87,834</u>		Percent of Project: <u>11.7</u>			
<input type="checkbox"/>	Subcontractor (✓)	<input type="checkbox"/>	Supplier (✓)	<input type="checkbox"/>	Manufacturer (✓)	<input type="checkbox"/>	Broker (✓)

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

Subcontractors, Suppliers Manufacturers or Brokers (check one box)				
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Subcontractor (√)		Supplier (√)		Manufacturer (√) Broker (√)
Business Name:				
Address:			Type of Service:	
Contact Person:			Dollar Amount: \$:	Percent of Project:
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Subcontractor (√)		Supplier (√)		Manufacturer (√) Broker (√)
Business Name:				
Address:			Type of Service:	
Contact Person:			Dollar Amount: \$:	Percent of Project:
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Subcontractor (√)		Supplier (√)		Manufacturer (√) Broker (√)
Business Name:				
Address:			Type of Service:	
Contact Person:			Dollar Amount: \$:	Percent of Project:
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Subcontractor (√)		Supplier (√)		Manufacturer (√) Broker (√)
Business Name:				
Address:			Type of Service:	
Contact Person:			Dollar Amount: \$:	Percent of Project:
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Subcontractor (√)		Supplier (√)		Manufacturer (√) Broker (√)
Business Name:				
Address:			Type of Service:	
Contact Person:			Dollar Amount: \$:	Percent of Project:
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Subcontractor (√)		Supplier (√)		Manufacturer (√) Broker (√)
Business Name:				
Address:			Type of Service:	
Contact Person:			Dollar Amount: \$:	Percent of Project:

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: 2492 W. 2ND AVE.

City, State, Zip Code: DENVER, CO 80223

Telephone Number of Bidder: (303)742-4400 Fax No. (303)742-4520

Social Security or Federal Employer ID Number of Bidder: 84-0970945

Name and location of the last work of this kind herein contemplated upon which the Bidder was engaged:
RED ROCKS MISC. RAILS, EARTH AND LIGHTS. RED ROCKS AMPHITHEATRE 18300 ALMEDA PKWY MORRISON, CO

For information relative thereto, please refer to:

Name: MARK GUERRERO

Title: PROJECT MANAGER/ARCHITECT

Address: CITY AND COUNTY OF DENVER PUBLIC WORKS 201 W. COLFAX AVE., DEPT 506 DENVER, CO 80223

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

Addenda Number 1 Date 07.02.14

Addenda Number 2 Date 07.08.14

Addenda Number _____ Date _____

Dated this 10TH day of JULY, 2014.

Signature of Bidder:

If an Individual: _____ N/A _____ doing business

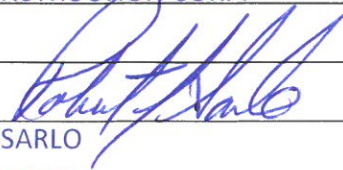
as _____ N/A _____.

If a Partnership: _____ N/A _____

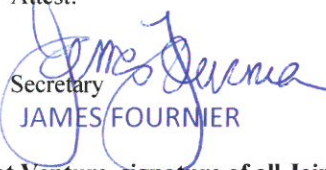
by: _____ N/A _____ General Partner.

If a Corporation: _____ INTERLOCK CONSTRUCTION CORP. _____

a _____ COLORADO _____ Corporation,

by: _____  _____, its President.
ROBERT J. SARLO

Attest:


Secretary
JAMES FOURNIER

(Corporate Seal)



If a Joint Venture, signature of all Joint Venture participants:

Firm: _____ N/A _____

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

By: _____ N/A _____ (If a Corporation)
Attest: _____ N/A _____
Secretary (Corporate Seal)

Firm: _____ N/A _____

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

By: _____ N/A _____ (If a Corporation)
Attest: _____ N/A _____
Secretary (Corporate Seal)

Firm: _____ N/A _____

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

By: _____ N/A _____ (If a Corporation)
Attest: _____ N/A _____
Secretary (Corporate Seal)



DENVER
OFFICE OF ECONOMIC
DEVELOPMENT

COMMITMENT TO MWBE PARTICIPATION

Office of Economic Development
Division of Small Business Opportunity
Compliance Unit
201 West Colfax Avenue, Dept. 907
Denver, CO 80202
Phone: 720-913-1999
Fax : 720-913-1803
DSBO@denvergov.org

***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 advertised project goal for **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: With the proposal when due

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 in accordance with DRMC Section 28-62 and 28-67 of Ordinance 85 and must submit Letters of Intent for each **MWBE** listed in the Bid Forms, within three (3) business days after the bid opening or at time proposal is submitted.

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): INTERLOCK CONSTRUCTION CORP.

Firm's Representative (Please print): ROBERT J. SARLO

Signature (Firm's Representative):

Title: PRESIDENT

Address: 2492 W. 2ND AVE.

City: DENVER

State: CO

Zip: 80223

Phone: (303)742-4400

Fax: (303)742-4520

Email:
bob@interlockcorp.com



DENVER
THE MILE HIGH CITY

Office of Economic Development
Division of Small Business Opportunity
Compliance Unit
201 West Colfax Ave., Dept. 907
Denver, CO 80202
Phone: 720-913-1999 Fax: 720-913-1803

LETTER OF INTENT (LOI)

INSTRUCTIONS FOR COMPLETION & SUBMISSION:

- All lines must be completed or marked N/A for Not Applicable
- Submit the attached completed checklist with this letter
 - Email to dsbo@denvergov.org, OR
 - Fax: 720-913-1803, OR
 - Hand-Delivery: Office Economic Dev. Receptionist, 2nd Fl.
- FOR RFPs: LOIs should be submitted with Proposal.

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 or DBE					
Name of Bidder/Consultant:			Self-Performing: <input type="checkbox"/> Yes <input type="checkbox"/> No		Phone:
Contact Person:		Email:		Fax:	
Address:		City:		State:	Zip:
B. The Following Section is To Be Completed by the M/WBE, SBE or DBE, at any Tier This Letter of Intent Must be Signed by the M/WBE, SBE 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.		MBE/WBE (<input checked="" type="checkbox"/>)	SBE (<input checked="" type="checkbox"/>)	DBE (<input checked="" type="checkbox"/>)	Self-Performing (<input checked="" type="checkbox"/>)
Indirect Utilization: If this M/WBE, SBE 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 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. <u>On unit price bids only, identify which bid line items the M/WBE/SBE/DBEs scope of work or supply corresponds to.</u>					
		<input checked="" type="checkbox"/> Subcontractor/Subconsultant (<input checked="" type="checkbox"/>)		<input checked="" type="checkbox"/> Supplier (<input checked="" type="checkbox"/>)	
				<input checked="" type="checkbox"/> Broker (<input checked="" type="checkbox"/>)	
Bidder intends to utilize the aforementioned M/WBE, SBE or DBE for the Work/Supply described above. The cost of the work and percentage of the total subcontractor M/WBE, SBE or DBE bid amount is:					
\$				%	
Consultant intends to utilize the aforementioned M/WBE, SBE or DBE for the Work/Supply described above. The percentage of the work of the total subconsultant M/WBE, SBE 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 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.					

COMP-FRM-012 Revised 09/30-13

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 ✓	
<input type="checkbox"/>	Project Number & Project Name
<input type="checkbox"/>	Section A: Name of Bidder/Consultant, Contact Person, Address, City, State, Zip, Phone, Email
<input type="checkbox"/>	Section B: Name of Certified Firm, Contact Person, Address, City, State, Zip, Phone, Email
<input type="checkbox"/>	Designation checked for MBE/WBE, SBE or DBE
<input type="checkbox"/>	Indirect Utilization: Name of subcontractor/subconsultant, supplier or broker is indicated if using the participation of a 2 nd tier subcontractor/subconsultant, supplier or broker.
<input type="checkbox"/>	Scope of work performed or item supplied by M/WBE, SBE or DBE
<input type="checkbox"/>	Line items performed, if line-item bid
<input type="checkbox"/>	Copy of M/WBE, SBE or DBE Letter of Certification Attached
<input type="checkbox"/>	Designation checked for Subcontractor/Subconsultant, Supplier or Broker
	If project is a hard bid...
<input type="checkbox"/>	Bidder has indicated dollar amount for value of work going to Subcontractor/ Subconsultant, Supplier or Broker
<input type="checkbox"/>	Bidder has indicated percentage for value of work going to Subcontractor/ Subconsultant, Supplier or Broker
	If project is an RFP/RFQ...
<input type="checkbox"/>	Consultant has indicated percentage for value of work going to Subcontractor/ Subconsultant, Supplier or Broker Name & contact name for MWBE.
<input type="checkbox"/>	Fee amount if fee amount of work to be performed is requested.
<input type="checkbox"/>	Bidder/Consultant's Signature, Title & Date
<input type="checkbox"/>	M/WBE, SBE or DBE Firm's Signature, Title and Date
Select One ✓	SUBMITTED VIA... (Bidder/Consultant is strongly urged to deliver the LOI via one of the methods below. Preferred method is to scan/email completed forms to email below. Delivery to any other point cannot be guaranteed timely delivery.)
<input type="checkbox"/>	Email to DSB@denvergov.org
<input type="checkbox"/>	Fax to 720-913-1003
<input type="checkbox"/>	Hand Delivery to WEBB Bldg - Office of Economic Development, 2nd Floor, Receptionist Area

The complete and accurate information that is required for the Letter of Intent is based on the following sections of the Ordinance: 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.

COMP-FRM-012 Revised 09/30-13



DENVER
THE MILE HIGH CITY

JOINT VENTURE AFFIDAVIT

Office of Economic Development
Division of Small Business Opportunity
Compliance Unit
201 West Colfax Avenue, Dept. 907
Denver, CO 80202
Phone: 720-913-1999
Fax: 720-913-1803
DSBO@denvergov.org

The Undersigned swear 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 Seal
Notary Signature: _____		
Address: _____		

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 Seal
Notary Signature: _____		
Address: _____		

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 Seal
Notary Signature: _____		
Address: _____		

Rev 122910 JG



JOINT VENTURE ELIGIBILITY FORM

Office of Economic Development
Division of Small Business Opportunity
Compliance Unit
201 West Colfax Avenue, Dept. 907
Denver, CO 80202
Phone: 720-913-1999
Fax: 720-913-1803
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, 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/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/M/W or DBE)	
Type of Work for which Certification was granted:			

General Information

SBE/MBE/WBE/DBE Initial Capital Contributions: \$ _____ %	
Future capital contributions (explain requirements) (attach additional sheets if necessary):	
Source of Funds for the SBE/MBE/WBE/DBE Capital Contributions:	
Describe the portion of the work or elements of the business controlled by the SBE/MBE/WBE or DBE: (attach additional sheets if necessary)	
Describe the portion of the work or elements of the business controlled by non-SBE/MBE/WBE or DBE: (attach additional sheets if necessary)	

Revised 032211 JG

JOINT VENTURE ELIGIBILITY FORM

General information

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

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

Describe the roles and responsibilities of each joint venture participant with respect to managing the joint venture (use additional sheets if necessary):

a. SBE/MBE/WBE or DBE joint venture participant:

b. Non- SBE/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/MBE/WBE or DBE joint venture participant:

b. Non- SBE/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 SMWBE, non-SMWBE or joint venture:

	Non- SBE/MBE/WBE/DBE	SBE/MBE/WBE/DBE	Joint Venture
Management			
Administrative			
Support			
Hourly Employees			

Revised 032211 JG

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 _____, as Principal, and _____, a corporation organized and existing under and by virtue of the laws of the State of _____, 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 Obligees, in full and just sum of _____ 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 _____, 20__ , for the construction of: **Contract No. 201416785, 678 S. JASON ST.**, as set forth in detail in the Contract Documents for the City and County of Denver, Colorado, and said Obligees 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 Obligees 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 Obligees 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 Obligees, 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 Obligees 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 _____ day of _____, 20__ .

ATTEST

Secretary

Principal

By _____

Title _____

Surety

By _____

Seal if Bidder is Corporation
(Attach Power-of-Authority)

[SEAL]



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 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 item below. Missing or incomplete responses will be recorded as "no" 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.**

Project Name: SOUTH JASON STREET MAINTENANCE FACILITY

BID / RFP No.: 201416785

Name of Contractor/Consultant INTERLOCK CONSTRUCTION CORP.

Address:

2492 W. 2ND AVE

DENVER, CO 80223

Email: bob@interlockcorp.com

Business Phone No.: (303)742-4400

Business Facsimile No.: (303)742-4520

1. Do you have a diversity and inclusiveness program?

Yes No

If yes, does it address:

Employment and retention?

Yes No

Procurement and supply chain activities?

Yes No

Customer service?

Yes No

1a. If yes, 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.)

Employee training is first addressed in The Company's "Employee Welcome Packet" (attached). Additional employee training occurs in the field on a regular basis, overseen by the Project Manager and Superintendent. We have no separate budget for this training as it is part of the overall Company culture.

Additional information is attached (See 1b).

1b. If yes, please attach a copy of any written materials on your diversity and inclusiveness program. Attached Not attached

1c. If yes, how does your company regularly communicate its diversity and inclusiveness policies to employees?

- Employee Training
- Pamphlets
- Public EEO postings
- Other Policies are reviewed at each of our internal pre-bid conferences.
- Not Applicable

1d. 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.

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

- Monthly Annually
 Quarterly Not Applicable Other Through continuing education courses as

opportunities present.

2a. What percentage of the total number of employees generally participate?

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

3. 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.)

See attached "Business Development Policy"

4. Do you have a diversity and inclusiveness committee? Yes No

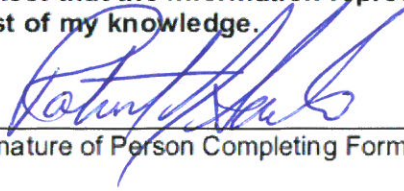
4a. If so, how often does it meet?

- Monthly Annually No Committee
 Quarterly Other Or as needed

4b. 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.

5. Do you have a budget for diversity and inclusiveness efforts? Yes No
There is no separate budget line item for this program.
6. Does your company integrate diversity and inclusion competencies into executive/manager performance evaluation plans? Yes No

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



Signature of Person Completing Form

07.10.14

Date

Robert J. Sarlo

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."



Interlock Construction Corp.

General Contractors – Construction Managers

www.interlockcorp.com

2492 W. 2nd. Avenue, Denver, Colorado 80223
ph. 303-742-4400
fx. 303-742-4520

Bidding Services:

Interlock Construction Corp. (herein after called “The Company”) is dedicated to fostering an atmosphere of diversity and inclusivity in our business relationships, bidding processes, and professional community. The Company provides all services necessary to furnish qualified, professional subcontractor and supplier bids to all construction, reconstruction and remodeling projects out for public solicitation. The Company provides ample opportunity to qualified subcontractors and suppliers to submit proposals for review. We prepare instructions and scope definitions to bidders to facilitate the proposal process. Advertisement for bids and Invitations to Bid are part of our regular bid solicitation process. Performance and costing methods are evaluated on a constant basis in an effort to provide the best value to the Owner and positive feedback to the subcontractors.

The Company is well-versed in the solicitation and utilization of Certified M/WBE, SBE and DBE firms for partnership in our construction, reconstruction and remodeling projects. The Bid Coordinator is responsible for providing these firms with the opportunity to participate fully in the bidding process, resulting in more diverse and inclusive project teams and ideally, the best value to the Owner.

Business Development, Procurement and Supply Chain:

The Company has developed and is using a Compliance Plan authorized by the City’ and County of Denver’s (herein after called the “City”) Department of Small Business Opportunity. Our Business Development Policy fosters diversity and inclusivity, and encompasses but is not limited to the following practices of that Compliance Plan:

The Bid Coordinator is responsible for soliciting and guiding subcontractors and suppliers through the bidding process. Bid packages are reviewed and refined as the scope of work is further defined and ready for the process of subcontracting. Specifically, prior to advertising any package of work for bids or proposals, The Company will review the work in detail to determine the types of work that can be performed by M/WBE firms, with reference to the DSBO’s database and directory of certified M/WBE firms, and will adjust its subcontracting packages to maximize opportunities for M/WBE participation in such subcontracting, within economically feasible packages.

The Company has the following preliminary schedule for issuance of each bid package:

- Review of plans, specifications, and/or project narrative when available.
- Evaluation of scope of work.
- Breakout of skilled trades and sub-trades for Subcontracting; and material needs for procurement of supplies.
- Review of currently Certified M/WBE Contractors on the City of Denver’s Office of Economic Development’s website to fill the required trades.

- Develop a comprehensive ITB (Invitation to Bid) letter to be emailed or faxed to appropriate subcontractors and suppliers. A response is requested. Special emphasis is given at this stage to invite all currently certified M/WBE firms within the scope of the project.
- Follow-up emails, faxes, and phone calls are made to confirm receipt of ITB and status of bid participation for all firms that have not yet responded (“Are you bidding? Yes or No?”).
- Plans and specifications, when available, are posted on our Company’s website for easy access by bidders. Hard copies are made available for review by appointment in our office during normal business hours. When necessary, The Company will make copies of plans and specs for M/WBE bidders to take back to their offices for their own use in preparing their bids.
- After the bidding process for each project, results are evaluated. We analyze coverage by trade, verify contact information for the next bidding opportunity, and review participation of M/WBE firms.

The Company will conduct the following outreach efforts:

- A. The Company will use the City’s M/WBE directory and encourage all non-M/WBE subcontractors to use the directory when soliciting any of their own tier-subcontractors or suppliers for the project.
- B. If during outreach efforts, The Company locates a firm which appears to be eligible for City M/WBE certification but is not so certified, The Company will direct the firm to DSBO and encourage the firm to pursue certification if eligible.
- C. The Company will conduct at least one pre-bid meeting whenever possible which all interested subcontractors and suppliers may attend, at which The Company will present information and answer questions about the work. Notification of this pre-bid meeting will be outlined in the ITB and in the notices placed with above listed Organizations. The Company will also make the Chief Estimator, the Project Coordinator, and the Bid Coordinator available to answer questions via email from bidders throughout the solicitation process.
- D. In addition to relentless follow-up efforts to encourage M/WBE participation in our bidding process, The Company makes the bid documents available to all interested parties in several different ways:
 - Plans and specifications, when available, are posted on our Company’s website for easy access by bidders. These bid documents can be easily downloaded and viewed at the bidders’ convenience.
 - Hard copies are made available for review by appointment in our office during normal business hours.
 - When necessary, The Company will make copies of plans and specs, on CD or hardcopy, for M/WBE bidders to take back to their offices for their own use in preparing their bids.

- E. We promptly analyze any project presented by the City for scope and distribute it to subcontractors and suppliers for pricing as outlined in Sections 4.B and 4.C. We schedule a pre-bid meeting when possible for all interested parties. We then set a deadline for pricing submittals and begin the solicitation process. The Estimator analyzes all bids to find and assemble the best possible combination of subcontractors for the project, keeping the overall M/WBE Goals in mind. Our goal is to deliver the best value and performance schedule for each project. In the event that a subcontractor can perform work for a better value than we would normally self-perform, our standard practice is to contract that work out. We will consider bids on any portion of work or combination of work.

- F. The Company will make available to each bidder/proposer, bid results in their scope of work no later than 10 business days after award, so that unsuccessful bidders/proposers can be aware of the result of the bid/proposal process and their standing in the final results. Bidders can call The Company's office for bid results during normal business hours.

Customer Service:

In addition to providing ample opportunities to Vendors to access bid documents and establishing appropriate scope definition for suitable and successful bid pricing, it is our standard business practice to encourage and support our Vendors beyond the bidding process. The Company strives to develop long-term relationships with suppliers, subcontractors, and other Vendors to encourage continued participation in our bidding opportunities. Our administrative staff assists Vendors with purchasing issues by establishing joint check agreements when necessary or required; supporting bonding inquiries and acquisition; and referring qualified Vendors to the DSBO registration process when appropriate.

Vendors who are new to or unfamiliar with the City's contracting policies receive additional training and support with City documents and reporting requirements, such as DSBO Background Information Forms, LCP Tracker Prevailing Wage Reporting, DSBO's B2G payment confirmation process, lien waiver requirements, etc. The Company's customer service outreach extends from pre-construction bidding assistance to post-construction project close-out and beyond.



Interlock Construction Corp.

General Contractors – Construction Managers

www.interlockcorp.com

2492 W. 2nd. Avenue, Denver, Colorado 80223

ph. 303-742-4400

fx. 303-742-4520

Welcome to Interlock Construction Corp.! We are excited to have you as a new employee. Your Benefits Package follows. Please feel free to discuss any issues or questions you have with the Business Manager. This Policy is reviewed and updated annually.

Commitment to Diversity and Inclusivity in the Workplace

Interlock Construction Corp. (hereafter called "The Company") invites values, perspectives and contributions of people from diverse backgrounds, and integrates diversity into our 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.

- The Company's hiring and retention policy does not discriminate based differences that include, but are not limited to: race, age, gender, gender identity, sexual orientation, ethnicity, physical disabilities; nor based on such social identities that include, but are not limited to: religion, marital status, language ability, education, and veteran status.
- Training opportunities are available to all full time employees, regardless of above listed differences or identities, on an as-needed basis or as opportunities become available. Continuing education courses are offered through our membership with Associated General Contractors of Colorado.
- The Company advertises open positions through avenues that serve diverse populations, including, but not limited to: Colorado Workforce Center, Craigslist Denver, Denver Post, and other local community media publications as needed.

Eligibility for Benefits

Employees are considered eligible for benefits after 60 days of continuous employment, except where otherwise specified.

Holidays

All permanent employees are eligible for holiday pay. We schedule all national holidays on the day designated by common business practice. Holiday pay is paid on only those holidays that are recognized in a regular work week. The following six holidays are recognized by The Company as paid holidays:

New Year's Day • Memorial Day • 4th of July • Labor Day • Thanksgiving Day • Christmas Day

You may take time off to observe your personal religious holidays if not included above. You must notify the Business Manager or your Superintendent as soon as possible. You may use your Paid Time Off if applicable.

Paid Time Off

Employees are eligible for five (5) days (40 hours) of Paid Time Off after one (1) year of continuous employment and ten (10) days (80 hours) of Paid Time Off after two (2) years of continuous employment. Paid Time Off may be split between "personal days", "sick days" and "vacation days". Paid Time Off may not be carried over to subsequent calendar years.

Unused accrued PTO will be paid out to the employee at calendar year's end. Unused PTO will NOT be paid upon separation of employment.

Jury Duty

It is your civic duty as a citizen to report for jury duty whenever called. If you are called for jury duty, we will permit you to take the necessary time off and we wish to help you avoid any financial loss because of such service.

You must notify your Superintendent or the Business Manager within 48-hours of receiving your jury summons. Upon receiving a notice for jury duty, you must provide us with a copy of the notice as soon as possible.

We will pay regular wages, not to exceed \$50 per day, for your first three (3) days of jury duty as required by Colorado state law.

You are expected to report for work if you are released from jury duty before the end of our workday or if you are temporarily released from jury duty.

Unpaid Leaves of Absence

Occasionally, for medical, personal, or other reasons, you may need to be temporarily released from the duties of your job with The Company but may not wish to submit your resignation. Under certain circumstances, determined on a case-by-case basis, you may be eligible for an unpaid leave of absence.

Retirement Plan

Employees are eligible to participate in The Company's voluntary SIMPLE Pension Program after 90 days of continuous employment. A participating employee contributes, pre-tax, a fixed percentage of his/her weekly gross income. The Company will match that percentage up to three percent (3%). The total employee contributions may not exceed \$12,000/year per employee in 2013 and subsequent years. If an employee is or will be 50 years of age by December 31, 2013, their total employee contributions may not exceed \$14,500/year in 2013 and subsequent years.

Health/Dental/Life Insurance

Group Health and Dental Insurance is available to employees the first month after 60 days of continuous employment or the plan renewal date (December 1 for all insurance coverages), whichever applies. Enrollment is optional. The Company pays a portion of the premium for covered employees or employees and their dependents for both insurance coverages. Group Health is provided under Kaiser Permanente. The Company pays 75% of the Employee Only premium; all other premium expenses for optionally enrolled dependents are the Employee's financial responsibility. Group Dental is provided under Delta Dental. The Company pays 50% of the total premium, regardless of

the coverage. The Employee's portion of coverage premiums is taken as a pre-tax payroll deduction through a "Flex-Magic" spending plan. Your portion of your premium depends on your coverage and your age. A separate determination will be provided for you.

Basic Life Insurance (\$15,000 death benefit) is provided at no cost to all FT Employees.

The Company will provide access to additional coverage under AFLAC for employees if they wish to participate at their own cost. Premiums will be made via payroll deductions, and The Company will administer the premium payments to AFLAC, but The Company will not pay any portion of these premiums. Participation is voluntary.

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

**CONTRACT NO. 201416785
PROJECT NAME: 678 S JASON ST. MAINTENANCE FACILITY**

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:

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

BID FORM PACKAGE

Contractors are reminded that there is a new form in the Bid Submittal Package BF-21 "Diversity and Inclusiveness" in City Solicitations information Request Form.

If not completed and signed your bid will be deemed non-responsive and rejected.

QUESTIONS AND ANSWERS

1. **QUESTION:** Sheet S-102 References a new 6" slab w/ a minimum of 6" free draining gravel on compacted subgrade at the eastern side of the Building. The existing dirt grade appears to be too high to accommodate the new 12" of material. Please clarify that grading, compaction and export of the existing subgrade will be required.

ANSWER: The existing material is to be graded, removed as necessary, and compacted to accommodate the 6" concrete slab and 6" of free draining gravel.

2. **QUESTION:** Sheet P110 call to reuse the existing WC and LAV at Bathrooms 100A, 100B, 116 & 118. The items on site do not appear to be code compliant as regards water usage. Their working condition is also questionable.

ANSWER: Contractor to provide new fixtures; see P – 501. Rooms 116 & 118 use WC-2 & L-2; 100A & 100B use WC-1 & L-1. Contractor to discard existing fixtures per SC-12.

3. **QUESTION:** Sheet A-100 Shows a new trench drain in the parking lot adjacent to the new sand/oil interceptor location. It references the Plumbing drawings. There is no trench drain shown on the plumbing drawings Sheet P-110.

ANSWER: Remove trench drain from sheet A-100.

4. **QUESTION:** In Alternate 2 the Irrigation system will require a backflow preventer and an electrical connection for the controller. These are not shown on any drawings.

ANSWER: The irrigation system is assumed to be completed as a design/build system per Denver Parks and Recreation standards. Include backflow preventer and controller per those standards. If this alternate is accepted, power will be incorporated for the controller.

5. **QUESTION:** Is a building management system required, no sequence of operations is provided and each piece of equipment operates on a stand-alone thermostat, timer, or switch so I'm not seeing how they would tie together. Asking due to their being a spec section on controls listing the big building management systems (Honeywell, trane, long).

ANSWER: There is no BAS system. All mechanical units will be modulated with stand alone controls via thermostat or timeclock.

6. **QUESTION:** We connect several plumbing fixtures with piping and 3 roof top units with ducting however we aren't demo'ing any existing duct or pipe to these units. Is someone else doing demo or are these units all sitting there now un-piped/ un-ducted? (If un-used what would the expectation be on startup/ activation of the existing RTU's?)

ANSWER: Demo has been done in a previous phase. Units that are present on the project now shall be utilized in the new work phase of construction. Any un-used piping on roof shall be capped. Any unused ductwork or piping shall be removed. Any unused mechanical equipment on the roof shall be coordinated with engineer, but will need to be removed.

7. **QUESTION:** Sheet A-100 Site Plan General Notes:
#2 - Storm Piping is not a part of the Base Bid.

ANSWER 7: Refer to civil drawings for extent of work to be bid as Base Bid versus Add Alternate #1. Correct, landscaping and irrigation are Add Alternate #2 per specification section 012300.

8. **QUESTION:** Please clarify if Detail Notes 1,3,5, 7, & 8 on Sheet E-100 as regards the fueling station conduits are to be included in the Base Bid or Alternate 1.

ANSWER: All electrical work associated with the fueling station to be included with Add Alternate No. 1.

9. **QUESTION:** Detail Note 1 on Sheet E-001 mentions that the 75kva Transformer may be replaced. Will this expense be paid by the owner?

ANSWER: The City will pay Xcel Energy costs directly. All other related expenses are the responsibility of the contractor.

10. **QUESTION:** Please review the Bid Form on Page BF-7. Do you care about the 2k cost of Textura? I am instructed elsewhere in the documents to be responsible for the cost.

ANSWER: questions regarding the BF-7 and the cost of Textura were covered extensively in the pre-bid. The contractor will be responsible for all Textura fees.

11. **QUESTION:** If I am reading the language correctly there is nowhere for the Base Bid amount to go.

ANSWER: On the BF-7 there is a line for the bid sub-total, Textura, and the bid total.

12. **QUESTION:** Are the exterior wall packs existing? Do they need to be demolished per the demolition play?

ANSWER: The existing wall packs shown on E-100 site plan are existing and will need to be circuited as shown once the service upgrade is completed. The demolition plan ED110 indicates approximate locations of additional lighting fixtures left over from the previous occupant's use. These fixtures are to be removed such that the only remaining fixtures are the ones shown on the site plan E-100.

Clarifications & Revisions:

- A. Sheet C1 – 1: Change the size of the fuel station pad to 12' x 19' x 6". Exact location to be coordinated with owner.
- B. Sheets A – 111 & A – 121: change "wash bays" to "service bays".
- C. Key note 2 on P-110 conflicts with C4-1. Abandon the existing 4" sanitary pipe in place, per C4-1.
- D. Sheet MCS – 1 notes electrical supply by others; this is incorrect. The contractor is responsible for providing and installing a complete, working methane control system, including supplying all equipment, all electrical connections and roof penetrations.
- E. The report "Landfill Evaluation and Sampling, for the City and County of Denver, Denver Municipal Animal Shelter" dated February 12, 2007, is included for reference.
- F. The geotechnical report is included for reference.

Incorporate the following modifications, corrections, additions and/or deletions into the Drawings, Specifications and Construction Documents issued for this project. (Drawings November 11, 2013) This Addendum is dated July 2, 2014.

Item No. 1.01:
SPECIFICATIONS

SECTION 312000 - EARTHWORK

Article 2.1, Paragraph E, Page 31 2000-4

REVISE: paragraph to "Base course: Artificially graded mixture of crushed gravel, crushed stone and crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve. Aggregate gradation and quality per CDOT Class 6 Base Course specifications."

Article 2.1, Paragraph H, Page 31 2000-4

REVISE: "Drainage Course" to "Drainage Course and Methane Control Gravel Layer".

Article 3.11, Paragraph A, Page 31 2000-7

REVISE: "2 percent" to "3 percent".

REVISE: 2. "2 percent" to "3 percent".

Article 3.12, Paragraph C, Page 31 20000-7

REVISE: "ASTM D 698" to "ASTM D 1557".

Article 3.14, Paragraph B, Page 31 2000-9

REVISE: 3. "ASTM D 69" to "ASTM D 1557".

Article 3.15, Page 31 2000-9

REVISE: article title to "DRAINAGE COURSE AND METHANE CONTROL GRAVEL LAYER UNDER CONCRETE SLABS-ON-GRADE".

REVISE: Paragraph B2. "ASTM D 698" to "ASTM D 1557".

Item No. 1.02:
SPECIFICATIONS

SECTION 31 2316.13 - TRENCHING

Article 2.04, Paragraph E, Page 31 2316.13-2

REVISE: 1. "97 percent" to "95 percent".

Article 2.05, Paragraph A, Page 31 2316.13-2

REVISE paragraph to "A. Evaluate results in relation to compaction curve determined by testing uncompacted materials in accordance with ASTM D 1557."

Item No. 1.03:
SPECIFICATIONS

SECTION 321313 - CONCRETE WALKS, CURBS, MISCELLANEOUS FLATWORK

Article 2.2, Paragraph G, Page 321313-2

REVISE: "4,500 PSI" to "4,200 PSI".

Item No. 1.04:
DRAWINGS

SHEET C1-1 – SITE PLAN

REVISE: Fueling station pad to be 12'x19'x6" thick concrete pad.

BID DOCUMENT PACKAGE

Prevailing Wage Rates:

Replace Building Construction Projects dated June 13, 2014 and Heavy Construction Projects dated June 13, 2014.

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

Bid Post for:
Lesley B. Thomas
City Engineer
7/2/14
Date

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

Robert J. Sarlo
Robert J. Sarlo Contractor

ADDENDUM NO. 1

DATE: 07.10.14



DENVER
THE MILE HIGH CITY

Office of Human Resources
Denver's Human Resource Agency

201 W. Colfax, Department 412
Denver, CO 80202
p: 720.913.5751
f: 720.913.5720
www.denvergov.org/csa

TO: All Users of the City of Denver Prevailing Wage Schedules
FROM: Seth Duhon-Thornton, Associate Human Resources Professional
DATE: Friday June 13, 2014
SUBJECT: Latest Change to Prevailing Wage Schedules

Please be advised, prevailing wage rates for some building, heavy, and highway 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 rates will be provided as a supplemental to the Davis-Bacon Building rates issued by OHR.

The attached Prevailing Wage Schedule is effective as of **Friday June 13, 2014** and applies to the City and County of Denver for **BUILDING CONSTRUCTION PROJECTS** (does not include residential construction consisting of single family homes and apartments up to and including 4 stories) in accordance with the Denver Revised Municipal Code, Section 20-76(c).

General Wage Decision No. CO140004
Superseded General Decision No. CO20130004
Modification No.08
Publication Date: 6/6/14
(5 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.

For questions call (720) 913-5018

Attachments as listed above.

General Decision Number: CO140004 06/06/2014 CO4

Superseded General Decision Number: CO20130004

State: Colorado

Construction Type: Building

County: Denver County in Colorado.

BUILDING CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Modification Number	Publication Date
0	01/03/2014
1	01/17/2014
2	01/24/2014
3	01/31/2014
4	02/07/2014
5	03/07/2014
6	04/04/2014
7	05/23/2014
8	06/06/2014

ASBE0028-001 10/01/2013

	Rates	Fringes
Asbestos Workers/Insulator (Includes application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical systems).....	\$ 28.83	13.18

BRCO0007-001 09/01/2013

	Rates	Fringes
BRICKLAYER.....	\$ 23.68	8.34

BRCO0007-005 05/16/2013

	Rates	Fringes
TILE SETTER.....	\$ 27.15	7.63

CARP0001-004 05/01/2013

	Rates	Fringes
Carpenters: Acoustical, Drywall Hanging/Framing and Metal		

Stud, Form Building/Setting.\$ 25.00 5.39

CARP1607-002 06/01/2012

	Rates	Fringes
MILLWRIGHT.....	\$ 28.95	11.10

* ELEC0068-002 06/01/2014

	Rates	Fringes
ELECTRICIAN (Includes Low Voltage Wiring and Installation of Fire alarms, Security Systems, Telephones, Computers and Temperature Controls).....	\$ 32.65	12.70

ELEV0025-002 01/01/2014

	Rates	Fringes
Elevator Constructor.....	\$ 40.10	26.785

FOOTNOTE:

a. Employer contributes 8% of basic hourly rate for over 5 years' service and 6% basic hourly rate for 6 months' to 5 years' service as Vacation Pay Credit.

PAID HOLIDAYS: New Year's Day; Memorial Day; Independence Day; Labor Day; Veterans Day; Thanksgiving Day; Friday after Thanksgiving Day; and Christmas Day.

ENGI0009-003 10/23/2013

	Rates	Fringes
Power equipment operator - crane		
141 tons and over.....	\$ 25.97	9.15
50 tons and under.....	\$ 24.88	9.15
51 to 90 tons.....	\$ 25.04	9.15
91 to 140 tons.....	\$ 25.19	9.15

IRON0024-001 11/01/2013

	Rates	Fringes
IRONWORKER, STRUCTURAL.....	\$ 24.80	10.14

LABO0720-003 05/01/2014

	Rates	Fringes
--	-------	---------

LABORER
 Concrete/Mason Tenders.....\$ 16.42 6.38

 PAIN0079-002 01/01/2014

	Rates	Fringes
Drywall Finisher/Taper		
Hand.....	\$ 19.40	6.66
Tool.....	\$ 19.75	6.66
Painters:.....	\$ 18.70	6.66
PAPERHANGER.....	\$ 19.40	6.66

 PAIN0930-001 07/01/2013

	Rates	Fringes
GLAZIER.....	\$ 28.67	7.52

 PLAS0577-001 05/01/2013

	Rates	Fringes
Cement Mason/Concrete Finisher...	\$ 23.25	10.23

 PLUM0003-001 07/01/2013

	Rates	Fringes
PLUMBER (Excluding HVAC work).....	\$ 33.18	12.44

 PLUM0208-001 07/01/2013

	Rates	Fringes
PIPEFITTER (Including HVAC pipe).....	\$ 33.35	12.27

 SFCO0669-001 07/01/2013

	Rates	Fringes
SPRINKLER FITTER.....	\$ 33.09	18.60

 SHEE0009-001 07/01/2013

	Rates	Fringes
Sheet metal worker (Includes HVAC duct and installation of HVAC systems).....	\$ 32.04	13.13

 SUCO2001-011 12/20/2001

	Rates	Fringes
--	-------	---------

Carpenters:		
All Other Work.....	\$ 16.12	2.84
Ironworkers:		
Reinforcing.....	\$ 18.49	3.87
Laborers:		
Brick Finisher/Tender.....	\$ 12.78	1.41
Common.....	\$ 10.62	2.09
Power equipment operators:		
Mechanic.....	\$ 18.48	

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

Office of Human Resources
Supplemental to the Davis-Bacon *Building* Construction Project rates
(Specific to the Denver projects)
Supp #100, Date: 03-02-2012

Classification		Base	Fringe
Boilermakers		\$30.97	\$21.45
Power Equipment Operators (Concrete Mixers):			
	Less than 1 yd	\$23.67	\$10.67
	1 yd and over	\$23.82	\$10.68
	Drillers	\$23.97	\$10.70
	Loaders over 6 cu yd	\$23.82	\$10.68
	Oilers	\$22.97	\$10.70
Soft Floor Layers		\$16.70	\$9.81
Ironworkers (Ornamental)		\$24.80	\$10.03
Plasters		\$24.60	\$12.11
Plaster Tenders		\$10.79	-
Laborers: Concrete Saw		\$13.89	-
Power Equipment Operators:			
	Backhoe	\$23.67	\$10.67
	Loader up to and incl 6 cu yd	\$23.67	\$10.67
	Motor Grader	\$23.97	\$10.70
	Roller	\$23.67	\$10.67
Truck Drivers (Dump Trucks):			
	6 to 14 cu yds	\$19.14	\$10.07
	15 to 29 cu yds	\$19.48	\$10.11
	Flatbed	\$19.14	\$10.07
	Semi	\$19.48	\$10.11

- To determine the Tile Setters-Marble Mason-Terrazzo mechanic rates—Use Davis Bacon-Building rates adopted by the Career Service Board.
- To determine the Tile Finisher-Floor Grinder-Base Grinder—Use current Career Service Prevailing Wage Schedules.
- Caulkers—Receive rate prescribed for craft performing operation to which caulking is incidental .i.e. glazier, painter, brick layer, cement mason.
- Use the “Carpenters—All Other Work” rates published by the federal Davis Bacon rates for batt insulation, pre-stress concrete and tilt up concrete walls, Roofers (including foundation waterproofing).
- Use the “Laborer—Common”, rates published by the federal Davis Bacon rates for General Housekeeping, Final Cleanup and Fence Installer.



DENVER
THE MILE HIGH CITY

Office of Human Resources
Denver's Human Resource Agency

201 W. Colfax, Department 412
Denver, CO 80202
p: 720.913.5751
f: 720.913.5720
www.denvergov.org/csa

TO: All Users of the City of Denver Prevailing Wage Schedules
FROM: Seth Duhon-Thornton, Associate Human Resource Professional
DATE: Friday June 13, 2014
SUBJECT: Latest Change to Prevailing Wage Schedules

Please be advised, prevailing wage rates for some building, heavy, and highway 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 rates will be provided as a supplemental to the Davis-Bacon Heavy rates issued by OHR.

The effective date for this publication will be **Friday June 13, 2014** 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. CO140012
Superseded General Decision No. CO20130012
Modification No. 05
Publication Date: 6/6/2014
(8 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.

For questions please call (720) 913-5018

Attachments as listed above.

General Decision Number: CO140012 06/06/2014 CO12

Superseded General Decision Number: CO20130012

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

Modification Number	Publication Date
0	01/03/2014
1	01/24/2014
2	01/31/2014
3	02/07/2014
4	04/18/2014
5	06/06/2014

ASBE0028-001 10/01/2013

	Rates	Fringes
Asbestos Workers/Insulator (Includes application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical systems).....	\$ 28.83	13.18

BRCO0007-004 09/01/2013

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

	Rates	Fringes
BRICKLAYER.....	\$ 23.68	8.34

BRCO0007-006 09/01/2013

EL PASO AND PUEBLO COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 23.88	8.46

ELEC0012-004 09/01/2013

PUEBLO COUNTY

	Rates	Fringes
ELECTRICIAN Electrical contract over \$1,000,000.....	\$ 27.25	11.92
Electrical contract under		

\$1,000,000.....\$ 24.75 11.84

* ELEC0068-001 06/01/2014

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

	Rates	Fringes
ELECTRICIAN.....	\$ 32.65	12.70

ELEC0111-001 09/01/2013

	Rates	Fringes
Line Construction:		
Cable Splicer.....	\$ 28.65	13.75%+4.75
Equipment Operator-		
Underground.....	\$ 25.05	9.20
Groundman.....	\$ 22.76	9.87
Line Equipment Operator.....	\$ 27.78	10.91
Lineman and Welder.....	\$ 39.81	14.60

ELEC0113-002 06/01/2013

EL PASO COUNTY

	Rates	Fringes
ELECTRICIAN.....	\$ 29.55	14.48

ELEC0969-002 07/01/2012

MESA COUNTY

	Rates	Fringes
ELECTRICIAN.....	\$ 21.00	8.57

ENGI0009-001 10/23/2013

	Rates	Fringes
Power equipment operators:		
Blade: Finish.....	\$ 25.04	9.15
Blade: Rough.....	\$ 24.73	9.15
Bulldozer.....	\$ 24.73	9.15
Cranes: 50 tons and under..	\$ 24.88	9.15
Cranes: 51 to 90 tons.....	\$ 25.04	9.15
Cranes: 91 to 140 tons.....	\$ 25.19	9.15
Cranes: 141 tons and over...	\$ 25.97	9.15
Forklift.....	\$ 24.37	9.15
Mechanic.....	\$ 24.88	9.15
Oiler.....	\$ 24.01	9.15
Scraper: Single bowl		
under 40 cubic yards.....	\$ 24.88	9.15
Scraper: Single bowl,		
including pups 40 cubic		
yards and over and tandem		
bowls.....	\$ 25.04	9.15
Trackhoe.....	\$ 24.88	9.15

IRON0024-003 11/01/2013

	Rates	Fringes
Ironworkers:.....	\$ 24.80	18.77
Structural		

LABO0086-001 05/01/2009

	Rates	Fringes
Laborers:		
Pipelayer.....	\$ 18.68	6.78

PLUM0003-005 07/01/2013

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

	Rates	Fringes
PLUMBER.....	\$ 35.68	12.34

PLUM0058-002 07/01/2013

EL PASO COUNTY

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 32.55	13.65

PLUM0058-008 07/01/2013

PUEBLO COUNTY

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 32.55	13.65

PLUM0145-002 07/01/2013

MESA COUNTY

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 32.67	11.55

PLUM0208-004 07/01/2013

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

	Rates	Fringes
PIPEFITTER.....	\$ 33.35	12.27

SHEE0009-002 07/01/2013

	Rates	Fringes
Sheet metal worker.....	\$ 32.04	13.13

TEAM0455-002 07/01/2013

	Rates	Fringes
Truck drivers:		
Pickup.....	\$ 18.41	3.87
Tandem/Semi and Water.....	\$ 19.04	3.87

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 to the Davis-Bacon HEAVY Construction Projects rates
(Specific to the Denver Projects)
(Supp #74, Date: 02-03-2012)

<u>Classification</u>		<u>Base</u>	<u>Fringe</u>
Millwrights		\$28.00	\$10.00
Line Construction:			
	Lineman, Gas Fitter/Welder	\$36.88	\$9.55
	Line Eq Operator/Line Truck Crew	\$25.74	\$8.09
Power Equipment Operators (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 Operators:			
	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
Ironworkers (Ornamental)		\$24.80	\$10.03
Laborers:			
	GROUP 1	\$17.68	\$8.22
	GROUP 2	\$18.18	\$8.27
	GROUP 3	\$21.59	\$8.61
Laborers: (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
Laborers (Removal of Asbestos)		\$21.03	\$8.55
Truck Drivers:			
	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

POWER EQUIPMENT OPERATOR CLASSIFICATIONS
(TUNNELS ABOVE AND BELOW GROUND, SHAFTS, AND RAISES):

GROUP 1 - Brakeman

GROUP 2 - Motorman

GROUP 3 - Compressor

GROUP 4 - Air Tractors; Grout Machine; Gunnite Machine; Jumbo Form

GROUP 5 - Concrete Placement Pumps; Mucking Machines and Front End Loaders, Underground, Slusher; Mine Hoist Operator; Mechanic

GROUP 6 - Mechanic Welder

GROUP 7 - Mole

NOTE: Any equipment listed below being used in tunnel work, below or above ground shall be paid not less than \$2.00 per hour above the listed wage rates.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS:

GROUP 1 - Air compressor, brakeman, drill operator - smaller than Watson 2500 and similar, operators of 5 or more light plants, welding machines, generators, single unit conveyor, pumps, vacuum well point system, tractor, under 70 hp with or without attachments compressors, 360 C.F.M. or less.

GROUP 2 - Conveyor, handling **building** materials, ditch witch and similar trenching machine, haulage motor man, pugmill, portable screening plant with or without a spray bar, screening plants, with classifier.

GROUP 3 - Asphalt screed, asphalt plant, backfiller, bituminous spreader or laydown machine; cableway signalman, caisson drill, William MF, similar or larger; C.M.I. and similar, concrete batching plants, concrete finish machine, concrete gang saw on concrete paving, concrete mixer, less than 1 yd., concrete placement pumps, under 8 inches, distributors, bituminous surfaces dozer, drill, diamond or core, drill rigs, rotary, churn, or cable tool, elevating graders, elevator operator, equipment, lubricating and service engineer, grout machine, gunnite machine, hoist, 1 drum, horizontal directional drill operator, sandblasting machine, single unit portable crusher, with or without washer, tie tamper, wheel mounted, tractor, 70 hp and over with or without attachments, trenching machine operator, winch on truck.

GROUP 4 - Cable operated power shovels, draglines, clamshells, and backhoes, 5 cubic yards and under, concrete mixer over 1 cubic yard, concrete paver 34E or similar, concrete placement pumps, 8 inches and over, grade checker, hoist, 2 drums, hydraulic backhoe, 3/4 yds and over, loader, over 6 cubic yards, mechanic, mixer mobile, multiple unit portable crusher, with or without washer; piledriver, tractor with sideboom, roto- mill and similar, welder.

GROUP 5 - Cable operated power shovels, draglines, clamshells and backhoes over 5 cubic yards, caisson drill Watson 2500 similar or larger, hoist 3 drum or more, mechanic – welder (heavy-duty).

GROUP 6 - Cableway, derrick, quad nine push unit, wheel excavator, belt or elevating loader

GROUP 7 - tower cranes all types

LABORER CLASSIFICATIONS:

GROUP 1 - Janitors; Yardmen

GROUP 2 –Erosion Control, Dowel Bars; Fence Erectors; Gabion Basket and Reno mattresses; Signaling, Metal Mesh; Stake Caser; Traffic Control Devices; Tie Bars and Chairs in Concrete; Paving; Waterproofing Concrete; Air, Gas, Hydraulic Tools and Electrical Tool Operators; Barco Hammers; Cutting Torches; drill; diamond and core drills; Core, diamond, air track including but not

limited to; Joy, Mustang, PR-143, 220 Gardner-**Denver**, Hydrosonic, and water blaster operator; Chuck Tender; Electric hammers; Jackhammers; Hydraulic Jacks; Tampers; Air Tampers; Automatic Concrete Power Curbing Machines; Concrete Processing Material; Concrete Tender; Operators of concrete saws on pavement (other than gangsaws); Power operated Concrete Buggies; Hot Asphalt Labor; Asphalt Curb Machines; Paving Breakers; Transverse Concrete Conveyor Operator; Cofferdams; Boxtenders; Caisson 8' to 12'; Caisson Over 12'; Jackhammer Operators in Caissons over 12'; Labor applicable to Pipe coating or Wrapping; Pipe Wrappers, Plant and Yard; Relining Pipe; Hydroliner (a plastic may be used to waterproof); Pipelayer on Underground Bores; Sewer, Water, Gas, Oil Conduit; Enamalers on Pipe, inside and out, Mechanical Grouters; Monitors; Jeep Holiday Detector Men; Pump Operators; Rakers; Vibrators; Hydro- broom, Mixer Man; Gunnite Nozzlemen; Shotcrete Operator; and chain saws, gas and electric; Sand Blaster; Licensed Powdermen; Powdermen and Blaster; Siphons; Signalmen; Dumpman/spotter; Grade Checker.

GROUP 3 - Plug and galleys in dams; Scalers; any work on or off Bridges 40' above the ground performed by Laborers working from a Bos'n Chair, Swing Stage, Life Belt, or Block and Tackle as a safety requirement.

TUNNEL LABORER CLASSIFICATIONS:

GROUP 1 - Outside Laborer - Above ground

GROUP 2 - Minimum Tunnel Laborer, Dry Houseman

GROUP 3 - Cable or Hose Tenders, Chuck Tenders, Concrete Laborers, Dumpmen, Whirley Pump Operators

GROUP 4 - Tenders on Shotcrete, Guniting and Sand Blasting; Tenders, core and Diamond Drills; Pot Tenders

GROUP 5 - Collapsible Form Movers and Setters; Miners; Machine Men and Bit Grinders; Nippers; Powdermen and Blasters; Reinforcing Steel Setters; Timbermen (steel or wood tunnel support, including the placement of sheeting when required); and all Cutting and Welding that is incidental to the Miner's work; Tunnel Liner Plate Setters; Vibrator Men, Internal and External; Unloading, stopping and starting of Moran Agitator Cars; Diamond and Core Drill Operators; Shotcrete operator; Gunnite Nozzlemen; Sand Blaster; Pump Concrete Placement Men.

TRUCK DRIVER CLASSIFICATIONS:

GROUP 1 - Sweeper Truck, Flat Rack Single Axle and Manhaul, Shuttle Truck or Bus.

GROUP 2 - Dump Truck Driver to and including 6 cubic yards, Dump Truck Driver over 6 cubic yards to and including 14 cubic yards, Straddle Truck Driver, Liquid and Bulk Tankers Single Axle, Euclid Electric or Similar, Multipurpose Truck Specialty and Hoisting.

GROUP 3 - Truck Driver Snow Plow.

GROUP 4 - Cement Mixer Agitator Truck over 10 cubic yards to and including 15 cubic yards.

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

**Geotechnical Report
South Jason Street
Maintenance Facility
Denver, Colorado**

October 2, 2012

Submitted To:
City and County of Denver
Department of Public Works
Capital Project Management
201 West Colfax Ave, Department 507
Denver, Colorado 80202

By:
Shannon & Wilson, Inc.
1060 Bannock Street, Suite 200
Denver, Colorado 80204

23-1-01285-103

October 2, 2012

City and County of Denver
Department of Public Works
Capital Project Management
201 West Colfax Ave, Department 507
Denver, Colorado 80202

Attn: Ms. Julia Fitzpatrick

**RE: GEOTECHNICAL REPORT, SOUTH JASON STREET MAINTENANCE
FACILITY, DENVER, COLORADO**

We are pleased to submit our geotechnical report for the above-referenced project. The enclosed report summarizes subsurface conditions encountered, laboratory test results, and geotechnical engineering recommendations for the proposed maintenance facility.

We appreciate the opportunity to be of service to you on this project. If you have any questions or require further information, please contact me at 303-825-3800.

Sincerely,

SHANNON & WILSON, INC.



Gregory R. Fischer, PhD, P.E.
Senior Vice President

JSC:MGG:GRF/jjs

Enc: Geotechnical Report

23-1-01285-103-L1

TABLE OF CONTENTS

Page

1.0 INTRODUCTION1

2.0 SITE AND PROJECT DESCRIPTION.....1

3.0 FIELD EXPLORATIONS AND LABORATORY TESTING2

 3.1 Explorations2

 3.2 Laboratory Test Results2

4.0 GEOLOGY AND SUBSURFACE CONDITIONS2

 4.1 Regional Geology2

 4.2 Subsoil Conditions3

 4.3 Groundwater Conditions4

5.0 GEOLOGIC HAZARDS4

 5.1 Landfill Material4

 5.2 Seismicity.....4

6.0 GEOTECHNICAL RECOMMENDATIONS4

 6.1 Foundations.....5

 6.2 Floor Slabs6

 6.3 Exterior Flatwork6

 6.4 Drainage.....7

 6.5 Pavement Design7

 6.5.1 Pavement Thickness Alternatives8

 6.5.2 Subgrade Preparation8

 6.6 Sulfates and Corrosion.....8

7.0 CONSTRUCTION CONSIDERATIONS9

 7.1 Earthwork.....9

 7.1.1 Excavation.....9

 7.1.2 Fill Placement and Compaction9

 7.1.3 Proof-rolling.....10

 7.2 Utilities.....10

 7.3 Aggregate Base Coarse (ABC) Material.....10

 7.4 Hot-Mix-Asphalt (HMA) Pavement Materials11

8.0 PLAN REVIEW11

9.0 CONSTRUCTION MONITORING11

10.0 LIMITATIONS12

11.0 REFERENCES13

FIGURES

- 1 Vicinity Map
- 2 Site and Exploration Plan

APPENDICES

- A Field Explorations
- B Laboratory Test Results
- C Important Information about Your Geotechnical/Environmental Report

**GEOTECHNICAL REPORT
SOUTH JASON STREET MAINTENANCE FACILITY
DENVER, COLORADO**

1.0 INTRODUCTION

This report presents geotechnical engineering recommendations for the South Jason Street Maintenance Facility located at 678 South Jason Street in Denver, Colorado (Figure 1). The report summarizes our subsurface explorations, laboratory testing and geotechnical engineering studies, and presents conclusions and recommendations for site grading, earthwork, and the design of foundations, floor slabs, and pavements. Our services were conducted in general accordance with our On-Call Contract, OC01282, with the City and County of Denver.

2.0 SITE AND PROJECT DESCRIPTION

The project is located southeast of the intersection of South Jason Street and West Exposition Avenue in Denver, Colorado. The project involves remodeling of the existing structure and construction of new pavement areas to the east of the existing building. Relatively small areas of existing pavement to the west of the building will be removed and replaced. The proposed future use is as a maintenance facility for the City and County of Denver Department of Parks and Recreation.

The existing one-story structure was previously the Denver Municipal Animal Shelter (Figure 2). The vacant portion of the property is relatively flat with a small knoll at the southeast corner, and the ground surface is covered with scattered vegetation. The site is located in an area known to have been gravel mined in the past and subsequently filled.

Based on our discussions with you, we understand the structural aspect of the remodeling consists of removing the slab in the southeastern portion of the building and reconfiguring walls with installation of several new columns. Remodeling in other areas will re-use the existing structural system and were not part of our work. Flood walls about 2 feet high will also be constructed at various locations around the site. Based on grading plans provided to us, cuts and fills for pavements will be on the order of about 2 feet or less.

3.0 FIELD EXPLORATIONS AND LABORATORY TESTING

3.1 Explorations

Shannon & Wilson implemented a field exploration program on September 8, 17 and 24, 2012 to evaluate subsurface conditions at the site. The field exploration program consisted of drilling six borings in or near the building area (designated SW-01, SW-02, SW-11, SW-11A, SW-12 and SW-12A) and eleven borings in pavement areas (designated SW-03 through SW-10A, SW-13 and SW-14). Two of the borings (borings SW-11A and SW-12A) were drilled and completed as soil vapor points and three borings (SW-10A, SW-13 and SW-14) were drilled to obtain additional sample material.

The boring locations are shown on Figure 2. The locations of the borings were determined using a handheld GPS device. Elevations of the borings were approximated from site topographic information. Appendix A presents a discussion of the drilling and sampling procedures used in completing the borings followed by an explanation of the symbols and terminology used and individual exploration logs.

3.2 Laboratory Test Results

Shannon & Wilson completed geotechnical laboratory testing to determine index and engineering properties of samples retrieved from the field exploration program. The testing program included visual classification, water contents, liquid and plastic Atterberg limits, grain size analyses, percent passing the number 200 U.S. sieve, and corrosion testing. The laboratory test results are presented in Appendix B. The natural water contents, Atterberg limits, and percent fines are also included on the individual boring logs in Appendix A.

4.0 GEOLOGY AND SUBSURFACE CONDITIONS

4.1 Regional Geology

Shroba (1980) mapped the surficial and bedrock geology of the Englewood quadrangle, which includes the proposed South Jason Street Maintenance Facility. The geologic map indicates the surficial deposit underlying the site is artificial fill. According to Shroba (1980), the large areas of artificial fill on the west side of the South Platte River mainly consist of mined-out sand and gravel pits that were reclaimed for commercial, industrial, and recreational uses. Based on our understanding of the site history, the area was previously used as a landfill.

West and south of the site, the geologic map indicates surficial deposits are post-Piney Creek alluvium that forms channel, flood plain, and low terraces less than about 15 feet above the South Platte River. Denver Formation bedrock underlies the surficial deposits. The Denver

Formation consists of interbedded layers of sedimentary claystone, siltstone, sandstone, and conglomerate. The bedding of the rock layers is generally horizontal, and the transition between rock types is gradual and gradational.

4.2 Subsoil Conditions

Prior to our field exploration program, we reviewed the Landfill Evaluation and Sampling Program report for the former Denver Municipal Animal Shelter building (Brown and Caldwell, 2006). The thirteen borings drilled as part of their evaluation indicate the bottom of the landfill material was approximately 8.5 to 22 feet below the ground surface at the time of the project.

For purposes of this report, we discuss two types of fill at the site.

- Landfill. Based on our observations, this material primarily consisted of sand containing variable amounts of organic material (such as paper or wood) along with construction debris (such as brick, concrete, ceramic, metal, plastic or glass fragments). In some cases, a petroleum odor was noted. The landfill material was primarily brown, dark brown and gray, and occasionally black. The type and volume of deleterious material was variable as to location and thickness. In general, we observed that deleterious materials constituted a minor portion of the sampled volume of landfill material.
- Fill. This type of fill was natural sand and gravel in which little to no deleterious material was observed. The fill consisted of medium dense, brown and gray, slightly gravelly, slightly clayey to clayey sand. This fill type was found in our borings below and adjacent to the building.

Based on our borings in or near the building area (SW-01, SW-02, SW-11, SW-11A, SW-12 and SW-12A), subsoil conditions beneath the existing building generally consist of fill underlain by alluvial sand. The alluvium was loose to medium dense, typically brown, slightly gravelly, trace of clay to clayey sand with occasional thin clay seams. Below the building, the alluvium was gray and in places had a slight petroleum odor, possibly due to leaching of former landfill material. Most borings terminated in the fill material. Claystone bedrock of the Denver Formation was found at depths of about 36 and 34 feet in borings SW-11 and SW-12, respectively.

Significant amounts of organic material, debris or other deleterious material was not noted in the fill below the building area. Based on our limited explorations, it appears that landfill material below the building was removed and replaced with “clean” fill prior to construction of the building.

The borings drilled east of the existing building (SW-03 through SW-10A, SW-13 and SW-14) terminated in landfill material at depths of about 9 to 17 feet. Boring SW-12 drilled near the

northeast corner of the existing building encountered about 17 feet of landfill material overlying alluvium and Denver Formation bedrock.

4.3 Groundwater Conditions

At the time of drilling, groundwater levels were measured in six borings at depths ranging from 13.2 to 16.5 feet below the ground surface. Refer to the individual boring logs for the groundwater measurements. Please note that groundwater measurements were taken over a relatively short time period and only reflect conditions at the time of measurement. Groundwater fluctuations will occur and may be caused by several factors. Precipitation, irrigation, and the water level in the nearby South Platte River can result in groundwater fluctuations.

5.0 GEOLOGIC HAZARDS

5.1 Landfill Material

As discussed in the previous section, landfill material was encountered in borings east of the building. The presence of a previous landfill beneath proposed parking lot areas presents increased risk of settlement. The landfill material may be compressible and contains potentially decomposing debris. As a result, settlement may occur due to traffic loads applied to the pavement, as well as settlement caused by decomposing landfill material.

5.2 Seismicity

A geologic map of the area does not show any mapped faults crossing the site (Shroba, 1980). Based on a 1998 Open-File Report by the Colorado Geological Survey, the nearest fault to the project site is in Golden, Colorado (Widmann et al., 1998). The Golden Fault is over 10 miles west of the site and it is believed that this fault has not moved for at least 500,000 years (Dames & Moore, 1981). Therefore, because we consider the likelihood of a seismic event occurring on this fault in the foreseeable future to be low, and given the distance of the fault from the project site, it is our opinion that the risk of damage to the renovated building due to ground shaking related to a seismic event on the Golden Fault is low.

6.0 GEOTECHNICAL RECOMMENDATIONS

The landfill material beneath the site is capable of causing damage to pavements and other engineered structures. The recommendations in this report attempt to address the potential effects of the landfill materials. However, the risk can only be reduced and not entirely eliminated by geotechnical engineering considerations.

6.1 Foundations

As discussed in Section 4.2, it appears that the landfill was removed beneath the existing building and replaced with granular fill. If this is the case, the risk of excessive settlement due to underlying landfill material is low.

Construction plans for the Municipal Animal Pound (Marshall Kasch & Associates, 1975), indicate the existing building was constructed with a shallow foundation system using a maximum allowable bearing pressure of 3,000 pounds per square foot (psf) for design. Based on our discussions with City and County of Denver representatives, we understand the building and floor slab has performed satisfactorily. During our site visit, we did not observe building damage or distress indicative of excessive settlement.

In our opinion, shallow foundations are suitable for the proposed renovation. Individual column footings and continuous wall (strip) footings may be designed using the same maximum allowable bearing pressure of 3,000 psf. Footings should be cast on existing or recompacted on-site granular fill, as discussed in Section 7.1. The above bearing pressure can be increased by 33 percent for short-term wind or seismic loads. Spread footings and continuous wall footings should have minimum dimension of 24 inches. Exterior footings should be embedded at least 3 feet below the lowest adjacent exterior grade (for frost depth). For this bearing pressure, we estimate less than about 1 inch of total footing settlement and $\frac{3}{4}$ inch of differential footing settlement over a length of about 40 feet, assuming landfill materials are not beneath the building.

Based on criteria presented in the 2006 International Building Code (IBC), it is our opinion that the site is best classified as Site Class D.

Horizontal seismic or wind loads on the building may be resisted by friction along the base of the foundation and by passive soil resistance against the buried portion of the foundation. Passive soil resistance may be calculated based on an allowable equivalent fluid density of 350 pounds per cubic foot (pcf). This value has been reduced by a factor of two to provide a factor of safety and take into account the limited lateral deflections typical of small structures. The value also assumes the backfill is above the groundwater table. Because of the design frost depth, passive resistance should be ignored around the exterior of the building in the upper 36 inches. Footings cast on properly prepared material may be designed using an allowable coefficient of base friction of 0.35. This value includes a factor of safety of 1.5 on ultimate soil strength.

We understand flood walls about 2 feet in height will be constructed around the site. The above criteria provided can be used for design of these wall footings.

6.2 Floor Slabs

We understand a new slab-on-grade floor is planned in the southeastern portion of the building, in the truck maintenance area. Recommendations regarding slab subgrade preparation are presented in Section 7.1.2. Excessive slab settlement is not anticipated provide the subgrade is reasonably well prepared.

We recommend a coefficient of vertical subgrade reaction for design of slabs [based on a one-foot square plate (k_1)] equal to 150 pounds per cubic inch (pci) for slabs supported on granular fill. This modulus value should be adjusted for larger square or rectangular loaded areas using the following equations:

$$k_{\text{square}} = k_1 \left(\frac{B + 1}{2B} \right)^2$$

$$k_{\text{rectangular}} = k_{\text{square}} \left(\frac{1 + 0.5 \frac{B}{L}}{1.5} \right)$$

Where B and L are the loaded area width and length, respectively, in feet

The following details are recommended for slabs on grade.

- To reduce the effects of differential movement, slabs on grade should be separated from bearing walls, columns and utility projections with expansion joints that allow unrestrained vertical movement.
- Frequent control joints should be used to reduce damage due to shrinkage cracking. ACI recommendations should be consulted for control joint frequency to help reduce problems associated with shrinkage and cracking.

6.3 Exterior Flatwork

Exterior slab-on-grade construction (such as flatwork for sidewalks and entrances) could be subject to movement if the area is underlain by landfill materials. As such, the Owner must be aware of and accept the risk of movement of flatwork. However, there are relatively economical measures that can be taken to reduce the potential magnitude of this movement and lessen its effects. Such measures include:

- Reinforcing concrete slabs
- Providing frequent control joints in concrete slabs

We recommend exterior flatwork subgrade be compacted and evaluated in manner similar to floor slab subgrade (Section 7.1.2).

6.4 Drainage

Positive surface drainage around the building can help improve performance of exterior flatwork and to a degree interior slabs or footings.

We recommend that as much as practical, the ground surface around the structures be sloped to provide positive drainage away from the foundation. We recommend providing a slope of at least 10 percent for the first 5 feet surrounding the buildings.

Roof downspouts should discharge into the storm drain system. If this is not possible, roof downspouts should discharge beyond the limits of foundation backfill or a minimum of 5 feet. We recommend providing splash blocks and downspout extenders, or tightlining downspouts away from the building. Roof downspouts should not be connected into a perimeter foundation drain system.

Perimeter drains are typically not recommended provided there are no below-grade interior spaces planned. If below grade areas are planned, then an interior drain should be considered to prevent the ponding of water from sources such as a water supply leak. Interior perimeter drains should consist of a perforated, 4-inch-diameter PVC pipe (holes oriented down) in a trench filled with clean, washed gravel. A minimum of 2 inches of gravel should be provided around the pipe. The drain should have a minimum depth of 6 inches at the high point and slope to a sump and pump or gravity outlet (minimum slope of 0.5%).

6.5 Pavement Design

Pavements to the east of the building will be constructed on a relatively deep deposit of landfill materials with potentially highly variable engineering and pavement support properties. It is not practical to remove or improve the material to eliminate risk of pavement distress due to settlement or deterioration of the underlying fill. Based on our discussion with City and County of Denver representatives, we have developed recommended pavement sections to reduce the risk of poor pavement performance; however, there will remain a significant risk of pavement settlement or distress compared to “normal” sites on natural ground.

Our pavement recommendations assume that the landfill subgrade immediately below the pavement consists primarily of sand without significant deleterious, organic material. It will be important to retain Shannon & Wilson to observe subgrade excavation, compaction and proof-rolling in pavement areas to identify particularly poor pavement support areas during construction. We can then identify areas for selective removal and replacement with aggregate base course to help improve pavement performance. We suggest the construction contract

include a unit price for additional landfill material removal and disposal, and replacement with base course, to accommodate this process.

We understand the traffic areas will consist of two areas: automobile parking only and truck traffic areas. Truck traffic is anticipated to consist primarily of pickup trucks and utility trailers with occasional, slightly heavier dual-axle flat bed trucks. Weekly trash truck traffic is also anticipated.

6.5.1 Pavement Thickness Alternatives

We used Colorado Asphalt Pavement Association (2006) guidelines and our experience as a basis for selecting the following pavement thickness alternatives.

- Automobile Traffic Only Areas. We recommend a pavement section consisting of 6 inches of Aggregate Base Course (ABC) overlain by 4 inches of Hot Mix Asphalt (HMA).
- Truck Traffic Areas. We recommend a pavement section consisting of 4 inches of ABC as a leveling course, a layer of geogrid, then 6 inches of ABC, overlain by 6 inches of HMA. This results in a 16-inch-thick total section. Geogrid should consist of Tensar International Corporation biaxial geogrid BX1100 or equivalent.

A 6-inch-thick concrete pavement section can be considered for limited areas adjacent to the maintenance bay doors or at trash trucks loading areas. Concrete is less tolerant of settlement and cracking than asphalt and can be more expensive to repair. Providing light reinforcement (about 0.1 percent) could help span small settlement areas and would help hold cracked sections together. If reinforcing bars are used, the concrete thickness should be increased to 6.5 inches to provide a minimum of 3 inches of cover.

6.5.2 Subgrade Preparation

Details regarding compaction requirements and proof-rolling are presented in Section 7.1. We recommend we observe the pavement subgrade after excavation and before any fill is placed. During compaction and proof-rolling we can visually identify soft or loose zones, or areas containing excessive deleterious materials, and recommend the extent and depth of removal. We should also observe and test ABC, and asphalt and concrete pavement construction.

6.6 Sulfates and Corrosion

We completed corrosion testing (including soil resistivity, water soluble sulfate, chloride, and pH testing) on two samples of the landfill material. The sample locations and results are summarized in Table B-1. American Concrete Institute (ACI) guidelines for sulfate resistance

should be used. A corrosion expert can evaluate the test results with respect to utilities/piping or other features in contact with the soil.

7.0 CONSTRUCTION CONSIDERATIONS

The applicability of the design recommendations presented in Section 6.0 is contingent upon good construction practice. Poor construction techniques may alter conditions from those upon which our recommendations are based, and therefore result in reduced foundation capacity or additional movement. The following sections present additional construction considerations for this project.

Debris in the landfill material may complicate excavation, disposal of the excess material and proof rolling, or compaction of the landfill material prior to fill placement. We recommend we be retained to observe and consult during construction to adapt procedures and testing as required.

7.1 Earthwork

7.1.1 Excavation

In our opinion, excavation of site soils will be possible with conventional excavating equipment, such as heavy-duty loaders or tracked hydraulic excavators. Rock excavation or ripping is not anticipated. Disposal of landfill material should follow applicable rules and regulations.

7.1.2 Fill Placement and Compaction

Fill and backfill should be placed in maximum 8-inch-thick lifts when using heavy compaction equipment. The lift thickness should be reduced to 4 inches when using small compaction equipment for backfilling against foundation walls or utilities.

Prior to constructing interior slabs or footings, we recommend that the existing fill subgrade be compacted. Observations and probing during construction to evaluate potential loose subgrade should be performed.

All fill and backfill should be compacted to a dense/firm and unyielding condition. Cohesive soils should be moisture conditioned to between 1 and 3 percent above optimum moisture content; granular soils to within 3 percent of optimum. Fill and backfill should be compacted to at least 95 percent of the Standard Proctor maximum dry density (ASTM D-698 for cohesive soils and 95 percent of the Modified Proctor maximum dry density (ASTM D-1557) for granular soils. The compaction can be reduced to 90 percent for fill in landscape areas.

7.1.3 Proof-rolling

In pavement areas, the exposed subgrade after stripping or excavation will consist of landfill material with variable amounts of debris and deleterious material. Where practical we recommend the subgrade (prior to fill placement) be scarified to a depth of 8 inches, moisture-conditioned, and compacted in place to a dense and unyielding condition and to at least 95 percent of the Proctor maximum dry density (ASTM D-698 for cohesive soils and ASTM D-1557 for granular soils). The compacted surface should then be proof-rolled with a fully-loaded, tandem-axle, 10-yard dump truck or equivalent. Areas that are identified as being loose, soft, or yielding during proof-rolling should be wetted or dried, as required, and recompact or removed. Care should be taken during proof-rolling and subgrade preparation to avoid disturbing subgrade soils and supporting soils that will remain in place, as they can rut and pump under repeated construction traffic.

7.2 Utilities

Where possible, contractors typically use temporary excavation slopes for installation of shallow pipelines. If temporary slopes will be made, they should be consistent with the Occupational Safety & Health Administration (OSHA) guidelines contained in 29 CFR 1926, Subpart P (OSHA, 1994). For cost estimating and planning purposes only, we anticipate temporary excavations will be on the order of 1H:1V (horizontal to vertical) to 1.5H:1V in the landfill material. This material can be variable and the contractor's responsible person should evaluate conditions on an on-going basis. If excessive deleterious material, or groundwater seeping or flowing into the excavation, is encountered, then flatter slopes should be anticipated.

Consistent with conventional practice, the excavation contractor should be responsible for the actual temporary excavations or shoring, including methods, sequence, and schedule of construction. The contractor is able to observe the nature and conditions of the subsurface materials encountered and should evaluate the factors discussed above. If instability is observed, slopes should be flattened or shored. All excavations should be accomplished in accordance with local, state, and federal safety regulations.

7.3 Aggregate Base Coarse (ABC) Material

The ABC material should meet CDOT Class 6 specifications and have an R-value greater than 78. ABC material should be placed in maximum 6-inch-thick lifts and compacted to a dense and unyielding condition and to at least 95 percent of the Modified Proctor maximum dry density (AASHTO T-180 or ASTM D-1557).

Note that because interlocking of the base course material is desired to engage the geogrid material, we recommend crushed natural rock or crushed recycled concrete for base course. Pit-run, rounded sand and gravel base course is not recommended.

7.4 Hot-Mix-Asphalt (HMA) Pavement Materials

We recommend that the HMA mix design be in accordance with CDOT and Superpave standards. We recommend using a Grade SX mix with a nominal maximum aggregate size (NMAS) of ½ inch for the surface layer of HMA and a Grade S mix with a NMAS of ¾ inch for any layers below the surface. In addition, we recommend a Superpave design gyratory number (N) of 75 with an asphalt binder of PG 64-28 for HMA. Binder selection is based on the anticipated pavement temperatures, traffic patterns, and local availability. Grade SX mixes should be placed in lifts ranging from 2 to 2.5 inches, and Grade S should be placed in lifts ranging between 2 and 3 inches. A tack coat should be placed between subsequent lifts if the underlying lift will be used for traffic or left uncovered for a significant period of time.

8.0 PLAN REVIEW

We recommend that we be retained to review the geotechnical aspects of the plans and specifications before construction begins to determine that they are in accordance with our recommendations. Although this phase of a project is often neglected, it has been our experience that substantial savings in future cost overruns during construction can be avoided by a geotechnical review of these documents prior to construction.

9.0 CONSTRUCTION MONITORING

Geotechnical design recommendations are developed from a limited number of explorations and tests. Therefore, recommendations may need to be adjusted in the field. This is particularly important for this project due to the variability of the landfill material that will support pavements.

We recommend that Shannon & Wilson be retained to monitor the geotechnical aspects of construction, particularly fill placement and subgrade preparation for pavements, slabs, and foundations. This monitoring would allow us to evaluate the subsurface conditions as they are exposed during construction, adapt procedures as required, and evaluate if the work is accomplished in accordance with our recommendations and good construction practice.

10.0 LIMITATIONS

This report has been prepared for the exclusive use of the City and County of Denver (and their design team) for specific application to the design and construction of the project at this site as it relates to the geotechnical aspects discussed herein. Its purpose is to provide information on factual data only; it should not be construed as a warranty of subsurface conditions, such as those interpreted from the boring logs and discussions of subsurface conditions in this report.


The conclusions and recommendations made in this report are based on site conditions as they presently exist. They assume that the explorations are representative of the subsurface conditions beneath the site; that is, the subsurface conditions everywhere are not significantly different from those encountered in the previous and current explorations.

Within the limitations of scope, schedule and budget, the conclusions and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical and geological principles and practice at the time this report was prepared. We make no other warranty, either express or implied.

We are currently preparing a report evaluating environmental conditions at the site. This report should be reviewed prior to excavation to evaluate required safety and regulatory impacts due to the presence of landfill material and methane gasses. Disposal of all excavated materials should follow applicable laws and regulations.

Like all professional persons rendering advice, we do not act as insurers of the conclusions we reach, but we commit ourselves to care and competence in reaching these conclusions. We have prepared the document, "Important Information About Your Geotechnical / Environmental Report," to assist you and others in understanding the use and limitations of our reports. This document is included in Appendix C.

SHANNON & WILSON, INC.


Justin S. Crummett
Geotechnical Staff

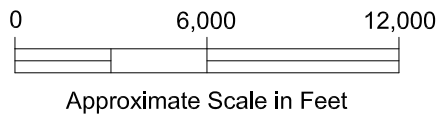
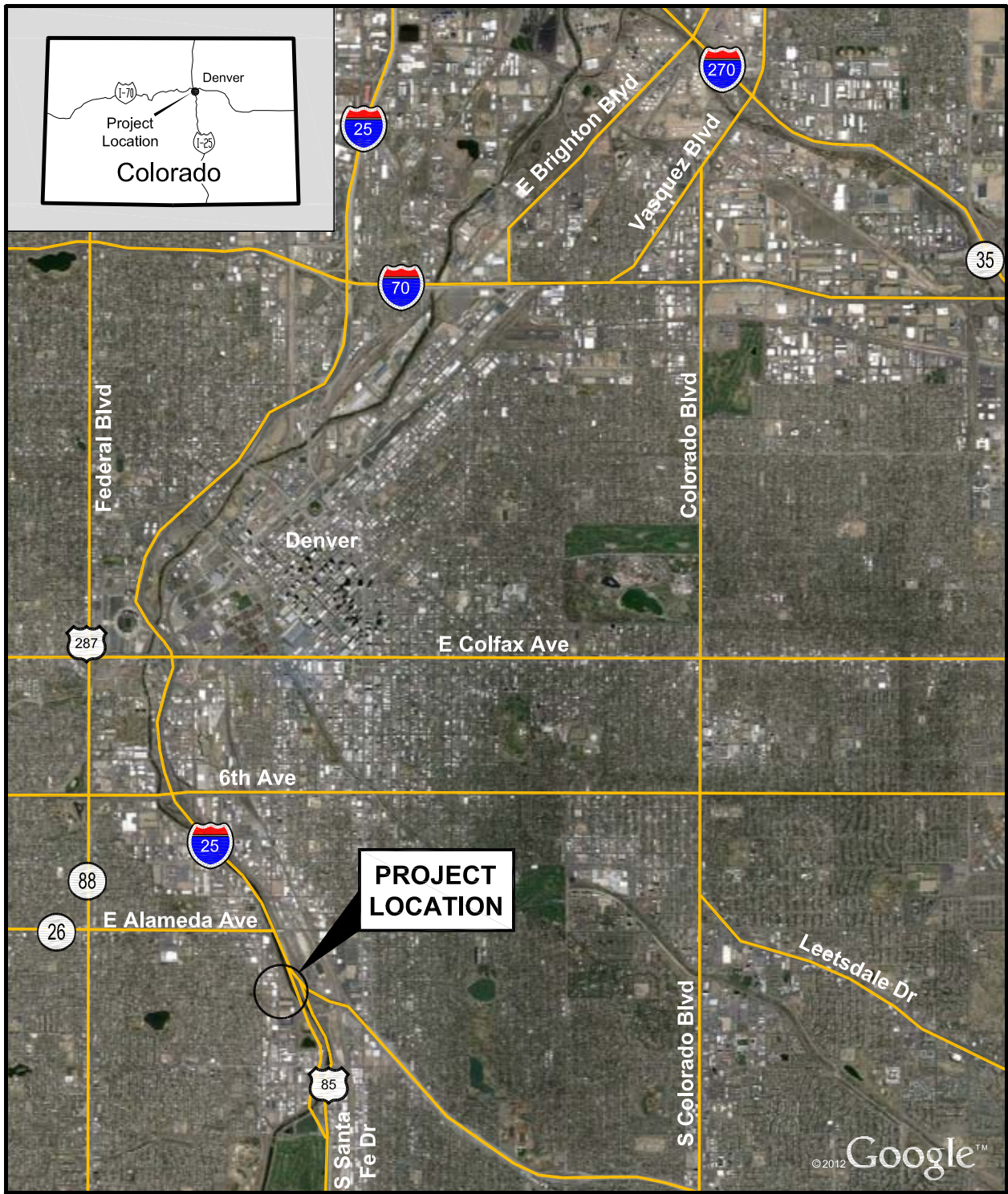


Gregory R. Fischer, PhD, P.E.
Senior Vice President

JSC:MTG:MGG:GRF/jsc

11.0 REFERENCES

- Brown and Caldwell, 2006, Landfill Evaluation and Sampling Program, Denver Municipal Animal Shelter, Denver, Colorado, November.
- Colorado Asphalt Pavement Association, 2006, A Guideline for the Design and Construction of Asphalt Parking Lots in Colorado, Centennial, Colorado.
- Dames & Moore, 1981, Geologic and seismologic investigations for Rocky Flats Plant: unpublished report prepared for U.S. Department of Energy.
- Marshall Kasch & Associates, 1975, Municipal Animal Pound for the City and County of Denver, City Project No. 74-133, Foundation Plan and General Notes, Sheet S-1.
- Occupational Safety & Health Administration, 1994, Part 1926, Safety and Health Regulations for Construction, Subpart P, accessed October 1, 2012, from Occupational Safety & Health Administration web site:
http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10930
- Shroba, R.R., 1980, Geologic map and physical properties of the surficial and bedrock units of the Englewood quadrangle, Denver, Arapahoe, and Adams Counties, Colorado: U.S. Geological Survey, Geologic Quadrangle Map GQ-1524, scale 1:24000.
- Widmann, B.L., Kirkham, R.M., and Rogers, W.P., 1998, Preliminary Quaternary Fault and Fold Map and Database of Colorado: Colorado Geological Survey, Denver, Colorado, Open-File Report 98-8, 331 p.



NOTE

Map adapted from aerial imagery provided by Google Earth Pro, reproduced by permission granted by Google Earth™ Mapping Service.

South Jason Street Maintenance Facility
Denver, Colorado

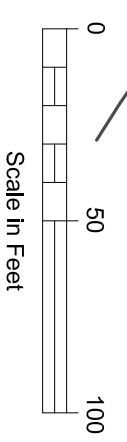
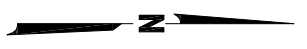
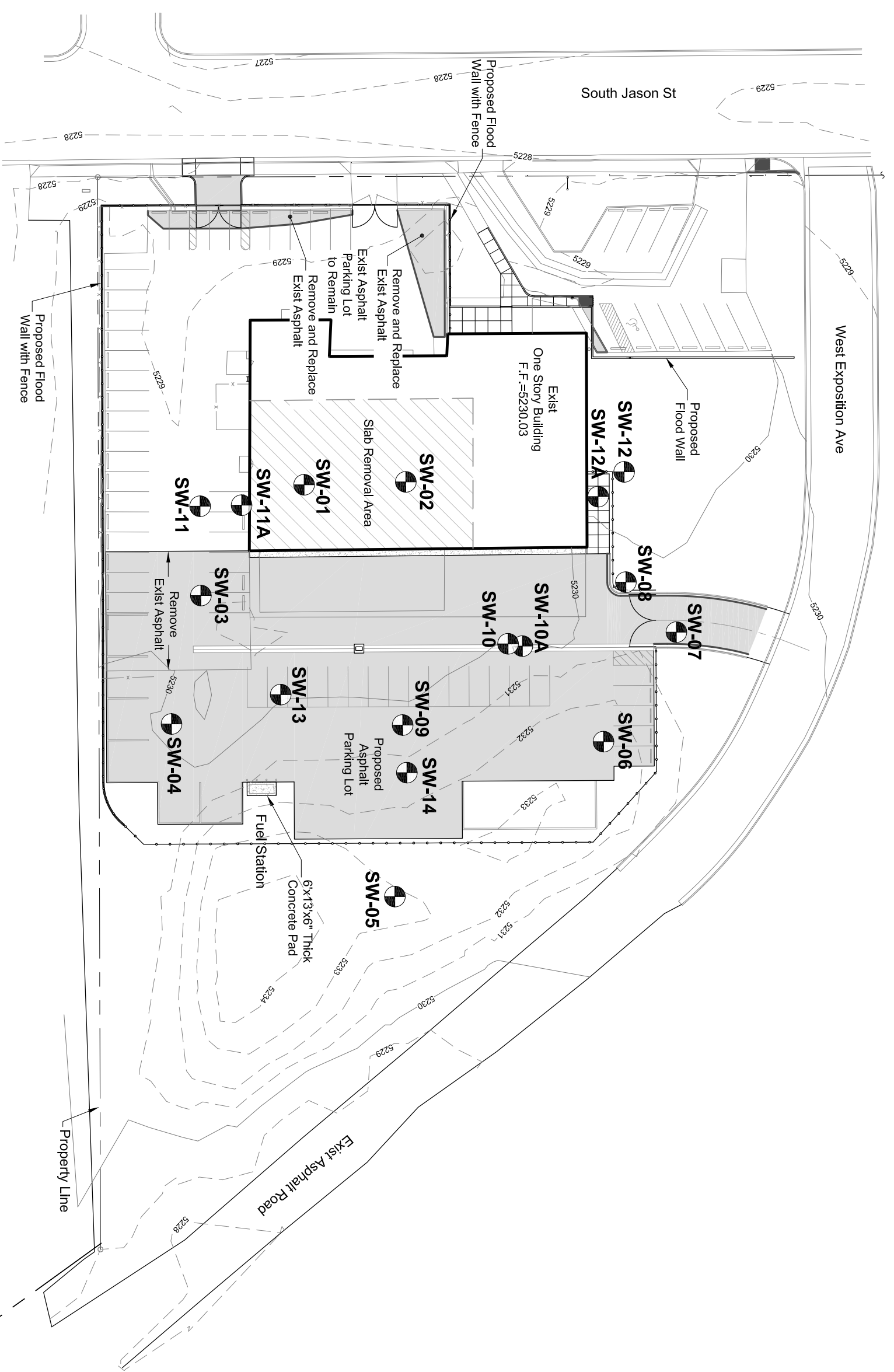
VICINITY MAP

October 2012

23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 1



- LEGEND**
- Boring Designation and Approximate Location
 - Existing Grade Contours, Major
 - Existing Grade Contours, Intermediate

NOTES

1. Figure adapted from files Base 557-0201.dwg, C1-1 Site.dwg, and X-Site 557-0201.dwg dated 4-20-2012 by SlaterPaull Architects.
2. Boring locations shown approximately based on location by handheld GPS Devices.

South Jason Street Maintenance Facility
Denver, Colorado

SITE AND EXPLORATION PLAN

October 2012 23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 2

APPENDIX A
FIELD EXPLORATIONS

APPENDIX A

FIELD EXPLORATIONS

TABLE OF CONTENTS

	Page
A.1 INTRODUCTION	A-1
A.2 EXPLORATIONS	A-1
A.3 SOIL SAMPLING	A-2
A.4 SOIL AND ROCK CLASSIFICATION SYSTEM.....	A-2

FIGURES

A-1	Soil Classification and Log Key (2 sheets)
A-2	Rock Classification and Log Key (2 sheets)
A-3	Log of Boring SW-01
A-4	Log of Boring SW-02
A-5	Log of Boring SW-03
A-6	Log of Boring SW-04
A-7	Log of Boring SW-05
A-8	Log of Boring SW-06
A-9	Log of Boring SW-07
A-10	Log of Boring SW-08
A-11	Log of Boring SW-09
A-12	Log of Boring SW-10
A-12	Log of Boring SW-10A
A-14	Log of Boring SW-11
A-15	Log of Boring SW-11A
A-16	Log of Boring SW-12
A-17	Log of Boring SW-12A
A-18	Log of Boring SW-13
A-19	Log of Boring SW-14

APPENDIX A

FIELD EXPLORATIONS

A.1 INTRODUCTION

Shannon & Wilson completed a field exploration program on September 8, 17 and 24, 2012 consisting of drilling and sampling a total of 17 borings for the proposed South Jason Street Maintenance Facility. All borings were coordinated by a geologist from Shannon & Wilson (including subcontractor coordination and utility locates) and most of the borings were observed by a field representative with Pinyon Environmental Engineering Resources, Inc (Pinyon). Five borings (SW-10A, SW-11A, SW-12A, SW-13, and SW-14) were observed by a geologist from Shannon & Wilson. Individual boring logs are presented in Figures A-3 through A-19. These exploration logs represent our interpretation of the field logs and the results of laboratory testing. The methods used to conduct the field exploration program are described below.

A.2 EXPLORATIONS

The exterior borings were drilled by Vine Laboratories, Inc. (Vine) of Denver, Colorado under subcontract to Shannon & Wilson. All borings were drilled using a truck-mounted CME-55 drill rig. The two interior borings (SW-01 and SW-02) were drilled by Unlimited Access Drilling under subcontract to Vine. Six borings were drilled in and near the proposed building renovation (designated SW-01, SW-02, SW-11, SW11A, SW-12 and SW-12A) to depths ranging from approximately 16.5 to 36 feet below the existing ground surface. Eleven pavement borings were drilled in the proposed parking lot east of the building (designated SW-03 through SW-10A, SW-13 and SW-14). These borings were drilled to depths ranging between 9 and 16.5 feet below the existing ground surface. All the borings were completed using solid stem auger drilling and drive sampling methods.

Following completion of drilling activities, the Pinyon or Shannon & Wilson field representative measured water levels in the borings with a weighted tape. The approximate boring locations are shown on Figure 2 and were determined by a handheld GPS device and should be considered approximate. Following drilling and measurement activities, Vine personnel backfilled the borings with cuttings generated during drilling.

A.3 SOIL SAMPLING

Soil samples were obtained from the borings using several types of samplers, including the Standard Penetration Test (SPT) split-spoon sampler and the modified California (MC) barrel sampler.

Disturbed samples were collected from the borings in general accordance with the SPT, ASTM Designation: D 1586. The SPT consists of driving a 2-inch outside-diameter, split-spoon sampler a distance of 18 inches beneath the bottom of the borehole with a 140-pound hammer free-falling a distance of 30 inches. The number of blows required to advance the split-spoon through each of three 6-inch increments was recorded. The SPT resistance, or N-value, is defined as the number of blows required to drive the last 12 inches. Where high penetration resistance prevented driving the total length of the sampler, the penetration resistance for the partial penetration was recorded. The N-values provide a means for evaluating the relative density or compactness of cohesionless (granular) soils and consistency or stiffness of cohesive (fine-grained) soils (see Figure A-1). The SPT blow counts are shown on the individual boring logs.

Disturbed samples were also obtained using a 2-inch inside-diameter, MC barrel sampler with liner tubes. The MC sampler was advanced 12 inches by driving a 140-pound-hammer falling freely from a height of 30 inches. The penetration resistance in blows for the first 12 inches was recorded, similar to SPT techniques. These blow counts are also shown on the boring logs. While these blow counts are not precisely equivalent to SPT blow counts, we assigned relative density and consistency descriptions based on the SPT blow count system shown in Figure A-1.

Following sampling, representative portions of the split-spoon samples were placed in airtight plastic containers (for SPT samples) or sealed in the liner tubes (for MC samples) and transported to our laboratory for further observation and testing.

A.4 SOIL AND ROCK CLASSIFICATION SYSTEM

During drilling, the Pinyon or Shannon & Wilson field representative collected soil samples and prepared field logs of the borings. Soil classifications, as shown on the field logs, are based on ASTM International (ASTM) Designation: D 2487, Standard Test Method for Classification of Soil for Engineering Purposes, and ASTM Designation: D 2488, Standard Recommended Practice for Description of Soils (Visual-Manual Procedure). The system is called the Unified Soil Classification System (USCS) and is summarized in Figure A-1. Rock was classified in accordance with the system shown in Figure A-2.

File: I:\WIP\23-1-01200s\23-1-01285 (CCD On Call)\-103 Jason Street Maintenance Facility (GEOTECH)\Report\Appendix A\Soil Log Keys Approved by WAH.dwg Date: 10-01-2012 Author: mtg

Shannon & Wilson, Inc. (S&W), uses a soil classification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following page. Soil descriptions are based on visual-manual procedures (ASTM D 2488-93) unless otherwise noted.

S&W CLASSIFICATION OF SOIL CONSTITUENTS

- MAJOR constituents compose more than 50 percent, by weight, of the soil. Major constituents are capitalized (SAND).
- Minor constituents compose 12 to 50 percent of the soil and precede the major constituents (silty SAND). Minor constituents preceded by "slightly" compose 5 to 12 percent of the soil (slightly silty SAND).
- Trace constituents compose 0 to 5 percent of the soil (slightly silty SAND, trace of gravel).

MOISTURE CONTENT DEFINITIONS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

ABBREVIATIONS

ATD	At Time of Drilling
Elev.	Elevation
ft	feet
HSA	Hollow Stem Auger
ID	Inside Diameter
in	inches
lbs	pounds
Mon.	Monument cover
N	Blows for last two 6-inch increments
NA	Not Applicable or Not Available
OD	Outside Diameter
OVA	Organic Vapor Analyzer
PID	Photoionization Detector
ppm	parts per million
PVC	Polyvinyl Chloride
SS	Split Spoon sampler
SPT	Standard Penetration Test
USC	Unified Soil Classification
WLI	Water Level Indicator

GRAIN SIZE DEFINITIONS













DESCRIPTION	SIEVE SIZE
FINES	< #200 (0.8 mm)
SAND*	<ul style="list-style-type: none"> ▪ Fine #200 - #40 (0.4 mm) ▪ Medium #40 - #10 (2 mm) ▪ Coarse #10 - #4 (5 mm)
GRAVEL*	<ul style="list-style-type: none"> ▪ Fine #4 - 3/4 inch ▪ Coarse 3/4 - 3 inches
COBBLES	3 - 12 inches
BOULDERS	> 12 inches

* Unless otherwise noted, sand and gravel, when present, range from fine to coarse in grain size.

RELATIVE DENSITY / CONSISTENCY

COARSE-GRAINED SOILS		FINE-GRAINED/COHESIVE SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
0 - 4	Very loose	<2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
Over 50	Very dense	15 - 30	Very stiff
		Over 30	Hard

WELL AND OTHER SYMBOLS

	Cement/Concrete		Asphalt or PVC Cap
	Bentonite Grout		Cobbles
	Bentonite Seal		Fill
	Slough		Ash
	Silica Sand		Bedrock
	2" I.D. PVC Screen (0.020-inch Slot)		Gravel

South Jason Street Maintenance Facility
Denver, Colorado

SOIL CLASSIFICATION AND LOG KEY

October 2012

23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-1
Sheet 1 of 2

UNIFIED SOIL CLASSIFICATION SYSTEM (From USACE Tech Memo 3-357)					
MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL ②	TYPICAL DESCRIPTION	
Coarse-Grained Soils (more than 50% retained on No. 200 sieve) [use Dual Symbols for 5 - 12% Fines (i.e. GP-GM)]①	Gravels (more than 50% of coarse fraction retained on No. 4 sieve)	Clean Gravels ① (less than 5% fines)	GW		Well-Graded Gravels, Gravel-Sand Mixtures, Little or No Fines
			GP		Poorly Graded Gravels, Gravel-Sand Mixtures, Little or No Fines
		Gravels with Fines ① (more than 12% fines)	GM		Silty Gravels, Gravel-Sand-Silt Mixtures
			GC		Clayey Gravels, Gravel-Sand-Clay Mixtures
	Sands (50% or more of coarse fraction passes the No. 4 sieve)	Clean Sands ① (less than 5% fines)	SW		Well-Graded Sands, Gravelly Sands, Little or No Fines
			SP		Poorly Graded Sand, Gravelly Sands, Little or No Fines
		Sands with Fines ① (more than 12% fines)	SM		Silty Sands, Sand-Silt Mixtures
			SC		Clayey Sands, Sand-Silt Mixtures
Fine-Grained Soils (50% or more passes the No. 200 sieve)	Silts and Clays (liquid limit less than 50)	Inorganic	ML		Inorganic Silts of Low to Medium Plasticity, Rock Flour, or Clayey Silts With Slight Plasticity
			CL		Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
	Silts and Clays (liquid limit 50 or more)	Organic	OL		Organic Silts and Organic Silty Clays of Low Plasticity
		Inorganic	CH		Inorganic Clays of Medium to High Plasticity, Sandy Fat Clay, Gravelly Fat Clay
			MH		Inorganic Silts, Micaceous or Diatomaceous Fine Sands or Silty Soils, Elastic Silt
		Organic	OH		Organic Clays of Medium to High Plasticity, Organic Silts
Highly Organic Soils	Primarily organic matter, dark in color, and organic odor	PT		Peat, Humus, Swamp Soils with High Organic Content (See D 4427-92)	

NOTES

- Dual symbols (symbols separated by a hyphen, i.e., SP-SM, slightly silty fine SAND) are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart.
- Borderline symbols (symbols separated by a slash, i.e., CL/ML, silty CLAY/clayey SILT; GW/SW, sandy GRAVEL/gravelly SAND) indicate that the soil may fall into one of two possible basic groups.

South Jason Street Maintenance Facility Denver, Colorado	
SOIL CLASSIFICATION AND LOG KEY	
October 2012	23-1-01285-103
SHANNON & WILSON, INC. Geotechnical and Environmental Consultants	FIG. A-1 Sheet 2 of 2

WEATHERING OR ALTERATION

TERM	DESCRIPTION
Fresh	No evidence of alteration
Slightly	Slight discoloration on surface
Moderately	Discoloring evident; Alteration penetrating well below rock surface
Highly	Entire rock mass discolored
Completely	Rock reduced to a soil with relict rock texture

STRENGTH

TERM	APPROX. UCS (psi x 1000)
Very Low	<0.7
Low	0.7 to 4
Moderate	4 to 7
Medium High	7 to 15
High	15 to 36
Very High	>36

JOINT ROUGHNESS COEFFICIENT (JRC)

COEFFICIENT	DESCRIPTION
14 to 20	VERY ROUGH: Near vertical edges evident
10 to 14	ROUGH: Smooth ridges, surface abrasion
6 to 10	SLIGHTLY ROUGH: Asperities on surface can be felt
2 to 6	SMOOTH: Appears and feels smooth
0 to 2	SLICKENSIDED: Visible polishing, striated surface

DISCONTINUITY DATA

SPACING	
TERM	SPACING
Very Wide	>10 ft.
Wide	3 to 10 ft.
Moderately Close	1 to 3 ft.
Close	2 in. to 1 ft.
Very Close	<2 in.

DISCONTINUITY TERMS

FRACTURE - Collective term for any natural break excluding shears, shear zones, and faults

JOINT (JT) - Planar break with little or no displacement

FOLIATION JOINT (FJ) or BEDDING JOINT (BJ) - Joint along foliation or bedding

INCIPIENT JOINT (IJ) or INCIPIENT FRACTURE (IF) - Joint or fracture not evident until wetted and dried; breaks along existing surface

RANDOM FRACTURE (RF) - Natural, very irregular fracture that does not belong to a set

BEDDING PLANE SEPARATION or PARTING - A separation along bedding after extraction from stress relief or slaking

FRACTURE ZONE (FZ) - Planar zone of broken rock without gouge

MECHANICAL BREAK (MB) - Breaks due to drilling or handling; drilling break (DB), hammer break (HB)

SHEAR (SH) - Surface of differential movement evident by presence of slickensides, striations, or polishing

SHEAR ZONE (SZ) - Zone of gouge and rock fragments bounded by planar shear surfaces

FAULT (FT) - Shear zone of significant extent; differentiation from shear zone may be site-specific

APERTURE WIDTH

TERM	SPACING
Very Tight	<0.1mm
Tight	0.1 to 0.25mm
Partly Open	0.25 to 0.5mm
Open	0.5 to 2.5mm
Moderately Wide	2.5 to 10mm
Wide	10mm to 1cm
Very Wide	1 to 10cm
Extremely Wide	10 to 100cm
Cavernous	>1m

South Jason Street Maintenance Facility
Denver, Colorado

**ROCK CLASSIFICATION
AND LOG KEY**

October 2012

23-1-01285-103

ROCK CLASSIFICATION SYMBOLS		
BEDROCK TYPE	GRAPHIC SYMBOL	ROCK NAME
Clastic Sedimentary Rocks		Breccia
		Conglomerate
		Sandstone
		Siltstone
		Claystone / Interbedded claystone and siltstone
		Shale
		Coal
Carbonate Sedimentary Rocks		Limestone
		Dolomite
		Corral
Evaporite Rocks		Gypsum
		Halite
		Calcite
Extrusive Igneous Rocks		Tuff
		Rhyolite
		Dacite
		Andesite
		Basalt
Intrusive Igneous Rocks		Granite
		Grano-diorite
		Diorite
		Gabbro
		Marble
Metamorphic Rocks		Quartzite
		Slate
		Phyllite
		Schist
		Gneiss

South Jason Street Maintenance Facility
Denver, Colorado

**ROCK CLASSIFICATION
AND LOG KEY**

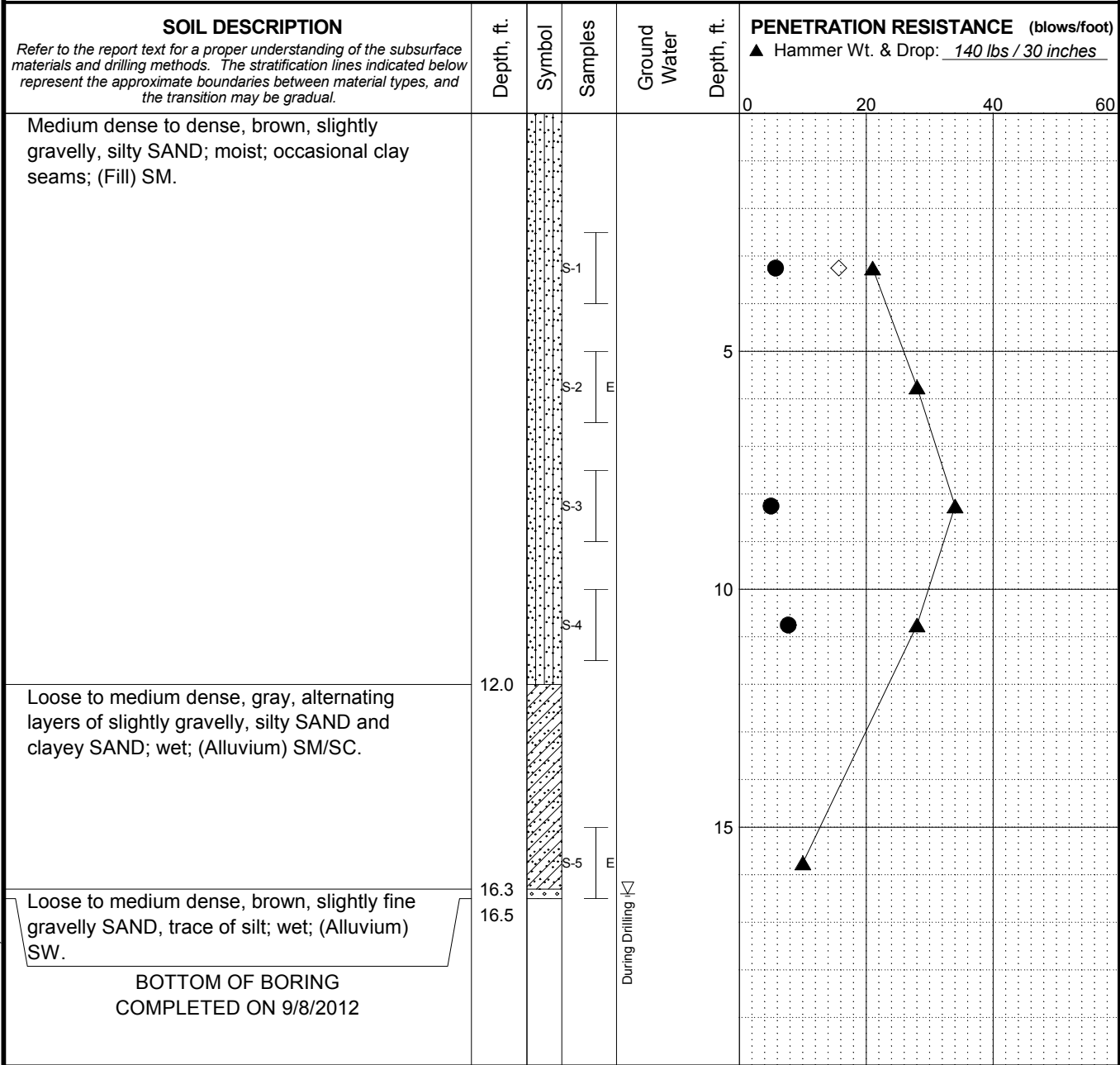
October 2012

23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-2
Sheet 2 of 2

Total Depth: 16.5 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 3.25 in.
 Top Elevation: ~ Longitude: _____ Drilling Company: Unlimited Access Rod Type.: AWJ
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Cathead
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



LEGEND

* Sample Not Recovered ∇ Ground Water Level ATD
 E Environmental Sample Obtained
 | Standard Penetration Test

◇ % Fines (<0.075mm)
 ● % Water Content

- NOTES**
1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
 2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
 3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
 4. Groundwater level, if indicated above, is for the date specified and may vary.
 5. USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
Denver, Colorado

LOG OF BORING SW-01

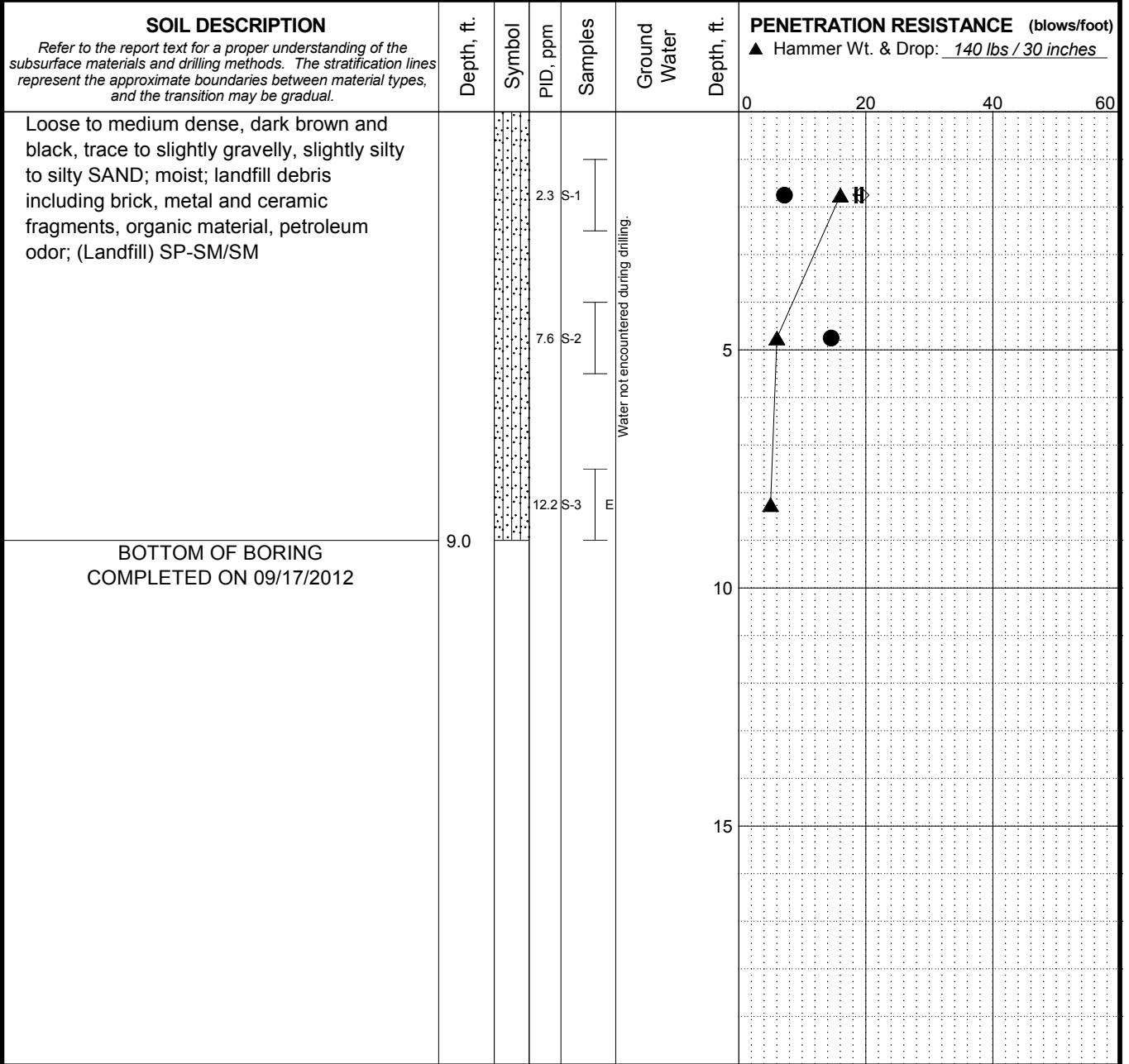
October 2012 23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-3

MASTER LOG E. POCKETPEN LAT&LONG 23-1-01285-103 (SOUTH JASON STREET).GPJ 10/2/12

Total Depth: 9 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 4 in.
 Top Elevation: ~ 5229 ft. Longitude: _____ Drilling Company: Vine Laboratories Rod Type.: NA
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



LEGEND

- * Sample Not Recovered
- E Environmental Sample Obtained
- ┌ Standard Penetration Test

◇ % Fines (<0.075mm)
 ● % Water Content
 Plastic Limit —●— Liquid Limit
 Natural Water Content

NOTES

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
Denver, Colorado

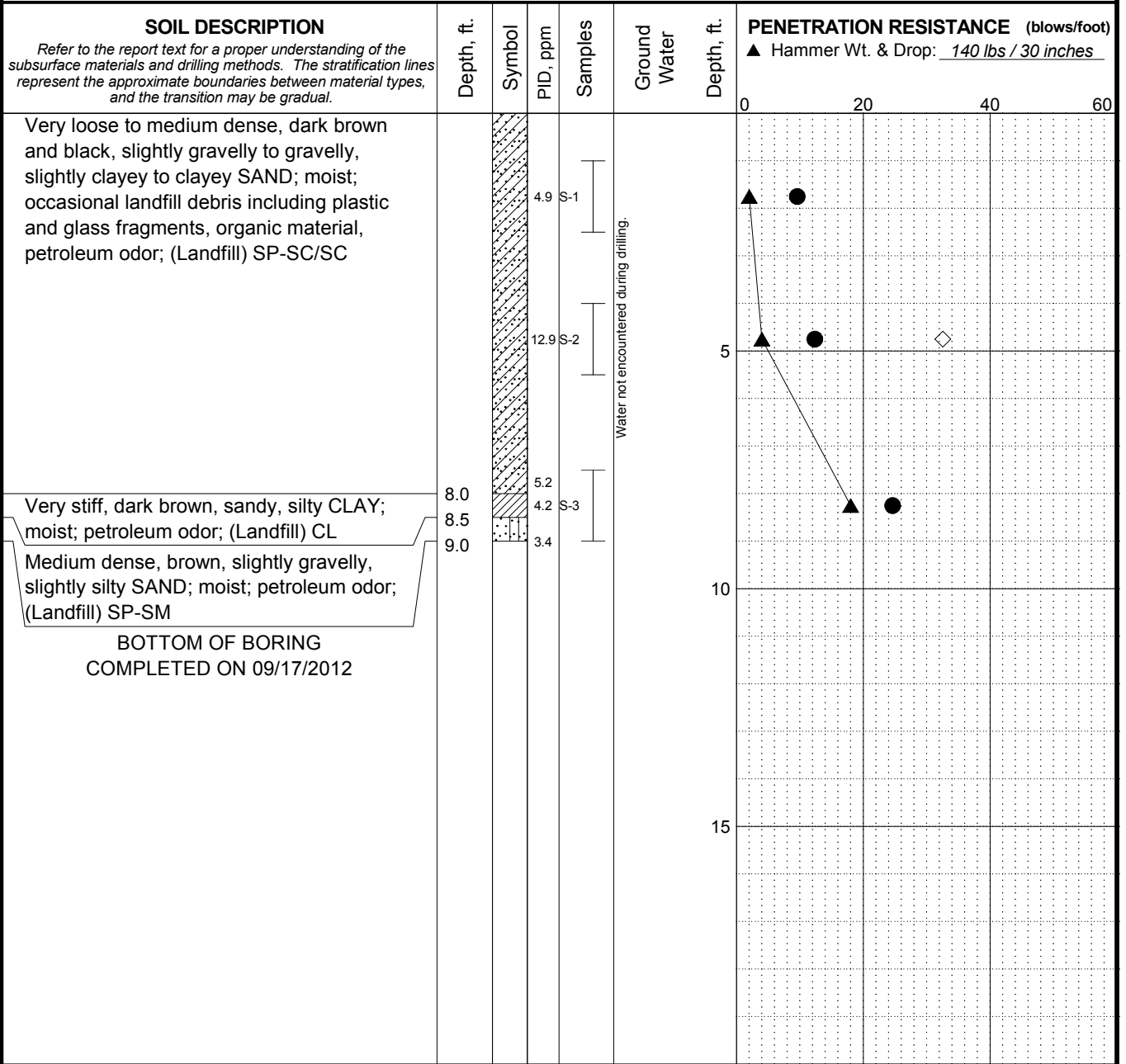
LOG OF BORING SW-03

October 2012 23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants **FIG. A-5**

MASTER LOG E. POCKETPEN LAT&LONG 23-1-01285-103 (SOUTH JASON STREET).GRJ 10/2/12

Total Depth: 9 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 4 in.
 Top Elevation: ~ 5230 ft. Longitude: _____ Drilling Company: Vine Laboratories Rod Type.: NA
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



LEGEND

* Sample Not Recovered
 I Standard Penetration Test
 ◇ % Fines (<0.075mm)
 ● % Water Content

NOTES

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
 Denver, Colorado

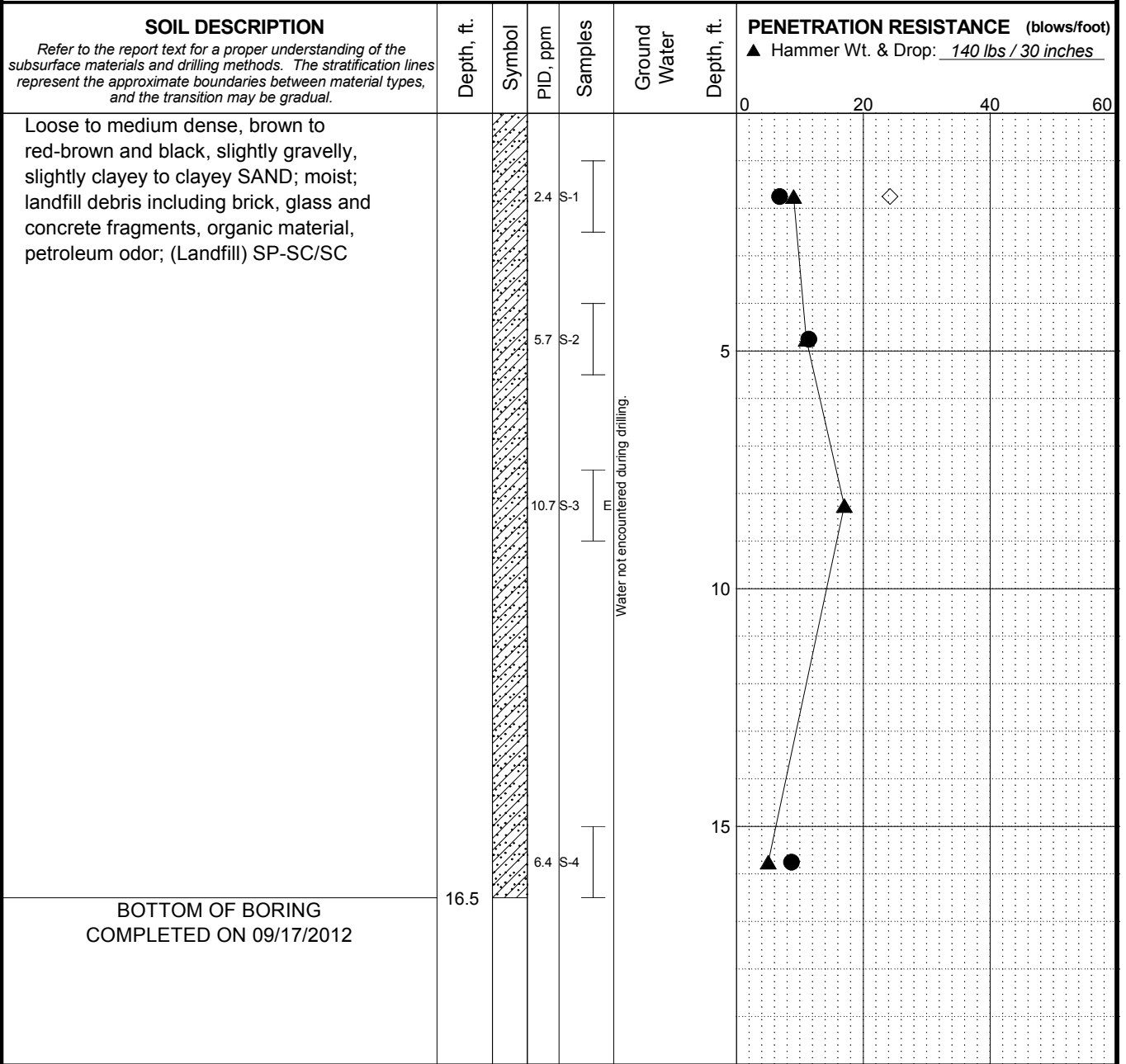
LOG OF BORING SW-04

October 2012 23-1-01285-103

SHANNON & WILSON, INC.
 Geotechnical and Environmental Consultants **FIG. A-6**

MASTER LOG E. POCKETPEN LAT&LONG (SOUTH JASON STREET).GRJ 10/2/12

Total Depth: 16.5 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 4 in.
 Top Elevation: ~ 5233 ft. Longitude: _____ Drilling Company: Vine Laboratories Rod Type.: NA
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



LEGEND
 * Sample Not Recovered
 E Environmental Sample Obtained
 Standard Penetration Test

◇ % Fines (<0.075mm)
 ● % Water Content

NOTES

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
Denver, Colorado

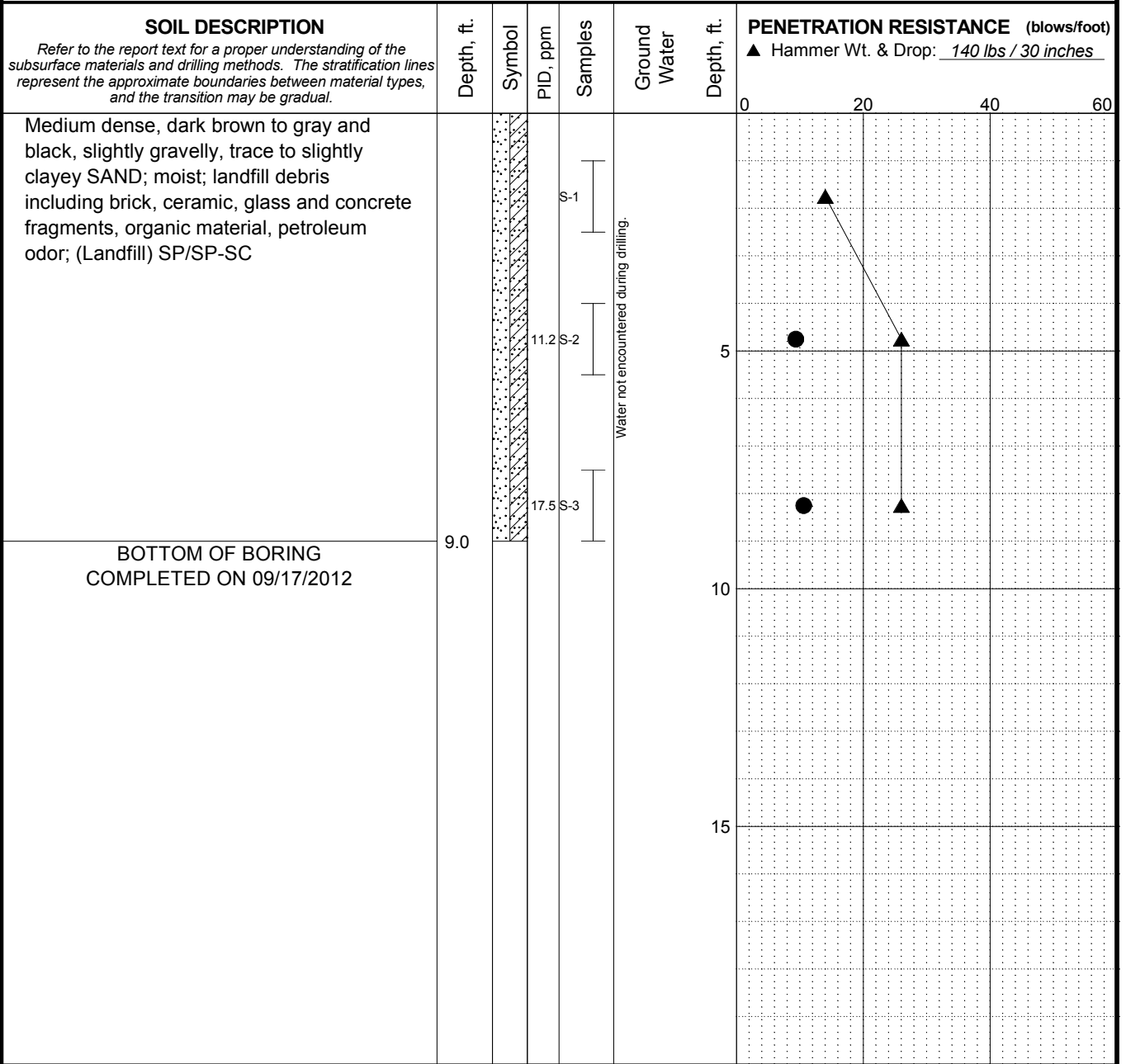
LOG OF BORING SW-05

October 2012 23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants **FIG. A-7**

MASTER LOG E. POCKETPEN LAT&LONG 23-1-01285-103 (SOUTH JASON STREET).GPRJ 10/2/12

Total Depth: 9 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 4 in.
 Top Elevation: ~ 5232 ft. Longitude: _____ Drilling Company: Vine Laboratories Rod Type.: NA
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



LEGEND

- * Sample Not Recovered
- ┆ Standard Penetration Test

● % Water Content

NOTES

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
Denver, Colorado

LOG OF BORING SW-06

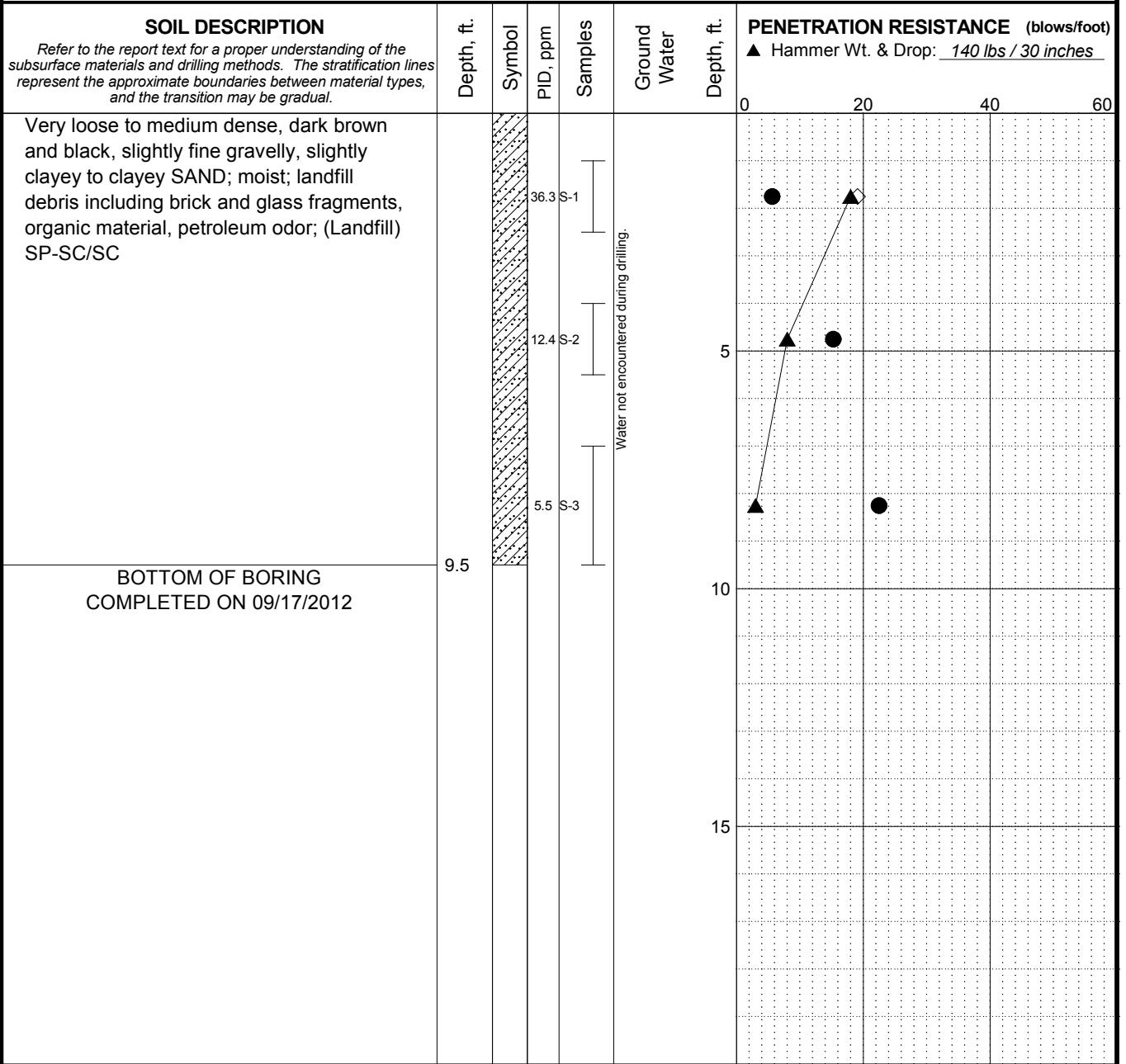
October 2012

23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-8

Total Depth: 9.5 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 4 in.
 Top Elevation: ~ 5230.5 ft. Longitude: _____ Drilling Company: Vine Laboratories Rod Type.: NA
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



LEGEND
 * Sample Not Recovered
 Standard Penetration Test

% Fines (<0.075mm)
 % Water Content

NOTES

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
 Denver, Colorado

LOG OF BORING SW-07

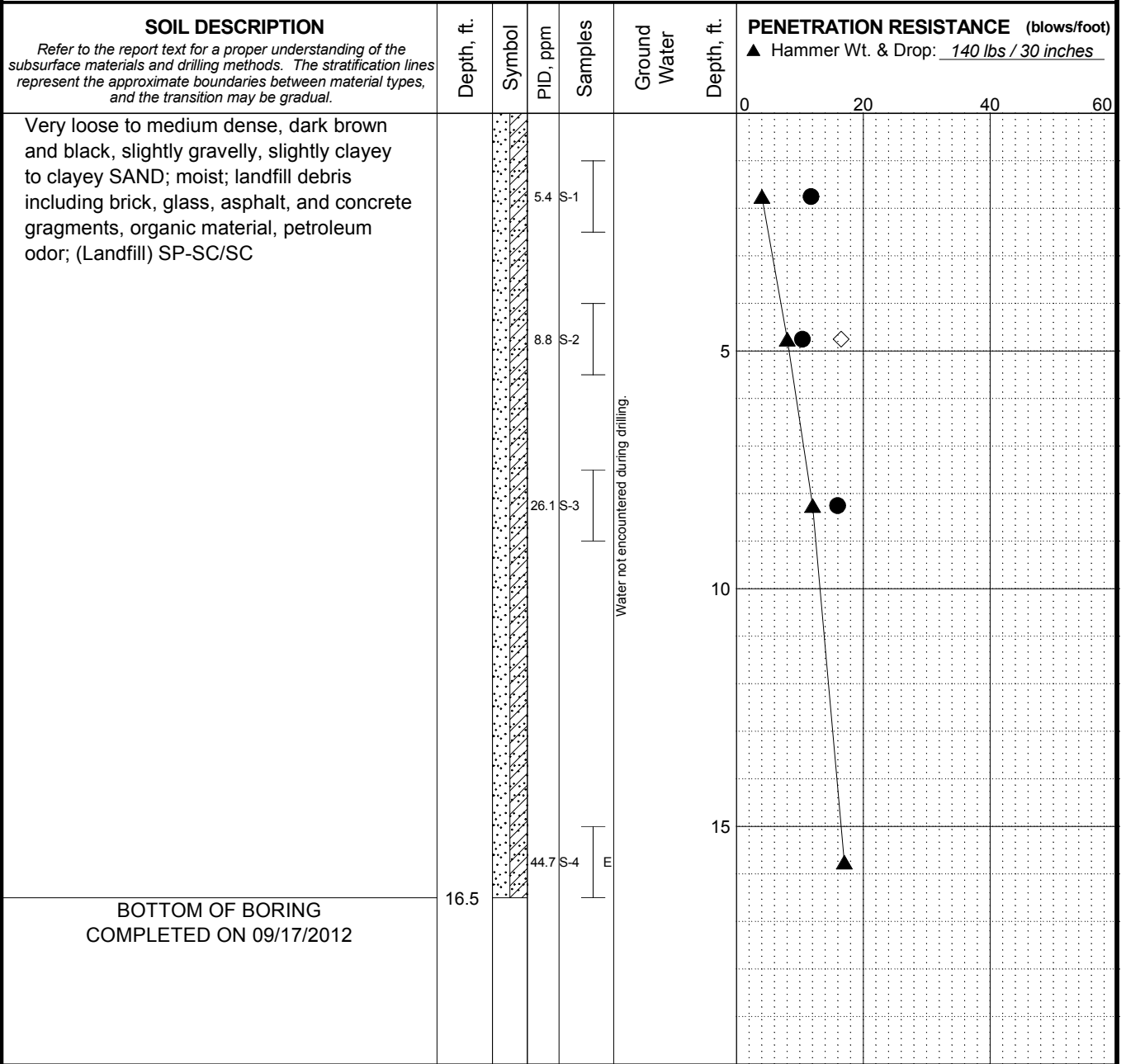
October 2012

23-1-01285-103

SHANNON & WILSON, INC.
 Geotechnical and Environmental Consultants

FIG. A-9

Total Depth: 16.5 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 4 in.
 Top Elevation: ~ 5230 ft. Longitude: _____ Drilling Company: Vine Laboratories Rod Type.: NA
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



BOTTOM OF BORING
COMPLETED ON 09/17/2012

LEGEND

- * Sample Not Recovered
- E Environmental Sample Obtained
- ┆ Standard Penetration Test
- ◇ % Fines (<0.075mm)
- % Water Content

NOTES

- Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
- The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
- The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
- Groundwater level, if indicated above, is for the date specified and may vary.
- USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
Denver, Colorado

LOG OF BORING SW-08

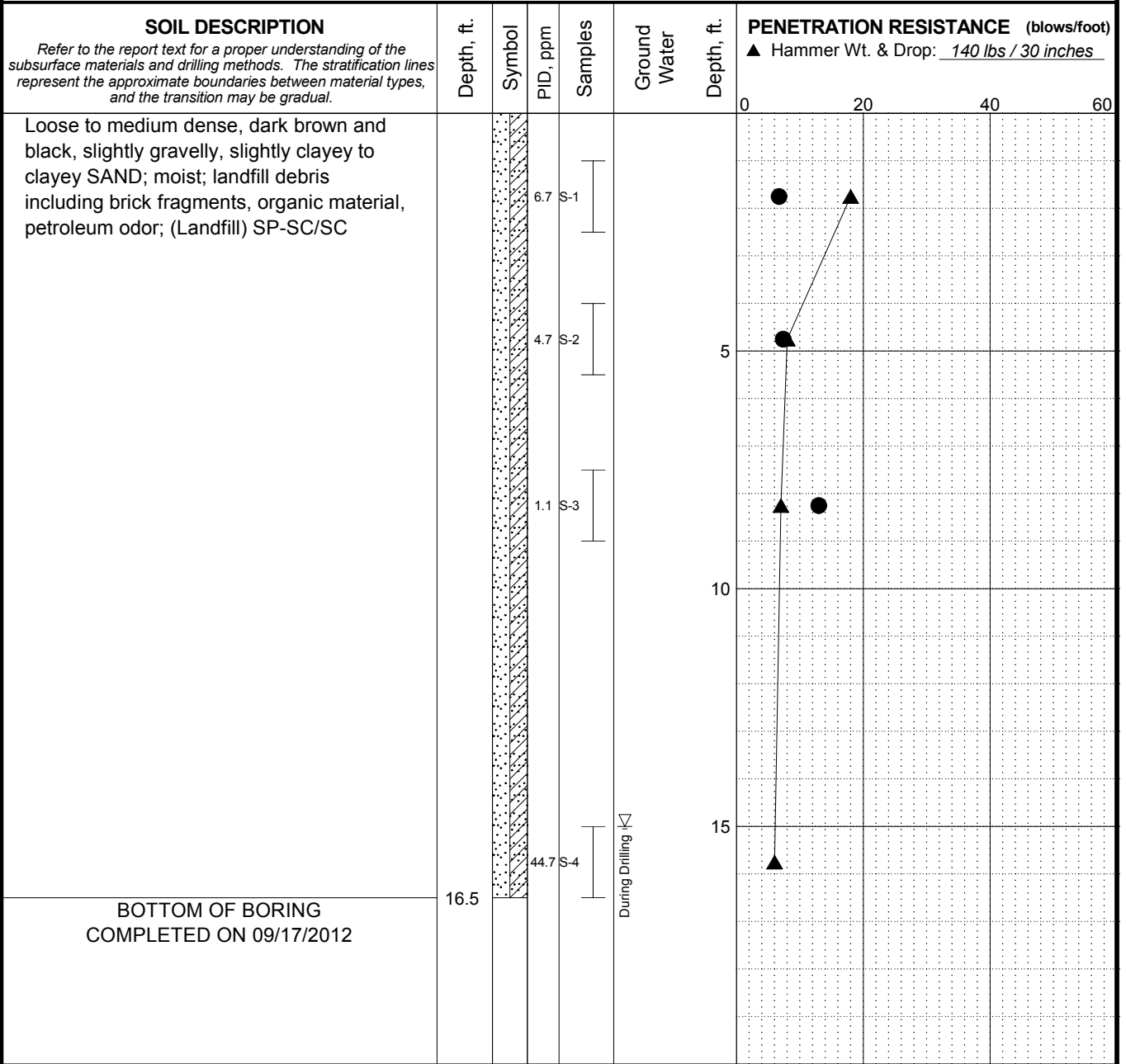
October 2012

23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-10

Total Depth: 16.5 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 4 in.
 Top Elevation: ~ 5230.5 ft. Longitude: _____ Drilling Company: Vine Laboratories Rod Type.: NA
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



BOTTOM OF BORING
COMPLETED ON 09/17/2012

LEGEND

- * Sample Not Recovered
- ∇ Ground Water Level ATD
- ⊥ Standard Penetration Test
- % Water Content

NOTES

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
Denver, Colorado

LOG OF BORING SW-09

October 2012

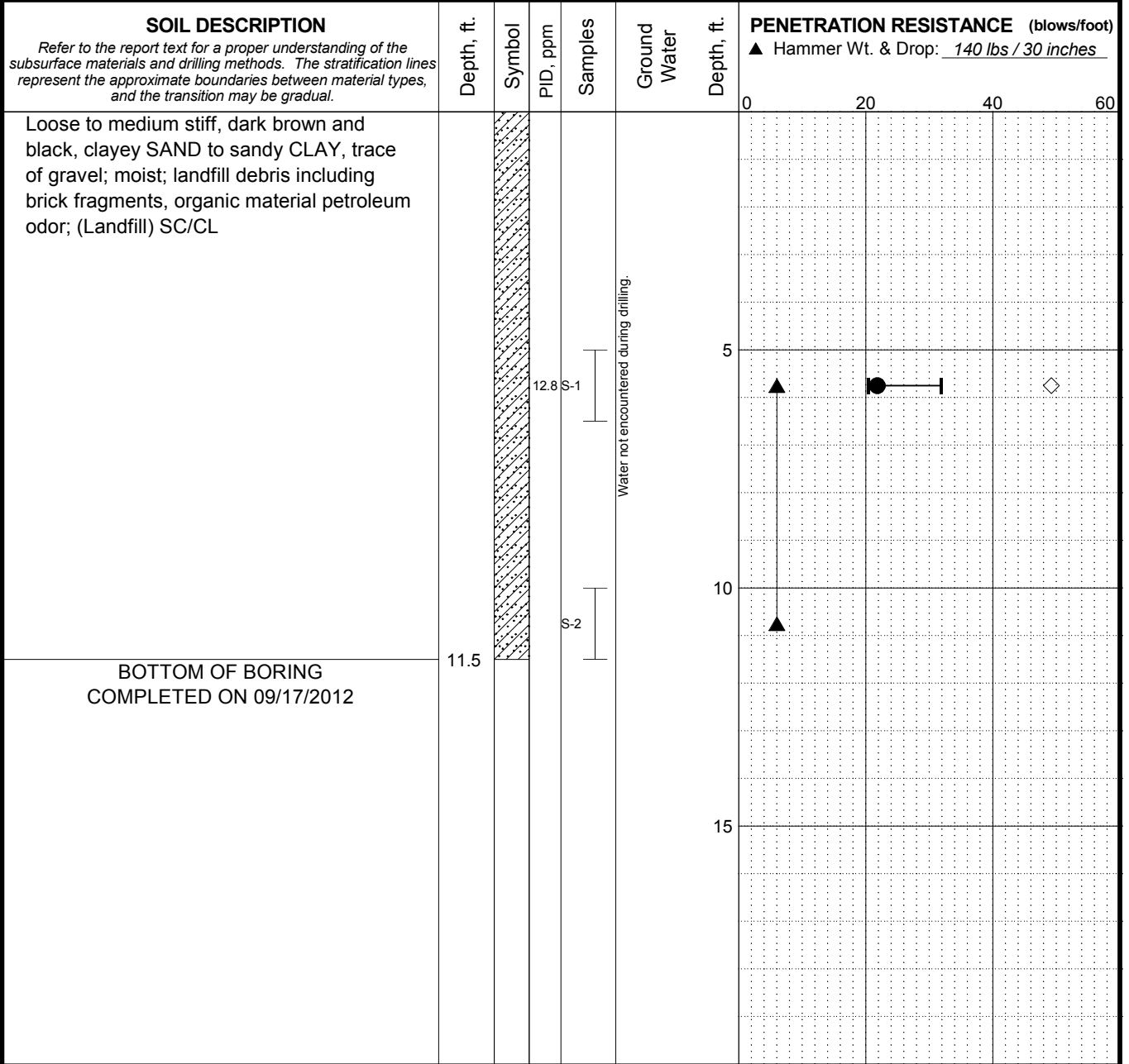
23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-11

MASTER LOG E. POCKETPEN LAT&LONG 23-1-01285-103 (SOUTH JASON STREET).GRJ 10/2/12

Total Depth: 11.5 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 4 in.
 Top Elevation: ~ 5230 ft. Longitude: _____ Drilling Company: Vine Laboratories Rod Type.: NA
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



LEGEND
 * Sample Not Recovered
 I Standard Penetration Test

◇ % Fines (<0.075mm)
 ● % Water Content
 Plastic Limit —●— Liquid Limit
 Natural Water Content

NOTES

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
 Denver, Colorado

LOG OF BORING SW-10

October 2012

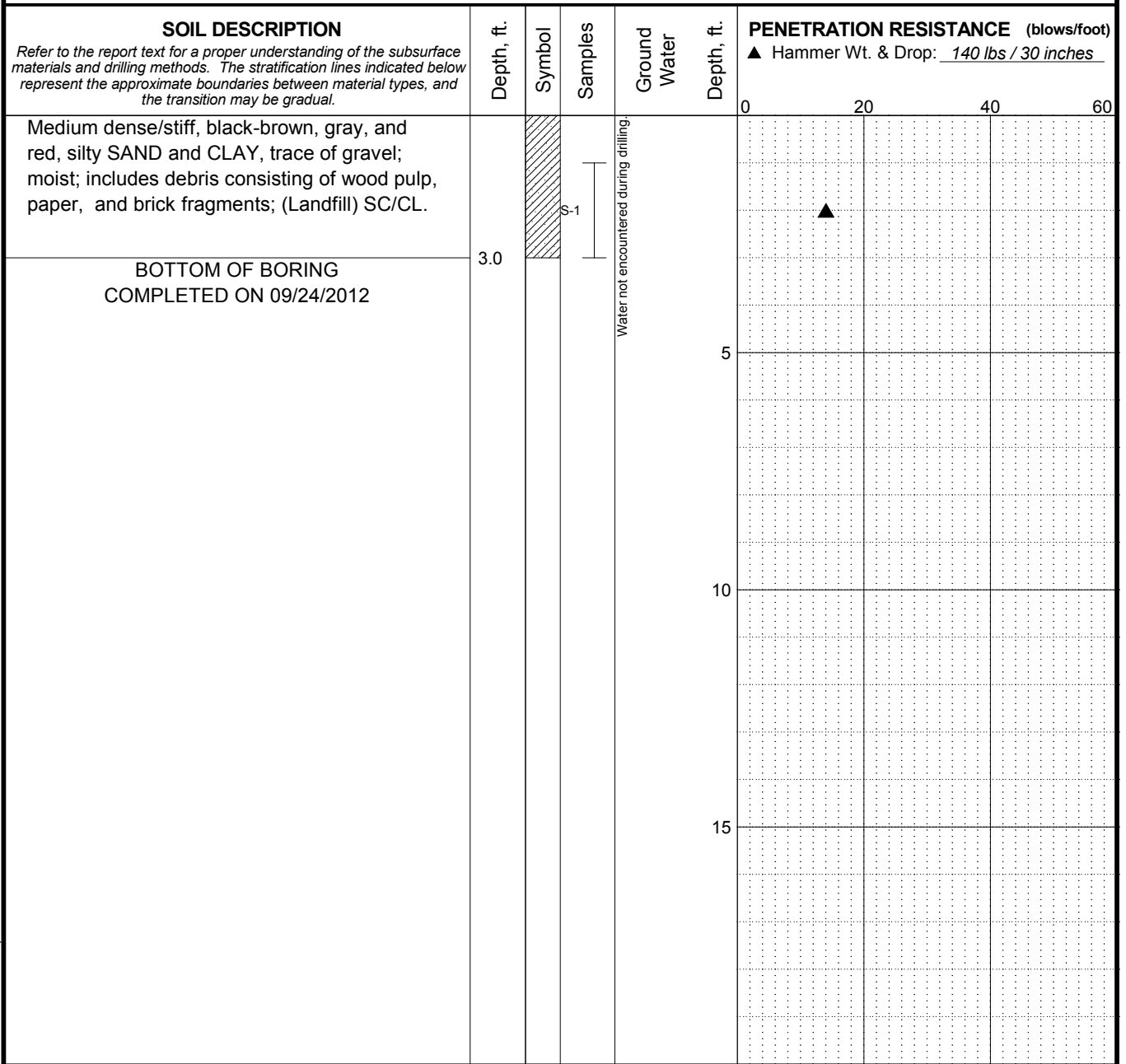
23-1-01285-103

SHANNON & WILSON, INC.
 Geotechnical and Environmental Consultants

FIG. A-12

MASTER LOG E. POCKETPEN LAT&LONG 23-1-01285-103 (SOUTH JASON STREET).GPFJ 10/2/12

Total Depth: 3 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 4 in.
 Top Elevation: ~ 5230 ft. Longitude: _____ Drilling Company: Vine Laboratories Rod Type.: AWJ
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



LEGEND

- * Sample Not Recovered
- Standard Penetration Test

NOTES

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
Denver, Colorado

LOG OF BORING SW-10A

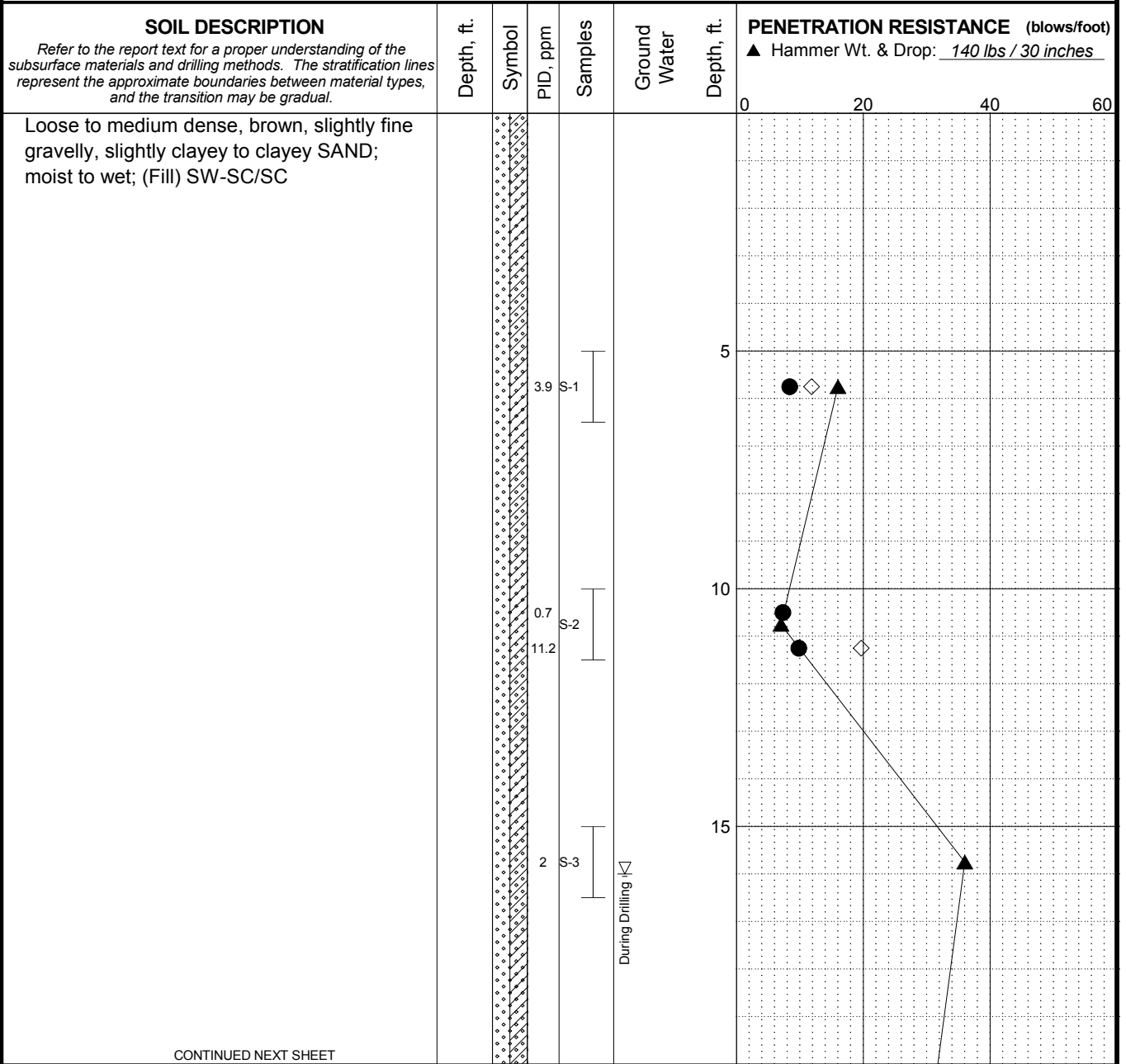
October 2012

23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-13

Total Depth: 36 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 4 in.
 Top Elevation: ~ 5229.5 ft. Longitude: _____ Drilling Company: Vine Laboratories Rod Type.: NA
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



CONTINUED NEXT SHEET

- LEGEND**
- * Sample Not Recovered
 - ∇ Ground Water Level ATD
 - ⊥ Standard Penetration Test
 - ◇ % Fines (<0.075mm)
 - % Water Content

NOTES

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
Denver, Colorado

LOG OF BORING SW-11

October 2012

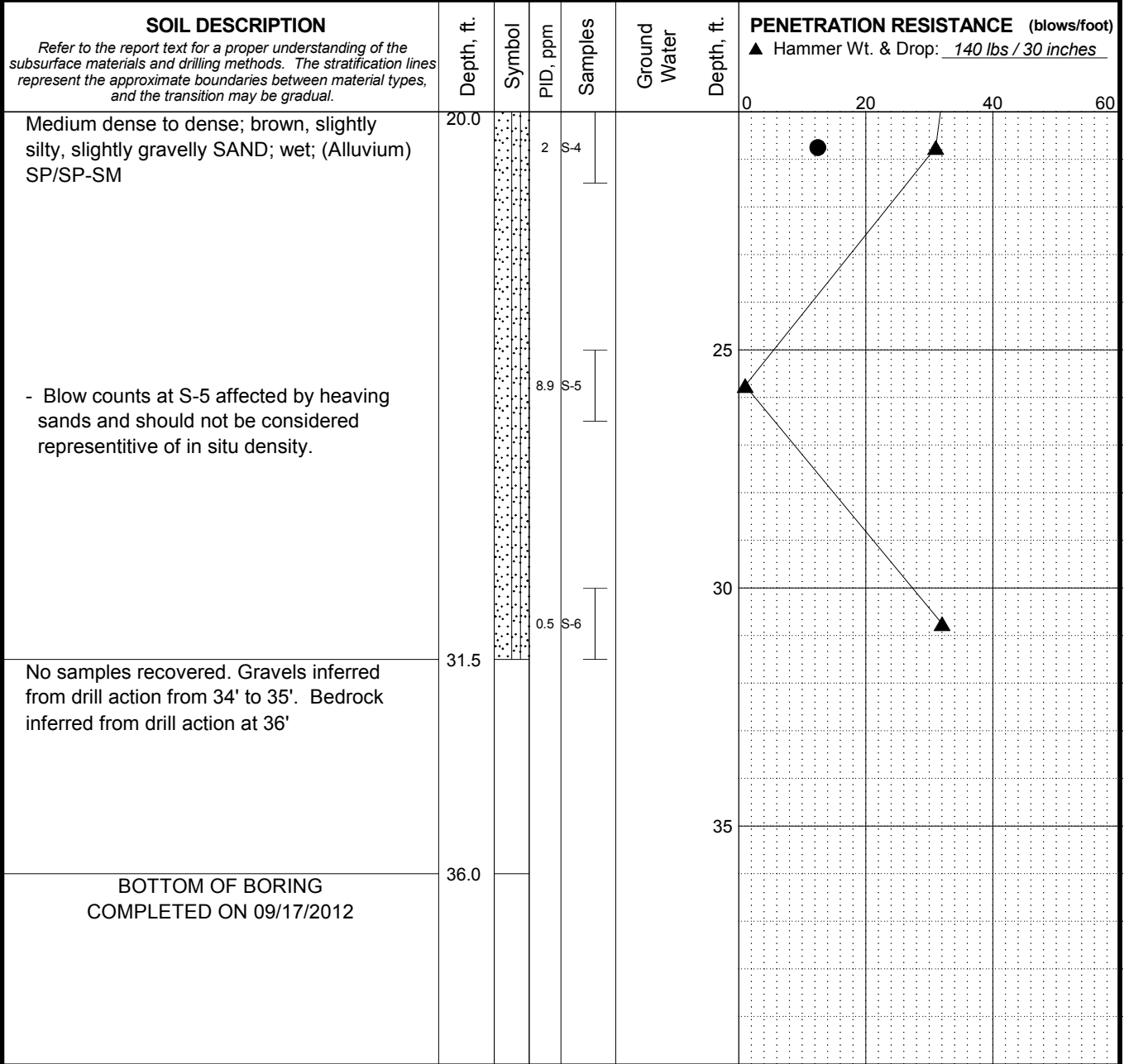
23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-14
Sheet 1 of 2

MASTER LOG E. POCKETPEN LAT&LONG 23-1-01285-103 (SOUTH JASON STREET).GPRJ 10/2/12

Total Depth: 36 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 4 in.
 Top Elevation: ~ 5229.5 ft. Longitude: _____ Drilling Company: Vine Laboratories Rod Type.: NA
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



LEGEND

* Sample Not Recovered ▽ Ground Water Level ATD ◇ % Fines (<0.075mm)
 I Standard Penetration Test ● % Water Content

- NOTES**
- Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
 - The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
 - The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
 - Groundwater level, if indicated above, is for the date specified and may vary.
 - USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
 Denver, Colorado

LOG OF BORING SW-11

October 2012

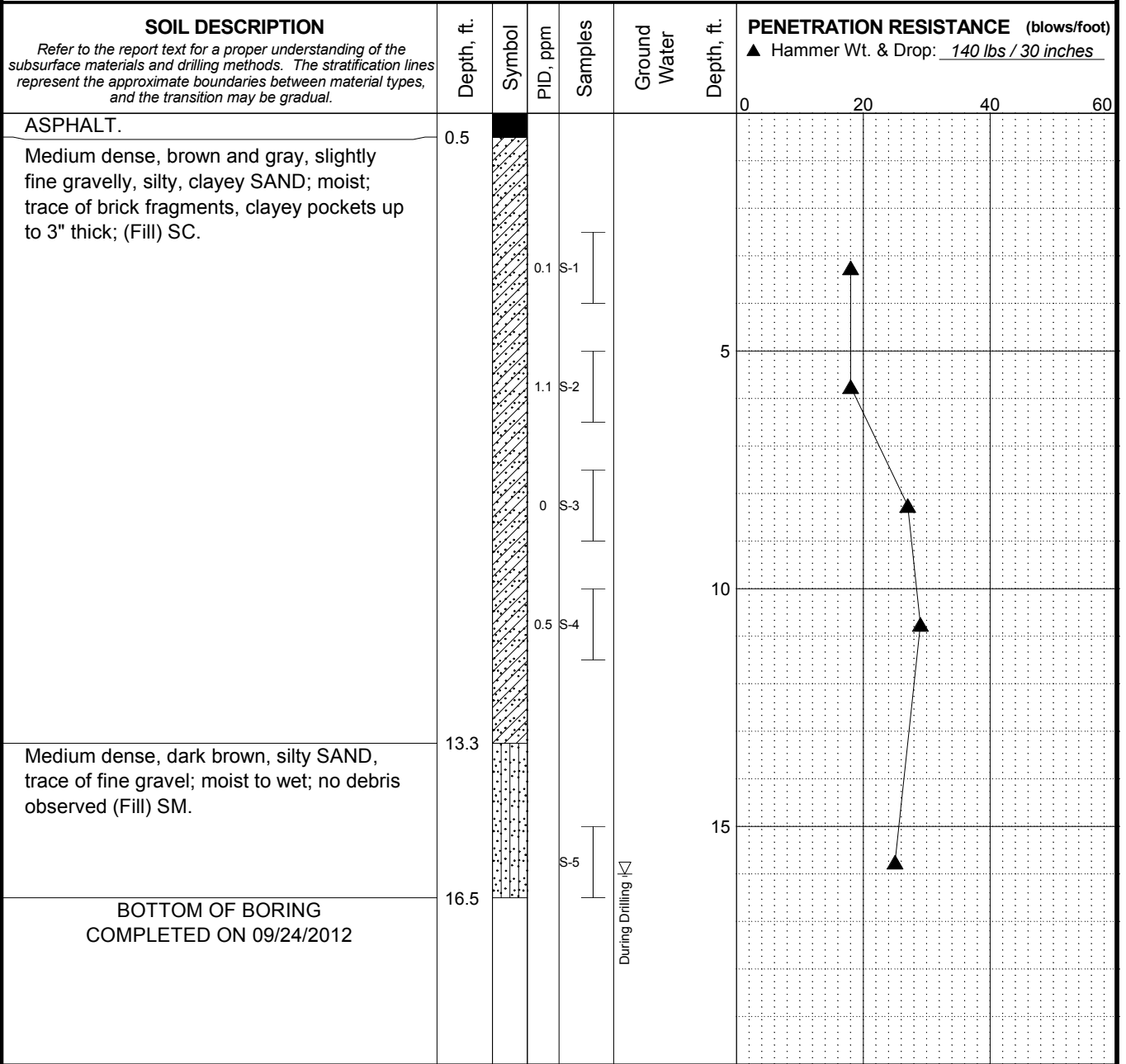
23-1-01285-103

SHANNON & WILSON, INC.
 Geotechnical and Environmental Consultants

FIG. A-14
 Sheet 2 of 2

MASTER LOG E. POCKETPEN LAT&LONG 23-1-01285-103 (SOUTH JASON STREET).GPJ 10/2/12

Total Depth: 16.5 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 4 in.
 Top Elevation: ~ 5229.5 ft. Longitude: _____ Drilling Company: Vine Laboratories Rod Type.: AWJ
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



LEGEND

* Sample Not Recovered ▽ Ground Water Level ATD
 Standard Penetration Test

- NOTES**
1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
 2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
 3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
 4. Groundwater level, if indicated above, is for the date specified and may vary.
 5. USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
 Denver, Colorado

LOG OF BORING SW-11A

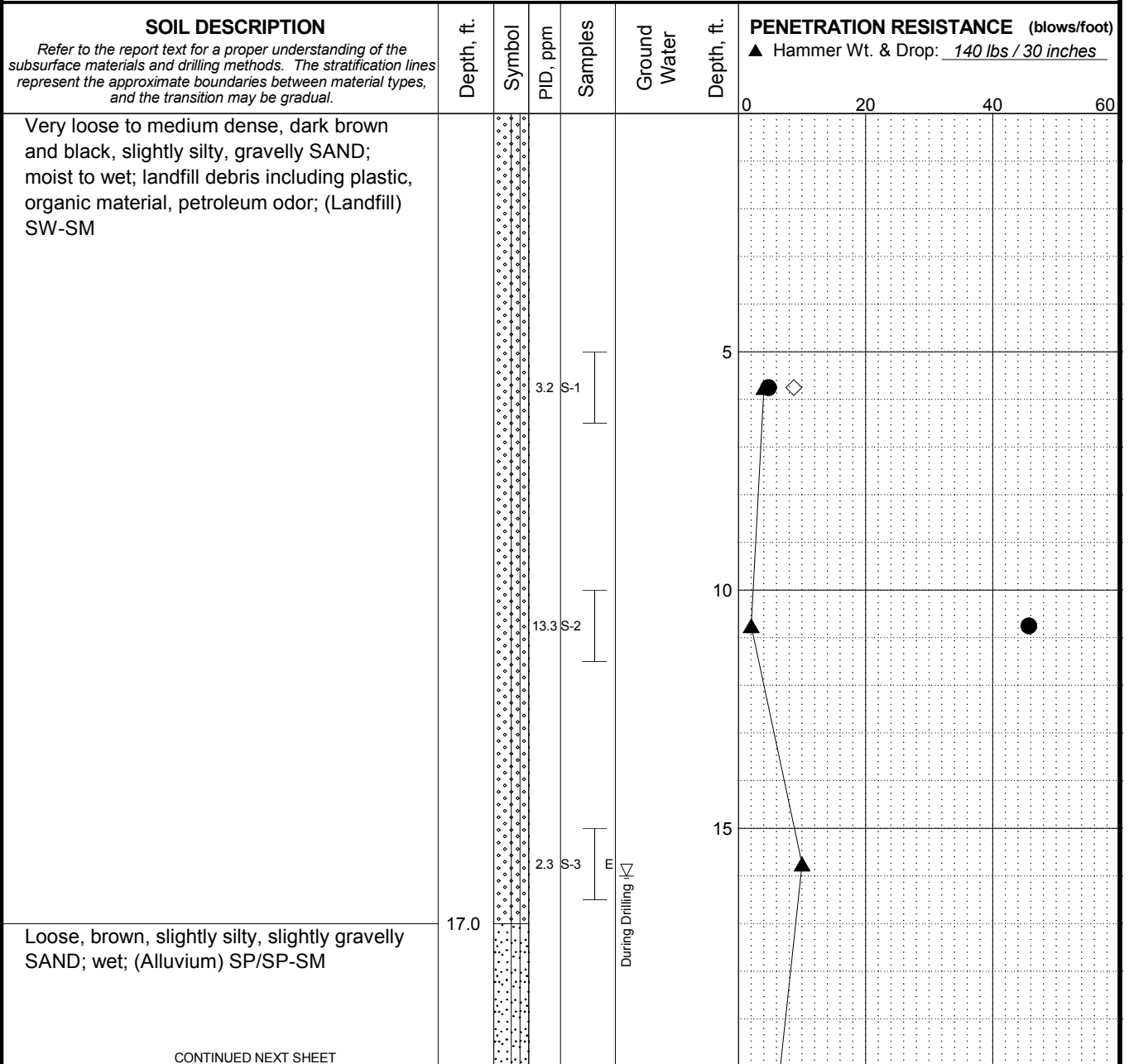
October 2012

23-1-01285-103

SHANNON & WILSON, INC.
 Geotechnical and Environmental Consultants

FIG. A-15

Total Depth: 34.5 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 4 in.
 Top Elevation: ~ 5230 ft. Longitude: _____ Drilling Company: Vine Laboratories Rod Type.: NA
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- E Environmental Sample Obtained
- | Standard Penetration Test
- ⬤ Modified California Sampler
- ∇ Ground Water Level ATD
- ◇ % Fines (<0.075mm)
- % Water Content

NOTES

- Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
- The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
- The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
- Groundwater level, if indicated above, is for the date specified and may vary.
- USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
Denver, Colorado

LOG OF BORING SW-12

October 2012

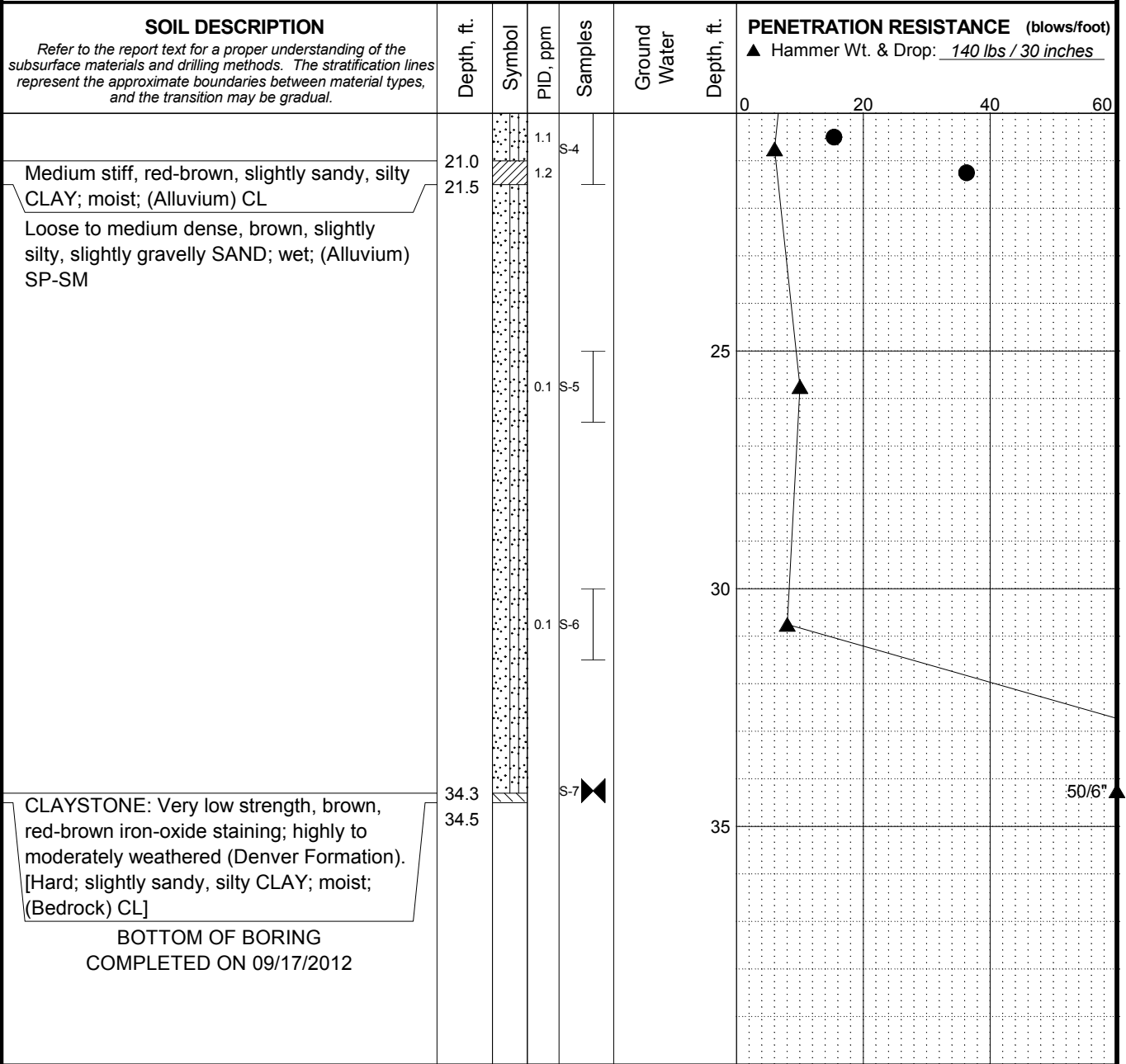
23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-16
Sheet 1 of 2

MASTER LOG E. POCKETPEN LAT&LONG 23-1-01285-103 (SOUTH JASON STREET).GPJ 10/2/12

Total Depth: 34.5 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 4 in.
 Top Elevation: ~ 5230 ft. Longitude: _____ Drilling Company: Vine Laboratories Rod Type.: NA
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



- LEGEND**
- * Sample Not Recovered
 - E Environmental Sample Obtained
 - ┆ Standard Penetration Test
 - ⊠ Modified California Sampler
 - ∇ Ground Water Level ATD

- ◇ % Fines (<0.075mm)
- % Water Content

NOTES

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
Denver, Colorado

LOG OF BORING SW-12

October 2012

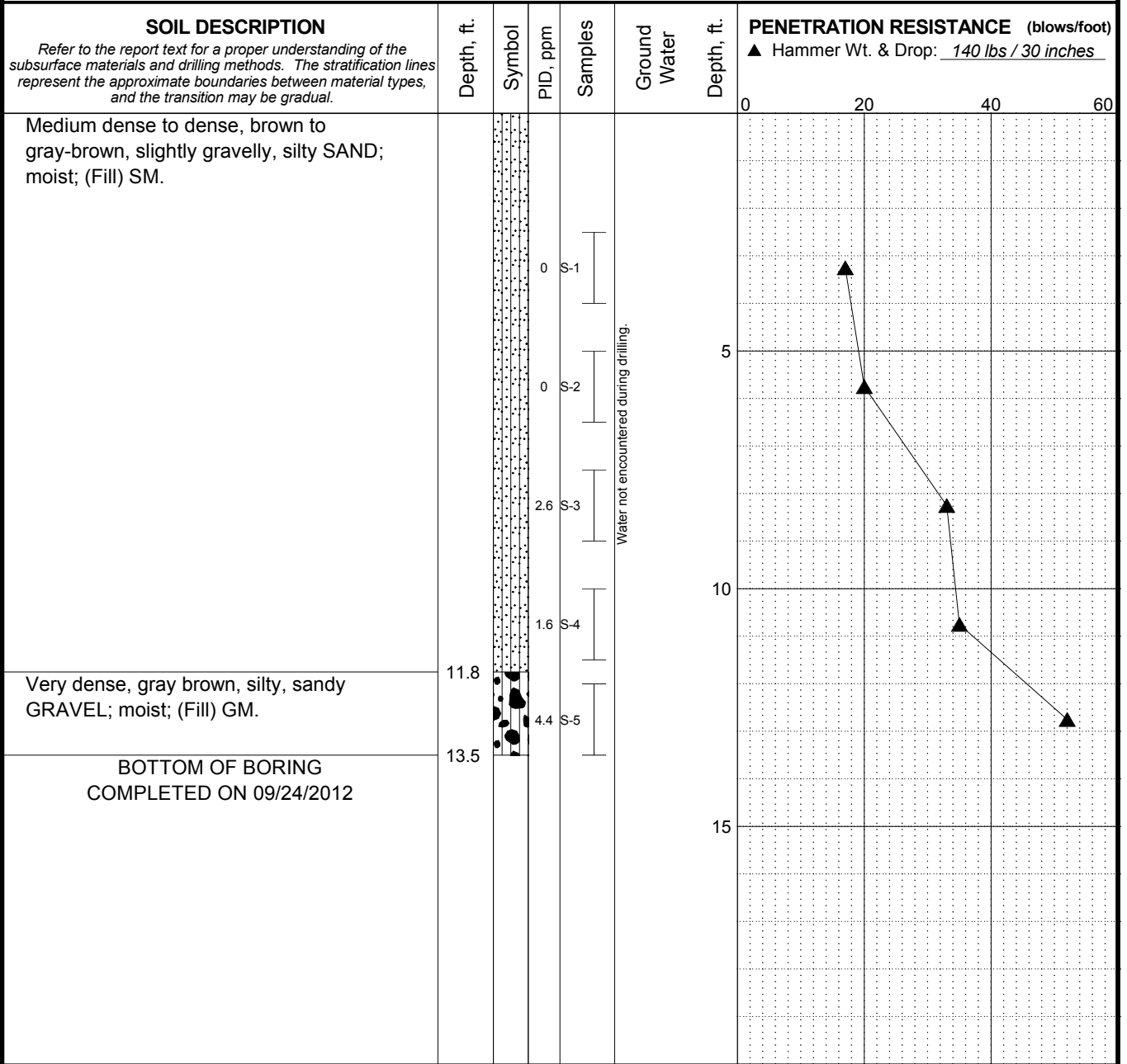
23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-16
Sheet 2 of 2

MASTER LOG E. POCKETPEN LAT&LONG 23-1-01285-103 (SOUTH JASON STREET).GPRJ 10/2/12

Total Depth: 13.5 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 4 in.
 Top Elevation: ~ 5230 ft. Longitude: _____ Drilling Company: Vine Laboratories Rod Type.: AWJ
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



LEGEND

- * Sample Not Recovered
- ┃ Standard Penetration Test

NOTES

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
Denver, Colorado

LOG OF BORING SW-12A

October 2012

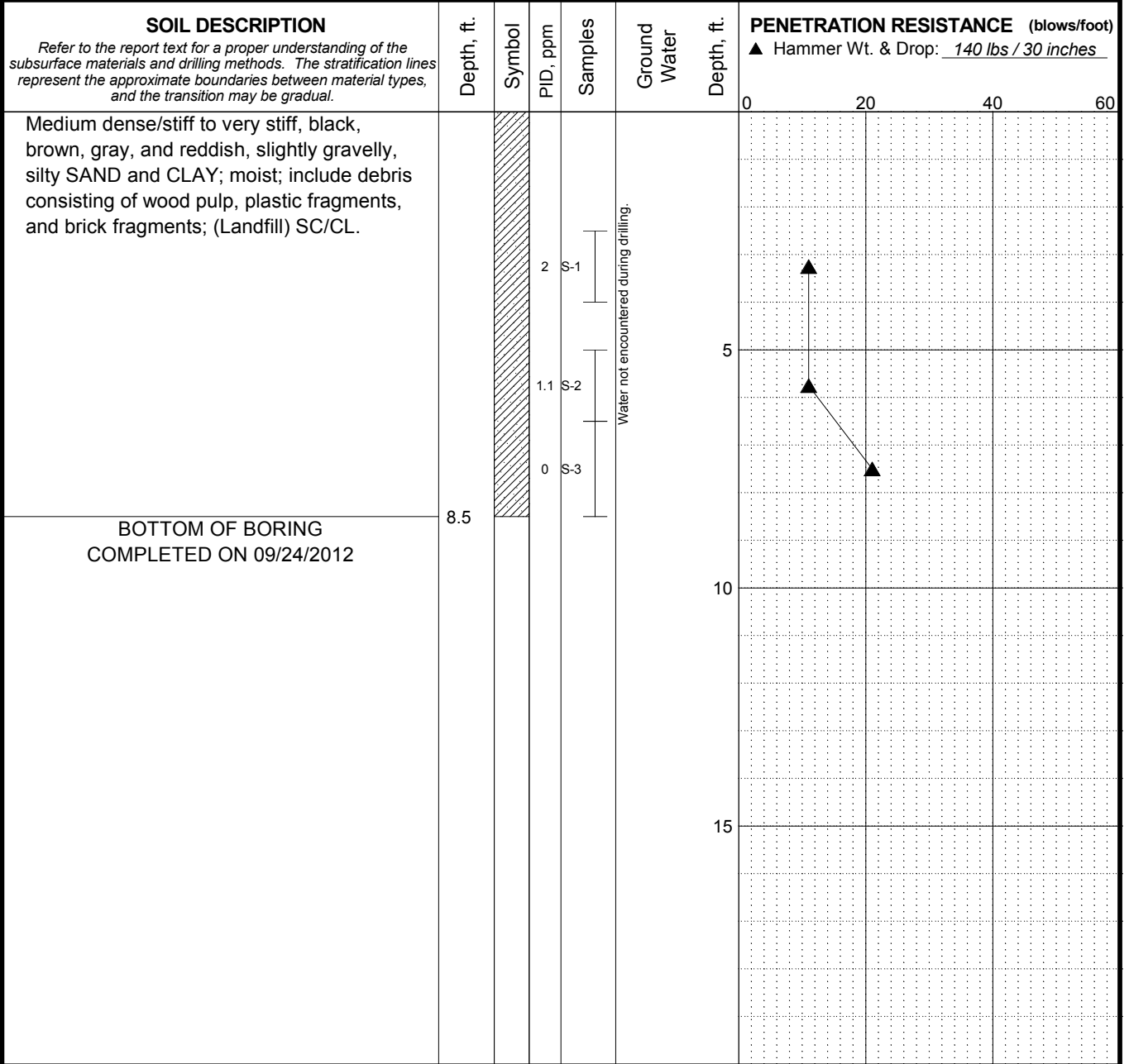
23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-17

MASTER LOG_E_POCKETPEN_LAT&LONG_23-1-01285-103 (SOUTH JASON STREET).GPJ 10/2/12

Total Depth: 8.5 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 4 in.
 Top Elevation: ~ 5230 ft. Longitude: _____ Drilling Company: Vine Laboratories Rod Type.: AWJ
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



LEGEND

- * Sample Not Recovered
- Standard Penetration Test

NOTES

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
Denver, Colorado

LOG OF BORING SW-13

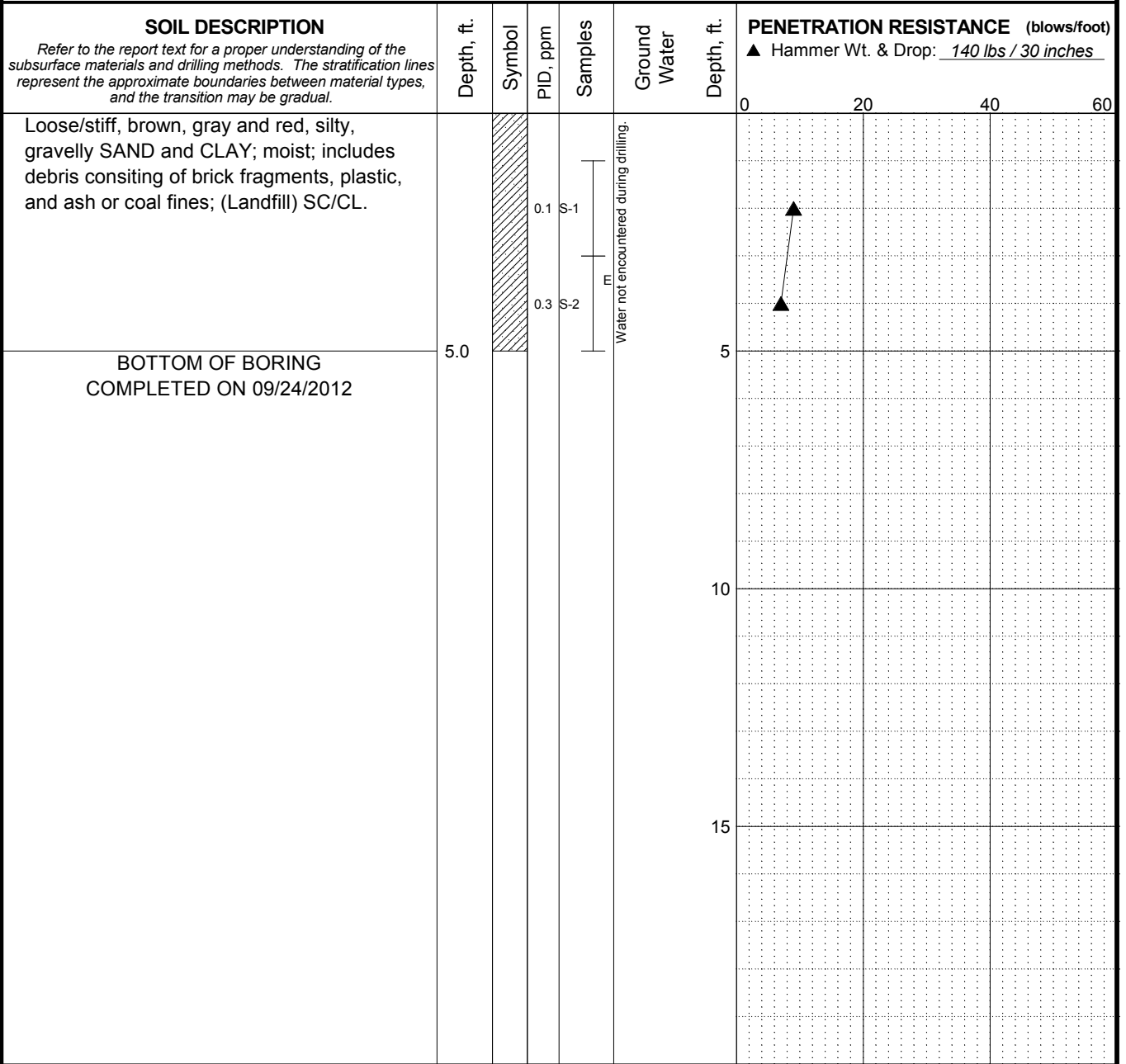
October 2012

23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-18

Total Depth: 5 ft. Latitude: _____ Drilling Method: Solid Auger Hole Diam.: 4 in.
 Top Elevation: ~ 5231 ft. Longitude: _____ Drilling Company: Vine Laboratories Rod Type.: AWJ
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: _____ Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



LEGEND

- * Sample Not Recovered
- E Environmental Sample Obtained
- ┃ Standard Penetration Test

NOTES

1. Refer to Figure A-1 for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

South Jason Street Maintenance Facility
Denver, Colorado

LOG OF BORING SW-14

October 2012

23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-19

APPENDIX B
LABORATORY TEST RESULTS

APPENDIX B
LABORATORY TEST RESULTS

TABLE OF CONTENTS

	Page
B.1 INTRODUCTION	B-1
B.2 TESTS.....	B-1
B.2.1 Water Content.....	B-1
B.2.2 Gradation	B-1
B.2.3 Atterberg Limits Determination	B-2
B.2.4 Corrosion Testing.....	B-2

TABLE

B-1	Summary of Laboratory Test Results by Boring (2 pages)
-----	--

FIGURES

B-1	Grain Size Distribution
B-2	Plasticity Chart

APPENDIX B

LABORATORY TEST RESULTS

B.1 INTRODUCTION

Laboratory tests were completed on soil retrieved from the borings in general accordance with ASTM testing methods. The laboratory testing program was completed to provide data for engineering studies and to classify the materials into similar geologic groups. The testing program included index tests and geotechnical engineering property tests. Individual test results are presented in Table B-1. The following sections describe the laboratory testing procedures.

B.2 TESTS

Classification and index laboratory testing included visual classification and tests to determine natural water content, unit weight, grain size distribution, fines content, and Atterberg limits. A summary of visual classification procedures is included as Figure A-1 in Appendix A. The following sections describe individual index test procedures.

B.2.1 Water Content

Water content was determined in general accordance with ASTM D 2216, Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass, and D 2937. To perform these tests, samples were weighed before and after oven-drying, and the water content was calculated. Water content determinations are presented in Table B-1 and shown graphically in the boring logs presented in Appendix A.

B.2.2 Gradation

The grain size distribution of selected samples was determined in general accordance with the ASTM D 6913, Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis, or ASTM D 1140, Standard Test Method for Amount of Material in Soils Finer than No. 200 Sieve. These tests are useful for classifying soils and providing correlation with soil properties. Results of these analyses are presented as grain size distribution curves in Figure B-1. Each gradation sheet provides the Unified Soil Classification System (USCS) group symbol, the sample description, water content, and the Atterberg limits (if performed). The results are also tabulated in Table B-1.

B.2.3 Atterberg Limits Determination

Soil plasticity was determined by performing liquid and plastic Atterberg limits tests on selected fine-grained samples. The tests were completed in general accordance with ASTM D 4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils. The Atterberg limits include liquid limit (LL), plastic limit (PL), and plasticity index (PI equals the LL minus the PL). They are generally used to assist in classification of soils, to indicate soil consistency (when compared to natural water content), and to provide correlation to soil properties. The results of the Atterberg limits tests are plotted on plasticity charts on Figure B-2, shown graphically on the boring logs in Appendix A, and summarized in Table B-1.

B.2.4 Corrosion Testing

A corrosion suite was completed on select samples. Samples were tested for pH, sulfate and chloride content, and resistivity. Testing for pH and sulfate content was done in general accordance with ASTM G 51, Standard Test Method for Measuring pH of Soil for Use in Corrosion Testing and ASTM D 516, Standard Test Methods for Sulfate Ion in Water. Chloride testing was done in accordance with EPA SW846 Method 9250, Chloride (Colorimetric, Automated Ferricyanide AAI). Resistivity measurements were obtained by saturating select soil samples using the method outlined in Section 61-1 in the "Method of Soil Analysis" published by the U.S. Department of Agriculture (USDA), filtering the water, and measuring the conductivity of the water to determine the resistivity. The results are listed in Table B-1.

TABLE B-1

SHANNON & WILSON, INC.

SUMMARY OF LABORATORY TEST RESULTS BY BORING

SAMPLE DATA				USCS Symbol ⁽¹⁾	Natural Water Content (%)	Moist Unit Weight (pcf)	GRAIN-SIZE ANALYSES ⁽²⁾			ATTERBERG LIMITS			CORROSION			
Boring	Sample	Depth (feet)					Gravel (%)	Sand (%)	Fines (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	pH	Resistivity (ohm-cm)	Sulfates (%)	Chlorides (%)
		Top	Bottom													
SW-01	S-1	2.5	4.0	SM	5.7		10	74	16	NP						
	S-3	7.5	9.0		5.0											
	S-4	10.0	11.5		7.7											
SW-02	S-1	2.5	4.0		4.9											
	S-2	5.0	6.5	SM	5.2		11	75	14							
	S-3	7.5	9.0		3.9											
	S-5	15.0	16.5		10.2				8							
SW-03	S-1	1.0	2.5	SM	7.2		4	77	19	19	18	1				
	S-2	4.0	5.5		14.5											
SW-04	S-1	1.0	2.5		9.6								7.5	1,122	0.22	0.018
	S-2	4.0	5.5	SC	12.3		12	55	33							
	S-3B	8.0	8.5		24.6											
SW-05	S-1	1.0	2.5		6.8				24							
	S-2	4.0	5.5		11.4											
	S-4	15.0	16.5		8.7											
SW-06	S-2	4.0	5.5		9.4											
	S-3	7.5	9.0		10.6											
SW-07	S-1	1.0	2.5	SC	5.6		9	72	19							
	S-2	4.0	5.5		15.3											
	S-3	7.5	9.0		22.5											

NOTES: 1) Refer to Appendix A, Figure A-1 for definitions.

2) Gravel defined as particles larger than the No. 4 sieve size, Sand as particles between the No. 4 and No. 200 sieve sizes, and Fines as particles passing the No. 200 sieve.

TABLE B-1

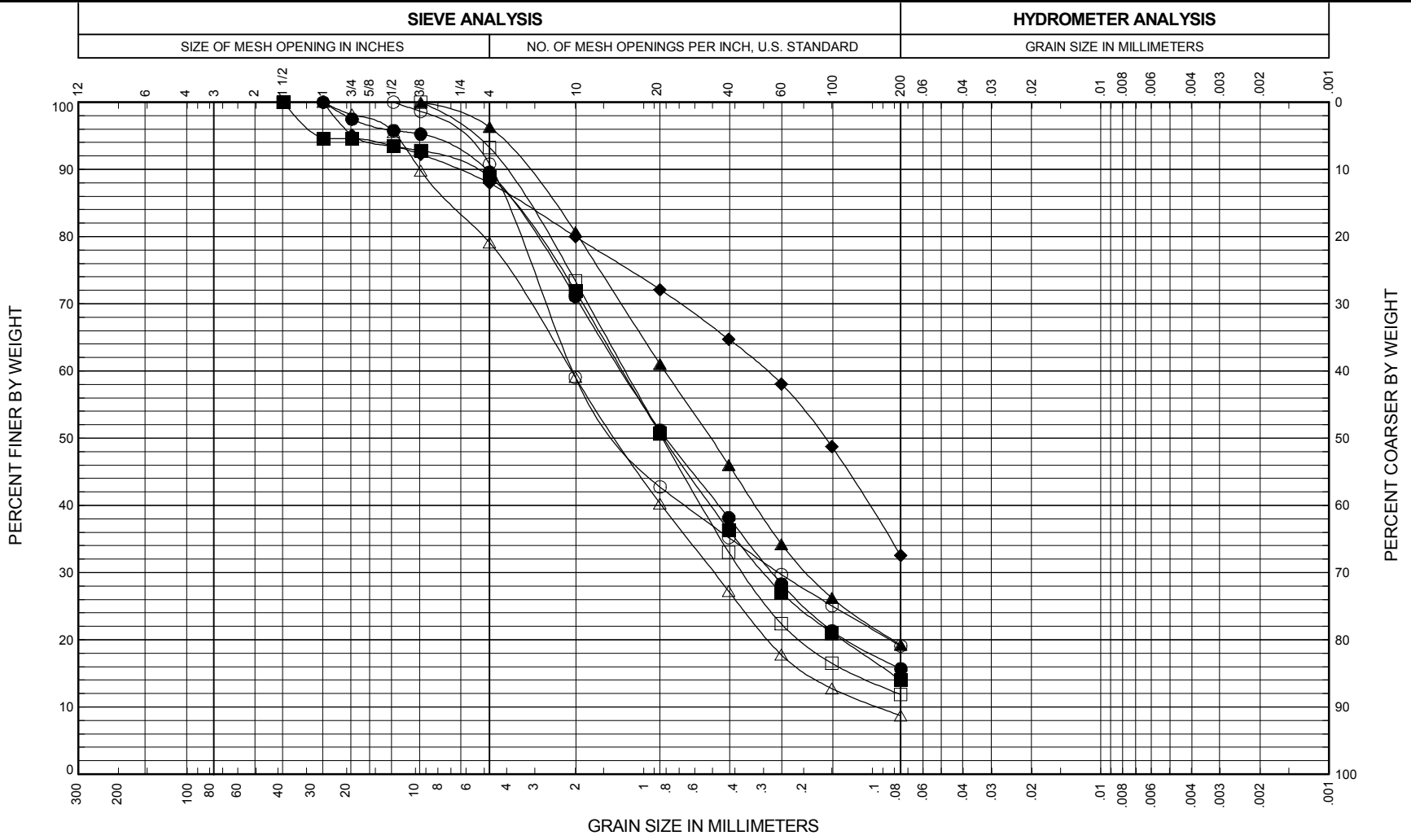
SHANNON & WILSON, INC.

SUMMARY OF LABORATORY TEST RESULTS BY BORING

SAMPLE DATA				USCS Symbol ⁽¹⁾	Natural Water Content (%)	Moist Unit Weight (pcf)	GRAIN-SIZE ANALYSES ⁽²⁾			ATTERBERG LIMITS			CORROSION			
Boring	Sample	Depth (feet)					Gravel (%)	Sand (%)	Fines (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	pH	Resistivity (ohm-cm)	Sulfates (%)	Chlorides (%)
		Top	Bottom													
SW-08	S-1	1.0	2.5			11.7						7.6	1,215	0.1	0.003	
	S-2	4.0	5.5			10.4		16								
	S-3	7.5	9.0			15.9										
SW-09	S-1	1.0	2.5			6.7										
	S-2	4.0	5.5			7.4										
	S-3	7.5	9.0			13.0										
SW-10	S-1	5.0	6.5	SC		21.8		49	32	20	12					
SW-11	S-1	5.0	6.5	SW-SC		8.4	7	81	12							
	S-2A	10.0	11.0			7.3										
	S-2B	11.0	11.5			9.8		20								
	S-4	20.0	21.5			12.4										
SW-12	S-1	5.0	6.5	SW-SM		4.7	21	70	9							
	S-2	10.0	11.5			45.7										
	S-4A	20.0	21.0			15.4										
	S-4B	21.0	21.5			36.3										

NOTES: 1) Refer to Appendix A, Figure A-1 for definitions.

2) Gravel defined as particles larger than the No. 4 sieve size, Sand as particles between the No. 4 and No. 200 sieve sizes, and Fines as particles passing the No. 200 sieve.



COBBLES	COARSE	FINE	COARSE	MEDIUM	FINE	FINES: SILT OR CLAY
	GRAVEL		SAND			

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SAMPLE DESCRIPTION	FINES %	NAT. W.C. %	LL %	PL %	PI %
● SW-01, S-1	3.3	SM	Slightly gravelly, silty SAND	15.7	5.7			
■ SW-02, S-2	5.8	SM	Slightly gravelly, silty SAND	14.0	5.2			
▲ SW-03, S-1	1.8	SM	Silty SAND, trace of fine gravel	19.2	7.2	19	18	1
◆ SW-04, S-2	4.8	SC	Gravelly, clayey SAND	32.5	12.3			
○ SW-07, S-1	1.8	SC	Slightly gravelly, clayey SAND	19.1	5.6			
□ SW-11, S-1	5.8	SW-SC	Slightly gravelly, slightly clayey SAND	11.8	8.4			
△ SW-12, S-1	5.8	SW-SM	Slightly silty, gravelly SAND	8.7	4.7			

South Jason Street Maintenance Facility
Denver, Colorado

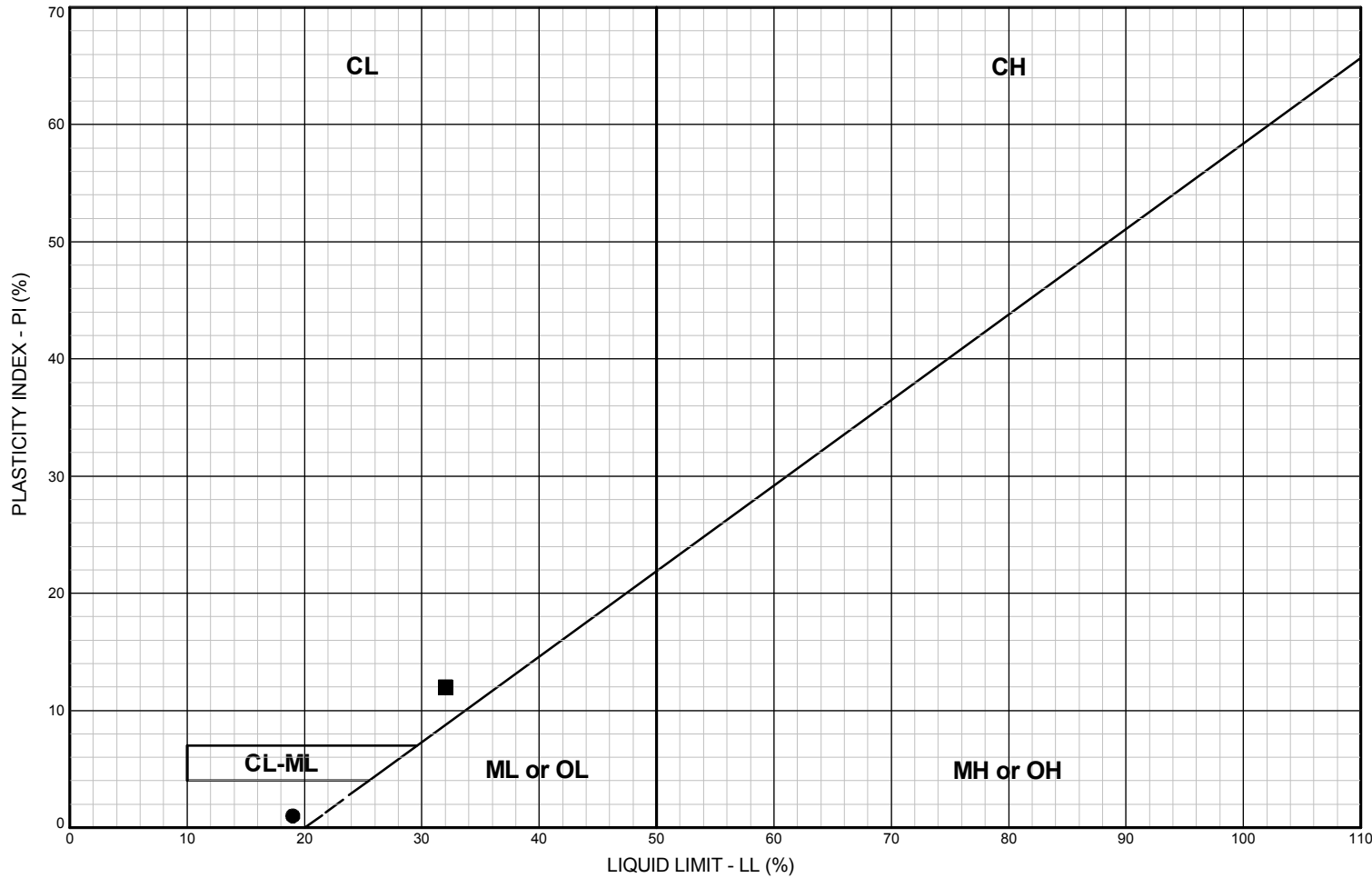
GRAIN SIZE DISTRIBUTION

October 2012 23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-1

FIG. B-1



LEGEND

- CL:** Low plasticity inorganic clays; sandy and silty clays
- CH:** High plasticity inorganic clays
- ML or OL:** Inorganic and organic silts and clayey silts of low plasticity
- MH or OH:** Inorganic and organic silts and clayey silts of high plasticity
- CL-ML:** Silty clays and clayey silts

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT. W.C. %	PASS. #200, %
● SW-03, S-1	1.8	SM	Silty SAND, trace of fine gravel	19	18	1	7.2	19.2
■ SW-10, S-1	5.8	SC	Clayey SAND	32	20	12	21.8	49.2

South Jason Street Maintenance Facility
Denver, Colorado

PLASTICITY CHART

October 2012 23-1-01285-103

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-2

FIG. B-2

APPENDIX C

**IMPORTANT INFORMATION ABOUT
YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT**



Date: October 2012
To: City and County of Denver

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland



DENVER
THE MILE HIGH CITY



Figure 1. Aerial photograph showing location of subject property and approximate uses.



DENVER
THE MILE HIGH CITY

Findings

Thirteen borings were drilled across the site (Figure 2) to assess the current subsurface soil conditions. Samples were collected and variously analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and the eight metals specified by regulation. Boring identification and sample collection and analysis is summarized below:

BORING CLASSIFICATION						
Boring #	S	G	SS	TMW	LGS	WS
DAS-1	x				x	
DAS-2	x		x		x	
DAS-3	x	x	x	x	x	
DAS-4	x				x	
DAS-5	x	x			x	
DAS-6	x				x	
DAS-7	x	x		x	x	x
DAS-8	x			x	x	
DAS-9	x				x	
DAS-10	x				x	
DAS-11	x		x		x	
DAS-12	x				x	
DAS-13					x	

S – Soil Boring
 G – Geotechnical Sample Collected
 SS – Soil Sample Collected
 TMW – Temporary Groundwater Monitoring Well
 LGS – Landfill Gas Sample Collected
 WS – Water Sample Collected



DENVER
THE MILE HIGH CITY

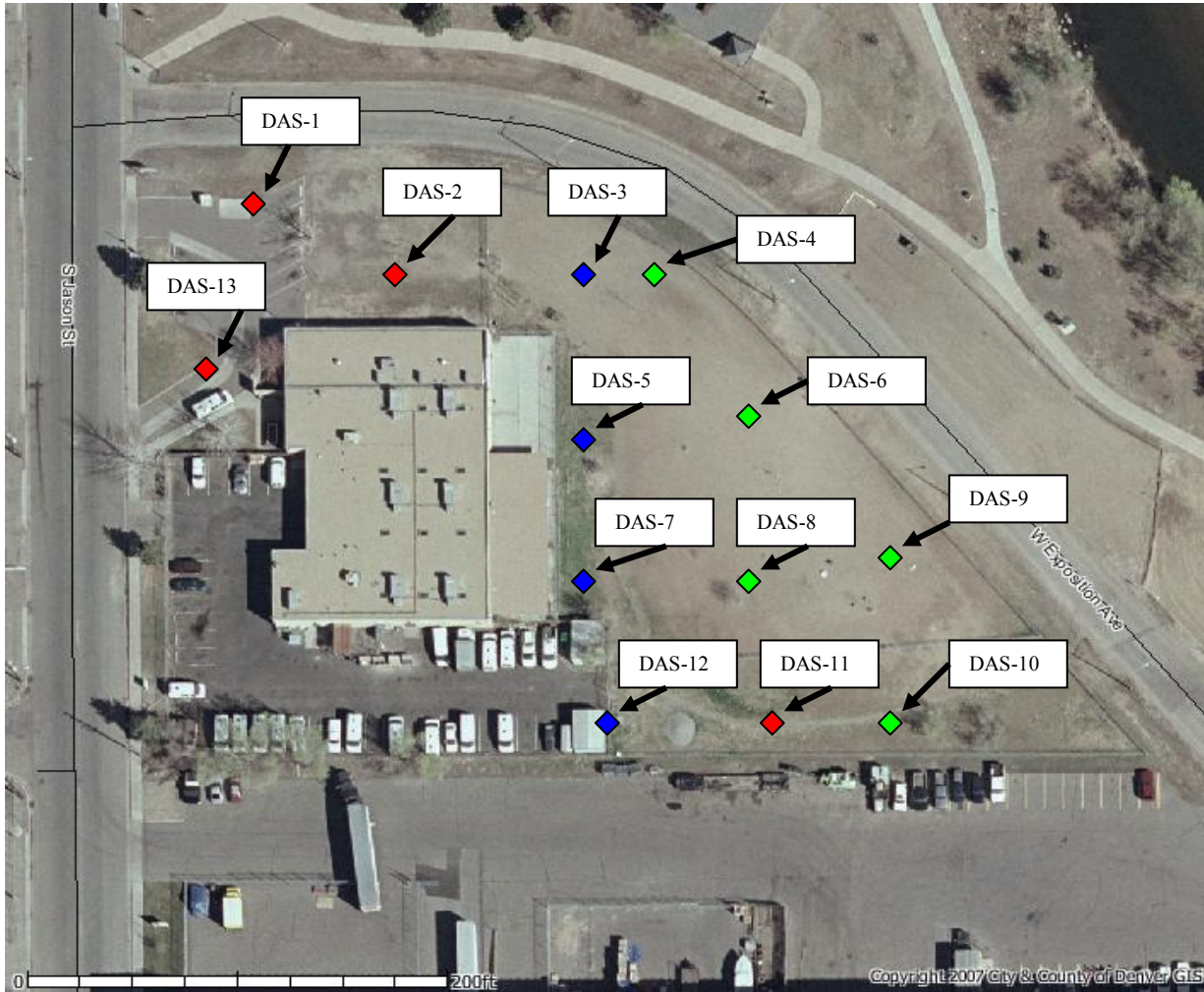


Figure 2. Sampling locations: those with high methane >20% are in red, 5-20% are in blue and <5% are in green

Soil:

All three soil samples collected at the site exceeded the Colorado Department of Public Health and Environment (CDPHE) commercial land use level for arsenic of 1.04 milligram per kilogram (mg/Kg) and two of those (DAS-2-8'-12'' and DAS-11-12' 16'') exceeded the City and County of Denver's (Denver's) commercial soil screening level of 3.61 milligram per liter (mg/L). However, none of the soil samples exceeded Denver's special case soil screening level of 24 mg/Kg, and the concentrations could be representative of the background arsenic levels in the Denver region.

Four SVOCs were reported above Denver's commercial land use soil screening levels in sample DAS-2-8'-12'. Those SVOCs were benzo(a)anthracene at 38,000 microgram per kilogram ($\mu\text{g/Kg}$)



DENVER
THE MILE HIGH CITY

(standard = 6,050 $\mu\text{g}/\text{Kg}$), benzo(a)pyrene at 40,000 $\mu\text{g}/\text{Kg}$ (standard = 610 $\mu\text{g}/\text{Kg}$), dibenz(a,h)anthracene at 10,000 $\mu\text{g}/\text{Kg}$ (standard = 610 $\mu\text{g}/\text{Kg}$) and indeno(123-cd)pyrene at 28,000 $\mu\text{g}/\text{Kg}$ (standard = 6,050 $\mu\text{g}/\text{Kg}$). There are no CDPHE commercial land use standards for these four compounds.

Groundwater:

There were no reported compounds in the groundwater sample (DAS-7) that exceeded CDPHE groundwater standards.

Landfill Gas:

Eight of thirteen landfill gas samples indicated methane in the soil vapor at levels above the lower explosive limit (LEL) of 5%. The highest recorded methane percentage was 21.2% and was obtained from boring DAS-2. Other results indicated the high methane concentrations in borings DAS-1, DAS-2, DAS-3 located north and northwest of the current structure and appearing to taper off to the southeast, however, rather elevated levels up to 20% (DAS-11) were still found along the southern edge of the property.

Summary and Conclusions

EQ recommends that if this property is to be developed in the future that the impacted landfill soils be properly removed and disposed. Contractors should be informed of the potential landfill materials and methane concentrations and advised of the appropriate precautions during construction activities. Soil samples should be collected and analyzed during earthmoving activities to determine soil disposal, re-grading and stockpiling options.

EQ has the following recommendations:

- Soil in excavated areas should be visually inspected for landfill debris and soil staining. If landfill debris or impacted soils are encountered on the site, the material cannot be reused on site. The material must be manifested and transported to Denver Arapahoe Disposal Site (DADS). EQ will assist with the manifests and profile for acceptance of any contaminated soil to DADS.
- A materials management plan (MMP) is recommended to address proper notifications, handling and disposal of any landfill debris or contaminated soil that is excavated.
- The potential exists for explosive levels of methane gas in and around the subject property area. EQ recommends monitoring air quality during excavation and construction for methane gas using a landfill gas meter.



DENVER
THE MILE HIGH CITY

Brown and Caldwell estimated the volume of landfill impacted materials at approximately 66,000 cubic yards. This was calculated by finding the potential lateral and vertical extent of the landfill material by the placement of the soil borings. The results were then put into the Surfer[®] Software to calculate the total potential volume of the landfill material in the northern and eastern portions of the site. Based on this volume, the estimated cost for of remediation is totaled at approximately \$435,000. The cost estimate includes transportation and disposal of soil at the Denver Arapahoe Disposal Site (DADS), replacement of the material removed with clean fill, and engineering planning and oversight costs. It is EQ's recommendation that the subject properties be cleaned up to residential standards prior to acquisition.

The limited scope of this environmental review must be understood. Future regulatory changes, agency interpretations, and/or concepts of due diligence industry standards are beyond the control of EQ.

EQ's objective is to perform our work with care, exercising the customary skill and competence of Environmental Site Assessment professionals in the relevant disciplines. The opinions presented herein apply to subject property conditions existing at the time of our investigation and those reasonably foreseeable. EQ does not warrant or guarantee the subject properties suitable for any particular use or purpose, or certify that the subject property is "clean".

As with any environmental concern, Denver's Department of Environmental Health, Division of Environmental Quality is available to advise all city agencies and is pleased to be of service. If you have any questions or concerns that you would like to discuss regarding this environmental site assessment, please telephone Lisa Farrell (720-865-5439).

cc: Derek Brown, Asset Management
Steve Wirth, Asset Management
File 2005077

**LANDFILL EVALUATION AND SAMPLING
CITY AND COUNTY OF DENVER**



**DENVER MUNICIPAL ANIMAL SHELTER
DENVER, COLORADO
FEBRUARY 12, 2007**



DENVER
THE MILE HIGH CITY



Figure 1. Aerial photograph showing location of subject property and approximate uses.



Findings

Thirteen borings were drilled across the site (Figure 2) to assess the current subsurface soil conditions. Samples were collected and variously analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and the eight metals specified by regulation. Boring identification and sample collection and analysis is summarized below:

BORING CLASSIFICATION						
Boring #	S	G	SS	TMW	LGS	WS
DAS-1	x				x	
DAS-2	x		x		x	
DAS-3	x	x	x	x	x	
DAS-4	x				x	
DAS-5	x	x			x	
DAS-6	x				x	
DAS-7	x	x		x	x	x
DAS-8	x			x	x	
DAS-9	x				x	
DAS-10	x				x	
DAS-11	x		x		x	
DAS-12	x				x	
DAS-13					x	

S – Soil Boring
 G – Geotechnical Sample Collected
 SS – Soil Sample Collected
 TMW – Temporary Groundwater Monitoring Well
 LGS – Landfill Gas Sample Collected
 WS – Water Sample Collected



DENVER
THE MILE HIGH CITY

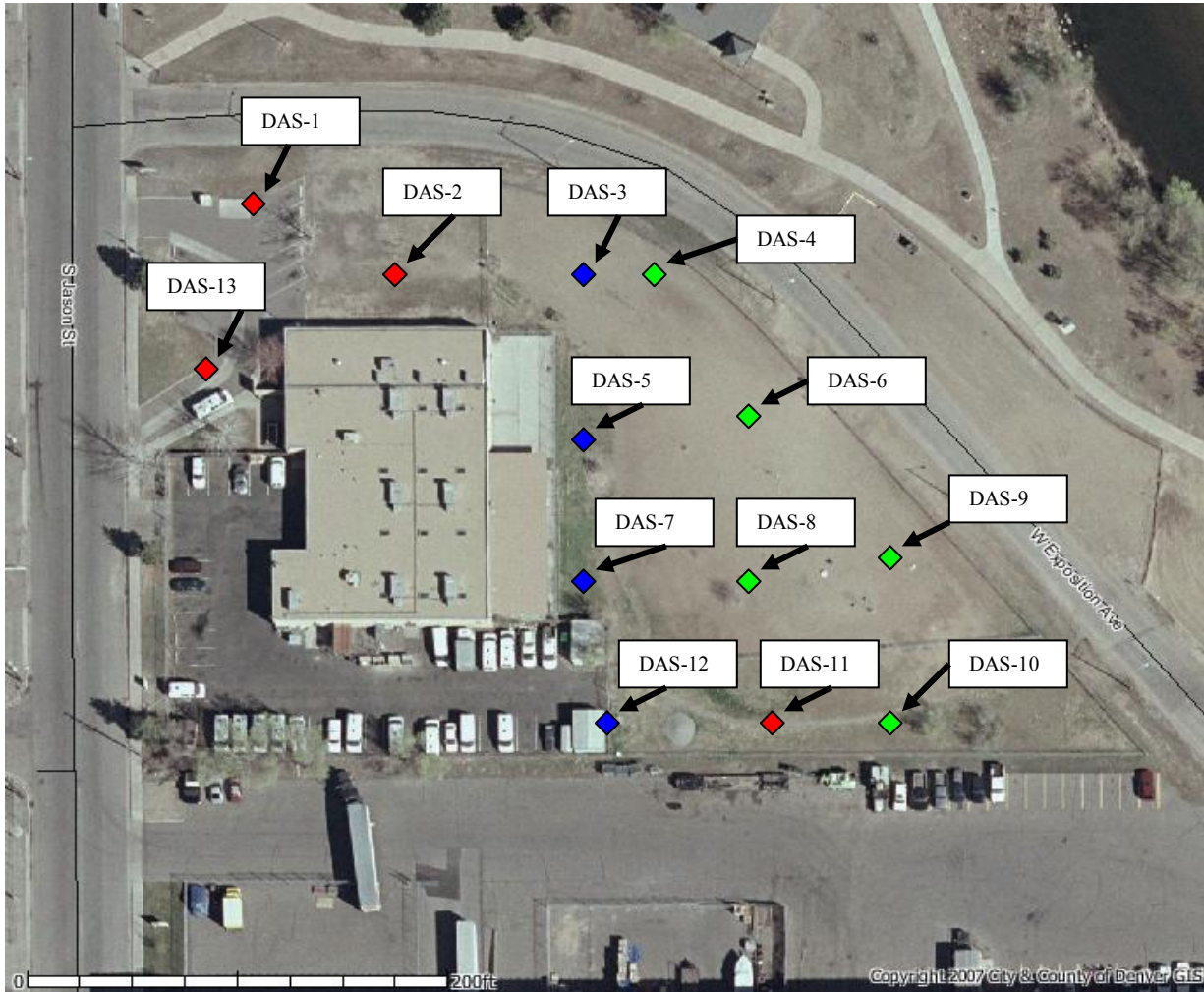


Figure 2. Sampling locations: those with high methane >20% are in red, 5-20% are in blue and <5% are in green

Soil:

All three soil samples collected at the site exceeded the Colorado Department of Public Health and Environment (CDPHE) commercial land use level for arsenic of 1.04 milligram per kilogram (mg/Kg) and two of those (DAS-2-8'-12" and DAS-11-12' 16") exceeded the City and County of Denver's (Denver's) commercial soil screening level of 3.61 milligram per liter (mg/L). However, none of the soil samples exceeded Denver's special case soil screening level of 24 mg/Kg, and the concentrations could be representative of the background arsenic levels in the Denver region.

Four SVOCs were reported above Denver's commercial land use soil screening levels in sample DAS-2-8'-12'. Those SVOCs were benzo(a)anthracene at 38,000 microgram per kilogram ($\mu\text{g/Kg}$)



DENVER
THE MILE HIGH CITY

(standard = 6,050 $\mu\text{g}/\text{Kg}$), benzo(a)pyrene at 40,000 $\mu\text{g}/\text{Kg}$ (standard = 610 $\mu\text{g}/\text{Kg}$), dibenz(a,h)anthracene at 10,000 $\mu\text{g}/\text{Kg}$ (standard = 610 $\mu\text{g}/\text{Kg}$) and indeno(123-cd)pyrene at 28,000 $\mu\text{g}/\text{Kg}$ (standard = 6,050 $\mu\text{g}/\text{Kg}$). There are no CDPHE commercial land use standards for these four compounds.

Groundwater:

There were no reported compounds in the groundwater sample (DAS-7) that exceeded CDPHE groundwater standards.

Landfill Gas:

Eight of thirteen landfill gas samples indicated methane in the soil vapor at levels above the lower explosive limit (LEL) of 5%. The highest recorded methane percentage was 21.2% and was obtained from boring DAS-2. Other results indicated the high methane concentrations in borings DAS-1, DAS-2, DAS-3 located north and northwest of the current structure and appearing to taper off to the southeast, however, rather elevated levels up to 20% (DAS-11) were still found along the southern edge of the property.

Summary and Conclusions

EQ recommends that if this property is to be developed in the future that the impacted landfill soils be properly removed and disposed. Contractors should be informed of the potential landfill materials and methane concentrations and advised of the appropriate precautions during construction activities. Soil samples should be collected and analyzed during earthmoving activities to determine soil disposal, re-grading and stockpiling options.

EQ has the following recommendations:

- Soil in excavated areas should be visually inspected for landfill debris and soil staining. If landfill debris or impacted soils are encountered on the site, the material cannot be reused on site. The material must be manifested and transported to Denver Arapahoe Disposal Site (DADS). EQ will assist with the manifests and profile for acceptance of any contaminated soil to DADS.
- A materials management plan (MMP) is recommended to address proper notifications, handling and disposal of any landfill debris or contaminated soil that is excavated.
- The potential exists for explosive levels of methane gas in and around the subject property area. EQ recommends monitoring air quality during excavation and construction for methane gas using a landfill gas meter.



DENVER
THE MILE HIGH CITY

Brown and Caldwell estimated the volume of landfill impacted materials at approximately 66,000 cubic yards. This was calculated by finding the potential lateral and vertical extent of the landfill material by the placement of the soil borings. The results were then put into the Surfer[®] Software to calculate the total potential volume of the landfill material in the northern and eastern portions of the site. Based on this volume, the estimated cost for of remediation is totaled at approximately \$435,000. The cost estimate includes transportation and disposal of soil at the Denver Arapahoe Disposal Site (DADS), replacement of the material removed with clean fill, and engineering planning and oversight costs. It is EQ's recommendation that the subject properties be cleaned up to residential standards prior to acquisition.

The limited scope of this environmental review must be understood. Future regulatory changes, agency interpretations, and/or concepts of due diligence industry standards are beyond the control of EQ.

EQ's objective is to perform our work with care, exercising the customary skill and competence of Environmental Site Assessment professionals in the relevant disciplines. The opinions presented herein apply to subject property conditions existing at the time of our investigation and those reasonably foreseeable. EQ does not warrant or guarantee the subject properties suitable for any particular use or purpose, or certify that the subject property is "clean".

As with any environmental concern, Denver's Department of Environmental Health, Division of Environmental Quality is available to advise all city agencies and is pleased to be of service. If you have any questions or concerns that you would like to discuss regarding this environmental site assessment, please telephone Lisa Farrell (720-865-5439).

cc: Derek Brown, Asset Management
Steve Wirth, Asset Management
File 2005077

LANDFILL EVALUATION AND SAMPLING
FOR THE CITY AND COUNTY OF DENVER
DENVER MUNICIPAL ANIMAL SHELTER
DENVER, COLORADO

FEBRUARY 12, 2007

Prepared for: City and County of Denver
Department of Environmental Health
Division of Environmental Quality
210 West Colfax Avenue, Department 1009
Denver, Colorado 80202

Prepared by: Brown and Caldwell
1697 Cole Boulevard, Suite 200
Golden, Colorado 80401

TABLE OF CONTENTS

TABLE OF CONTENTS	i
LIST OF TABLES	ii
LIST OF FIGURES.....	ii
LIST OF APPENDICES.....	ii
ACRONYMS AND ABBREVIATIONS	iii
1.0 EXECUTIVE SUMMARY	1-1
2.0 INTRODUCTION	2-1
3.0 FIELD ACTIVITIES.....	3-1
3.1 UTILITY IDENTIFICATION.....	3-1
3.2 SOIL CHARACTERIZATION BORINGS.....	3-1
3.3 GROUNDWATER SAMPLING	3-2
3.4 LANDFILL GAS SAMPLING	3-2
3.5 GEOTECHNICAL SAMPLING	3-2
4.0 SUMMARY OF LABORATORY ANALYSES.....	4-1
4.1 SOIL SAMPLING RESULTS.....	4-1
4.2 GROUNDWATER SAMPLING RESULTS	4-1
4.3 LANDFILL GAS SAMPLING RESULTS.....	4-1
4.4 GEOTECHNICAL SAMPLING RESULTS	4-2
5.0 ESTIMATED VOLUME OF LANDFILL MATERIALS	5-1
6.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS	6-1
6.1 SUMMARY AND CONCLUSIONS	6-1
6.2 RECOMMENDATIONS	6-1

LIST OF TABLES

Table 1	Soil Analytical Results
Table 2	Groundwater Analytical Results
Table 3	Groundwater Static Water Level Results
Table 4	Landfill Gas Sampling Results
Table 5	Estimated Thickness of Boring Landfill Material

LIST OF FIGURES

Figure 1	Site Vicinity Map
Figure 2	Site Map with Sample Locations and Potentiometric Contours

LIST OF APPENDICES

Appendix A	Field Notes, Field Boring Logs, CCoD Boring Logs, and Field Landfill Gas Forms
Appendix B	Laboratory Data with Chain-Of-Custody Form
Appendix C	Geotechnical Stress-Strain Graphs
Appendix D	1948 Aerial Photograph of Site and Sample Location Coordinates

ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CO ₂	carbon dioxide
CCoD	City and County of Denver
CDPHE	Colorado Department of Public Health and Environment
DEQ	CCoD, Department of Environmental Health, Division of Environmental Quality
EAL	Evergreen Analytical Laboratory Inc.
EPA	Environmental Protection Agency
ESN	Environmental Services Network-Rocky Mountain
LEL	lower explosive limit
CH ₄	methane
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
O ₂	oxygen
PID	Photoionization Detector
ppm	parts per million
psf	pounds per square foot
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
Site	Denver Municipal Animal Shelter, Denver, Colorado
SVOCs	Semivolatile Organic Compounds
TOC	top of casing
TPH-DRO	Total Petroleum Hydrocarbons-Diesel Range Organics
UNCC	Utility Notification Center of Colorado
USCS	Unified Soil Classification System
VOCs	Volatile Organic Compounds

1.0 EXECUTIVE SUMMARY

Brown and Caldwell performed a Landfill Evaluation and Sampling Program for the City and County of Denver (CCoD) at the Denver Municipal Animal Shelter located in Denver, Colorado (Site). These activities were conducted from October 17th to October 19th, 2006.

The purpose of this investigation was to identify and evaluate conditions of potential soil, soil vapor, and groundwater impacts associated with historical activities on or adjacent to the Site. Specific tasks included soil sampling, groundwater sampling, geotechnical sampling, and landfill gas sampling.

As a result of the activities, the following conditions were observed:

- The three soil samples (DAS-2-8'-12', DAS-3-8'-12', and DAS-11-12'-16') collected at the Site exceeded the Colorado Department of Public Health and Environment (CDPHE) commercial landuse soil cleanup standard of 1.04 mg/kg for arsenic. Arsenic concentrations in soil samples DAS-2-8'-12' and DAS-11-12'-16' also exceeded the City and County of Denver (CCoD) commercial landuse soil screening level. However, the CCoD special case soil screening standard for arsenic of 24 mg/kg was not exceeded in the soil samples. The arsenic concentrations may simply be an indication of the higher background concentrations of arsenic in the Denver region's soil.
- Sample DAS-2-8'-12' contained four SVOC analytes (benzo(a)anthracene, benzo(a)pyrene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene) with concentrations above their respective CCoD commercial landuse soil screening levels. The CDPHE commercial landuse soil standards have no standards for these four particular analytes.
- There were no CDPHE groundwater standard exceedances in groundwater sample DAS-7, the only groundwater sample collected at the Site.
- Field screening of eight of the landfill gas samples (DAS-1, DAS-2, DAS-3, DAS-5, DAS-DAS-7, DAS-11, DAS-12, and DAS-13) indicated the presence of methane in soil vapor at concentrations above the lower explosive limit (LEL) for methane (5% of total).
- The geotechnical sample results, measuring unconfined compressive strength using Test Method ASTM D-2166, present the compressive stress (psf) values immediately east of the current Denver Municipal Animal Shelter structure. These tests were performed due to the potential expansion of the Animal Shelter structure to the east.

2.0 INTRODUCTION

From October 17th to October 19th, 2006, Brown and Caldwell performed a Landfill Evaluation and Sampling Program at the Denver Municipal Animal Shelter in Denver, Colorado (Site). The general location of the Site is shown in **Figure 1**. The work described in this program was conducted for CCoD, Department of Environmental Health, Division of Environmental Quality (DEQ).

Based on information provided by CCoD and from viewing aerial photographs dated 1948, 1955, and 1964, historic uses of the Site included a gravel pit (1948 photo), a small lake (1955 photo), and a capped landfill (1964 photo). The current use of the Site is the presence of the Denver Municipal Animal Shelter, located on the western portion of the Site, and an “off-leash dog run” situated on the eastern portion of the Site.

The purpose of this investigation was to provide characterization of the soil (including six unconfined compressive strength tests), groundwater, and landfill materials, if present, and evaluate the presence and concentration, if any, of methane in soil vapor beneath the Site. In addition, the investigation included the potential presence of asbestos in soil, the estimated volume of potential landfilled materials, and the estimated cost for excavation, loading, transportation, disposal and replacement of potential landfilled materials. Specific tasks included the following activities:

- Soil Sampling – To assess the Site, a total of twelve soil borings (DAS-1 through DAS-12) were advanced to a depth, where possible, below the landfill debris to characterize the landfill area. Soil samples were collected from three of the twelve borings (DAS-2 from 8 to 12 feet bgs, DAS-3 from 8 to 12 feet bgs, and DAS-11 from 12 to 16 feet bgs), and analyzed by Evergreen Analytical Laboratory, Inc. (EAL) for Volatile Organic Compounds (VOCs) by Environmental Protection Agency (EPA) Method 8260B, Semi-Volatile Organic Compounds (SVOCs) by EPA Method 8270C, and the eight Resource Conservation and Recovery Act (RCRA) metals by EPA Methods 6010 and 7471.
- Groundwater Sampling – To assess groundwater levels and flow direction, three of the twelve soil borings (DAS-3, DAS-7, and DAS-8) were converted to temporary monitoring wells to measure static groundwater levels, and to produce a potentiometric map of the Site. In addition, a groundwater sample was collected at DAS-7 and analyzed by EAL for VOCs by EPA Method 8260B..
- Landfill Gas Sampling – To assess the property, twelve landfill gas borings were advanced immediately adjacent to their corresponding soil borings (DAS-1 through DAS-12) to estimate the concentration of methane in soil vapor. An additional landfill gas boring (DAS-13) was located west of the Animal Shelter structure. Each boring was advanced to an approximate depth of 6 feet bgs. Field readings were then collected using a Landtec GA-90 Gas Analyzer.
- Geotechnical Sampling – To assess the proposed building footprint located east of the current Animal Shelter structure, three geotechnical samples, using a modified California sampler, were advanced immediately adjacent to their corresponding soil borings (DAS-3, DAS-5, and DAS-7) and tested for their unconfined compressive strength using Test Method ASTM D-2166. Each location had two 4 inch soil intervals tested from a depth

range of 1 foot-8 inches to 3 feet. The specific locations of the geotechnical samples were chosen, with DEQ's support, due to increased topography further east within the Site.

The tables and figures referenced in the body of this document are presented in the sections entitled **Tables** and **Figures**, respectively, following the text. Field notes, field boring logs, CCoD boring logs, and field landfill gas forms are presented in **Appendix A**. Laboratory analytical data with the chain-of-custody form are presented in **Appendix B**. Geotechnical graphs are presented in **Appendix C**. A 1948 aerial photograph of the Site area and sample location coordinates are presented in **Appendix D**.

3.0 FIELD ACTIVITIES

The following sections describe the activities conducted in the field during the course of this investigation.

3.1 UTILITY IDENTIFICATION

Brown and Caldwell contacted the Utility Notification Center of Colorado (UNCC) to identify the locations of underground utilities in the area near the proposed drilling activities. UNCC provided Ticket No. B224462. No UNCC member utilities were identified as having a potential conflict at the Site. An on-site meeting with Denver Parks and Recreation was held on October 13, 2006 prior to initiation of subsurface investigation activities to identify subsurface utilities in the vicinity of the proposed boring locations. Denver Parks and Recreation was the only non-UNCC member utility with a potential conflict in this geographic area.

3.2 SOIL CHARACTERIZATION BORINGS

Brown and Caldwell completed a total of twelve soil borings (DAS-1 through DAS-12) on October 17th and 18th, 2006 with driller ESN-Rocky Mountain to assess the current subsurface soil conditions. Specifically, the purpose of the soil characterization borings was to assess the presence of asbestos containing materials, VOCs, SVOCs and RCRA Metals, and to assess the potential lateral and vertical extent of landfill debris within the Site. The soil borings were advanced by using a 48-inch, dual tube system, direct push sampling device at approximately four-foot intervals with a Geoprobe[®] DT-54 track-mounted drilling rig. The locations of the soil borings are shown on **Figure 2**.

The soil borings were advanced through the subsurface, and logged in approximately four foot intervals with the intent to reach a total depth below the landfill debris. Soil samples were logged in the field according to the Unified Soil Classification System (USCS). Field boring logs, CCoD boring logs, and field notes are included in **Appendix A**. No asbestos containing materials were observed at the surface or in the soil borings. Field headspace screening analyses for the presence of VOCs were conducted using a MiniRae photoionization detector (PID) calibrated daily to 100 parts per million (ppm) isobutylene gas. Field headspace screening analyses were performed for each interval by placing a representative portion of the soil in dedicated Ziploc[®] plastic bags, allowing the material to volatilize for approximately 15 minutes, and screening the sample with the PID. Field screening results and observations were recorded on the soil boring logs. Soil samples from three of the twelve borings were selected for laboratory analysis from discrete intervals in each soil boring based on PID screening, proximity to the groundwater interface, and visual staining, discoloration or odor. Soil samples were collected from the three borings (DAS-2 from 8 to 12 feet bgs, DAS-3 from 8 to 12 feet bgs, and DAS-11 from 12 to 16 feet bgs), placed in coolers with ice, and hand delivered for analysis by CCoD's contracted laboratory, Evergreen Analytical, Inc., for VOCs, SVOCs, and eight RCRA metals. The analytical results for the soil samples are summarized in **Table 1**. A copy of the laboratory results and the chain-of-custody form are located in **Appendix B**.

Upon completion of each soil characterization location, excluding the three borings converted to temporary groundwater monitoring wells, each boring was immediately abandoned by pouring bentonite chips in the open bore-hole until they reached the surface.

3.3 GROUNDWATER SAMPLING

Temporary groundwater monitoring wells were installed at three (DAS-3, DAS-7, and DAS-8) of the twelve soil borings. Each well was set using five feet of one-inch diameter, 0.010-inch machine slotted polyvinyl-chloride (PVC) screen and blank PVC casing to the surface.

A groundwater sample was collected from monitoring well DAS-7 using a 0.75" x 36" stainless steel mini-bailer and disposable nylon bailing cord. The sample was collected in two 40 milli-liter volatile organic ampoules and submitted to CCoD's contracted analytical laboratory, EAL, for VOC analyses. The analytical results for the groundwater sample are summarized in **Table 2**. A copy of the laboratory results is located in **Appendix B**.

On October 19, 2006, the three temporary groundwater monitoring well locations were surveyed and the static water level for each was measured. The static water level data is presented in **Table 3** and the corresponding potentiometric map is presented as **Figure 2**. Upon completion of the groundwater static water level measurements, each temporary monitoring well was pulled from the ground, and the boring was abandoned by pouring bentonite chips in the open bore-hole until they reached the surface.

3.4 LANDFILL GAS SAMPLING

Twelve landfill gas borings were completed immediately adjacent to their corresponding soil borings (DAS-1 through DAS-12) on October 17th and 18th, 2006 by ESN-Rocky Mountain. An additional landfill gas boring (DAS-13) was completed west of the Animal Shelter structure. The purpose of these borings was to evaluate whether methane is present beneath the Site, and if so, to analyze the concentrations of methane (as a percentage).

Each boring was advanced, using a Geoprobe[®] DT-54 track-mounted drilling rig, to an approximate depth of 6 feet bgs, using 1 inch diameter, perforated, nickel-plated drill rods. Methane readings were then collected by connecting Teflon tubing from the drill rod to a portable Landtec[®] GA-90 Gas Analyzer. In addition to methane (CH₄), the percentage of carbon dioxide (CO₂), oxygen (O₂), and the remaining balance for each boring were recorded on field notes once the readings stabilized. These values are presented in **Table 4** and the field landfill gas forms are presented in **Appendix A**.

3.5 GEOTECHNICAL SAMPLING

Three geotechnical samples, using a modified California sampler, were collected immediately adjacent to their corresponding soil borings (DAS-3, DAS-5, and DAS-7) on October 17th and 18th, 2006 by ESN-Rocky Mountain. The purpose of these samples was to determine the unconfined

compressive strength of the soil located east of the current Animal Shelter structure, where a proposed building footprint may be located. The specific sample locations, with DEQ's support, were chosen due to increased topography further to the east within the Site. Each sample consisted of soil captured in four 4" brass liners collected from a depth of 1'8" bgs to 3' bgs. The samples were capped, labeled and hand delivered to CTL/Thompson Inc. for unconfined compressive strength tests employing Test Method ASTM D-2166. CTL/Thompson chose two 4" liners from each sample location for the tests. The resulting stress-strain graphs are presented in **Appendix C**.

4.0 SUMMARY OF LABORATORY ANALYSES

The following sections describe the analytical methods and summarize the results for samples collected at the Site.

4.1 SOIL SAMPLING RESULTS

Soil samples from locations DAS-2, DAS-3, and DAS-11 were submitted to EAL to be analyzed for VOCs by EPA Method 8260B, SVOCs by EPA Method 8270C, and eight RCRA metals by EPA Methods 6010 and 7471. The analytical results for the soil samples are summarized in **Table 1**. A copy of the laboratory results and the chain-of-custody form are located in **Appendix B**.

In summary, arsenic exceedances using the CDPHE commercial landuse soil cleanup standard (1.04 mg/kg) were detected, with concentrations of 3.7 mg/kg, 2.7 mg/kg, and 8.4 mg/kg, from soil samples DAS-2-8'-12', DAS-3-8'-12', and DAS-11-12'-16', respectively. Arsenic concentrations from soil samples DAS-2-8'-12' and DAS-11-12'-16' also exceeded the CCoD commercial landuse soil screening level of 3.61 mg/kg, although none of the samples exceeded the CCoD special case soil screening standard for arsenic of 24 mg/kg. The arsenic concentrations from these three samples may represent background conditions within the Denver region.

Soil sample DAS-2-8'-12' contained four SVOC/PAH (polycyclic aromatic hydrocarbon) analytes with concentrations above their respective CCoD soil screening level. Sample DAS-2-8'-12' had a benzo(a)anthracene concentration of 38000 µg/kg, a benzo(a)pyrene concentration of 40000 µg/kg, a dibenz(a,h)anthracene concentration of 10000 µg/kg, and an indeno(1,2,3-cd)pyrene concentration of 28000 µg/kg. These concentrations were above their respective CCoD soil screening levels of 6050 µg/kg, 610 µg/kg, 610 µg/kg, and 6050 µg/kg. Polycyclic aromatic hydrocarbons are found in coal and petroleum, but they are also products of incomplete combustion, of either natural or anthropogenic origin. Anthropogenic sources to the environment are more abundant than natural sources and include burning of wood, coal, oil and gas, garbage, or other organic substances.

4.2 GROUNDWATER SAMPLING RESULTS

Groundwater sample DAS-7 was submitted to EAL to be analyzed for VOCs by EPA Method 8260B. The analytical results for groundwater sample DAS-7 are summarized in **Table 2**. A copy of the laboratory results is located in **Appendix B**.

No CDPHE groundwater standard exceedances were recorded for groundwater sample DAS-7.

4.3 LANDFILL GAS SAMPLING RESULTS

Landfill gas sampling was conducted at each boring location (DAS-1 through DAS-12) using a portable Landtec® GA-90 Gas Analyzer to estimate the concentrations of methane, oxygen, and

carbon dioxide in soil vapor. An additional landfill gas sample (DAS-13) was collected west of the Denver Municipal Animal Shelter. The results of the sampling are located in **Table 4**. Field landfill gas forms are located in **Appendix A**.

Eight of the thirteen landfill gas samples recorded methane concentrations in excess of methane's LEL (5.0%). The highest recorded methane percentage, at 51.2%, was recorded at location DAS-2, located approximately 36 feet north of the Denver Municipal Animal Shelter.

4.4 GEOTECHNICAL SAMPLING RESULTS

Geotechnical sampling was conducted at boring locations, DAS-3, DAS-5, and DAS-7 and tested for unconfined compressive strength using test method ASTM D-2166. The two 4" intervals tested at location DAS-3 were one foot-eight inches to two feet, and two feet-four inches to two feet-eight inches. The two intervals tested at location DAS-5 were two feet-four inches to two feet-eight inches, and two feet-eight inches to three feet. The two intervals tested at location DAS-7 were one foot-eight inches to two feet, and two feet-four inches to two feet-eight inches. The resulting stress-strain graphs are presented in **Appendix C**.

5.0 ESTIMATED VOLUME OF LANDFILL MATERIALS

The soil borings completed at the Site provide for the estimation of the potential lateral and vertical extent of the landfill material. By observing the presence of landfill material in the borings, an estimated volumetric calculation of the landfill material at the Site can be made. **Table 5** shows the estimated thickness of the landfill material by recording the initial depth at which landfill material was first observed in each boring. The depth to the bottom of the landfill material was then recorded. In some cases, the lower depth of the landfill material had to be estimated due to drilling complications, such as, drilling refusal or sample flushing. When sample flushing occurred, the depth to where the core liner was water saturated was equated to the bottom of landfill material. By subtracting the depth of the top of the landfill material from the depth to the bottom of the landfill material, the thickness of the landfill material within each boring was calculated.

Through the use of Surfer[®] Software, the total potential volume of landfill material in the northern and eastern portions of the Denver Municipal Animal Shelter is calculated to be 66,000 cubic yards.

6.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Brown and Caldwell performed a Landfill Evaluation and Sampling Program for the City and County of Denver (CCoD) at the Denver Municipal Animal Shelter, located in Denver, Colorado (Site). These activities were conducted from October 17th through October 19th, 2006.

6.1 SUMMARY AND CONCLUSIONS

The purpose of this investigation was to identify and evaluate conditions of potential soil, soil vapor, and groundwater, impacts associated with historical activities on the Site. Specific tasks included soil sampling, groundwater sampling, landfill gas sampling, and geotechnical sampling.

As a result of the activities, the following conditions were observed:

- The three soil samples (DAS-2-8'-12', DAS-3-8'-12', and DAS-11-12'-16') collected at the Site exceeded the CDPHE commercial landuse soil standard of 1.04 mg/kg for arsenic. Two of the soil samples (DAS-2-8'-12' and DAS-11-12'-16') also exceeded the CCoD commercial soil screening level of 3.61 mg/kg for arsenic. None of the soil samples exceeded CCoD's special case soil screening level of 24 mg/kg. The arsenic concentrations recorded may represent the background level of arsenic in the Denver region.
- The one groundwater sample collected at the Site (DAS-7) did not exceed CDPHE groundwater standards.
- Eight of the landfill gas samples (DAS-1, DAS-2, DAS-3, DAS-5, DAS-DAS-7, DAS-11, DAS-12, and DAS-13) indicated the presence of methane in soil vapor at concentrations above the lower explosive limit (LEL) for methane (5% of total). The highest recorded methane percentage (51.2%) was contained in boring DAS-2, located approximately 36 feet north of the Denver Municipal Animal Shelter.

6.2 RECOMMENDATIONS

- Based on the quantity of landfill material observed and the increased methane concentrations encountered, Brown and Caldwell recommends additional investigation activities at this time. Specifically, Brown and Caldwell recommends the design and installation of an active depressurization system that will be suitable for extracting air exchanges beneath the current Animal Shelter structure and the proposed extension, thus removing potentially harmful vapors.
- In the event of construction or earthmoving activities, contractors should be informed of potential landfill materials and methane concentrations, and advised of the appropriate precautions. It is recommended that soil be sampled and analyzed during earthmoving

activities prior to removal of the soil from the site or placement of the soil closer to ground surface (regrading, stockpiling, etc.).

TABLES

Table 1
Soil Analytical Results
Denver Municipal Animal Shelter
October 17-19, 2006

Analyte	DAS-2-8'-12'		DAS-3-8'-12'		DAS-11-12'-16'		CDPHE Commercial Landuse Soil Standards	CCoD Commercial Landuse Soil Screening Levels
	Result	Qualifier	Result	Qualifier	Result	Qualifier		
RCRA Metals By EPA Methods 6010 and 7471 (mg/kg)								
Arsenic	3.7*	J	2.7*	J	8.4*		1.04	3.61
Barium	140	B	100	B	200	B	NV	132777
Cadmium	1.1		1.6		2.2		1052.46	2004
Chromium	4.6		5.7		44		212.92	1135
Lead	54		240		120		2920	2920
Selenium	1.0	J	<8.2		<81		NV	10031
Silver	<2.5		<2.5		0.91	J	NV	10031
Mercury	2.2		0.065		0.16		176.53	5
Volatile Organic Compounds (VOCs) By EPA Method 8260B (µg/kg)								
1,1,1-Trichloroethane	<39		<33		<36		1000000	1000000
1,1,2,2-Tetrachloroethane	<78		<66		<72		NV	3000
1,1,2-Trichloroethane	<39		<33		<36		NV	5110
1,1-Dichloroethane	<39		<33		<36		1000000	1000000
1,1-Dichloroethene	<39		<33		<36		270	370
1,2-Dichlorobenzene	<39		<33		<36		NV	1000000
1,2-Dichloroethane	<39		<33		<36		NV	1950
1,2-Dichloropropane	<39		<33		<36		NV	70000
1,3-Dichlorobenzene	<39		<33		<36		NV	1000000
1,4-Dichlorobenzene	<39		<33		<36		NV	20000
2-Butanone	<160		61	J	<140		NV	1000000
2-Chloroethylvinylether	<160		<130		<140		NV	NV
2-Hexanone	<160		<130		<140		NV	1000000
4-Methyl-2-pentanone	<160		<130		<140		NV	1000000
Acetone	240		270		120	J	NV	1000000
Benzene	13		17		<7.2		3590	4470
Bromodichloromethane	<39		<33		<36		NV	77700
Bromoform	<39		<33		<36		NV	610000
Bromomethane	<39		<33		<36		NV	44000
Carbon disulfide	20	J	29	J	<36		NV	1000000
Carbon tetrachloride	<39		<33		<36		1340	1760
Chlorobenzene	<39		45		<36		NV	591000

Table 1
Soil Analytical Results
Denver Municipal Animal Shelter
October 17-19, 2006

Analyte	DAS-2-8'-12'		DAS-3-8'-12'		DAS-11-12'-16'		CDPHE Commercial Landuse Soil Standards	CCoD Commercial Landuse Soil Screening Levels
	Result	Qualifier	Result	Qualifier	Result	Qualifier		
Chloroethane	<39		<33		<36		NV	1000000
Chloroform	<39		<33		<36		NV	1550
Chloromethane	<39		<33		<36		NV	4490
cis-1,2-Dichloroethene	21	J	<33		<36		NV	1000000
cis-1,3-Dichloropropene	<39		<33		<36		NV	3360
Dibromochloromethane	<39		<33		<36		NV	57300
Ethylbenzene	47		<33		<36		1000000	1000000
Methylene chloride	<39		<33		<36		NV	64000
Styrene	<39		21	J	<36		NV	1000000
Tetrachloroethene	<39		<33		<36		8970	36000
Toluene	38		<13		<14		1000000	1000000
trans-1,2-Dichloroethene	<39		<33		<36		NV	NV
trans-1,3-Dichloropropene	<39		<33		<36		NV	NV
Trichloroethene	31	J	<33		<36		16840	24300
Vinyl acetate	<160		<130		<140		NV	1000000
Vinyl chloride	<39		<33		<36		NV	2270
Xylene, Total	240		41		<36		1000000	1000000
Semi-Volatile Organic Compounds (SVOCs) By EPA Method 8270C (µg/kg)								
1,2,4-Trichlorobenzene	<31000		<4400		<7700		NV	1000000
1,2-Dichlorobenzene	<31000		<4400		<7700		NV	NV
1,3-Dichlorobenzene	<31000		<4400		<7700		NV	NV
1,4-Dichlorobenzene	<31000		<4400		<7700		NV	NV
2,4,5-Trichlorophenol	<16000		<2200		<3900		NV	1000000
2,4,6-Trichlorophenol	<16000		<2200		<3900		NV	438000
2,4-Dichlorophenol	<16000		<2200		<3900		NV	1000000
2,4-Dimethylphenol	<16000		<2200		<3900		NV	NV
2,4-Dinitrophenol	<31000		<11000		<19000		NV	1000000
2,4-Dinitrotoluene	<16000		<2200		<3900		NV	1000000
2,6-Dinitrotoluene	<16000		<2200		<3900		NV	1000000
2-Chloronaphthalene	<16000		<2200		7000		NV	1000000
2-Chlorophenol	<31000		<4400		<7700		NV	1000000
2-Methylnaphthalene	<31000		<4400		<7700		NV	1000000

Table 1
Soil Analytical Results
Denver Municipal Animal Shelter
October 17-19, 2006

Analyte	DAS-2-8'-12'		DAS-3-8'-12'		DAS-11-12'-16'		CDPHE Commercial Landuse Soil Standards	CCoD Commercial Landuse Soil Screening Levels
	Result	Qualifier	Result	Qualifier	Result	Qualifier		
2-Methylphenol	<31000		<4400		<7700		NV	1000000
2-Nitroaniline	<16000		<2200		<3900		NV	NV
2-Nitrophenol	<31000		<4400		<7700		NV	NV
3,3'-Dichlorobenzidine	<31000		<4400		<7700		NV	10700
3-Nitroaniline	<16000		<2200		<3900		NV	NV
4,6-Dinitro-2-methylphenol	<16000		<2200		<3900		NV	NV
4-Bromophenyl phenyl ether	<16000		<2200		<3900		NV	NV
4-Chloro-3-methylphenol	<16000		<2200		<3900		NV	NV
4-Chloroaniline	<16000		<2200		<3900		NV	NV
4-Chlorophenyl phenyl ether	<16000		<2200		<3900		NV	NV
4-Methylphenol	11000	J	<4400		<7700		NV	1000000
4-Nitroaniline	<16000		<2200		<3900		NV	NV
4-Nitrophenol	<16000		<2200		<3900		NV	1000000
Acenaphthene	9000	J	<2200		<3900		NV	1000000
Acenaphthylene	<16000		<2200		<3900		NV	NV
Anthracene	15000	J	<2200		<3900		NV	1000000
Benzo(a)anthracene	38000		<2200		<3900		NV	6050
Benzo(a)pyrene	40000		<2200		<3900		NV	610
Benzo(b&k)fluoranthene	70000		<4400		<7700		NV	NV
Benzo(g,h,i)perylene	28000		<2200		<3900		NV	605000
Benzoic acid	<63000		<8800		<15000		NV	1000000
Benzyl alcohol	<31000		<4400		<7700		NV	1000000
Bis(2-chloroethoxy)methane	<31000		<4400		<7700		NV	NV
Bis(2-chloroethyl)ether	<31000		<4400		<7700		NV	NV
Bis(2-ethylhexyl)phthalate	<31000		<4400		<7700		NV	344000
Butyl benzyl phthalate	<16000		<2200		<3900		NV	1000000
Chrysene	65000		<2200		<3900		NV	605000
Dibenz(a,h)anthracene	10000	J	<2200		<3900		NV	610
Dibenzofuran	<16000		<2200		<3900		NV	1000000
Dichlorodiisopropyl ether	<31000		<4400		<7700		NV	NV
Diethyl phthalate	<16000		<2200		<3900		NV	1000000
Dimethyl phthalate	<16000		<2200		<3900		NV	1000000

Table 1
Soil Analytical Results
Denver Municipal Animal Shelter
October 17-19, 2006

Analyte	DAS-2-8'-12'		DAS-3-8'-12'		DAS-11-12'-16'		CDPHE Commercial Landuse Soil Standards	CCoD Commercial Landuse Soil Screening Levels
	Result	Qualifier	Result	Qualifier	Result	Qualifier		
Di-n-butyl phthalate	<16000		<2200		<3900		NV	1000000
Di-n-octyl phthalate	<16000		<2200		<3900		NV	1000000
Fluoranthene	96000		<2200		<3900		NV	NV
Fluorene	9700	J	<2200		<3900		NV	1000000
Hexachlorobenzene	<16000		<2200		<3900		NV	3010
Hexachlorobutadiene	<31000		<4400		<7700		NV	61800
Hexachlorocyclopentadiene	<16000		<2200		<3900		NV	1000000
Hexachloroethane	<31000		<4400		<7700		NV	344000
Indeno(1,2,3-cd)pyrene	28000		<2200		<3900		NV	6050
Isophorone	<31000		<4400		<7700		NV	NV
Naphthalene	<31000		<4400		<7700		1000000	785000
Nitrobenzene	<31000		<4400		<7700		NV	NV
N-Nitrosodi-n-propylamine	<31000		<4400		<7700		NV	700
N-Nitrosodiphenylamine	18000		<2200		<3900		NV	NV
Pentachlorophenol	<16000		<2200		<3900		NV	32400
Phenanthrene	110000		<2200		<3900		NV	NV
Phenol	<31000		<4400		<7700		1000000	1000000
Pyrene	110000		<2200		<3900		NV	1000000

B - Analyte detected in the associated Method Blank, value is not subtracted from the result

CDPHE - Colorado Department of Public Health and Environment

CCoD - City and County of Denver

J - Indicates an estimated value when the compound is detected, but is below the Lower Quantitation Limit

NV - No value available

2.7 - Blue bold value exceeds CDPHE commercial landuse soil cleanup standard

3.7 - Red bold value exceeds CCoD commercial landuse soil screening level

* - The CCoD special case soil screening standard for arsenic is 24 mg/kg. These concentrations may represent background conditions for the region.

Table 2
Groundwater Analytical Results
Denver Municipal Animal Shelter
October 17-19, 2006

Analyte	DAS-7		CDPHE Ground Water Standards
	Result (µg/L)	Qualifier	
Volatile Organic Compounds (VOCs) By EPA Method 8260B (µg/L)			
1,1,1-Trichloroethane	<2.0		200
1,1,2,2-Tetrachloroethane	<4.0		0.18
1,1,2-Trichloroethane	<4.0		2.8
1,1-Dichloroethane	<2.0		NV
1,1-Dichloroethene	<2.0		7
1,2-Dichlorobenzene	<4.0		600
1,2-Dichloroethane	<2.0		0.38
1,2-Dichloropropane	<4.0		0.52
1,3-Dichlorobenzene	<4.0		94
1,4-Dichlorobenzene	<4.0		75
2-Butanone	<20		NV
2-Chloroethylvinylether	<10		NV
2-Hexanone	<4.0		NV
4-Methyl-2-pentanone	<10		NV
Acetone	<10		NV
Benzene	<1.0		5
Bromodichloromethane	<4.0		0.56
Bromoform	<4.0		4
Bromomethane	<10		NV
Carbon disulfide	<4.0		NV
Carbon tetrachloride	<2.0		0.27
Chlorobenzene	<3.0		100
Chloroethane	<5.0		NV
Chloroform	<2.0		3.5
Chloromethane	<4.0		NV
cis-1,2-Dichloroethene	<2.0		70
cis-1,3-Dichloropropene	<2.0		NV
Dibromochloromethane	<2.0		14
Ethylbenzene	<2.0		700
Methylene chloride	<4.0		4.7
Styrene	<4.0		100
Tetrachloroethene	<2.0		5
Toluene	<2.0		1000
trans-1,2-Dichloroethene	<2.0		NV
trans-1,3-Dichloropropene	<2.0		NV
Trichloroethene	1.5	J	5
Vinyl acetate	<5.0		NV
Vinyl chloride	<2.0		0.023
Xylene, Total	<4.0		1400

J - Indicates an estimated value when the compound is detected, but is below the Lower Quantitation Limit

CDPHE - Colorado Department of Public Health and Environment

Table 3
Groundwater Elevations
Denver Municipal Animal Shelter
October 17-19, 2006

Boring	Northing (State Plane)	Easting (State Plane)	Date Measured	Top of Casing Elevation (feet)	Depth to Groundwater (ft btoc)
DAS-3	1135668.323	3141150.261	10/19/2006	95.00	16.80
DAS-7	1135529.323	3141153.429	10/19/2006	96.24	17.68
DAS-8	1135531.095	3141229.560	10/19/2006	97.34	18.75

ft btoc - feet below top of casing

**CCOD Environmental Services Division
Soil Gas Survey Field Form**

Site Name: Denver Animal Shelter

Date of Survey: October 17, 2006

Consultant: Brown and Caldwell

Consultant Proj #: 130687.010

Name(s) of Field Personnel: Tom Van Arsdale

Instruments Used: Landtec GA-90

Collection Method: Direct Push Passive Other: _____

Sampling Point	Time of Sample	Depth of Sample (ft)	Concentration (%)				Split/Dup? (If yes, complete form)	PID Reading (ppm)	Sample to Lab? (Y/N)	Sample Name
			CAS #74-82-8 CH ₄	CAS 124-38-9 CO ₂	CAS 7782-44-7 O ₂	Balance				
DAS-10	0826	6	0.0%	12.4%	9.5%	78.1%	NA	N	NA	
DAS-11	0920	6	20.0%	22.0%	0.2%	57.8%	NA	N	NA	
DAS-12	1015	6	9.0%	19.2%	0.0%	71.8%	NA	N	NA	
DAS-9	1105	6	0.0%	10.0%	12.0%	78.0%	NA	N	NA	
DAS-8	1305	6	3.9%	25.4%	0.0%	70.7%	NA	N	NA	
DAS-7	1435	6	9.2%	22.8%	0.0%	68.0%	NA	N	NA	
DAS-3	1640	6	8.6%	18.7%	0.8%	71.9%	NA	N	NA	

Notes:
 NA Not Applicable
 If sample collected in building or above ground, note depth as height above ground surface

Table 5
Estimated Thickness of Boring Landfill Material
Denver Municipal Animal Shelter
October 17-19, 2006

Boring	Northing (State Plane)	Easting (State Plane)	Date Completed	Top of Landfill Material (ft bgs)	Bottom of Landfill Material (ft bgs)	Thickness Of Boring Landfill Material (ft)
DAS-1	1135703.669	3140989.485	10/18/2006	3.9	15.0	11.1
DAS-2	1135668.499	3141061.839	10/18/2006	3.9	15.5	11.6
DAS-3	1135668.323	3141150.261	10/18/2006	3.5	16.0	12.5
DAS-4	1135668.601	3141187.610	10/18/2006	3.5	19.5 ^a	16.0 ^c
DAS-5	1135600.837	3141151.392	10/18/2006	3.0	18.0	15.0
DAS-6	1135608.290	3141222.511	10/18/2006	3.9	20.0 ^a	16.1 ^c
DAS-7	1135529.323	3141153.429	10/17/2006	4.0	20.0 ^a	16.0
DAS-8	1135531.095	3141229.560	10/17/2006	3.5	19.5 ^a	16.0 ^c
DAS-9	1135534.053	3141301.003	10/17/2006	4.5	22.0 ^b	17.5 ^c
DAS-10	1135456.051	3141303.953	10/17/2006	5.0	15.0 ^b	10.0 ^c
DAS-11	1135456.799	3141231.677	10/17/2006	3.8	15.5	11.7
DAS-12	1135451.249	3141161.322	10/17/2006	3.5	8.5	5.0

a - estimated depth due to material compaction and sample flushing

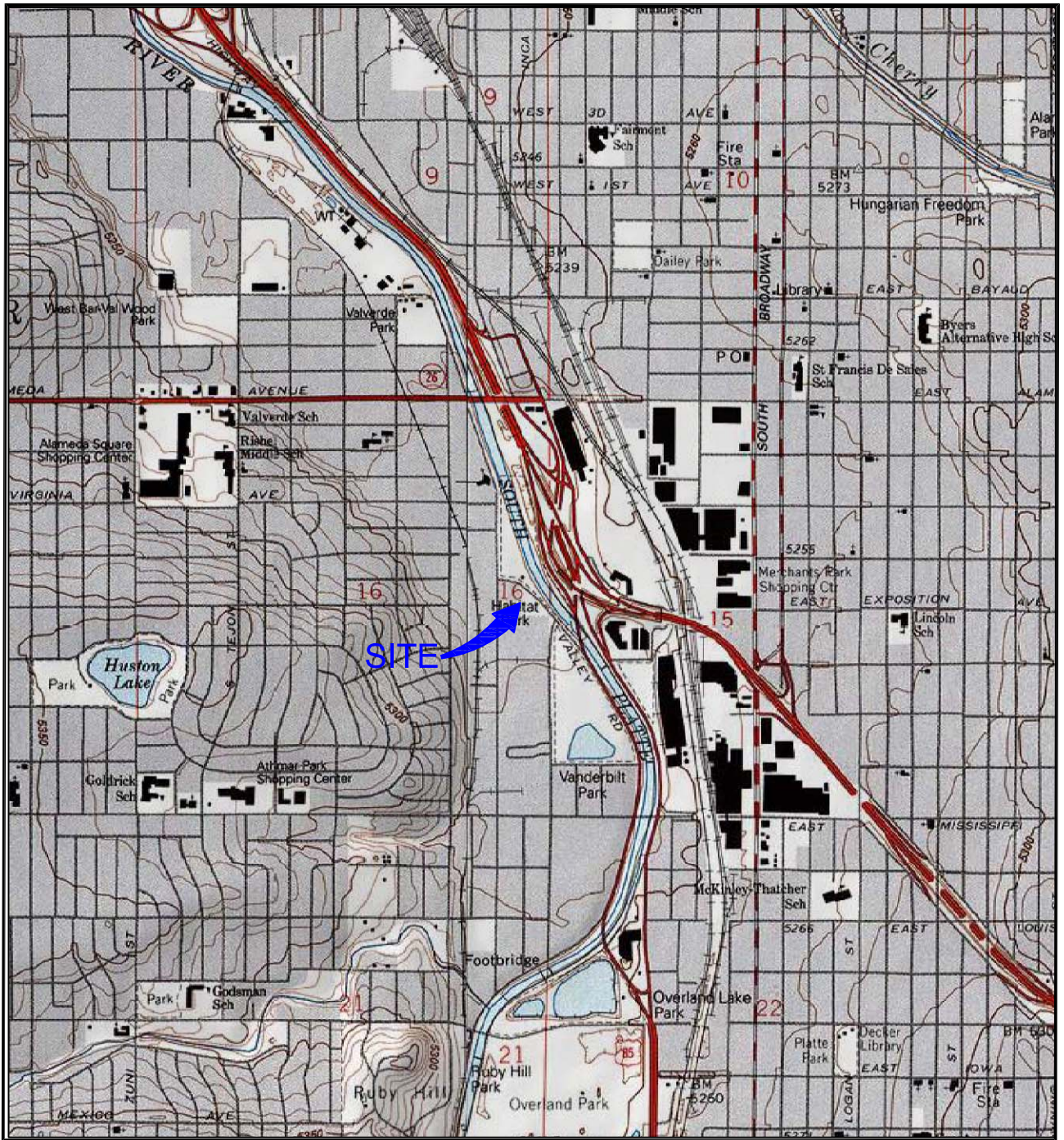
b - estimated depth due to boring refusal

c - estimated thickness

ft - feet

ft bgs - feet below ground surface

FIGURES



SOURCE: USGS 7.5 MINUTE TOPOGRAPHIC MAP - ENGLEWOOD QUAD

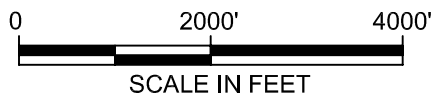
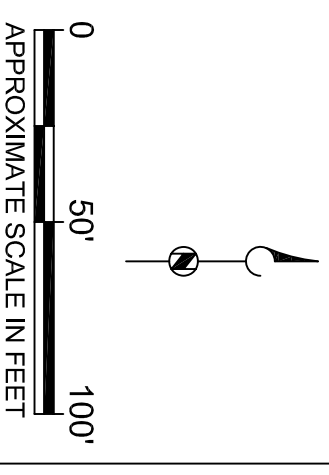
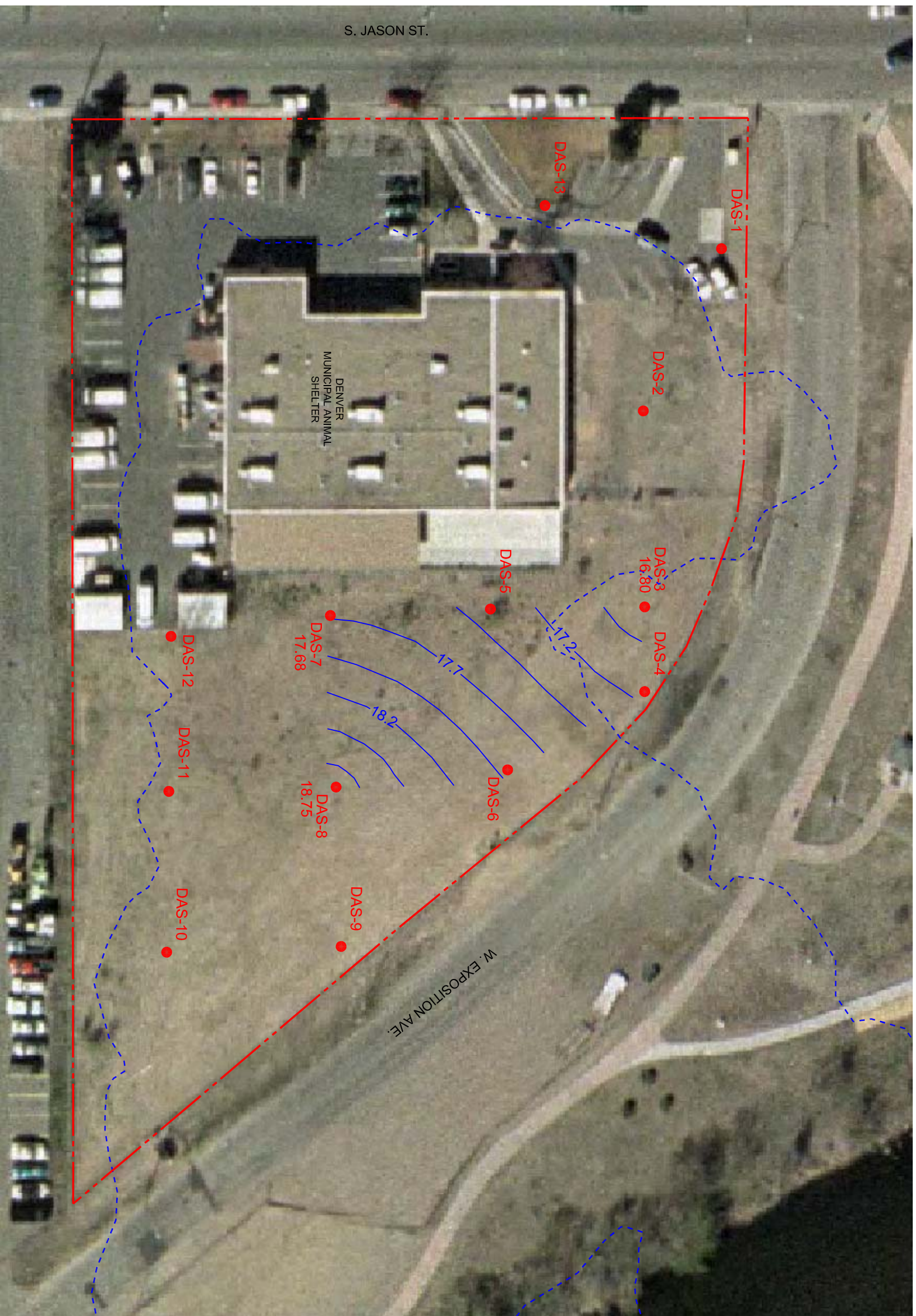


Figure 1 SITE VICINITY MAP

CITY AND COUNTY
OF DENVER
DENVER MUNICIPAL ANIMAL SHELTER
DENVER, COLORADO

**BROWN AND
CALDWELL**



LEGEND

- DAS-1 BORING LOCATION
- 18.75 GROUNDWATER ELEVATION
- BOUNDARY OF DENVER MUNICIPAL ANIMAL SHELTER
- - - APPROXIMATE AREA OF (1948) WATER FILLED GRAVEL PIT
- POTENTIOMETRIC CONTOURS

BORING CLASSIFICATION						
BORING #	S	G	SS	TMW	LGS	WS
DAS-1	✓					✓
DAS-2	✓		✓			
DAS-3	✓		✓	✓		
DAS-4	✓				✓	
DAS-5	✓		✓			
DAS-6	✓					✓
DAS-7	✓	✓		✓		✓
DAS-8	✓			✓		✓
DAS-9	✓				✓	
DAS-10	✓				✓	
DAS-11	✓		✓			✓
DAS-12	✓					✓
DAS-13						✓

- S SOIL BORING
- G GEOTECHNICAL SAMPLE COLLECTED
- SS SOIL SAMPLE COLLECTED
- TMW TEMPORARY GROUNDWATER MONITORING WELL
- LGS LANDFILL GAS SAMPLE COLLECTED
- WS WATER SAMPLE COLLECTED

BROWN AND CALDWELL

FIGURE 2 - SITE MAP WITH SAMPLE LOCATIONS AND POTENTIOMETRIC CONTOURS CITY AND COUNTY OF DENVER DENVER MUNICIPAL ANIMAL SHELTER

APPENDIX A

**FIELD NOTES, FIELD BORING LOGS, CCoD BORING LOGS
AND FIELD LANDFILL GAS FORMS**

CCOD Environmental Services Division

Boring Log Field Form

Consultant: Brown and Caldwell			Field Geologist: Tom Van Arsdale		
Site Name: Denver Animal Shelter			Project Number: 130687.010		
Driller: Environmental Services Network			Boring Number: DAS-1		
Drilling Date: October 18, 2006			Drilling Method: Direct Push		
Sample Collection/Drive Method: Dual Tube System					
Field Instruments Used: Landtec GA-90, PID					
Samples Collected?		Headspace Performed?		Background PID Measured?	
Yes	No X	Yes X	No	Yes	No X

Depth of Drive (ft)	Symbol	Description (profile)	Drive Info.		Sample Information								
			Blows/6 in.	Recovery (ft)	Sample Interval (ft)	Headspace (ppm)	Time (Unique Value)	Sample Name for Lab	Split/Duplicate? (if yes, complete form)	Composite? (If yes, complete form)	Background PID (ppm)		
2		No recovery		0									
4.0	SM	Sand, lt-med-brn, subang, f-coarse gr, well graded, loose, dry, silty, sl yellow stain and burnt material at 3.9'		2		14.4							
8	SM	Sand, lt-med-brn, subang, f-coarse gr, well graded, loose, dry, silty, white ash, burnt wood chips, brick and glass fragments		2		0.9							
12	SW	Sand, f-coarse gr, subang, white, black, some pink, burnt appearance throughout, loose, dry, few gravel		4		0.6							
15	SW	Sand, f-coarse gr, subang, loose, dry, with white ash		3									
16	SW	Sand, m-coarse gr, clear, white, pink, subang-subrd, well graded, loose, wet (native sand)		1		0							
Depth to Water (ft)		Final Depths (ft)		Well Details (ft)		Diameters (in.)		Materials:					
At Drilling: 15		Boring: 16		Top Screen:		Boring: 2		Sand:					
		Well:		Bottom Screen:		Well:		Grout:					
		To Bedrock: 15		To Sand:				Seal:					
				To Seal:				Surface Grout: Bentonite					

**CCOD Environmental Services Division
Boring Log Field Form**

Consultant: Brown and Caldwell		Field Geologist: Tom Van Arsdale	
Site Name: Denver Animal Shelter		Project Number: 130687.010	
Driller: Environmental Services Network		Boring Number: DAS-2	
Drilling Date: October 18, 2006		Drilling Method: Direct Push	
Sample Collection/Drive Method: Dual Tube System			
Field Instruments Used: Landtec GA-90, PID			
Samples Collected?		Headspace Performed?	
Yes <input checked="" type="checkbox"/> No		Yes <input checked="" type="checkbox"/> No	
		Background PID Measured?	
		Yes No <input checked="" type="checkbox"/>	

Depth of Drive (ft)	Symbol	Description (profile)	Drive Info.		Sample Information								
			Blows/6 in.	Recovery (ft)	Sample Interval (ft)	Headspace (ppm)	Time (Unique Value)	Sample Name for Lab	Split/Duplicate? (if yes, complete form)	Composite? (If yes, complete form)	Background PID (ppm)		
1		No recovery		0									
4	SM	Sand, lt-med brn, f-coarse gr, subang, well graded, loose dry, silty, with white sand interval at 3'-3.5', brick fragments at 3.9'		3		0							
8	SM	Sand, lt-med brn, f-coarse gr, subang, well graded, loose dry, silty, with F ₂ O stain at 7.5'		1		0.4							
12		Landfill debris, wood chips with moist black coating with oil odor, burnt, black to 11.5', white ash 11.5'-12'		4	8'-12'	NES	1430		Soil Smpl DAS-2-8'- 12'				
15.5	SW	Sand, m-coarse gr, dk gray-blk, subang, loose, well graded, dry, few brick fragments		3.5		0.3							
16	SW	Sand, m-coarse gr, white, pink, subang-subrd, well graded, loose, wet (native sand)		0.5									
Depth to Water (ft)		Final Depths (ft)		Well Details (ft)			Diameters (in.)		Materials:				
At Drilling: 15.5		Boring: 16		Top Screen:			Boring: 2		Sand:				
		Well:		Bottom Screen:			Well:		Grout:				
		To Bedrock: 15.5		To Sand:					Seal:				
				To Seal:					Surface Grout: Bentonite				

**CCOD Environmental Services Division
Boring Log Field Form**

Consultant: Brown and Caldwell		Field Geologist: Tom Van Arsdale	
Site Name: Denver Animal Shelter		Project Number: 130687.010	
Driller: Environmental Services Network		Boring Number: DAS-3	
Drilling Date: October 17-18, 2006		Drilling Method: Direct Push	
Sample Collection/Drive Method: Dual Tube System			
Field Instruments Used: Landtec GA-90, PID			
Samples Collected?		Headspace Performed?	
Yes <input checked="" type="checkbox"/> No		Yes <input checked="" type="checkbox"/> No	
		Background PID Measured?	
		Yes No <input checked="" type="checkbox"/>	

Depth of Drive (ft)	Symbol	Description (profile)	Drive Info.		Sample Information							
			Blows/6 in.	Recovery (ft)	Sample Interval (ft)	Headspace (ppm)	Time (Unique Value)	Sample Name for Lab	Split/Duplicate? (if yes, complete form)	Composite? (If yes, complete form)	Background PID (ppm)	
3		Collected Geotech sample at 1'8" - 3.0'. Shut down drilling operations for the day.		0	1'8"-3'		1700	Geotech Smpl DAS 3-1'8"-3'				
2		Offset Geotech sample borehole and resume drilling operations 10/18/2006. No recovery		0								
3.5	SM	Sand, lt-med brn, subang, f-coarse gr, loose, dry, silty		1.5		0.9						
4	SM	Sand, black burned, subang, f-coarse gr, loose, dry, silty		0.5								
5		No recovery		0								
7	SM	Sand, black burned, subang, f-coarse gr, loose, dry, silty, glass fragments		2		0.6						
8	SM	Sand, black with orange brick fragments, subang-subrd, m-coarse gr, loose, dry, silty		1								
10.5		No recovery		0								
11	SM	Sand, black and green with orange brick fragments, subang-subrd, m-coarse gr, loose, dry, silty		0.5	8'-12'	NES	0900	Soil Smpl DAS-3- 8'-12'				
12		Landfill debris, wood chips, black, moist coating with oil odor		1								
14		No recovery		0								
16		Landfill debris, black material with wood, glass and brick fragments, moist at 15.5'		2		4.7						
20	SW	Sand, m-coarse gr, subrd, well graded, loose, wet (native sand). Set temporary well.		0.5		0.4						
Depth to Water (ft)		Final Depths (ft)	Well Details (ft)		Diameters (in.)		Materials:					
At Drilling: 16		Boring: 20	Top Screen: 14.5		Boring: 2		Sand:					
		Well: 19.5	Bottom Screen: 19.5		Well: 1		Grout:					
		To Bedrock: 16	To Sand:				Seal:					
			To Seal:				Surface Grout: Bentonite					

**CCOD Environmental Services Division
Boring Log Field Form**

Consultant: Brown and Caldwell		Field Geologist: Tom Van Arsdale	
Site Name: Denver Animal Shelter		Project Number: 130687.010	
Driller: Environmental Services Network		Boring Number: DAS-4	
Drilling Date: October 18, 2006		Drilling Method: Direct Push	
Sample Collection/Drive Method: Dual Tube System			
Field Instruments Used: Landtec GA-90, PID			
Samples Collected?		Headspace Performed?	
Yes	No X	Yes X	No
Background PID Measured?		Background PID Measured?	
Yes		No X	

Depth of Drive (ft)	Symbol	Description (profile)	Drive Info.		Sample Information							
			Blows/6 in.	Recovery (ft)	Sample Interval (ft)	Headspace (ppm)	Time (Unique Value)	Sample Name for Lab	Split/Duplicate? (if yes, complete form)	Composite? (If yes, complete form)	Background PID (ppm)	
2		No recovery		0								
3.5	SM	Sand, lt-med-brn, subang, f-coarse gr, well graded, loose, dry, silty		1.5		0.2						
4	SM	Sand, lt-med-brn, subang, f-coarse gr, well graded, loose, dry, silty, with F ₂ O stain and black burned material		0.5								
8	SM	Sand, lt-med-brn, subang, f-coarse gr, well graded, loose, dry, silty, black burned cinders, wood strips at 6'		4		0.4						
12	SM	Sand, lt-med-brn, subang, f-coarse gr, well graded, loose, dry, with greenish black silt, brick fragments at 11.5'		4		0.7						
15		Landfill material, wood chips, brick fragments, greenish black with oil odor. Refusal at 15'		1		3.1						
16		No sample. Moved rig 1' to northeast and resumed coring at 16'		0		NES						
20		Landfill materials, red vinyl/rubber material, green vinyl/rubber material, burnt materials, all moist with oil odor, wet at 19.5'		0.5		13.2						
24		No recovery, liner wet (smpl apparently flushed)		0		NES						
Depth to Water (ft)		Final Depths (ft)	Well Details (ft)		Diameters (in.)		Materials:					
At Drilling: Est. 19.5		Boring: 24	Top Screen:		Boring: 2		Sand:					
		Well:	Bottom Screen:		Well:		Grout:					
		To Bedrock: Est. 19.5	To Sand:				Seal:					
			To Seal:				Surface Grout: Bentonite					

**CCOD Environmental Services Division
Boring Log Field Form**

Consultant: Brown and Caldwell		Field Geologist: Tom Van Arsdale	
Site Name: Denver Animal Shelter		Project Number: 130687.010	
Driller: Environmental Services Network		Boring Number: DAS-5	
Drilling Date: October 18, 2006		Drilling Method: Direct Push	
Sample Collection/Drive Method: Dual Tube System			
Field Instruments Used: Landtec GA-90, PID			
Samples Collected?		Headspace Performed?	
Yes <input checked="" type="checkbox"/> No		Yes <input checked="" type="checkbox"/> No	
		Background PID Measured?	
		Yes No <input checked="" type="checkbox"/>	

Depth of Drive (ft)	Symbol	Description (profile)	Drive Info.		Sample Information								
			Blows/6 in.	Recovery (ft)	Sample Interval (ft)	Headspace (ppm)	Time (Unique Value)	Sample Name for Lab	Split/Duplicate? (if yes, complete form)	Composite? (If yes, complete form)	Background PID (ppm)		
3		No recovery		0	1'8"-3'		1.4	0957	Geotech Smpl DAS 5-1'8"-3'				
4	SM	Sand, f-coarse gr, lt-med brn, subang-subrd, well graded, loose, dry, with glass fragments		1									
6		No recovery		0									
7	SM	Sand, f-coarse gr, lt brn, lt green, subang-subrd, well graded, loose, dry		1			4.9						
8	SM	Sand, f-coarse gr, green, black, subang-subrd, well graded, loose, dry, with brick fragments		1									
12		Landfill material, wood chips, green "plastic" chips, glass, white ash layer at 11.5'		4			1.8						
13		No recovery		0									
15	SM	Sand, f-coarse gr, white, black, pink, subang, loose, dry white ash layer at 13.5'		2			0.9						
16	SM	Sand, f-coarse gr, white, pink, black burned material, subang, loose, dry		1									
17		No recovery		0									
18	SW	Sand, f-coarse gr, white, pink, black burned material, subang, loose, dry		1			0.9						
20	SW	Sand, m-coarse gr, subang-subrd, well graded, clear, med brn, pink, loose, wet (native sand)		2									
Depth to Water (ft)		Final Depths (ft)		Well Details (ft)		Diameters (in.)		Materials:					
At Drilling: 18		Boring: 20		Top Screen:		Boring: 2		Sand:					
		Well:		Bottom Screen:		Well:		Grout:					
		To Bedrock: 18		To Sand:				Seal:					
				To Seal:				Surface Grout: Bentonite					

**CCOD Environmental Services Division
Boring Log Field Form**

Consultant: Brown and Caldwell		Field Geologist: Tom Van Arsdale	
Site Name: Denver Animal Shelter		Project Number: 130687.010	
Driller: Environmental Services Network		Boring Number: DAS-6	
Drilling Date: October 18, 2006		Drilling Method: Direct Push	
Sample Collection/Drive Method: Dual Tube System			
Field Instruments Used: Landtec GA-90, PID			
Samples Collected?		Headspace Performed?	
Yes	No X	Yes X	No
		Background PID Measured?	
		Yes	No X

Depth of Drive (ft)	Symbol	Description (profile)	Drive Info.		Sample Information							
			Blows/6 in.	Recovery (ft)	Sample Interval (ft)	Headspace (ppm)	Time (Unique Value)	Sample Name for Lab	Split/Duplicate? (if yes, complete form)	Composite? (if yes, complete form)	Background PID (ppm)	
3		No recovery		0								
4	SM	Sand, f-coarse gr, lt-med brn, subang, well graded, loose, dry, silty, with small brick pieces at 3.9'		1		1.9						
12		No recovery. Move rig 2' south and resume coring at 12'		0		NES						
13		No recovery		0								
14	SM	Sand, f-coarse gr, lt-med brn, subang, well graded, loose, dry, silty, with white ash		1								
15	SM	Sand, f-coarse gr, lt-med brn, subang, well graded, loose, dry, silty, with orange brick fragments		1		5.8						
16		Landfill debris, wood chips, greenish black, slight oil odor		1								
20		Landfill debris, wood chips, black burned material, amber glass fragments, moist		4		24.3						
24		No recovery, liner wet		0		NES						
28		No recovery, liner wet (smpl apparently flushed)		0		NES						
Depth to Water (ft)		Final Depths (ft)		Well Details (ft)		Diameters (in.)		Materials:				
At Drilling: Est. 20		Boring: 28		Top Screen:		Boring: 2		Sand:				
		Well:		Bottom Screen:		Well:		Grout:				
		To Bedrock: Est. 20		To Sand:				Seal:				
				To Seal:				Surface Grout: Bentonite				

**CCOD Environmental Services Division
Boring Log Field Form**

Consultant: Brown and Caldwell		Field Geologist: Tom Van Arsdale	
Site Name: Denver Animal Shelter		Project Number: 130687.010	
Driller: Environmental Services Network		Boring Number: DAS-7	
Drilling Date: October 17, 2006		Drilling Method: Direct Push	
Sample Collection/Drive Method: Dual Tube System			
Field Instruments Used: Landtec GA-90, PID			
Samples Collected?		Headspace Performed?	
Yes <input checked="" type="checkbox"/> No		Yes <input checked="" type="checkbox"/> No	
		Background PID Measured?	
		Yes No <input checked="" type="checkbox"/>	

Depth of Drive (ft)	Symbol	Description (profile)	Drive Info.		Sample Information								
			Blows/6 in.	Recovery (ft)	Sample Interval (ft)	Headspace (ppm)	Time (Unique Value)	Sample Name for Lab	Split/Duplicate? (if yes, complete form)	Composite? (if yes, complete form)	Background PID (ppm)		
1.5		No recovery		0									
4	SM	Sand, silty, f-med gr, lt-med brn, subang, well graded, loose, dry		2.5	1'8"-3'		34.8	1500	Geotech Smpl DAS-7-1'8"-3'				
8		Landfill material, orange brick and black burned materials, green plastic		1			6.9						
10		No recovery		0									
11	SM	Sand, silty, f-med gr, subang, pink, well graded, loose, dry, with black burned materials		1			1.1						
12	SM	Sand, silty, f-med gr, subang, clear, lt-med gray, well graded, loose, dry, with black burned material		1									
14		No recovery		0									
15	SM	Sand, f-coarse gr, dk gray-black, subang, well graded, loose, dry,		1	water level @ 14.4'		0.5	1615	GW Smpl DAS-7				
16	ML	Silt, very clayey, black with F2O stain, med stiff		1									
24		No recovery. 20'-24' liner wet.		0			NES						
28	SW	Sand, f-coarse gr, lt-dk brn, orange, clear-white, subang-subrd, well graded, loose, wet, tr gravel (liner full of water and native sand). Set temporary well.		4			0.1						
Depth to Water (ft)		Final Depths (ft)		Well Details (ft)		Diameters (in.)			Materials:				
At Drilling: Est. 20		Boring: 28		Top Screen: 22		Boring: 2			Sand:				
		Well: 27		Bottom Screen: 27		Well: 1			Grout:				
		To Bedrock: Est. 20		To Sand:					Seal:				
				To Seal:					Surface Grout: Bentonite				

**CCOD Environmental Services Division
Boring Log Field Form**

Consultant: Brown and Caldwell		Field Geologist: Tom Van Arsdale	
Site Name: Denver Animal Shelter		Project Number: 130687.010	
Driller: Environmental Services Network		Boring Number: DAS-8	
Drilling Date: October 17, 2006		Drilling Method: Direct Push	
Sample Collection/Drive Method: Dual Tube System			
Field Instruments Used: Landtec GA-90, PID			
Samples Collected?		Headspace Performed?	
Yes	No X	Yes X	No
		Background PID Measured?	
		Yes	No X

Depth of Drive (ft)	Symbol	Description (profile)	Drive Info.		Sample Information								
			Blows/6 in.	Recovery (ft)	Sample Interval (ft)	Headspace (ppm)	Time (Unique Value)	Sample Name for Lab	Split/Duplicate? (if yes, complete form)	Composite? (If yes, complete form)	Background PID (ppm)		
2		No recovery		0									
3.5	SM	Sand, lt-med brn, f-med gr, subang, well greded, dry, silty, few coarse gr		1.5		0.5							
4	SM	Sand, lt-med brn, f-med gr, subang, well graded, dry, silty, F ₂ O stain and red fabric pieces		0.5									
8	SM	Black burned material with sand, m-coarse gr, white-black, subang, well graded, sl silty, dry (crushed core liner)		0.33		0.3							
10		Landfill material, black, burned, wood pieces/chunks		2									
12	SM	Sand, f-med gr with gravel, lt-olive green, subrd, loose, dry		2		0.7							
16		Landfill material, orange brick material at 12'-13', black burned material at 13'-14', white ash layer at 14'-15', black burned material with brick fragments at 15'-16'		4		6.3							
20		No recovery (bottom of liner appeared wet at approximately 19.5')		0		NES							
24		Landfill material, black, wood chips and oil odor, wet. Refusal at 24'. Set temporary well.		0.5		2.0							
Depth to Water (ft)		Final Depths (ft)	Well Details (ft)		Diameters (in.)		Materials:						
At Drilling: Est. 19.5		Boring: 24 - Refusal	Top Screen: 19		Boring: 2		Sand:						
		Well: 24	Bottom Screen: 24		Well: 1		Grout:						
		To Bedrock: Est. 19.5	To Sand:				Seal:						
			To Seal:				Surface Grout: Bentonite						

**CCOD Environmental Services Division
Boring Log Field Form**

Consultant: Brown and Caldwell		Field Geologist: Tom Van Arsdale	
Site Name: Denver Animal Shelter		Project Number: 130687.010	
Driller: Environmental Services Network		Boring Number: DAS-9	
Drilling Date: October 17, 2006		Drilling Method: Direct Push	
Sample Collection/Drive Method: Dual Tube System			
Field Instruments Used: Landtec GA-90, PID			
Samples Collected?		Headspace Performed?	
Yes	No X	Yes X	No
Background PID Measured?		Background PID Measured?	
Yes	No X	Yes	No X

Depth of Drive (ft)	Symbol	Description (profile)	Drive Info.		Sample Information							
			Blows/6 in.	Recovery (ft)	Sample Interval (ft)	Headspace (ppm)	Time (Unique Value)	Sample Name for Lab	Split/Duplicate? (if yes, complete form)	Composite? (if yes, complete form)	Background PID (ppm)	
1.5		No recovery		0								
4	SM	Sand, lt-med brn, lt gray, orange at 3.4'-3.6', f-coarse gr, subang, well graded, dry, silty		2.5		0.1						
8	SM	Sand, lt brn at 4.0'-4.5', white ash at 4.5'-5.0', med brn at 5.0'-5.5', black at 5.5'-8.0', f-coarse gr, subang, well graded, dry, silty		4		0.3						
12	SM	Sand, dk gray-black, burned, f-coarse gr, subang, well graded, dry, silty, wood chips		4		0.4						
16	SM	Sand, greenish black, green, f-med gr, subang-subrd, poorly graded, dry, silty, orange brick material at 14'-14.5'		4		0.2						
18		No recovery		0								
19	SM	Sand, lt-med gray, pink, f-coarse gr, subang, well graded, dry, silty		1		31.2						
20	ML	Clay, silty with burned materials, wood fragments, sl moist, green-black, soft, strong oil odor		1								
22	ML	Clay, silty, green-black, sl moist, soft, paper and fabric materials, wood strips. Refusal at 22'		2		9.1						
Depth to Water (ft)		Final Depths (ft)	Well Details (ft)		Diameters (in.)		Materials:					
At Drilling:		Boring: 22 - Refusal	Top Screen:		Boring: 2		Sand:					
		Well:	Bottom Screen:		Well:		Grout:					
		To Bedrock:	To Sand:				Seal:					
			To Seal:				Surface Grout: Bentonite					

**CCOD Environmental Services Division
Boring Log Field Form**

Consultant: Brown and Caldwell		Field Geologist: Tom Van Arsdale	
Site Name: Denver Animal Shelter		Project Number: 130687.010	
Driller: Environmental Services Network		Boring Number: DAS-10	
Drilling Date: October 17, 2006		Drilling Method: Direct Push	
Sample Collection/Drive Method: Dual Tube System			
Field Instruments Used: Landtec GA-90, PID			
Samples Collected?		Headspace Performed?	
Yes	No X	Yes X	No
Background PID Measured?		Background PID Measured?	
Yes		No X	

Depth of Drive (ft)	Symbol	Description (profile)	Drive Info.		Sample Information							
			Blows/6 in.	Recovery (ft)	Sample Interval (ft)	Headspace (ppm)	Time (Unique Value)	Sample Name for Lab	Split/Duplicate? (if yes, complete form)	Composite? (If yes, complete form)	Background PID (ppm)	
2		No recovery		0								
3	SM	Sand, lt-md brn, subang, f-gr, loose, dry, silty		1								
3.5	SM	Sand, med-coarse gr, lt brn, pink, subang, well graded, loose, dry, silty		0.5		0.4						
4	ML	Silt, med-dk brn, dry		0.5								
7.5	SM	Sand, med-coarse gr, subang, loose, dry, mainly black, F ₂ O stain at 4.5', glass fragments at 5', silty, few brick fragments, few gravel		3.5		0.3						
8	ML	Silt, black		0.5								
12	ML	Silt, black, wood frag, red crushed brick, moist at 12'		3		0.4						
15		Black wood chips, written/printed material, oily odor on greenish blk wood chips. Refusal at 15'		0.33		112.0						
Depth to Water (ft)		Final Depths (ft)		Well Details (ft)		Diameters (in.)		Materials:				
At Drilling:		Boring: 15 - Refusal		Top Screen:		Boring: 2		Sand:				
		Well:		Bottom Screen:		Well:		Grout:				
		To Bedrock:		To Sand:				Seal:				
				To Seal:				Surface Grout: Bentonite				

**CCOD Environmental Services Division
Boring Log Field Form**

Consultant: Brown and Caldwell		Field Geologist: Tom Van Arsdale	
Site Name: Denver Animal Shelter		Project Number: 130687.010	
Driller: Environmental Services Network		Boring Number: DAS-11	
Drilling Date: October 17, 2006		Drilling Method: Direct Push	
Sample Collection/Drive Method: Dual Tube System			
Field Instruments Used: Landtec GA-90, PID			
Samples Collected?		Headspace Performed?	
Yes <input checked="" type="checkbox"/> No		Yes <input checked="" type="checkbox"/> No	
		Background PID Measured?	
		Yes No <input checked="" type="checkbox"/>	

Depth of Drive (ft)	Symbol	Description (profile)	Drive Info.		Sample Information							
			Blows/6 in.	Recovery (ft)	Sample Interval (ft)	Headspace (ppm)	Time (Unique Value)	Sample Name for Lab	Split/Duplicate? (if yes, complete form)	Composite? (If yes, complete form)	Background PID (ppm)	
2.5		No recovery		0								
4	SM	Sand, f-coarse gr, subang, loose, well graded, dry, med brn, silty, white ash layer at 3.8'		2.5		3.8						
7	SM	Sand, med-coarse gr, subang, loose, well graded, dry, med brn, black burn material at 6'		3								
8	SM	Sand, med-coarse gr, subang, loose, well graded, dry, med brn, with greenish blk silt with red brick fragments		1		21.7						
12	SM	Sand, f-coarse gr, silty, greenish blk, loose, dry, blk and red brick fragments		0.33		NES						
15.5		Landfill materials - paper, wood chips, brick fragments with oily odor		3.5								
16	SP	Sand, med-coarse gr, poorly graded, subrd, med dense, dry (native sand)		0.5	12'-16'	NES	0950	Soil Smpl DAS-11 12'-16'				
Depth to Water (ft)		Final Depths (ft)		Well Details (ft)		Diameters (in.)		Materials:				
At Drilling:		Boring: 16		Top Screen:		Boring: 2		Sand:				
		Well:		Bottom Screen:		Well:		Grout:				
		To Bedrock: 15.5		To Sand:				Seal:				
				To Seal:				Surface Grout: Bentonite				

**CCOD Environmental Services Division
Boring Log Field Form**

Consultant: Brown and Caldwell		Field Geologist: Tom Van Arsdale	
Site Name: Denver Animal Shelter		Project Number: 130687.010	
Driller: Environmental Services Network		Boring Number: DAS-12	
Drilling Date: October 17, 2006		Drilling Method: Direct Push	
Sample Collection/Drive Method: Dual Tube System			
Field Instruments Used: Landtec GA-90, PID			
Samples Collected?		Headspace Performed?	
Yes	No X	Yes X	No
		Background PID Measured?	
		Yes	No X

Depth of Drive (ft)	Symbol	Description (profile)	Drive Info.		Sample Information								
			Blows/6 in.	Recovery (ft)	Sample Interval (ft)	Headspace (ppm)	Time (Unique Value)	Sample Name for Lab	Split/Duplicate? (if yes, complete form)	Composite? (If yes, complete form)	Background PID (ppm)		
2		No recovery		0									
4	SM	Sand, f-coarse gr, lt-med brn, pink, loose, well graded, dry, brick frag at 3.5', black silt at 3.7'-4.0'		2		0.2							
8		Landfill material - black burn materials, paper, wood chips		4		0.2							
8.5				0.5									
12	SW	Sand, m-coarse gr, few gravel, lt-dk brn, subang, well graded, dry, loose (native sand)		3.5		0.2							
Depth to Water (ft)		Final Depths (ft)	Well Details (ft)			Diameters (in.)		Materials:					
At Drilling:		Boring: 12	Top Screen:			Boring: 2		Sand:					
		Well:	Bottom Screen:			Well:		Grout:					
		To Bedrock: 8.5	To Sand:					Seal:					
			To Seal:					Surface Grout: Bentonite					

Denver Animal Shelter

October 2006

SAMPLE - DAS 1 6' 1450 10/17/06

CH4 - 42.0

O2 - 0

CO2 - 23.1

BAL - 34.9

SAMPLE - DAS 2 6' 1410 10/18/06

CH4 - 51.2

O2 - 0.7

CO2 - 28.8

BAL - 19.3

SAMPLE - DAS 3 6' 1640 10/17/06

CH4 - 8.6

O2 - 0.8

CO2 - 18.7

BAL - 79.9

SAMPLE - DAS 4 6' 12:37 10/18/06

CH4 - 0.0

O2 - 12.3

CO2 - 8.2

BAL - 79.5

Denver Animal Shelter
October 2006

SAMPLE - DAS 5 6' @ 0953 10/18/06

CH4 - 14.4

O2 - 9.4

CO2 - 15.6

BAL - 60.6

SAMPLE - DAS 6 6' @ 1055 10/18/06

CH4 - 1.6

O2 - 0

CO2 - 21.7

BAL - 76.7

SAMPLE - DAS 7 6' @ 1435 10/17/06

CH4 - 9.2

O2 - 0

CO2 - 22.8

BAL - 68.0

SAMPLE - DAS-8 6' @ 1305 10/17/06

CH4 - 3.9

O2 - 0

CO2 - 25.4

BAL - 70.7

Denver Animal Shelter

October 2006

SAMPLE - DAS 9 6' @ 1105 10/17/06

CH4 - 0

O2 - 12.0

CO2 - 10.0

BAL - 78.0

SAMPLE - DAS 10 6' @ 0826 10/17/06

CH4 - 0

O2 - ~~11.5~~ 9.5

CO2 - 12.4

BAL - 78.1

SAMPLE - DAS 11 6' @ 0920 10/17/06

CH4 - 20.0

O2 - 0.2

CO2 - 22.0

BAL - 57.8

SAMPLE - DAS 12 6' @ 1015 10/17/06

CH4 - 9.0

O2 - 0

CO2 - 19.2

BAL - ~~71.8~~

Denver Animal Shelter
October 2006

SAMPLE - DAS 13 6' @ 1525 10/18/06

CH4 - 28.5

O2 - 0

CO2 - 15.9

BAL - 55.6

SAMPLE - DAS 14

CH4 -

O2 -

CO2 -

BAL -

SAMPLE - DAS 15

CH4 -

O2 -

CO2 -

BAL -

SAMPLE - DAS 16

CH4 -

O2 -

CO2 -

BAL -

Location Denver Animal Shelter Date 10/17/06
Project / Client 130687.010 CCoD

0730 - On location
0812 - PID low - call Matt
0817 - H+S Meeting

0822 - Methane test @ DAS-10
0830 - Start core @ DAS-10

0920 - Methane test @ DAS-11
CH4 = 20.90%
0930 - Start core @ DAS-11

0950 - Smp/d DAS-11-12-K
Soil smp
3 containers

10/5 - Methane test @ DAS-12
1020 Start core @ DAS-12

1035 Meet with Deb Gomez & Lisa

129738.006

Berkeley Lake

CCoD

130687.005

Ferril Lake

CCoD "Life in the Rain"

ALL-WEATHER
Environmental
FIELD BOOK

No. 550

130687.010
Denver Animal Shelter

CCoD

Location Denver Animal Shelter Date 10/17/06
Project / Client 130687.010 CCoD

1105 Methane test @ DAS-9

1115 Start core @ DAS-9

1205 Lunch & warm-up

1305 Methane test @ DAS-8

1315 Start core @ DAS-8

very poor recovery 16-24', but encountered wtr for first time today. Will attempt to set well. Successful, set 5' of screen @ 24' bgs and (20' of riser) 19' below surface, 1' above surface time = 1415

1435 Methane test @ DAS-7

1500 Geotech smpl 1.8' - 3.0' bgs

1508 Start Core @ DAS-7

Location Denver Animal Shelter Date 10/17/06
Project / Client 130687.010 CCoD

Set well at DAS-7

1610-1410 Water level bgr = 14.4'
1415 Smpl'd DAS-7 GW, 2 vacs
1615

Set well 5' screen @ 27' bgs
25' riser, 22' bgs

1640 Methane test @ DAS-3

1700 Geotech smpl 1.8' - 3.0' bgs

Shut down for today

Tom Van Arsdale

Jason of Denver Animal Shelter OK'd me holding onto BACK GATE keys until tomorrow.

Location Denver Animal Shelter Date 10/18/06
 Project / Client 130687, 010 CCoD

0730 On location w/6 drillers

Equipment - Direct Push: Geoprobe
 DT-54

Methane Detector: Landtec GA-90
 Gas Analyzer

0825 Drillers arrive

0840 Hqs Meeting

0845 Start core at DAS-3

0900 Collect Smp^l DAS-3-8-12' soil smp^l
 3 containers

0910 Set well to 19.5'

5' Screen

14.5' Riser bgs

.5' Riser above ground

0923 Driller left to obtain fuel for Geoprobe

Location Denver Animal Shelter Date 10/18/06
 Project / Client 130687, 010 CCoD

0950 Methane test @ DAS-5

0957 Start Core Geotech Smp^l
 DAS-5 18"-3.0'

1010 Start Core @ DAS-5
 hit rock, will start over

1055 Methane test @ DAS-6

1103 Start Core @ DAS-6

0-4 Smp^l - collapse liner

At 12' moved rig over two ft south
 and cored 12-16 "

Call Deb Gomez - Blastop locations
 not necessary

1235 Methane test @ DAS-4
 quick lunch

1300 Start Core @ DAS-4
 had returned @ 15', more 1' to NE
 and pushed to 16' and resumed
 coring.

Location Denver Animal Shelter Date 10/18/06
Project / Client 130687.010 CCoD

1410 Start Methane test @ DAS-2
City Reading = 51.270 !!

1420 Start core @ DAS-2
1430 Collected soil/smpl DAS-2-8-12'

1450 Start Methane Test @ DAS-1

1500 Start Core @ DAS-1

1525 Start Methane Test @ DAS-13

1540 Lock both gates & Leave location

Tam Van Arsdale

1610 Delivered Lab smpls to Evergreen

Location Denver Animal Shelter Date 10/19/06
Project / Client 130687.010 CCoD

1435

"Temporary" Bench Mark

East gate of fence yard, north post
of gate (west gate of the 2 gates)

Shot = 0.25
instrument ht = 100.25

DAS-8 = 2.91

DAS-7 = 4.01

DAS-3 = 5.25

Back shot to BM-0.25

with levels @ 1510

DAS-8 = 18.75' BTOC

DAS-7 = 17.68' BTOC

DAS-3 = 16.80' BTOC

Location Denver Animal Shelter Date 10/19/06
Project / Client 130687.010 CCoD

Pulled casing from all three wells
and placed bentonite in holes to surface

535 Use Trimble ^{Geo} GH to x, y locate
DAS-1 through DAS-13

1555 Leave location

Jon Van Arsdale

Location _____ Date _____
Project / Client _____

Large grid area for notes on page 21.

APPENDIX B

LABORATORY DATA WITH CHAIN-OF-CUSTODY FORM

WORK ORDER Summary**Evergreen Analytical, Inc.****06-7267**

Rpt To: Tom Van Arsdale

Email To: tvanarsdale@brwncald.com

Brown & Caldwell

10/20/2006 10:55:58 AM

1697 Cole Blvd. Suite 200

Client Project ID: Denver Animal Shelter

Golden, CO 80401

(303) 239-5478

QC Level: LEVEL I

Comments: Under CCOD contract. CCOD projects require all QC (MB, LCS, LCS, LCSD if analyzed, MS, MSD, and DUP if analyzed) to be reported. PDF and EDD in Farrell format.

Sample ID	Client Sample ID	Matrix	Collection Date	Date Received	Test Code	Test Name	Hold MS	Date Due	Hold Time
06-7267-01A	DAS-11-12-16'	Soil	10/17/06 0950	10/18/06	8260_S *	8260B: VOA HSL	<input type="checkbox"/>	11/01/06	10/31/06
06-7267-01B	DAS-11-12-16'	Soil	10/17/06 0950	10/18/06	8270_S *	8270C: BNA HSL	<input type="checkbox"/>	11/01/06	10/31/06
06-7267-01C	DAS-11-12-16'	Soil	10/17/06 0950	10/18/06	6010_S *	6010: Soil/Solids	<input type="checkbox"/>	11/01/06	4/15/07
06-7267-01C	DAS-11-12-16'	Soil	10/17/06 0950	10/18/06	7471_S	7471: Mercury Solid	<input type="checkbox"/>	11/01/06	11/14/06
06-7267-02A	DAS-7	Groundwater	10/17/06 1415	10/18/06	8260_W *	8260B: VOA HSL	<input type="checkbox"/>	11/01/06	10/31/06
06-7267-03A	DAS-3-8-12'	Soil	10/18/06 0900	10/18/06	8260_S *	8260B: VOA HSL	<input type="checkbox"/>	11/01/06	11/01/06
06-7267-03B	DAS-3-8-12'	Soil	10/18/06 0900	10/18/06	8270_S *	8270C: BNA HSL	<input type="checkbox"/>	11/01/06	11/01/06
06-7267-03C	DAS-3-8-12'	Soil	10/18/06 0900	10/18/06	6010_S *	6010: Soil/Solids	<input type="checkbox"/>	11/01/06	4/16/07
06-7267-03C	DAS-3-8-12'	Soil	10/18/06 0900	10/18/06	7471_S	7471: Mercury Solid	<input type="checkbox"/>	11/01/06	11/15/06
06-7267-04A	DAS-2-8-12'	Soil	10/18/06 1430	10/18/06	8260_S *	8260B: VOA HSL	<input type="checkbox"/>	11/01/06	11/01/06
06-7267-04B	DAS-2-8-12'	Soil	10/18/06 1430	10/18/06	8270_S *	8270C: BNA HSL	<input type="checkbox"/>	11/01/06	11/01/06
06-7267-04C	DAS-2-8-12'	Soil	10/18/06 1430	10/18/06	6010_S *	6010: Soil/Solids	<input type="checkbox"/>	11/01/06	4/16/07
06-7267-04C	DAS-2-8-12'	Soil	10/18/06 1430	10/18/06	7471_S	7471: Mercury Solid	<input type="checkbox"/>	11/01/06	11/15/06

Definitions: * - Test Code has a Select List

CHAIN OF CUSTODY RECORD / ANALYTICAL SERVICES AGREEMENT **

002
CLIENT INFORMATION

CLIENT Brown and Caldwell
 ADDRESS 1697 Cole Blvd Ste 200
 CITY Golden STATE CO ZIP 80401

4036 Youngfield St.
 Wheat Ridge, Colorado 80033
 (303) 425-6021
 FAX (303) 425-6854

Evergreen Analytical Laboratory Inc.

Report Results by: _____ (Date)*
 Standard 2 working weeks
 UST Analyses per Fee Schedule

PHONE 303-239-5400 FAX 303-239-5454 E-mail TomVanArsdale@brownandcaldwell.com
 REPORT BY MAIL FAX PDF EDD

* Rush: less than 24 hrs, 150% 1 - 2 work days, 100%
 3 - 5 work days, 50% 6 - 9 work days, 25%
 * Subject to surcharge & exceptions noted in fee schedule.

REPORT CHROMATOGRAMS YES
 REPORT TO (M/R/M/S) Tom VanArsdale
 INVOICE TO Scott Lesikar
 PROJECT I.D. Denver Animal Shelter
 P.O. # _____ EAL QUOTE # _____
 Sampler: Tom VanArsdale

NOTE: Identify Known Hazards Below

SAMPLE IDENTIFICATION	DATE SAMPLED	TIME
DAS-11-12-16'	10/17/06	0950
DAS-7	10/17/06	1415
DAS-3-8-12'	10/18/06	0900
DAS-2-8-12'	10/18/06	1430

No. of Containers	MATRIX			ANALYSES (check analysis)
	1) Drinking Water or 2) Discharge Water or 3) Ground Water (circle one)	Soil / Solid / Air / Gas	Oil / Sludge / Wipe	
3	S			8260 Volatile Org by GC/MS
2	GW			8270 Semivol. Org by GC/MS
3	S			600: Soil/Solids 7471: Mercury Solid
3	S			8260 Volatile Org by GC/MS

Does this analysis involve property transfer? Yes or No

A B C A

Sample Fraction

For Laboratory Use Only
 WO # 06-7267
 B.O.F. # 16869
 CS (O) 11/21/14/5
 CS (I) 11/21/14/5
 Temp. °C 5 / °F 11 / °C 5 / °F 11
 Seals Present Y / NA
 Samples Pres. N / NA
 Headspace Y / NA
 By: [Signature]

** Important Note: See reverse side hereof for terms and conditions.

Relinquished by: (Signature) <u>Tom VanArsdale</u>	Date/Time 10/18/06	Received by: (Signature) <u>[Signature]</u>	Date/Time 10/18/06	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
---	-----------------------	--	-----------------------	------------------------------	-----------	--------------------------	-----------

Evergreen Analytical, Inc.

Date: 01-Nov-06

Client Project ID: Denver Animal Shelter

Lab Order: 06-7267

CASE NARRATIVE

SAMPLE RECEIVING

Sample(s) were hand delivered to the laboratory by the client.

Custody seals were not present.

The temperature of the sample(s) upon arrival was 5.1 °C.

Sample(s) were received in good condition, in the proper container, and within holding times.

VOC sample(s) were received with no headspace present. NJO

QUALITY ASSURANCE

Analyses performed on samples in this work order meet the requirements of the EAL Quality Assurance Program unless otherwise explained. Analyses of RCRA samples meet the requirements of NELAC and Utah Rule R444-14 unless otherwise explained. CMS

CLIENT SERVICES

There are no anomalies to report. SG

METALS ANALYSIS

RCRA 8 : The method blank showed 0.14 mg/Kg barium. This amount was not subtracted from the sample results. The batch matrix spikes (on another client's sample) showed low recoveries on arsenic and silver. The LCS and PDS recoveries were all within QC limits, proving the analysis was in control. There are no anomalies to report. CMS

GAS CHROMATOGRAPHY / MASS SPECTROMETRY

Method 8260_W: The matrix spikes showed no recoveries on 2-Chloroethylvinylether due to the acid preservation in the spike sample, which destroys this compound. There are no other anomalies to report. DC

Method 8260_S: The batch matrix spikes (done on another client's sample) showed recoveries for 1,1,2,2-Tetrachloroethane and Vinyl acetate below QC limits while recoveries for Trichloroethene were above QC limits. These recoveries are assumed due to matrix interference, since the laboratory control spike (LCS) recoveries were all within QC limits. There are no other anomalies to report. DC/CMS

Method 8270_S: All samples required analysis at dilution due to high hydrocarbon levels in the samples. Sample 06-7267-01B was analyzed at dilutions of 16X and 40X (8X in prep and 2 X and 5X at the instrument). Sample 06-7267-03B was analyzed at dilutions of 10X and 25 X (5X in prep and 2X and 5X at the instrument). The 40X and 25X dilutions on samples -01B and -03B were for 2,4-Dinitrophenol only, due to the CCV failure for that analyte at a lower dilution. Some analyte

Client Project ID: Denver Animal Shelter

Lab Order: 06-7267

CASE NARRATIVE

recoveries are outside QC limits on batch matrix spikes 06-7239-01AMS/MSD but all recoveries on the other spikes (06-7215-01BMS/MSD) and the laboratory control spike (LCS-11157) are within QC limits, proving the analysis is in control. There are no other anomalies to report. TMB/JM/CMS

Evergreen Analytical, Inc.

4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862
(303) 425-6021


Client Sample ID: DAS-11-12'-16'
Client Project ID: Denver Animal Shelter
Date Collected: 10/17/06
Date Received: 10/18/06
Date Prepared: 10/20/06
Date Analyzed: 10/20/06
Percent Moisture 30.86

Lab Work Order 06-7267
Lab Sample ID: 06-7267-01A
Sample Matrix: Soil
Lab File ID: VOA21020\0901009.D
Method Blank: MB2102006-S
Prep Factor: 1.000
Dilution Factor: 5.00

Method: SW8260B
Prep Method: SW5035A

VOLATILE ORGANICS

Analytes	CAS Number	Result	Units: µg/Kg-dry LQL
Acetone	67-64-1	120 J	140
Benzene	71-43-2	U	7.2
Bromodichloromethane	75-27-4	U	36
Bromoform	75-25-2	U	36
Bromomethane	74-83-9	U	36
2-Butanone	78-93-3	U	140
Carbon disulfide	75-15-0	U	36
Carbon tetrachloride	56-23-5	U	36
Chlorobenzene	108-90-7	U	36
Chloroethane	75-00-3	U	36
2-Chloroethylvinylether	110-75-8	U	140
Chloroform	67-66-3	U	36
Chloromethane	74-87-3	U	36
Dibromochloromethane	124-48-1	U	36
1,2-Dichlorobenzene	95-50-1	U	36
1,3-Dichlorobenzene	541-73-1	U	36
1,4-Dichlorobenzene	106-46-7	U	36
1,1-Dichloroethane	75-34-3	U	36
1,2-Dichloroethane	107-06-2	U	36
1,1-Dichloroethene	75-35-4	U	36
cis-1,2-Dichloroethene	156-59-2	U	36
trans-1,2-Dichloroethene	156-60-5	U	36
1,2-Dichloropropane	78-87-5	U	36
cis-1,3-Dichloropropene	10061-01-5	U	36
trans-1,3-Dichloropropene	10061-02-6	U	36
Ethylbenzene	100-41-4	U	36



Analyst



Approved

Qualifiers: See the case narrative for a discussion

- B - Analyte detected in the Method Blank, value not subtracted from result
- E - Extrapolated value. Value exceeds calibration range
- H - Prep or Analytical holding time exceeded
- S - Spike Recovery outside acceptance limits
- X - See case narrative
- * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Qualifiers: U - Analyte not detected at or above the reporting limit

J - Estimated value below the LQL

- Definitions: NA - Not Applicable
- LQL - Lower Quantitation Limit
- MDL - Method Detection Limit
- Surr - Surrogate Standard

Print Date: 10/23/06

Evergreen Analytical, Inc.
 4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862
 (303) 425-6021

9006

Client Sample ID: DAS-11-12'-16'
Client Project ID: Denver Animal Shelter
Date Collected: 10/17/06
Date Received: 10/18/06
Date Prepared: 10/20/06
Date Analyzed: 10/20/06
Percent Moisture 30.86

Lab Work Order 06-7267
Lab Sample ID: 06-7267-01A
Sample Matrix: Soil
Lab File ID: VOA21020\0901009.D
Method Blank: MB2102006-S
Prep Factor: 1.000
Dilution Factor: 5.00

Method: SW8260B
Prep Method: SW5035A

VOLATILE ORGANICS

Analytes	CAS Number	Result	Units: µg/Kg-dry LQL
2-Hexanone	591-78-6	U	140
Methylene chloride	75-09-2	U	36
4-Methyl-2-pentanone	108-10-1	U	140
Styrene	100-42-5	U	36
1,1,2,2-Tetrachloroethane	79-34-5	U	72
Tetrachloroethene	127-18-4	U	36
Toluene	108-88-3	U	14
1,1,1-Trichloroethane	71-55-6	U	36
1,1,2-Trichloroethane	79-00-5	U	36
Trichloroethene	79-01-6	U	36
Vinyl acetate	108-05-4	U	140
Vinyl chloride	75-01-4	U	36
Xylene, Total	1330-20-7	U	36
Surr: 1,2-Dichloroethane-d4	17060-07-0	104	QC Limits: 70-130 %REC
Surr: 4-Bromofluorobenzene	460-00-4	100	QC Limits: 70-130 %REC
Surr: Toluene-d8	2037-26-5	102	QC Limits: 70-130 %REC



Analyst



Approved

Qualifiers: See the case narrative for a discussion

- B - Analyte detected in the Method Blank, value not subtracted from result
- E - Extrapolated value. Value exceeds calibration range
- H - Prep or Analytical holding time exceeded
- S - Spike Recovery outside acceptance limits
- X - See case narrative
- * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Qualifiers: U - Analyte not detected at or above the reporting limit

J - Estimated value below the LQL

- Definitions:** NA - Not Applicable
 LQL - Lower Quantitation Limit
 MDL - Method Detection Limit
 Surr - Surrogate Standard

Print Date: 10/23/06

Quantitation Report

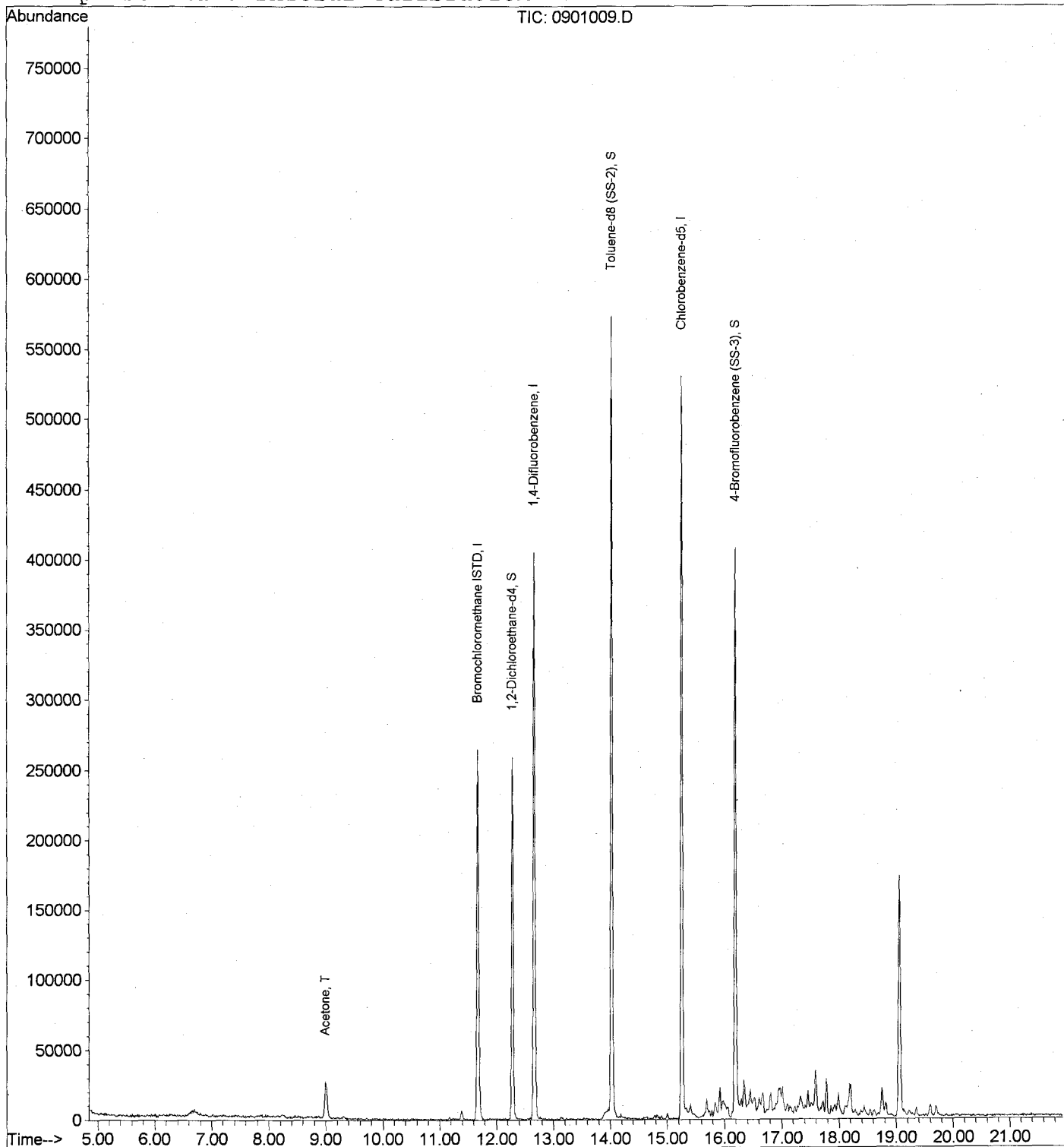
Data File : C:\HPCHEM\1\DATA\VOA21020\0901009.D
Acq On : 20 Oct 2006 1:58 pm
Sample : 06-7267-01A DF=5
Misc : SAMP 8260_S
MS Integration Params: rteint.p
Quant Time: Oct 23 14:26 19106

Vial: 9
Operator: Don Chamot
Inst : GC/MS Ins
Multiplr: 1.00

007

Quant Results File: 82601019.RE

Method : C:\HPCHEM\1\METHODS\82601019.M (RTE Integrator)
Title : 8260 VOA2
Last Update : Fri Oct 20 13:16:16 2006
Response via : Initial Calibration



Evergreen Analytical, Inc.
 4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862
 (303) 425-6021


808

Client Sample ID: DAS-3-8'-12'	Lab Work Order: 06-7267
Client Project ID: Denver Animal Shelter	Lab Sample ID: 06-7267-03A
Date Collected: 10/18/06	Sample Matrix: Soil
Date Received: 10/18/06	Lab File ID: VOA21020\1001010.D
Date Prepared: 10/20/06	Method Blank: MB2102006-S
Date Analyzed: 10/20/06	Prep Factor: 1.000
Percent Moisture: 24.53	Dilution Factor: 5.00

Method: SW8260B
Prep Method: SW5035A

VOLATILE ORGANICS

Analytes	CAS Number	Result	Units: µg/Kg-dry LQL
Acetone	67-64-1	270	130
Benzene	71-43-2	17	6.6
Bromodichloromethane	75-27-4	U	33
Bromoform	75-25-2	U	33
Bromomethane	74-83-9	U	33
2-Butanone	78-93-3	61 J	130
Carbon disulfide	75-15-0	29 J	33
Carbon tetrachloride	56-23-5	U	33
Chlorobenzene	108-90-7	45	33
Chloroethane	75-00-3	U	33
2-Chloroethylvinylether	110-75-8	U	130
Chloroform	67-66-3	U	33
Chloromethane	74-87-3	U	33
Dibromochloromethane	124-48-1	U	33
1,2-Dichlorobenzene	95-50-1	U	33
1,3-Dichlorobenzene	541-73-1	U	33
1,4-Dichlorobenzene	106-46-7	U	33
1,1-Dichloroethane	75-34-3	U	33
1,2-Dichloroethane	107-06-2	U	33
1,1-Dichloroethene	75-35-4	U	33
cis-1,2-Dichloroethene	156-59-2	U	33
trans-1,2-Dichloroethene	156-60-5	U	33
1,2-Dichloropropane	78-87-5	U	33
cis-1,3-Dichloropropene	10061-01-5	U	33
trans-1,3-Dichloropropene	10061-02-6	U	33
Ethylbenzene	100-41-4	U	33



Analyst



Approved

Qualifiers: See the case narrative for a discussion
 B - Analyte detected in the Method Blank, value not subtracted from result
 E - Extrapolated value. Value exceeds calibration range
 H - Prep or Analytical holding time exceeded
 S - Spike Recovery outside acceptance limits
 X - See case narrative
 * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Qualifiers: U - Analyte not detected at or above the reporting limit
 J - Estimated value below the LQL
Definitions: NA - Not Applicable
 LQL - Lower Quantitation Limit
 MDL - Method Detection Limit
 Surr - Surrogate Standard

Evergreen Analytical, Inc.

4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862
(303) 425-6021

Client Sample ID: DAS-3-8'-12'
Client Project ID: Denver Animal Shelter
Date Collected: 10/18/06
Date Received: 10/18/06
Date Prepared: 10/20/06
Date Analyzed: 10/20/06
Percent Moisture 24.53

Lab Work Order 06-7267
Lab Sample ID: 06-7267-03A
Sample Matrix: Soil
Lab File ID: VOA21020\1001010.D
Method Blank: MB2102006-S
Prep Factor: 1.000
Dilution Factor: 5.00

Method: SW8260B
Prep Method: SW5035A

VOLATILE ORGANICS

Analytes	CAS Number	Result	Units: µg/Kg-dry LQL
2-Hexanone	591-78-6	U	130
Methylene chloride	75-09-2	U	33
4-Methyl-2-pentanone	108-10-1	U	130
Styrene	100-42-5	21 J	33
1,1,2,2-Tetrachloroethane	79-34-5	U	66
Tetrachloroethene	127-18-4	U	33
Toluene	108-88-3	U	13
1,1,1-Trichloroethane	71-55-6	U	33
1,1,2-Trichloroethane	79-00-5	U	33
Trichloroethene	79-01-6	U	33
Vinyl acetate	108-05-4	U	130
Vinyl chloride	75-01-4	U	33
Xylene, Total	1330-20-7	41	33
Surr: 1,2-Dichloroethane-d4	17060-07-0	99	QC Limits: 70-130 %REC
Surr: 4-Bromofluorobenzene	460-00-4	104	QC Limits: 70-130 %REC
Surr: Toluene-d8	2037-26-5	100	QC Limits: 70-130 %REC



Analyst



Approved

Qualifiers: See the case narrative for a discussion

- B - Analyte detected in the Method Blank, value not subtracted from result
- E - Extrapolated value. Value exceeds calibration range
- H - Prep or Analytical holding time exceeded
- S - Spike Recovery outside acceptance limits
- X - See case narrative
- * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Qualifiers: U - Analyte not detected at or above the reporting limit

J - Estimated value below the LQL

- Definitions:** NA - Not Applicable
LQL - Lower Quantitation Limit
MDL - Method Detection Limit
Surr - Surrogate Standard

Print Date: 10/23/06

Quantitation Report

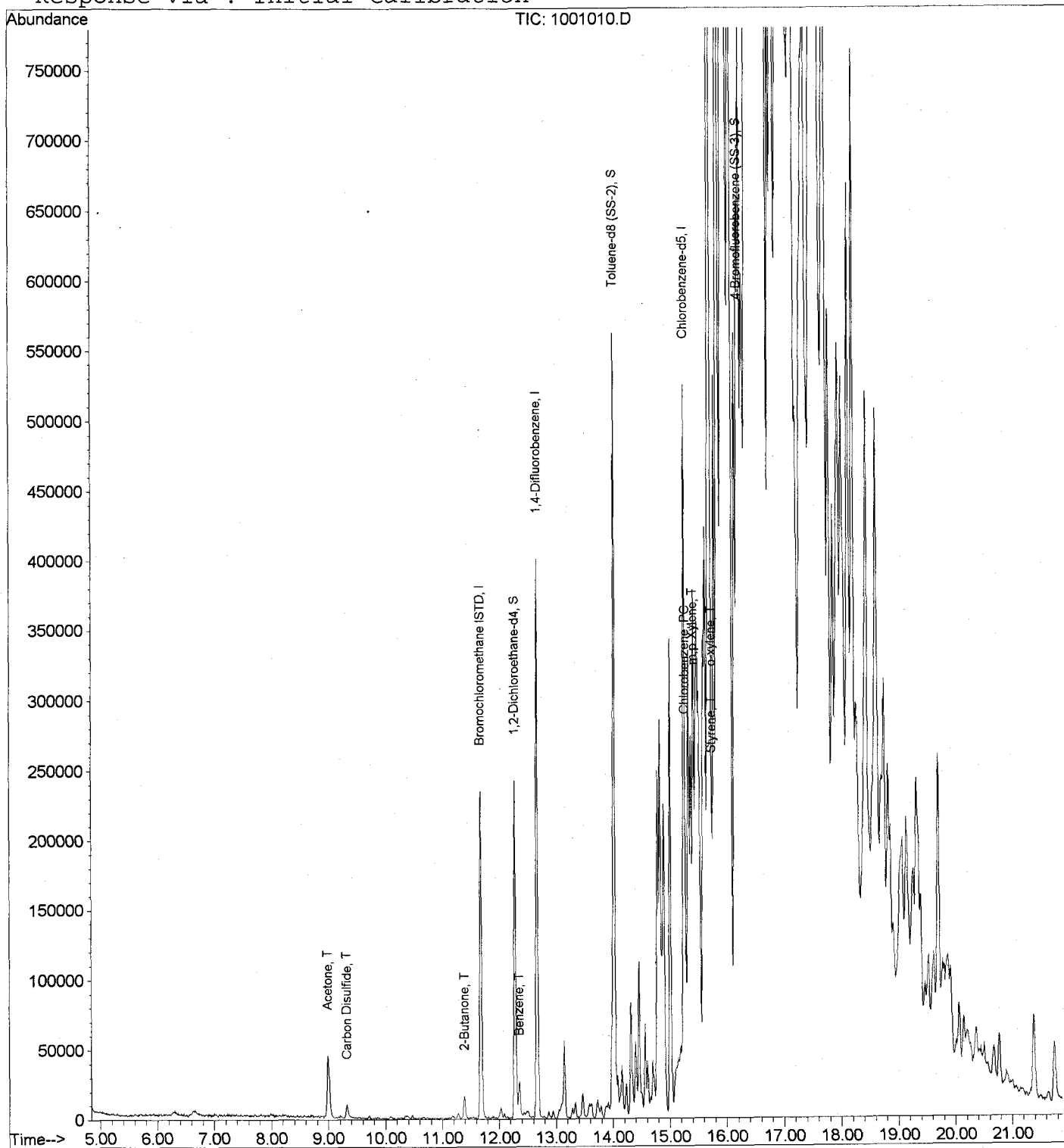
Data File : C:\HPCHEM\1\DATA\VOA21020\1001010.D
Acq On : 20 Oct 2006 2:30 pm
Sample : 06-7267-03A DF=5
Misc : SAMP 8260_S
MS Integration Params: rteint.p
Quant Time: Oct 23 14:57 19106

Vial: 10
Operator: Don Chamot
Inst : GC/MS Ins
Multiplr: 1.00

010

Quant Results File: 82601019.RE

Method : C:\HPCHEM\1\METHODS\82601019.M (RTE Integrator)
Title : 8260 VOA2
Last Update : Fri Oct 20 13:16:16 2006
Response via : Initial Calibration



Evergreen Analytical, Inc.
 4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862
 (303) 425-6021

Client Sample ID: DAS-2-8'-12'
Client Project ID: Denver Animal Shelter
Date Collected: 10/18/06
Date Received: 10/18/06
Date Prepared: 10/20/06
Date Analyzed: 10/20/06
Percent Moisture: 36.04

Lab Work Order: 06-7267
Lab Sample ID: 06-7267-04A
Sample Matrix: Soil
Lab File ID: VOA21020\1101011.D
Method Blank: MB2102006-S
Prep Factor: 1.000
Dilution Factor: 5.00

Method: SW8260B
Prep Method: SW5035A

VOLATILE ORGANICS

Analytes	CAS Number	Result	Units: µg/Kg-dry LQL
Acetone	67-64-1	240	160
Benzene	71-43-2	13	7.8
Bromodichloromethane	75-27-4	U	39
Bromoform	75-25-2	U	39
Bromomethane	74-83-9	U	39
2-Butanone	78-93-3	U	160
Carbon disulfide	75-15-0	20 J	39
Carbon tetrachloride	56-23-5	U	39
Chlorobenzene	108-90-7	U	39
Chloroethane	75-00-3	U	39
2-Chloroethylvinylether	110-75-8	U	160
Chloroform	67-66-3	U	39
Chloromethane	74-87-3	U	39
Dibromochloromethane	124-48-1	U	39
1,2-Dichlorobenzene	95-50-1	U	39
1,3-Dichlorobenzene	541-73-1	U	39
1,4-Dichlorobenzene	106-46-7	U	39
1,1-Dichloroethane	75-34-3	U	39
1,2-Dichloroethane	107-06-2	U	39
1,1-Dichloroethene	75-35-4	U	39
cis-1,2-Dichloroethene	156-59-2	21 J	39
trans-1,2-Dichloroethene	156-60-5	U	39
1,2-Dichloropropane	78-87-5	U	39
cis-1,3-Dichloropropene	10061-01-5	U	39
trans-1,3-Dichloropropene	10061-02-6	U	39
Ethylbenzene	100-41-4	47	39



 Analyst



 Approved

Qualifiers: See the case narrative for a discussion

B - Analyte detected in the Method Blank, value not subtracted from result
 E - Extrapolated value. Value exceeds calibration range
 H - Prep or Analytical holding time exceeded
 S - Spike Recovery outside acceptance limits
 X - See case narrative
 * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Qualifiers: U - Analyte not detected at or above the reporting limit

J - Estimated value below the LQL

Definitions: NA - Not Applicable
 LQL - Lower Quantitation Limit
 MDL - Method Detection Limit
 Surr - Surrogate Standard

Print Date: 10/23/06

Evergreen Analytical, Inc.

4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862
(303) 425-6021

Client Sample ID: DAS-2-8'-12'
Client Project ID: Denver Animal Shelter
Date Collected: 10/18/06
Date Received: 10/18/06
Date Prepared: 10/20/06
Date Analyzed: 10/20/06
Percent Moisture 36.04

Lab Work Order 06-7267
Lab Sample ID: 06-7267-04A
Sample Matrix: Soil
Lab File ID: VOA21020\1101011.D
Method Blank: MB2102006-S
Prep Factor: 1.000
Dilution Factor: 5.00

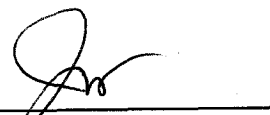
Method: SW8260B
Prep Method: SW5035A

VOLATILE ORGANICS

Analytes	CAS Number	Result	Units: µg/Kg-dry LQL
2-Hexanone	591-78-6	U	160
Methylene chloride	75-09-2	U	39
4-Methyl-2-pentanone	108-10-1	U	160
Styrene	100-42-5	U	39
1,1,2,2-Tetrachloroethane	79-34-5	U	78
Tetrachloroethene	127-18-4	U	39
Toluene	108-88-3	38	16
1,1,1-Trichloroethane	71-55-6	U	39
1,1,2-Trichloroethane	79-00-5	U	39
Trichloroethene	79-01-6	31 J	39
Vinyl acetate	108-05-4	U	160
Vinyl chloride	75-01-4	U	39
Xylene, Total	1330-20-7	240	39
Surr: 1,2-Dichloroethane-d4	17060-07-0	99	QC Limits: 70-130 %REC
Surr: 4-Bromofluorobenzene	460-00-4	79	QC Limits: 70-130 %REC
Surr: Toluene-d8	2037-26-5	93	QC Limits: 70-130 %REC



Analyst



Approved

Qualifiers: See the case narrative for a discussion

- B - Analyte detected in the Method Blank, value not subtracted from result
- E - Extrapolated value. Value exceeds calibration range
- H - Prep or Analytical holding time exceeded
- S - Spike Recovery outside acceptance limits
- X - See case narrative
- * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Qualifiers: U - Analyte not detected at or above the reporting limit

J - Estimated value below the LQL

Definitions: NA - Not Applicable
LQL - Lower Quantitation Limit
MDL - Method Detection Limit
Surr - Surrogate Standard

Quantitation Report

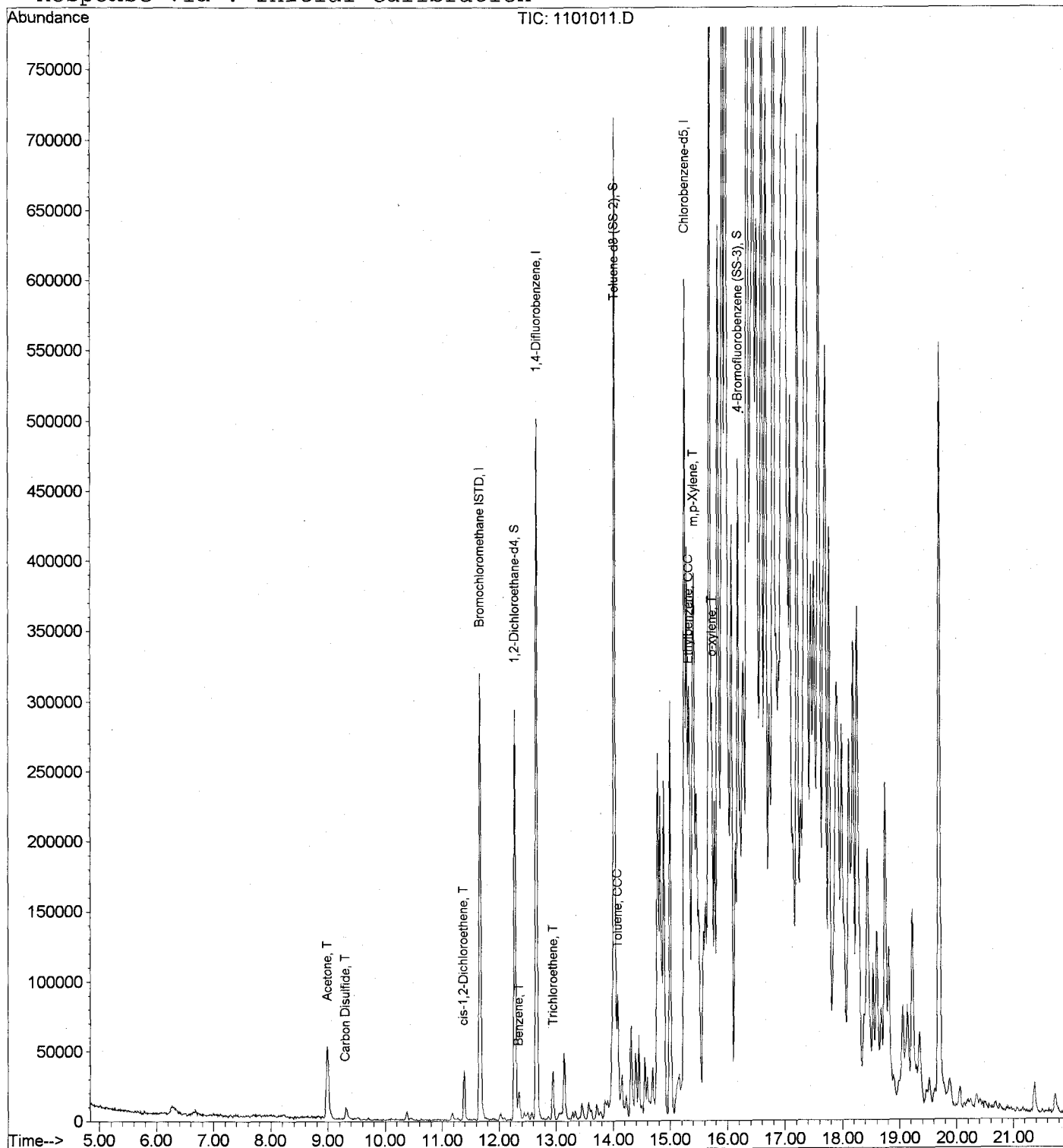
Data File : C:\HPCHEM\1\DATA\VOA21020\1101011.D
Acq On : 20 Oct 2006 3:02 pm
Sample : 06-7267-04A DF=5
Misc : SAMP 8260_S
MS Integration Params: rteint.p
Quant Time: Oct 23 14:34 19106

Vial: 11
Operator: Don Chamot
Inst : GC/MS Ins
Multiplr: 1.00

015

Quant Results File: 82601019.RE

Method : C:\HPCHEM\1\METHODS\82601019.M (RTE Integrator)
Title : 8260 VOA2
Last Update : Fri Oct 20 13:16:16 2006
Response via : Initial Calibration



10/23/06
[Signature]

Evergreen Analytical, Inc.

4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862
(303) 425-6021

Client Sample ID: DAS-7
 Client Project ID: Denver Animal Shelter
 Date Collected: 10/17/06
 Date Received: 10/18/06
 Date Prepared: 10/19/06
 Date Analyzed: 10/19/06
 Percent Moisture NA

Lab Work Order 06-7267
 Lab Sample ID: 06-7267-02A
 Sample Matrix: Groundwater
 Lab File ID: VOA21019\1401014.D
 Method Blank: MB2101906-W
 Prep Factor: 1.000
 Dilution Factor: 1.00

Method: SW8260B
 Prep Method: SW5030A

VOLATILE ORGANICS

Analytes	CAS Number	Result	Units: µg/L LQL
Acetone	67-64-1	U	10
Benzene	71-43-2	U	1.0
Bromodichloromethane	75-27-4	U	4.0
Bromoform	75-25-2	U	4.0
Bromomethane	74-83-9	U	10
2-Butanone	78-93-3	U	20
Carbon disulfide	75-15-0	U	4.0
Carbon tetrachloride	56-23-5	U	2.0
Chlorobenzene	108-90-7	U	3.0
Chloroethane	75-00-3	U	5.0
2-Chloroethylvinylether	110-75-8	U	10
Chloroform	67-66-3	U	2.0
Chloromethane	74-87-3	U	4.0
Dibromochloromethane	124-48-1	U	2.0
1,2-Dichlorobenzene	95-50-1	U	4.0
1,3-Dichlorobenzene	541-73-1	U	4.0
1,4-Dichlorobenzene	106-46-7	U	4.0
1,1-Dichloroethane	75-34-3	U	2.0
1,2-Dichloroethane	107-06-2	U	2.0
1,1-Dichloroethene	75-35-4	U	2.0
cis-1,2-Dichloroethene	156-59-2	U	2.0
trans-1,2-Dichloroethene	156-60-5	U	2.0
1,2-Dichloropropane	78-87-5	U	4.0
cis-1,3-Dichloropropene	10061-01-5	U	2.0
trans-1,3-Dichloropropene	10061-02-6	U	2.0
Ethylbenzene	100-41-4	U	2.0



Analyst



Approved

Qualifiers: See the case narrative for a discussion

B - Analyte detected in the Method Blank, value not subtracted from result
 E - Extrapolated value. Value exceeds calibration range
 H - Prep or Analytical holding time exceeded
 S - Spike Recovery outside acceptance limits
 X - See case narrative
 * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Qualifiers: U - Analyte not detected at or above the reporting limit

J - Estimated value below the LQL

Definitions: NA - Not Applicable
 LQL - Lower Quantitation Limit
 MDL - Method Detection Limit
 Surr - Surrogate Standard


Print Date: 10/23/06

Evergreen Analytical, Inc.

4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862
(303) 425-6021

Client Sample ID: DAS-7	Lab Work Order: 06-7267
Client Project ID: Denver Animal Shelter	Lab Sample ID: 06-7267-02A
Date Collected: 10/17/06	Sample Matrix: Groundwater
Date Received: 10/18/06	Lab File ID: VOA21019\1401014.D
Date Prepared: 10/19/06	Method Blank: MB2101906-W
Date Analyzed: 10/19/06	Prep Factor: 1.000
Percent Moisture: NA	Dilution Factor: 1.00

Method: SW8260B		VOLATILE ORGANICS	
Prep Method: SW5030A			Units: µg/L
Analytes	CAS Number	Result	LQL
2-Hexanone	591-78-6	U	4.0
Methylene chloride	75-09-2	U	4.0
4-Methyl-2-pentanone	108-10-1	U	10
Styrene	100-42-5	U	4.0
1,1,2,2-Tetrachloroethane	79-34-5	U	4.0
Tetrachloroethene	127-18-4	U	2.0
Toluene	108-88-3	U	2.0
1,1,1-Trichloroethane	71-55-6	U	2.0
1,1,2-Trichloroethane	79-00-5	U	4.0
Trichloroethene	79-01-6	1.5 J	2.0
Vinyl acetate	108-05-4	U	5.0
Vinyl chloride	75-01-4	U	2.0
Xylene, Total	1330-20-7	U	4.0
Surr: 1,2-Dichloroethane-d4	17060-07-0	102	QC Limits: 70-130 %REC
Surr: 4-Bromofluorobenzene	460-00-4	101	QC Limits: 70-130 %REC
Surr: Toluene-d8	2037-26-5	103	QC Limits: 70-130 %REC



Analyst



Approved

Qualifiers: See the case narrative for a discussion

- B - Analyte detected in the Method Blank, value not subtracted from result
- E - Extrapolated value. Value exceeds calibration range
- H - Prep or Analytical holding time exceeded
- S - Spike Recovery outside acceptance limits
- X - See case narrative
- * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Qualifiers: U - Analyte not detected at or above the reporting limit
J - Estimated value below the LQL

Definitions: NA - Not Applicable
LQL - Lower Quantitation Limit
MDL - Method Detection Limit
Surr - Surrogate Standard

Quantitation Report

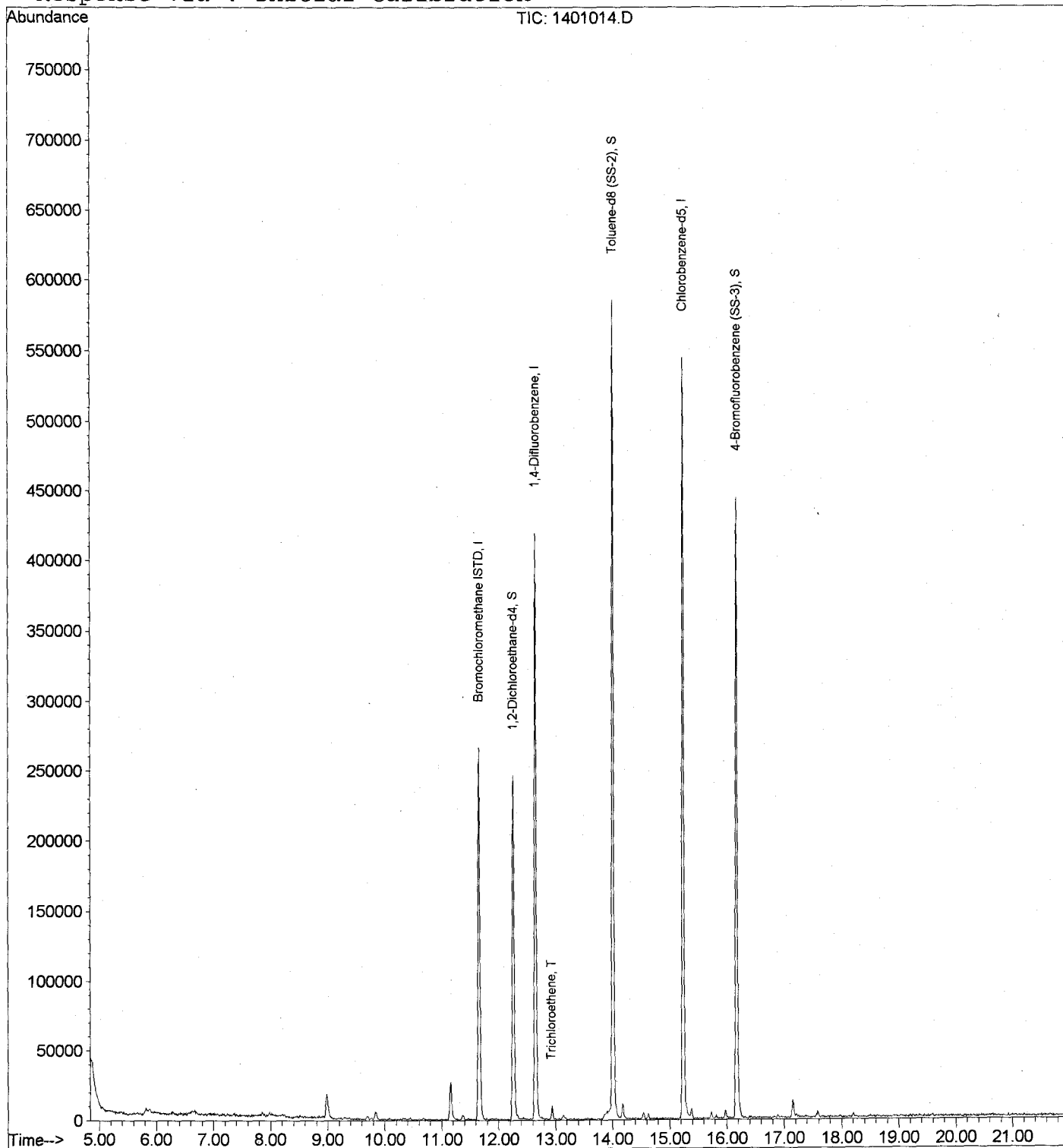
Data File : C:\HPCHEM\1\DATA\VOA21019\1401014.D
Acq On : 19 Oct 2006 5:48 pm
Sample : 06-7267-02A
Misc : SAMP 8260_W
MS Integration Params: rteint.p
Quant Time: Oct 20 15:18 19106

Vial: 14
Operator: Don Chamot
Inst : GC/MS Ins
Multiplr: 1.00

016

Quant Results File: 82601019.RE

Method : C:\HPCHEM\1\METHODS\82601019.M (RTE Integrator)
Title : 8260 VOA2
Last Update : Fri Oct 20 13:16:16 2006
Response via : Initial Calibration



Handwritten signature

Client Sample ID: DAS-11-12'-16'	Lab Work Order: 06-7267
Client Project ID: Denver Animal Shelter	Lab Sample ID: 06-7267-01B
Date Collected: 10/17/06	Sample Matrix: Soil
Date Received: 10/18/06	Lab File ID: \GCMS1023\2701027.D
Date Prepared: 10/19/06	Method Blank: MB-11157
Date Analyzed: 10/24/06	Prep Factor: 266.312
Percent Moisture: 30.86	Dilution Factor: 2.00

Method: SW8270C
Prep Method: SW3540A

SEMIVOLATILE ORGANICS

Units: µg/Kg-dry

Analytes	CAS Number	Result	LQL
Acenaphthene	83-32-9	U	3900
Acenaphthylene	208-96-8	U	3900
Anthracene	120-12-7	U	3900
Benzo(a)anthracene	56-55-3	U	3900
Benzo(b&k)fluoranthene	205-99-2 & 207-08-9	U	7700
Benzoic acid	65-85-0	U	15000
Benzo(g,h,i)perylene	191-24-2	U	3900
Benzo(a)pyrene	50-32-8	U	3900
Benzyl alcohol	100-51-6	U	7700
4-Bromophenyl phenyl ether	101-55-3	U	3900
Butyl benzyl phthalate	85-68-7	U	3900
4-Chloroaniline	106-47-8	U	3900
Bis(2-chloroethoxy)methane	111-91-1	U	7700
Bis(2-chloroethyl)ether	111-44-4	U	7700
4-Chloro-3-methylphenol	59-50-7	U	3900
2-Chloronaphthalene	91-58-7	7000	3900
2-Chlorophenol	95-57-8	U	7700
4-Chlorophenyl phenyl ether	7005-72-3	U	3900
Chrysene	218-01-9	U	3900
Dibenz(a,h)anthracene	53-70-3	U	3900
Dibenzofuran	132-64-9	U	3900
Di-n-butyl phthalate	84-74-2	U	3900
1,2-Dichlorobenzene	95-50-1	U	7700
1,3-Dichlorobenzene	541-73-1	U	7700
1,4-Dichlorobenzene	106-46-7	U	7700
3,3'-Dichlorobenzidine	91-94-1	U	7700
Dichlorodisopropyl ether	108-60-1	U	7700
2,4-Dichlorophenol	120-83-2	U	3900
Diethyl phthalate	84-66-2	U	3900
2,4-Dimethylphenol	105-67-9	U	3900
Dimethyl phthalate	131-11-3	U	3900
4,6-Dinitro-2-methylphenol	534-52-1	U	3900
2,4-Dinitrotoluene	121-14-2	U	3900
2,6-Dinitrotoluene	606-20-2	U	3900
Di-n-octyl phthalate	117-84-0	U	3900
Bis(2-ethylhexyl)phthalate	117-81-7	U	7700
Fluoranthene	206-44-0	U	3900
Fluorene	86-73-7	U	3900
Hexachlorobenzene	118-74-1	U	3900
Hexachlorobutadiene	87-68-3	U	7700


Analyst


Approved

Qualifiers: See case narrative for a discussion

- B - Analyte detected in the Method Blank, value not subtracted from result
- E - Extrapolated value. Value exceeds calibration range
- H - Prep or Analytical holding time exceeded
- S - Spike Recovery outside acceptance limits
- X - See case narrative
- * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Qualifiers: U - Analyte not detected at or above the reporting limit

J - Estimated value below the LQL

Definitions: NA - Not Applicable
LQL - Lower Quantitation Limit
MDL - Method Detection Limit
Surr - Surrogate Standard

Print Date: 11/1/06

Client Sample ID: DAS-11-12'-16'
Client Project ID: Denver Animal Shelter
Date Collected: 10/17/06
Date Received: 10/18/06
Date Prepared: 10/19/06
Date Analyzed: 10/24/06
Percent Moisture: 30.86

Lab Work Order: 06-7267
Lab Sample ID: 06-7267-01B
Sample Matrix: Soil
Lab File ID: \GCMS1023\2701027.D
Method Blank: MB-11157
Prep Factor: 266.312
Dilution Factor: 2.00

Method: SW8270C
Prep Method: SW3540A

SEMIVOLATILE ORGANICS

Units: µg/Kg-dry

Analytes	CAS Number	Result	LQL
Hexachlorocyclopentadiene	77-47-4	U	3900
Hexachloroethane	67-72-1	U	7700
Indeno(1,2,3-cd)pyrene	193-39-5	U	3900
Isophorone	78-59-1	U	7700
2-Methylnaphthalene	91-57-6	U	7700
2-Methylphenol	95-48-7	U	7700
4-Methylphenol	106-44-5	U	7700
Naphthalene	91-20-3	U	7700
2-Nitroaniline	88-74-4	U	3900
3-Nitroaniline	99-09-2	U	3900
4-Nitroaniline	100-01-6	U	3900
Nitrobenzene	98-95-3	U	7700
2-Nitrophenol	88-75-5	U	7700
4-Nitrophenol	100-02-7	U	3900
N-Nitrosodi-n-propylamine	621-64-7	U	7700
N-Nitrosodiphenylamine	86-30-6	U	3900
Pentachlorophenol	87-86-5	U	3900
Phenanthrene	85-01-8	U	3900
Phenol	108-95-2	U	7700
Pyrene	129-00-0	U	3900
1,2,4-Trichlorobenzene	120-82-1	U	7700
2,4,5-Trichlorophenol	95-95-4	U	3900
2,4,6-Trichlorophenol	88-06-2	U	3900
Surr: 2,4,6-Tribromophenol	118-79-6	89	QC Limits: 40-130 %REC
Surr: 2-Fluorobiphenyl	321-60-8	83	QC Limits: 37-130 %REC
Surr: 2-Fluorophenol	367-12-4	105	QC Limits: 24-130 %REC
Surr: Nitrobenzene-d5	4165-60-0	87	QC Limits: 27-130 %REC
Surr: Phenol-d6	13127-88-3	109	QC Limits: 30-130 %REC
Surr: Terphenyl-d14	1718-51-0	104	QC Limits: 41-135 %REC


 Analyst


 Approved

Qualifiers: See case narrative for a discussion

- B - Analyte detected in the Method Blank, value not subtracted from result
- E - Extrapolated value. Value exceeds calibration range
- H - Prep or Analytical holding time exceeded
- S - Spike Recovery outside acceptance limits
- X - See case narrative
- * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Qualifiers: U - Analyte not detected at or above the reporting limit

J - Estimated value below the LQL

- Definitions:** NA - Not Applicable
 LQL - Lower Quantitation Limit
 MDL - Method Detection Limit
 Surr - Surrogate Standard

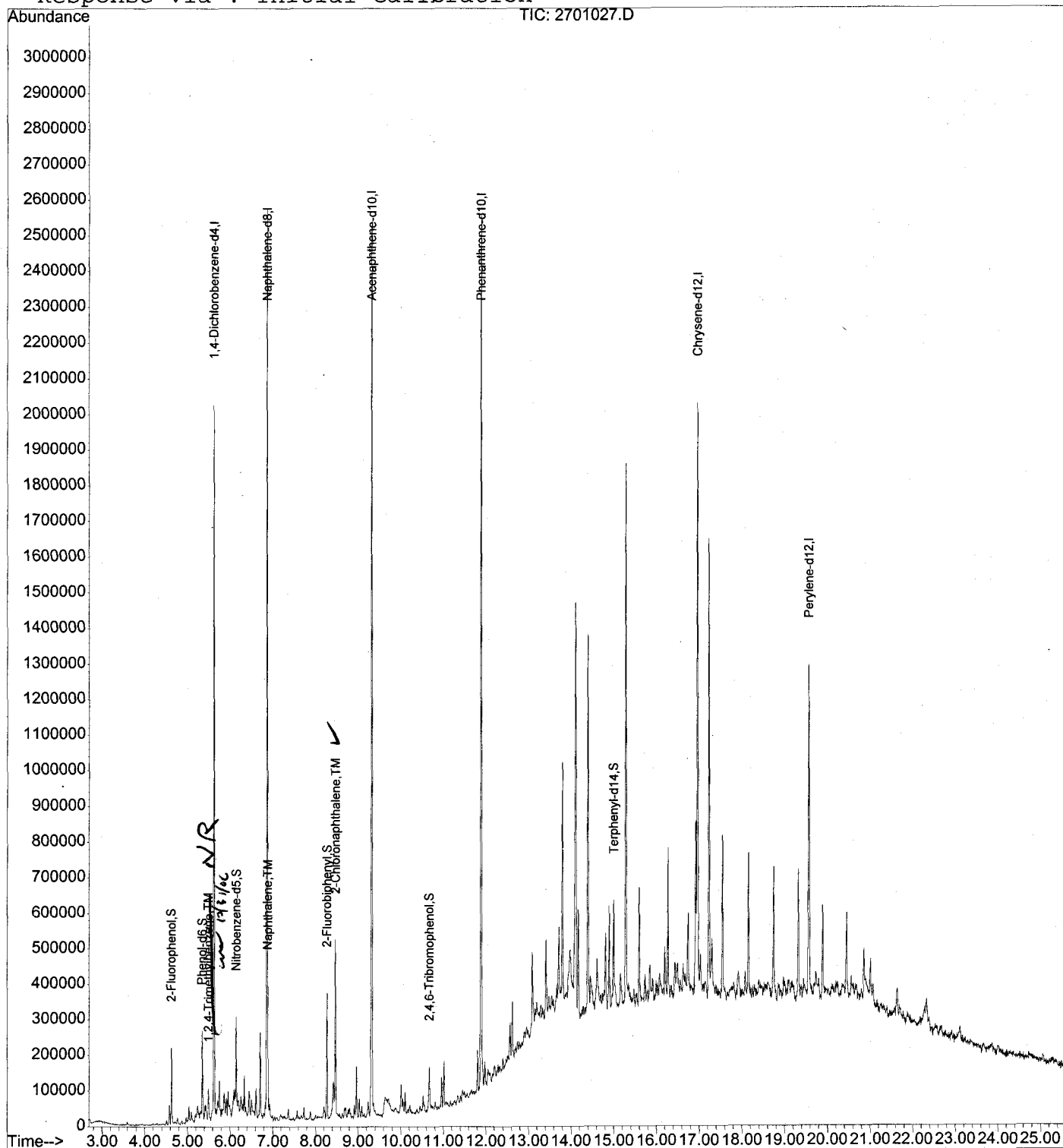
Print Date: 11/1/06

Data File : D:\MSDCHEM\1\DATA\GCMS1023\2701027.D
 Acq On : 24 Oct 2006 2:50 am
 Sample : 06-7267-01B DF=2
 Misc : SAMP 8270_S
 MS Integration Params: RTEINT.P
 Quant Time: Oct 24 9:42 2006

Vial: 27
 Operator: T. Buchner
 Inst : GCMS1
 Multiplr: 1.00

Quant Results File: BNA1020.RES

Method : D:\MSDCHEM\1\METHODS\BNA1020.M (RTE Integrator)
 Title : 8270C Calibration
 Last Update : Mon Oct 23 10:05:23 2006
 Response via : Initial Calibration



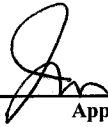
Client Sample ID: DAS-11-12'-16'	Lab Work Order: 06-7267
Client Project ID: Denver Animal Shelter	Lab Sample ID: 06-7267-01B
Date Collected: 10/17/06	Sample Matrix: Soil
Date Received: 10/18/06	Lab File ID: \GCMS1023\0601006.D
Date Prepared: 10/19/06	Method Blank: MB-11157
Date Analyzed: 10/23/06	Prep Factor: 266.312
Percent Moisture: 30.86	Dilution Factor: 5.00

Method: SW8270C SEMIVOLATILE ORGANICS **Units: µg/Kg-dry**
Prep Method: SW3540A

Analytes	CAS Number	Result	LQL
2,4-Dinitrophenol	51-28-5	U	19000
Surr: 2,4,6-Tribromophenol	118-79-6	82	QC Limits: 40-130 %REC
Surr: 2-Fluorobiphenyl	321-60-8	81	QC Limits: 37-130 %REC
Surr: 2-Fluorophenol	367-12-4	88	QC Limits: 24-130 %REC
Surr: Nitrobenzene-d5	4165-60-0	79	QC Limits: 27-130 %REC
Surr: Phenol-d6	13127-88-3	95	QC Limits: 30-130 %REC
Surr: Terphenyl-d14	1718-51-0	98	QC Limits: 41-135 %REC



 Analyst



 Approved

Qualifiers: See case narrative for a discussion

- B - Analyte detected in the Method Blank, value not subtracted from result
- E - Extrapolated value. Value exceeds calibration range
- H - Prep or Analytical holding time exceeded
- S - Spike Recovery outside acceptance limits
- X - See case narrative
- * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Qualifiers: U - Analyte not detected at or above the reporting limit
 J - Estimated value below the LQL

Definitions: NA - Not Applicable
 LQL - Lower Quantitation Limit
 MDL - Method Detection Limit
 Surr - Surrogate Standard

Print Date: 10/24/06

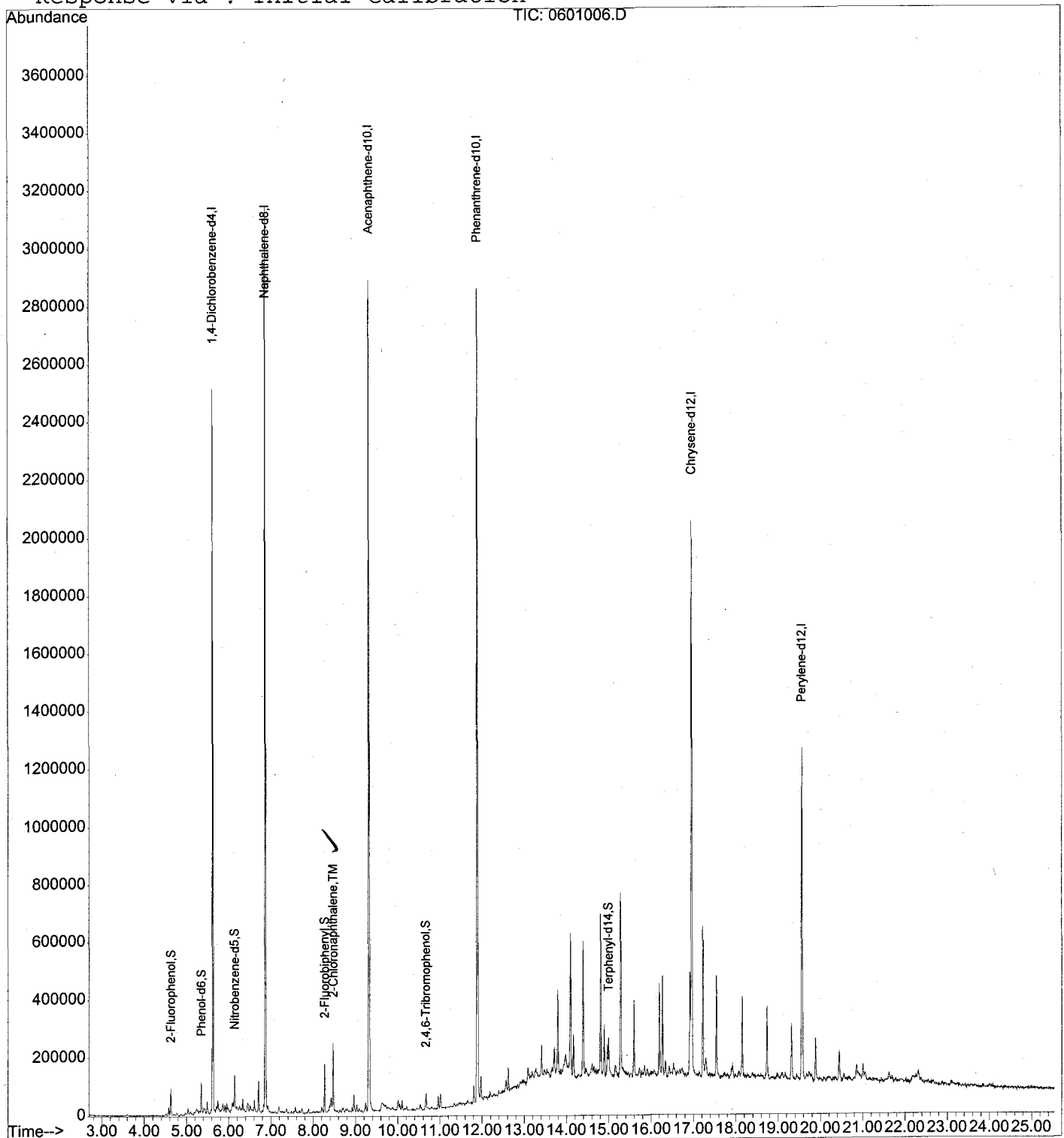
Data File : D:\MSDCHEM\1\DATA\GCMS1023\0601006.D
 Acq On : 23 Oct 2006 1:11 pm
 Sample : 06-7267-01B DF=5
 Misc : SAMP 8270_S
 MS Integration Params: RTEINT.P
 Quant Time: Oct 24 9:47 2006

Vial: 6
 Operator: T. Buchner
 Inst : GCMS1
 Multiplr: 1.00

021

Quant Results File: BNA1020.RES

Method : D:\MSDCHEM\1\METHODS\BNA1020.M (RTE Integrator)
 Title : 8270C Calibration
 Last Update : Mon Oct 23 10:05:23 2006
 Response via : Initial Calibration



Client Sample ID: DAS-3-8'-12'
Client Project ID: Denver Animal Shelter
Date Collected: 10/18/06
Date Received: 10/18/06
Date Prepared: 10/19/06
Date Analyzed: 10/24/06
Percent Moisture: 24.53

Lab Work Order: 06-7267
Lab Sample ID: 06-7267-03B
Sample Matrix: Soil
Lab File ID: \GCMS1023\2801028.D
Method Blank: MB-11157
Prep Factor: 166.389
Dilution Factor: 2.00

Method: SW8270C
Prep Method: SW3540A

SEMIVOLATILE ORGANICS

Units: µg/Kg-dry

Analytes	CAS Number	Result	LQL
Acenaphthene	83-32-9	U	2200
Acenaphthylene	208-96-8	U	2200
Anthracene	120-12-7	U	2200
Benzo(a)anthracene	56-55-3	U	2200
Benzo(b&k)fluoranthene	205-99-2 & 207-08-9	U	4400
Benzoic acid	65-85-0	U	8800
Benzo(g,h,i)perylene	191-24-2	U	2200
Benzo(a)pyrene	50-32-8	U	2200
Benzyl alcohol	100-51-6	U	4400
4-Bromophenyl phenyl ether	101-55-3	U	2200
Butyl benzyl phthalate	85-68-7	U	2200
4-Chloroaniline	106-47-8	U	2200
Bis(2-chloroethoxy)methane	111-91-1	U	4400
Bis(2-chloroethyl)ether	111-44-4	U	4400
4-Chloro-3-methylphenol	59-50-7	U	2200
2-Chloronaphthalene	91-58-7	U	2200
2-Chlorophenol	95-57-8	U	4400
4-Chlorophenyl phenyl ether	7005-72-3	U	2200
Chrysene	218-01-9	U	2200
Dibenz(a,h)anthracene	53-70-3	U	2200
Dibenzofuran	132-64-9	U	2200
Di-n-butyl phthalate	84-74-2	U	2200
1,2-Dichlorobenzene	95-50-1	U	4400
1,3-Dichlorobenzene	541-73-1	U	4400
1,4-Dichlorobenzene	106-46-7	U	4400
3,3'-Dichlorobenzidine	91-94-1	U	4400
Dichlorodiisopropyl ether	108-60-1	U	4400
2,4-Dichlorophenol	120-83-2	U	2200
Diethyl phthalate	84-66-2	U	2200
2,4-Dimethylphenol	105-67-9	U	2200
Dimethyl phthalate	131-11-3	U	2200
4,6-Dinitro-2-methylphenol	534-52-1	U	2200
2,4-Dinitrotoluene	121-14-2	U	2200
2,6-Dinitrotoluene	606-20-2	U	2200
Di-n-octyl phthalate	117-84-0	U	2200
Bis(2-ethylhexyl)phthalate	117-81-7	U	4400
Fluoranthene	206-44-0	U	2200
Fluorene	86-73-7	U	2200
Hexachlorobenzene	118-74-1	U	2200
Hexachlorobutadiene	87-68-3	U	4400



Analyst



Approved

Qualifiers: See case narrative for a discussion

- B - Analyte detected in the Method Blank, value not subtracted from result
- E - Extrapolated value. Value exceeds calibration range
- H - Prep or Analytical holding time exceeded
- S - Spike Recovery outside acceptance limits
- X - See case narrative
- * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Qualifiers: U - Analyte not detected at or above the reporting limit

J - Estimated value below the LQL


Definitions: NA - Not Applicable
LQL - Lower Quantitation Limit
MDL - Method Detection Limit
Surr - Surrogate Standard

Print Date: 11/1/06


Client Sample ID: DAS-3-8'-12'	Lab Work Order: 06-7267
Client Project ID: Denver Animal Shelter	Lab Sample ID: 06-7267-03B
Date Collected: 10/18/06	Sample Matrix: Soil
Date Received: 10/18/06	Lab File ID: \GCMS1023\2801028.D
Date Prepared: 10/19/06	Method Blank: MB-11157
Date Analyzed: 10/24/06	Prep Factor: 166.389
Percent Moisture: 24.53	Dilution Factor: 2.00

Method: SW8270C SEMIVOLATILE ORGANICS **Units: µg/Kg-dry**
Prep Method: SW3540A

Analytes	CAS Number	Result	LQL
Hexachlorocyclopentadiene	77-47-4	U	2200
Hexachloroethane	67-72-1	U	4400
Indeno(1,2,3-cd)pyrene	193-39-5	U	2200
Isophorone	78-59-1	U	4400
2-Methylnaphthalene	91-57-6	U	4400
2-Methylphenol	95-48-7	U	4400
4-Methylphenol	106-44-5	U	4400
Naphthalene	91-20-3	U	4400
2-Nitroaniline	88-74-4	U	2200
3-Nitroaniline	99-09-2	U	2200
4-Nitroaniline	100-01-6	U	2200
Nitrobenzene	98-95-3	U	4400
2-Nitrophenol	88-75-5	U	4400
4-Nitrophenol	100-02-7	U	2200
N-Nitrosodi-n-propylamine	621-64-7	U	4400
N-Nitrosodiphenylamine	86-30-6	U	2200
Pentachlorophenol	87-86-5	U	2200
Phenanthrene	85-01-8	U	2200
Phenol	108-95-2	U	4400
Pyrene	129-00-0	U	2200
1,2,4-Trichlorobenzene	120-82-1	U	4400
2,4,5-Trichlorophenol	95-95-4	U	2200
2,4,6-Trichlorophenol	88-06-2	U	2200
Surr: 2,4,6-Tribromophenol	118-79-6	68	QC Limits: 40-130 %REC
Surr: 2-Fluorobiphenyl	321-60-8	71	QC Limits: 37-130 %REC
Surr: 2-Fluorophenol	367-12-4	76	QC Limits: 24-130 %REC
Surr: Nitrobenzene-d5	4165-60-0	66	QC Limits: 27-130 %REC
Surr: Phenol-d6	13127-88-3	83	QC Limits: 30-130 %REC
Surr: Terphenyl-d14	1718-51-0	108	QC Limits: 41-135 %REC



Analyst



Approved

Qualifiers: See case narrative for a discussion

- B - Analyte detected in the Method Blank, value not subtracted from result
- E - Extrapolated value. Value exceeds calibration range
- H - Prep or Analytical holding time exceeded
- S - Spike Recovery outside acceptance limits
- X - See case narrative
- * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Qualifiers: U - Analyte not detected at or above the reporting limit
J - Estimated value below the LQL

Definitions: NA - Not Applicable
LQL - Lower Quantitation Limit
MDL - Method Detection Limit
Surr - Surrogate Standard

Print Date: 11/1/06

Quantitation Report (QT Reviewed)

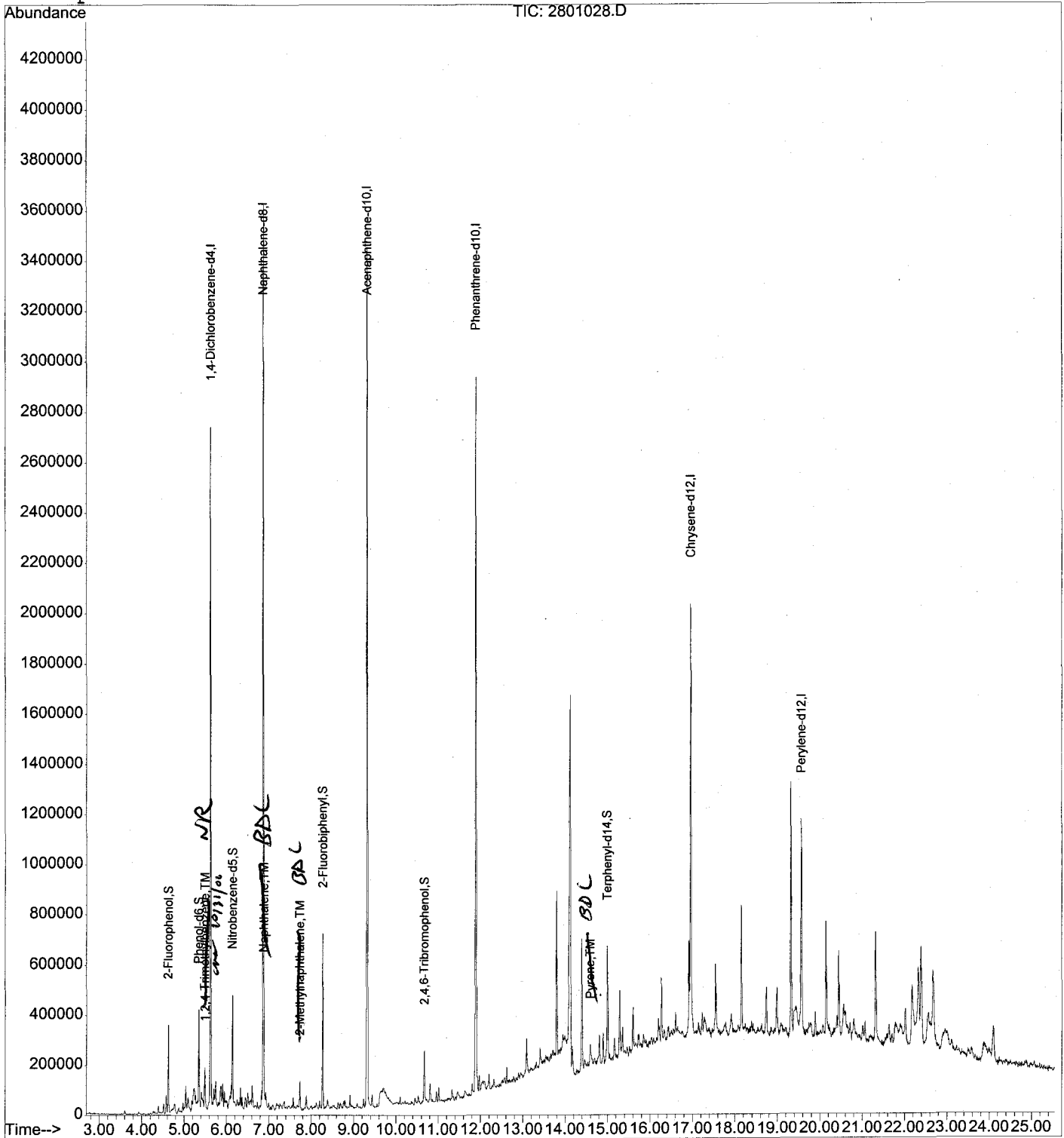
Data File : D:\MSDCHEM\1\DATA\GCMS1023\2801028.D
Acq On : 24 Oct 2006 3:28 am
Sample : 06-7267-03B DF=2
Misc : SAMP 8270_S
MS Integration Params: RTEINT.P
Quant Time: Oct 24 9:44 2006

Vial: 28
Operator: T. Buchner
Inst : GCMS1
Multiplr: 1.00

024

Quant Results File: BNA1020.RES

Method : D:\MSDCHEM\1\METHODS\BNA1020.M (RTE Integrator)
Title : 8270C Calibration
Last Update : Mon Oct 23 10:05:23 2006
Response via : Initial Calibration




Client Sample ID: DAS-3-8'-12' Client Project ID: Denver Animal Shelter Date Collected: 10/18/06 Date Received: 10/18/06 Date Prepared: 10/19/06 Date Analyzed: 10/23/06 Percent Moisture: 24.53	Lab Work Order: 06-7267 Lab Sample ID: 06-7267-03B Sample Matrix: Soil Lab File ID: \GCMS1023\0701007.D Method Blank: MB-11157 Prep Factor: 166.389 Dilution Factor: 5.00
---	--

Method: SW8270C **SEMIVOLATILE ORGANICS** **Units: µg/Kg-dry**
Prep Method: SW3540A

Analytes	CAS Number	Result	LQL
2,4-Dinitrophenol	51-28-5	U	11000
Surr: 2,4,6-Tribromophenol	118-79-6	73	QC Limits: 40-130 %REC
Surr: 2-Fluorobiphenyl	321-60-8	77	QC Limits: 37-130 %REC
Surr: 2-Fluorophenol	367-12-4	78	QC Limits: 24-130 %REC
Surr: Nitrobenzene-d5	4165-60-0	71	QC Limits: 27-130 %REC
Surr: Phenol-d6	13127-88-3	82	QC Limits: 30-130 %REC
Surr: Terphenyl-d14	1718-51-0	110	QC Limits: 41-135 %REC



Analyst



Approved

Qualifiers: See case narrative for a discussion

- B - Analyte detected in the Method Blank, value not subtracted from result
- E - Extrapolated value. Value exceeds calibration range
- H - Prep or Analytical holding time exceeded
- S - Spike Recovery outside acceptance limits
- X - See case narrative
- * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Qualifiers: U - Analyte not detected at or above the reporting limit

J - Estimated value below the LQL

Definitions: NA - Not Applicable
 LQL - Lower Quantitation Limit
 MDL - Method Detection Limit
 Surr - Surrogate Standard

Print Date: 10/24/06

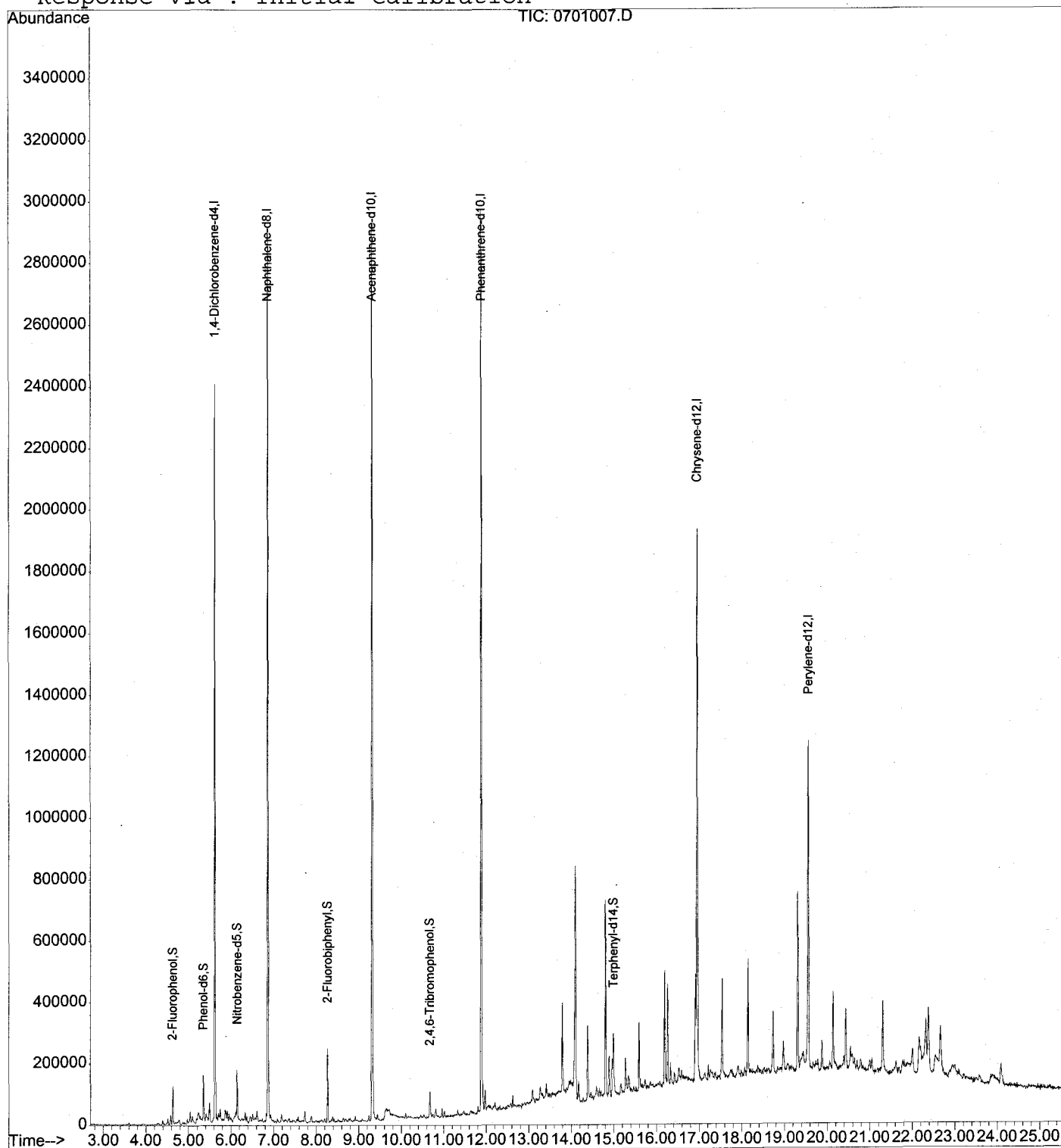
Data File : D:\MSDCHEM\1\DATA\GCMS1023\0701007.D
Acq On : 23 Oct 2006 1:49 pm
Sample : 06-7267-03B DF=5
Misc : SAMP 8270_S
MS Integration Params: RTEINT.P
Quant Time: Oct 24 9:48 2006

Vial: 7
Operator: T. Buchner
Inst : GCMS1
Multiplr: 1.00

026

Quant Results File: BNA1020.RES

Method : D:\MSDCHEM\1\METHODS\BNA1020.M (RTE Integrator)
Title : 8270C Calibration
Last Update : Mon Oct 23 10:05:23 2006
Response via : Initial Calibration



Client Sample ID: DAS-2-8'-12'
Client Project ID: Denver Animal Shelter
Date Collected: 10/18/06
Date Received: 10/18/06
Date Prepared: 10/19/06
Date Analyzed: 10/23/06
Percent Moisture: 36.04

Lab Work Order: 06-7267
Lab Sample ID: 06-7267-04B
Sample Matrix: Soil
Lab File ID: \GCMS1023\0801008.D
Method Blank: MB-11157
Prep Factor: 199.867
Dilution Factor: 10.00

Method: SW8270C
Prep Method: SW3540A

SEMIVOLATILE ORGANICS

Units: µg/Kg-dry

Analytes	CAS Number	Result	LQL
Acenaphthene	83-32-9	9000 J	16000
Acenaphthylene	208-96-8	U	16000
Anthracene	120-12-7	15000 J	16000
Benzo(a)anthracene	56-55-3	38000	16000
Benzo(b&k)fluoranthene	205-99-2 & 207-08-9	70000	31000
Benzoic acid	65-85-0	U	63000
Benzo(g,h,i)perylene	191-24-2	28000	16000
Benzo(a)pyrene	50-32-8	40000	16000
Benzyl alcohol	100-51-6	U	31000
4-Bromophenyl phenyl ether	101-55-3	U	16000
Butyl benzyl phthalate	85-68-7	U	16000
4-Chloroaniline	106-47-8	U	16000
Bis(2-chloroethoxy)methane	111-91-1	U	31000
Bis(2-chloroethyl)ether	111-44-4	U	31000
4-Chloro-3-methylphenol	59-50-7	U	16000
2-Chloronaphthalene	91-58-7	U	16000
2-Chlorophenol	95-57-8	U	31000
4-Chlorophenyl phenyl ether	7005-72-3	U	16000
Chrysene	218-01-9	65000	16000
Dibenz(a,h)anthracene	53-70-3	10000 J	16000
Dibenzofuran	132-64-9	U	16000
Di-n-butyl phthalate	84-74-2	U	16000
1,2-Dichlorobenzene	95-50-1	U	31000
1,3-Dichlorobenzene	541-73-1	U	31000
1,4-Dichlorobenzene	106-46-7	U	31000
3,3'-Dichlorobenzidine	91-94-1	U	31000
Dichlorodiisopropyl ether	108-60-1	U	31000
2,4-Dichlorophenol	120-83-2	U	16000
Diethyl phthalate	84-66-2	U	16000
2,4-Dimethylphenol	105-67-9	U	16000
Dimethyl phthalate	131-11-3	U	16000
4,6-Dinitro-2-methylphenol	534-52-1	U	16000
2,4-Dinitrophenol	51-28-5	U	31000
2,4-Dinitrotoluene	121-14-2	U	16000
2,6-Dinitrotoluene	606-20-2	U	16000
Di-n-octyl phthalate	117-84-0	U	16000
Bis(2-ethylhexyl)phthalate	117-81-7	U	31000
Fluoranthene	206-44-0	96000	16000
Fluorene	86-73-7	9700 J	16000
Hexachlorobenzene	118-74-1	U	16000



Analyst



Approved

Qualifiers: See case narrative for a discussion

- B - Analyte detected in the Method Blank, value not subtracted from result
- E - Extrapolated value. Value exceeds calibration range
- H - Prep or Analytical holding time exceeded
- S - Spike Recovery outside acceptance limits
- X - See case narrative
- * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Qualifiers: U - Analyte not detected at or above the reporting limit

J - Estimated value below the LQL

- Definitions:** NA - Not Applicable
LQL - Lower Quantitation Limit
MDL - Method Detection Limit
Surr - Surrogate Standard

Print Date: 11/1/06


Client Sample ID: DAS-2-8'-12'	Lab Work Order: 06-7267
Client Project ID: Denver Animal Shelter	Lab Sample ID: 06-7267-04B
Date Collected: 10/18/06	Sample Matrix: Soil
Date Received: 10/18/06	Lab File ID: \GCMS1023\0801008.D
Date Prepared: 10/19/06	Method Blank: MB-11157
Date Analyzed: 10/23/06	Prep Factor: 199.867
Percent Moisture: 36.04	Dilution Factor: 10.00

Method: SW8270C SEMIVOLATILE ORGANICS **Units: µg/Kg-dry**
Prep Method: SW3540A

Analytes	CAS Number	Result	LQL
Hexachlorobutadiene	87-68-3	U	31000
Hexachlorocyclopentadiene	77-47-4	U	16000
Hexachloroethane	67-72-1	U	31000
Indeno(1,2,3-cd)pyrene	193-39-5	28000	16000
Isophorone	78-59-1	U	31000
2-Methylnaphthalene	91-57-6	U	31000
2-Methylphenol	95-48-7	U	31000
4-Methylphenol	106-44-5	11000 J	31000
Naphthalene	91-20-3	U	31000
2-Nitroaniline	88-74-4	U	16000
3-Nitroaniline	99-09-2	U	16000
4-Nitroaniline	100-01-6	U	16000
Nitrobenzene	98-95-3	U	31000
2-Nitrophenol	88-75-5	U	31000
4-Nitrophenol	100-02-7	U	16000
N-Nitrosodi-n-propylamine	621-64-7	U	31000
N-Nitrosodiphenylamine	86-30-6	18000	16000
Pentachlorophenol	87-86-5	U	16000
Phenanthrene	85-01-8	110000	16000
Phenol	108-95-2	U	31000
Pyrene	129-00-0	110000	16000
1,2,4-Trichlorobenzene	120-82-1	U	31000
2,4,5-Trichlorophenol	95-95-4	U	16000
2,4,6-Trichlorophenol	88-06-2	U	16000
Surr: 2,4,6-Tribromophenol	118-79-6	67	QC Limits: 40-130 %REC
Surr: 2-Fluorobiphenyl	321-60-8	88	QC Limits: 37-130 %REC
Surr: 2-Fluorophenol	367-12-4	109	QC Limits: 24-130 %REC
Surr: Nitrobenzene-d5	4165-60-0	89	QC Limits: 27-130 %REC
Surr: Phenol-d6	13127-88-3	106	QC Limits: 30-130 %REC
Surr: Terphenyl-d14	1718-51-0	115	QC Limits: 41-135 %REC



Analyst



Approved

Qualifiers: See case narrative for a discussion

- B - Analyte detected in the Method Blank, value not subtracted from result
- E - Extrapolated value. Value exceeds calibration range
- H - Prep or Analytical holding time exceeded
- S - Spike Recovery outside acceptance limits
- X - See case narrative
- * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Qualifiers: U - Analyte not detected at or above the reporting limit

J - Estimated value below the LQL

- Definitions:** NA - Not Applicable
LQL - Lower Quantitation Limit
MDL - Method Detection Limit
Surr - Surrogate Standard

Print Date: 11/1/06

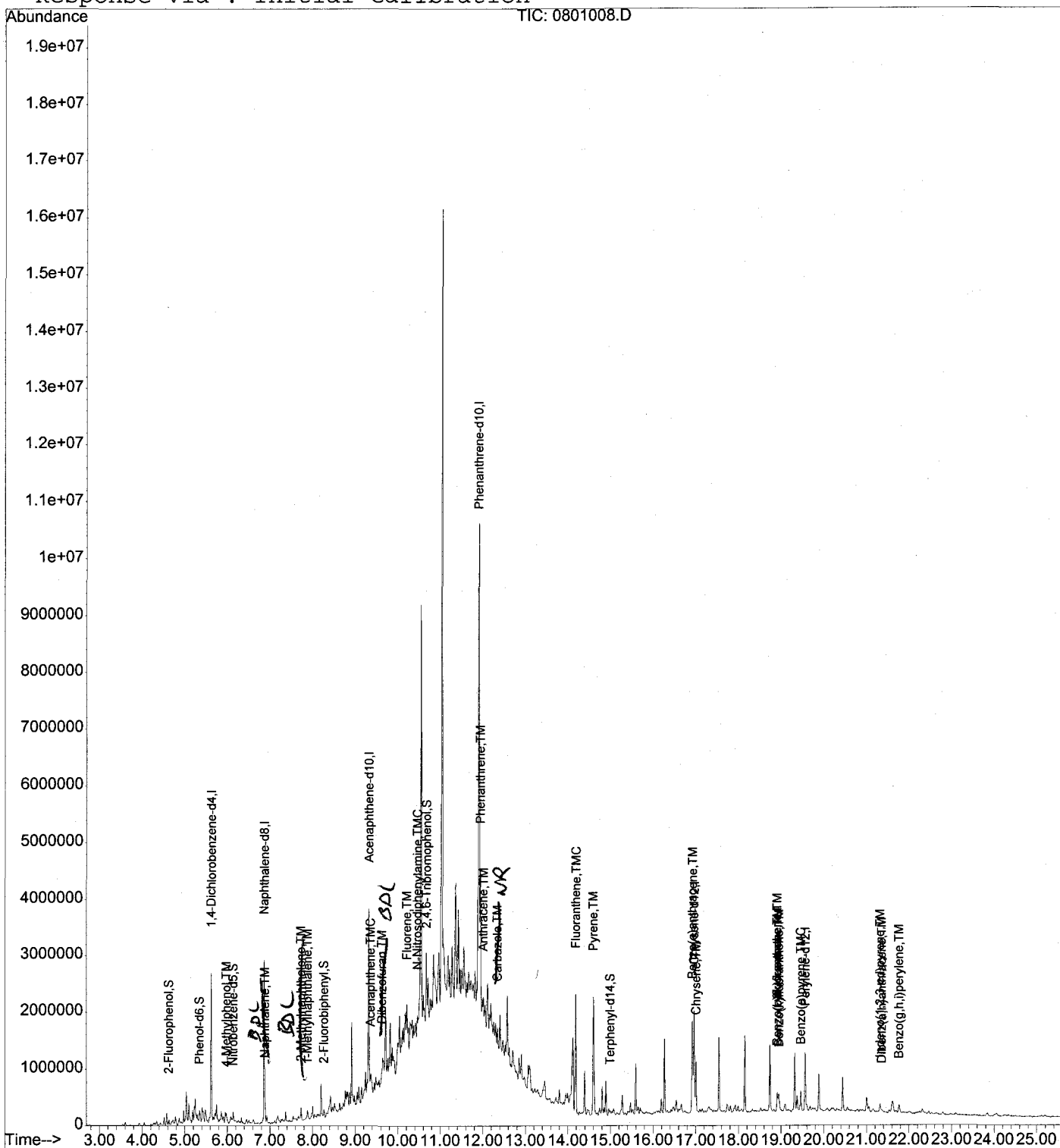
Data File : D:\MSDCHEM\1\DATA\GCMS1023\0801008.D
Acq On : 23 Oct 2006 2:28 pm
Sample : 06-7267-04B DF=10
Misc : SAMP 8270_S
MS Integration Params: RTEINT.P
Quant Time: Oct 23 15:09 2006

Vial: 8
Operator: T. Buchner
Inst : GCMS1
Multiplr: 1.00

029

Quant Results File: BNA1020.RES

Method : D:\MSDCHEM\1\METHODS\BNA1020.M (RTE Integrator)
Title : 8270C Calibration
Last Update : Mon Oct 23 10:05:23 2006
Response via : Initial Calibration



Handwritten: 10/31/06

Evergreen Analytical, Inc.
 4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862
 (303) 425-6021

003

Client Sample ID: DAS-11-12'-16'
Client Project ID: Denver Animal Shelter
Date Collected: 10/17/06
Date Received: 10/18/06

Lab Work Order: 06-7267
Lab Sample ID: 06-7267-01
Sample Matrix: Soil

METALS

Method: SW6010

Prep Method: SW3050

Date Prepared: 10/19/06
Date Analyzed: 10/23/06

Lab File ID: 102306PM
Method Blank: MB-11161

Dilution Factor: 1
Lab Fraction ID: 06-7267-01C

Analytes	CAS Number	Result	LQL	Units
Arsenic	7440-38-2	8.4	4.0	mg/Kg
Barium	7440-39-3	200 B	0.081	mg/Kg
Cadmium	7440-43-9	2.2	0.81	mg/Kg
Chromium	7440-47-3	44	0.81	mg/Kg
Lead	7439-92-1	120	5.9	mg/Kg
Silver	7440-22-4	0.91 J	2.4	mg/Kg

Date Prepared: 10/19/06
Date Analyzed: 10/27/06

Lab File ID: 102606PM
Method Blank: MB-11161

Dilution Factor: 10
Lab Fraction ID: 06-7267-01C

Analytes	CAS Number	Result	LQL	Units
Selenium	7782-49-2	U	81	mg/Kg

MERCURY

Method: SW7471

Prep Method: SW7471

Date Prepared: 10/20/06
Date Analyzed: 10/20/06

Lab File ID: 102006s
Method Blank: MB-11148

Dilution Factor: 1
Lab Fraction ID: 06-7267-01C

Analytes	CAS Number	Result	LQL	Units
Mercury	7439-97-6	0.16	0.019	mg/Kg

MB

Analyst

WJH

Approved

Qualifiers: B - Analyte detected in the associated Method Blank, value not subtracted from result
 E - Extrapolated value. Value exceeds calibration range
 H - Sample analysis exceeded analytical holding time
 J - Indicates an estimated value when the compound is detected, but is below the LQL
 S - Spike Recovery outside accepted limits
 U - Compound analyzed for but not detected
 X - See case narrative
 * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Definitions: NA - Not Applicable
 LQL - Lower Quantitation Limit
 Surr - Surrogate

Print Date: 11/14/2006

Evergreen Analytical, Inc.
 4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862
 (303) 425-6021

004

Client Sample ID: DAS-3-8'-12'
Client Project ID: Denver Animal Shelter
Date Collected: 10/18/06
Date Received: 10/18/06

Lab Work Order: 06-7267
Lab Sample ID: 06-7267-03
Sample Matrix: Soil

METALS

Method: SW6010

Prep Method: SW3050

Date Prepared: 10/19/06
Date Analyzed: 10/23/06

Lab File ID: 102306PM
Method Blank: MB-11161

Dilution Factor: 1
Lab Fraction ID: 06-7267-03C

Analytes	CAS Number	Result	LQL	Units
Arsenic	7440-38-2	2.7 J	4.1	mg/Kg
Barium	7440-39-3	100 B	0.082	mg/Kg
Cadmium	7440-43-9	1.6	0.82	mg/Kg
Chromium	7440-47-3	5.7	0.82	mg/Kg
Lead	7439-92-1	240	6.0	mg/Kg
Selenium	7782-49-2	U	8.2	mg/Kg
Silver	7440-22-4	U	2.5	mg/Kg

MERCURY

Method: SW7471

Prep Method: SW7471

Date Prepared: 10/20/06
Date Analyzed: 10/20/06

Lab File ID: 102006s
Method Blank: MB-11148

Dilution Factor: 1
Lab Fraction ID: 06-7267-03C

Analytes	CAS Number	Result	LQL	Units
Mercury	7439-97-6	0.065	0.016	mg/Kg

MB

Analyst

WJH

Approved

Qualifiers: B - Analyte detected in the associated Method Blank, value not subtracted from result
 E - Extrapolated value. Value exceeds calibration range
 H - Sample analysis exceeded analytical holding time
 J - Indicates an estimated value when the compound is detected, but is below the LQL
 S - Spike Recovery outside accepted limits
 U - Compound analyzed for but not detected
 X - See case narrative
 * - Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Definitions: NA - Not Applicable
 LQL - Lower Quantitation Limit
 Surr - Surrogate

Print Date: 11/14/2006

Evergreen Analytical, Inc.
 4036 Youngfield Street, Wheat Ridge, Colorado 80033-3862
 (303) 425-6021

005

Client Sample ID: DAS-2-8'-12'
Client Project ID: Denver Animal Shelter
Date Collected: 10/18/06
Date Received: 10/18/06

Lab Work Order: 06-7267
Lab Sample ID: 06-7267-04
Sample Matrix: Soil

METALS

Method: SW6010

Prep Method: SW3050

Date Prepared: 10/19/06
Date Analyzed: 10/23/06

Lab File ID: 102306PM
Method Blank: MB-11161

Dilution Factor: 1
Lab Fraction ID: 06-7267-04C

Analytes	CAS Number	Result	LQL	Units
Arsenic	7440-38-2	3.7 J	4.1	mg/Kg
Barium	7440-39-3	140 B	0.082	mg/Kg
Cadmium	7440-43-9	1.1	0.82	mg/Kg
Chromium	7440-47-3	4.6	0.82	mg/Kg
Lead	7439-92-1	54	6.0	mg/Kg
Selenium	7782-49-2	1.0 J	8.2	mg/Kg
Silver	7440-22-4	U	2.5	mg/Kg

MERCURY

Method: SW7471

Prep Method: SW7471

Date Prepared: 10/20/06
Date Analyzed: 10/20/06

Lab File ID: 102006s
Method Blank: MB-11148

Dilution Factor: 10
Lab Fraction ID: 06-7267-04C

Analytes	CAS Number	Result	LQL	Units
Mercury	7439-97-6	2.2	0.20	mg/Kg

MB

Analyst

UJA

Approved

Qualifiers: B - Analyte detected in the associated Method Blank, value not subtracted from result
 E - Extrapolated value. Value exceeds calibration range
 H - Sample analysis exceeded analytical holding time
 J - Indicates an estimated value when the compound is detected, but is below the LQL
 S - Spike Recovery outside accepted limits
 U - Compound analyzed for but not detected
 X - See case narrative
 * -Value exceeded the Maximum Contamination Level (MCL), TCLP limit, or if compound is undetected, LQL exceeds MCL.

Definitions: NA - Not Applicable
 LQL - Lower Quantitation Limit
 Surr - Surrogate

Print Date: 11/14/2006

QUALITY ASSURANCE REPORTS

METHOD BLANKS (MB, MEB)

LABORATORY CONTROL SPIKES (LCS)

MATRIX SPIKES (MS/MSD)*

DUPLICATES (DUP)*

***Only included if requested or if performed on this client's samples.**

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: MB2102006-S	Sample Type: MBLK	TestCode: 8260_S	Run ID: VOA-2_061020A	Prep Date: 10/20/06	Units: µg/Kg
Batch ID: R27748	TestNo: SW8260B	FileID: VOA210200301003.D	Analysis Date: 10/20/06	SeqNo: 501648	
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual

Acetone	U	100										
Benzene	U	5.0										
Bromodichloromethane	U	25										
Bromoform	U	25										
Bromomethane	U	25										
2-Butanone	U	100										
Carbon disulfide	U	25										
Carbon tetrachloride	U	25										
Chlorobenzene	U	25										
Chloroethane	U	25										
2-Chloroethoxyvinylether	U	100										
Chloroform	U	25										
Chloromethane	U	25										
Dibromochloromethane	U	25										
1,2-Dichlorobenzene	U	25										
1,3-Dichlorobenzene	U	25										
1,4-Dichlorobenzene	U	25										
1,1-Dichloroethane	U	25										
1,2-Dichloroethane	U	25										
1,1-Dichloroethene	U	25										
cis-1,2-Dichloroethene	U	25										
trans-1,2-Dichloroethene	U	25										
1,2-Dichloropropane	U	25										
cis-1,3-Dichloropropene	U	25										
trans-1,3-Dichloropropene	U	25										
Ethylbenzene	U	25										
2-Hexanone	U	100										
Methylene chloride	U	25										
4-Methyl-2-pentanone	U	100										
Styrene	U	25										

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: MB2102006-S	Sample Type: MBLK	TestCode: 8260_S	Run ID: VOA-2_061020A	Prep Date: 10/20/06	Units: µg/Kg						
Batch ID: R27748	TestNo: SW8260B	FileID: VOA210200301003.D	Analysis Date: 10/20/06	SeqNo: 501648							
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

1,1,2,2-Tetrachloroethane	U	50									
Tetrachloroethene	U	25									
Toluene	U	10									
1,1,1-Trichloroethane	U	25									
1,1,2-Trichloroethane	U	25									
Trichloroethene	U	25									
Vinyl acetate	U	100									
Vinyl chloride	U	25									
Xylene, Total	U	25									
Surr: 1,2-Dichloroethane-d4	243.8	0	250	0	97.5	70	130	0	0		
Surr: 4-Bromofluorobenzene	247.4	0	250	0	98.9	70	130	0	0		
Surr: Toluene-d8	256.8	0	250	0	103	70	130	0	0		

Sample ID: LCS2102006H-S	Sample Type: LCS	TestCode: 8260_S	Run ID: VOA-2_061020A	Prep Date: 10/20/06	Units: µg/Kg						
Batch ID: R27748	TestNo: SW8260B	FileID: VOA210200401004.D	Analysis Date: 10/20/06	SeqNo: 501649							
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Acetone	41.95	20	50	0	83.9	20	232	0	0		
Benzene	50.27	1.0	50	0	101	70	130	0	0		
Bromodichloromethane	55.78	5.0	50	0	112	70	130	0	0		
Bromoform	49.3	5.0	50	0	98.6	70	134	0	0		
Bromomethane	58.96	5.0	50	0	118	31	157	0	0		
2-Butanone	38.65	20	50	0	77.3	50	130	0	0		
Carbon disulfide	36.06	5.0	50	0	72.1	27	168	0	0		
Carbon tetrachloride	58.52	5.0	50	0	117	70	130	0	0		
Chlorobenzene	50.62	5.0	50	0	101	70	130	0	0		
Chloroethane	54.02	5.0	50	0	108	44	161	0	0		
2-Chloroethylvinylether	48.64	20	50	0	97.3	1	173	0	0		
Chloroform	56.08	5.0	50	0	112	70	130	0	0		
Chloromethane	48.58	5.0	50	0	97.2	36	135	0	0		
Dibromochloromethane	57.58	5.0	50	0	115	70	130	0	0		

Qualifiers:
 NID - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 10/23/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: LCS2102006H-S	SamplType: LCS	TestCode: 8260_S	Run ID: VOA2-061020A	Prep Date: 10/20/06	Units: µg/Kg
Batch ID: R27748	TestNo: SW8260B	FileID: VOA2102010401004.D	Analysis Date: 10/20/06	SeqNo: 501649	

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,2-Dichlorobenzene	51.21	5.0	50	0	102	67	130	0	0		
1,3-Dichlorobenzene	49.47	5.0	50	0	98.9	56	130	0	0		
1,4-Dichlorobenzene	47.61	5.0	50	0	95.2	54	130	0	0		
1,1-Dichloroethane	54.77	5.0	50	0	110	70	130	0	0		
1,2-Dichloroethane	52.45	5.0	50	0	105	70	130	0	0		
1,1-Dichloroethene	56.92	5.0	50	0	114	66	140	0	0		
cis-1,2-Dichloroethene	55.95	5.0	50	0	112	70	130	0	0		
trans-1,2-Dichloroethene	57.62	5.0	50	0	115	60	141	0	0		
1,2-Dichloropropane	50.86	5.0	50	0	102	70	130	0	0		
cis-1,3-Dichloropropene	54.32	5.0	52	0	104	70	130	0	0		
trans-1,3-Dichloropropene	50.06	5.0	48	0	104	67	130	0	0		
Ethylbenzene	51.64	5.0	50	0	103	70	130	0	0		
2-Hexanone	43.41	20	50	0	86.8	62	144	0	0		
Methylene chloride	50.6	5.0	50	0	101	47	156	0	0		
4-Methyl-2-pentanone	44.99	20	50	0	90	70	159	0	0		
Styrene	30.18	5.0	50	0	60.4	44	130	0	0		
1,1,2,2-Tetrachloroethane	48.17	10	50	0	96.3	70	130	0	0		
Tetrachloroethene	49.93	5.0	50	0	99.9	70	130	0	0		
Toluene	50.98	2.0	50	0	102	70	130	0	0		
1,1,1-Trichloroethane	57.89	5.0	50	0	116	70	130	0	0		
1,1,2-Trichloroethane	52.35	5.0	50	0	105	70	130	0	0		
Trichloroethene	53.44	5.0	50	0	107	70	130	0	0		
Vinyl acetate	53.49	20	50	0	107	70	152	0	0		
Vinyl chloride	51.64	5.0	50	0	103	37	142	0	0		
Xylene, Total	94.02	5.0	100	0	94	70	130	0	0		
Surr: 1,2-Dichloroethane-d4	50.11	0	50	0	100	70	130	0	0		
Surr: 4-Bromofluorobenzene	51.94	0	50	0	104	70	130	0	0		
Surr: Toluene-d8	50.23	0	50	0	100	70	130	0	0		

Qualifiers:
 NID - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 10/23/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: 06-7294-01AMS	Samp Type: MS	TestCode: 8260_S	Run ID: VOA-2_061020A	Prep Date: 10/20/06	Units: µg/Kg-dry
Batch ID: R27748	TestNo: SW8260B	FileID: VOA210200601006.D	Analysis Date: 10/20/06	SeqNo: 501651	

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Acetone	217.6	110	263.7	0	82.5	1	257	0	0	0	
Benzene	253	5.3	263.7	0	96	70	130	0	0	0	
Bromodichloromethane	303.3	26	263.7	0	115	70	130	0	0	0	
Bromoform	259.4	26	263.7	0	98.4	70	148	0	0	0	
Bromomethane	282.2	26	263.7	0	107	21	161	0	0	0	
2-Butanone	221	110	263.7	0	83.8	50	137	0	0	0	
Carbon disulfide	162.3	26	263.7	0	61.5	21	176	0	0	0	
Carbon tetrachloride	275.8	26	263.7	0	105	70	130	0	0	0	
Chlorobenzene	264.1	26	263.7	0	100	70	130	0	0	0	
Chloroethane	263.6	26	263.7	0	100	43	167	0	0	0	
2-Chloroethylvinylether	279.7	110	263.7	0	106	1	195	0	0	0	
Chloroform	270.3	26	263.7	0	103	70	130	0	0	0	
Chloromethane	244.1	26	263.7	0	92.6	31	145	0	0	0	
Dibromochloromethane	301.4	26	263.7	0	114	70	130	0	0	0	
1,2-Dichlorobenzene	270.7	26	263.7	0	103	56	130	0	0	0	
1,3-Dichlorobenzene	263.7	26	263.7	0	100	50	130	0	0	0	
1,4-Dichlorobenzene	251.7	26	263.7	0	95.4	50	130	0	0	0	
1,1-Dichloroethane	267.6	26	263.7	0	102	70	130	0	0	0	
1,2-Dichloroethane	282.5	26	263.7	0	107	70	130	0	0	0	
1,1-Dichloroethene	284.5	26	263.7	0	108	58	149	0	0	0	
cis-1,2-Dichloroethene	275.7	26	263.7	0	105	70	130	0	0	0	
trans-1,2-Dichloroethene	272.6	26	263.7	0	103	55	145	0	0	0	
1,2-Dichloropropane	265	26	263.7	0	100	70	130	0	0	0	
cis-1,3-Dichloropropene	295.8	26	274.2	0	108	70	130	0	0	0	
trans-1,3-Dichloropropene	266.4	26	253.1	0	105	61	130	0	0	0	
Ethylbenzene	269.9	26	263.7	0	102	70	130	0	0	0	
2-Hexanone	231.7	110	263.7	0	87.9	54	178	0	0	0	
Methylene chloride	255.4	26	263.7	0	96.8	47	156	0	0	0	
4-Methyl-2-pentanone	248.6	110	263.7	0	94.3	59	202	0	0	0	
Syvene	160.3	26	263.7	0	60.8	39	130	0	0	0	
1,1,2,2-Tetrachloroethane	177.8	53	263.7	0	67.4	69	138	0	0	0	
Tetrachloroethene	250.2	26	263.7	0	94.9	70	130	0	0	0	S

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 10/23/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: 06-7294-01AMS	Sample Type: MS	TestCode: 8260_S	Run ID: VOA-2_061020A	Prep Date: 10/20/06	Units: µg/Kg-dry						
Batch ID: R27748	TestNo: SW8260B	FileID: VOA210200601006.D	Analysis Date: 10/20/06	SeqNo: 501651							
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Toluene	260	11	263.7	0	98.6	70	130	0	0	30	
1,1,1-Trichloroethane	282.3	26	263.7	0	107	70	130	0	0	30	
1,1,2-Trichloroethane	270.9	26	263.7	0	103	70	130	0	0	30	
Trichloroethene	360.8	26	263.7	0	137	70	130	0	0	30	S
Vinyl acetate	U	110	263.7	0	0	50	182	0	0	30	S
Vinyl chloride	247.5	26	263.7	0	93.9	35	148	0	0	30	
Xylene, Total	482.9	26	527.4	0	91.6	70	130	0	0	30	
Surr: 1,2-Dichloroethane-d4	275.2	0	263.7	0	104	70	130	0	0	30	
Surr: 4-Bromofluorobenzene	268	0	263.7	0	102	70	130	0	0	30	
Surr: Toluene-d8	265.2	0	263.7	0	101	70	130	0	0	30	

Sample ID: 06-7294-01AMS	Sample Type: MSD	TestCode: 8260_S	Run ID: VOA-2_061020A	Prep Date: 10/20/06	Units: µg/Kg-dry						
Batch ID: R27748	TestNo: SW8260B	FileID: VOA210200701007.D	Analysis Date: 10/20/06	SeqNo: 501652							
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Acetone	217.6	110	263.7	0	82.5	1	257	217.6	0.0242	30	
Benzene	264.7	5.3	263.7	0	100	70	130	253	4.50	30	
Bromodichloromethane	304.6	26	263.7	0	116	70	130	303.3	0.434	30	
Bromoform	265.3	26	263.7	0	101	70	148	259.4	2.25	30	
Bromomethane	296.7	26	263.7	0	113	21	161	282.2	5.01	30	
2-Butanone	195.1	110	263.7	0	74	50	137	221	12.4	30	
Carbon disulfide	169.9	26	263.7	0	64.4	21	176	162.3	4.60	30	
Carbon tetrachloride	278.5	26	263.7	0	106	70	130	275.8	0.970	30	
Chlorobenzene	263.5	26	263.7	0	99.9	70	130	264.1	0.220	30	
Chloroethane	268.6	26	263.7	0	102	43	167	263.6	1.90	30	
2-Chloroethylether	262.3	110	263.7	0	99.5	1	195	279.7	6.40	30	
Chloroform	282.6	26	263.7	0	107	70	130	270.3	4.43	30	
Chloromethane	248.1	26	263.7	0	94.1	31	145	244.1	1.61	30	
Dibromochloromethane	313.7	26	263.7	0	119	70	130	301.4	4.01	30	
1,2-Dichlorobenzene	261.7	26	263.7	0	99.3	56	130	270.7	3.37	30	
1,3-Dichlorobenzene	252.7	26	263.7	0	95.8	50	130	263.7	4.27	30	

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 10/23/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: 06-7267-01AMSD	SampType: MSD	TestCode: 8260_S	Run ID: VOA-2_061020A	Prep Date: 10/20/06	Units: µg/Kg-dry
Batch ID: R27748	TestNo: SW8260B	FileID: VOA210200701007.D	Analysis Date: 10/20/06	SeqNo: 501652	

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,4-Dichlorobenzene	248.5	26	263.7	0	94.2	50	130	251.7	1.27	30	
1,1-Dichloroethane	275.6	26	263.7	0	105	70	130	267.6	2.91	30	
1,2-Dichloroethane	292.8	26	263.7	0	111	70	130	282.5	3.58	30	
1,1-Dichloroethene	283.3	26	263.7	0	107	58	149	284.5	0.427	30	
cis-1,2-Dichloroethene	275.3	26	263.7	0	104	70	130	275.7	0.134	30	
trans-1,2-Dichloroethene	281.7	26	263.7	0	107	55	145	272.6	3.29	30	
1,2-Dichloropropane	273.4	26	263.7	0	104	70	130	265	3.13	30	
cis-1,3-Dichloropropene	290.5	26	274.2	0	106	70	130	295.8	1.80	30	
trans-1,3-Dichloropropene	271	26	253.1	0	107	61	130	266.4	1.69	30	
Ethylbenzene	257.7	26	263.7	0	97.7	70	130	269.9	4.62	30	
2-Hexanone	238.5	110	263.7	0	90.4	54	178	231.7	2.89	30	
Methylene chloride	263.5	26	263.7	0	99.9	47	156	255.4	3.13	30	
4-Methyl-2-pentanone	251.7	110	263.7	0	95.5	59	202	248.6	1.24	30	
Styrene	155.9	26	263.7	0	59.1	39	130	160.3	2.74	30	
1,1,2,2-Tetrachloroethane	177	53	263.7	0	67.1	69	138	177.8	0.446	30	S
Tetrachloroethene	236.4	26	263.7	0	89.7	70	130	250.2	5.68	30	
Toluene	260.3	11	263.7	0	98.7	70	130	260	0.122	30	
1,1,1-Trichloroethane	283.1	26	263.7	0	107	70	130	282.3	0.298	30	
1,1,2-Trichloroethane	285.1	26	263.7	0	108	70	130	270.9	5.14	30	
Trichloroethene	356.9	26	263.7	0	135	70	130	360.8	1.07	30	S
Vinyl acetate	U	110	263.7	0	0	50	182	0	0	30	S
Vinyl chloride	256.3	26	263.7	0	97.2	35	148	247.5	3.50	30	
Xylene, Total	466.1	26	527.4	0	88.4	70	130	482.9	3.55	30	
Surr: 1,2-Dichloroethane-d4	275.2	0	263.7	0	104	70	130	0	0	0	
Surr: 4-Bromofluorobenzene	265.1	0	263.7	0	101	70	130	0	0	0	
Surr: Toluene-d8	265	0	263.7	0	101	70	130	0	0	0	

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 10/23/06

Work Order: 06-7267
Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_W

Sample ID: MB2101906-W	Samp Type: MBLK	TestCode: 8260_W	Run ID: VOA-2_061019A	Prep Date: 10/19/06	Units: µg/L						
Batch ID: R27769	TestNo: SW8260B	FileID: VOA2101911201012D	Analysis Date: 10/19/06	SeqNo: 501967							
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Acetone	U	10									
Benzene	U	1.0									
Bromodichloromethane	U	4.0									
Bromoform	U	4.0									
Bromomethane	U	10									
2-Butanone	U	20									
Carbon disulfide	U	4.0									
Carbon tetrachloride	U	2.0									
Chlorobenzene	U	3.0									
Chloroethane	U	5.0									
2-Chloroethoxyvinylether	U	10									
Chloroform	U	2.0									
Chloromethane	U	4.0									
Dibromochloromethane	U	2.0									
1,2-Dichlorobenzene	U	4.0									
1,3-Dichlorobenzene	U	4.0									
1,4-Dichlorobenzene	U	4.0									
1,1-Dichloroethane	U	2.0									
1,2-Dichloroethane	U	2.0									
1,1-Dichloroethene	U	2.0									
cis-1,2-Dichloroethene	U	2.0									
trans-1,2-Dichloroethene	U	2.0									
1,2-Dichloropropane	U	4.0									
cis-1,3-Dichloropropane	U	2.0									
trans-1,3-Dichloropropane	U	2.0									
Ethylbenzene	U	2.0									
2-Hexanone	U	4.0									
Methylene chloride	U	4.0									
4-Methyl-2-pentanone	U	10									
Styrene	U	4.0									

Qualifiers:

NID - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits
B - Analyte detected in the associated Method Blank
H - Sample exceeded analytical holding time

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_W

Sample ID: MB2101906-W	SampType: MBLK	TestCode: 8260_W	Run ID: VOA-2_061019A	Prep Date: 10/19/06	Units: µg/L
Batch ID: R27769	TestNo: SW8260B	FileID: VOA2101911201012.D	Analysis Date: 10/19/06	SeqNo: 501967	

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1,2-Trichloroethane	U	4.0									
Tetrachloroethene	U	2.0									
Toluene	U	2.0									
1,1,1-Trichloroethane	U	2.0									
1,1,2-Trichloroethane	U	4.0									
Trichloroethene	U	2.0									
Vinyl acetate	U	5.0									
Vinyl chloride	U	2.0									
Xylene, Total	U	4.0									
Surr: 1,2-Dichloroethane-d4	50.79	0	50	0	102	70	130	0	0	0	
Surr: 4-Bromofluorobenzene	49.07	0	50	0	98.1	70	130	0	0	0	
Surr: Toluene-d8	49.8	0	50	0	99.6	70	130	0	0	0	

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Acetone	37.4	1.0	50	0	74.8	57	167	0	0	0	
Benzene	49.21	1.0	50	0	98.4	70	130	0	0	0	
Bromodichloromethane	54.55	4.0	50	0	109	70	130	0	0	0	
Bromoform	47.9	4.0	50	0	95.8	66	137	0	0	0	
Bromomethane	54.64	1.0	50	0	109	58	148	0	0	0	
2-Butanone	37.5	2.0	50	0	75	52	132	0	0	0	
Carbon disulfide	33.17	4.0	50	0	66.3	42.2	130	0	0	0	
Carbon tetrachloride	51.98	2.0	50	0	104	70	130	0	0	0	
Chlorobenzene	49.76	3.0	50	0	99.5	70	130	0	0	0	
Chloroethane	51.03	5.0	50	0	102	65	140	0	0	0	
2-Chloroethylvinylether	54.69	1.0	50	0	109	1	318	0	0	0	
Chloroform	51.4	2.0	50	0	103	70	130	0	0	0	
Chloromethane	48.75	4.0	50	0	97.5	38	130	0	0	0	
Dibromochloromethane	54.61	2.0	50	0	109	70	130	0	0	0	

Qualifiers:
 NID - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 10/23/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_W

Sample ID: LCS2101906H-W	Sample Type: LCS	TestCode: 8260_W	Run ID: VOA2_061019A	Prep Date: 10/19/06	Units: µg/L						
Batch ID: R27769	TestNo: SW8260B	FileID: VOA210191301013.D	Analysis Date: 10/19/06	SeqNo: 501969							
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

1,2-Dichlorobenzene	53.6	4.0	50	0	107	54	135	0	0	130	
1,3-Dichlorobenzene	54.77	4.0	50	0	110	55.6	131	0	0	130	
1,4-Dichlorobenzene	50.8	4.0	50	0	102	54.1	130	0	0	130	
1,1-Dichloroethane	50.69	2.0	50	0	101	70	130	0	0	130	
1,2-Dichloroethane	50.98	2.0	50	0	102	70	130	0	0	130	
1,1-Dichloroethene	49.68	2.0	50	0	99.4	70	133	0	0	130	
cis-1,2-Dichloroethene	54.07	2.0	50	0	108	70	130	0	0	130	
trans-1,2-Dichloroethene	54.15	2.0	50	0	108	70	133	0	0	130	
1,2-Dichloropropane	51.76	4.0	50	0	104	70	130	0	0	130	
cis-1,3-Dichloropropene	54.34	2.0	50	0	109	70	130	0	0	130	
trans-1,3-Dichloropropene	48.45	2.0	50	0	96.9	70	130	0	0	130	
Ethylbenzene	51.38	2.0	50	0	103	70	130	0	0	130	
2-Hexanone	45.86	4.0	50	0	91.7	53	147	0	0	143	
Methylene chloride	48.72	4.0	50	0	97.4	70	143	0	0	173	
4-Methyl-2-pentanone	48.52	10	50	0	97	44	173	0	0	130	
Styrene	30.61	4.0	50	0	61.2	33	130	0	0	130	
1,1,2,2-Tetrachloroethane	51.3	4.0	50	0	103	70	130	0	0	130	
Tetrachloroethene	48.94	2.0	50	0	97.9	70	130	0	0	130	
Toluene	49.68	2.0	50	0	99.4	70	130	0	0	130	
1,1,1-Trichloroethane	51.64	2.0	50	0	103	70	130	0	0	130	
1,1,2-Trichloroethane	51.54	4.0	50	0	103	70	130	0	0	130	
Trichloroethene	49.9	2.0	50	0	99.8	70	130	0	0	130	
Vinyl acetate	53.21	5.0	50	0	106	70	130	0	0	130	
Vinyl chloride	49.11	2.0	50	0	98.2	45	130	0	0	130	
Xylene, Total	93.47	4.0	100	0	93.5	70	130	0	0	130	
Surr: 1,2-Dichloroethane-d4	51.68	0	50	0	103	70	130	0	0	130	
Surr: 4-Bromofluorobenzene	52.9	0	50	0	106	70	130	0	0	130	
Surr: Toluene-d8	51.69	0	50	0	103	70	130	0	0	130	

Qualifiers:

NID - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 10/23/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_W

Sample ID: 06-7267-02AMS	SamplType: MS	TestCode: 8260_W	Run ID: VOA2-061019A	Prep Date: 10/19/06	Units: µg/L						
Client ID: DAS-7	Batch ID: R27769	TestNo: SW8260B	FileID: VOA210191501015.D	Analysis Date: 10/19/06	SeqNo: 501972						
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Acetone	34.63	10	50	0	69.3	14	222	0	0		
Benzene	49.48	1.0	50	0	99	70	130	0	0		
Bromodichloromethane	56.05	4.0	50	0	112	70	130	0	0		
Bromoform	51.72	4.0	50	0	103	63	137	0	0		
Bromomethane	50.75	10	50	0	102	46	158	0	0		
2-Butanone	38.42	20	50	0	76.8	43	149	0	0		
Carbon disulfide	30.24	4.0	50	0	60.5	48	148	0	0		
Carbon tetrachloride	48.44	2.0	50	0	96.9	70	130	0	0		
Chlorobenzene	49.69	3.0	50	0	99.4	70	130	0	0		
Chloroethane	47.09	5.0	50	0	94.2	54	155	0	0		
2-Chloroethylvinylether	U	10	50	0	0	1	318	0	0		S
Chloroform	49.47	2.0	50	0	98.9	70	130	0	0		
Chloromethane	46.06	4.0	50	0	92.1	36	145	0	0		
Dibromochloromethane	58.55	2.0	50	0	117	70	130	0	0		
1,2-Dichlorobenzene	52.74	4.0	50	0	105	54	135	0	0		
1,3-Dichlorobenzene	49.28	4.0	50	0	98.6	55.6	131	0	0		
1,4-Dichlorobenzene	47.35	4.0	50	0	94.7	54.1	130	0	0		
1,1-Dichloroethane	48.87	2.0	50	0	97.7	70	139	0	0		
1,2-Dichloroethane	54.22	2.0	50	0	108	70	130	0	0		
1,1-Dichloroethene	46.22	2.0	50	0	92.4	64	143	0	0		
cis-1,2-Dichloroethene	50.84	2.0	50	0	102	70	130	0	0		
trans-1,2-Dichloroethene	50.44	2.0	50	0	101	61	143	0	0		
1,2-Dichloropropane	51.96	4.0	50	0	104	70	130	0	0		
cis-1,3-Dichloropropene	55.56	2.0	50	0	111	70	130	0	0		
trans-1,3-Dichloropropene	51.83	2.0	50	0	104	70	130	0	0		
Ethylbenzene	49.45	2.0	50	0	98.9	70	130	0	0		
2-Hexanone	49.41	4.0	50	0	98.8	53	147	0	0		
Methylene chloride	46.7	4.0	50	0	93.4	56	155	0	0		
4-Methyl-2-pentanone	51.54	10	50	0	103	44	173	0	0		
Styrene	29.5	4.0	50	0	59	33	130	0	0		
1,1,2,2-Tetrachloroethane	54.12	4.0	50	0	108	70	131	0	0		
Tetrachloroethene	47.43	2.0	50	0	94.9	44	140	0	0		

Qualifiers:
 NID - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_W

Sample ID: 06-7267-02AMS	Sample Type: MS	TestCode: 8260_W	Run ID: VOA-2_061019A	Prep Date: 10/19/06	Units: µg/L						
Client ID: DAS-7	Batch ID: R27769	TestNo: SW8260B	FileID: VOA210191501015.D	Analysis Date: 10/19/06	SeqNo: 501972						
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Toluene	49.23	2.0	50	0	98.5	70	130	0	0	30	
1,1,1-Trichloroethane	48.68	2.0	50	0	97.4	70	130	0	0	30	
1,1,2-Trichloroethane	56.03	4.0	50	0	112	70	130	0	0	30	
Trichloroethene	49.68	2.0	50	1.47	99.4	70	130	0	0	30	
Vinyl acetate	53.19	5.0	50	0	106	70	135	0	0	30	
Vinyl chloride	44.76	2.0	50	0	89.5	45	142	0	0	30	
Xylene, Total	89.11	4.0	100	0	89.1	70	130	0	0	30	
Surr: 1,2-Dichloroethane-d4	49.29	0	50	0	98.6	70	130	0	0	30	
Surr: 4-Bromofluorobenzene	48.66	0	50	0	97.3	70	130	0	0	30	
Surr: Toluene-d8	48.82	0	50	0	97.6	70	130	0	0	30	

Sample ID: 06-7267-02AMS	Sample Type: MSD	TestCode: 8260_W	Run ID: VOA-2_061019A	Prep Date: 10/19/06	Units: µg/L						
Client ID: DAS-7	Batch ID: R27769	TestNo: SW8260B	FileID: VOA210191501016.D	Analysis Date: 10/19/06	SeqNo: 501973						
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Acetone	32.82	1.0	50	0	65.6	14	222	34.63	5.37	30	
Benzene	49.66	1.0	50	0	99.3	70	130	49.48	0.363	30	
Bromodichloromethane	56.39	4.0	50	0	113	70	130	56.05	0.605	30	
Bromoform	49.35	4.0	50	0	98.7	63	137	51.72	4.69	30	
Bromomethane	50.51	1.0	50	0	101	46	158	50.75	0.474	30	
2-Butanone	39.28	2.0	50	0	78.6	43	149	38.42	2.21	30	
Carbon disulfide	30.57	4.0	50	0	61.1	48	148	30.24	1.09	30	
Carbon tetrachloride	48.88	2.0	50	0	97.8	70	130	48.44	0.904	30	
Chlorobenzene	49.83	3.0	50	0	99.7	70	130	49.69	0.281	30	
Chloroethane	45.2	5.0	50	0	90.4	54	155	47.09	4.10	30	
2-Chloroethylvinylether	U	1.0	50	0	0	1	318	0	0	30	S
Chloroform	49.47	2.0	50	0	98.9	70	130	49.47	0	30	
Chloromethane	44.95	4.0	50	0	89.9	36	145	46.06	2.44	30	
Dibromochloromethane	57.69	2.0	50	0	115	70	130	58.55	1.48	30	
1,2-Dichlorobenzene	53.96	4.0	50	0	108	54	135	52.74	2.29	30	
1,3-Dichlorobenzene	52.41	4.0	50	0	105	55.6	131	49.28	6.16	30	

Qualifiers:
 NID - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_W

Sample ID: 06-7267-02AMSD	SamplType: MSD	TestCode: 8260_W	Run ID: VOA-2_061019A	Prep Date: 10/19/06	Units: µg/L						
Client ID: DAS-7	Batch ID: R27769	TestNo: SW8260B	FileID: VOA210191601016.D	Analysis Date: 10/19/06	SeqNo: 501973						
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

1,4-Dichlorobenzene	49.24	4.0	50	0	98.5	54.1	130	47.35	3.91	30	
1,1-Dichloroethane	47.48	2.0	50	0	95	70	139	48.87	2.89	30	
1,2-Dichloroethane	53.4	2.0	50	0	107	70	130	54.22	1.52	30	
1,1-Dichloroethene	43.95	2.0	50	0	87.9	64	143	46.22	5.03	30	
cis-1,2-Dichloroethene	51.39	2.0	50	0	103	70	130	50.84	1.08	30	
trans-1,2-Dichloroethene	49.62	2.0	50	0	99.2	61	143	50.44	1.64	30	
1,2-Dichloropropane	51.54	4.0	50	0	103	70	130	51.96	0.812	30	
cis-1,3-Dichloropropene	55.39	2.0	50	0	111	70	130	55.56	0.306	30	
trans-1,3-Dichloropropene	50.43	2.0	50	0	101	70	130	51.83	2.74	30	
Ethylbenzene	49.88	2.0	50	0	99.8	70	130	49.45	0.866	30	
2-Hexanone	46.33	4.0	50	0	92.7	53	147	49.41	6.43	30	
Methylene chloride	46.2	4.0	50	0	92.4	56	155	46.7	1.08	30	
4-Methyl-2-pentanone	48.28	10	50	0	96.6	44	173	51.54	6.53	30	
Styrene	30.3	4.0	50	0	60.6	33	130	29.5	2.68	30	
1,1,2,2-Tetrachloroethane	52.49	4.0	50	0	105	70	131	54.12	3.06	30	
Tetrachloroethene	47.15	2.0	50	0	94.3	44	140	47.43	0.592	30	
Toluene	49.15	2.0	50	0	98.3	70	130	49.23	0.163	30	
1,1,1-Trichloroethane	48.35	2.0	50	0	96.7	70	130	48.68	0.680	30	
1,1,2-Trichloroethane	52.91	4.0	50	0	106	70	130	56.03	5.73	30	
Trichloroethene	52.22	2.0	50	1.47	104	70	130	49.68	4.99	30	
Vinyl acetate	52.03	5.0	50	0	104	70	135	53.19	2.20	30	
Vinyl chloride	45	2.0	50	0	90	45	142	44.76	0.535	30	
Xylene, Total	92.31	4.0	100	0	92.3	70	130	89.11	3.53	30	
Surr: 1,2-Dichloroethane-d4	49.41	0	50	0	98.8	70	130	0	0	0	
Surr: 4-Bromofluorobenzene	50.53	0	50	0	101	70	130	0	0	0	
Surr: Toluene-d8	49.61	0	50	0	99.2	70	130	0	0	0	

Qualifiers:

NID - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S

Sample ID: MB-11157	SampType: MBLK	TestCode: 8270_S	Run ID: GCMS1_061020A	Prep Date: 10/19/06	Units: µg/Kg						
Batch ID: 11157	TestNo: SW8270C	FieldID: VGCMS10201501015.D	Analysis Date: 10/20/06	SeqNo: 502191							
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Acenaphthene	U	170									
Acenaphthylene	U	170									
Anthracene	U	170									
Benzo(a)anthracene	U	170									
Benzo(b&k)fluoranthene	U	330									
Benzoic acid	U	670									
Benzo(g,h,i)perylene	U	170									
Benzo(a)pyrene	U	170									
Benzyl alcohol	U	330									
4-Bromophenyl phenyl ether	U	170									
Butyl benzyl phthalate	U	170									
4-Chloroaniline	U	170									
Bis(2-chloroethoxy)methane	U	330									
Bis(2-chloroethyl)ether	U	330									
4-Chloro-3-methylphenol	U	170									
2-Chloronaphthalene	U	170									
2-Chlorophenol	U	330									
4-Chlorophenyl phenyl ether	U	170									
Chrysene	U	170									
Dibenz(a,h)anthracene	U	170									
Dibenzofuran	U	170									
Di-n-butyl phthalate	U	170									
1,2-Dichlorobenzene	U	330									
1,3-Dichlorobenzene	U	330									
1,4-Dichlorobenzene	U	330									
3,3'-Dichlorobenzidine	U	330									
Dichlorodisopropyl ether	U	330									
2,4-Dichlorophenol	U	170									
Diethyl phthalate	U	170									
2,4-Dimethylphenol	U	170									

Qualifiers:

ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 11/1/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S

Sample ID: MB-11157	Sample Type: MBLK	TestCode: 8270_S	Run ID: GCMS1_061020A	Prep Date: 10/19/06	Units: µg/Kg						
Batch ID: 11157	TestNo: SW8270C	FileID: VGCMS10201501015.D	Analysis Date: 10/20/06	SeqNo: 502191							
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Dimethyl phthalate	U	170									
4,6-Dinitro-2-methylphenol	U	170									
2,4-Dinitrophenol	U	330									
2,4-Dinitrotoluene	U	170									
2,6-Dinitrotoluene	U	170									
Di-n-octyl phthalate	U	170									
Bis(2-ethylhexyl)phthalate	U	330									
Fluoranthene	U	170									
Fluorene	U	170									
Hexachlorobenzene	U	170									
Hexachlorobutadiene	U	330									
Hexachlorocyclopentadiene	U	170									
Hexachloroethane	U	330									
Indeno(1,2,3-cd)pyrene	U	170									
Isophorone	U	330									
2-Methylnaphthalene	U	330									
2-Methylphenol	U	330									
4-Methylphenol	U	330									
Naphthalene	U	330									
2-Nitroaniline	U	170									
3-Nitroaniline	U	170									
4-Nitroaniline	U	170									
Nitrobenzene	U	330									
2-Nitrophenol	U	330									
4-Nitrophenol	U	170									
N-Nitrosodi-n-propylamine	U	330									
N-Nitrosodiphenylamine	U	170									
Pentachlorophenol	U	170									
Phenanthrene	U	170									
Phenol	U	330									
Pyrene	U	170									
1,2,4-Trichlorobenzene	U	330									

Qualifiers:

ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 11/1/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S

Sample ID: MB-11157	SampType: MBLK	TestCode: 8270_S	Run ID: GCMS1_061020A	Prep Date: 10/19/06	Units: µg/Kg
Batch ID: 11157	TestNo: SW8270C	FileID: IGCMS10201501015.D	Analysis Date: 10/20/06	SeqNo: 502191	
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual

2,4,5-Trichlorophenol	U	170	3333	0	69.1	40	130	0	0
2,4,6-Trichlorophenol	U	170	3333	0	70.3	37	130	0	0
Surr: 2,4,6-Tribromophenol		0	3333	0	75.3	24	130	0	0
Surr: 2-Fluorobiphenyl		0	3333	0	69.8	27	130	0	0
Surr: 2-Fluorophenol		0	3333	0	82.7	30	130	0	0
Surr: Nitrobenzene-d5		0	3333	0	95.3	41	135	0	0
Surr: Phenol-d6		0	3333	0					
Surr: Terphenyl-d14		0	3333	0					

Sample ID: LCS-11157	SampType: LCS	TestCode: 8270_S	Run ID: GCMS1_061020A	Prep Date: 10/19/06	Units: µg/Kg				
Batch ID: 11157	TestNo: SW8270C	FileID: IGCMS102011601016.D	Analysis Date: 10/20/06	SeqNo: 502185					
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual				
Acenaphthene	2076	170	3333	0	62.3	15	130	0	0
Acenaphthylene	2113	170	3333	0	63.4	12	130	0	0
Anthracene	2403	170	3333	0	72.1	44	130	0	0
Benzo(a)anthracene	2103	170	3333	0	63.1	34	130	0	0
Benzo(b&k)fluoranthene	4662	330	6666	0	69.9	48	130	0	0
Benzoic acid	1206	670	3333	0	36.2	10	130	0	0
Benzo(g,h,i)perylene	2283	170	3333	0	68.5	47	130	0	0
Benzo(e)pyrene	2426	170	3333	0	72.8	52	130	0	0
Benzyl alcohol	1961	330	3333	0	58.8	19	130	0	0
4-Bromophenyl phenyl ether	2336	170	3333	0	70.1	36	130	0	0
Butyl benzyl phthalate	2553	170	3333	0	76.6	38	130	0	0
4-Chloroaniline	2075	170	3333	0	62.3	20	130	0	0
Bis(2-chloroethoxy)methane	1863	330	3333	0	55.9	16	130	0	0
Bis(2-chloroethyl)ether	1833	330	3333	0	55	10	130	0	0
4-Chloro-3-methylphenol	2254	170	3333	0	67.6	10	130	0	0
2-Chloronaphthalene	1951	170	3333	0	58.5	18	130	0	0
2-Chlorophenol	1798	330	3333	0	54	16	130	0	0
4-Chlorophenyl phenyl ether	2376	170	3333	0	71.3	32	130	0	0

Qualifiers: ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time
 Print Date: 11/1/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S

Sample ID: LCS-11157	SamplType: LCS	TestCode: 8270_S	Run ID: GCMS1_061020A	Prep Date: 10/19/06	Units: µg/Kg						
Batch ID: 11157	TestNo: SW8270C	FileID: VGCMS102011601016.D	Analysis Date: 10/20/06	SeqNo: 502185							
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Chrysene	2824	170	3333	0	84.7	39	130	0	0		
Dibenz(a,h)anthracene	3066	170	3333	0	92	50	130	0	0		
Dibenzofuran	2191	170	3333	0	65.7	32	130	0	0		
Di-n-butyl phthalate	2588	170	3333	0	77.6	51	130	0	0		
1,2-Dichlorobenzene	1728	330	3333	0	51.8	16	130	0	0		
1,3-Dichlorobenzene	1709	330	3333	0	51.3	16	130	0	0		
1,4-Dichlorobenzene	1703	330	3333	0	51.1	17	130	0	0		
3,3'-Dichlorobenzidine	2538	330	3333	0	76.1	24	130	0	0		
Dichlorodisopropyl ether	1768	330	3333	0	53	17	130	0	0		
2,4-Dichlorophenol	1917	170	3333	0	57.5	16	130	0	0		
Diethyl phthalate	2507	170	3333	0	75.2	53	130	0	0		
2,4-Dimethylphenol	1598	170	3333	0	48	13	130	0	0		
Dimethyl phthalate	2434	170	3333	0	73	42	130	0	0		
4,6-Dinitro-2-methylphenol	2316	170	3333	0	69.5	42	130	0	0		
2,4-Dinitrotoluene	2580	170	3333	0	77.4	46	130	0	0		
2,6-Dinitrotoluene	2485	170	3333	0	74.6	35	130	0	0		
Di-n-octyl phthalate	2520	170	3333	0	75.6	53	130	0	0		
Bis(2-ethylhexyl)phthalate	2505	330	3333	0	75.2	35	130	0	0		
Fluoranthrene	2537	170	3333	0	76.1	47	130	0	0		
Fluorene	2346	170	3333	0	70.4	38	130	0	0		
Hexachlorobenzene	2330	170	3333	0	69.9	42	130	0	0		
Hexachlorobutadiene	1731	330	3333	0	51.9	10	130	0	0		
Hexachlorocyclopentadiene	1598	170	3333	0	48	10	130	0	0		
Hexachloroethane	1687	330	3333	0	50.6	14	130	0	0		
Indeno(1,2,3-cd)pyrene	2304	170	3333	0	69.1	47	130	0	0		
Isophorone	1898	330	3333	0	56.9	18	130	0	0		
2-Methylnaphthalene	1833	330	3333	0	55	17	130	0	0		
2-Methylphenol	1894	330	3333	0	56.8	16	130	0	0		
4-Methylphenol	1948	330	3333	0	58.4	17	130	0	0		
Naphthalene	1778	330	3333	0	53.3	14	130	0	0		
2-Nitroaniline	2375	170	3333	0	71.3	26	130	0	0		
3-Nitroaniline	2542	170	3333	0	76.3	40	130	0	0		

Qualifiers: ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 11/1/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S

Sample ID: LCS-11157	Sample Type: LCS	TestCode: 8270_S	Run ID: GCMS1_061020A	Prep Date: 10/19/06	Units: µg/Kg
Batch ID: 11157	TestNo: SW8270C	FileID: VGCMS102011601016.D	Analysis Date: 10/20/06	SeqNo: 502185	

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4-Nitroaniline	2602	170	3333	0	78.1	51	130	0	0		
Nitrobenzene	1792	330	3333	0	53.8	14	130	0	0		
2-Nitrophenol	1909	330	3333	0	57.3	12	130	0	0		
4-Nitrophenol	2406	170	3333	0	72.2	40	130	0	0		
N-Nitrosodiphenylamine	2657	170	3333	0	79.7	48	130	0	0		
Pentachlorophenol	2114	170	3333	0	63.4	35	130	0	0		
Phenanthrene	2341	170	3333	0	70.2	43	130	0	0		
Phenol	1906	330	3333	0	57.2	16	130	0	0		
Pyrene	2410	170	3333	0	72.3	43	130	0	0		
1,2,4-Trichlorobenzene	1749	330	3333	0	52.5	13	130	0	0		
2,4,5-Trichlorophenol	2251	170	3333	0	67.5	12	130	0	0		
2,4,6-Trichlorophenol	2154	170	3333	0	64.6	18	130	0	0		
Surr: 2,4,6-Tribromophenol	2269	0	3333	0	68.1	40	130	0	0		
Surr: 2-Fluorobiphenyl	1730	0	3333	0	51.9	37	130	0	0		
Surr: 2-Fluorophenol	1534	0	3333	0	46	24	130	0	0		
Surr: Nitrobenzene-d5	1666	0	3333	0	50	27	130	0	0		
Surr: Phenol-d6	1787	0	3333	0	53.6	30	130	0	0		
Surr: Terphenyl-d14	2538	0	3333	0	76.1	41	135	0	0		

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Acenaphthene	3279	210	4221	0	77.7	57	130	0	0		
Acenaphthylene	3317	210	4221	0	78.6	51	130	0	0		
Anthracene	3492	210	4221	0	82.7	61	130	0	0		
Benzo(a)anthracene	3119	210	4221	0	73.9	47	130	0	0		
Benzo(b&k)fluoranthene	6772	420	8442	0	80.2	54	130	0	0		
Benzoic acid	735.8	850	4221	0	17.4	7	130	0	0		J
Benzo(g,h,i)perylene	3513	210	4221	0	83.2	58	130	0	0		
Benzo(a)pyrene	3473	210	4221	0	82.3	58	130	0	0		

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 11/1/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S

Sample ID: 06-7215-01BMS	Samp Type: MS	TestCode: 8270_S	Run ID: GCMS1_061023A	Prep Date: 10/19/06	Units: µg/Kg-dry
Batch ID: 11157	TestNo: SW8270C	FieldID: VGCMS10231001010.D	Analysis Date: 10/23/06	SeqNo: 502257	

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzyl alcohol	3296	420	4221	0	78.1	50	130	0	0		
4-Bromophenyl phenyl ether	3491	210	4221	0	82.7	50	130	0	0		
Butyl benzyl phthalate	4045	210	4221	0	95.8	55	130	0	0		
4-Chloroaniline	3475	210	4221	0	82.3	46	130	0	0		
Bis(2-chloroethoxy)methane	3299	420	4221	0	78.2	48	130	0	0		
Bis(2-chloroethyl)ether	3080	420	4221	0	73	49	130	0	0		
4-Chloro-3-methylphenol	3593	210	4221	0	85.1	53	130	0	0		
2-Chloronaphthalene	3224	210	4221	0	76.4	47	130	0	0		
2-Chlorophenol	3108	420	4221	0	73.6	41	130	0	0		
4-Chlorophenyl phenyl ether	3518	210	4221	0	83.3	55	130	0	0		
Chrysene	4122	210	4221	0	97.7	54	130	0	0		
Dibenz(a,h)anthracene	4584	210	4221	0	109	28	130	0	0		
Dibenzofuran	3329	210	4221	0	78.9	55	130	0	0		
Di-n-butyl phthalate	3633	210	4221	0	86.1	64	130	0	0		
1,2-Dichlorobenzene	3014	420	4221	0	71.4	40	130	0	0		
1,3-Dichlorobenzene	2931	420	4221	0	69.4	40	130	0	0		
1,4-Dichlorobenzene	2975	420	4221	0	70.5	39	130	0	0		
3,3'-Dichlorobenzidine	3816	420	4221	0	90.4	46	130	0	0		
Dichlorodisopropyl ether	2978	420	4221	0	70.6	42	130	0	0		
2,4-Dichlorophenol	3304	210	4221	0	78.3	52	130	0	0		
2,4-Dimethylphenol	2669	210	4221	0	63.2	32	130	0	0		
Dimethyl phthalate	3466	210	4221	0	82.1	56	130	0	0		
4,6-Dinitro-2-methylphenol	3341	210	4221	0	79.1	54	130	0	0		
2,4-Dinitrophenol	2933	420	4221	0	69.5	42	130	0	0		
2,4-Dinitrotoluene	3588	210	4221	0	85	56	130	0	0		
2,6-Dinitrotoluene	3528	210	4221	0	83.6	58	130	0	0		
Di-n-octyl phthalate	4084	210	3048	0	134	60	140	0	0		
Bis(2-ethylhexyl)phthalate	4166	420	4221	371.7	98.7	54	131	0	0		
Fluoranthene	3251	210	4221	0	77	61	130	0	0		
Fluorene	3400	210	4221	0	80.5	56	130	0	0		
Hexachlorobenzene	3385	210	4221	0	80.2	51	130	0	0		
Hexachlorobutadiene	3077	420	4221	0	72.9	34	130	0	0		

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 11/1/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S

Sample ID: 06-7215-01BMS	Sample Type: MS	TestCode: 8270_S	Run ID: GCMS1_061023A	Prep Date: 10/19/06	Units: µg/Kg-dry
Batch ID: 11157	TestNo: SW8270C	FieldID: IGCMS102311001010.D	Analysis Date: 10/23/06	SeqNo: 502257	

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Hexachlorocyclopentadiene	2605	210	4221	0	61.7	35	130	0	0		
Hexachloroethane	2938	420	4221	0	69.6	38	130	0	0		
Indeno(1,2,3-cd)pyrene	3540	210	4221	0	83.9	49	130	0	0		
Isophorone	3118	420	4221	0	73.9	51	130	0	0		
2-Methylnaphthalene	3168	420	4221	0	75.1	42	130	0	0		
2-Methylphenol	3191	420	4221	0	75.6	43	130	0	0		
4-Methylphenol	3314	420	4221	0	78.5	45	130	0	0		
Naphthalene	3128	420	4221	0	74.1	41	130	0	0		
2-Nitroaniline	3374	210	4221	0	79.9	55	130	0	0		
3-Nitroaniline	3577	210	4221	0	84.7	54	130	0	0		
4-Nitroaniline	3626	210	4221	0	85.9	54	130	0	0		
Nitrobenzene	3094	420	4221	0	73.3	41	130	0	0		
2-Nitrophenol	3346	420	4221	0	79.3	42	130	0	0		
4-Nitrophenol	3412	210	4221	0	80.8	53	130	0	0		
N-Nitrosodi-n-propylamine	3364	420	4221	0	79.7	50	130	0	0		
N-Nitrosodiphenylamine	3929	210	4221	0	93.1	40	140	0	0		
Pentachlorophenol	2990	210	4221	0	70.8	47	130	0	0		
Phenanthrene	3416	210	4221	0	80.9	60	130	0	0		
Phenol	3189	420	4221	0	75.6	43	130	0	0		
Pyrene	3599	210	4221	0	85.3	50	130	0	0		
1,2,4-Trichlorobenzene	3119	420	4221	0	73.9	38	130	0	0		
2,4,5-Trichlorophenol	3538	210	4221	0	83.8	50	130	0	0		
2,4,6-Trichlorophenol	3426	210	4221	0	81.2	56	130	0	0		
Surr: 2,4,6-Tribromophenol	3174	0	4221	0	75.2	40	130	0	0		
Surr: 2-Fluorobiphenyl	2919	0	4221	0	69.2	37	130	0	0		
Surr: 2-Fluorophenol	2644	0	4221	0	62.6	24	130	0	0		
Surr: Nitrobenzene-d5	2936	0	4221	0	69.6	27	130	0	0		
Surr: Phenol-d6	2987	0	4221	0	70.8	30	130	0	0		
Surr: Terphenyl-d14	3902	0	4221	0	92.5	41	135	0	0		

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 11/1/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S

Sample ID: 06-7239-01AMS	Sample Type: MS	TestCode: 8270_S	Run ID: GCM51_061023A	Prep Date: 10/19/06	Units: µg/Kg-dry
Batch ID: 11157	TestNo: SW8270C	FieldID: VGCMS102311401014.D	Analysis Date: 10/23/06	SeqNo: 502262	

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Acenaphthene	3536	950	3789	0	93.3	57	130	0	0		
Acenaphthylene	3350	950	3789	0	88.4	51	130	0	0		
Anthracene	3562	950	3789	0	94	61	130	0	0		
Benzo(a)anthracene	2819	950	3789	0	74.4	47	130	0	0		
Benzo(b&k)fluoranthene	6272	1900	7578	0	82.8	54	130	0	0		
Benzoic acid	U	3800	3789	0	0	7	130	0	0		S
Benzo(g,h,i)perylene	3089	950	3789	0	81.5	58	130	0	0		
Benzo(a)pyrene	3197	950	3789	0	84.4	58	130	0	0		
Butyl alcohol	3742	1900	3789	0	98.8	50	130	0	0		
Butyl benzyl phthalate	3538	950	3789	0	93.4	55	130	0	0		
4-Chloroaniline	U	950	3789	0	0	46	130	0	0		S
Bis(2-chloroethoxy)methane	4640	1900	3789	0	122	48	130	0	0		
Bis(2-chloroethyl)ether	3699	1900	3789	0	97.6	49	130	0	0		
4-Chloro-3-methylphenol	3788	950	3789	0	100	53	130	0	0		
2-Chloronaphthalene	3143	950	3789	0	83	47	130	0	0		
2-Chlorophenol	3399	1900	3789	0	89.7	41	130	0	0		
4-Chlorophenyl phenyl ether	3517	950	3789	0	92.8	55	130	0	0		
Chrysene	3767	950	3789	0	99.4	54	130	0	0		
Dibenz(a,h)anthracene	4134	950	3789	0	109	28	130	0	0		
Dibenzofuran	3443	950	3789	0	90.9	55	130	0	0		
Di-n-butyl phthalate	2950	950	3789	0	77.9	64	130	0	0		
1,2-Dichlorobenzene	3526	1900	3789	0	93.1	40	130	0	0		
1,3-Dichlorobenzene	3356	1900	3789	0	88.6	40	130	0	0		
1,4-Dichlorobenzene	3293	1900	3789	0	86.9	39	130	0	0		
3,3'-Dichlorobenzidine	3693	1900	3789	0	97.5	46	130	0	0		
Dichlorodisopropyl ether	3488	1900	3789	0	92.1	42	130	0	0		
2,4-Dichlorophenol	3740	950	3789	0	98.7	52	130	0	0		
Diethyl phthalate	3386	950	3789	0	89.4	59	130	0	0		
2,4-Dimethylphenol	3049	950	3789	0	80.5	32	130	0	0		
Dimethyl phthalate	3191	950	3789	0	84.2	56	130	0	0		
4,6-Dinitro-2-methylphenol	3202	950	3789	0	84.5	54	130	0	0		
2,4-Dinitrophenol	2969	1900	3789	0	78.4	42	130	0	0		

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 11/1/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S

Sample ID: 06-7239-01AMS	Sample Type: MS	TestCode: 8270_S	Run ID: GCMS1_061023A	Prep Date: 10/19/06	Units: µg/Kg-dry
Batch ID: 11157	TestNo: SW8270C	Field: IGCMS102311401014.D	Analysis Date: 10/23/06	SeqNo: 502262	

Analyte	Result	LCL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
2,4-Dinitrotoluene	5006	950	3789	0	132	56	130	0	0	0	S
2,6-Dinitrotoluene	3503	950	3789	0	92.5	58	130	0	0	0	
Di-n-octyl phthalate	4074	950	2736	0	149	60	140	0	0	0	S
Bis(2-ethylhexyl)phthalate	3632	1900	3789	0	95.9	54	131	0	0	0	
Fluoranthene	2630	950	3789	0	69.4	61	130	0	0	0	
Fluorene	5825	950	3789	2805	79.7	56	130	0	0	0	
Hexachlorobenzene	3217	950	3789	0	84.9	51	130	0	0	0	
Hexachlorobutadiene	3210	1900	3789	0	84.7	34	130	0	0	0	
Hexachlorocyclopentadiene	2115	950	3789	0	55.8	35	130	0	0	0	
Hexachloroethane	11320	1900	3789	0	299	38	130	0	0	0	
Indeno(1,2,3-cd)pyrene	3020	950	3789	0	79.7	49	130	0	0	0	S
Isophorone	3286	1900	3789	0	86.7	51	130	0	0	0	
2-Methylnaphthalene	17740	1900	3789	14450	86.9	42	130	0	0	0	
2-Methylphenol	3738	1900	3789	0	98.7	43	130	0	0	0	
4-Methylphenol	3553	1900	3789	0	93.8	45	130	0	0	0	
Naphthalene	9226	1900	3789	6029	84.4	41	130	0	0	0	
2-Nitroaniline	3113	950	3789	0	82.2	55	130	0	0	0	
3-Nitroaniline	3911	950	3789	0	103	54	130	0	0	0	
4-Nitroaniline	3206	950	3789	0	84.6	54	130	0	0	0	
Nitrobenzene	4110	1900	3789	0	108	41	130	0	0	0	
2-Nitrophenol	4011	1900	3789	0	106	42	130	0	0	0	
4-Nitrophenol	3106	950	3789	0	82	53	130	0	0	0	
N-Nitrosodi-n-propylamine	5283	1900	3789	0	139	50	130	0	0	0	
N-Nitrosodiphenylamine	6433	950	3789	2449	105	40	140	0	0	0	S
Pentachlorophenol	2693	950	3789	0	71.1	47	130	0	0	0	
Phenanthrene	5955	950	3789	3038	77	60	130	0	0	0	
Phenol	3373	1900	3789	0	89	43	130	0	0	0	
Pyrene	3663	950	3789	649.3	96.7	50	130	0	0	0	
1,2,4-Trichlorobenzene	3149	1900	3789	0	83.1	38	130	0	0	0	
2,4,5-Trichlorophenol	3181	950	3789	0	84	50	130	0	0	0	
2,4,6-Trichlorophenol	3111	950	3789	0	82.1	56	130	0	0	0	
Surr: 2,4,6-Tribromophenol	2700	0	3789	0	71.3	40	130	0	0	0	

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 11/1/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S

Sample ID: 06-7239-01AMS	Sample Type: MS	TestCode: 8270_S	Run ID: GCMS1_061023A	Prep Date: 10/19/06	Units: µg/Kg-dry
Batch ID: 11157	TestNo: SW8270C	FileID: IGCMS102311401014.D	Analysis Date: 10/23/06	SeqNo: 502262	

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: 2-Fluorobiphenyl	2897	0	3789	0	76.5	37	130	0	0		
Surr: 2-Fluorophenol	2713	0	3789	0	71.6	24	130	0	0		
Surr: Nitrobenzene-d5	3143	0	3789	0	83	27	130	0	0		
Surr: Phenol-d6	3102	0	3789	0	81.9	30	130	0	0		
Surr: Terphenyl-d14	3323	0	3789	0	87.7	41	135	0	0		

Sample ID: 06-7215-01BMSD	Sample Type: MSD	TestCode: 8270_S	Run ID: GCMS1_061023A	Prep Date: 10/19/06	Units: µg/Kg-dry						
Batch ID: 11157	TestNo: SW8270C	FileID: IGCMS10231101011.D	Analysis Date: 10/23/06	SeqNo: 502258							
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Acenaphthene	3057	210	4225	0	72.4	57	130	3279	7.01	30	
Acenaphthylene	3057	210	4225	0	72.4	51	130	3317	8.15	30	
Anthracene	3286	210	4225	0	77.8	61	130	3492	6.10	30	
Benzo(a)anthracene	2919	210	4225	0	69.1	47	130	3119	6.60	30	
Benzo(b&k)fluoranthene	6322	420	8451	0	74.8	54	130	6772	6.88	30	
Benzoic acid	724.8	850	4225	0	17.2	7	130	735.8	1.51	30	J
Benzo(g,h,i)perylene	3515	210	4225	0	83.2	58	130	3513	0.0361	30	
Benzo(a)pyrene	3238	210	4225	0	76.6	58	130	3473	7.01	30	
Benzyl alcohol	3063	420	4225	0	72.5	50	130	3296	7.31	30	
4-Bromophenyl phenyl ether	3450	210	4225	0	81.7	50	130	3491	1.18	30	
Butyl benzyl phthalate	3761	210	4225	0	89	55	130	4045	7.29	30	
4-Chloroaniline	3135	210	4225	0	74.2	46	130	3475	10.3	30	
Bis(2-chloroethoxy)methane	2951	420	4225	0	69.8	48	130	3299	11.2	30	
Bis(2-chloroethyl)ether	2828	420	4225	0	66.9	49	130	3080	8.53	30	
4-Chloro-3-methylphenol	3358	210	4225	0	79.5	53	130	3593	6.75	30	
2-Chloronaphthalene	3035	210	4225	0	71.8	47	130	3224	6.03	30	
2-Chlorophenol	2770	420	4225	0	65.6	41	130	3108	11.5	30	
4-Chlorophenyl phenyl ether	3264	210	4225	0	77.3	55	130	3518	7.48	30	
Chrysene	3826	210	4225	0	90.6	54	130	4122	7.45	30	
Dibenz(a,h)anthracene	4534	210	4225	0	107	28	130	4584	1.09	30	
Dibenzofuran	3102	210	4225	0	73.4	55	130	3329	7.08	30	

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 11/1/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S

Sample ID: 06-7215-01BMSD	Sample Type: MSD	TestCode: 8270_S	Run ID: GCMS1_061023A	Prep Date: 10/19/06	Units: µg/Kg-dry
Batch ID: 11157	TestNo: SW8270C	Field: VGCMS10231101011.D	Analysis Date: 10/23/06	SeqNo: 502258	

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Di-n-butyl phthalate	3319	210	4225	0	78.6	64	130	3633	9.01	30	
1,2-Dichlorobenzene	2675	420	4225	0	63.3	40	130	3014	11.9	30	
1,3-Dichlorobenzene	2590	420	4225	0	61.3	40	130	2931	12.3	30	
1,4-Dichlorobenzene	2625	420	4225	0	62.1	39	130	2975	12.5	30	
3,3'-Dichlorobenzidine	3595	420	4225	0	85.1	46	130	3816	5.98	30	
Dichlorodisopropyl ether	2653	420	4225	0	62.8	42	130	2978	11.5	30	
2,4-Dichlorophenol	3048	210	4225	0	72.1	52	130	3304	8.05	30	
2,4-Dimethylphenol	2550	210	4225	0	60.3	32	130	2669	4.59	30	
Dimethyl phthalate	3231	210	4225	0	76.5	56	130	3466	7.01	30	
4,6-Dinitro-2-methylphenol	3152	210	4225	0	74.6	54	130	3341	5.82	30	
2,4-Dinitrophenol	2674	420	4225	0	63.3	42	130	2933	9.26	30	
2,4-Dinitrotoluene	3293	210	4225	0	77.9	56	130	3588	8.58	30	
2,6-Dinitrotoluene	3269	210	4225	0	77.4	58	130	3528	7.60	30	
Di-n-octyl phthalate	3772	210	3051	0	124	60	140	4084	7.94	30	
Bis(2-ethylhexyl)phthalate	3935	420	4225	371.7	93.1	54	131	4166	5.69	30	
Fluoranthrene	2923	210	4225	0	69.2	61	130	3251	10.6	30	
Fluorene	3119	210	4225	0	73.8	56	130	3400	8.60	30	
Hexachlorobenzene	3203	210	4225	0	75.8	51	130	3385	5.55	30	
Hexachlorobutadiene	2742	420	4225	0	64.9	34	130	3077	11.5	30	
Hexachlorocyclopentadiene	2306	210	4225	0	54.6	35	130	2605	12.2	30	
Hexachloroethane	2613	420	4225	0	61.8	38	130	2938	11.7	30	
Indeno(1,2,3-cd)pyrene	3521	210	4225	0	83.3	49	130	3540	0.551	30	
Isophorone	2827	420	4225	0	66.9	51	130	3118	9.80	30	
2-Methylnaphthalene	2911	420	4225	0	68.9	42	130	3168	8.46	30	
2-Methylphenol	2910	420	4225	0	68.9	43	130	3191	9.22	30	
4-Methylphenol	3072	420	4225	0	72.7	45	130	3314	7.59	30	
Naphthalene	2804	420	4225	0	66.4	41	130	3128	10.9	30	
2-Nitroaniline	3155	210	4225	0	74.7	55	130	3374	6.71	30	
3-Nitroaniline	3173	210	4225	0	75.1	54	130	3577	12.0	30	
4-Nitroaniline	3060	210	4225	0	72.4	54	130	3626	16.9	30	
Nitrobenzene	2784	420	4225	0	65.9	41	130	3094	10.6	30	
2-Nitrophenol	2989	420	4225	0	70.7	42	130	3346	11.3	30	

Qualifiers: ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time
 Print Date: 11/1/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S

Sample ID: 06-7215-01BMSD	SampType: MSD	TestCode: 8270_S	Run ID: GCM51_061023A
Batch ID: 11157	TestNo: SW8270C	FileID: VGCMS10231101011.D	Prep Date: 10/19/06
			Analysis Date: 10/23/06
			SeqNo: 502258
Units: µg/Kg-dry			

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4-Nitrophenol	2907	210	4225	0	68.8	53	130	3412	16.0	30	
N-Nitrosodi-n-propylamine	3140	420	4225	0	74.3	50	130	3364	6.88	30	
N-Nitrosodiphenylamine	3925	210	4225	0	92.9	40	140	3929	0.0969	30	
Pentachlorophenol	2788	210	4225	0	66	47	130	2990	6.98	30	
Phenanthrene	3228	210	4225	0	76.4	60	130	3416	5.65	30	
Phenol	2898	420	4225	0	68.6	43	130	3189	9.57	30	
Pyrene	3340	210	4225	0	79	50	130	3599	7.48	30	
1,2,4-Trichlorobenzene	2821	420	4225	0	66.8	38	130	3119	10.0	30	
2,4,5-Trichlorophenol	3325	210	4225	0	78.7	50	130	3538	6.22	30	
2,4,6-Trichlorophenol	3242	210	4225	0	76.7	56	130	3426	5.52	30	
Surr: 2,4,6-Tribromophenol	2798	0	4225	0	66.2	40	130	0	0	0	
Surr: 2-Fluorobiphenyl	2670	0	4225	0	63.2	37	130	0	0	0	
Surr: 2-Fluorophenol	2362	0	4225	0	55.9	24	130	0	0	0	
Surr: Nitrobenzene-d5	2513	0	4225	0	59.5	27	130	0	0	0	
Surr: Phenol-d6	2640	0	4225	0	62.5	30	130	0	0	0	
Surr: Terphenyl-d14	3568	0	4225	0	84.5	41	135	0	0	0	

Sample ID: 06-7239-01A MSD	SampType: MSD	TestCode: 8270_S	Run ID: GCM51_061023A
Batch ID: 11157	TestNo: SW8270C	FileID: VGCMS102311501015.D	Prep Date: 10/19/06
			Analysis Date: 10/23/06
			SeqNo: 502356
Units: µg/Kg-dry			

Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Acenaphthene	3401	950	3789	0	89.8	57	130	3536	3.88	30	
Acenaphthylene	3166	950	3789	0	83.6	51	130	3350	5.64	30	
Anthracene	3087	950	3789	0	81.5	61	130	3562	14.3	30	
Benzo(a)anthracene	2675	950	3789	0	70.6	47	130	2819	5.24	30	
Benzo(b&k)fluoranthene	5825	1900	7578	0	76.9	54	130	6272	7.39	30	
Benzoic acid	U	3800	3789	0	0	7	130	0	0	30	S
Benzo(g,h,i)perylene	2954	950	3789	0	78	58	130	3089	4.45	30	
Benzo(a)pyrene	2992	950	3789	0	79	58	130	3197	6.61	30	
Benzyl alcohol	3233	1900	3789	0	85.3	50	130	3742	14.6	30	
Butyl benzyl phthalate	3430	950	3789	0	90.5	55	130	3538	3.10	30	

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 11/1/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S

Sample ID: 06-7239-01AMSD	SampType: MSD	TestCode: 8270_S	Run ID: GCMS1_061023A	Prep Date: 10/19/06	Units: µg/Kg-dry
Batch ID: 11157	TestNo: SW8270C	FieldID: VGCMS10231501015.D	Analysis Date: 10/23/06	SeqNo: 502356	

Analyte	Result	LCL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4-Chloroaniline	4549	950	3789	0	120	46	130	0	200	30	R
Bis(2-chloroethoxy)methane	4267	1900	3789	0	113	48	130	4640	8.38	30	
Bis(2-chloroethyl)ether	3066	1900	3789	0	80.9	49	130	3699	18.7	30	
4-Chloro-3-methylphenol	3255	950	3789	0	85.9	53	130	3788	15.1	30	
2-Chloronaphthalene	3054	950	3789	0	80.6	47	130	3143	2.87	30	
2-Chlorophenol	2638	1900	3789	0	69.6	41	130	3399	25.2	30	
4-Chlorophenyl phenyl ether	3278	950	3789	0	86.5	55	130	3517	7.03	30	
Chrysene	3513	950	3789	0	92.7	54	130	3767	6.98	30	
Dibenz(a,h)anthracene	3905	950	3789	0	103	28	130	4134	5.70	30	
Dibenzofuran	3085	950	3789	0	81.4	55	130	3443	11.0	30	
Di-n-butyl phthalate	2687	950	3789	0	70.9	64	130	2950	9.34	30	
1,2-Dichlorobenzene	2721	1900	3789	0	71.8	40	130	3526	25.8	30	
1,3-Dichlorobenzene	2628	1900	3789	0	69.4	40	130	3356	24.3	30	
1,4-Dichlorobenzene	2619	1900	3789	0	69.1	39	130	3293	22.8	30	
3,3'-Dichlorobenzidine	3178	1900	3789	0	83.9	46	130	3693	15.0	30	
Dichlorodisopropyl ether	2967	1900	3789	0	78.3	42	130	3488	16.1	30	
2,4-Dichlorophenol	3363	950	3789	0	88.8	52	130	3740	10.6	30	
Diethyl phthalate	3121	950	3789	0	82.4	59	130	3386	8.15	30	
2,4-Dimethylphenol	2651	950	3789	0	70	32	130	3049	14.0	30	
Dimethyl phthalate	3102	950	3789	0	81.9	56	130	3191	2.83	30	
4,6-Dinitro-2-methylphenol	U	950	3789	0	0	54	130	3202	0	30	S
2,4-Dinitrophenol	2933	1900	3789	0	77.4	42	130	2969	1.22	30	
2,4-Dinitrotoluene	4081	950	3789	0	108	56	130	5006	20.4	30	
2,6-Dinitrotoluene	3367	950	3789	0	88.9	58	130	3503	3.97	30	
Di-n-octyl phthalate	3807	950	2736	0	139	60	140	4074	6.78	30	
Bis(2-ethylhexyl)phthalate	3200	1900	3789	0	84.5	54	131	3632	12.6	30	
Fluoranthene	2488	950	3789	0	65.7	61	130	2630	5.55	30	
Fluorene	5622	950	3789	2805	74.3	56	130	5825	3.54	30	
Hexachlorobenzene	2869	950	3789	0	75.7	51	130	3217	11.5	30	
Hexachlorobutadiene	2812	1900	3789	0	74.2	34	130	3210	13.2	30	
Hexachlorocyclopentadiene	2033	950	3789	0	53.7	35	130	2115	3.93	30	
Hexachloroethane	10580	1900	3789	0	279	38	130	11320	6.73	30	S

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 11/1/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S

Sample ID: 06-7239-01AMSD	SampType: MSD	TestCode: 8270_S	Run ID: GCMS1_061023A	Prep Date: 10/19/06	Units: µg/Kg-dry
Batch ID: 11157	TestNo: SW8270C	Field: IGCMS10231501015.D	Analysis Date: 10/23/06	SeqNo: 502356	

Analyte	Result	LCL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Indeno(1,2,3-cd)pyrene	2937	950	3789	0	77.5	49	130	3020	2.80	30	
Isophorone	2982	1900	3789	0	78.7	51	130	3286	9.67	30	
2-Methylnaphthalene	17530	1900	3789	14450	81.4	42	130	17740	1.19	30	
2-Methylphenol	3219	1900	3789	0	85	43	130	3738	14.9	30	
4-Methylphenol	3041	1900	3789	0	80.3	45	130	3553	15.5	30	
Naphthalene	9317	1900	3789	6029	86.8	41	130	9226	0.981	30	
2-Nitroaniline	2986	950	3789	0	78.8	55	130	3113	4.16	30	
3-Nitroaniline	3797	950	3789	0	100	54	130	3911	2.95	30	
4-Nitroaniline	U	950	3789	0	0	54	130	3206	0	30	S
Nitrobenzene	3716	1900	3789	0	98.1	41	130	4110	10.1	30	
2-Nitrophenol	3500	1900	3789	0	92.4	42	130	4011	13.6	30	
4-Nitrophenol	3286	950	3789	0	86.7	53	130	3106	5.63	30	
N-Nitrosodi-n-propylamine	4722	1900	3789	0	125	50	130	5283	11.2	30	
N-Nitrosodiphenylamine	6272	950	3789	2449	101	40	140	6433	2.54	30	
Pentachlorophenol	2738	950	3789	0	72.3	47	130	2693	1.67	30	
Phenanthrene	5845	950	3789	3038	74.1	60	130	5955	1.86	30	
Phenol	2636	1900	3789	0	69.6	43	130	3373	24.5	30	
Pyrene	3665	950	3789	649.3	96.7	50	130	3663	0.0517	30	
1,2,4-Trichlorobenzene	2846	1900	3789	0	75.1	38	130	3149	10.1	30	
2,4,5-Trichlorophenol	3666	950	3789	0	96.8	50	130	3181	14.2	30	
2,4,6-Trichlorophenol	3153	950	3789	0	83.2	56	130	3111	1.33	30	
Surr: 2,4,6-Tribromophenol	2594	0	3789	0	68.5	40	130	0	0	0	
Surr: 2-Fluorobiphenyl	2965	0	3789	0	78.3	37	130	0	0	0	
Surr: 2-Fluorophenol	1846	0	3789	0	48.7	24	130	0	0	0	
Surr: Nitrobenzene-d5	2990	0	3789	0	78.9	27	130	0	0	0	
Surr: Phenol-d6	2560	0	3789	0	67.6	30	130	0	0	0	
Surr: Terphenyl-d14	3293	0	3789	0	86.9	41	135	0	0	0	

Qualifiers:

ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time

Print Date: 11/1/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT
 BatchID: 11161

Sample ID: LCS-11161	Sample Type: LCS1	TestCode: 6010_S	Run ID: ICP_061023A	Prep Date: 10/19/06	Units: mg/Kg						
Batch ID: 11161	TestNo: SW6010	FieldID: 102306PM	Analysis Date: 10/23/06	SeqNo: 502277							
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Arsenic	82.78	5.0	101	0	82	75.3	123.8	0	0	0	
Barium	958.5	0.10	1030	0.141	93	84.4	115.5	0	0	0	B
Cadmium	86.73	1.0	89.6	0	96.8	81.1	119.4	0	0	0	
Chromium	60.3	1.0	71.1	0	84.8	81.9	118.1	0	0	0	
Lead	116.9	7.3	127	1.53	92	83.5	117.3	0	0	0	
Selenium	139.6	10	163	0	85.6	81.6	117.8	0	0	0	
Silver	93.95	3.0	99.3	0	94.6	75.6	123.9	0	0	0	

Sample ID: MB-11161	Sample Type: MBLK	TestCode: 6010_S	Run ID: ICP_061023A	Prep Date: 10/19/06	Units: mg/Kg						
Batch ID: 11161	TestNo: SW6010	FieldID: 102306PM	Analysis Date: 10/23/06	SeqNo: 502276							
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Arsenic	U	5.0									
Barium	0.141	0.10									
Cadmium	U	1.0									
Chromium	U	1.0									
Lead	U	7.3									
Selenium	U	10									
Silver	U	3.0									

Sample ID: 06-7033-01AAMS	Sample Type: MS	TestCode: 6010_S	Run ID: ICP_061023A	Prep Date: 10/19/06	Units: mg/Kg						
Batch ID: 11161	TestNo: SW6010	FieldID: 102306PM	Analysis Date: 10/23/06	SeqNo: 502284							
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Arsenic	124	4.0	158.7	6.107	74.3	75	125	0	0	0	S
Barium	478.6	0.079	396.8	150.5	82.7	75	125	0	0	0	B
Cadmium	14.82	0.79	15.87	0.7565	93.4	75	125	0	0	0	
Chromium	135.7	0.79	158.7	13.3	77.1	75	125	0	0	0	
Lead	130.2	5.8	158.7	8.569	76.7	75	125	0	0	0	
Selenium	119.4	7.9	158.7	0	75.2	75	125	0	0	0	
Silver	10.14	2.4	15.87	0	63.9	75	125	0	0	0	S

Qualifiers: ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time
 Print Date: 10/27/06

Work Order: 06-7267
 Client Project ID: Denver Animal Shelter

ANALYTICAL QC SUMMARY REPORT

BatchID: 11148

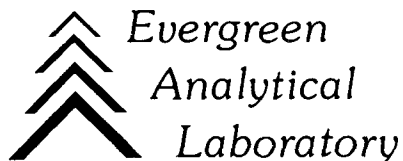
Sample ID: MB-11148	SampType: MBLK	TestCode: 7471_S	Run ID: HG ANALYZER_061020A	Prep Date: 10/20/06	Units: mg/Kg
Batch ID: 11148	TestNo: SW7471	FileID: 102006s	Analysis Date: 10/20/06	SeqNo: 501607	
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Mercury		U	0.020		

Sample ID: LCS-11148	SampType: LCS	TestCode: 7471_S	Run ID: HG ANALYZER_061020A	Prep Date: 10/20/06	Units: mg/Kg
Batch ID: 11148	TestNo: SW7471	FileID: 102006s	Analysis Date: 10/20/06	SeqNo: 501609	
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Mercury	4.529	0.20	5.706	0	79.4 57.3 142 0 0

Sample ID: 06-7084-11BMS	SampType: MS	TestCode: 7471_S	Run ID: HG ANALYZER_061020A	Prep Date: 10/20/06	Units: mg/Kg
Batch ID: 11148	TestNo: SW7471	FileID: 102006s	Analysis Date: 10/20/06	SeqNo: 501611	
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Mercury	0.6817	0.017	0.6667	0	102 70 130 0 0

Sample ID: 06-7084-11BMSD	SampType: MSD	TestCode: 7471_S	Run ID: HG ANALYZER_061020A	Prep Date: 10/20/06	Units: mg/Kg
Batch ID: 11148	TestNo: SW7471	FileID: 102006s	Analysis Date: 10/20/06	SeqNo: 501612	
Analyte	Result	LQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Mercury	0.7361	0.019	0.7407	0	99.4 70 130 0.6817 7.68 20

Qualifiers: ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank
 H - Sample exceeded analytical holding time



October 31, 2006

Tom Van Arsdale
Brown & Caldwell
1697 Cole Blvd. Suite 200
Golden, CO 80401

Lab Work Order: 06-7267
Client Project ID: Denver Animal Shelter

Dear Tom Van Arsdale:

Enclosed are the analytical results for the samples shown in the Laboratory Work Order Summary. The invoice is included with this report or has been mailed to another party as indicated on the chain of custody.

The enclosed data for testing performed at Evergreen Analytical Laboratory (EAL) have been reviewed for quality assurance. A case narrative is included to describe any anomalies associated with the samples or data.

EAL will dispose of all samples one month from the date of this letter. If you want samples returned, please advise us by mail or fax as soon as possible.

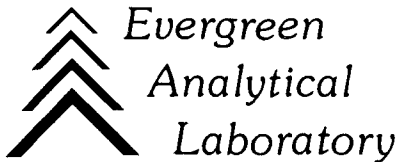
A copy of this project report and supporting data will be retained for a period of five years unless we are otherwise advised by you. A document retrieval charge will apply.

Thank you for using the services of Evergreen Analytical. If you have any questions concerning the analytical data, please contact me. Please direct other questions to Client Services.

Sincerely,

A handwritten signature in cursive script that reads "Carl Smits".

Carl Smits / Kaprie Hollman
Technical Director of Chemical Analysis



November 14, 2006

Tom Van Arsdale
Brown & Caldwell
1697 Cole Blvd. Suite 200
Golden, CO 80401

Lab Work Order: 06-7267
Client Project ID: Denver Animal Shelter

Dear Tom Van Arsdale:

Please find the enclosed revised SW6010 Metals analytical reports for samples 06-7267-01, -03, and -04. "J" values (indicates an estimated value when the compound is detected, but is below the LQL) for arsenic, selenium, and silver have been added.

The enclosed data for testing performed at Evergreen Analytical Laboratory (EAL) have been reviewed for quality assurance. A case narrative is included to describe any anomalies associated with the samples or data.

EAL will dispose of all samples one month from the date of this letter. If you want samples returned, please advise us by mail or fax as soon as possible.

A copy of this project report and supporting data will be retained for a period of five years unless we are otherwise advised by you. A document retrieval charge will apply.

Thank you for using the services of Evergreen Analytical. If you have any questions concerning the analytical data, please contact me. Please direct other questions to Client Services.

Sincerely,

A handwritten signature in cursive script that reads "Kaprie S. Hollman".

Carl Smits / Kaprie S. Hollman
Technical Director of Chemical Analysis

Kaprie Hollman

From: "Kaprie Hollman" <khollman@evergreenanalytical.com>
To: "Patty McClellan" <patty@evergreenanalytical.com>
Sent: Tuesday, November 14, 2006 10:45 AM
Subject: Re: 06-7267 Denver Animal Shelter

The differences found are due to "J" values not being reported for the metals analyses. Revised reports including "J" values have been printed, and signed. The reports will be scanned into Docuware and will need to be sent via email to the client.

Kaprie S. Hollman

Quality Assurance Manager
Evergreen Analytical, Inc.
303-425-6021
khollman@evergreenanalytical.com

----- Original Message -----

From: Patty McClellan
To: Bob Guthrie ; Kaprie Hollman
Cc: tvanarsdale@brwncald.com
Sent: Tuesday, November 14, 2006 8:36 AM
Subject: Fw: 06-7267 Denver Animal Shelter

Bob and Kaprie,
Please take a look.

----- Original Message -----

From: Van Arsdale, Tom
To: patty@evergreenanalytical.com
Sent: Monday, November 13, 2006 1:11 PM
Subject: 06-7267 Denver Animal Shelter

Patty,

After QCing our work we noticed 4 differences between EAL's electronic concentrations and the hard copy of the lab report sent to us.

They are: Arsenic in DAS-2-8-12 and DAS-3-8-12
 Selenium in DAS-2-8-12
 Silver in DAS-11-12-16

Of course I'll need to know the correct values to enter into our Table, but I'll also need an updated copy of the correct data (whether electronic, hard copy or both).

The Lab Work Order is 06-7267 (Denver Animal Shelter).

Thanks,

Tom

Evergreen Analytical Laboratory



4036 Youngfield Street
Wheat Ridge, CO 80033-3862

(303) 425-6021
FAX (303) 425-6854

INVOICE

06110027

Invoice Date: November 01, 2006

Invoice To: CCOD Environmental Services
201 W Colfax Ave., 7th Floor
Denver, CO 80202

Attn: Lisa Farrell
Phone: (720) 865-5439

MAIL PAYMENTS TO:
Evergreen Analytical Laboratory
Dept. 1819
Denver, CO 80291-1819

Client Project ID: Denver Animal Shelter Agrmt No: Work Order: 06-7267
Date Samples Received: 10/18/06 PO Number: OC62060 QuoteID: 7521

Item	Matrix	Qty	Unit Price	Unit Surcharge	Total Unit Price	Extended Price
8 RCRA Total Metals, Soil/Solids 6010/7471	Soil	3	\$100.80	0%	\$100.80	\$302.40
8260B VOA Hazardous Substance List	Soil	3	\$132.00	0%	\$132.00	\$396.00
8260B VOA Hazardous Substance List	Groundwater	1	\$132.00	0%	\$132.00	\$132.00
8270C BNA Hazardous Substance List	Soil	3	\$260.00	0%	\$260.00	\$780.00

Sub total: \$1,610.40
 Surcharge: 0.00%
 Discount: 0.00%
 Misc: \$0.00

Invoice Total \$1,610.40

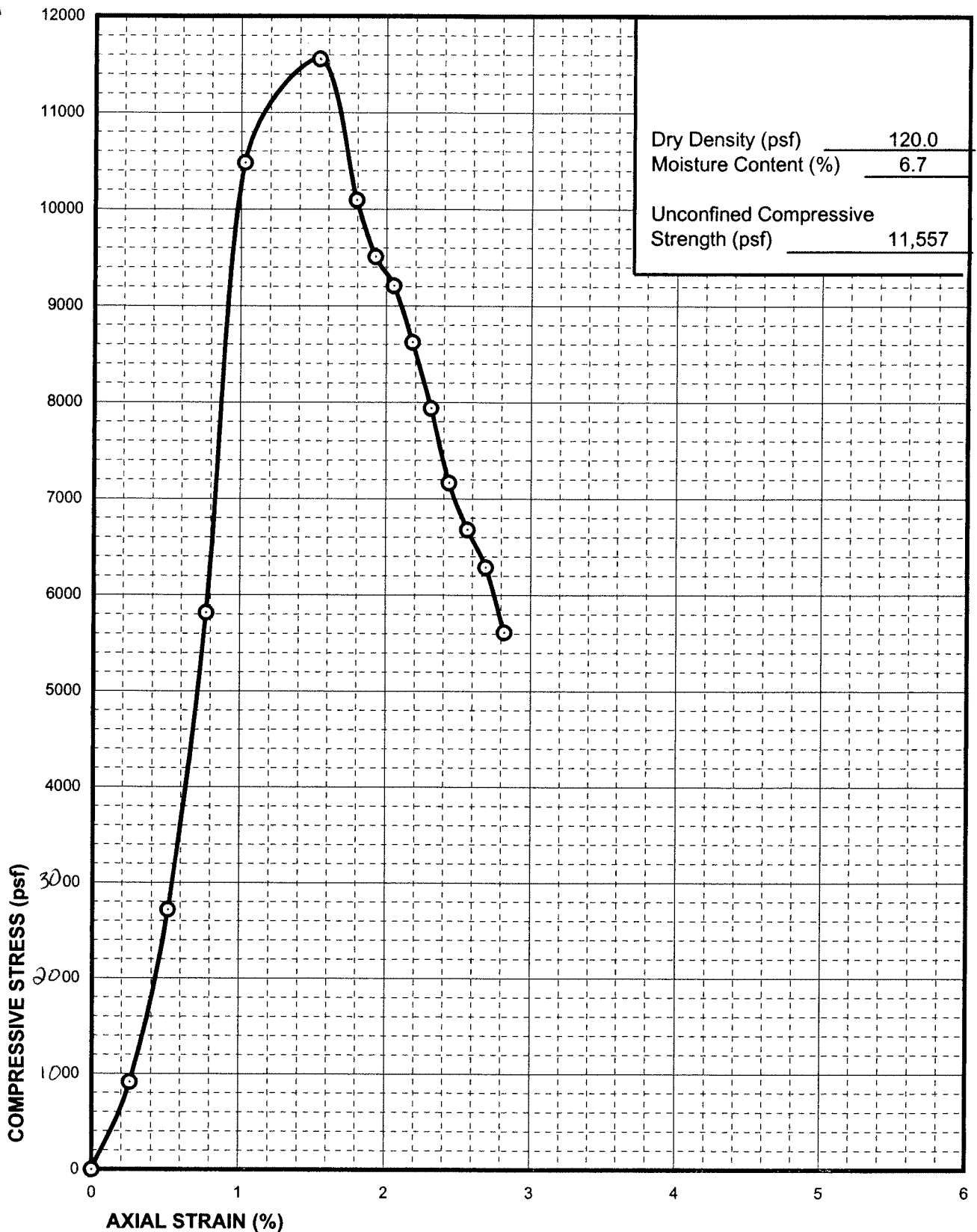
Prepayment: \$0.00

Balance Due: \$1,610.40

Comments: Reported to Brown & Caldwell. 20% Discount applied for CCOD contract reference # OC62060. 6010 Metals pricing based on \$12/metal.

FEIN	84-0906043	WE ARE AN EQUAL OPPORTUNITY EMPLOYER
TERMS	NET 30 Days. A 1.5% service charge will be added to all past due accounts. THANK YOU FOR YOUR BUSINESS	

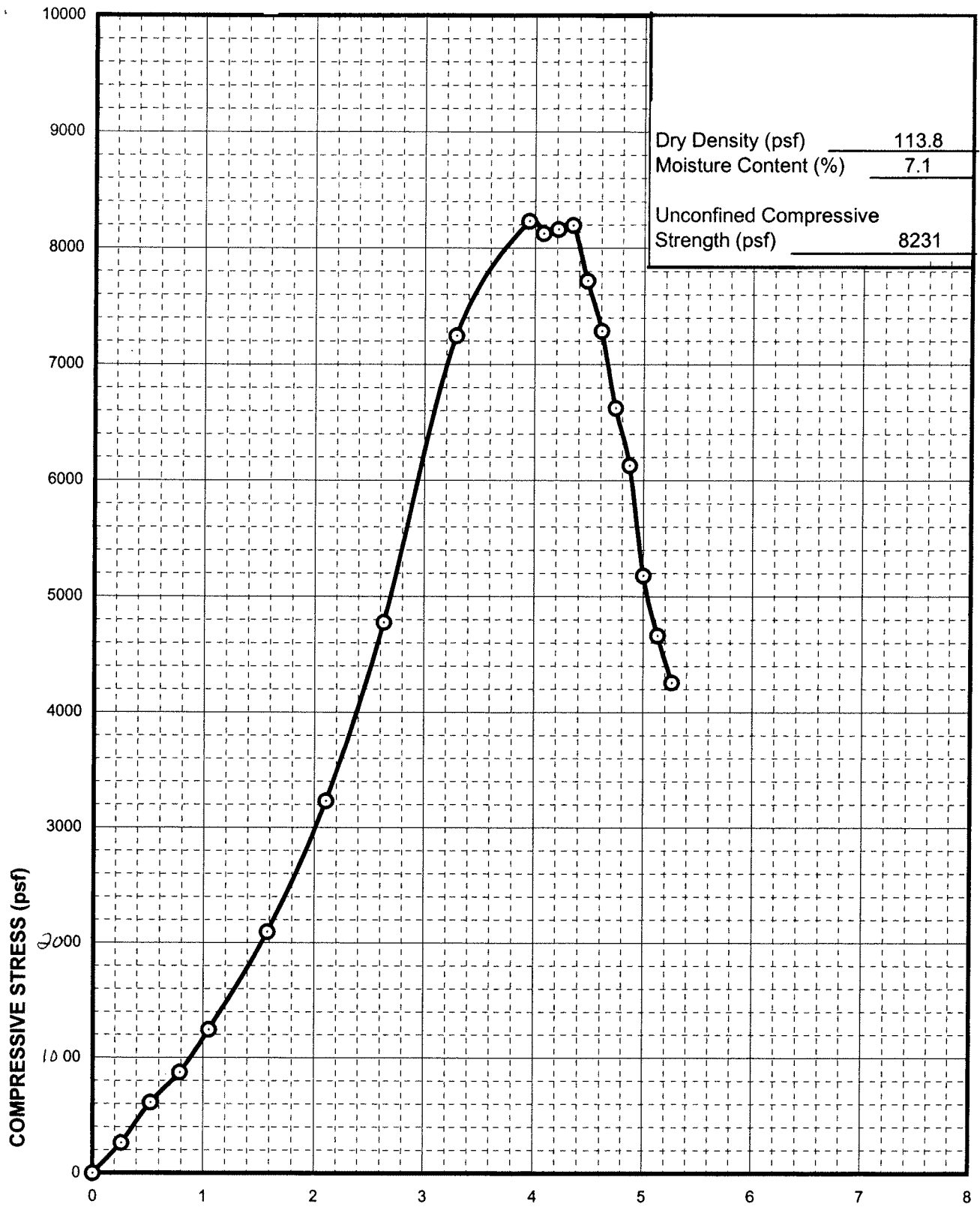
APPENDIX C
GEO' TECHNICAL SAMPLE GRAPHS



Dry Density (psf)	120.0
Moisture Content (%)	6.7
Unconfined Compressive Strength (psf)	11,557

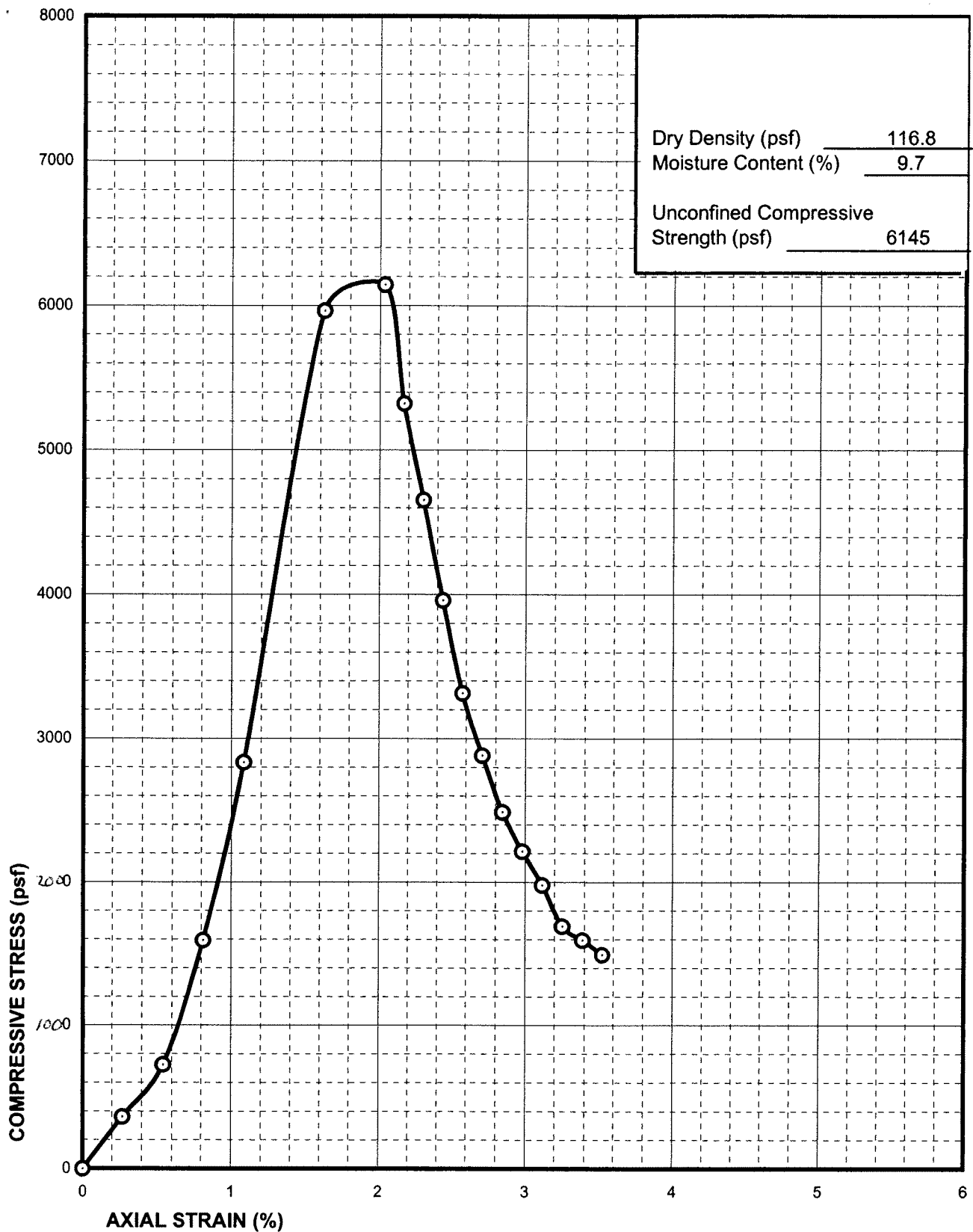
Sample Description:	<u>Fill, Clay, Sandy, Gravelly,</u>	LIQUID LIMIT	_____ %
	<u>with pieces of glass</u>	PLASTICITY INDEX	_____ %
Location:	<u>DAS-3 at 1'-8" to 2'</u>	GRAVEL	_____ %
		SAND	_____ %
Test Procedure:	<u>ASTM D-2166</u>	SILT AND CLAY	_____ %

Unconfined Compressive Strength Test Results



Sample Description:	<u>Fill, Clay, Sandy, Gravelly</u>	LIQUID LIMIT	_____ %
Location:	<u>DAS-3 at 2'-4" to 2'-8"</u>	PLASTICITY INDEX	_____ %
Test Procedure:	<u>ASTM D-2166</u>	GRAVEL	_____ %
		SAND	_____ %
		SILT AND CLAY	_____ %

Unconfined Compressive Strength Test Results



Sample Description: Fill, Clay, Sandy, Gravelly

Location: DAS-7 at 2'-4" to 2'-8"

Test Procedure: ASTM D-2166

LIQUID LIMIT _____ %

PLASTICITY INDEX _____ %

GRAVEL _____ %

SAND _____ %

SILT AND CLAY _____ %

Unconfined Compressive Strength Test Results

APPENDIX D

**1948 AERIAL PHOTOGRAPH OF SITE AND SAMPLE
LOCATION COORDINATES**





DENVER
THE MILE HIGH CITY

INTEROFFICE MEMORANDUM

TO: Steve Sholler, Facilities Planning and Management
FROM: Lisa Farrell, Environmental Quality Division
DATE: 8 March 2007
SUBJECT: Animal Shelter Expansion (EQ Job # 20055077)

At your request, Denver Department of Environmental Health, Environmental Quality Division (EQ) contracted with Brown and Caldwell to conduct a Phase II environmental site assessment for the proposed building expansion at the present Animal Control Shelter located at 678 South Jason Street.

This review was done to obtain information that would indicate or identify recognized environmental conditions in connection with the subject property. The scope of the site assessment tasks performed consisted of the following:

- Review of county, state and federal lists of known potential hazardous waste sites or landfills, and sites currently under investigation for environmental violations, including any registered underground storage tanks;
- Review of aerial photographs of the site from 1948, 1955, 1964, 1990;
- Review of City and County of Denver Historic Landfill Database (Pinyon, 1997);
- A Phase II environmental site assessment Landfill Evaluation and Sampling conducted by Brown and Caldwell and documented in a draft report dated 12 February 2007; and
- Preparation of this memorandum to present a review of the findings.

Project Description and Background

The City proposes to expand the existing Animal Shelter structure located at 678 South Jason Street onto the land currently used as an off-leash dog park (Figure 1). From the aerial photo review, past uses of 678 South Jason Street include a gravel pit (1948), a small lake (1955) and a capped landfill (1964). The land is currently occupied by the Denver Municipal Animal Shelter in the western part of the site, and a dog park on the eastern portion of the site. The purpose of the Phase II site assessment landfill evaluation and sampling, conducted by Brown and Caldwell, was to assess the current environmental condition of soil and groundwater on the site.



DENVER
THE MILE HIGH CITY



Figure 1. Aerial photograph showing location of subject property and approximate uses.



Findings

Thirteen borings were drilled across the site (Figure 2) to assess the current subsurface soil conditions. Samples were collected and variously analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and the eight metals specified by regulation. Boring identification and sample collection and analysis is summarized below:

BORING CLASSIFICATION						
Boring #	S	G	SS	TMW	LGS	WS
DAS-1	x				x	
DAS-2	x		x		x	
DAS-3	x	x	x	x	x	
DAS-4	x				x	
DAS-5	x	x			x	
DAS-6	x				x	
DAS-7	x	x		x	x	x
DAS-8	x			x	x	
DAS-9	x				x	
DAS-10	x				x	
DAS-11	x		x		x	
DAS-12	x				x	
DAS-13					x	

S – Soil Boring
 G – Geotechnical Sample Collected
 SS – Soil Sample Collected
 TMW – Temporary Groundwater Monitoring Well
 LGS – Landfill Gas Sample Collected
 WS – Water Sample Collected



DENVER
THE MILE HIGH CITY

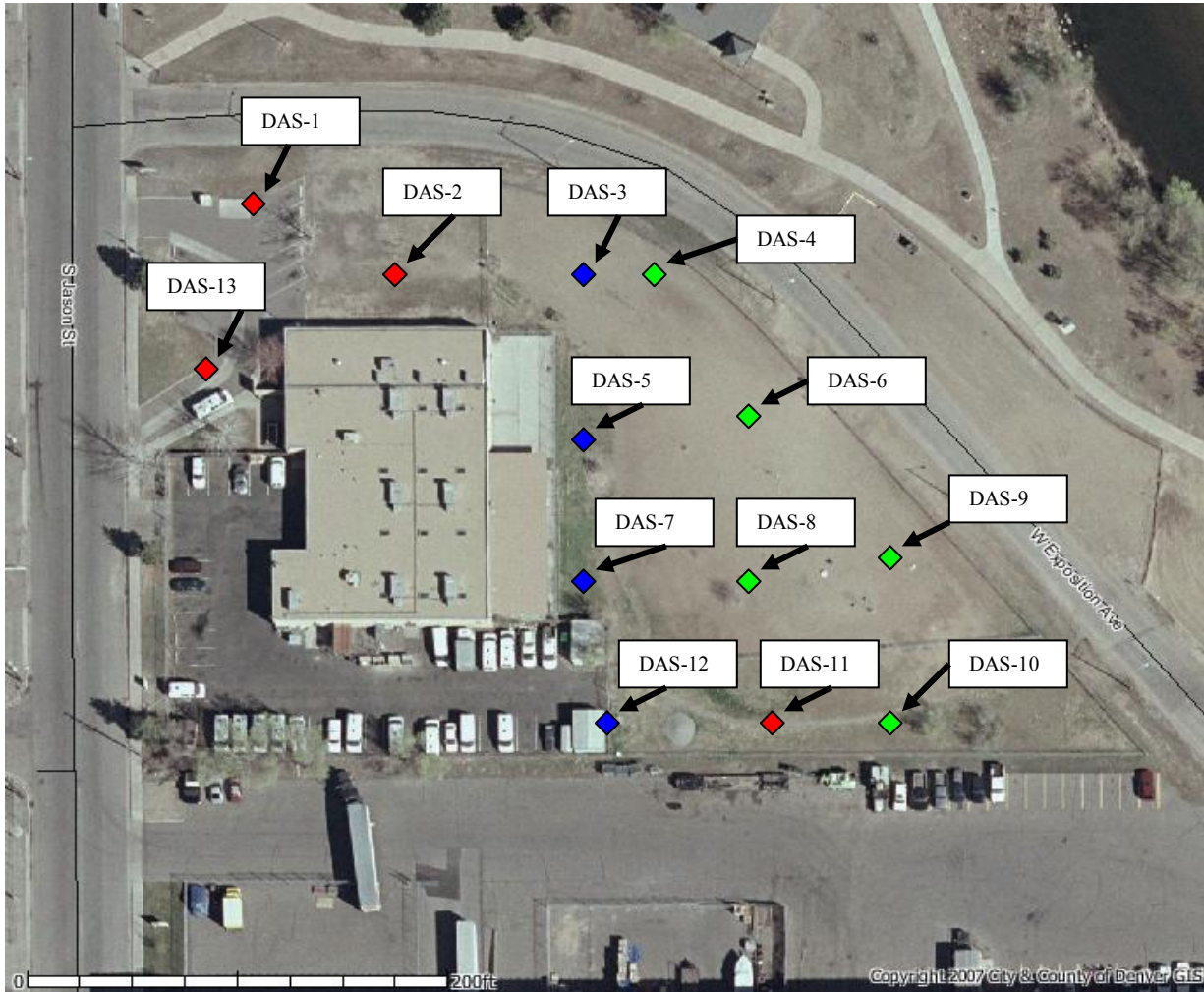


Figure 2. Sampling locations: those with high methane >20% are in red, 5-20% are in blue and <5% are in green

Soil:

All three soil samples collected at the site exceeded the Colorado Department of Public Health and Environment (CDPHE) commercial land use level for arsenic of 1.04 milligram per kilogram (mg/Kg) and two of those (DAS-2-8'-12" and DAS-11-12' 16") exceeded the City and County of Denver's (Denver's) commercial soil screening level of 3.61 milligram per liter (mg/L). However, none of the soil samples exceeded Denver's special case soil screening level of 24 mg/Kg, and the concentrations could be representative of the background arsenic levels in the Denver region.

Four SVOCs were reported above Denver's commercial land use soil screening levels in sample DAS-2-8'-12'. Those SVOCs were benzo(a)anthracene at 38,000 microgram per kilogram ($\mu\text{g/Kg}$)



DENVER
THE MILE HIGH CITY

(standard = 6,050 $\mu\text{g}/\text{Kg}$), benzo(a)pyrene at 40,000 $\mu\text{g}/\text{Kg}$ (standard = 610 $\mu\text{g}/\text{Kg}$), dibenz(a,h)anthracene at 10,000 $\mu\text{g}/\text{Kg}$ (standard = 610 $\mu\text{g}/\text{Kg}$) and indeno(123-cd)pyrene at 28,000 $\mu\text{g}/\text{Kg}$ (standard = 6,050 $\mu\text{g}/\text{Kg}$). There are no CDPHE commercial land use standards for these four compounds.

Groundwater:

There were no reported compounds in the groundwater sample (DAS-7) that exceeded CDPHE groundwater standards.

Landfill Gas:

Eight of thirteen landfill gas samples indicated methane in the soil vapor at levels above the lower explosive limit (LEL) of 5%. The highest recorded methane percentage was 21.2% and was obtained from boring DAS-2. Other results indicated the high methane concentrations in borings DAS-1, DAS-2, DAS-3 located north and northwest of the current structure and appearing to taper off to the southeast, however, rather elevated levels up to 20% (DAS-11) were still found along the southern edge of the property.

Summary and Conclusions

EQ recommends that if this property is to be developed in the future that the impacted landfill soils be properly removed and disposed. Contractors should be informed of the potential landfill materials and methane concentrations and advised of the appropriate precautions during construction activities. Soil samples should be collected and analyzed during earthmoving activities to determine soil disposal, re-grading and stockpiling options.

EQ has the following recommendations:

- Soil in excavated areas should be visually inspected for landfill debris and soil staining. If landfill debris or impacted soils are encountered on the site, the material cannot be reused on site. The material must be manifested and transported to Denver Arapahoe Disposal Site (DADS). EQ will assist with the manifests and profile for acceptance of any contaminated soil to DADS.
- A materials management plan (MMP) is recommended to address proper notifications, handling and disposal of any landfill debris or contaminated soil that is excavated.
- The potential exists for explosive levels of methane gas in and around the subject property area. EQ recommends monitoring air quality during excavation and construction for methane gas using a landfill gas meter.



DENVER
THE MILE HIGH CITY

Brown and Caldwell estimated the volume of landfill impacted materials at approximately 66,000 cubic yards. This was calculated by finding the potential lateral and vertical extent of the landfill material by the placement of the soil borings. The results were then put into the Surfer[®] Software to calculate the total potential volume of the landfill material in the northern and eastern portions of the site. Based on this volume, the estimated cost for of remediation is totaled at approximately \$435,000. The cost estimate includes transportation and disposal of soil at the Denver Arapahoe Disposal Site (DADS), replacement of the material removed with clean fill, and engineering planning and oversight costs. It is EQ's recommendation that the subject properties be cleaned up to residential standards prior to acquisition.

The limited scope of this environmental review must be understood. Future regulatory changes, agency interpretations, and/or concepts of due diligence industry standards are beyond the control of EQ.

EQ's objective is to perform our work with care, exercising the customary skill and competence of Environmental Site Assessment professionals in the relevant disciplines. The opinions presented herein apply to subject property conditions existing at the time of our investigation and those reasonably foreseeable. EQ does not warrant or guarantee the subject properties suitable for any particular use or purpose, or certify that the subject property is "clean".

As with any environmental concern, Denver's Department of Environmental Health, Division of Environmental Quality is available to advise all city agencies and is pleased to be of service. If you have any questions or concerns that you would like to discuss regarding this environmental site assessment, please telephone Lisa Farrell (720-865-5439).

cc: Derek Brown, Asset Management
Steve Wirth, Asset Management
File 2005077

CITY AND COUNTY OF DENVER DEPARTMENT OF
PUBLIC WORKS

CONTRACT NO. 201416785
PROJECT NAME: 678 S JASON ST. MAINTENANCE FACILITY

ADDENDUM NO. 2 TO CONTRACT DOCUMENTS

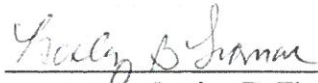
Bidders are hereby instructed that the drawings, specifications, and other contract documents are modified, corrected, supplemented and/or superseded for the above mentioned project as hereinafter described in the following attachments:

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

BID FORM PACKAGE

Replace page BF-7 with the attached revised BF-7.

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

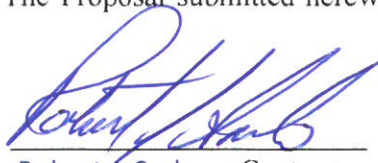


Lesley B. Thomas
City Engineer

7.8.14

Date

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



Robert J. Sarlo Contractor

ADDENDUM NO. 2

DATE: 07.10.14

Lump Sum Bid Amount:

_____ Dollars (\$) _____)

In accordance with the Bidder's Checklist on Page BF-3:

Textura® Construction Payment Management System Fee Amount applicable to Lump Sum amount above:

_____ % of Lump Sum Bid Amount

_____ Dollars (\$) _____)

Total Bid Amount equals the Lump Sum Bid Amount and the Textura® Construction Payment Management System Fee:

_____ Dollars (\$) _____)

Alternate 1 - Site work and paving _____
_____ Dollars (\$) _____)

Alternate 2 - Planting _____
_____ Dollars (\$) _____)

Alternate 3 - Exterior painting _____
_____ Dollars (\$) _____)

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 _____, a corporation of the State of _____, 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 _____. 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:

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
Parks and Recreation

TABLE OF CONTENTS FOR CONTRACT DOCUMENTS

BID FORM AND SUBMITTAL PACKAGE	<u>PAGE</u>
Bid Form and Submittal Package (bound separately and attached as part of these Bid Documents)	
Table of Contents	BF-1
Bidder's Checklist	BF-2 through BF-3
Bid Form and Submittal Package Acknowledgment Form	BF-4 through BF-5
Bid Form	BF-6 through BF-8
List of Proposed Minority and Woman Business Enterprise(s)	BF-9 through BF-12
Commitment to Minority and Woman Business Enterprise Participation	BF-13
Minority and Woman Business Enterprise Letter(s) of Intent & Checklist	BF-14 through BF-15
Joint Venture Affidavit	BF-16
Joint Venture Eligibility Form	BF-17 through BF-19
Bid Bond	BF-20
Diversity and Inclusiveness in City Solicitations Form	BF-21 through BF-24
 BID DOCUMENTS	
Table of Contents	BDP-1
Notice of Invitation for Bids	BDP-2 through BDP-3
Instructions to Bidders	BDP-4 through BDP-16
Equal Employment Opportunity Provisions	BDP-17 through BDP-26
Appendix A	
Appendix F	
Contract Form	BDP-27 through BDP-31
Index of the General Contract Conditions	BDP-32 through BDP-36
Special Contract Conditions	BDP-37 through BDP-47
Final/Partial Release and Certificate of Payment Forms (Samples)	BDP-40 through BDP-42
Performance and Payment Bond Form	BDP-46 through BDP-47
Performance and Payment Bond Surety Authorization letter (Sample)	BDP - 48
Notice to Apparent Low Bidder (Sample)	BDP-49 through BDP-50
Notice To Proceed (Sample)	BDP-51
Certificate of Contract Release (Sample)	BDP-52
Prevailing Wage Rate Schedule	37 pages
Index to Technical Specifications	5 pages
Technical Specifications	746 pages
Drawings	46 pages

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
Parks and Recreation

NOTICE FOR INVITATION FOR BIDS
FOR CONTRACT NO. 201416785

678 S. JASON ST.

BID SCHEDULE:
11:00 AM, Local Time
JULY 10, 2014

Sealed bids will be received at the Development Permits Counter Station #22, located on the 2nd floor at 201 West Colfax Ave., Denver, CO 80202, beginning at 10:30 a.m., no later than 11:00 a.m., on bid day.

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 West Colfax Avenue, Department 614, Denver, Colorado 80202. All properly delivered bids will then be publicly opened and read aloud in Room 4.I.2 on the fourth floor at 201 West Colfax Ave., Denver, Colorado 80202.

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

GENERAL STATEMENT OF WORK:

Renovate former animal shelter for use as a Parks Department storage and maintenance facility. Landscaping and paving are included as bid alternates. Scope includes general construction, concrete, mechanical, electrical and plumbing.

ESTIMATED CONSTRUCTION COST:

The estimated cost of construction for this project is between \$710,000.00 and \$877,000.00.

TEXTURA CONSTRUCTION PAYMENT MANAGEMENT:

Bidders are required, when preparing a bid, to agree that it shall use the Textura® Construction Payment Management System (CPM System) for this Project and recognizes that all fees associated with the CPM System are to be paid by the awarded Contractor for billings for work performed. 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 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 \$10.00 per download, reference eBid Document Number #3381456. Contact QuestCDN.com at 952-233-1632 or info@questcdn.com for assistance.

PRE-BID CONFERENCE:

A pre-bid conference will be held for this Project at 9:00 AM, local time, on JUNE 24, 2014. This meeting will take place at: 201 W. Colfax, Room 4.I.4, Denver, CO 80202. Site visit to follow immediately after.

DEADLINE TO SUBMIT QUESTIONS: June 30, 2014 by 5:00 PM local time.

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:

27% 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.

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: June 13, 16, 17, 2014
Published In: The Daily Journal

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
Parks and Recreation

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 of 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 proper bid guarantee, satisfying all of the requirements specified herein and on the form provided herein shall render the bid nonresponsive and may 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 WAGE RATE REQUIREMENTS

In preparing any bid hereunder, the Contractor must comply with and should carefully consider 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.

At the time of the preparation of the Contract Documents, the then-current prevailing wage rates applicable to this Project shall be bound within the Contract Documents made available to potential bidders for the Project. If, more than ten (10) days prior to the actual date of bid opening, the Career Service Board determines that prevailing wages rates different from those bound in the Contract Documents are applicable to one or more of the various classes of laborers, mechanics and workers encompassed by this Project, such

different prevailing wage rates shall be provided in an addendum. If different prevailing wage rates are determined by the Career Service Board ten (10) or less days prior to the actual date of bid opening, the City will determine on a case by case basis in its sole discretion whether such different prevailing wage rates are to be included in an addendum. In conjunction with such determination, the City may elect, in its sole discretion, to postpone the date of bid opening on the Project. In any event, the bidder will be held, at the actual date of bid opening, to those prevailing wage rates incorporated into the Contract Documents and as modified by any such addenda.

These prevailing wage rates shall be considered the **minimum** City prevailing wage rates to be paid by all contractors or subcontractors for a period not to exceed one (1) year from the date of the Contract. Increases in prevailing wages subsequent to the date of the Contract for a period not to exceed one (1) year shall not be mandatory on either the contractor or subcontractors. Future increases in prevailing wages on contracts whose period of performance exceeds one (1) year shall be mandatory for the contractor and subcontractors only on the yearly anniversary date of the Contract. The **minimum** City prevailing wage rate for any such subsequent yearly period or portion thereof shall be the wage rates in effect on the yearly anniversary date of the contract which begins such subsequent period. In no event shall any increases in prevailing wages over the amounts thereof as stated in such Technical Specifications and addenda thereto result in any increased liability on the part of the City and the possibility and risk of any such increase is assumed by all contractors entering into any such contract with the City. Decreases in prevailing wages subsequent to the date of the contract for a period not to exceed one year (1) shall not be permitted. Decreases in prevailing wages on contracts whose period of performance exceeds one (1) year shall not be effective except on the yearly anniversary date of the contract.

IB-23 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. Construction and building materials sold to contractors and subcontractors for use on structures, roads, streets, highways, and other public works owned by the City and County of Denver are exempt from state, RTD, and Cultural Facilities District sales and use taxes. However, such materials will be subject to sales and use taxes imposed by the City and County of Denver.

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 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 over \$500 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-24 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-25 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 or DBE 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. 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.
4. 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 [DSBO](#) Compliance.

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.

5. 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.
 - e. 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.
 - f. 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.

- g. 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.
6. 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 only 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- 26 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-27 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 DenverGov.com for information, both general and project specific. The Contract Administrator assigned to this project is Debby Gibson who can be reached via email at debby.gibson@denvergov.org.

IB-28 PAYMENT PROCEDURE REQUIREMENTS

Contractor recognizes and agrees that it shall be required to use the Textura® Construction Payment Management System (CPM System) for this Project. All fees associated with the CPM System are to be paid by the Contractor for billings for work performed. Bidders are required, when preparing a bid, to enter the price of the CPM service on the line provided for the service. The fee is all inclusive of all subcontractor, project and subscription fees associated with the CPM system. The bidder will calculate the fee based on a percentage of their overall base bid, and then should 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. Textura will invoice the awarded contractor directly.

PROJECT SIZE	FEE (% OF BID)
< \$1,000,000	0.22% (.0022)
\$1,000,001 - \$5,000,000	0.17% (.0017)
\$5,000,001 - \$20,000,000	0.12% (.0012)
\$20,000,001 - \$50,000,000	0.10% (.0010)
\$50,000,001 - \$100,000,000	0.08% (.0008)
\$100,000,001 - \$500,000,000	0.05% (.0005)
> \$500,000,000	CONTACT TEXTURA FOR PROGRAM PRICING

For more information:

<http://www.denvergov.org/constructioncontracts/ContractAdministration/BiddingProcess/TexturaPaymentSystem/ta/bid/443165/Default.aspx>

**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.

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
Parks and Recreation

APPENDIX A

**CITY AND COUNTY OF DENVER EQUAL OPPORTUNITY CLAUSE -
ALL CONTRACTS**

1. The Contractor will not discriminate against any employee or applicant for employment because of race, creed, color, sex, age, national origin, religion, marital status, political opinion or affiliation, or mental or physical handicap. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, creed, color, sex, age, national origin, religion, marital status, political opinion or affiliation, or mental or physical handicap. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.
2. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, sex, age, national origin, religion, marital status, political opinion or affiliation, or mental or physical handicap.
3. The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided, advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
4. Each Contractor will comply with all provisions of Article III, Division 2 of Chapter 28 of the Revised Municipal Code, and the rules, regulations, and relevant orders of the Manager and the Director.
5. The Contractor will furnish all information and reports required by Article III, Division 2 of Chapter 28 of the Revised Municipal Code, and by rules, regulations and orders of the Manager and Director or pursuant thereto, and will permit access to his books, records, and accounts by the Manager, Director, or their designee for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
6. In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations or orders, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further City contracts in accordance with procedures authorized in Article III, Division 2, Chapter 28 of the Revised Municipal Code, or by rules, regulations, or order of the Manager.
7. The Contractor will include Regulation 12, Paragraph 2 and the provisions of paragraphs (1) through (6) in every subcontract of purchase order unless exempted by rules, regulations, or orders of the Manager issued pursuant to Article III, Division 2, Chapter 28 of the Revised Municipal Code, so that such provisions will be binding on each subcontractor or supplier. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance.

The applicant further agrees to be bound by the above equal opportunity clauses with respect to its own employment practices when it participates in City contracts. The Contractor agrees to assist and cooperate actively with the Manager and the Director in obtaining compliance of subcontractors and suppliers with the equal opportunity clause and the rules, regulations and relevant orders of the Manager, and will furnish the Manager and the Director such information as they may require for the supervision of compliance, and will otherwise assist the Manager and Director in the discharge of the City's primary responsibility for

securing 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
Parks and Recreation

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
Parks and Recreation

CONTRACT NO. 201416785

678 S. JASON ST.

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,

INTERLOCK CONSTRUCTION CORP.
2492 W. 2nd Avenue
Denver, CO 80223

WITNESSETH, Commencing on **June 13, 2014**, 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. 201416785

678 S. JASON ST.

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 **180** (One Hundred Eighty Days) 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 **Lump Sum**, the total estimated cost thereof being **Seven Hundred Forty Nine Thousand Five Hundred Sixty Five Dollars and Forty Two Cents (\$749,565.42)**. 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 the Work under this Contract, the Contractor agrees not to refuse to hire, discharge, promote or demote, or to discriminate in matters of compensation against any person otherwise qualified, solely because of race, color, religion, national origin, gender, age, military status, sexual orientation, marital status, or physical or mental disability; and the Contractor further agrees to insert the foregoing provision in all subcontracts hereunder.

6. COMPLIANCE WITH M/WBE REQUIREMENT

This Contract is subject to all applicable provisions of Divisions 1 and 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.

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:

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:

REGISTERED AND COUNTERSIGNED:

By _____

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: 201416785

Vendor Name: INTERLOCK CONSTRUCTION CORP.

By: *Robert J. Sarlo*

Name: Robert J. Sarlo
(please print)

Title: *Robert* President
(please print)

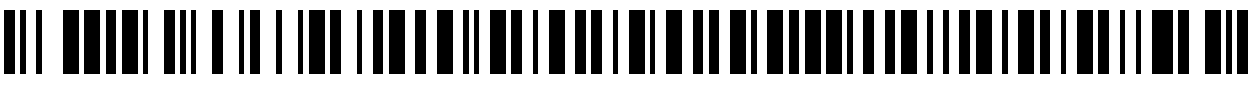


ATTEST: [if required]

By: *James Fournier*

Name: JAMES FOURNIER
(please print)

Title: VICE-PRES
(please print)



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

General Contract Conditions

INDEX

TITLE 1		
DEFINITIONS		1
101	CITY	1
102	CONTRACT	1
103	CONTRACT AMOUNT	1
104	CONTRACT DOCUMENTS	1
105	CONTRACT TIME	1
106	CONTRACTOR	2
107	CONTRACTOR PERSONNEL	2
108	DAYS	2
109	DEPUTY MANAGER	2
110	DESIGNER	2
111	FINAL COMPLETION	2
112	MANAGER	3
113	PRODUCT DATA	3
114	PROJECT	3
115	PROJECT MANAGER	3
116	SAMPLES	3
117	SHOP DRAWINGS	3
118	SUBCONTRACTOR	3
119	SUBSTANTIAL COMPLETION	3
120	SUPPLIER	4
121	WORK	4
TITLE 2		
CITY ADMINISTRATIVE ORGANIZATIONS; LINE OF AUTHORITY		5
201	DEPARTMENT OF AVIATION	5
202	MANAGER OF AVIATION	5
203	DEPARTMENT OF PUBLIC WORKS	5
204	MANAGER OF PUBLIC WORKS	5
205	BUILDING INSPECTION	5
206	ZONING	5
207	DIVISION OF SMALL BUSINESS OPPORTUNITY	6
208	CITY AUDITOR	6
209	MANAGER OF FINANCE	6
210	CITY ATTORNEY	6
211	OFFICE OF RISK MANAGEMENT	6
212	CITY'S CONTRACT ADMINISTRATION LINE OF AUTHORITY	6
213	CITY'S COMMUNICATION WITH THE CONTRACTOR	7

TITLE 3

CONTRACTOR PERFORMANCE AND SERVICES..... 8

- 301 CONSIDERATION
(CONTRACTOR’S PROMISE OF PERFORMANCE)..... 8
- 302 NOTICE TO PROCEED AND COMPLETION OF THE WORK 8
- 303 EXACT CONTRACTOR PERFORMANCE 8
- 304 SUBSTITUTED PERFORMANCE 8
- 305 WORK PERFORMED UNDER ADVERSE
WEATHER CONDITIONS..... 9
- 306 WORKING HOURS AND SCHEDULE 9
- 307 CONTRACTOR’S SUPERINTENDENT 10
- 308 COMMUNICATIONS 10
- 309 CONTRACTOR SUBMITTALS
AND OTHER WRITTEN COMMUNICATIONS TO THE CITY..... 10
- 310 COMPETENCE OF CONTRACTOR’S WORK FORCE 11
- 311 NO EMPLOYMENT OF ILLEGAL ALIENS
TO PERFORM WORK UNDER THE CONTRACT 11
- 312 CONDUCT OF CONTRACTOR’S PERSONNEL 12
- 313 SUGGESTIONS TO CONTRACTOR..... 12
- 314 WORK FORCE 12
- 315 CONSTRUCTION MACHINES AND STANDBY EQUIPMENT 13
- 316 CUTTING AND PATCHING THE WORK 13
- 317 PERMITS AND LICENSES 13
- 318 CONSTRUCTION SURVEYS 14
- 319 PRESERVATION OF PERMANENT
LAND SURVEY CONTROL MARKERS 14
- 320 TRADEMARKS, COPYRIGHTS AND PATENTED DEVICES,
MATERIALS, AND PROCESSES 15
- 321 PROJECT SIGNS..... 15
- 322 PUBLICITY AND ADVERTISING 16
- 323 TAXES 16
- 324 DOCUMENTS AND SAMPLES AT THE SITE 17
- 325 CLEANUP DURING CONSTRUCTION..... 17
- 326 SANITARY FACILITIES..... 18
- 327 POWER, LIGHTING, HEATING, VENTILATING,
AIR CONDITIONING AND WATER SERVICES 18

TITLE 4

CONTRACT DOCUMENTS (DRAWINGS AND TECHNICAL SPECIFICATIONS) 19

- 401 CONTRACT DOCUMENTS - REVIEW AND INTERPRETATION..... 19
- 402 OWNERSHIP OF CONTRACT DRAWINGS
AND TECHNICAL SPECIFICATIONS..... 20
- 403 CONTRACT DRAWINGS AND TECHNICAL SPECIFICATIONS
ISSUED TO THE CONTRACTOR 20
- 404 REQUESTS FOR INFORMATION OR CLARIFICATION 21
- 405 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 21
- 406 SUBSTITUTION OF MATERIALS AND EQUIPMENT 22

TITLE 5

SUBCONTRACTS24

- 501 SUBCONTRACTS..... 24
- 502 SUBCONTRACTOR ACCEPTANCE 24

TITLE 6

TIME OF COMMENCEMENT AND COMPLETION 27

- 601 BEGINNING, PROGRESS AND TIME OF COMPLETION 27
- 602 LIQUIDATED DAMAGES; ADMINISTRATIVE COSTS;

ACTUAL DAMAGES.....	27
603 DELAY DAMAGES.....	28
TITLE 7	
COOPERATION, COORDINATION AND RATE OF PROGRESS	29
701 COOPERATION WITH OTHER WORK FORCES	29
702 COORDINATION OF THE WORK.....	30
703 COORDINATION OF PUBLIC CONTACT.....	30
704 RATE OF PROGRESS	30
TITLE 8	
PROTECTION OF PERSONS AND PROPERTY	32
801 SAFETY OF PERSONS	32
802 PROTECTIVE DEVICES AND SAFETY PRECAUTIONS	33
803 PROTECTION OF PROPERTY AND WORK IN PROGRESS	33
804 PROTECTION OF MUNICIPAL, PUBLIC SERVICE OR PUBLIC UTILITY SYSTEMS	34
805 PROTECTION OF STREET AND ROAD SYSTEM	35
806 PROTECTION OF DRAINAGE WAYS.....	36
807 PROTECTION OF THE ENVIRONMENT	36
808 HAZARDOUS AND EXPLOSIVE MATERIALS OR SUBSTANCES.....	37
809 ARCHAEOLOGICAL AND HISTORICAL DISCOVERIES	37
TITLE 9	
COMPENSATION	38
901 CONSIDERATION (CITY'S PROMISE TO PAY).....	38
902 PAYMENT PROCEDURE	38
903 SCHEDULE OF VALUES IN LUMP SUM CONTRACTS	39
904 UNIT PRICE CONTRACTS.....	39
905 PROGRESS PERIOD.....	39
906 APPLICATIONS FOR PAYMENT.....	40
907 RELEASES AND CONTRACTORS CERTIFICATIONS OF PAYMENT	41
908 RETAINAGE	41
909 ADDITIONAL WITHHOLDING OF PROGRESS PAYMENTS	42
910 FINAL ESTIMATE AND PAYMENT.....	43
911 ACCOUNTING OF COSTS AND AUDIT	43
TITLE 10	
WAGE	45
1001 PREVAILING WAGE ORDINANCE.....	45
1002 POSTING OF THE APPLICABLE WAGE RATES	45
1003 RATE AND FREQUENCY OF WAGES PAID.....	45
1004 REPORTING WAGES PAID	45
1005 FAILURE TO PAY PREVAILING WAGES	46
TITLE 11	
CHANGES IN THE WORK, CONTRACT PRICE OR CONTRACT TIME	47
1101 CHANGE ORDER.....	47
1102 CITY INITIATED CHANGES	47
1103 CONTRACTOR CHANGE REQUEST.....	48
1104 ADJUSTMENT TO CONTRACT AMOUNT	51
1105 TIME EXTENSIONS.....	54
TITLE 12	
CONTRACTOR CLAIMS FOR ADJUSTMENT AND DISPUTES.....	56
1201 NOTICE OF INTENT TO CLAIM.....	56

1202	SUBMITTAL OF CLAIMS	56
1203	WAIVER OF CLAIMS	58
TITLE 13		
DISPUTES		59
1301	DISPUTES	59
TITLE 14		
SITE CONDITIONS		60
1401	DIFFERING SITE CONDITIONS.....	60
1402	SITE INSPECTIONS AND INVESTIGATIONS.....	60
TITLE 15		
PERFORMANCE AND PAYMENT BONDS		62
1501	SURETY BONDS	62
1502	PERFORMANCE BOND	62
1503	PAYMENT BOND.....	62
TITLE 16		
INSURANCE AND INDEMNIFICATION		63
1601	INSURANCE	63
1602	DEFENSE AND INDEMNIFICATION	63
TITLE 17		
INSPECTION AND DEFECTS		64
1701	CONSTRUCTION INSPECTION BY THE CITY.....	64
1702	AUTHORITY OF INSPECTORS	64
1703	OBSERVABLE DEFECTS.....	64
1704	DEFECTS - UNCOVERING WORK	64
1705	LATENT DEFECTS	65
1706	REMOVAL OF DEFECTIVE MATERIALS AND WORK	65
TITLE 18		
WARRANTIES, GUARANTEES AND CORRECTIVE WORK.....		66
1801	CONTRACTOR'S WARRANTIES, GUARANTEES AND CORRECTION OF WORK	66
1802	PERFORMANCE DURING WARRANTY PERIOD	67
TITLE 19		
SUBSTANTIAL COMPLETION OF THE WORK.....		69
1901	CONTRACTOR'S NOTICE OF SUBSTANTIAL COMPLETION	69
1902	INSPECTION AND PUNCH LIST	69
1903	CERTIFICATE OF SUBSTANTIAL COMPLETION	69
1904	RIGHT OF EARLY OCCUPANCY OR USE	69
TITLE 20		
FINAL COMPLETION AND ACCEPTANCE OF THE WORK.....		71
2001	CLEAN-UP UPON COMPLETION.....	71
2002	FINAL COMPLETION AND ACCEPTANCE OF THE WORK	71
2003	FINAL SETTLEMENT.....	71
TITLE 21		
SUSPENSION OF WORK.....		74
2101	SUSPENSION OF WORK.....	74
2102	SUSPENSION OF THE WORK FOR THE CITY'S CONVENIENCE	74
2103	SUSPENSION BECAUSE OF ORDER OF CITY, STATE	

OR FEDERAL COURT OR AGENCY	75
2104 SUSPENSION RESULTING FROM CONTRACTOR'S FAILURE TO PERFORM.....	75
TITLE 22	
CITY'S RIGHT TO TERMINATE THE CONTRACT	76
2201 TERMINATION OF CONTRACT FOR CAUSE	76
2202 TERMINATION OF CONTRACT FOR CONVENIENCE OF THE CITY	77
TITLE 23	
MISCELLANEOUS PROVISIONS	80
2301 PARTIES TO THE CONTRACT.....	80
2302 FEDERAL AID PROVISIONS.....	80
2303 NO WAIVER OF RIGHTS	80
2304 NO THIRD PARTY BENEFICIARY	80
2305 GOVERNING LAW; VENUE.....	81
2306 ABBREVIATIONS	81
2307 STATUTE OF LIMITATIONS IN C.R.S. § 13-80-102(1)(h)	81

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
Parks and Recreation

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 2009 Series, City and County of Denver Amendments 2011)

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: http://www.denvergov.org/dpw_contract_admin/ContractAdministration/ContractorReferenceDocuments/t/abid/440535/Default.aspx. *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 / Engineering Division,

<u>Project Manager</u>		<u>Telephone</u>
City Project Manager		
David Brown		(720) 865-3039
<u>Consultant</u>	<u>Name</u>	<u>Telephone</u>
Design Consultant	Consultant Contact	
SLATERPAULL ARCHITECTS	Lisa Gardner	(303) 222-0230

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 \$200.00 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. Contractor further agrees that, to the fullest extent possible within the CPM System, 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 the CPM System, including, but not limited to, information related to Contractor and subcontractor billings. To that end, Contractor agrees that it will activate any available settings within the CPM System that are 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:

<u>Agency/Firm</u>	<u>Name</u>	<u>Telephone</u>
Public Works/Engineering Division	David Brown	(720) 865-3039

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.

In accordance with General Contract condition 907, RELEASES AND CONTRACTORS CERTIFICATION OF PAYMENT, Applications for Payment must be accompanied by completed Partial or Final Claim Release Form, as appropriate, from EACH subcontractor and supplier, AND/OR the Contractors' Certification of Payment Form. The forms, Final/Partial Release and Certificate of Payment (Subcontractor/Supplier) and the Contractor's Certification of Payment, both of which must be used are as follows.

**DEPARTMENT OF PUBLIC WORKS
Engineering Division**

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

<hr/> <p style="text-align: center;">(PROJECT NO. and NAME)</p> <hr/> <p style="text-align: center;">(NAME OF CONTRACTOR)</p> <hr/> <p style="text-align: center;">(NAME OF SUBCONTRACTOR/SUPPLIER)</p>	<p>Date: _____, 20__.</p> <p>Subcontract #: _____.</p> <p>Subcontract Value: \$ _____.</p> <p>Last Progress Payment: \$ _____.</p> <p>Date: _____.</p> <p>Total Paid to Date: \$ _____.</p> <p>Date of Last Work: _____.</p>
---	--

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: _____



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
Fax: 720-913-1803
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.

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/DBEs use the exact name listed in the DSBO Directory.

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

COMP-REF-031

Rev 032211 JG

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.

Builders' Risk or Installation Floater: Contractor shall maintain limits equal to the completed value of the project. Coverage shall be written on an all risk, replacement cost basis including coverage for soft costs, flood and earth movement, if in a flood or quake zone, and, if applicable, equipment breakdown including testing. The City and County of Denver, Contractor, and sub-contractors shall be Additional Named Insureds under the policy. Policy shall remain in force until acceptance of the project by the City.

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>

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS

Bond No. 58718099

PERFORMANCE AND PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned INTERLOCK CONSTRUCTION CORP. 2492 W. 2nd AVENUE, a corporation organized and existing under and by virtue of the laws of the State of COLORADO, hereafter referred to as the "Contractor", and WESTERN SURETY COMPANY, a corporation organized and existing under and by virtue of the laws of the State of SOUTH DAKOTA, 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 Seven Hundred Forty Nine Thousand Five Hundred Sixty Five Dollars and Forty Two Cents Dollars (\$749,565.42), 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. 201416785 678 S. JASON ST., 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;

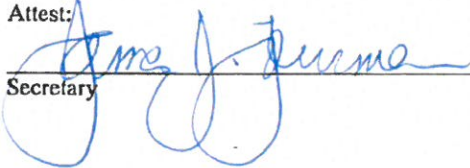
PROVIDED FURTHER, that if the said Contractor shall satisfy all claims and demands incurred by the Contractor in the performance of said Contract, and shall fully indemnify and save harmless the City from all damages, claims, demands, expense and charge of every kind (including claims of patent infringement) 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.

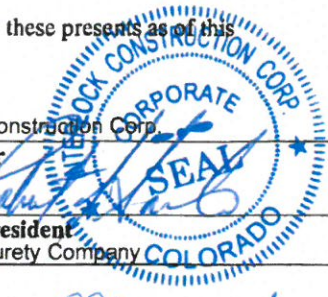
IN WITNESS WHEREOF, said Contractor and said Surety have executed these presents as of this
21st day of August, 2014.

Attest:

Secretary

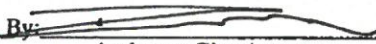
Interlock Construction Corp
Contractor

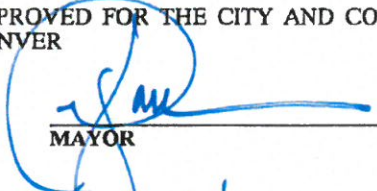
By: 
President
Western Surety Company
Surety

By: 
Attorney-In-Fact Jennifer L. Clampert



(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: 
MANAGER OF PUBLIC WORKS



May 7, 2014

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

RE: Interlock Construction Corp.
Contract No. 201416785
Project Name: 678 S. Jason St.
Contract Amount: \$749,565.42
Performance & Payment Bond No. 58718099

Dear Assistant City Attorney,

The Performance and Payment Bonds covering the above captioned project were executed by this agency through Western Surety Company on August 11, 2014.

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 (303) 824-6603.

Sincerely,

A handwritten signature in blue ink that reads 'Jennifer L. Clampert'.

Jennifer L. Clampert
Surety Account Manager



CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)
9/12/2014

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 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 Moody Insurance Agency, Inc. 8055 East Tufts Avenue Suite 1000 Denver CO 80237	CONTACT NAME: Julie Bell PHONE (A/C No. Ext): (303)824-6600 E-MAIL ADDRESS: jbell@moodyins.com	FAX (A/C No): (303)370-0118
	INSURER(S) AFFORDING COVERAGE	
INSURED Interlock Construction Corp. 2492 W. 2nd Avenue Denver CO 80223	INSURER A: Bituminous Casualty Corp	NAIC # 02075
	INSURER B: Pinnacol Assurance	NAIC # 41190
	INSURER C:	
	INSURER D:	
	INSURER E:	

COVERAGES

CERTIFICATE NUMBER:

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 INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	GENERAL LIABILITY			CLP3596857	1/1/2014	1/1/2015	EACH OCCURRENCE	\$ 1,000,000
	<input checked="" type="checkbox"/> COMMERCIAL GENERAL LIABILITY	<input checked="" type="checkbox"/>					DAMAGE TO RENTED PREMISES (Ea occurrence)	\$ 100,000
	<input type="checkbox"/> CLAIMS-MADE <input checked="" type="checkbox"/> OCCUR						MED EXP (Any one person)	\$ 5,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						PERSONAL & ADV INJURY	\$ 1,000,000
	<input type="checkbox"/> POLICY <input checked="" type="checkbox"/> PROJECT <input type="checkbox"/> LOC						GENERAL AGGREGATE	\$ 2,000,000
							PRODUCTS - COMP/OP AGG	\$ 2,000,000
								\$
A	AUTOMOBILE LIABILITY			CAP3596858	1/1/2014	1/1/2015	COMBINED SINGLE LIMIT (Ea accident)	\$ 1,000,000
	<input checked="" type="checkbox"/> ANY AUTO						BODILY INJURY (Per person)	\$
	<input type="checkbox"/> ALL OWNED AUTOS		<input checked="" type="checkbox"/> SCHEDULED AUTOS				BODILY INJURY (Per accident)	\$
	<input checked="" type="checkbox"/> HIRED AUTOS		<input checked="" type="checkbox"/> NON-OWNED AUTOS				PROPERTY DAMAGE (Per accident)	\$
								\$
A	<input checked="" type="checkbox"/> UMBRELLA LIAB			CUP2804860	1/1/2014	1/1/2015	EACH OCCURRENCE	\$ 5,000,000
	<input type="checkbox"/> EXCESS LIAB		<input checked="" type="checkbox"/> OCCUR				AGGREGATE	\$ 5,000,000
	<input type="checkbox"/> DED <input checked="" type="checkbox"/> RETENTION \$ 10,000							\$
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY			4088214	1/1/2014	1/1/2015	<input checked="" type="checkbox"/> WC STATUTORY LIMITS	OTHE-R
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH)	<input type="checkbox"/> Y/N	N/A				E.L. EACH ACCIDENT	\$ 1,000,000
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	\$ 1,000,000
							E.L. DISEASE - POLICY LIMIT	\$ 1,000,000
A	Installation Floater			CLP3596857	1/1/2014	1/1/2015	Any Single Location	\$1,200,000
	Special Form						(\$1,000 Deductible)	Transit: \$100,000


DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

Contract #201416785, Project: 678 S. Jason Street Maintenance Facility

As required by written contract, the City and County of Denver, its elected and appointed officials, employees and volunteers are included as additional insured with regards to the commercial general liability policy and the business auto liability policy.

CERTIFICATE HOLDER

CANCELLATION

City and County of Denver, Department of Public Works 201 W. Colfax Ave. Dept. 611 Denver, CO 80202	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 Gail Clark/GAICLA 



Denver Public Works

Engineering Division
Capital Projects Management – Dept. 506
Right-of-Way Services – Dept 507
Traffic Engineering Services – Dept 508
Policy and Planning – Dept. 509

201 West Colfax Ave, Dept 614
Denver, CO 80202
www.work4denver.com

**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: 201416785
Project Name: 678 S. JASON ST.
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,



Protecting the Present & Building the Future
Accountability, Innovation, Empowerment, Performance, Integrity,
Diversity, Teamwork, Respect, Excellence, Safety



Denver Public Works

Engineering Division
Capital Projects Management – Dept. 506
Right-of-Way Services – Dept 507
Traffic Engineering Services – Dept 508
Policy and Planning – Dept. 509

201 West Colfax Ave, Dept 614
Denver, CO 80202
www.work4denver.com

NOTICE OF APPARENT LOW BIDDER
(SAMPLE)

Current Date

To:

Gentlemen:

The MANAGER OF PUBLIC WORKS has considered the Bids submitted on July 10, 2014 for work to be done and materials to be furnished in and for:

CONTRACT No. 201416785 678 S. JASON ST.

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., 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)**

CONTRACT NO. 201416785

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

FOR CITY SERVICES VISIT | CALL
DenverGov.org | 311

Protecting the Present & Building the Future
Accountability, Innovation, Empowerment, Performance, Integrity,
Diversity, Teamwork, Respect, Excellence, Safety



Denver Public Works

Engineering Division
Capital Projects Management – Dept. 506
Right-of-Way Services – Dept 507
Traffic Engineering Services – Dept 508
Policy and Planning – Dept. 509

201 West Colfax Ave, Dept 614
Denver, CO 80202
www.work4denver.com

Current Date

**NOTICE TO PROCEED
(SAMPLE)**

Name
Company
Street
City/State/Zip

CONTRACT NO. 201416785, 678 S. JASON ST.

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 201416785, 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:

FOR CITY SERVICES VISIT | CALL
DenverGov.org | **311**

Protecting the Present & Building the Future
Accountability, Innovation, Empowerment, Performance, Integrity,
Diversity, Teamwork, Respect, Excellence, Safety



Denver Public Works

Engineering Division
Capital Projects Management – Dept. 506
Right-of-Way Services – Dept 507
Traffic Engineering Services – Dept 508
Policy and Planning – Dept. 509

201 West Colfax Ave, Dept 614
Denver, CO 80202
www.work4denver.com

Certificate of Contract Release
(SAMPLE)

Date

Name
Company
Street
City/State/Zip

RE: Certificate of Contract Release for
201416785, 678 S. JASON ST.

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.



Protecting the Present & Building the Future
Accountability, Innovation, Empowerment, Performance, Integrity,
Diversity, Teamwork, Respect, Excellence, Safety

CITY AND COUNTY OF DENVER

STATE OF COLORADO



DEPARTMENT OF PUBLIC WORKS/ PARKS AND RECREATION DIVISION

PREVAILING WAGE RATES

Contract No. 201416785

678 S. JASON ST.

June 13, 2014



DENVER
THE MILE HIGH CITY

Career Service Authority

Denver's Human Resource Agency

201 W. Colfax, Department 412

Denver, CO 80202

p: 720.913.5751

f: 720.913.5720

www.denvergov.org/csa

TO: All Users of the City of Denver Prevailing Wage Schedules
FROM: Seth Duhon-Thornton Staff HR Professional
DATE: Friday April 11, 2014
SUBJECT: Latest Change to Prevailing Wage Schedules

Please be advised, prevailing wage rates for some building, heavy, and highway construction trades have not been updated by the United States Department of Labor (DOL) since March 1, 2002. The Career Service Authority 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 rates will be provided as a supplemental to the Davis-Bacon Highway rates issued by CSA.

The effective date for this publication is **Friday April 11, 2014** 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. CO140019
Superseded General Decision No. CO20130019
Modification No. 03
Publication Date: 4/4/2014
(8 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.

For questions call (720) 913-5018

Attachments as listed above.

General Decision Number: CO140019 04/04/2014 CO19

Superseded General Decision Number: CO20130019

State: Colorado

Construction Type: Highway

Counties: Denver and Douglas Counties in Colorado.

HIGHWAY CONSTRUCTION PROJECTS

Modification Number	Publication Date
0	01/03/2014
1	01/24/2014
2	01/31/2014
3	04/04/2014

* CARP9901-008 05/01/2013

	Rates	Fringes
CARPENTER (Form Work Only).....	\$ 25.00	5.39

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.

ENGI0009-008 10/23/2013

	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.).....	\$ 24.73	9.15
(3)-Loader (under 6 cu. yd.)		

Denver County.....	\$ 24.73	9.15
(3)-Motor Grader (blade-rough)		
Douglas County.....	\$ 24.73	9.15
(4)-Crane (50 tons and under), Scraper (single bowl, under 40 cu. yd).....	\$ 24.88	9.15
(4)-Loader (over 6 cu. yd)		
Denver County.....	\$ 24.88	9.15
(5)-Drill Rig Caisson (Watson 2500 similar or larger), Crane (51-90 tons), Scraper (40 cu.yd and over),.....	\$ 25.04	9.15
(5)-Motor Grader (blade-finish)		
Douglas County.....	\$ 25.04	9.15
(6)-Crane (91-140 tons).....	\$ 25.19	9.15

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.

Career Service Authority

Supplemental to the Davis-Bacon *HIGHWAY* Construction Projects rates

(Specific to the Denver Projects)

(Supp 35, Date: 01-13-2012)

<u>Classification</u>		<u>Base</u>	<u>Fringe</u>
Millwrights		\$28.00	\$10.00
Line Construction:			
	Lineman, Gas Fitter/Welder	\$36.88	\$9.55
	Line Eq Operator/Line Truck Crew	\$25.74	\$8.09
Power Equipment Operators (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 Operators:			
	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
Ironworkers (Ornamental)		\$24.80	\$10.03
Laborers (Removal of Asbestos)		\$21.03	\$8.55
Plumbers		\$30.19	\$13.55
Pipefitters		\$30.45	\$12.85
Truck Drivers:			
	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

POWER EQUIPMENT OPERATOR CLASSIFICATIONS
(TUNNELS ABOVE AND BELOW GROUND, SHAFTS, AND RAISES):

GROUP 1 - Brakeman

GROUP 2 - Motorman

GROUP 3 - Compressor

GROUP 4 - Air Tractors; Grout Machine; Gunnite Machine; Jumbo Form

GROUP 5 - Concrete Placement Pumps; Mucking Machines and Front End Loaders, Underground, Slusher; Mine Hoist Operator; Mechanic

GROUP 6 - Mechanic Welder

GROUP 7 - Mole

NOTE: Any equipment listed below being used in tunnel work, below or above ground shall be paid not less than \$2.00 per hour above the listed wage rates.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS:

GROUP 1 - Air compressor, brakeman, drill operator -smaller than Watson 2500 and similar, operators of 5 or more light plants, welding machines, generators, single unit conveyor, pumps, vacuum well point system, tractor, under 70 hp with or without attachments compressors, 360 C.F.M. or less

GROUP 2 - Conveyor, handling building materials, ditch witch and similar trenching machine, forklift, haulage motor man, pugmill, portable screening plant with or without a spray bar, screening plants, with classifier, self-propelled roller, rubber-tires under 5 tons.

GROUP 3 - asphalt plant, backfiller; cableway signalman; C.M.I. and similar, concrete batching plants, concrete finish machine, concrete gang saw on concrete paving, concrete mixer, less than 1 yd., under 8 inches, distributors, bituminous surfaces dozer, drill, diamond or core, elevating graders, elevator operator, lubricating and service engineer, grout machine, gunnite machine, hoist, 1 drum, horizontal directional drill operator, hydraulic backhoes; road stabilization machine, sandblasting Machine, single unit portable crusher, with or without washer, Tie tamper, wheel mounted, trenching machine operator, winch on truck.

GROUP 4 - Cable operated power shovels, draglines, clamshells, 5 cubic yards and under, concrete mixer over 1 Cubic yard, concrete pavers 34E or similar, grade Checker, hoist, 2 drums, mechanic, mixer mobile, Portable crusher, with or without washer; tractor with sideboom, roto-M ill and similar, welder.

GROUP 5 - Cable operated power shovels, draglines, clamshells and Backhoes over 5 cubic yards, caisson drill Watson 2500 similar or larger, motor grader blade-finish, hoist 3 drum or more.

GROUP 6 - Cableway, derrick, quad nine push unit, wheel excavator, belt or elevating loader.

GROUP 7 - tower cranes all types.

TRUCK DRIVER CLASSIFICATIONS:

GROUP 1 - Greasemen, Servicemen and Ambulance Drivers, Battery Men, Shuttle Truck or Bus, Flat Rack Tandem Axle.

GROUP 2 - Fork Lift Driver, Straddle Truck Driver, Lumber Carrier, Liquid and Bulk Tankers Single Axle, Combination, Euclid Electric or Similar, Specialty and Hoisting, Truck Drivers Fuel Truck, Grease Truck, Combination Fuel and Grease.

GROUP 3 - Truck Driver Snow Plow, Truck Driver Dump or Type Jumbo and similar type equipment.

GROUP 4 - Cement Mixer Agitator Truck over 10 cubic yards to and including 15 cubic yards, Tire Man, Cab Operated Distributor Truck Driver.

GROUP 5 - Heavy Duty Diesel Mechanic, Body Man, Welders or Combination Men.

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



DENVER
THE MILE HIGH CITY

Office of Human Resources
Denver's Human Resource Agency

201 W. Colfax, Department 412
Denver, CO 80202
p: 720.913.5751
f: 720.913.5720
www.denvergov.org/csa

TO: All Users of the City of Denver Prevailing Wage Schedules
FROM: Seth Duhon-Thornton, Associate Human Resource Professional
DATE: Friday April 25, 2014
SUBJECT: Latest Change to Prevailing Wage Schedules

Please be advised, prevailing wage rates for some building, heavy, and highway 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 rates will be provided as a supplemental to the Davis-Bacon Heavy rates issued by OHR.

The effective date for this publication will be **Friday April 25, 2014** 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. CO140012
Superseded General Decision No. CO20130012
Modification No. 04
Publication Date: 4/18/2014
(8 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.

For questions please call (720) 913-5018

Attachments as listed above.

General Decision Number: CO140012 04/18/2014 CO12

Superseded General Decision Number: CO20130012

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

Modification Number	Publication Date
0	01/03/2014
1	01/24/2014
2	01/31/2014
3	02/07/2014
4	04/18/2014

ASBE0028-001 10/01/2013

	Rates	Fringes
Asbestos Workers/Insulator (Includes application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical systems).....	\$ 28.83	13.18

BRCO0007-004 09/01/2013

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

	Rates	Fringes
BRICKLAYER.....	\$ 23.68	8.34

BRCO0007-006 09/01/2013

EL PASO AND PUEBLO COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 23.88	8.46

ELEC0012-004 09/01/2013

PUEBLO COUNTY

	Rates	Fringes
ELECTRICIAN Electrical contract over \$1,000,000.....	\$ 27.25	11.92
Electrical contract under \$1,000,000.....	\$ 24.75	11.84

ELEC0068-001 12/01/2012

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

	Rates	Fringes
ELECTRICIAN.....	\$ 32.10	12.53

ELEC0111-001 09/01/2013

	Rates	Fringes
Line Construction:		
Cable Splicer.....	\$ 28.65	13.75%+4.75
Equipment Operator-		
Underground.....	\$ 25.05	9.20
Groundman.....	\$ 22.76	9.87
Line Equipment Operator.....	\$ 27.78	10.91
Lineman and Welder.....	\$ 39.81	14.60

ELEC0113-002 06/01/2013

EL PASO COUNTY

	Rates	Fringes
ELECTRICIAN.....	\$ 29.55	14.48

ELEC0969-002 07/01/2012

MESA COUNTY

	Rates	Fringes
ELECTRICIAN.....	\$ 21.00	8.57

ENGI0009-001 10/23/2013

	Rates	Fringes
Power equipment operators:		
Blade: Finish.....	\$ 25.04	9.15
Blade: Rough.....	\$ 24.73	9.15
Bulldozer.....	\$ 24.73	9.15
Cranes: 50 tons and under..	\$ 24.88	9.15
Cranes: 51 to 90 tons.....	\$ 25.04	9.15
Cranes: 91 to 140 tons.....	\$ 25.19	9.15
Cranes: 141 tons and over...	\$ 25.97	9.15
Forklift.....	\$ 24.37	9.15
Mechanic.....	\$ 24.88	9.15
Oiler.....	\$ 24.01	9.15
Scraper: Single bowl		
under 40 cubic yards.....	\$ 24.88	9.15
Scraper: Single bowl,		
including pups 40 cubic		
yards and over and tandem		
bowls.....	\$ 25.04	9.15
Trackhoe.....	\$ 24.88	9.15

IRON0024-003 11/01/2013

	Rates	Fringes
Ironworkers:.....	\$ 24.80	18.77
Structural		

LABO0086-001 05/01/2009

	Rates	Fringes
Laborers:		
Pipelayer.....	\$ 18.68	6.78

PLUM0003-005 07/01/2013

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

	Rates	Fringes
PLUMBER.....	\$ 35.68	12.34

PLUM0058-002 07/01/2013

EL PASO COUNTY

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 32.55	13.65

PLUM0058-008 07/01/2013

PUEBLO COUNTY

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 32.55	13.65

PLUM0145-002 07/01/2013

MESA COUNTY

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 32.67	11.55

PLUM0208-004 07/01/2013

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

	Rates	Fringes
PIPEFITTER.....	\$ 33.35	12.27

SHEE0009-002 07/01/2013

	Rates	Fringes
Sheet metal worker.....	\$ 32.04	13.13

* TEAM0455-002 07/01/2013

	Rates	Fringes
Truck drivers:		
Pickup.....	\$ 18.41	3.87
Tandem/Semi and Water.....	\$ 19.04	3.87

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 to the Davis-Bacon HEAVY Construction Projects rates
(Specific to the Denver Projects)
(Supp #74, Date: 02-03-2012)

<u>Classification</u>		<u>Base</u>	<u>Fringe</u>
Millwrights		\$28.00	\$10.00
Line Construction:			
	Lineman, Gas Fitter/Welder	\$36.88	\$9.55
	Line Eq Operator/Line Truck Crew	\$25.74	\$8.09
Power Equipment Operators (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 Operators:			
	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
Ironworkers (Ornamental)		\$24.80	\$10.03
Laborers:			
	GROUP 1	\$17.68	\$8.22
	GROUP 2	\$18.18	\$8.27
	GROUP 3	\$21.59	\$8.61
Laborers: (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
Laborers (Removal of Asbestos)		\$21.03	\$8.55
Truck Drivers:			
	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

POWER EQUIPMENT OPERATOR CLASSIFICATIONS
(TUNNELS ABOVE AND BELOW GROUND, SHAFTS, AND RAISES):

GROUP 1 - Brakeman

GROUP 2 - Motorman

GROUP 3 - Compressor

GROUP 4 - Air Tractors; Grout Machine; Gunnite Machine; Jumbo Form

GROUP 5 - Concrete Placement Pumps; Mucking Machines and Front End Loaders, Underground, Slusher; Mine Hoist Operator; Mechanic

GROUP 6 - Mechanic Welder

GROUP 7 - Mole

NOTE: Any equipment listed below being used in tunnel work, below or above ground shall be paid not less than \$2.00 per hour above the listed wage rates.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS:

GROUP 1 - Air compressor, brakeman, drill operator - smaller than Watson 2500 and similar, operators of 5 or more light plants, welding machines, generators, single unit conveyor, pumps, vacuum well point system, tractor, under 70 hp with or without attachments compressors, 360 C.F.M. or less.

GROUP 2 - Conveyor, handling **building** materials, ditch witch and similar trenching machine, haulage motor man, pugmill, portable screening plant with or without a spray bar, screening plants, with classifier.

GROUP 3 - Asphalt screed, asphalt plant, backfiller, bituminous spreader or laydown machine; cableway signalman, caisson drill, William MF, similar or larger; C.M.I. and similar, concrete batching plants, concrete finish machine, concrete gang saw on concrete paving, concrete mixer, less than 1 yd., concrete placement pumps, under 8 inches, distributors, bituminous surfaces dozer, drill, diamond or core, drill rigs, rotary, churn, or cable tool, elevating graders, elevator operator, equipment, lubricating and service engineer, grout machine, gunnite machine, hoist, 1 drum, horizontal directional drill operator, sandblasting machine, single unit portable crusher, with or without washer, tie tamper, wheel mounted, tractor, 70 hp and over with or without attachments, trenching machine operator, winch on truck.

GROUP 4 - Cable operated power shovels, draglines, clamshells, and backhoes, 5 cubic yards and under, concrete mixer over 1 cubic yard, concrete paver 34E or similar, concrete placement pumps, 8 inches and over, grade checker, hoist, 2 drums, hydraulic backhoe, 3/4 yds and over, loader, over 6 cubic yards, mechanic, mixer mobile, multiple unit portable crusher, with or without washer; piledriver, tractor with sideboom, roto- mill and similar, welder.

GROUP 5 - Cable operated power shovels, draglines, clamshells and backhoes over 5 cubic yards, caisson drill Watson 2500 similar or larger, hoist 3 drum or more, mechanic – welder (heavy-duty).

GROUP 6 - Cableway, derrick, quad nine push unit, wheel excavator, belt or elevating loader

GROUP 7 - tower cranes all types

LABORER CLASSIFICATIONS:

GROUP 1 - Janitors; Yardmen

GROUP 2 –Erosion Control, Dowel Bars; Fence Erectors; Gabion Basket and Reno mattresses; Signaling, Metal Mesh; Stake Caser; Traffic Control Devices; Tie Bars and Chairs in Concrete; Paving; Waterproofing Concrete; Air, Gas, Hydraulic Tools and Electrical Tool Operators; Barco Hammers; Cutting Torches; drill; diamond and core drills; Core, diamond, air track including but not limited to; Joy, Mustang, PR-143, 220 Gardner-**Denver**, Hydrosonic, and water blaster operator;

Chuck Tender; Electric hammers; Jackhammers; Hydraulic Jacks; Tampers; Air Tampers; Automatic Concrete Power Curbing Machines; Concrete Processing Material; Operators of concrete saws on pavement (other than gangsaws); Power operated Concrete Buggies; Hot Asphalt Labor; Asphalt Curb Machines; Paving Breakers; Transverse Concrete Conveyor Operator; Cofferdams; Boxtenders; Caisson 8' to 12'; Caisson Over 12'; Jackhammer Operators in Caissons over 12'; Labor applicable to Pipe coating or Wrapping; Pipe Wrappers, Plant and Yard; Relining Pipe; Hydroliner (a plastic may be used to waterproof); Pipelayer on Underground Bores; Sewer, Water, Gas, Oil Conduit; Enamalers on Pipe, inside and out, Mechanical Grouters; Monitors; Jeep Holiday Detector Men; Pump Operators; Rakers; Vibrators; Hydro- broom, Mixer Man; Gunitite Nozzelmen; Shotcrete Operator; and chain saws, gas and electric; Sand Blaster; Licensed Powdermen; Powdermen and Blaster; Siphons; Signalmen; Dumpman/spotter; Grade Checker.

GROUP 3 - Plug and galleys in dams; Scalers; any work on or off Bridges 40' above the ground performed by Laborers working from a Bos'n Chair, Swing Stage, Life Belt, or Block and Tackle as a safety requirement.

TUNNEL LABORER CLASSIFICATIONS:

GROUP 1 - Outside Laborer - Above ground

GROUP 2 - Minimum Tunnel Laborer, Dry Houseman

GROUP 3 - Cable or Hose Tenders, Chuck Tenders, Concrete Laborers, Dumpmen, Whirley Pump Operators

GROUP 4 - Tenders on Shotcrete, Guniting and Sand Blasting; Tenders, core and Diamond Drills; Pot Tenders

GROUP 5 - Collapsible Form Movers and Setters; Miners; Machine Men and Bit Grinders; Nippers; Powdermen and Blasters; Reinforcing Steel Setters; Timberman (steel or wood tunnel support, including the placement of sheeting when required); and all Cutting and Welding that is incidental to the Miner's work; Tunnel Liner Plate Setters; Vibrator Men, Internal and External; Unloading, stopping and starting of Moran Agitator Cars; Diamond and Core Drill Operators; Shotcrete operator; Gunitite Nozzelmen; Sand Blaster; Pump Concrete Placement Men.

TRUCK DRIVER CLASSIFICATIONS:

GROUP 1 - Sweeper Truck, Flat Rack Single Axle and Manhaul, Shuttle Truck or Bus.

GROUP 2 - Dump Truck Driver to and including 6 cubic yards, Dump Truck Driver over 6 cubic yards to and including 14 cubic yards, Straddle Truck Driver, Liquid and Bulk Tankers Single Axle, Euclid Electric or Similar, Multipurpose Truck Specialty and Hoisting.

GROUP 3 - Truck Driver Snow Plow.

GROUP 4 - Cement Mixer Agitator Truck over 10 cubic yards to and including 15 cubic yards.

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



DENVER
THE MILE HIGH CITY

Office of Human Resources
Denver's Human Resource Agency

201 W. Colfax, Department 412
Denver, CO 80202
p: 720.913.5751
f: 720.913.5720
www.denvergov.org/csa

TO: All Users of the City of Denver Prevailing Wage Schedules
FROM: Seth Duhon-Thornton, Associate Human Resources Professional
DATE: Friday May 30, 2014
SUBJECT: Latest Change to Prevailing Wage Schedules

Please be advised, prevailing wage rates for some building, heavy, and highway 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 rates will be provided as a supplemental to the Davis-Bacon Building rates issued by OHR.

The attached Prevailing Wage Schedule is effective as of **Friday May 30, 2014** and applies to the City and County of Denver for **BUILDING CONSTRUCTION PROJECTS** (does not include residential construction consisting of single family homes and apartments up to and including 4 stories) in accordance with the Denver Revised Municipal Code, Section 20-76(c).

General Wage Decision No. CO140004
Superseded General Decision No. CO20130004
Modification No.07
Publication Date: 5/23/14
(5 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.

For questions call (720) 913-5018

Attachments as listed above.

General Decision Number: CO140004 05/23/2014 CO4

Superseded General Decision Number: CO20130004

State: Colorado

Construction Type: Building

County: Denver County in Colorado.

BUILDING CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Modification Number	Publication Date
0	01/03/2014
1	01/17/2014
2	01/24/2014
3	01/31/2014
4	02/07/2014
5	03/07/2014
6	04/04/2014
7	05/23/2014

ASBE0028-001 10/01/2013

	Rates	Fringes
Asbestos Workers/Insulator (Includes application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical systems).....	\$ 28.83	13.18

BRCO0007-001 09/01/2013

	Rates	Fringes
BRICKLAYER.....	\$ 23.68	8.34

BRCO0007-005 05/16/2013

	Rates	Fringes
TILE SETTER.....	\$ 27.15	7.63

CARP0001-004 05/01/2013

	Rates	Fringes
Carpenters: Acoustical, Drywall Hanging/Framing and Metal Stud, Form Building/Setting.\$	25.00	5.39

CARP1607-002 06/01/2012

	Rates	Fringes
MILLWRIGHT.....	\$ 28.95	11.10

ELEC0068-002 12/01/2012

	Rates	Fringes
ELECTRICIAN (Includes Low Voltage Wiring and Installation of Fire alarms, Security Systems, Telephones, Computers and Temperature Controls).....	\$ 32.10	12.53

ELEV0025-002 01/01/2014

	Rates	Fringes
Elevator Constructor.....	\$ 40.10	26.785

FOOTNOTE:

a. Employer contributes 8% of basic hourly rate for over 5 years' service and 6% basic hourly rate for 6 months' to 5 years' service as Vacation Pay Credit.

PAID HOLIDAYS: New Year's Day; Memorial Day; Independence Day; Labor Day; Veterans Day; Thanksgiving Day; Friday after Thanksgiving Day; and Christmas Day.

ENGI0009-003 10/23/2013

	Rates	Fringes
Power equipment operator - crane		
141 tons and over.....	\$ 25.97	9.15
50 tons and under.....	\$ 24.88	9.15
51 to 90 tons.....	\$ 25.04	9.15
91 to 140 tons.....	\$ 25.19	9.15

IRON0024-001 11/01/2013

	Rates	Fringes
IRONWORKER, STRUCTURAL.....	\$ 24.80	10.14

* LABO0720-003 05/01/2014

	Rates	Fringes
LABORER		

Concrete/Mason Tenders.....	\$ 16.42	6.38

PAIN0079-002 01/01/2014		
	Rates	Fringes
Drywall Finisher/Taper		
Hand.....	\$ 19.40	6.66
Tool.....	\$ 19.75	6.66
Painters:.....	\$ 18.70	6.66
PAPERHANGER.....	\$ 19.40	6.66

PAIN0930-001 07/01/2013		
	Rates	Fringes
GLAZIER.....	\$ 28.67	7.52

PLAS0577-001 05/01/2013		
	Rates	Fringes
Cement Mason/Concrete Finisher...	\$ 23.25	10.23

PLUM0003-001 07/01/2013		
	Rates	Fringes
PLUMBER		
(Excluding HVAC work).....	\$ 33.18	12.44

PLUM0208-001 07/01/2013		
	Rates	Fringes
PIPEFITTER		
(Including HVAC pipe).....	\$ 33.35	12.27

SFCO0669-001 07/01/2013		
	Rates	Fringes
SPRINKLER FITTER.....	\$ 33.09	18.60

SHEE0009-001 07/01/2013		
	Rates	Fringes
Sheet metal worker		
(Includes HVAC duct and		
installation of HVAC		
systems).....	\$ 32.04	13.13

SUCO2001-011 12/20/2001		
	Rates	Fringes

Carpenters:		
All Other Work.....	\$ 16.12	2.84
Ironworkers:		
Reinforcing.....	\$ 18.49	3.87
Laborers:		
Brick Finisher/Tender.....	\$ 12.78	1.41
Common.....	\$ 10.62	2.09
Power equipment operators:		
Mechanic.....	\$ 18.48	

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

Office of Human Resources
Supplemental to the Davis-Bacon *Building* Construction Project rates
(Specific to the Denver projects)
Supp #100, Date: 03-02-2012

Classification		Base	Fringe
Boilermakers		\$30.97	\$21.45
Power Equipment Operators (Concrete Mixers):			
	Less than 1 yd	\$23.67	\$10.67
	1 yd and over	\$23.82	\$10.68
	Drillers	\$23.97	\$10.70
	Loaders over 6 cu yd	\$23.82	\$10.68
	Oilers	\$22.97	\$10.70
Soft Floor Layers		\$16.70	\$9.81
Ironworkers (Ornamental)		\$24.80	\$10.03
Plasters		\$24.60	\$12.11
Plaster Tenders		\$10.79	-
Laborers: Concrete Saw		\$13.89	-
Power Equipment Operators:			
	Backhoe	\$23.67	\$10.67
	Loader up to and incl 6 cu yd	\$23.67	\$10.67
	Motor Grader	\$23.97	\$10.70
	Roller	\$23.67	\$10.67
Truck Drivers (Dump Trucks):			
	6 to 14 cu yds	\$19.14	\$10.07
	15 to 29 cu yds	\$19.48	\$10.11
	Flatbed	\$19.14	\$10.07
	Semi	\$19.48	\$10.11

- To determine the Tile Setters-Marble Mason-Terrazzo mechanic rates—Use Davis Bacon-Building rates adopted by the Career Service Board.
- To determine the Tile Finisher-Floor Grinder-Base Grinder—Use current Career Service Prevailing Wage Schedules.
- Caulkers—Receive rate prescribed for craft performing operation to which caulking is incidental .i.e. glazier, painter, brick layer, cement mason.
- Use the “Carpenters—All Other Work” rates published by the federal Davis Bacon rates for batt insulation, pre-stress concrete and tilt up concrete walls, Roofers (including foundation waterproofing).
- Use the “Laborer—Common”, rates published by the federal Davis Bacon rates for General Housekeeping, Final Cleanup and Fence Installer.



DENVER
THE MILE HIGH CITY

TO: All Users of the City of Denver Prevailing Wage Schedules
FROM: Seth Duhon-Thornton, OHR Compensation and Classification
DATE: May 16, 2014
SUBJECT: Latest Update to Prevailing Wage Schedules

Please find an attachment to this memorandum all of the current Office of Human Resources Prevailing Wage Schedules issued in accordance with the City and County of Denver's Revised Municipal Code, Section 20-76(c). This schedule does not include the Davis-Bacon rates. The Davis-Bacon wage rates will continue to be published separately as they are announced.

Modification No. 111
Publication Date: 5-15-14
(13 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. The employer and the individual apprentice must be registered in a program, which has received prior approval, by the U.S. Department of Labor. 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.

Questions call (720) 913-5664

Attachments as listed above.

APPLIANCE MECHANIC

Last Revision: 02-19-2009

Effective: 02-19-2009

Classification:	<u>Base Wage</u>	<u>Fringes</u>
Appliance Mechanic	\$22.34/hour	\$5.82/hour

Plus 10% shift differential for regularly scheduled hours worked between 6:00 p.m. and 6:00 a.m.

The Appliance Mechanic installs, services and repairs stoves, refrigerators, dishwashing machines, and other electrical household or commercial appliances, using hand tools, test equipment and following wiring diagrams and manufacturer's specifications. Responsibilities include: connects appliance to power source and test meters, such as wattmeter, ammeter, or voltmeter, observes readings on meters and graphic recorders, examines appliance during operating cycle to detect excess vibration, overheating, fluid leaks and loose parts, and disassembles appliances and examines mechanical and electrical parts. Additional duties include: traces electrical circuits, following diagram and locates shorts and grounds, using ohmmeter, calibrates timers, thermostats and adjusts contact points, and cleans and washes parts, using wire brush, buffer, and solvent to remove carbon, grease and dust. Replaces worn or defective parts, such as switches, pumps, bearings, transmissions, belts, gears, blowers and defective wiring, repairs and adjusts appliance motors, reassembles appliance, adjusts pulleys and lubricates moving parts, using hand tools and lubricating equipment.

Note: This position does not perform installations done at new construction.

BAGGAGE HANDLING SYSTEM MAINTENANCE

Last Revision: 11-2-2012

Effective: 12-6-2013

Classification:	<u>Base Wage</u>	<u>Fringes</u>
Entry-Support Mechanic	\$15.26/hour	\$5.57/hour
Machinery Maintenance Mechanic	\$19.33/hour	\$6.04/hour
Controls System Technician	\$24.90/hour	\$6.68/hour

Plus 10% shift differential for regularly scheduled hours worked between 6:00 p.m. and 6:00 a.m.

Entry Support Mechanic

Under direct supervision, assists the Machinery Maintenance Mechanic in maintaining the operational status of the baggage handling system. Duties include but are not limited to; assisting with adjustments with belt tracking, belt tension, and gearbox.

Machinery Maintenance Mechanic

Performs routine and basic adjustments of baggage handling system equipment including but not limited to, belt tracking, belt tension, and gearbox and bearing lubrication. Performs daily and periodic shift inspections, cleaning, and diagnostics of mechanical system components based on an established preventive maintenance program. Dismantles, repairs, and reassembles equipment or machines for stock replacement or to restore baggage handling system equipment to operational status. Preventive maintenance and overhauling machines includes, but is not limited to, motors, clutches, brakes, transporting telecars, bearings, drive belts, drive shafts, pulleys, gearboxes (speed reducers), and conveyor belting. Maintains daily turnover reports and hourly labor time sheets for warranty reimbursement and statistical tracking of repairs.

Controls System Technician

Performs a variety of functions such as installation, maintenance, and repair of devices which control and are controlled by the baggage handling system and related equipment. Such devices include, but are not

limited to, personal computers, programmable logic controllers and peripherals, motor control panels, photoelectric sensors, sync-pulse tachometers, laser and RF readers, linear induction motors and servo-drives. Troubleshoots and repairs all control system and electrical failures by applying comprehensive technical knowledge to solve problems by interpreting manufacturer manuals or similar documents. Work requires familiarity with the interrelationships of electro-mechanical devices.

Removes and replaces plug-in type boards and components. Aligns, replaces, and cleans photocells. Makes minor repairs of connectors, wiring and fuses on-site, and cleans and performs diagnostic routines of electrical and control system components. Performs scheduled routine maintenance on all control system components and reporting devices (including personal computers), based on recommended manufacturer practices. Uses a personal computer to diagnose and correct PLC and operating system software problems. Diagnoses, repairs and aligns laser array (baggage tag reader) and RF reader hardware and software.

Note: Incumbents must possess an Electrician's license when work warrants.

BUILDING ENGINEER

Last Revision: 07-19-2012
 Effective: 09-05-2013

Classification:	<u>Base Wage</u>	<u>Fringes</u>
Building Engineer	\$28.91/hour	\$7.15/hour

This classification of work is responsible for operating, monitoring, maintaining/repairing the facilities mechanical systems to ensure peak performance of the systems. This includes performing P.M. and repair work of the building mechanical systems, inspecting, adjusting, and monitoring the building automation and life safety systems, contacting vendors and place order replacement parts, responding to customer service requests and performing maintenance/repairs in tenant or public spaces, performing routine P.M. i.e. light plumbing and electrical repairs, ballast lamp and tube replacement, operating mechanical systems both on site and via a remote laptop computer, maintaining inventory of spare parts and tools, painting and cleaning mechanical equipment and machine rooms, etc.

FUEL HANDLER SERIES

Last Revision: 11-2-2012
 Effective: 12-6-2013

Classification:	<u>Base Wage</u>	<u>Fringes</u>
Fuel Distribution System Operator	\$18.97/hour	\$6.00/hour
Lead Fuel Distribution System Operator	\$19.83/hour	\$6.10 /hour
Fuel Distribution System Mechanic	\$23.46/hour	\$6.52/hour
Lead Fuel Distribution System Mechanic	\$24.53/hour	\$6.64/hour

Plus 10% shift differential for hours worked between 6:00 p.m. and 6:00 a.m.

Fuel Distribution System Operator:

Receives, stores, transfers, and issues fuel. Performs various testing procedures and documentation on fuel samples. Gauges tanks for water, temperature and fuel levels. Performs temperature and gravity testing for correct weight of fuel. Checks pumping systems for correct operating pressure or unusual noises. Inspects fuel receiving, storage, and distribution facilities to detect leakage, corrosion, faulty fittings, and malfunction of mechanical units, meters, and gauges such as distribution lines, float gauges, piping valves, pumps, and roof sumps. Operates a 24-hour control center; operates various computer equipments

to determine potential equipment failure, leak and cathodic protection systems, pump failure, and emergency fuel shutoff systems. Monitors quality of fuel and drains excess condensation from fuel sumps and underground fuel pits. Inspects fuel tank farm for such items as leaks, low pressure, and unauthorized personnel. Performs general housekeeping and grounds maintenance for terminal, pipeline and dock areas, including fuel pits and valve vault cleaning and pump out activities. May connect lines, grounding wires, and loading and off loading arms of hoses to pipelines. May assist Fuel Distribution System Mechanics by preparing work areas. Maintains record of inspections, observations and test results.

Lead Fuel Distribution System Operator:

Performs lead duties such as making and approving work assignments and conducting on-the-job training as well as performing the various tasks performed by the Operator classification.

Fuel Distribution System Mechanic:

Maintains and repairs fuel storage and distribution systems, equipment and filtration systems, and differential pressure valves. Corrects leakage, corrosion, faulty fittings, and malfunction of mechanical units, meters, and gauges such as distribution lines, float gauges, piping valves, pumps, and roof sumps. Inspects electrical wiring, switches, and controls for safe-operating condition, grounding, and adjustment; may make minor repairs. Lubricates and repacks valves. Lubricates pumps, replaces gaskets, and corrects pumping equipment misalignment. May clean strainers and filters, service water separators, and check meters for correct delivery and calibration. Overhauls system components such as pressure regulating valves and excess valves. Disassembles, adjusts, aligns, and calibrates gauges and meters or replaces them. Removes and installs equipment such as filters and piping to modify system or repair and replace system component. Cleans fuel tanks and distribution lines. Removes corrosion and repaints surfaces. Overhauls vacuum and pressure vents, floating roof seals, hangers, and roof sumps. Some positions maintain fuel-servicing equipment such as hydrant and tanker trucks. Maintains record of inspections and repairs and other related paperwork as required.

Lead Fuel Distribution System Mechanic:

Performs lead duties such as making and approving work assignments and conducting on-the-job training as well as performing the various tasks performed by the Mechanic classification.

These classifications are recommended to be inclusive and to supersede any previously adopted classifications.

CUSTODIANS

Last Revision: 09-06-2012
Effective: 12-06-2013

<u>Classification</u>	<u>Base Wage</u>	<u>Fringes</u>
Custodian I	\$13.53/hour	\$3.95 SINGLE \$5.43 2-PARTY \$6.65 FAMILY
Custodian II	\$13.88/hour	\$4.01 SINGLE \$5.49 2-PARTY \$6.71 FAMILY

Benefits and Overtime

Parking	With valid receipt from approved parking lot, employees are reimbursed the actual monthly cost of parking.
RTD Bus Pass	Employer will provide employees with the Bus Pass or pay (\$0.11) per hour for travel differential.
Shift Differential	2nd shift (2:30 p.m.-10:30 p.m.): \$.50/hr 3rd shift (10:31 p.m.-6:30 a.m.): \$1.00/hr.
Overtime	Time worked in excess of seven and one-half (7 ½) hours in one (1) day or in excess of thirty-seven and one-half (37 ½) hours in one week shall constitute overtime and shall be paid for at the rate of time and one-half (1 ½) at the employee's basic straight time hourly rate of pay.
Lunch	Any employee working seven and a half (7.5) hours in a day is entitled to a thirty (30) minute paid lunch.
Note	The Career Service Board in their public hearing on March 15, 2007 approved to amend prevailing wages paid to the Custodian as follows: "All contractors shall provide fringe benefits or cash equivalent at not less than the single rate amount. Contractors who offer health insurance shall provide an employer contribution to such insurance of not less than the 2-party or family rate for any employee who elects 2-party or family coverage. Contractors who offer such coverage will be reimbursed for their employer contributions at the above rates under any City contract incorporating this wage specification."

Position Descriptions:

Custodian I	Any employee performing general clean-up duties using equipment that does not require special training: i.e., dust mopping, damp mopping, vacuuming, emptying trash, spray cleaning, washing toilets, sinks, walls, cleaning chairs, etc.
Custodian II	Any employee performing specialized cleaning duties requiring technical training and the use of heavy and technical equipment, i.e., heavy machine operators floor strippers and waxers, carpet shampooers, spray buffing, re-lamping, mopping behind machines, high ladder work, chemical stripping and finishing of stainless steel.

DIA Oil and Gas Wages

Last Revision: 3-21-2013
Effective: 4-3-2013

Classification:	Base Wages:	Fringes:
Mechanic	\$22.05	\$6.35
Pipefitter	\$24.59	\$6.65
Rig/Drill Operator	\$20.88	\$6.22
Derrick Hand/Roustabout	\$13.87	\$5.41
Truck Driver	\$20.37	\$6.16

Service Contract Act Wage Determination No. 2005-2081 Rev No. 13 was used to obtain the base wages.

Service Contract Act Wage Determination No. : 2005-2081, Rev No. 12, Dated 06/25/2013 was used to calculate benefits:

HEAVY EQUIPMENT MECHANIC

The Heavy Equipment Mechanic analyzes malfunctions and repairs, rebuilds and maintains power equipment, such as cranes, power shovels, scrapers, paving machines, motor graders, trench-digging machines, conveyors, bulldozers, dredges, pumps, compressors and pneumatic tools. This worker operates and inspects machines or equipment to diagnose defects, dismantles and reassembles equipment, using hoists and hand tools, examines parts for damage or excessive wear, using micrometers and gauges, replaces defective engines and subassemblies, such as transmissions, and tests overhauled equipment to insure operating efficiency. The mechanic welds broken parts and structural members, may direct workers engaged in cleaning parts and assisting with assembly and disassembly of equipment, and may repair, adjust and maintain mining machinery, such as stripping and loading shovels, drilling and cutting machines, and continuous mining machines.

PIPEFITTER, MAINTENANCE

The Pipefitter, Maintenance installs or repairs water, steam, gas or other types of pipe and pipefitting. Work involves most of the following: laying out work and measuring to locate position of pipe from drawings or other written specifications, cutting various sizes of pipe to correct lengths with chisel and hammer, oxyacetylene torch or pipe-cutting machines, threading pipe with stocks and dies. This person is responsible for bending pipe by hand-driven or power-driven machines, assembling pipe with couplings and fastening pipe to hangers, making standard shop computations relating to pressures, flow and size of pipe required; and making standard tests to determine whether finished pipes meet specifications. In general, the work of the Maintenance Pipefitter requires rounded training and experience usually acquired through a formal apprenticeship or equivalent training and experience.

WELL DRILLER

This incumbent sets up and operates portable drilling rig (machine and related equipment) to drill wells, extends stabilizing jackscrews to support and level drilling rig, moves levers to control power-driven winch that raises and extends telescoping mast. This person bolts trusses and guy wires to raise mast and anchors them to machine frame and stakes, and assembles drilling tools, using hand tools or power tools. The Well Driller moves levers and pedals to raise tools into vertical drilling position and lowers well casing (pipe that shores up walls of well) into well bore, using winch, moves levers and pedals and turns hand wells to control reciprocating action of machine and to drive or extract well casing.

LABORER

The Laborer performs tasks that require mainly physical abilities and effort involving little or no specialized skill or prior work experience. The following tasks are typical of this occupation: The Laborer loads and unloads trucks, and other conveyances, moves supplies and materials to proper location by wheelbarrow or hand truck; stacks materials for storage or binning, collects refuse and salvageable materials, and digs, fills, and tamps earth excavations, The Laborer levels ground using pick, shovel, tamper and rake, shovels concrete and snow; cleans culverts and ditches, cuts tree and brush; operates power lawnmowers, moves and arranges heavy pieces of office and household furniture, equipment, and appliance, moves heavy pieces of automotive, medical engineering, and other types of machinery and equipment, spreads sand and salt on icy roads and walkways, and picks up leaves and trash.

TRUCKDRIVER, HEAVY TRUCK

Straight truck, over 4 tons, usually 10 wheels. The Truckdriver drives a truck to transport materials, merchandise, equipment, or workers between various types of establishments such as: manufacturing plants, freight depots, warehouses, wholesale and retail establishments, or between retail establishments and customers' houses or places of business. This driver may also load or unload truck with or without helpers, make minor mechanical repairs, and keep truck in good working order.

Glycol Facility Wages

Established June 6, 2013

Classification:	SCA Title	Base Wage	Fringes	Total
Deicing Facility Operator	Water Treatment Plant Operator	\$22.79	\$6.34	\$29.13
Maintenance Mechanic	Machinery Maintenance Mechanic	\$23.43	\$6.41	\$29.84
Material Handling Laborer	Material Handling Laborer	\$17.36	\$5.71	\$23.07

Service Contract Act Wage Determination No. 2005-2081 Rev No. 12 was used to obtain the base wages.

Service Contract Act Wage Determination No. : 2005-2081, Rev No. 12, Dated 06/13/2012 was used to calculate benefits:

FIRE EXTINGUISHER REPAIRER

Last Revision: 09/06/2012

Effective Date: 09/05/2013

Classification:

Base Wages:

Fringes:

Fire Extinguisher Repairer

\$18.97/hour

\$6.00/hour

The Fire Extinguisher Repairer performs the following duties: repairs and tests fire extinguishers in repair shops and in establishments, such as factories, homes, garages, and office buildings, Using hand tools and hydrostatic test equipment, this repairer dismantles extinguisher and examines tubings, horns, head gaskets, cutter disks, and other parts for defects, and replaces worn or damaged parts. Using hand tools, this repairer cleans extinguishers and recharges them with materials, (such as soda water and sulfuric acid, carbon tetrachloride, nitrogen or patented solutions); tests extinguishers for conformity with legal specifications using hydrostatic test equipment, and may install cabinets and brackets to hold extinguishers.

FURNITURE MOVERS

(Moving, Storage and Cartage Workers)

Last Revision: 11-2-2012

Effective: 12-6-2013

Classification:	<u>Base Wage</u>	<u>Fringes</u>
Laborer/Helper	\$17.36/hour	\$5.81/hour
Driver/Packer	\$17.43/hour	\$5.82/hour
Lead Worker	\$18.22/hour	\$5.91/hour

LANDSIDE PARKING ELECTRONICS TECHNICIAN

Last Revision: 11-2-2012

Effective: 12-6-2013

Classification:	<u>Base Wage</u>	<u>Fringes</u>
Landside Parking Electronics Technician	\$22.14/hour	\$6.36/hour

Plus 10% shift differential for regularly scheduled hours worked between 6:00 p.m. and 6:00 a.m.

This classification of work installs, modifies, troubleshoots, repairs and maintains revenue control equipment at manned and unmanned parking entrance and exit gates. Replaces consumable items such as tickets, printer ribbons, and light bulbs. Replaces modules and related equipment as needed to repair existing equipment, modify applications, or resolve unusual problems. Troubleshoots, tests, diagnoses, calibrates, and performs field repairs. Performs preventive maintenance such as inspection, testing, cleaning, lubricating, adjusting and replacing of serviceable parts to prevent equipment failure for electromechanical control in order to minimize repair problems and meet manufacturers' specifications.

SIGN ERECTOR

Last Revision: 10-15-2009

Effective: 10-15-2010

Classification:	<u>Base Wage</u>	<u>Fringes</u>
Sign Erector	\$20.19/hour	\$3.80/hour

This classification of work erects, assembles, and/or maintains signs, sign structures and/or billboards using various tools. Erects pre-assembled illuminated signs on buildings or other structures according to sketches, drawings, or blueprints. Digs and fills holes, places poles. Bolts, screws, or nails sign panels to sign post or frame. Replaces or repairs damaged or worn signs. May use welding equipment when installing sign. This classification is not a licensed electrician and therefore cannot make connections to power sources (i.e., provide exit lighting).

TELEDATA TECHNICIAN

Last Revision: 07-19-2012
Effective: 09-05-2013

Classification:	<u>Base Wage</u>	<u>Fringes</u>
Teledata Technician	\$35.31/hour	\$7.78/hour

This classification of work is responsible for telephone installation, removal, relocation, problem resolution, cable maintenance and repair ; installs and maintains large programmable PBX systems (Panasonic 1, 2, & 3 line sets, ISDN 6504, 6508, 7504, 7505, 7506, 7507; Northstar stations and systems; Northern Telecom Option 11 system, Vodavi Executive sets and systems, AT&T system 75, Eagle sets and systems; 2/06, 4/10, 8/20, 10/30, 30/70 Merlin systems; 3/8, 6/16, 12/24, and 24/48 Vodavi systems). Duties also include testing circuits, analyzing results, repairing and modifying circuits and equipment in a step by step XY all relay and/or electronic switch system. This classification of worker locates electrical, electronic, and mechanical failures in telephone switching and carrier equipment; repairs equipment by replacing defective parts by such procedures as setting clearances, adjusting spring tensions, wipers, relay contacts and other interrelated mechanisms ; installs or rearranges equipment frames and shelves, and such equipment as line finders, switch banks, selectors, connectors, repeaters, peg counters, restricting post cams, and various interrelated truck circuits. Workers resolve complex problems between exchange, both government and commercial and may direct, instruct, and assist lower level employees with their overall assignments.

**TILE SETTER-MARBLE MASONS-TERRAZZO
FINISHERS, FLOOR GRINDERS, AND BASE GRINDERS**

Last Revision: 09-06-2012
Effective: 09-05-2013

Classification:	<u>Base Wage</u>	<u>Fringes</u>
Finisher (Tile- Marble-Terrazzo)	\$19.81 /hour	\$7.57/hr

Effective May 1, 2008, Local Union 7 of Colorado combined three classes of Finishers, Floor Grinders, and Base Grinders into Finisher using one pay schedule.

Journeyman Rates for the Tile Setter classification of work (Tile Setter, Marble Mason, and Terrazzo Worker) are provided by the Davis-Bacon Act.

TRANSIT TECHNICIANS

Last Revision: 01-01-2013

Transit Technician Series Effective: 01-16-2014

Elevator Repairer Effective: 1-1-2014

Classification:	<u>Base Wage</u>	<u>Fringes</u>
Transit Technician - Entry	\$22.21/hour	\$6.37/hour
Transit Technician - Senior	\$24.28/hour	\$6.61/hour
Transit Technician - Lead	\$25.38/hour	\$6.74/hour
Elevator Mechanic/Repairer	\$40.10/hour	\$30.73/hour (< 5 yrs service) \$31.52/hour (> 5 yrs service)

In addition, Shift differentials of eight percent (8%) of the employee's straight time pay rate for the second shift and ten percent (10%) for the third shift for straight time work regularly scheduled providing more than (50%) of the employee's work occurred on such shift.

Transit Technician-Entry: Associates in this position will be given instruction by on-the-job and/or classroom training to perform corrective and preventive maintenance, inspections, repairs, and adjustments to all systems, subsystems, and components of an electronic, mechanical, electro/mechanical, hydraulic, and pneumatic nature. This classification of workers may assist with routine preventive maintenance, inspection, and adjustment. Tasks and procedures are well established and require close supervision. Incumbents will follow the direction of higher level personnel in preventive or corrective maintenance phases of work. Most tasks will be of an apprentice nature and will require close supervision. Incumbents will progress to the journey level after one year as a Transit Technician-Entry.

Transit Technician-Senior: This is a full performance level class performing various corrective and preventive maintenance, inspections, repairs, and adjustments to all systems, subsystems, and components of an electronic, mechanical, electro-mechanical, hydraulic, and pneumatic nature; monitors the transit system via a central computer system to make automated adjustments in the operation and maintenance of the transit system.

Transit Technician-Lead: Performs lead technical duties such as making work assignments and conducting on-the-job informal training as well as performing various tasks involved with the operation and maintenance of the transit system. The Lead Transit Technician is the specialist in terms of hands-on diagnosis and troubleshooting various problems that may arise on the transit system.

TREE TRIMMERS

Last Revision: 10-15-2009
Effective: 10-15-2010

Classification:	<u>Base Wage</u>	<u>Fringes</u>
Tree Trimmer	\$16.77/hour	\$2.48/hour

This classification of work trims, removes, and applies insecticides to trees and shrubbery including trimming dead, diseased, or broken limbs from trees utilizing rope and saddle, chain, handsaw and other related equipment common to the care of trees and shrubs. Removes limbs, branches and other litter from the work area, observes safety rules, inspects and identifies tree diseases and insects of the area distinguishing beneficial insects and environmental stress, takes samples from diseased or insect infested trees for lab analysis, operates a wide variety of heavy and power equipment in trimming and removing trees and shrubbery i.e. mobile aerial tower unit, tandem trucks, loaders, chipper, etc., maintains all equipments.

WINDOW CLEANERS

Last Revision: 1-16-2014
Effective: 5-15-2014

Classification:	<u>Base Wage</u>	<u>Fringes</u>
Window Cleaner	\$22.45 /hour	\$7.69/hr (Single) \$9.47/hr (2-Party) \$11.16/hr (Family)

Benefits/Overtime

Parking	With valid monthly parking receipt from approved parking lot, employees are reimbursed for the cost of parking. The employer shall reimburse employees for parking expenses from other parking lots up to the amount reimbursed for DIA Employee Parking Lot upon the submission of a monthly parking receipt. Only (1) one receipt per month.
Shift Differential	\$0.75 per hour for employees assigned to 3rd shift (11:00 p.m. to 7:00 a.m.)
Overtime	One and one-half (1½) times the basic rate of pay in excess of 7.5 hours worked per day or 37.5 hours worked per week.
Lunch	Any employee working seven and a half (7.5) hours in a day is entitled to a thirty (30) minute paid lunch.
Lead Work	\$1.25 per hour above highest paid employee under supervision
High Work	\$1.75 per hour (21 feet or more from ground (base) to top of surface/structure being cleaned)
Training	\$0.25 per hour
ECOPASS	The Company will provide an Eco-Pass to all bargaining unit employees or pay \$.17 per hour for travel differential.

Note: The Career Service Board in their public hearing on April 3, 2008, approved to amend prevailing wages paid to the Window Cleaners as follows: "All contractors shall provide fringe benefits or cash equivalent at not less than the single rate amount. Contractors who offer health insurance shall provide an employer contribution to such insurance of not less than the 2-party or family rate for any employee who elects 2-party or family coverage. Contractors who offer such coverage will be reimbursed for their employer contributions at the above rates under any City contract incorporating this wage specification."

Pest Controller

Last Revision: 08-02-2012
Effective Date: 9-5-2013

Classification:	<u>Base Wage</u>	<u>Fringes</u>
Pest Controller	\$20.41/hour	\$6.17/hour

The Pest Controller sprays chemical solutions or toxic gases and sets mechanical traps to kill pests that infest buildings and surrounding areas, fumigates rooms and buildings using toxic gases, sprays chemical solutions or dusts powders in rooms and work areas, places poisonous paste or bait and mechanical traps where pests are present; may clean areas that harbor pests, using rakes, brooms, shovels, and mops preparatory to fumigating; and may be required to hold State license

CITY AND COUNTY OF DENVER

STATE OF COLORADO



DEPARTMENT OF PUBLIC WORKS/ PARKS AND RECREATION DIVISION

TECHNICAL SPECIFICATIONS

Contract No. 201416785

678 S. JASON ST.

June 13, 2014



CITY & COUNTY OF DENVER
DEPARTMENT OF PARKS AND
RECREATION

SOUTH JASON STREET
MAINTENANCE FACILITY

SPECIFICATIONS

ISSUE FOR BIDDING & CONSTRUCTION

November 11, 2013



1331 Nineteenth Street
Denver, Colorado 80202
303-607-0977 Phone
303-607-0767 Fax

SOUTH JASON STREET MAINTENANCE FACILITY
CITY AND COUNTY OF DENVER
FACILITIES CAPITAL PROJECTS
MANAGEMENT

DENVER, COLORADO

TABLE OF CONTENTS

November 11, 2013

DIVISION1-GENERALREQUIREMENTS

SECTION 01 1000	SUMMARY OF WORK
SECTION 01 0500	LAYOUT OF WORK AND SURVEYS
SECTION 01 0600	REGULATORY REQUIREMENTS
SECTION 01 1100	CONSTRUCTION SAFETY
SECTION 01 2000	PROJECT MEETINGS
SECTION 01 2300	ALTERNATES
SECTION 01 3000	SUBMITTALS
SECTION 01 3100	SCHEDULE
SECTION 01 3400	SHOP AND WORKING DRAWINGS, PRODUCT DATA AND SAMPLES
SECTION 01 3700	SCHEDULE OF VALUES
SECTION 01 4000	CONTRACTOR QUALITY CONTROL
SECTION 01 4020	QUALITY ASSURANCE
SECTION 01 5000	TENMPORARY FACILITIES
SECTION 01 6200	STORAGE AND PROTECTION
SECTION 01 6300	SUBSTITUTIONS
SECTION 01 6500	SYSTEM STARTUP TESTING AND TRAINING
SECTION 01 7000	CONTRACT CLOSEOUT
SECTION 01 7100	CLEANING
SECTION 01 7200	CONTRACT RECORD DOCUMENTS
SECTION 01 7300	OPERATION AND MAINTENANCE DATA
SECTION 01 7320	CUTTING AND PATCHING
SECTION 01 7360	SELECTIVE DEMOLITION
SECTION 01 7400	WARRANTIES AND BONDS
SECTION 01 7419	CONSTRUCTION WASTE MANAGEMENT

DIVISION2-SITWORK

NOT USED

DIVISION3-CONCRETE

SECTION 03 3000	CAST-IN-PLACE CONCRETE
-----------------	------------------------

DIVISION4-MASONRY

SECTION 04 2000 UNIT MASONRY

DIVISION5-METALS

SECTION 05 5000 METAL FABRICATIONS

DIVISION6-WOODANDPLASTICS

SECTION 06 1050 MISCELLANEOUS CARPENTRY

DIVISION7-THERMALANDMOISTUREPROTECTION

SECTION 07 0150.61 REPAIR OF BITUMINOUS MEMBRANE ROOFING
SECTION 07 6200 SHEET METAL FLASHING AND TRIM
SECTION 07 8200 PENETRATION FIRESTOPPING
SECTION 07 9200 JOINT SEALANTS

DIVISION8-DOORSANDWINDOWS

SECTION 08 1113 HOLLOW METAL DOORS AND FRAMES
SECTION 08 1416 FLUSH WOOD DOORS
SECTION 08 7100 DOOR HARDWARE
SECTION 08 8000 GLAZING

DIVISION9-FINISHES

SECTION 09 2216 NON-STRUCTURAL METAL FRAMING
SECTION 09 2900 GYPSUM BOARD
SECTION 09 3000 TILING
SECTION 09 5113 ACOUSTICAL PANEL CEILINGS
SECTION 09 6513 RESILIENT BASE AND ACCESSORIES
SECTION 09 6519 RESILIENT TILE FLOORING
SECTION 09 6813 CARPET TILE
SECTION 09 9080 COATING SYSTEMS FOR EXTERIOR MASONRY
SECTION 09 9100 PAINTING

DIVISION10-SPECIALTIES

SECTION 10 1100 VISUAL DISPLAY SURFACES
SECTION 10 1400 SIGNAGE
SECTION 10 2113 TOILET COMPARTMENTS
SECTION 10 2800 TOILET ACCESSORIES
SECTION 10 4413 FIRE PROTECTION SPECIALTIES
SECTION 10 5113 METAL LOCKERS

DIVISION11-EQUIPMENT

NOT USED

DIVISION12-FURNISHINGS

SECTION 12 2413 ROLLER WINDOW SHADES

DIVISION13-SPECIALCONSTRUCTION

NOT USED

DIVISION14-CONVEYINGEQUIPMENT

NOT USED

DIVISION22-PLUMBING

SECTION 22 0500 COMMON WORK RESULTS FOR PLUMBING SECTION 22
0523 GENERAL-DUTY VALVES FOR PLUMBING PIPING
SECTION 22 0529 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND
EQUIPMENT
SECTION 22 0533 HEAT TRACING FOR PLUMBING PIPING
SECTION 22 1116 DOMESTIC WATER PIPING
SECTION 22 1119 DOMESTIC WATER PIPING SPECIALTIES
SECTION 22 1316 SANITARY WASTE AND VENT PIPING
SECTION 22 1323 SANITARY WASTE INTERCEPTORS
SECTION 22 4000 PLUMBING FIXTURES
SECTION 22 4700 DRINKING FOUNTAINS AND WATER COOLERS

DIVISION23-HEATING,VENTILATINGANDAIRCONDITIONING

SECTION 23 0500 COMMON WORK RESULTS FOR HVAC
SECTION 23 0513 COMMON MOTOR REQUIREMENTS FOR HVAC
EQUIPMENT
SECTION 23 0529 HANGERS AND SUPPORTS FOR HVAC PIPING AND
EQUIPMENT
SECTION 23 0593 TESTING, ADJUSTING, AND BALANCING FOR HVAC
SECTION 23 0700 HVAC AND PLUMBING INSULATION
SECTION 23 0900 INSTRUMENTATION AND CONTROL FOR HVAC
SECTION 23 1123 FACILITY NATURAL-GAS PIPING
SECTION 23 3113 METAL DUCTS
SECTION 23 3300 AIR DUCT ACCESSORIES
SECTION 23 3423 HVAC POWER VENTILATORS
SECTION 23 3713 DIFFUSERS, REGISTERS, AND GRILLES
SECTION 23 5100 BREECHINGS, CHIMNEYS, AND STACKS
SECTION 23 5523 GAS-FIRED RADIANT HEATERS
SECTION 23 5533 FUEL-FIRED UNIT HEATERS
SECTION 23 7413 PACKAGED, OUTDOOR, CENTRAL-STATION AIR-
HANDLING UNITS

DIVISION26-ELECTRICAL

SECTION 26 0500 BASIC ELECTRICAL REQUIREMENTS

SECTION 26 0519	BUILDING WIRE AND CABLE
SECTION 26 0526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
SECTION 26 0529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
SECTION 26 0534	CONDUIT
SECTION 26 0535	SURFACE RACEWAYS
SECTION 26 0537	BOXES
SECTION 26 0553	IDENTIFICATION FOR ELECTRICAL SYSTEMS
SECTION 26 0914	ELECTRICAL POWER MONITORING
SECTION 26 0919	ENCLOSED CONTACTORS
SECTION 26 0923	LIGHTING CONTROL DEVICES
SECTION 26 2416	PANELBOARDS
SECTION 26 2701	ELECTRICAL SERVICE ENTRANCE
SECTION 26 2716	ELECTRICAL CABINETS AND ENCLOSURES
SECTION 26 2717	EQUIPMENT WIRING
SECTION 26 2726	WIRING DEVICES
SECTION 26 2813	FUSES
SECTION 26 2818	ENCLOSED SWITCHES
SECTION 26 5100	INTERIOR LIGHTING
SECTION 26 5600	EXTERIOR LIGHTING

DIVISION28-ELECTRONICSAFETYANDSECURITY

SECTION 28 3100	FIRE DETECTION AND ALARM
-----------------	--------------------------

DIVISION31-EARTHWORK

SECTION 31 1000	SITE CLEARING
SECTION 31 2000	EARTH MOVING
SECTION 31 2316.13	TRENCHING

DIVISION32-EXTERIORIMPROVEMENTS

SECTION 32 1216	ASPHALT PAVING
SECTION 32 1313	CONCRETE WALK, CURBS AND MISCELLANEOUS FLATWORK
SECTION 32 1373	CONCRETE PAVING JOINT SEALANTS
SECTION 32 3113	CHAIN LINK FENCES
SECTION 32 9300	PLANTS

DIVISION33-UTILITIES

SECTION 33 4100	STORM UTILITY DRAINAGE PIPING
-----------------	-------------------------------

APPENDIX

A - CITY OF DENVER EROSION CONTROL SPECIFICATION – SECTION 208

B - ASBESTOS-CONTAMINATED SOIL MANAGEMENT STANDARD
OPERATING PROCEDURE FOR CITY AND COUNTY OF DENVER

END OF TABLE OF CONTENTS

SECTION 01 0100

SUMMARY OF WORK

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Work specified in this contract consists of furnishing all management, supervision, labor, materials, tools, equipment, services, testing and incidentals for the construction of the Work indicated in the contract documents including lump sum items and unit price items.
- B. Reference: City and County of Denver Standard Specifications for Construction General Contract Conditions 2011 Edition (the yellow book) Contract General Conditions, GC 301 Consideration, GC 306 Working Hours and Schedule, GC Title 8 Protection of Persons and Property and GC Title 14 Site Conditions
- C. Project Description: The Work consists of tenant finish build out of an existing masonry building, including but is not strictly limited to the following trades and specialties: selective demolition; cutting, patching and repair of existing arch interior and exterior finish materials; metal stud assemblies; finishes; doors, frames and hardware; rough carpentry; HVAC installation; electrical wiring and lighting; site improvements.
- D. Project Location: 678 S. Jason Street, Denver, CO 80223
- E. Project Team Members (all contact information can be found on the cover of the construction documents):

Owner: City and County of Denver, Dept. of Parks and Recreation

Architect: SLATERPAULL Architects

Landscape Architect: Studio Insite

Structural Engineer: Anderson & Hastings Consultants, Inc.

Mechanical Engineer: ME Group, Inc.

Electrical Engineer: Corey Electrical Engineering, Inc.

Civil Engineer: Lund Partnership, Inc.

1.02 SITE CONDITIONS

- A. The Contractor acknowledges that he has reviewed sections 1401 and 1402 of Title 14 of City and County of Denver Standard Specifications for Construction General Contract Conditions 2011 Edition (the yellow book). The Contractor warrants that as a result of examination and investigation of all the aforesaid data and the site, that the Contractor can perform the Work in a good and workmanlike manner and to the satisfaction of the City. The City assumes no responsibility for any representations made by any of its officers or agents during or prior to the execution of this contract unless such representation is expressly stat-

ed in the contract.

1.03 WORK SEQUENCE

- A. The work will be conducted in a single phase.
- B. Work shall be substantially complete and ready for inspection and punch list within 150 calendar days of the Notice to Proceed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONTRACTOR'S DUTIES

- A. Except as otherwise specified, furnish the following to the full extent required by the contract:
 - 1. Labor, superintendence, supervision and products.
 - 2. Construction equipment, tools, machinery and materials.
 - 3. Utilities required for construction and related activities.
 - 4. Other facilities and services necessary to properly execute and complete the Work, including security for worksite, and storage and protection of all materials awaiting incorporation into the Work, providing a safe working environment for workers, City and County of Denver representatives, and the public in accordance with all local, state and federal requirements.
- B. Prosecute the Work as specified and in a timely manner. Submit a schedule of Work in accordance with GC 306 Working Hours and Schedule.

3.02 COORDINATION

- A. Coordinate prosecution of the Work in accordance with GC 801 Safety of Persons and GC 802 Protective Devices and Safety Precautions; GC 803 Protection of Property and Work in Progress; and GC 804 Protection of Municipal Public Service and Utility Systems with those ongoing City and County of Denver operations, public utilities, governmental bodies, private utilities and other contractors performing work on and adjacent to the worksites. Eliminate or minimize delays in the Work and conflicts with those operations, utilities, bodies and contractors. Schedule governmental, private utility and public utility work that relies upon survey points, lines and grades established by the Contractor to occur immediately after those points, lines and grades have been established. Confirm coordination measures for each individual case with the City in writing.
- B. In the coordination effort of work by others, the Contractor shall obtain and refer to equipment locations and other layouts, as available, to avoid interface problems.
- C. The City reserves the right to permit access to the site of the Work for the performance of work by other contractors and persons at such times that the City deems proper. The exercise of such reserved right shall in no way or to any extent relieve the Contractor from liability for loss and damage to the work due to or resulting from its operations or from responsibility for complete execution of the Contract. The Contractor shall cooperate with other contractors and persons in all matters requiring common effort.

3.03 CONTRACTOR USE OF WORKSITE

- A. Confine worksite operations to areas permitted by law, ordinances, permits and the contract.
- B. Per GC 801, consider the safety of the Work and that of the people and property on and adjacent to the worksite when determining amount, location, movement and use of materials and equipment on worksite.
- C. Do not load worksite with equipment and products that would interfere with the Work. Only equipment, tools or materials required for this Work may be stored at the worksite.
- D. Per GC 803, Protect products, equipment and materials stored on worksite.
- E. Relocate stored products, equipment and materials which interfere with operations of City, government bodies, public and private utilities, and other contractors.

END OF SECTION

SECTION 01 0500

LAYOUT OF WORK AND SURVEYS

PART 1 - GENERAL

1.01 SCOPE

- A. This Section covers the procedures and accuracy requirements for survey services for layout of work and field measurement of work quantities to be determined by surveys.
- B. Reference Contract General Conditions, GC 318 and GC 319

1.02 SUBMITTAL

- A. Refer to Technical Specifications Section 01 3000 for submittal requirements.
 - 1. Copies of original pages of field notes.
 - 2. Original field notebooks when filled and at end of contract.
 - 3. As-built measurements.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONSTRUCTION LINES AND GRADES

- A. The Contractor shall make surveys and layouts as necessary to delineate the work. The Contractor shall review GC 318 and CG 319 to assure construction surveys for the proper performance of the Work. The City will provide all reference points shown on the contract documents. The Contractor shall accurately transfer the survey control information to the points of application and maintain in good order survey control points that may be required for the completion of the Work subject as to their location, sufficiency and adequacy. The Contractor shall furnish skilled labor, instrument platforms, ladders and such other temporary structures as may be necessary for making and maintaining points and lines in connection with the surveys required.
- B. The City may draw the Contractor's attention to errors or omissions in lines or grades, but the failure to point out such errors or omissions shall not give the Contractor any right or claim nor shall in any way relieve the Contractor of his obligations according to the terms of this contract.
- C. The Contractor's instruments and other survey equipment shall be accurate, suitable for the surveys required in accordance with recognized professional standards and in proper condition and adjustment at all times. Surveys shall be performed under the direct supervision of a Colorado licensed surveyor.

3.02 AS-BUILT MEASUREMENTS

- A. As-built measurement for items that will be hidden or visible including all civil, mechanical, electrical, control work and all utilities that are placed in concrete, earth or behind walls shall be made. Items located within five feet beyond a building shall be referenced to building column lines and finish floor elevations. Special attention shall be paid to items requiring service, sensors, items with moving parts, access points and locations of junctions, elevation changes and directional changes.

END OF SECTION

SECTION 01 0600

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section identifies primary compliance with the State, City and County of Denver's regulatory requirements outlined in Special Contract conditions SC-1 Construction Specifications and SC-13 Construction Inspection by the City.
- B. Reference: City and County of Denver Standard Specifications for Construction General Contract Conditions 2011 Edition (the yellow book) Contract General Conditions, GC 205 Building Inspection and GC 317 Permits and Licenses

1.02 BUILDING AND FIRE CODES

- A. All design and construction work shall be governed by the Building Code for the City and County of Denver, latest edition. This is based upon the International Building Code of the International Code Council with Denver Amendments to this code. See Special Contract Conditions, Construction Specifications.

1.03 DENVER BUILDING DEPARTMENT

- A. For review and approval of all construction documents for compliance to the International Building Code 2006 and City and County and Denver Amendments 2006 or later approved editions.
- B. City and County of Denver
Community Planning and Development
Building Inspection Division
201 West Colfax Avenue, Dept 205
Denver, Colorado 80202
Telephone 720-865-2720
Fax 720-865-2880

1.04 DENVER FIRE DEPARTMENT

- A. For review and approval of plans for compliance with the Denver Fire Department's requirements as they apply to projects for the Department of Public Works:
- B. Denver Fire Department
745 W. Colfax Ave.
Denver, Colorado 80204 Telephone: 720-913-3474, or
E-mail: denfpb@denvergov.org
Fax 720-865-2833
- C. The Contractor is advised that the Denver Fire Department – Fire Prevention Bureau requires permitting for the following activities as they apply to the scope of work. The Contractor is responsible for obtaining the appropriate permits necessary to complete the work. All costs associated with this permitting and policy compliance shall be the responsibility of the Contractor. The policies all reference the International Fire Code (IFC).

1. "Hot work", which is defined as the operation of any equipment or tool that creates sparks, hot slag, or radiant or convective heat as a result of the work. This includes, but is not limited to, welding, cutting, brazing, or soldering.
 2. Use and storage of compressed gas for both temporary storage and permanent facility installation. This includes, but is not limited to, flammable gas (excluding propane-LPG), oxidizer (including oxygen), and inert and/or simple asphyxiates.
 3. Tank installation, which includes above-ground storage tanks (AST) and underground storage tanks (UST) for both temporary tanks and permanent facility installations.
- D. In addition to the above permits, the Denver Fire Department may require other permits that are associated with the specific work in the Contract Documents. Policies provided by the Denver Fire Department are meant to provide basic information for the most common conditions and situations. In any given occupancy, many other International Fire Code (IFC) requirements may be enforced. These should be addressed with the Denver Fire Department before construction begins and during construction with premise inspection(s). Any questions can be addressed to the Fire Prevention Bureau between 6:30 AM and 9:00 AM Monday-Friday at 720-913-8242 or -8237.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PERMITS AND CERTIFICATIONS

- A. The Contractor shall maintain records on site of all permits acquired by federal, state, and local agencies. Posting of permits shall conform to requirements of the respective agencies.
- B. At the time of Substantial Completion and Final Acceptance, the Contractor shall forward to the Project Manager a copy of the Temporary Certificate of Occupancy and the final Certificate of Occupancy.

END OF SECTION

SECTION 01 1100

CONSTRUCTION SAFETY

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Work specified in this Section includes construction safety precautions and programs by the Contractor
- B. Reference Contract General Conditions, GC 801 Safety of Persons, GC 802 Protective Devices and Safety, GC 803 Protection of Property and Work in Progress.

1.02 RESPONSIBILITY

- A. The General Conditions make it clear in section 801 that all safety precautions during the construction process are the responsibility of the Contractor. The Contractor is responsible for the health and safety of his employees, agents, subcontractors and their employees, and other persons on the worksite; for the protection and preservation of the work and all materials and equipment to be incorporated therein; and for the worksite and the area surrounding the worksite. The Contractor shall take all necessary and reasonable precautions and actions to protect all such persons and property.

1.03 SUBMITTAL

- A. Refer to Technical Specifications 01 3000 for submittal requirements. A safety plan shall be submitted by the General Contract prior to commencing any work.

PART 2 - PRODUCTS

2.01 CONTRACTOR'S SAFETY PLAN

- A. Provide a Contractor's Safety Program that as a minimum meets all applicable federal, state and local government requirements.

PART 3 - EXECUTION

3.01 IMPLEMENT CONTRACTOR'S SAFETY PLAN

- A. Implement the approved Contractor's Operational Safety Plan as described in this Technical Specifications

END OF SECTION

SECTION 01 2000

PROJECT MEETINGS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Work specified in this Section requires the Contractor's Project Manager, Superintendent and Quality Control representative to attend meetings scheduled by the City for the collection and dissemination of information related to the subject contract.
- B. The Contractor will prepare the minutes of each construction meeting and distribute them to each of the participants.

1.02 OTHER MEETINGS

- A. The Contractor will be advised of times, dates and places of City initiated meetings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. A Preconstruction Meeting will be scheduled by the City after the Contract has been signed by all parties. The purpose of this meeting is to introduce the City's representatives to their counterparts in the Contractor's organization and to establish lines of communication between these representatives and outline some contract requirements. The Contractor's Superintendent and Quality Control Representative(s) shall attend this meeting.
- B. The Project Manager will distribute a notice of this meeting, along with an agenda of the subjects to be addressed.
- C. The Project Manager will explain and discuss the responsibilities and authorities of the City, the Designer, and the Project Manager's organization.
- D. The City will provide highlights of the following information at this meeting:
 - 1. Minority Business Enterprise (MBE) and Women Business Enterprise (WBE) or Small Business Enterprise (SBE) if such was a specifically designated requirement.
 - 2. Insurance and permit requirements.
 - 3. Procedures for processing change orders.
 - 4. Procedures for submitting shop and working drawings, product data and samples.
 - 5. Monthly pay estimate cutoff dates.
 - 6. Payment procedures.
 - 7. Request for information procedures.
 - 8. Communication procedures.
 - 9. Contractor-required Daily Report
 - 10. Scheduling and coordination requirements including utility outage notifications
 - 11. Site and building access, staging areas, and parking for contractors

12. Any concerns for public interface during the execution of the work
 13. Quality control/assurance procedures.
 14. Environmental requirements regarding finding potentially contaminated materials during the execution of the work..
 15. As-built documents.
 16. Project closeout requirements.
- E. The Contractor will introduce the Contractor's representatives and briefly describe each person's responsibilities. The Contractor will provide the following:
1. A list of all subcontractors.
 2. Office, storage areas and construction area layouts, along with temporary easements.
 3. Safety, first aid, emergency actions and security procedures including the name of the Contractor's insurance company.
 4. 60 day preliminary milestone schedule.
 5. Sequence of work.
 6. Construction worksite waste stream sorting and haul plan.
 7. Housekeeping procedures.
 8. The Contractor's general erosion and sedimentation control plans, noise, hazardous material, air and water pollution control plans.
 9. Coordination and notification for utility work and utility outages
 10. Deliveries and priorities of major equipment.
 11. Submittal Schedule
- F. Explanations provided by the City will not amend, supersede or alter the terms or meaning of any contract document and the Contractor shall not claim reliance on such explanations as a defense to any breach or failure by the Contractor to perform as specified in the contract.

3.02 CONSTRUCTION PROGRESS MEETINGS

- A. Progress meetings will be scheduled weekly. The meetings will be held at the worksite or at a location selected by the Team. Meetings will be chaired by the Contractor.
- B. The Contractor's personnel shall attend and the Contractor will be responsible for publishing minutes of the meetings.
- C. At a minimum, the following items will be addressed at each meeting. The items addressed in the meeting do not waive notification or submittal requirements as required elsewhere in the contract.
1. Safety: Contractor shall report any safety issues
 2. Quality Control
 - a. The Contractor's Quality Control Representative shall report on inspections by other agencies and any follow-up activity required.
 - b. The Project Manager and/or the Designer will present and discuss issues regarding quality control.
 3. Quality Assurance

- a. The Contractor will present and discuss issues regarding quality assurance.
- 4. Design activities: open discussion
- 5. Shop drawings/submittals/material procurement
 - a. The Contractor shall provide and review the Contractor's submittal schedule and provide any updated information and/or changes to the schedule.
 - b. The Contractor shall provide information on the status of submittals requiring re-submittal.
 - c. The Contractor shall review any accepted submittals that the Contractor plans to re-submit with changes.
 - d. Contract shall provide the status of material procurement for long-lead items. All long-lead items shall be identified with a separate activity on the approved CPM project schedule.
- 6. Construction activities: Open discussion to include coordination items with other Contractors and or agencies.
- 7. Schedule
 - a. The Contractor shall provide the attendees with the Contractor's three week look-ahead schedule and review the items on the schedule. The schedule shall be in bar chart format and coordinated with the approved CPM.

END OF SECTION

SECTION 012300

ALTERNATES

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Technical Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.03 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if City decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.04 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

1.05 SCHEDULE OF ALTERNATES

- A. Alternate No. 01: Addition of site improvements as indicated on civil and landscape drawings.
 - 1. Base Bid: Sanitary sewer work including sand and oil interceptor and related work.
 - 2. Alternate: All paving, associated grading, curb and gutter, curb cuts, concrete pans, asphalt patch, handicap ramps, sidewalks, fuel station pad, striping and storm drain improvements.

- B. Alternate No. 02: Addition of design/build services for irrigation system.
 - 1. Base Bid: No work.
 - 2. Alternate: Landscape contractor to provide design/build services for the irrigation system. Irrigation system to be installed per Parks and Rec standards. Soil amendment to be provided per Denver Water Standards.

- C. Alternate No. 03: Paint exterior building.
 - 1. Base bid: No work.
 - 2. Alternate: Prep and paint exterior CMU around entire building. Painting does not include existing hollow metal doors and frames, overhead doors, aluminum windows or any pre-finished sheet metal flashing and trim. Protect all items listed that are not to be painted.

END OF SECTION

SECTION 01 3000

SUBMITTALS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Work specified in this Section summarizes the requirements for the submittal of documents to the City that are defined in these Specifications. It also describes the procedures for "supplemental" submittals.
- B. Reference Contract General Conditions, GC 309 and GC 405.

PART 2 - PRODUCTS

2.01 SUBMITTAL SCHEDULE

- A. The Contractor shall provide a submittal schedule within 14 days after Notice to Proceed. The Submittal Schedule shall be directly related to the CPM schedule, shall identify all the submittals, and shall include the following information for each submittal item:
 - 1. Specification section, contract article, or special condition
 - 2. Specification Subparagraph
 - 3. Item description
 - 4. Date the submittal shall be submitted
 - 5. Name of subcontractor or supplier
- B. The submittal schedule shall be updated every two weeks by the Contractor and reviewed with the Project Manager at the regular project meetings.

2.02 ELECTRONIC SUBMITTALS

- A. All submittals shall be delivered to the Project Manger and Designer in electronic format, whenever possible See Technical Specifications Section 01 3400 for additional information.
 - 1. Acceptable electronic formats
 - a. Adobe Acrobat 90 or newer. All files shall be fully compatible with Adobe Acrobat 9.0. File shall have no security and bookmark every applicable submittal.
 - 2. Formats are acceptable only with written permission of the project manager or required by individual spec sections:
 - a. Microsoft Office 2007 or newer. All files shall be fully compatible with Microsoft Office 2007.
 - b. AutoDesk AutoCAD 2007 or newer. All files shall be fully compatible with AutoDesk AutoCAD 2007.
 - 1) AutoCAD files shall be self contained with no external x-references.
 - c. Other files pre-approved by the Project Manager.
 - 3. Electronic file names: Each electronic document shall have a unique file name. File name convention shall be as follows unless otherwise agreed to by Project Manager: - AAA-BBBBB-CCC-RZ
 - a. AAA = sequential submittal number starting at 001.
 - b.BBBBB = specification section containing submittal requirements

- c. CCC = sequential specification submittal number starting at 001.
- d. RZ = sequential revision number. RZ not required on initial submittals.
- e. Example A:005-013700-002", five submittals have been logged overall with two submittals made to specification section 013700.
- f. Example B: 009-013700-002-R3, nine submittals made overall and three revisions to submittal 013700-002.

2.03 INITIAL SUBMITTAL

- A. Each submittal document shall include a title block showing the following information:
 - 1. Date of submittal and revision dates.
 - 2. Contract title and number.
 - 3. The names of Contractor, subcontractor, supplier, manufacturer and when applicable, the seal and signature of an engineer registered in the State of Colorado, for the involved discipline.
 - 4. Identification of product by either description, model number, style number or lot number.
 - 5. Subject identification by contract drawing or specification reference.
- B. On each submitted drawing, include a blank space on each sheet, three inches by four inches, in the lower right corner, just above the title block, the Designer of Record may indicate the action taken.
- C. Make submissions sufficiently in advance so that the Designer review may be completed before any material procurement or Work represented by those submittals is scheduled to be performed.
- D. Allow a minimum cycle of 10 working days for review of each submittal by the Designer of Record.
- E. The Contractor shall at the time of submission describe variations from the contract documents in writing, separate from the submittal document. If the Project Manager approves any such variations, an appropriate contract change order shall be issued except that, if the variation is minor and does not involve a change in price or in time of performance, a modification need not be issued. If a submission contains variations and the variation column is not marked on the transmittal form, it will not be considered for review and acceptance. Along with marking the transmittal as a variation, a description must be included which outlines all the differences including maintenance and utility services along with any cost savings from an item not containing the variation.
- F. Changes in accepted submittal documents will not be permitted unless those changes have been accepted, in writing, by the City.
- G. The form and quality of submittal documents shall comply with Technical Specifications Section 013400.

2.04 SUPPLEMENTAL SUBMITTALS

- A. Supplemental submittal documents initiated by the Contractor for consideration of corrective procedures shall contain sufficient data for review. Make supplemental submittals in the same manner as initial submittals with the appropriate primary transmittal referenced.

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

- A. The Contractor shall review submittal documents, stamp and sign as reviewed and approved as complying with contract documents prior to submission to the Designer of Record.

3.02 CITY REVIEW

- A. Submittal documents will be reviewed by the Designer for conformance to requirements of the contract drawings and specifications. Review of a separate item will not constitute review of an assembly in which the item functions. The Designer or the Project Manager will withhold approval of submittals that depend on other submittals not yet submitted. Review and acceptance will not relieve the Contractor from his responsibility for accuracy of submittals, for conformity of submittal document to requirements of contract drawings and specifications, for compatibility of described product with contiguous products and the rest of the system, or for protection and completion of the contract in accordance with the contract drawings and specifications.
- B. The Designer, will review the submittal documents for general conformance with the contract documents and mark the Action Code, sign and date the transmittal.
- C. The Action Codes have the following meanings:
 - 1. A - ACCEPTED is an approval, and means that the illustration and description appears to conform to the respective requirements of the contract documents.
 - 2. B - ACCEPTED AS NOTED is an approval, and means that the illustration and description will conform to the respective requirements of the contract documents after changes in recognition of the reviewer's comments. Submittals so marked need not be resubmitted.
 - 3. C - REVISE AND RESUBMIT means that the submittal is unacceptable and must be revised and resubmitted.
 - 4. E - NOT ACCEPTED means that the submittal is not approved and that a new submittal in accordance with the contract documents shall be made.
 - 5. F - RECEIPT ACKNOWLEDGED, means an item is received by the Designer but no review was made. This mark is for use in resubmitting items that were previously Accepted as Noted and the Contractor has incorporated the notes and wants the Project Managers' staff to have the same material that the Contractor's field staff is using.

3.03 CONTRACTOR'S RESPONSIBILITIES

- A. Coordinate each submittal document with the requirements of the Work; place particular emphasis upon ensuring that each submittal of one trade is compatible with other submittals of that trade and submittals of other trades including producing as needed drawings showing the relationship of the work of different trades.
- B. Contractor's responsibility for errors and omissions in submittal documents and associated calculations is not relieved by the City's review, correction and acceptance of submittals.
- C. Contractor's liability to the City, in case of variations in the submittal document from the requirements of the contract documents, is not relieved by the City's review and acceptance of submittals containing variations unless the City expressly approves the deviation in writing, in which the City describes the variation.
- D. The Contractor shall maintain a file of all approved submittal documents at the worksite.

The complete file of approved submittal documents shall be turned over to the City with the as-built documents at the end of the job.

- E. Schedule impact due to resubmittal requirements is the responsibility of the Contractor.

END OF SECTION

SECTION 01 3100

SCHEDULE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section specifies the preparation of a preliminary schedule, construction schedule, related narratives and monthly progress reports, all encompassing complete performance of contract requirements.
- B. The Contractor shall schedule and coordinate the work of all of its subcontractors and suppliers including their use of the worksite. The Contractor shall keep the subcontractors and suppliers informed of the project construction schedule to enable the subcontractors and suppliers to plan and perform their work properly.
- C. The Contractor shall, in accordance with the requirements of the technical specifications, submit a construction schedule that shall provide for the expeditious and practicable execution of the Work within the Contract Time
- D. The construction schedule for the performance of the Work shall be a Critical Path Method (CPM) system in bar chart format, unless an alternate system is specifically identified in the technical specifications, with reasonable detail..
- E. Float or slack is defined as the amount of time between the early start date and the late start date or the early finish date and the late finish date of any activities in the schedule. Float or slack is not time for the exclusive use or benefit of either the Contractor or the City.
- F. The Contractor shall submit a monthly progress report and schedule update.
- G. The Contractor shall complete the Work within the Contract Time and in accordance with the most recent schedule submittal that has been reviewed and approved by the Project Manager during regular project meetings.
- H. Reference Special Contract Conditions, Liquidated Damages, and Contract General Conditions, GC 306, GC 603, GC 909, GC 1103, GC 1202, GC704

1.02 PLANNING

- A. The schedule shall show total contract time, including project milestones as follow or as established elsewhere in the contract documents:
 - a. [Insert list of milestones]
- B. The Contractor shall prepare a work plan to complete the work within the contract time and complete those portions of work relating to each milestone date and other contract requirements. The Schedule shall be submitted electronically to the Project Manager in a dynamic format which will allow review and manipulation of any part of the schedule, and in PDF format. Upon the request of the Project Manager, the schedule activities shall be resource loaded showing labor man hours by crafts, major construction equipment by type and value of the work.

- C. In addition to the construction activities the schedule shall include activities for furnishing materials and equipment and vendor shop drawing preparation. The construction schedule, a supporting narrative, and the overall progress curve shall be submitted for approval within 30 days after Notice to Proceed. Within 30 days the City will respond with approval or direction to revise and resubmit within ten days. Failure of the Contractor to have a construction schedule approved by the City will be considered cause for withholding progress payment(s).
- D. To the extent that the construction schedule or any revisions thereof contains anything not jointly agreed upon in writing, or fails to show anything jointly agreed upon in writing, it shall not be considered to have the approval of the City. Failure to include any work item required for performance of this contract shall not excuse the Contractor from completing all work within applicable completion dates, regardless of the City's approval of the schedule.
- E. Failure of the Contractor to comply with this Section will be considered cause for withholding progress payment(s) or termination for default.

1.03 SUBMITTALS

- A. Refer to Technical Specifications Section 01 3000 for submittal procedures. Submit the following as indicated:
 - a. Preliminary schedule Construction schedule data and work plan Monthly progress report
 - b. As built construction schedule.

PART 2 - PRODUCT (NOT USED)

PART 3 - EXECUTION

3.01 PRELIMINARY SCHEDULE

- A. The Contractor shall prepare a preliminary schedule covering the first 90 calendar days of the contract. This preliminary schedule shall be submitted at the Preconstruction Meeting and shall be accompanied by a narrative description of the work plan. The preliminary schedule shall show all significant work tasks that occur in the first 90 days, including planning, mobilization, shop submittals and approvals, procurement, fabrication and construction. It shall identify work items or milestones that affect or are affected by the City, other Contractor's work, utilities and other third parties, and it shall list major data submittals required by the contract.

3.02 CONSTRUCTION SCHEDULE

- A. The construction schedule shall be a computerized CPM schedule that includes:
 - a. The order, sequence and interdependence of all significant work items including construction, procurement, fabrication, testing, startup and inspection and delivery of critical or special materials and equipment, submittals and approvals of critical samples, shop drawings, procedures, or other documents that could have a schedule impact.
 - b. Work items by the City, other Contractors, utilities and other third parties that may affect or be affected by Contractor's activities.
 - c. Proper referencing of all work items to identify applicable subcontractors or other performing parties.
 - d. The construction schedule shall be prepared to include the data for the total contract duration, and the critical path shall be identified, including critical paths for interim completion dates. Scheduled start or completion dates imposed on the

schedule by the Contractor shall be consistent with contract milestone dates. Milestone events shall be the schedule dates specified in the Special Conditions and shall be prominently identified and connected to the appropriate work item, denoting its start or completion. Work items related to any interim milestones shall be coded for that milestone.

3.03 PROGRESS REPORTING

- A. The Contractor shall submit a monthly progress report at the end of each month following the Notice to Proceed. At the end of each month, the Contractor and Project Manager shall agree on the progress of the work and the Contractor shall update the construction schedule accordingly. The updated construction schedule is a prerequisite to the submittal of the Contractor's application for progress payment. The schedule shall be made in accordance with Technical Specifications Section 013100-3.02. This review does not constitute an approval of the construction schedule and shall not be used for the purposes of modifying the initially approved construction schedule.
- B. The latest completion time for any work item does not fall within the time allowed by the construction schedule, the sequence of work and/or duration shall be revised by the Contractor through concurrent operations, additional manpower, additional shifts or overtime, additional equipment or alternative construction methods until the schedule produced indicates that all significant contract completion dates, occupancy dates and milestones will be met.

3.04 SCHEDULE CHANGES

- A. The Contractor's request for construction schedule changes shall be made on the latest approved construction schedule and shall be accompanied by a narrative description and justification for the change, and shall be submitted in accordance with the General Conditions Title 1105 on changes in time. Minor revisions submitted at monthly progress review meetings are not considered as changes in this context.
- B. The construction schedule may be changed when one or more of the following occur:
 - a. When a change order significantly affects the contract completion date or sequence of work items.
 - b. When the Contractor elects to change the sequence or duration of work items affecting the critical path.
 - c. When the City directs a change that affects a milestone date(s) specified in the Special Conditions or alters the length of a critical path.

3.05 CONTRACT EXTENSIONS

- A. If the Contractor is granted an extension of time for completion of any milestone or contract completion date under the provisions of the contract, the determination of the total number of extended days will be based upon the current analysis of the schedule and upon all data relevant to the extension. Such data shall be incorporated in the next monthly update of the schedule.
- B. The Contractor acknowledges and agrees that delays in work items which, according to schedule analysis do not affect any milestone dates or contract completion date shown on the CPM network at the time of the delay will not be the basis for a contract extension.

3.06 AS-BUILT CONSTRUCTION SCHEDULE

- A. After all contract work items are complete, the Contractor shall submit an as built construction schedule showing actual start and finish dates for all work items and milestones.

END OF SECTION

SECTION 01 3400

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Work specified in this Section consists of preparing and submitting shop and working drawings, product data, samples and record documents required by other technical specifications sections.
 - 1. The Contractor shall submit all shop drawings, working drawings, product data and samples, as defined in Title 1 of the General Conditions, to the Designer and Project Manager, if requested, in accordance with the requirements in the technical specifications. The Designer will return one copy of the shop drawings, working drawings and product data to the Contractor with a written transmittal within the time periods noted in the technical specifications.
- B. Reference Contract General Conditions, GC 110, GC 116, GC 117, GC 303, GC 324, GC 401, GC 402, and GC 405.

1.02 SUBMITTALS

- A. Refer to Technical Specifications Section 01 3000 for submittal procedures.
- B. Submittals shall be delivered to the Designer and Project Manager in electronic format, whenever possible. All submittals must be of a consistent format (all Acrobat or all Word, etc). No combination of electronic file types will be allowed unless required by a specific specification section..
 - 1. Acceptable electronic formats
 - a. Adobe Acrobat 9.0 or newer. All files shall be fully compatible with Adobe Acrobat 9.0
 - b. Formats are acceptable only with written permission of the Project Manager or required by individual spec sections:
 - 1) Microsoft Office 2007 or newer. All files shall be fully compatible with Microsoft Office 2007.
 - 2) AutoDesk AutoCAD 2007 or newer. All files shall be fully compatible with AutoDesk AutoCAD 2007.
 - a) AutoCAD files shall be self contained with no external x-references.
 - 3) Other files pre-approved by the Project Manager
 - 2. Adobe Acrobat Requirements:
 - a. Drawings shall have security set to "No Security". Commenting, printing, adding photos, form fields and document signing must be allowed.
 - b. PDF submittals shall be one continuous file. No external links are allowed.
 - c. All individual components of submittals shall be bookmarked inside the PDF file.
 - d. All original documents shall be directly converted from the original electronic format to PDF. Failure to comply with these requirements will result in a return of file to the Contractor for immediate revision.
- 1. Electronic file names: Each electronic document shall have a unique file name. File name convention shall be as follows unless otherwise agreed to by Project Manager: -

AAA-BBBBB-CCC-RZ

- a. AAA = sequential submittal number starting at 001.
- b. BBBBB = specification section containing submittal requirements
- c. CCC = sequential specification submittal number starting at 001.
- d. RZ = sequential revision number. RZ not required on initial submittals.
- e. Example A:005-013700-002", five submittals have been logged overall with two submittals made to specification section 013700.
- f. Example B: 009-013700-002-R3, nine submittals made overall and three revisions to submittal 013700-002.

C. Quantities

1. Post electronic submittals as PDF electronic files directly to Designer's FTP, Contractors FTP site or a site specifically established for the Project.
 - a. The Contractor should send an email for each submittal posted to all parties notifying them the submittal is available for review.
 - b. The Project Manager or Designer will send an email to the Contractor when the submittal review is complete.
2. Contractor can submit electronic submittals via email as PDF electronic files if approved by the Project Manager.
3. Three samples of each item specified in the various specification sections, unless otherwise specified.
4. Note: If manufacturer's printed information is in color, all copies of submittals must be in color.
 - a. Printed information is only allowed when electronic copies are not possible.

D. Review

1. Submittal review comments by the Designer will be in electronic form and incorporated into the electronic submittal file.
2. Resubmittals of electronic documents shall modify the original electronic file with new information and include the Designer's comments with appropriate responses and additional information.

1.03 CHANGES

- A. Changes in products for which shop or working drawings, product data or samples have been submitted will not be permitted unless those changes have been accepted and approved in writing by the City and County of Denver.

PART 2 - PRODUCTS

2.01 SHOP AND WORKING DRAWINGS

- A. Include the following as they apply to the subject:
 1. Contract title, work order and number.
 2. Respective contract drawing numbers.
 3. Applicable specification section numbers.
 4. Relation to adjacent structure or materials.
 5. Field dimensions clearly identified as such.

6. Applicable standards such as ASTM or Federal Specification number, and pertinent authority specifications or standards.
 7. Identification of deviations from the contract drawings and specifications.
 8. Drawing name, number and revision.
 9. Contractor's stamp, initialed or signed, certifying:
 - a. Verification of field measurements.
 - b. Review of submittals for compliance with contract requirements.
 - c. Compatibility of the Work shown thereon with that of affected trades.
 10. Blank space on each sheet per Technical Specifications Section 01300, paragraph 2.02.B.
- B. Drawings of equipment and other items that contain multiple parts shall include exploded views showing the relationship of parts and the description of the parts into the smallest units that may be purchased or serviced.

2.02 PRODUCT DATA

- A. Modify manufacturer's standard and/or schematic drawings to delete information which is not applicable to the contract. Supplement standard information with additional information applicable to this contract.
- B. Modify manufacturer's standard(s), diagrams, schedules, performance charts, illustrations, calculations and other descriptive data to delete information which is not applicable to the contract. Indicate dimensions, clearances, performance characteristics and capacities. Include with the submittal electrical, plumbing, HVAC and any other diagrams, as applicable.
- C. Modify erection, application and placing instructions to delete information that is not applicable to the contract or work order.
- D. Include the following:
 1. Contract title, work order and number
 2. Respective contract drawing numbers
 3. Applicable contract technical specification section numbers
 4. Applicable standards such as ASTM or Federal Specification number, and pertinent authority specification or standards
 5. Identification of deviations from the contract drawings and specifications
 6. Contractor's stamp, initialed or signed, certifying:
 - a. Dimensional compatibility of the product with the space in which it is intended to be used
 - b. Review of submittals for compliance with contract requirements
 - c. Compatibility of the product with other products with which it is to perform or which will be next to it.
 - d. The products electrical, plumbing, control and HVAC requirements conform to contract documents and the necessary utilities are provided for in the contract documents.
- E. Certificates of compliance shall be submitted for all products. The certificates shall:
 1. State that the product complies with the respective specification and contract drawing

requirements

2. Be accompanied by a certified copy of test results pertaining to the product
3. Show the submittals date, Contractor's name and address, contract title and number, product represented and its location in the contract, producer's name, product trade name and catalog number, place of product origin, test date, testing organization's name and address, quantity of the product to be furnished and related contract drawing and specification section numbers
4. Be signed by an officer or another authorized representative of the producer and notarized
5. Submit one electronic copy.
6. Be received by the City not later than 30 days before the acceptance is needed of the products for ordering.

2.03 SAMPLES

- A. Submit samples of sizes and quantities to clearly illustrate full color range and functional characteristics of products and materials including attachment devices.
- B. Erect field samples and mock ups at the worksite as specified in the several technical specifications sections and at locations acceptable to the Project Manager. All field samples shall be erected in a location that will be readily visible throughout the life of the contract to allow comparison of the work as it progresses to the field sample.
- C. The Contractor shall verify, through appropriate inspections and tests, that the samples submitted meet the specifications and shall provide inspection and test data with the samples. The review and comments on the sample shall not relieve the Contractor of his responsibility for completion of the contract.
- D. Show the following information:
 1. Contract title and number
 2. Respective contract drawing numbers
 3. Applicable technical specification section numbers
 4. Applicable standards such as ASTM or Federal Specification number
 5. Identification of deviations from the contract drawings and specifications
 6. Contractor's stamp, initialed or signed, certifying:
 - a. Dimensional compatibility of the product with the space in which it is intended to be used
 - b. Review of submittals for compliance with contract requirements
 - c. Compatibility of the product with other products with which it is to perform or which will be next to it
 7. If multiple samples are submitted and the Designer is requested to make a choice, each sample shall have a unique identification number attached to it so the returned transmittal can state the identification number of the accepted sample and the Contractor will know which one it is.

PART 3 - EXECUTION

3.01 CONTRACTOR RESPONSIBILITIES

- A. Verify field measurements, catalog numbers and similar data.
- B. The Contractor shall not start work for which submittals are required until a transmittal has been received by the Contractor showing acceptance or acceptance as noted by the Designer. Before making submittals ensure that products will be available in the quantities and at the times required by the contract.
- C. Submit final, corrected, electronic drawings of contract and shop and working drawings showing the Work as actually installed, placed, erected and applied. Refer to Technical Specification Section 017000, Contract Closeout.

3.02 REVIEW BY THE CITY

- A. One electronic copy of the marked-up shop and working drawing and one electronic copy of the product data will be returned to the Contractor by the Designer. Only the transmittal form, appropriately marked, and two samples will be returned on sample submittals. Contractor shall maintain one approved sample onsite for the duration of the project.
- B. Contractor's responsibility for errors and omissions in submittals for compatibility will not be reduced, waived or otherwise limited by the review and acceptance of submittals by the City's Designer of Record.

END OF SECTION

SECTION 01 3700

SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Work specified in this Section consists of preparing and submitting the Schedule of Values as referenced in the General Conditions. The Schedule of Values will be built upon a breakdown of the Work using specification sections and milestones. The Work also includes the preparing and submitting of updated copies of the Schedule of Values if the Schedule of Values is affected by change orders. The Project Manager may require additional breakdowns of information, or separate Schedules of Values for portions of work based upon project's funding requirements.
- B. A Schedule of Stored Material is a detailed cost breakdown for permanent materials that will be temporarily stored prior to their being installed and for which the Contractor seeks partial payments. The Schedule of Stored Material will be incorporated as a part of the Schedule of Values.
- C. Within 14 calendar days of issuance of the Notice to Proceed, the Contractor shall submit the Schedule of Values including the Schedule of Stored Material if applicable. The Schedule of Values and Schedule of Stored Material used to prepare the work/cost breakdown for the Schedule will be used for the Contractor's billings.
- D. Any contract allowances shall be included in the Schedule of Values. Expenditure of allowances shall be done through the use of the Allowance Authorization form. Use of this form does not increase or decrease the contract value.
- E. Reference Special Contract Conditions, Payment to Contractors, plus Contract General Conditions, GC 902, GC 903, and GC 906.

1.02 RELATED DOCUMENTS

- A. Technical Specifications Section 01 3000 Submittals

1.03 SUBMITTAL

- A. The Schedule of Values shall be submitted in a format approved by the Project Manager.
- B. Upon request by the City, the Contractor shall support values given with the data which will substantiate the correctness of the values.
- C. The Schedule of Values will be utilized as a basis for review of the Contractor's application for progress payment.

1.04 REVIEW AND RESUBMITTAL

- A. If review by the City indicates that changes to the Schedule of Values are required, the Contractor shall revise and resubmit the Schedule of Values.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

3.01 ALLOWANCE AUTHORIZATION AND PAYMENT

- A. Contractor shall request written approval for expenditure of any contract allowances PRIOR TO performing the Work involved. List work to be performed and estimated cost in the requesting correspondence.
- B. Using the format provided by the City, the Contractor's request for payment of all contract allowances shall be included in the Schedule of Values.

END OF SECTION

SECTION 01 4000

CONTRACTOR QUALITY CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section identifies the Quality Control activities to be performed during all phases of the contract by the Contractor.
- B. The Contractor shall have in place his Quality Control Program as necessary to ensure that all materials and work are completed in compliance with contract documents. The Contractor is solely responsible for Quality Control with the exception of those tests and/or audits that will be conducted by the City as defined in the contract documents.
- C. Test schedules and/or testing requirements for materials used on this project are included in the technical specifications. Laboratory and field testing identified in the technical specifications shall be conducted by an Independent Testing Agency (ITA) retained by the City unless stated otherwise.
- D. Reference General Contract Conditions GC 316, GC 702, GC 1801, GC 1902, and GC 2002

1.02 LEVEL OF CONTROL

- A. The intent of this section is to enable the Contractor to establish a necessary level of control that will:
 - 1. Adequately provide for the production of acceptable quality materials
 - 2. Provide sufficient information to ensure both the Contractor and the Designer of Record that the specification requirements are being met
 - 3. Allow the Contractor as much latitude as possible to develop his or her own standards of control.

1.03 SUBMITTALS

- A. Refer to Technical Specification Section 01 3000 and 013400 for submittal requirements.
- B. Quality Control Plan: Within 14 days after Notice to Proceed, the Contractor shall submit a Quality Control Plan for review and acceptance. Acceptance by the Project Manager does not relieve the Contractor of compliance with the contract requirements. The Contractor Quality Control Plan shall address the following as a minimum:
 - 1. Provide a general description of Quality Control monitoring to be performed until final acceptance by the City. Include securing of project site and staging areas and monitoring of the worksite during times no construction activity is scheduled to take place.
 - 2. The Contractor shall designate an employee as the Quality Control Manager qualified to perform quality control monitoring of the Work. The designated individual shall have the authority to direct work changes required to bring the Work into conformance with contract requirements including stopping non-conforming work in progress.
 - 3. Provide methodology of monitoring, testing and exercising of all equipment, valves and/or assemblies to ensure the Work installed is in proper working order.

4. The Contractor shall submit a list of suppliers and subcontractors. This list shall include items to be supplied by each supplier and/or subcontractor and shall identify work to be performed by each subcontractor. The list shall be updated and resubmitted as required.
 5. Provide emergency contact information including name, company, title, work phone number, cell phone number and other means of contact. The Emergency Contact list shall include at least four individuals. In the event there is any change in any of the information, the Contractor shall forward the updated list to the Project Manager. The Emergency Contact list shall include the project address, project title and date of issue.
- C. Daily Quality Control Report:
1. The Daily Quality Control Report shall be submitted daily in the format detailed in Technical Specifications Section 01999. The report shall address as a minimum the following: identify number of workers on site each day by trade, identify notifications and discussions with/by Quality Assurance Inspectors and other agency inspectors, identify quality of work placed that day and any deviations and/or corrections required to bring the Work into conformance with the contract. Daily reporting may be computerized or typed, but must contain a legible signature. Scanned copies of daily reports are acceptable.
 2. Submit one electronic copy of the Daily Quality Control Report to the Project Manager the day following the work. The report shall be signed by the Contractor's Quality Control Representative and the Contractor's Superintendent.
- D. Corrective Action Report (CAR)
1. Conditions adverse to quality will be reviewed by the Contractor to determine the cause and to recommend a corrective action that will preclude recurrence. The condition, its cause and the corrective action planned shall be reported to the Project Manager prior to implementation. Follow-up action shall be taken to verify implementation of the corrective action. The Contractor will document the corrective action and a copy of the Corrective Action Report (CAR) will be transmitted to the Project Manager.

1.04 DOCUMENTATION

- A. The Contractor shall not change or alter approved submittals, procedures, specifications, drawings or other pertinent documentation without the Project Manager's written authorization.
- B. All records and documents that are quality related shall be prepared, identified and maintained by the Contractor and shall be made available to the City upon request. Records shall be protected from damage, deterioration or loss.
- C. The Contractor shall maintain records at the actual worksite and at Contractor's office to show the inspection status of materials and items installed in order to ensure that the required inspections and tests have been performed in a timely and correct manner.

1.05 INSPECTIONS AND TESTS

- A. Inspections, tests and system shut down requests, conducted by persons or agencies other than the Contractor, shall not in any way relieve the Contractor of his responsibility and obligation to meet all specifications and the referenced standards. The Contractor's designated Quality Control Representative shall inspect the work and shall ensure the work complies with the contract requirements prior to any requests for inspection or testing.

- B. When the specifications, laws, ordinances, rules, regulations or orders of any public agency having jurisdiction require the ITA's surveillance of inspections or tests, the Contractor shall notify the ITA of the place, date and time 48 hours prior to the inspection and/or test. The Contractor shall be responsible for notifying and requesting inspection by other agencies including but not limited to the Denver Building Inspection Division, Denver Fire Department and Denver Water Department. Prior to request for other agency inspections, the Contractor shall meet and plan inspection times with the Project Manager and or the Project Manager's designated representative.
- C. Special inspections or tests may be required by the technical specifications, City, State and/or Federal Agencies in addition to those tests already performed. The Contractor shall notify the Project Manager at least 48 hours in advance of the additional inspections or tests.

1.06 INSPECTION PLAN

- A. The Contractor shall utilize the following six-point inspection plan to ensure the conformance of the Work performed by the Contractor meets the requirements of the contract drawings and specifications, the referenced codes and standards and the approved submittals:
 - 1. **Pework Coordination:** Prior to the start of construction work on the contract and prior to the start of work under each separate specification section and prior to the start of work where a change in a construction operation is contemplated by the Contractor and prior to a new subcontractor starting work, a coordination meeting will be held with the Contractor's superintendent, Quality Control and Safety representative(s). Some portions of the work may require coordination with the Project Manager, facility operator, Designer of Record, ITA and/or commissioning agent; this would be included as an activity in the regularly updated schedules and specific invitations will be issued by the Contractor. The Contractor's Quality Control Representative shall chair, prepare and distribute minutes of Quality Control meetings. Meeting minutes shall be electronically distributed within 48 hours of the meeting.
 - 2. The purpose of the meeting is to ensure that the Contractor's personnel and subcontractors have no misunderstandings regarding their safety and quality procedures as well as the technical requirements of the contract.
 - 3. **Initial Inspection:** Upon completion of a representative sample of a given feature of the Work and no later than two weeks after the start of a new or changed operation, the Project Manager's designated representatives will meet with the Contractor's Quality Control representative and applicable subcontractor's supervisor and their Quality Control representatives to check the following items, as a minimum:
 - a. Workmanship to established quality standards
 - b. Conformance to contract drawings, specifications and the accepted shop drawings
 - c. Adequacy of materials and articles utilized
 - d. Results of inspection and testing methods
 - e. Adequacy of as-built drawings maintained daily.
 - 4. Once accepted, the representative sample will become the physical baseline by which ongoing work is compared for quality and acceptability. To the maximum practical extent, approved representative samples of work elements shall remain visible until all work in the appropriate category is complete. Acceptance of a sample does not waive or alter any contract requirements or show acceptance of any deviation from the contract not approved in writing by a fully executed change order.
 - 5. **Follow-up Inspection:** The Contractor's Quality Control representative will monitor the work to review the continuing conformance of the work to the workmanship standards

established during the preparatory and initial inspections.

6. Pre-Final Acceptance Inspection: Prior to requesting a Pre-Final Acceptance Inspection by the City, all work and operational systems to be inspected shall be satisfactorily completed and tested by the Contractor. The Contractor's written request for this inspection shall be made 72 hours in advance. With the request shall come a list of any known deficiencies and when they will be corrected. If the list is too large or contains too many significant items, in the opinion of the Project Manager, no inspection will be held because of the incompleteness of the work.
7. The Project Manager will schedule the Pre-Final Acceptance Inspection and will prepare a list of deficient items (punch list) discovered during the inspection. If during the inspection the list becomes too large or too many significant items are on the list, the inspection will be canceled. After the inspection is completed, the Deficiency List will be transmitted to the Contractor for correction of the deficient items.
8. Final Acceptance Inspection: After the Contractor has completed all items on the Deficiency List (generated from the Pre-Final Acceptance Inspection) he shall request a Final Acceptance Inspection. The request shall be made in writing at least 72 hours in advance of the inspection. All areas must be cleaned and ready for turnover prior to this inspection. The Project Manager, the design consultant, the facility operator, a representative of the funding agency (if applicable) and other interested parties will inspect the subject Work to ensure that all deficiencies have been satisfactorily attended to and that no new deficiencies have appeared and that all systems are completely functional. Any outstanding or additional deficient items will be noted and handled per the requirements of the Pre-Final Acceptance Inspection noted above until the Work is acceptable to the Project Manager.

1.07 SAMPLES

- A. The Contractor shall maintain at the worksite a copy of all samples submitted and accepted by the City. Samples shall be made available to the designer or the Project Manager's designated representatives for review and comparison in the field. The Project Manager prior to use on the project must accept all items and materials.
- B. The installed work will be compared to the samples and if any of the work is not of the same quality, material, finish, color, texture or appearance as the sample, that portion that is not the same will be considered defective and in nonconformance.
- C. Contractor selection of samples will only be considered if taken at random. The Contractor shall permit representatives of the City to witness the selection of samples. Inspection or tests of items or materials that fail shall be sufficient cause to terminate further inspections/tests of the same brand, make or source of that product.
- D. The Contractor is obligated to correct any item deemed deficient.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 REQUIREMENTS

- A. All materials required for the contract shall be new except where specified otherwise. Inspections and tests performed by the City shall not relieve the Contractor from the responsibility to meet the specifications, nor shall such inspections/tests be considered a guarantee for acceptance of materials that will be delivered at a later time.
- B. The Contractor is obligated to correct or remove non-conforming materials, whether in place

or not. If necessary, the Project Manager will send written notification to the Contractor to correct or remove the defective materials from the project. If the Contractor fails to respond, the Project Manager may order correction, removal and/or replacement of defective materials by others, in which case the Contractor shall bear all costs incurred by such actions.

- C. Materials accepted on the basis of a Certificate of Compliance may be sampled and inspected/tested by the City Project Manager or its Designer at any time. The fact that the materials were accepted on the basis of such certification shall not relieve the Contractor of his responsibility to use materials that conform to the specifications.
- D. The Contractor shall impose upon his suppliers the same quality control requirements, including inspection and test procedures, as imposed upon him by the specifications and referenced standards. The Contractor shall apply appropriate controls, designed to ensure that all materials supplied meet the requirements and specifications.

END OF SECTION

SECTION 01 4020
QUALITY ASSURANCE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section identifies inspection activities to be performed by inspectors employed by the City and/or working under the direction of the City Project Manager.
- B. Inspection and tests, conducted by persons or agencies other than the Contractor, shall not in any way relieve the Contractor of his responsibility and obligation to meet all specifications and the referenced standards.
- C. The inspection and approval of work by other agencies above does not constitute inspection or acceptance of work required by the City. Technical specifications may contain requirements more stringent than Building Inspection Division or other code agency requirements.
- D. Reference Contract General Conditions, GC 1701, GC 1702, GC 1703, GC 1704, GC 1705, GC 1706

1.02 RELATED DOCUMENTS

- A. Technical Specifications Section 01 4000 – “Contractor Quality Control”
- B. Technical Specifications Section 01 3000 – “Submittals”
- C. Technical Specifications Section 01 3400 – “Shop and Working Drawings, Product Data and Samples”

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONTRACTOR'S QUALITY CONTROL SYSTEM

- A. The Contractor is responsible for quality control of the Construction. All acquisition of materials, sequence of construction (except as otherwise indicated), and means and methods of construction shall be the responsibility of the Contractor. Establish system to perform sufficient inspection and tests of all items of work, including that of subcontractors, to ensure conformance to Contract Documents for materials, workmanship, construction, finish, functional performance and identification.
 - 1. Control System: Establish for all construction except where Contract Documents provide for specific compliance tests by testing laboratories and engineers employed by the City.
 - 2. Control System: Specifically include all testing required by various sections of Specifications.
 - 3. Quality Control System: Means by which Contractor assures himself that construction complies with requirements of Contract Documents.
 - a. Controls: Adequate to cover all construction operations and keyed to proposed

construction schedule.

- B. The Contractor shall be responsible for assuring compliance with the quality standards as indicated in the Contract Documents. In addition, the Contractor shall be responsible for:
 - 1. Review of submittals prior to their being forwarded to the Designer for review. The Contractor shall mark submittals with comments and shall indicate the date and party conducting the Contractor's review of each submittal.
 - 2. Final inspection of the project prior to calling for the City to conduct a final inspection. The Contractor shall provide his inspection comments to the Designer and City prior to the scheduled final inspection.
 - 3. Verification of completion of punch-list items prior to calling for verification inspection by the Designer and the City.
- C. Records: Maintain correct records on appropriate form for all inspections and tests performed, instructions received from the Designer or Independent Testing Agency (ITA) and actions taken as result of those instructions.
 - 1. Records: Include evidence that required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for rejection, etc.) proposed or directed remedial action, and corrective action taken.
 - 2. Document inspections and tests as required by each section of Specifications.
- D. The Contractor is responsible for complying with the requirements of the Contract Documents. Testing performed by the City's Agents shall not be relied upon by the Contractor as sufficient to assure compliance with the Contract Documents. The Contractor shall procure and pay for testing necessary to assure that the construction is in compliance with the Contract Documents.

3.02 STANDARDS

- A. Generally accepted Construction Industry standards for materials, products, quality, and workmanship shall supplement the Specifications.
 - 1. Where industry standards are less than the Specifications and Drawings require, the Contract Documents shall govern.
 - 2. The Contractor shall provide materials and products which conform to industry standards of quality.
- B. Construction tasks shall be performed by craftsmen skilled and experienced in the trades required. Work shall be subject to review by the City and the Designer.
- C. Work and/or materials which fail to meet accepted industry standards of performance, quality, and/or appearance will be rejected and shall be brought into compliance or replaced by the Contractor at no additional cost to the City.

3.03 MATERIAL AND WORKMANSHIP

- A. Unless otherwise specified, or indicated on the Drawings, material shall be new, of best quality, and without flaws, and delivered upon completion in an undamaged condition.
- B. Workmanship shall be the best of its respective kind. Labor shall be performed in a thorough workmanlike manner by qualified, efficient, and skilled mechanics, acceptable to the City, Designer and other trades involved on the job requiring acceptable substrate for the performance of their work.

3.04 TESTING – GENERAL

- A. Testing Laboratory and/or Engineering services are required for quality control in portions of the work identified in other sections of these specifications.
- B. Tests required by these Specifications shall be performed in strict accordance with referenced testing methods, procedures, and conditions. Pertinent data shall be included in clear, comprehensive written forms according to the Designer's or Engineer's requirements.
- C. Contractor: Provide equipment and facilities as required for testing at no additional cost, subject to City's review, for conducting field tests and for collecting and forwarding samples.
 - 1. Do not use materials or equipment represented by samples until tests, if required, have been made and materials or equipment found to be acceptable.
 - 2. Do not incorporate any product into work which becomes unfit for use after acceptance thereof.
- D. Testing: Materials or equipment proposed to be used may be tested at any time during their preparation or use. Furnish required samples without charge and give sufficient notice of placing of orders to permit testing. Products may be sampled either prior to shipment or after being received at site of work.
- E. Tests: Made by accredited testing laboratory selected by City. Except as otherwise provided, sampling and testing of materials and laboratory methods and testing equipment shall be in accordance with latest standards and tentative methods of ASTM.

3.05 COST OF TESTING

- A. Unless indicated otherwise, City's testing shall be performed by the City's authorized agents, at the City's expense.
- B. Costs for re-testing of non-complying work shall be borne by the Contractor.
- C. According to the judgment of the City and/or Designer, ANY portion of the work in this contract may be tested at any time for any reason. Costs for such testing shall be borne by the Contractor only if such tests indicate that work does not meet Contract Document requirements.

3.06 OTHER TESTING

- A. Following Testing: Performed at expense of Contractor:
 - 1. Any additional tests required because of any tests that fail subject to following conditions:
 - a. Quantity and Nature of Tests: Determined by the Designer.
 - b. Tests: Taken in presence of the City and/or the Designer.
 - c. Proof of Noncompliance: Contractor liable for corrective action which the City and/or the Designer feel is required including complete removal and replacement of defective material.
 - 2. Material Substitution: Any tests of material or equipment offered as substitute for specified item on which test may be required in order to prove its compliance with Specifications.
- B. Contractor: May have tests performed on material and equipment for his own information and job control so long as the City does not assume responsibility for costs or for giving

them consideration when appraising quality of materials.

3.07 EQUIPMENT TESTING

- A. Equipment testing shall be as determined appropriate by the City to assure proper performance according to the manufacturer's specifications for each equipment item.
- B. After all utility connections to equipment are completed, the Contractor shall conduct final tests of equipment in presence of the City and the Designer.
- C. Unless waived in writing by the City, the requirements of this section shall apply to all installed equipment items having utility connections.

3.08 NOTIFICATION

- A. The Contractor shall be responsible for notifying the City and Designer at least three (3) working days prior to commencing work which is identified as requiring testing in their presence.
- B. The Contractor shall be responsible for scheduling and coordinating all required testing with the City and the City's Independent Testing Agency.

3.09 TEST REPORTS

- A. Test reports, whether performed for the City or the Contractor, shall be submitted to the City, the Designer, and Contractor as soon as results are available. Reports shall be clear, concise, comprehensive written forms containing required test results.
- B. Reports of tests made by testing laboratories shall be distributed via e-mail by testing laboratory as follows: to – City Project Manager, – Contractor, - Applicable Supplier or Subcontractor; – Designer and Applicable Engineer;

3.10 MANUFACTURING AND FABRICATION INSPECTIONS

- A. The Project Manager may elect to perform additional inspections and/or tests at the place of the manufacture, the shipping point or at the destination to verify conformance to applicable specifications. Inspections and tests performed by the City shall not relieve the Contractor from the responsibility to meet the specifications, nor shall such inspections/tests be considered to be a guarantee for acceptance of materials that will be delivered at a later time.
- B. The Project Manager or his authorized representative may inspect at its source any material or assembly to be used in the Work. Manufacturing plants may be inspected from time to time for the purpose of determining compliance with specified manufacturing methods or materials to be used in the Work and to obtain samples for testing and further inspection.
- C. Should the Project Manager conduct plant inspections the following conditions shall exist:
 - 1. The Project Manager shall have the cooperation and assistance of the Contractor and the producer with whom the Contractor has contracted for materials.
- D. It is understood and agreed that the City shall have the right to re-test at the City's expense any materials that have been tested and accepted at the source of supply after it has been delivered to the site.

END OF SECTION

SECTION 01 5000

TEMPORARY FACILITIES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Work specified in this Section consists of furnishing, installing, operating, maintaining and removing temporary construction barriers, enclosures and field facilities including the Contractor's construction offices, staging areas, yards, storage areas, electrical power, telephone, water, fire protection and sanitary service.
- B. Construction Office, Yards and Storage Areas
 - 1. Temporary facilities which the Contractor desires to locate in staging areas adjacent to the Work or within the project limits are subject to approval by the Project Manager.
 - 2. Contractor Field Office may be required based upon size and complexity of project, if required:
 - a. The Contractor shall acquire all necessary permits for installation and construction work related to the Contractor's field office and fencing.
 - b. The Contractor shall provide, as part of his on-site field office, a conference room for weekly meetings. The conference room shall have one available telephone with a speaker phone option.
 - c. Jack the mobile office unit off its wheels and provide support.
 - d. Install tie downs in compliance with code.
 - e. Provide access to the field office and easily accessible space for parking six full size passenger automobiles at a minimum. Grade the field office site, access roadway and parking area for drainage, and surface with gravel paving or crushed stone.
 - f. Water and sewer lines to the field office, if installed, shall be installed so they will not freeze.
- C. Electrical Service
 - 1. Reference Contract General Conditions, GC 327
 - 2. Provide lighting and power for field offices, storage facilities and other construction facilities and areas.
 - 3. Provide power centers for electrically operated and controlled construction facilities including tools, equipment, testing equipment, interior construction lighting, heating, cooling and ventilation equipment.
 - 4. Provide night security lighting at secured areas within construction limits at offices, storage facilities, temporary facilities and excavated areas.
 - 5. Provide battery operated or equivalent emergency lighting facilities at construction areas where normal light failures would cause employees to be subjected to hazardous conditions. Bear all costs of temporary electric and water service permits, fees and deposits required by the governing authorities, and connection charges and temporary easements including installation, maintenance and removal of equipment.
- D. Telephone Service
 - 1. The Contractor shall furnish, field staff cell phones

E. Internet Service

1. The Contractor shall furnish, install and maintain at least one computer with email in his main field office. This computer should be able to access all email and FTP as part of project submittal process.

F. Water Service

1. Reference Contract General Conditions, GC 327
2. The Contractor shall make all connections and extensions required and shall make use of water in direct support of the Work. The Contractor shall install an approved Water Department tap at the City's water source prior to obtaining any water. The Contractor shall arrange and pay for its supply/distribution system from the City's point of connection. The location and alignment of the Contractor's temporary supply/distribution system must be approved by the Project Manager prior to its installation. The Contractor shall leave in place all above ground and underground water distribution facilities unless otherwise directed by the Project Manager.
3. The Contractor shall not use in place fire hydrants or standpipes as sources for construction water or potable water.

G. Fire Protection

1. Furnish, install and maintain temporary portable fire protection equipment throughout the construction period at all buildings (including the project site), maintenance shops, and fuel storage on all large construction equipment and at the location of any flammable materials or construction materials.

H. Sanitary Service

1. Reference Contract General Conditions, GC 326
2. Furnish, install and maintain temporary sanitary facilities and services throughout the construction period.
3. Ensure that separate or single user toilets shall be provided to ensure privacy between the sexes.
4. Provide general washing facilities adequate for the number of employees.
5. Provide special washing facilities adequate for the number of employees engaged in the application of paints, coating and other volatile or hazardous materials.

1.02 QUALITY CONTROL

- A. Provide products for, and the execution of, the Work of this Section that will satisfy the requirements of the NEC, OSHA and local codes. Provide products that satisfy requirements of NEMA and are UL listed.

1.03 SUBMITTALS

- A. Refer to Technical Specifications Sections 01 3000 and 01 3400 for submittal procedures.
 1. Details and layout of temporary installations including fences, roads, parking, buildings, storage areas and drainage plans.
 2. Lighting plan showing temporary lighting facilities, electrical service panel location, electrical circuit diagram and anticipated light level on the working roadway, pathway or construction surface.

PART 2 - PRODUCTS

2.01 ELECTRICAL SERVICE

- A. Provide temporary power and lighting equipment consisting of fixtures, transformers, panel boards, groundings, lamps, switches, poles, conduits and wiring sized and capable of continuous service and having adequate capacity to ensure a complete operating system. Comply with NEMA.
- B. Provide temporary extension cords to supply tools not longer than 200 feet, except that additional length may be used if equipment will be grounded within 200 feet of tool or power.
- C. Portable power generators shall be grounded.

2.02 DRINKING WATER SERVICE

- A. Provide sanitary materials and equipment that satisfies the requirements of codes and regulations pertaining to temporary water systems. Bottled products may be used if those products comply with codes. Clearly label portable containers having a dispensing tap and used only for drinking water. Provide single service disposable cups and a sanitary container for dispensing cups. A trash receptacle shall be provided and maintained beside each portable water supply.

2.03 FIRE PROTECTION

- A. Fire extinguishers shall be UL rated and shall comply with the current City fire code.

2.04 SANITARY SERVICE

- A. Provide materials and equipment adequate for the intended purposes, which will neither create unsanitary conditions nor violate the codes applicable to temporary sanitary facilities. Enclosures for toilet and washing facilities shall be weatherproof, sight proof, ventilated and sturdy.
- B. Provide portable type toilet facilities that satisfy the requirements of OSHA.
- C. Provide washing facilities as needed. Furnish soap, single-service paper towels, towel dispenser and towel receptacle. If paints, coatings and other volatile or hazardous materials injurious to humans will be applied as part of the contract, provide washing facilities with warm water of approximately 120 degrees F.

PART 3 - EXECUTION

3.01 ELECTRICAL SERVICE

- A. The approximate location of primary power lines is shown on the Construction Drawings. The Contractor shall locate electrical service where it will not interfere with equipment, storage spaces, traffic, and prosecution of the Work or the work of others. Installation shall present a neat and orderly appearance and shall be structurally sound. Maintain service in a manner that will ensure continuous electrical service and safe working conditions.

3.02 TELEPHONE SERVICE

- A. Install temporary telephone service in a neat and orderly manner and make structurally and electrically sound to ensure continuous service. Modify, relocate and extend as work progress requires. Place conduit and cable where those products will not interfere with traffic, work areas, materials, handling equipment, storage areas and the work of other contractors. Service lines may be aerial.

3.03 WATER SERVICE

- A. Install the systems in a neat and orderly manner. Make them structurally and mechanically sound. Provide continuous service. Modify, relocate and extend the systems as the work progresses.
- B. Locate systems where they will be convenient to work stations, sanitary facilities and first aid station but will not interfere with traffic, work areas, materials handling equipment, storage areas or the work of other contractors.
- C. Install vacuum breakers, backflow preventers and similar devices in a manner and location which will prevent temporary water from returning to the water mains.
- D. Do not incorporate any part of temporary water distribution system into the permanent water distribution system.

3.04 FIRE PROTECTION

- A. Install products in conformance with the requirements of the applicable Denver Fire Department and OSHA regulations.
 - 1. Provide functional fire extinguishers that are clearly identified for fire and an accessible supply of water during the period of construction. These fire extinguishers shall remain in place until permanent fire protection systems are functional.
 - 2. Furnish not less than one 20-pound fire extinguisher, type 2A-20ABC within ten feet of cutting and welding operations.
 - 3. Provide 20-pound fire extinguishers, type 2A-20ABC no further then 100 feet apart in buildings.
 - 4. Provide not less than one 20-pound fire extinguisher, type 2A-20ABC on any equipment of 75 horsepower or more.
- B. Instruct construction personnel as to location and use of temporary fire protection equipment.
- C. Fire extinguishers shall be located for easy access. Their location shall be clearly marked so that they can be seen at least 75 feet away.

3.05 SANITARY SERVICE

- A. Place temporary sanitary (and washing) facilities in a neat and orderly manner within the limits of the work and convenient to the work stations. Make these facilities structurally and mechanically sound. Modify, relocate and extend the facilities as required by progress of the work.
- B. Service toilets at those time intervals which will minimize the accumulation of wastes and prevent creation of unsanitary conditions, but not less than once a week.
- C. The waste from the sanitary and wash facilities shall be disposed of in accordance with all applicable rules, regulations and laws and with the least environmental impact.

3.06 FENCING

- A. Contact all utility service companies prior to planning fence location and post locations for certification of current utilities. Locate pothole posts planned within 5 feet of known utilities.

Submit fencing plan and typical details to Project Manager at least seven days before planned execution for review and acceptance.

3.07 SIGNAGE

- A. Contractor shall not provide any signage for temporary facilities without prior approval from the Project Manager.

3.08 REMOVAL

- A. The Contractor shall locate all temporary facilities including the underground utilities so they can be completely removed without damaging permanent work or the worksite of other contractors.
- B. The Contractor shall remove all temporary facilities, including all underground utilities, and restore the site to the condition in which the City initially provided it to the Contractor.

END OF SECTION

SECTION 01 6200

STORAGE AND PROTECTION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Work specified in this Section consists of providing storage and protection of the materials, products and supplies which are to be incorporated into the construction and indicating such storage areas on the working drawings with the location and dates when such areas will be available for each purpose.
- B. Reference Contract General Conditions, GC 803

1.02 SUBMITTALS

- A. Refer to Technical Specifications Sections 01 3000 and 01 3400 for submittal procedures. Submit concurrently with submittals required in Section 01 0500.
- B. Submit working drawings showing locations of storage areas not indicated on the Contract Drawings.
- C. Submit descriptions of proposed methods and locations for storing and protecting products.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials required for the storage and protection of the items specified shall be durable, weatherproof and either factory finished or painted to present an appearance acceptable to the City. Storage facilities shall be uniform in appearance with similar materials used to the maximum extent possible.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS OF EXECUTION

- A. Palletize materials, products and supplies which are to be incorporated into the construction and stored off the ground. Store these items in a manner which will prevent damage and which will facilitate inspection. Leave seals, tags and labels intact and legible. Maintain access to products to allow inspection. Protect products that would be affected by adverse environmental conditions.
- B. Periodically inspect stored products to ensure that products are being stored as stipulated and that they are free from damage and deterioration.
- C. Do not remove items from storage until they are to be incorporated into the Work.
- D. The Contractor shall ensure that all protective wrappings and coverings are secure and ballasted to prevent any items from deterioration and/or subsequent dislodgment. All items on the worksite that are subject to becoming windborne shall be ballasted or anchored.

3.02 HANDLING AND TRANSPORTATION

- A. Handling

1. Avoid bending, scraping or overstressing products. Protect projecting parts by blocking with wood, by providing bracing or by other approved methods.
 2. Protect products from soiling and moisture by wrapping or by other approved means.
 3. Package small parts in containers such as boxes, crates or barrels to avoid dispersal and loss. Firmly secure an itemized list and description of contents to each container
- B. Transportation
1. Conduct the loading, transporting, unloading and storage of products so that they are kept clean and free from damage.

3.03 STORAGE

- A. Store items in a manner that shall prevent damage to the owner's property. Do not store hydraulic fluids, gasoline, liquid petroleum, gases, explosives, diesel fuel and other flammables in excavations, except one day's supply of diesel fuel may be stored in open excavations.
- B. Provide sheltered weather-tight or heated weather-tight storage as required for products subject to weather damage.
- C. Provide blocking, platforms or skids for products subject to damage by contact with the ground.
- D. All material shall be stored according to the manufacturer's recommendations. Any material that has to be stored within specified temperature or humidity ranges shall have a 24-hour continuously written recording made of the applicable condition. Should the recording show that the material was not stored within the recommended ranges the material shall be considered defective and in nonconformance. If a certification from the manufacturer's engineering design representative is provided stating that the actual variations are acceptable and will in no way harm the material or affect warranties, then the deficiency will be considered corrected.
- E. Store hazardous material separately, with all material marked with a label showing the hazard and how to treat exposure to the material.

3.04 LABELS

- A. Storage cabinets and sheds that will contain flammable substances and explosive substances shall be labeled FLAMMABLE--KEEP FIRE AWAY and NO SMOKING with conspicuous lettering and conforming to OSHA requirements.

END OF SECTION

SECTION 01 6300

SUBSTITUTIONS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Work specified in this Section consists of submitting for the approval of a different material, equipment or process than is described in the Contract Documents.
- B. If the substitution changes the scope of work, contract cost or contract time, a change order is required. As-built drawings and specifications must include all substitutions even if a change order is not issued.
- C. Reference Contract General Conditions, GC 406.

1.02 QUALITY CONTROL

- A. The substitution must provide the same quality as what it is replacing. The level of quality is defined by:
 - 1. Maintenance and operating cost
 - 2. Reliability
 - 3. Durability
 - 4. Life expectancy
 - 5. Ease of cleaning
 - 6. Ability to be upgraded as needed
 - 7. Ease of interacting with other systems or components
 - 8. Ability to be repaired
 - 9. Availability of replacement parts
 - 10. Established history of use in similar environments
 - 11. Performance equal or superior to that which it is replacing.

1.03 SUBMITTAL

- A. Refer to Technical Specifications Sections 01 3000 and 01 3400 for submittal procedures.
- B. A complete request for substitution must be made at least 60 days prior to when an order needs to be placed or a method needs to be changed.
- C. The submittal shall contain, as appropriate, detailed product data sheets for the specified items and the substitution. Samples and shop drawings shall also be submitted of the substitution as applicable. The submittal shall contain all the data required to be submitted for acceptance of the originally specified item or process.
- D. The submittal shall contain all the applicable information required in Technical Specifications Section 01 6300, paragraph 2.01 below.
- E. A signed statement as outlined in Technical Specifications Section 01 6300, paragraph

2.03.B below must accompany the Request for Substitution.

PART 2 - EXECUTION

2.01 INFORMATION

- A. Provide the following information as applicable with the Request for Substitution on the item or process that is being requested to be substituted:
1. A complete description of the item or process
 2. Utility connections including electrical, plumbing, HVAC, fire protection and controls
 3. The physical dimensions and clearances
 4. A parts list with prices
 5. Samples of color and texture
 6. Detailed cost comparisons of the substitution and the contract specified item or process
 7. Manufacturer warranties
 8. Energy consumption over a one-year period
 9. What local organization is certified to maintain the item
 10. Performance characteristics and production rates
 11. A list of any license fees or royalties that must be paid
 12. A list of all variations for the item or method specified
 13. A list of at least three other projects of similar nature to this contract where the products or methods have been in use for at least one year including telephone number and name of the person to contact at these other projects
 14. An analysis of the effect of the substitution on the schedule and contract cost and on the overall project as it relates to adjoining work.

2.02 SUBSTITUTION REQUEST

- A. The formal Request for Substitution will be evaluated by the Project Manager and the Designer of Record based on the following criteria:
1. Compatibility with the rest of the project
 2. Reliability, ease of use and maintenance
 3. Both initial and long term cost
 4. Schedule impact
 5. The willingness of the Contractor to share equally in any cost savings
 6. The ability of the item or process to meet all applicable governing regulations, rules and laws along with funding agency requirements
 7. The cost of evaluating the substitution.
- B. Based upon the above evaluation the Project Manager will make a final determination of what is in the best interest of the City and either approve, disapprove or approve as noted the requested substitution.

2.03 CONDITIONS

- A. As a condition for submitting a Request for Substitution the Contractor waives all rights to claim for extra cost or change in contract time other than those outlined in the request and approved by the Project Manager. The Contractor, by submitting a Request for Substitution, also accepts all liability for cost and scheduling impact on other contractors or the City due to the substitution.
- B. Included with the Request for Substitution shall be the following statement:
 - 1. "The substitution being submitted is equal to or superior in all respects to the contract-required item or process. All differences between the substitution and the contract-required item or process are described in this request along with all cost and scheduling data."
- C. The statement shall be signed and dated by the Contractor's Superintendent.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 6500

SYSTEM STARTUP, TESTING AND TRAINING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide complete startup, testing and operator training services to ensure operability of all electrical and electronic equipment supplied.

1.02 SUBMITTAL

- A. Refer to Technical Specifications Sections 01 3000 and 01 3400 for submittal procedures.
 - 1. Test procedures
 - 2. Test report
 - 3. Training outline.

1.03 FIELD TESTS AND ADJUSTMENTS

- A. All electrical and mechanical equipment including the interfaces with control systems and the communication system, and all alarm and operating modes for each piece of equipment shall be tested by the Contractor to the satisfaction of the Project Manager and/or the User Agency and/or Facility Operator before any facility is put into operation. Tests shall be as specified herein and shall be made to determine whether the equipment has been properly assembled, aligned and connected. Any changes, adjustments or replacements required to make the equipment operate as specified shall be carried out by the Contractor as part of the work.
 - 1. At least 7 days before the time allowed in the construction schedule for commencing startup and testing procedures, the Contractor shall submit to the Project Manager an electronic copy in a PDF format of the detailed procedures he proposes for testing and startup of all electrical and mechanical equipment. These procedures are submitted for review and acceptance.
 - 2. The Contractor's startup and testing procedures shall include detailed descriptions of all pre-operational hardware, electrical, mechanical and instrumentation used for testing work. Each control device, item of electrical, mechanical and instrumentation equipment, and all control circuits shall be considered in the testing procedures which shall be designed in a logical sequence to ensure that all equipment has been properly serviced, aligned, connected, wired, calibrated and adjusted prior to operation. Motors shall be tested in accordance with ANSI/IEEE Publication 112. The Contractor is advised that failure to observe these precautions may place the acceptability of the subject equipment in question, and he may either be required to demonstrate that the equipment has not been damaged, or replace it as determined by the Project Manager.
 - 3. Testing procedures shall be designed to duplicate as nearly as possible all conditions of operations and shall be carefully selected to ensure that the equipment is not damaged. All filters shall be in place during startup and testing. Once the Project Manager and/or the User Agency's Representative and/or Facility Operator has accepted the testing procedures, the Contractor shall provide checkout, alignment, adjustment and calibration signoff forms for each item of equipment and each system that will be used. The Contractor and the Project Manager and/or the User Agency's Representative and/or Facility Operator shall use the signoff forms in the field jointly to en-

sure that each item of electrical, mechanical and instrumentation equipment and each system has been properly installed and tested. The Contractor shall cooperate with project wide systems contractors where startup and testing is to be conducted concurrently.

4. Any special equipment needed to test equipment shall be provided to the City at no cost for a period of 30 days during startup.
- B. Before starting up the equipment, the Contractor shall properly service it and other items, which normally require service in accordance with the maintenance instructions. The Contractor shall be responsible for lubrication and maintenance of equipment and filters throughout the entire equipment "break-in" period described by the manufacturer.
1. The Contractor shall be responsible for the startup, adjustment, preliminary maintenance and checkout of all equipment and instrumentation. All systems shall be carefully checked for conformance with the design criteria.
 2. If any equipment or system does not operate as specified in the contract, the Contractor shall immediately replace or repair components until it operates properly.
 3. The Contractor shall submit a test report to the Project Manager and/or the User Agency's Representative and/or Facility Operator within 30 days after completion of the system startup period.

1.04 SYSTEMS STARTUP AND TESTING

- A. The Contractor shall be responsible for a 30-day startup period during which time all hardware, electrical and mechanical equipment, communications, alarm systems and associated devices shall be energized and operated under local and automatic controls. The Contractor shall be present during the startup period with adequate labor and support personnel to adjust equipment and troubleshoot system failures that might arise.
- B. When a piece of electrical or mechanical equipment is found to be in conflict with specific criteria, an experienced representative of the manufacturer shall make an adjustment to the item.
- C. If adjustments fail to correct the operation of a piece of equipment or fixture, the Contractor shall remove the equipment or fixture from the project site and replace it with a workable replacement that meets the specification requirements.
- D. The 30-day startup period shall commence 30 days prior to the contract completion date and shall be completed prior to final payment. If, during the startup, any system fails to operate in accordance with contract requirements, the failure shall be corrected and the startup period shall begin again. At the end of the startup period, all filters shall be replaced with new ones. The City may, at its option, provide a Commissioning Representative to observe or participate in the startup and testing of any system. The Contractor shall coordinate with the Commissioning Representative relating to scheduling, reporting, forms, methods and procedures of the startup and testing.

1.05 FINAL INSTRUCTIONS AND OPERATION TRAINING

- A. After startup and testing is completed, the Contractor shall demonstrate to the City's and/or the User Agency's Representative personnel the proper manner of operating the equipment, programming messages, making adjustments, responding to alarms and emergency signals, and maintaining the system.
- B. The Contractor shall provide on-the-job training by a suitably qualified instructor to designated personnel and shall instruct them in the operation and maintenance of the systems.

In the event qualified instructors on the Contractor's staff are not available, the Contractor shall arrange with the equipment manufacturer for such instruction at no additional cost to the City.

- C. The Contractor shall provide a syllabus to the Project Manager at least seven calendar days prior to the start of each course that outlines topics to be covered, the proposed time allotted to each topic, and the target audience of the training session (technical, casual operator, overview, etc.). The Contractor shall not commence any training courses until the syllabus has been reviewed and approved by the Project Manager.
- D. The Contractor shall videotape all training sessions and provide labeled digital video disks (DVD) to the Project Manager. The Contractor shall provide three copies of the DVD to the Project Manager in DVD+R format.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 7000

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work specified in this Section includes procedures required prior to Final Acceptance of the Work in addition to those specified in General Conditions Title 20 and Technical Specifications Section 01 7200.
- B. Reference Special Contract Conditions, Liquidated Damages, and Contract General Conditions, GC 602, GC906, GC 909, GC 910, GC 2003.

1.02 PREPARATION FOR FINAL INSPECTION

- A. Before requesting inspection for Final Acceptance of the Work by the City, inspect, clean and repair the Work as required.

1.03 FINAL INSPECTION

- A. When the Contractor considers that the Work is complete, he shall submit written certification that:
 - 1. All punch list items have been completed.
 - 2. All clean up at the project site has been accomplished.
 - 3. Work has been inspected by the Contractor for compliance with contract documents.
 - 4. Work has been completed in accordance with contract documents.
 - 5. Work is ready for final inspection by the City.
 - 6. All as-built required documents have been submitted and accepted.
 - 7. All damaged or destroyed real, personal, public or private property has been repaired or replaced.
 - 8. All operation and maintenance manuals have been submitted and accepted and all training has been completed.
- B. The Project Manager and/or the Designer of Record will inspect to verify the status of completion with reasonable promptness after receipt of such certifications. If the Project Manager and/or the Designer of Record finds incomplete or defective work:
 - 1. The Project Manager may, at the Project Manager's sole discretion, either terminate the inspection or prepare a punch list and notify the Contractor in writing, listing incomplete or defective work.
 - 2. The Contractor shall take immediate steps to remedy stated deficiencies and send a second written certification to the Project Manager that Work is complete.
 - 3. The Project Manager and the Designer of Record will then re-inspect the Work.

1.04 REINSPECTION FEES

- A. Should the Project Manager perform re-inspection due to failure of the Work to comply with the claims of status of completion made by the Contractor:

1. The Contractor shall compensate the City for such additional services at the rate identified in the Special Contract Conditions, Liquidated Damages,
2. The City shall deduct the amount of such compensation from the final payment to the Contractor.

1.05 FINAL CHANGE ORDER

- A. If required, the Project Manager will prepare a final change order, reflecting approved adjustments to the Contract sum which were not previously made by change orders including the following:
 1. Additions and deductions resulting from:
 - a. Allowances.
 - b. Final quantities for unit price items. Along with this statement shall be detailed backup for the quantities.
 - c. Deductions or corrected work.
 - d. Penalties.
 - e. Deductions for liquidated damages.
 - f. Deductions for re-inspection payments.
 - g. City resurveys required due to the Contractor.
 - h. Other adjustments.

1.06 FINAL APPLICATION FOR PAYMENT

- A. The Contractor shall submit the final application for payment in accordance with the procedures and requirements stated in the General Conditions Title 20.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 7100

CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Work specified in this section consists of maintaining a clean, orderly, hazard free worksite during construction, and final cleaning for the City's Final Acceptance. Failure to maintain the worksite will be grounds for withholding monthly payments until corrected to the satisfaction of the Project Manager and/or. the Project Inspector.
- B. Reference Contract General Conditions, GC 325, GC 803, GC 2001

1.02 JOB CONDITIONS

A. Safety Requirements

- 1. Maintain the worksite in a neat, orderly and hazard-free manner in conformance with all federal, state and local rules, codes, regulations and orders, including all OSHA requirements, until Final Acceptance of the Work. Keep catwalks, underground structures, worksite walks, sidewalks, roadways and streets, along with public and private walkways adjacent to the worksite, free from hazards caused by construction activities. Inspect those facilities regularly for hazardous conditions caused by construction activities.

B. Hazards Control

- 1. Store volatile wastes in covered metal containers and remove those wastes from worksite daily.
- 2. Do not accumulate wastes which create hazardous conditions.
- 3. If volatile and noxious substances are being used in spaces that are not naturally ventilated, provide artificial ventilation.
- 4. Hazard controls shall conform to the applicable federal, state and local rules and regulations.
- 5. Provide appropriate waste receptacles in all areas in which employees are working. Waste receptacles shall be kept covered at all times. All materials on site shall be anchored and covered to prevent any objects from becoming wind-borne.
- 6. Should an incident involving a spill or other encounter of a non-contained hazardous material occur on site, the Contractor shall immediately call 311 and ask to have Environmental Health notified of the event and also immediately notify the City Project Manager.

C. Access

- 1. Maintain the worksite to permit access by other City contractors as required and to allow access by emergency personnel.

1.03 SUBMITTALS

PART 2 - PRODUCTS

2.01 CLEANING MATERIALS

- A. Utilize the type of cleaning materials recommended by the manufacturer for the surfaces to be cleaned.
- B. Maintain current Material Safety Data Sheets (MSDS) on site for all chemicals.
- C. Ensure proper disposal of all wastes generated from the use of these materials. Must ensure compliance with all environmental regulations.

PART 3 - EXECUTION

3.01 INTERIM CLEANING

- A. Clean the worksite every shift/workday for the duration of the construction contract. Maintain structures, grounds, storage areas and other areas of worksite, including public and private properties immediately adjacent to worksite, free from accumulations of waste materials caused by construction operations. Place waste materials in covered metal containers. All hard concrete, steel, wood and finished walking surfaces shall be swept clean daily.
- B. Remove or secure loose material on open decks and on other exposed surfaces at the end of each workday or more often in a manner that will maintain the worksite hazard free. Secure material in a manner that will prevent dislodgment by wind and other forces.
- C. Sprinkle waste materials with water or acceptable chemical palliative to prevent blowing of dust.
- D. Promptly empty waste containers when they become full and legally dispose of the contents at dumping areas off the City's property.
- E. Control the handling of waste materials. Do not permit materials to be dropped or thrown from structures.
- F. Immediately remove spillage of construction related materials from haul routes, work site, private property or public rights of way.
- G. Clean only when dust and other contaminants will not precipitate upon newly painted surfaces.
- H. Cleaning shall be done in accordance with manufacturer's recommendation.
- I. Cleaning shall be done in a manner and using such materials as to not damage the Work.
- J. Clean areas prior to painting or applying adhesive.
- K. Clean all heating and cooling systems prior to operations. If the contractor is allowed to use the heating and cooling system it shall be cleaned prior to testing.
- L. Clean all areas that will be concealed prior to concealment.

3.02 FINAL CLEANING

- A. Inspect interior and exterior surfaces, including concealed spaces, in preparation for completion and acceptance.
- B. Remove dirt, dust, litter, corrosion, solvents, discursive paint, stains and extraneous markings.
- C. Remove surplus materials, except those materials intended for maintenance.
- D. Remove all tools, appliances, equipment and temporary facilities used in the construction.
- E. Remove detachable labels and tags. File them with the manufacturer's specifications for that specific material for the City's records.
- F. Repair damaged materials to the specified finish or remove and replace.
- G. After all trades have completed their work and just before Final Acceptance, all catch basins, manholes, drains, strainers and filters shall be cleaned; roadway, driveways, floors, steps and walks shall be swept. Interior building areas shall be vacuum cleaned and mopped.
- H. Final cleanup applies to all areas within and adjacent to the site.

END OF SECTION

SECTION 01 7200

CONTRACT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Work specified in this Section consists of maintaining, marking, recording and submitting contract record documents which include shop drawings, warranties, contract documents and contractor records.
- B. Reference Contract General Conditions, GC 324

1.02 RELATED DOCUMENTS

- A. Technical Specifications Section 01 4000 – “Contractor Quality Control”
- B. Technical Specifications Section 01 4200 – “Quality Assurance”

1.03 SUBMITTALS

- A. Each submittal of record documents shall contain the following information:
 - 1. Date
 - 2. Project title, address and numbers
 - 3. Contractor's name and address
 - 4. Title and number of each record document
 - 5. Certification that each document as submitted is complete and accurate
 - 6. Signature of the Contractor or his authorized representative.
- B. At the completion of this contract, deliver all record documents including the following:
 - 1. As-built shop drawings, diagrams, illustrations, schedules, charts, brochures and other similar data
 - 2. Warranties, guarantees and bonds
 - 3. Contract documents
 - 4. Contractor records.

1.04 QUALITY CONTROL

PART 2 - RECORD DOCUMENTS SHALL BE PREPARED TO A HIGH STANDARD OF QUALITY PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 MAINTENANCE OF DOCUMENTS

- A. The Contractor shall maintain at the worksite on a current basis one record copy of all drawings, specifications, addenda, change orders, approved shop drawings, working drawings, product data and samples in good order and marked currently to record all changes made during construction.

- B. Maintain at the field office one copy of the following record documents:
1. Contract Documents
 - a. Contract drawings with all clarifications, requests for information, directives, changes and as-built conditions clearly posted.
 - b. Contract specifications with all clarifications, requests for information, changes, directives and record of manufacturer actually used along with product trade name..
 - c. One set of drawings to record the following:
 - 1) Horizontal and vertical location of underground utilities affected by the Work.
 - 2) Location of internal utilities; include valves, controls, conduit, duct work, switches, pressure reducers, size reducers, transitions, crosses, tees, filters, motors, heaters, dampers, regulators, safety devices, sensors, access doors and appurtenances that are concealed in the construction shall be shown with dimensions given from a visible and recognizable reference to the item being located in all three dimensions. The drawing shall also reference the applicable submittal for the item being located.
 - 3) Field changes of dimensions and details including as-built elevations and location (station and offset).
 - 4) Details not on original contract drawings but obtained through requests for information or by other communications with the City or Designer of Record.
 2. Contractor Records
 - a. Daily QC Reports
 - b. Certificates of compliance for materials used in construction
 - c. Nonconformance Reports (NCRs)
 - d. Remedial Action Requests (RARs)
 - e. Completed inspection list
 - f. Inspection and test reports
 - g. Test procedures
 - h. Approved submittals
 - i. Material and equipment storage records
 - j. Erosion, sediment, hazardous and quality plans
 - k. Hazardous material records
 - l. First report of injuries

3.02 RECORDING

- A. Keep record documents current daily.
- B. Legibly mark copies of the contract drawings to record actual construction.
- C. Legibly mark up each Section of the technical specifications and contract drawings to record:
 1. Changes made by change orders, requests for information, substitutions and variations approved by submittals.

3.03 DOCUMENT MAINTENANCE

- A. Maintain Documents in a clean, dry and legible condition, which shall be turned over to the City prior to final acceptance.
- B. Do not use record documents for construction purposes.

- C. Make documents available for inspection by the Project Manager and any others having jurisdiction.

3.04 MONTHLY REVIEW

- A. The Project Manager or his designated representative can inspect the record documents to ensure that they are being maintained and contain the most current correct data with particular attention to as-built drawings.
- B. If, the Project Manager determines that the documents are not being maintained and kept current as to as-built conditions, an amount may be withheld from the payment request and deducted from the contract value to cover the City's cost of collecting and recording the as-built contract data. This cost will be determined on the basis of \$75.00 per man-hour of effort.

END OF SECTION

SECTION 01 7300

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Work specified in this Section consists of preparing and submitting operation and maintenance data for mechanical, electrical and other specified equipment.

1.02 SUBMITTALS

- A. Refer to Technical Specifications Section 01 3000 and 01 3400 for submittal procedures.
- B. Submit one (1) electronic copy and two (2) bound hard copy of the proposed Operation and Maintenance Data Manual format including a table of contents not less than 30 days prior to acceptance tests and final inspection.
- C. Submit one (1) electronic copy and two (2) bound hard copy of Operation and Maintenance Data Manual prior to final payment These copies shall incorporate any comments made on the previous submittals, along with final readings on all settings and gauges taken while the system is in fully satisfactory operation, final test and balance reports, and final sequence of operations standards.

1.03 CONTINUOUS UPDATING PROGRAM

- A. Furnish one electronic copy of the Contractor's letter indicating that suppliers have been notified to provide updated operation and maintenance data, service bulletins and other information pertinent to the equipment, as it becomes available.
 - 1. Contractor to verify with Project Manager to which Facility Operator these notices are to be sent. All updates after Final Acceptance are to be sent to a Facility Operator with only a copy of the transmittal to the Project Manger.

PART 2 - PRODUCTS

- A. The following products are the requirements of hard copies:
- B. PAPER SIZE 8-½ inches x 11 inches.
- C. PAPER White bond, at least 20 pound weight.
- D. TEXT typewritten.
- E. PRINTED DATA Manufacturer's catalog cuts, brochures, operation and maintenance data. Clear reproductions thereof will be acceptable. If this data is in color, all final manuals must contain color data.
- F. DRAWINGS 8-½ inches x 11 inches, bound with the text. Larger drawings are acceptable provided they are folded to fit into a pocket inside the rear cover of the manual. Reinforce edges of large drawings.
- G. PRINTS OF DRAWINGS black ink on white paper, sharp in detail and suitable for making

reproductions.

- H. FLYSHEETS Separate each portion of the manual with colored, neatly prepared flysheets briefly describing the contents of the ensuing portion.
- I. COVERS Provide 40 to 50 mil, clear plastic, front and plain back covers for each manual. The front covers shall contain the information required in paragraph 3.02 below.
- J. BINDINGS Conceal the binding mechanism inside the manual; lockable 3 ring binders shall be provided.

PART 3 - EXECUTION

3.01 COVER

- A. Include the following information on the front cover and on the inside cover sheet:
 - 1. OPERATION AND MAINTENANCE INSTRUCTIONS
 - 2. (TITLE OF STRUCTURE OR FACILITY AND ADDRESS)
 - 3. (TITLE AND NUMBER OF CONTRACT)
 - 4. (CONTRACTOR'S NAME AND ADDRESS)
 - 5. (GENERAL SUBJECT OF THE MANUAL)
 - 6. (Leave spaces for signatures of the City representatives and acceptance date)

3.02 CONTENTS OF THE MANUAL

- A. An index of all volumes in each volume of multiple volume systems.
- B. An index in front of each volume. List and combine the literature for each system in the sequence of operation.
- C. Name, address and telephone numbers of Contractor, suppliers and installers along with the manufacturer's order number and description of the order.
- D. Name, address and telephone numbers of manufacturer's nearest service representatives.
- E. Name, address and telephone number of nearest parts vendor and service agency.
- F. Copy of guaranties and warranties issued to, and executed in the name of, the City.
- G. Anticipated date City assumes responsibility for maintenance.
- H. Description of system and component parts including theory of operation.
- I. Pre operation check or inspection list.
- J. Procedures for starting, operating and stopping equipment.
- K. Post operation check or shutdown list.
- L. Inspection and adjustment procedures.

- M. Troubleshooting and fault isolation procedures for on-site level of repair.
- N. Emergency operating instructions.
- O. Accepted test data.
- P. Maintenance schedules and procedures.
- Q. Test procedures to verify the adequacy of repairs.
- R. One copy of each wiring diagram.
- S. One copy of each piping diagram.
- T. Location where all measurements are to be made.
- U. One copy of each duct diagram.
- V. One copy of control diagram.
- W. One copy of each accepted shop drawing.
- X. One copy of software programs imputable or changeable on site.
- Y. Manufacturer's parts list with catalog names, numbers and illustrations.
- Z. A list of components which are replaceable by the City.
- AA. An exploded view of each piece of the equipment with part designations.
- BB. List of manufacturer's recommended spare parts, current prices and recommended quantities for two years of operation.
- CC. List of special tools and test equipment required for the operation, maintenance, adjustment, testing and repair of the equipment, instruments and components.
- DD. Scale and corrosion control procedures.
- EE. Disassembly and re-assembly instructions.
- FF. Troubleshooting and repair instructions.
- GG. Calibration procedures.
- HH. Ordering information.
- II. Training course material used to train City staff, including DVD, slides and other presentation material.
- JJ. Inventory of all attic stock provided per the Technical Specifications and the specific location to which this was delivered.

END OF SECTION

SECTION 017320

CUTTING AND PATCHING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Technical Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for cutting and patching.
- B. Cutting and patching includes cutting existing construction to provide for installation or performance of other Work, and subsequent fitting and patching required to restore surfaces to original conditions.
- C. Demolition of selected portions of the building for alterations is included in Technical Specification Section 017360, "Selective Demolition."

1.03 SUBMITTALS

- A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a description of proposed procedures well in advance of the time cutting and patching will be performed and request approval to proceed from Project Manager and/or Designer. Include the following information, as applicable, in the proposal:
 - (1) Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
 - (2) Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
 - (3) List products to be used and firms or entities that will perform Work.
 - (4) List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
 - (5) Approval by the Project Manager and/or Designer to proceed with cutting and patching does not waive the Designer's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

1.04 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
 - (1) Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:

- (a) Foundation construction.
 - (b) Bearing walls.
 - (c) Wood beams.
- (2) Refer to General Contract Conditions Section 316 Cutting and Patching the Work.
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.
 - (1) Obtain approval from the Project Manager and/or Designer of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
 - (a) Primary operational systems and equipment.
 - (b) Water, moisture, or vapor barriers.
 - (c) Roofing and flashings.
 - (d) Control systems.
 - (e) Electrical wiring systems.
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Designer's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 EXECUTION

3.01 INSPECTION

- A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

3.02 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage.

- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.03 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
 - (1) Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
 - (1) In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Do not cut holes larger than necessary. Temporarily cover openings when not in use.
 - (2) To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 - (3) Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
 - (4) Comply with requirements of applicable Technical Specification Sections of Division-2 where cutting and patching requires excavating and backfilling.
 - (5) By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- C. Perform all patching with durable seams that are not discernable from normal viewing distances. Comply with specified tolerances.
 - (1) Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
 - (2) Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3.04 CLEANING

- A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION

SECTION 017360

SELECTIVE DEMOLITION

1.01 GENERAL

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Technical Specification Sections, apply to this Section.

1.03 SUMMARY

- A. This Section requires the selective removal and subsequent offsite disposal of the following:
 - (1) Portions of existing building indicated on drawings and as required to accommodate the restoration and rehabilitation of the building.
 - (2) Removal of items indicated "remove."
 - (3) Removal and protection of items indicated "remove," "salvage" or "relocate."
- B. Removal work specified elsewhere:
 - (1) Cutting and patching is specified in Technical Specification 017320.
- C. Related work specified elsewhere:
 - (1) Remodeling construction work and patching are included within the respective sections of specifications, including removal of materials for reuse and incorporation into remodeling.

1.04 SUBMITTALS

- A. Schedule indicating proposed sequence of operations for selective demolition work to Project Manager for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.
- B. Photograph existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. File with Project Manager prior to start of work.

1.05 JOB CONDITIONS

- A. Condition of Structures: City assumes no responsibility for actual condition of items to be removed.
 - (1) Conditions existing at time of inspection for bidding purposes will be maintained by City insofar as practicable. However, minor variations within structure may occur by City's removal and salvage operations prior to start of selective demolition work.

B. Partial Demolition and Removal: Items indicated to be removed but of salvageable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.

(1) Storage or sale of removed items on site will not be permitted.

C. Protections: Provide temporary barricades and other forms of protection to protect City's personnel and general public from injury due to selective demolition work.

(1) Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.

(2) Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.

(3) Protect floors with suitable coverings when necessary.

(4) Construct temporary dustproof partitions where required to separate areas where extensive dirt or dust operations are performed.

(5) Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.

(6) Remove protections at completion of work.

D. Damages: Promptly repair damages caused to adjacent facilities by demolition work.

E. Flame Cutting: Do not use cutting torches without obtaining prior permission from the Project Manager and/or Designer.

(1) Where permission is granted, do not proceed until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.

F. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

(1) Maintain fire protection services during selective demolition operations.

G. Environmental Controls: Use necessary and appropriate methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 INSPECTION

A. Prior to commencing with selective demolition work, inspect areas in which work will be performed. Photograph existing conditions of structure surfaces, equipment or surrounding

properties which could be misconstrued as damage resulting from selective demolition work; file with Designer prior to starting work.

3.02 PREPARATION

- A. General: Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.
 - (1) Cover and protect City's property from soilage or damage when demolition work is performed in areas where such items have not been removed.
 - (2) Locate, identify, stub off, and disconnect utility services that are not indicated to remain.
 - (a) Provide bypass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of 72 hours advance notice to Project Manager if shutdown of service is necessary during changeover.

3.03 DEMOLITION

- A. General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.
 - (1) Remove concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.
 - (2) Promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.
 - (3) Provide services for effective dust control.
- B. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Designer in written, accurate detail. Pending receipt of directive from Designer, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

3.04 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off site. Coordinate with City all building materials removed from the building for on-site disposal.
 - (1) If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution. Notify Project Manager and obtain specific direction regarding the suspected hazardous material from the City's Environmental Health Division.
 - (2) Burning of removed materials is not permitted on project site or elsewhere within the City and County of Denver.

3.05 CLEANUP AND REPAIR

- A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean.
 - (1) Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start of demolition operations. Repair and clean adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION

SECTION 01 7400

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Work specified in this Section consists of preparing and submitting warranties and bonds required by these specifications.
- B. Reference Contract General Conditions: GC 111, GC 1501, GC 1502, GC 1503, GC 1801, GC 1802.

1.02 SUBMITTALS

- A. Refer to Technical Specifications Section 01 3000 for submittal procedures.
- B. Submit executed warranties and bonds.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 WARRANTIES AND BONDS

- A. Execute the warranties and bonds required by the Contract Documents. Prepare and submit all bonds on the forms provided by the City. Deliver the executed warranties in electronic and hard copy format.
- B. Provide warranties or bonds for the materials, labor and time period set forth in the sections of these specifications requiring such documents. All warranties shall be in accordance with the Contract General Conditions. Refer to the Technical Specifications for all specific items requiring longer warranty periods.
- C. Provide all warranties and bonds that the manufacturer or supplier furnishes at no additional cost in regular commercial trade.

END OF SECTION

SECTION 017419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Technical Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous demolition waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements, if applicable:
 - 1. Division 02 Section "Selective Structure Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
 - 2. Division 31 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.03 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.04 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:

- a. Asphalt paving.
- b. Concrete.
- c. Concrete reinforcing steel.
- d. Terra cotta/plaster walls.
- e. Structural and miscellaneous steel.
- f. Rough hardware.
- g. Insulation.
- h. Doors and frames.
- i. Door hardware.
- j. Windows.
- k. Glazing.
- l. Gypsum board.
- m. Equipment.
- n. Cabinets.
- o. Piping.
- p. Supports and hangers.
- q. Valves.
- r. Mechanical equipment.
- s. Refrigerants.
- t. Electrical conduit.
- u. Copper wiring.
- v. Lighting fixtures.
- w. Lamps.
- x. Ballasts.
- y. Electrical devices.

2. Construction Waste:

- a. Lumber.
- b. Wood sheet materials.
- c. Metals.
- d. Insulation.
- e. Carpet.
- f. Metal studs.
- g. Gypsum board.
- h. Piping.
- i. Electrical conduit.
- j. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - 1) Paper.
 - 2) Cardboard.
 - 3) Boxes.
 - 4) Plastic sheet and film.
 - 5) Polystyrene packaging.

- 6) Wood crates.
- 7) Plastic pails.

1.05 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 7 days of date established for the Notice to Proceed.

1.06 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
 1. Material category.
 2. Generation point of waste.
 3. Total quantity of waste in tons.
 4. Quantity of waste salvaged, both estimated and actual in tons.
 5. Quantity of waste recycled, both estimated and actual in tons.
 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. LEED Submittal: (Not applicable)
- H. Qualification Data: For refrigerant recovery technician.
- I. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.07 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: General Contractor with a record of successful waste management coordination of projects with similar requirements.
- B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Technical Specification Section 012000 "Project Meetings." Meeting shall include contractors affected by the Waste Management Plan. Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

1.08 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification. Include separate sections in plan to distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: (Not applicable)
- D. Cost/Revenue Analysis: (Not applicable)

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

- B. General Contractor's Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on appropriate separation, handling, and recycling to be used by all parties and proper waste management procedures, as appropriate for the Work occurring at Project site.
 - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with Technical Specification Section 01500 "Temporary Facilities" for controlling dust and dirt, environmental protection, and noise control.
- E. Waste Management in Historic Zones or Areas: Hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by 12 inches or more.

3.02 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 - 3. Store items in a secure area until installation.
 - 4. Protect items from damage during transport and storage.
 - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Sale and Donation: Not permitted on Project site.
- C. Salvaged Items for Owner's Use: (Not applicable)
- D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- E. Lighting Fixtures: Separate lamps by type and protect from breakage.
- F. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.03 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following:

C. RECYCLING RECEIVERS AND PROCESSORS				
D. CO Resource E. Management	F. 400 Marriel Avenue G. Carbondale, CO 81623	H. (970) 963- 8900	I. George MacDonal d	
J. Oxford Recycling	K. 2400 W. Oxford Avenue L. Englewood, CO 80110	M. (303) 762- 1160	N. John Kent	
O. Allied Waste	P. 10303 E. Dry Creek Rd #250 Q. Englewood, CO 80112	R. (720) 895- 1500	S. Bill Kich	
T. Waste-Not	U. 1065 Poplar Street V. Loveland, CO 80534	W. (970) 669- 9912	X. Gary Gettman	
Y. Bunting Disposal	Z. 3315 State Street AA. Evans, CO 80620	BB. (970) 339- 3023	CC. Bryan Bunting	
DD. Phoenix Recycling	EE. 2501 Delwood Avenue FF. Durango, CO 81301	GG. (970) 375- 1300	HH. Mark Thompso n	
II. Waste Chasers	JJ. 19 Oak Avenue KK. Eaton, CO 80615	LL. (970) 454- 2497	MM. Jason Hawk	
NN. Colorado All Waste	OO. 7247 E. County Line Rd	QQ. (303) 702- 9955	RR. Majori McDonald	

	PP. Longmont, CO 80504		
SS. Patch Construction	TT. 12655 State Hwy 67 UU. Florence, CO 81226	VV. (719) 784- 6236	WW. David Patch Jr.
XX. Pueblo Disposal	YY. 28900 E. Hwy 96 ZZ. Pueblo, CO 81001	AAA. (719) 948- 0047	BBB.
CCC. Construction Endeavors	DDD. 2255 E. Las Vegas Rd EEE. Colorado Springs, CO	FFF. (303) 375- 0785	GGG.

HHH. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

III. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.04 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 1. Pulverize concrete to maximum 4-inch size.
- C. Masonry (Terra Cotta): Remove anchors and ties from masonry and sort with other metals.

1. Pulverize masonry to maximum 4-inch size.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, panel products, and treated wood materials.
- E. Metals: Separate metals by type.
1. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- F. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- G. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- H. Conduit: Reduce conduit to straight lengths and store by type and size.

3.05 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 2. Polystyrene Packaging: Separate and bag materials.
 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees on-site.
1. Comply with requirements in Division 32 Section "Plants" for use of chipped organic waste as organic mulch.
- C. Wood Materials:
1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 - a. Comply with requirements in Division 32 Section "Plants." for use of clean sawdust as organic mulch.
- D. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.06 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.
- D. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.
- B. Cast-in-place concrete includes the following:
 - (1) Slabs-on-grade.
 - (2) Foundation walls and footings.
 - (3) Miscellaneous concrete.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, vapor barriers, joint systems, curing compounds, and others as requested by Architect.
- C. Shop drawings for reinforcement, prepared by competent structural detailer/draftsman for fabrication, bending, and placement of concrete reinforcement. Comply with ACI SP-66 (88), "ACI Detailing Manual," showing placement plan, sections, elevations, bar schedules, stirrup spacing, diagrams of bent bars, and arrangement and support of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- D. Samples of materials as requested by Architect, including names, sources, and descriptions, as follows:
 - (1) Fibrous reinforcement.
- E. Laboratory test reports for concrete materials and mix design test.
- F. Materials certificates in lieu of materials laboratory test reports when permitted by Architect. Materials certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

- G. Recycled Content: Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost) of the total value of the materials.
- H. Regional Materials: Use products that have been extracted, harvested or recovered, as well as manufactured within 500 miles of the project site for a minimum of 10% (based on cost) of the total materials value.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - (1) Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:
 - (1) ACI 301, "Specifications for Structural Concrete for Buildings."
 - (2) ACI 318, "Building Code Requirements for Reinforced Concrete."
 - (3) Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."
- F. Concrete Testing Service: Owner will employ a testing laboratory to perform material evaluation tests.
- G. Materials and installed work may require testing and retesting at any time during progress of work. Original test will be paid for by the Owner. Retesting of rejected materials, shall be done at Contractor's expense.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Exposed-Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other paneled materials to provide as-cast surfaces. Furnish in largest sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form materials with sufficient thickness to withstand pressure of placed concrete without bow or deflection beyond allowable tolerances.
- B. Forms for Unexposed Finish Concrete: Form concrete surfaces that will be unexposed in finish structure with plywood, lumber, metal, or other acceptable material. Use lumber that is dressed on at least two edges and one side for a tight fit.
- C. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 mg/l volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- D. Form Ties: Provide factory-fabricated, adjustable-length, removable or snap-off metal or plastic form ties, designed to prevent deflection and to prevent spalling concrete surfaces when removed.
 - (1) Provide ties designed so that the portion remaining within the concrete after removal of exterior parts is at least 1 inch from the outer surface.
- E. Inserts: Provide metal inserts for anchorage of materials or equipment to concrete construction not supplied by other trades.

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire-bar-type supports complying with CRSI specifications.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I/II.
 - (1) Use one brand of cement throughout project unless otherwise acceptable to Architect.
- B. Fly Ash: ASTM C 618, Type C or Type F.
 - (1) Limit use of fly ash to not exceed 20% of cement content by weight.
- C. Normal Weight Aggregates: ASTM C 33 and as herein specified. Provide aggregates from a single source for exposed concrete.

- (1) For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.
 - (2) Local aggregates not complying with ASTM C 33 but that special tests or actual service have shown to produce concrete of adequate strength and durability may be used when acceptable to Architect.
- D. Water: Drinkable.
- E. Admixtures, General: Provide admixtures for concrete that contain not more than 0.05 percent chloride ions.
- F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- G. Water-Reducing Admixture: ASTM C 494, Type A.
- H. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G.
- I. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.
- J. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.
- K. Fibrous Reinforcement: Engineered polypropylene fibers designed for secondary reinforcement of concrete slabs, and complying with ASTM C 1116.

2.4 RELATED MATERIALS

- A. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
- (1) Waterproof paper.
 - (2) Polyethylene film.
 - (3) Polyethylene-coated burlap.
- B. Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal.
- C. Non-Shrink Grout: CRD-C621, factory pre-mixed, non-metallic grout.
- D. Patching Material: For patching minor defects in finished concrete work in accordance with ACI 301, use one of the following:
- (1) "All-Crete"; Concrete Products Inc.
 - (2) "Burke Stone"; The Burke Company.
 - (3) "SikaTop 121"; Sika Corporation.
 - (4) "Thorite"; Thoro System Products.

- E. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material "Type," "Grade," and "Class" to suit project requirements.
 - (1) Products: Subject to compliance with requirements, provide one of the following:
 - (a) "Burke Epoxy M.V.," The Burke Co.
 - (b) "Sikadur 32 Hi-Mod," Sika Corp.

2.5 FORMWORK DESIGN

- A. General: Design, brace, and maintain formwork so that it will safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry loads to the ground only by the formwork system and in-place construction that has attained adequate strength.
- B. Design forms and falsework to include values of live load, dead load, weight of moving equipment operated on formwork lateral loads, and other factors pertinent to safety of structure during construction.
- C. Design formwork for easy removal without impact, shock, or damage to cast-in-place concrete and adjacent materials.
- D. Fabricate formwork to prevent cement paste from leaking while placing concrete. Solidly butt joints and provide backup material at joint to prevent leakage and fins.

2.6 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method is used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.
- B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until proposed mix designs have been reviewed by Architect. Review of the mix design by the Architect in no way relieves the supplier of the responsibility for the performance of the concrete.
- C. Design mixes to provide normal weight concrete as indicated on Structural Drawings.
- D. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as indicated on Structural Drawings.
- E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for

revised mix design and strength results must be submitted to and accepted by Architect before using in work.

2.7 ADMIXTURES

- A. Use water-reducing admixture or high-range water-reducing admixture (Superplasticizer) in concrete as required for placement and workability.
- B. Use nonchloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F.
- C. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content indicated, with a tolerance of plus or minus 1-1/2 percent.
- D. Use admixtures for water reduction and set control in strict compliance with manufacturer's directions.
- E. Fibrous Reinforcement: Collated, fibrillated polypropylene fibers for secondary reinforcement of concrete, and complying with ASTM C 1116.

2.8 CONCRETE MIXING

- A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as specified.
 - (1) During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required.
 - (2) When air temperature is between 85 deg F and 90 deg F reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F reduce mixing and delivery time to 60 minutes.
 - (3) Discharge all concrete transmitted in a truck mixer, agitator or other transportation device not later than 1-1/2 hours or 300 revolutions of the drum after mixing water is added, whichever is earliest.

PART 3 - EXECUTION

3.1 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.

- D. Place reinforcement to obtain minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

3.2 JOINTS

- A. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Architect.
- B. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as otherwise indicated. Do not continue reinforcement through sides of strip placements.
- C. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

3.3 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.
- B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to obtain required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.4 PREPARATION OF FORM SURFACES

- A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before reinforcement is placed.
- B. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- C. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.5 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work.
- B. General: Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.
- C. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide

construction joints as herein specified. Deposit concrete to avoid segregation at its final location.

D. **Placing Concrete Slabs:** Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

- (1) Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
- (2) Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- (3) Maintain reinforcing in proper position during concrete placement.

E. **Cold-Weather Placing:** Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

- (1) When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
- (2) Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
- (3) Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

F. **Hot-Weather Placing:** When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

- (1) Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
- (2) Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
- (3) Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.
- (4) Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, when acceptable to Architect.

3.6 FINISH OF FORMED SURFACES

- A. Rough Form Finish: For formed concrete surfaces not exposed to view in the finish work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, painting, or other similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.7 MONOLITHIC SLAB FINISHES

- A. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, and as otherwise indicated.
 - (1) After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of Ff 18 - Fl 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- B. Trowel Finish: Apply trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.
 - (1) After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of Ff 20 - Fl 17. Grind smooth surface defects that would telegraph through applied floor covering system.

- C. Nonslip Broom Finish: Apply nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - (1) Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.8 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.9 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- C. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, or by combinations thereof, as required by ACI 301.
- D. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces, by application of appropriate curing method.
- E. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

3.10 REMOVAL OF FORMS

- A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

3.11 REUSE OF FORMS

- A. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces except as acceptable to Architect.

3.12 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Patch defective areas in accordance with ACI 301 and as follows:
 - (1) Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.
 - (2) Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar before bonding compound has dried.
 - (3) For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry-pack mortar, or precast cement cone plugs secured in place with bonding agent.
 - (1) Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
- C. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having required slope.
 - (1) Repair finished unformed surfaces that contain defects that affect durability of concrete. Surface defects, as such, include crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through

nonreinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.

- (2) Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
 - (3) Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with patching compound. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.
 - (4) Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- D. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.
- E. Repair methods not specified above may be used, subject to acceptance of Architect.

3.13 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. General: The Owner will employ a testing laboratory to perform tests and to submit test reports.
- B. Sampling and testing for quality control during placement of concrete may include the following, as directed by Architect.
- C. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94. Sample at point of placement.
- (1) Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
 - (2) Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
 - (3) Concrete Temperature: Test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and each time a set of compression test specimens is made.
 - (4) Compression Test Specimen: ASTM C 31; one set of 6 standard cylinders for each compressive strength test, unless otherwise directed. Mold and

store cylinders for laboratory-cured test specimens except when field-cure test specimens are required.

- (5) Compressive Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yds. plus additional sets for every 50 cu. yds. more than the first 25 cu. yd. of each concrete class placed in any one day; two specimens tested at 7 days, two specimens tested at 28 days, and two specimens retained in reserve for later testing if required.
 - (6) When frequency of testing will provide fewer than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
 - (7) When total quantity of a given class of concrete is less than 50 cu. yds., Architect may waive strength test if adequate evidence of satisfactory strength is provided.
 - (8) When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
 - (9) Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.
- D. Test results will be reported in writing to Architect, Structural Engineer, Ready-Mix Producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- F. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

END OF SECTION 03 3000

SECTION 042000-UNIT MASONRY

PART 1-GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

- (1) Concrete masonry units (CMUs).
- (2) Mortar and grout.
- (3) Steel reinforcing bars.
- (4) Masonry joint reinforcement.
- (5) Ties and anchors.
- (6) Embedded flashing.
- (7) Miscellaneous masonry accessories.

B. Related Sections:

- (1) Division 05 Section "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
- (2) Division 05 Section "Metal Fabrications" for furnishing steel lintels for unit masonry.
- (3) Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.
- (4) Division 07 Section "Joint Sealants" for sealing control and expansion joints in unit masonry.
- (5) Division 09 Section "Coating Systems for Exterior Masonry" for the sealing the site flood wall.
- (6) Division 09 Section "Painting" for the painting of concrete masonry units.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

- (1) Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

- (1) Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
- (2) Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength.
- (3) Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.
- (4) Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:

- (1) Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
- (2) Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
- (3) Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

- (1) Decorative CMUs, in the form of small-scale units.
- (2) Colored mortar.
- (3) Weep holes/vents.

- D. Samples for Verification: For each type and color of the following:
 - (1) Decorative CMUs.
 - (2) Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
 - (3) Weep holes and vents.
 - (4) Accessories embedded in masonry.
- E. Qualification Data: For testing agency.
- F. Material Certificates: For each type and size of the following:
 - (1) Masonry units.
 - (a) Include material test reports substantiating compliance with requirements.
 - (2) Cementitious materials. Include brand, type, and name of manufacturer.
 - (3) Pre-blended, dry mortar mixes. Include description of type and proportions of ingredients.
 - (4) Grout mixes. Include description of type and proportions of ingredients.
 - (5) Reinforcing bars.
 - (6) Joint reinforcement.
 - (7) Anchors, ties, and metal accessories.
- G. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - (1) Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 - (2) Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- H. Statement of Comprehensive strength of Measures.
- I. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- D. Mockups: Before installing unit masonry, build mockup to demonstrate aesthetic effects and qualities of materials and execution. Build mockup to comply with the following requirements, using materials indicated for the completed Work:
 - (1) Build mockups for typical infill wall in sizes approximately 36 inches long by 36 inches high by full thickness, including face and backup wythes and accessories.
 - (2) Build mockups for flood barrier wall in size identified on details on sheet A-100. Flood barrier mock up to be fully coated in modified waterbourne acrylate coating.
 - (3) Clean exposed faces of mockups with masonry cleaner as indicated.
 - (4) Protect accepted mockups from the elements with weather-resistant membrane.
 - (5) Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - (a) Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - (b) Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
- E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - (1) Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
 - (2) Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - (1) Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - (2) Protect sills, ledges, and projections from mortar droppings.
 - (3) Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - (4) Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - (1) Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
 - (2) Cold-Weather Construction: When the ambient temperature is within the limited indicated, use the following procedures:

- (a) 40 to 32 deg F: Heat mixing water or sand produce mortar temperature between 40 and 120 deg F.
 - (b) 32 to 25 deg F: Heat mixing water and sand to produce mortar temperature between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry.
 - (c) 25 to 20 deg F: Heat mixing water and sand to produce mortar temperature between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F if grouting. Use heat on both sides of walls under construction.
 - (d) 20 deg F and Below: Heat mixing water and sand to produce mortar temperature between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F. Provide enclosures and use heat on both sides of walls under construction to maintain temperatures above 32 deg F within enclosures.
- (3) Cold-Weather Protection: When the mean daily temperature is within the limits indicated, provide the following protection:
- (a) 40 to 25 deg F: Cover masonry with weather resistant membrane for 48 hours after construction.
 - (b) 25 to 20 deg F: Cover masonry with insulating blankets or provide enclosure and heat for 48 hours after construction to prevent freezing. Install wind breaks when wind velocity exceeds 15 mph.
 - (c) 20 deg F and Below: Provide enclosures and heat to maintain temperature 32 deg F within the enclosure for 48 hours after construction.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2-PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according

to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Recycled Content of Concrete Materials: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 20 percent.
- B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - (1) Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - (2) Provide bullnose units for outside corners in interior conditions unless otherwise indicated. Bullnose block shall be formed without lines at the bullnose or lines shall be ground off prior to block filling.
- C. Concrete Masonry Units: ASTM C 90.
 - (1) Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi (19.3 MPa).
 - (2) Weight Classification: Normal weight, unless otherwise indicated.
 - (3) Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 - (4) Exposed Faces: Refer to Drawings for colors and patterns.
 - (a) 8 x 8 x 16 standard grey fluted block to match existing.
 - (b) 8 x 8 x 16 standard grey CMU.
 - (c) 2 x 8 x 16 standard grey CMU wall cap.

2.3 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
 - (1) Products: Subject to compliance with requirements, provide one of the following:
 - (a) Davis Colors; True Tone Mortar Colors.

- (b) Lanxess Corporation; Bayferrox Iron Oxide Pigments.
 - (c) Solomon Colors, Inc.; SGS Mortar Colors.
- D. Aggregate for Mortar: ASTM C 144.
 - (1) For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - (2) For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - (3) White-Mortar Aggregates: Natural white sand or crushed white stone.
 - (4) Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- E. Aggregate for Grout: ASTM C 404.
- F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - (1) Products: Subject to compliance with requirements, provide one of the following:
 - (a) Euclid Chemical Company (The); Accelguard 80.
 - (b) Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
 - (c) Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.
- G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent by same manufacturer.
 - (1) Products: Subject to compliance with requirements, provide one of the following:
 - (a) ACM Chemistries; RainBloc for Mortar.
 - (b) BASF Aktiengesellschaft; Rheopel Mortar Admixture.
 - (c) Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
- H. Water: Potable.

2.4 REINFORCEMENT

- A. Recycled Content of Steel Products: Provide products with an average recycled content so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 60 percent.

- B. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M, Grade 60.
 - (1) Provide reinforcing bars with an average recycled content of reinforcing bars so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 30 percent.
- C. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
 - (1) Interior Walls: Hot-dip galvanized, carbon steel.
 - (2) Exterior Walls: Hot-dip galvanized, carbon steel.
 - (3) Wire Size for Side Rods: as indicated.
 - (4) Wire Size for Cross Rods: as indicated.
 - (5) Wire Size for Veneer Ties: 0.148-inch diameter.
 - (6) Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - (7) Provide in lengths of not less than 10 feet with prefabricated corner and tee units.
- D. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.5 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
 - (1) Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
 - (2) Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
 - (1) Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
 - (2) Where wythes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.

- (3) Wire: Fabricate from 3/16-inch diameter, hot-dip galvanized steel wire. Mill-galvanized wire ties may be used in interior walls unless otherwise indicated.
- D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
- (1) Anchor Section for Welding to Steel Frame: Crimped 1/4-inch diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls where humidity does not exceed 75 percent.
 - (2) Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls where humidity does not exceed 75 percent.
- E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
- (1) Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.
- F. Adjustable Masonry-Veneer Anchors:
- (1) General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - (a) Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
 - (2) Contractor's Option: Unless otherwise indicated, provide any of the following types of anchors:
 - (3) Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
 - (a) Products: Subject to compliance with requirements, provide one of the following:
 - Dayton Superior Corporation, Dur-O-Wal Division; D/A 213 or D/A 210 with D/A 700-708; DA5213 for masonry anchoring.
 - Heckmann Building Products Inc.; 315-D with 316 or Pos-I-Tie.
 - Hohmann & Barnard, Inc.; DW-10, DW-10HS or DW-10-X.
 - Wire-Bond; 1004, Type III, RJ-711 or SureTie.
 - Acceptable Substitution.

- (b) Fabricate sheet metal anchor sections and other sheet metal parts from 0.078-inch- thick, steel sheet, hot dip galvanized after fabrication.
 - (c) Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.187-inch- diameter, hot-dip galvanized steel wire.
- (4) Slip-in, Masonry-Veneer Anchors: Units consisting of a wire tie section and an anchor section designed to interlock with metal studs and be slipped into place as sheathing is installed.
- (a) Products: Subject to compliance with requirements, provide the following:
 - Hohmann & Barnard, Inc.; AA308.
 - Acceptable Substitution.
 - (b) Wire-Type Anchor: Bent wire anchor section with an eye to receive the wire tie. Wire tie has a vertical leg that slips into the eye of anchor section and allows vertical adjustment. Both sections are made from 3/16-inch, hot-dip galvanized wire.
- (5) Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
- (a) Products: Subject to compliance with requirements, provide one of the following:
 - ITW Buildex; Teks Maxiseal with Climaseal finish.
 - Textron Inc., Textron Fastening Systems; Elco Dril-Flex with Stalgard finish.
 - Acceptable Substitution.
- (6) Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads.
- (a) Products: Subject to compliance with requirements, provide one of the following:
 - Dayton Superior Corporation, Dur-O-Wal Division; Stainless Steel SX Fastener.
 - ITW Buildex; Scots long life Teks.
 - Acceptable Substitution.

2.6 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.7 EMBEDDED FLASHING MATERIALS

- A. Concealed Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:
- (1) Copper-Laminated Flashing: Manufacturer's standard laminated flashing consisting of 5-oz./sq. ft. sheet copper bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 - (2) Rubberized-Asphalt Flashing: Manufacturer's standard composite flashing product consisting of a pliable and highly adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of 0.030 inch.
 - (3) Reinforced Polyolefin/Polypropylene Flashing: 40 mil thick, reinforced polyolefin base, laminated to polypropylene layer. Adhesive backed with removable release liner. Hohmann & Barnard, Inc.; "X-Seal Transition Membrane" or Acceptable Substitution.
- B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by the flashing manufacturer for bonding flashing sheets to each other and to substrates.
- (1) Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - (a) Copper-Laminated Flashing:
 - Copper Fabric Flashing; Advanced Building Products, Inc.
 - Copper Fabric; AFCO Products, Inc.
 - H & B C-Fab Flashing; Hohmann & Barnard, Inc.
 - Copper Fabric Flashing; Polytite Manufacturing Corp.
 - Copper Fabric Flashing; Sandell Manufacturing Co., Inc.
 - York Copper Fabric Flashing; York Manufacturing, Inc.
 - (b) Rubberized-Asphalt Flashing:
 - Dur-O-Barrier; Dur-O-Wal, Inc.
 - Perm-A-Barrier Wall Flashing; W. R. Grace & Co., Construction Products Division.
 - Textroflash; Hohmann & Barnard, Inc.
 - Poly-Barrier Self-Adhering Wall Flashing; Polytite Manufacturing Corp.
 - Polyguard 300; Polyguard Products, Inc.
- C. Application: Unless otherwise indicated, use the following:

- (1) Where flashing is indicated to receive counterflashing, use Division 7 metal flashing.
- (2) Where flashing is fully concealed from view, use Division 4 flexible flashing.
- (3) Drip Plates and Drip Plate Corners: Hohmann & Barnard, Inc. or Acceptable Substitution.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Weep/Vent Products: Use one of the following unless otherwise indicated: (1)

Wicking Material: Absorbent rope, made from cotton or UV-resistant synthetic fiber, 1/4 to 3/8 inch in diameter, in length required to produce 2-inch exposure on exterior and 18 inches in cavity. Use only for weeps.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - (1) Products: Subject to compliance with requirements, provide one of the following:
 - (a) Advanced Building Products Inc.; Mortar Break.
 - (b) Archovations, Inc.; CavClear Masonry Mat.
 - (c) Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
 - (d) Mortar Net USA, Ltd.; Mortar Net.
 - (2) Provide one of the following configurations:
 - (a) Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.
 - (b) Strips, not less than 3/4 inch thick and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.

- (c) Sheets or strips full depth of cavity and installed to full height of cavity.
- F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
 - (1) Products: Subject to compliance with requirements, provide one of the following:
 - (a) Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
 - (b) Heckmann Building Products Inc.; No. 376 Rebar Positioner.
 - (c) Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
 - (d) Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.
 - (e) Acceptable Substitution.
- G. Masonry Cell Insulation: ASTM C578 Type I rigid foam with minimum R value of 4; install in CMU cores.

2.9 MASONRY CLEANERS

- A. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
 - (1) North Central Construction Supply Co.: "Masonry Cleaner."
 - (2) Sonneborn-Contech, Inc.: "Sonokleen 88."
 - (3) The Process Solvent Company, Inc.: Dark or Red brick "Sure-Klean No. 600," Buff or Light colored brick "Sure-Klean Vana Trol."
 - (4) Acceptable Substitution.

2.10 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - (1) Do not use calcium chloride in mortar or grout.
 - (2) Use portland cement-lime mortar unless otherwise indicated.
 - (3) Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - (1) For masonry below grade or in contact with earth, use Type M.
 - (2) For reinforced masonry, use Type S.
 - (3) For mortar parge coats, use Type N.
- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 - (1) Pigments shall not exceed 10 percent of portland cement by weight.
 - (2) Mix to match Architect's sample.
 - (3) Application: Use pigmented mortar for exposed mortar joints with the following units:
 - (a) Face brick.
- E. Grout for Unit Masonry: Comply with ASTM C 476.
 - (1) Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - (2) Proportion grout in accordance with ASTM C 476, Table 1.
 - (3) Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3-EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - (1) For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - (2) Verify that foundations are within tolerances specified.
 - (3) Verify that reinforcing dowels are properly placed.

- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - (1) Mix units from several pallets or cubes as they are placed.
- F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - (1) For dimensions in cross section or elevation do not vary by more than plus ½ inch or minus 1/4 inch.
 - (2) For location of elements in plan do not vary from that indicated by more than plus or minus ½ inch.
 - (3) For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or ½ inch total.
- B. Lines and Levels:
 - (1) For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or ½ inch maximum.

- (2) For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- (3) For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
- (4) For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- (5) For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
- (6) For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

C. Joints:

- (1) For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
- (2) For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
- (3) For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
- (4) For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
- (5) For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs. At interior masonry, lay exposed masonry in stacked bond to match existing.
- C. Lay interior concealed masonry with all units in a wythe in stacked bond to match existing masonry wall construction. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

- D. **Stopping and Resuming Work:** Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. **Built-in Work:** As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - (1) Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
 - (2) At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - (1) With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - (2) With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - (3) With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - (4) With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Set trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

- (1) Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - (2) Wet joint surfaces thoroughly before applying mortar.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
- (1) Space reinforcement not more than 16 inches o.c.
 - (2) Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 - (3) Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
- (1) Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 - (2) Install preformed control-joint gaskets designed to fit standard sash block.
 - (3) Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.

- (4) Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.
 - (1) Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.8 LINTELS

- A. Install steel lintels where indicated.
- B. Provide minimum bearing of 4 inches at each jamb unless otherwise indicated.

3.9 FLASHING

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - (1) Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - (2) At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 - (3) Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
 - (4) Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.10 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - (1) Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

- (2) Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - (1) Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - (2) Limit height of vertical grout pours to not more than 60 inches.

3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 2 special inspections according to the "International Building Code."
 - (1) Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - (2) Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - (3) Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM 140 for compressive strength.
- E. Mortar Test (Property Specification): For each mix provided, according to ASTM 780. Test mortar for mortar air content and compressive strength.
- F. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.12 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - (1) Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - (2) Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - (3) Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - (4) Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - (5) Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - (6) Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - (7) Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.13 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - (1) Crush masonry waste to less than 4 inches in each dimension.
 - (2) Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section "Earth Moving."
 - (3) Do not dispose of masonry waste as fill within 18 inches of finished grade.

- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.
- D. Documentation: Provide location of waste receiving agent (recycler/landfill) for waste and quantity of waste diverted by weight (tons) or volume (cubic yards).

3.14 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

- A. Manage construction waste in accordance with provisions of Section 01 7419.

END OF SECTION 04 2000

SECTION 05 5000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

- A. This section includes the following metal fabrications:
 - (1) Rough hardware.
 - (2) Ladders.
 - (3) Loose bearing and leveling plates.
 - (4) Loose steel lintels.
 - (5) Steel framing and supports.
 - (6) Miscellaneous steel trim.
 - (7) Pipe bollards.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - (1) Division 5 Section "Structural Steel" for structural steel framing system components.
 - (2) Division 6 Section "Miscellaneous Carpentry" for miscellaneous wood blocking and grounds.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for products used in miscellaneous metal fabrications, including paint products and grout.
- C. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.
 - (1) Where installed metal fabrications are indicated to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis that has been signed and

sealed by the qualified professional engineer who was responsible for their preparation.

- D. Welder certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.
- B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel," D1.3 "Structural Welding Code - Sheet Steel", and D1.2 "Structural Welding Code - Aluminum."
 - (1) Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved within the previous 12 months and, if pertinent, has undergone recertification.
- C. Engineer Qualifications: Professional engineer licensed to practice in jurisdiction where project is located and experienced in providing engineering services of the kind indicated that have resulted in the successful installation of metal fabrications similar in material, design, and extent to that indicated for this Project.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.
 - (1) Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

1.6 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use

materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36.
- B. Rolled Steel Floor Plates: ASTM A 786.
- C. Steel Tubing: Product type (manufacturing method) and as follows:
 - (1) Cold-Formed Steel Tubing: ASTM A 500, Grade A, unless otherwise indicated or required for design loading.
- D. Uncoated Structural Steel Sheet: Product type (manufacturing method), quality, and grade, as follows:
 - (1) Cold-Rolled Structural Steel Sheet: ASTM A 611, Grade A, unless otherwise indicated or required by design loading.
- E. Uncoated Steel Sheet: Commercial quality, cold-rolled steel sheet, ASTM A 366.
- F. Steel Pipe: ASTM A 53; black finish, Type F, standard weight (schedule 40), unless otherwise indicated, or another weight, type, and grade required by structural loads.
- G. Slotted Channel Framing: Cold-formed metal channels with flange edges returned toward web and with 9/16-inch- wide slotted holes in webs at 2 inches o.c.
 - (1) Width of Channels: 1-5/8 inches.
 - (2) Depth of Channels: 1-5/8 inches, unless otherwise indicated.
 - (3) Metal and Thickness: Uncoated steel complying with ASTM A 570, Grade 33; 0.0966-inch minimum thickness, unless otherwise indicated.
 - (4) Finish: Rust-inhibitive, baked-on, acrylic enamel.
- H. Gray Iron Castings: ASTM A 48, Class 30.
- I. Malleable Iron Castings: ASTM A 47, grade 32510.
- J. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.
- K. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 - (1) Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

- L. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

2.3 GROUT AND ANCHORING CEMENT

- A. Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD- C 621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.
- B. Anchoring Cement: 2-component, solvent-free, low-viscosity, moisture-insensitive, structural epoxy adhesive, complying with ASTM C881, Type I and II, Grade 1, Class C. Provide formulation that is recommended for exterior use by manufacturer.
- C. Products: Subject to compliance with requirements, provide grouts and cements manufactured by one of the following:

- (1) Nonshrink Nonmetallic Grouts:

- (a) "Bonsal Construction Grout"; W. R. Bonsal Co.
- (b) "Diamond-Crete Grout"; Concrete Service Materials Co.
- (c) "Euco N-S Grout"; Euclid Chemical Co.
- (d) "Kemset"; Chem-Masters Corp.
- (e) "Crystex"; L & M Construction Chemicals, Inc.
- (f) "Masterflow 713"; Master Builders.
- (g) "Sealtight 588 Grout"; W. R. Meadows, Inc.
- (h) "SonogROUT"; Sonneborn Building Products Div., Rexnord Chemical Products, Inc.
- (i) "Stoncrete NM1"; Stonhard, Inc.
- (j) "Five Star Grout"; U. S. Grout Corp.
- (k) "Vibropruf #11"; Lambert Corp.

- (2) Anchoring Cement:

- (a) "Sikadur 81-11", Sika Corporation.

2.4 FASTENERS

- A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36.
- D. Machine Screws: ASME B18.6.3.
- E. Lag Bolts: ASME B18.2.1.
- F. Wood Screws: Flat head, carbon steel, ASME B18.6.1.
- G. Plain Washers: Round, carbon steel, ASME B18.22.1.
- H. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.
- I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 - (1) Material:
 - (a) Indoor Conditions: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 - (b) Outdoor Conditions: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.
- J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.5 PAINT

- A. Shop Primer for Ferrous Metal: Manufacturer's or fabricator's standard, fast-curing, lead-free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure complying with performance requirements of FS TT-P-645.
- B. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.

2.6 FABRICATION, GENERAL

- A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

- C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
 - (1) Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Shear and punch metals cleanly and accurately. Remove burrs.
- E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- F. Remove sharp or rough areas on exposed traffic surfaces.
- G. Weld corners and seams continuously to comply with AWS recommendations and the following:
 - (1) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - (2) Obtain fusion without undercut or overlap.
 - (3) Remove welding flux immediately.
 - (4) At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.
- H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
- J. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- K. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.
- L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.7 ROUGH HARDWARE

- A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections.
- B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.8 STEEL LADDERS

- A. General: Fabricate ladders for the locations shown, with dimensions, spacings, details and anchorages as indicated. Comply with requirements of ANSI A14.3.
- B. Siderails: Continuous steel flat bars, ½ inch x 2-1/2 inches, with eased edges, spaced 18 inches apart.
- C. Bar Rungs: Fabricate from 13 gage, hot rolled, pickled and oiled carbon steel sheets, with embossed and punched surface to provide non-slip surface.
 - (1) Width: 1-5/8 inches.
 - (2) Height: 1-1/8 inches.
 - (3) Shape: Inverted U-shape.
 - (4) Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - (a) "Traction Tread" 3-hole ladder rung, as manufactured by GS Metals, Corp.
 - (b) "Tread Grip" 3 row skid resistant ladder rung, as manufactured by McNichols, Co.
- D. Fit rungs between side rails, weld and grind smooth.
- E. Top Platforms: Fabricate from 12 gage, hot-dipped, mill-galvanized steel sheets, with punched, serrated, diamond pattern surface to provide non-slip surface.
 - (1) Width: 11-3/4 inches.
 - (2) Height: 2 inches.
 - (3) Fabricate platforms with steel plate carrier at each end for connections to stringers with bolts.

- (4) Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - (a) "Grip Strut" stair treads, as manufactured by GS Metals, Corp.
 - (b) "Grip Strut" stair treads, as manufactured by McNichols, Co.
- F. Fit platforms between side rails at the top of the ladder, fasten securely with bolts.
- G. Support each ladder at top and bottom and at intermediate points spaced not more than 5'-0" o.c. by means of welded or bolted steel brackets.
 - (1) Size brackets to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 7 inches.
 - (2) Extend side rails 42 inches above top rung, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, goose-neck the extended rails back to the structure to provide secure ladder access.

2.9 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

2.10 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work.
- B. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - (1) Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
 - (a) Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide x 1/4 inch x 8 inches long.

2.11 MISCELLANEOUS STEEL TRIM

- A. Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever

possible. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.

2.12 PIPE BOLLARDS

- A. Fabricate pipe bollards from Schedule 80 steel pipe.

2.13 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
- B. Finish metal fabrications after assembly.
- C. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - (1) Exteriors (SSPC Zone 1B): SSPC-SP6/NACE No. 3, "Commercial Blast Cleaning."
 - (2) Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete construction. Coordinate delivery of such items to project site.

3.2 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
- E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:
 - (1) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - (2) Obtain fusion without undercut or overlap.
 - (3) Remove welding flux immediately.
 - (4) At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.3 SETTING LOOSE PLATES

- A. Clean concrete bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
- B. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
 - (1) Use nonmetallic nonshrink grout in all locations unless otherwise indicated.
 - (2) Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLATION OF LADDERS

- A. Install steel ladders by welding or bolting to steel structure or to weld plates cast into concrete, except where otherwise indicated.
- B. Set components accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

3.5 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

3.6 INSTALLATION OF BOLLARDS

- A. Anchor bollards in concrete. Support and brace bollards in position until concrete has been placed and cured.
- B. Fill bollards solidly with concrete, mounding top surface.

3.7 ADJUSTING AND CLEANING

- A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.
 - (1) Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

END OF SECTION 05 5000

SECTION 06 1050 - MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes miscellaneous carpentry required for the completion of the Project.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:
 - (1) For fire-retardant-treated wood products, include certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness, and fastener-holding capacities of treated materials.
- C. Material test reports from a qualified independent testing agency indicating and interpreting test results relative to compliance of fire-retardant-treated wood products with performance requirements indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.
 - (1) For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

- A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
 - (1) SPIB - Southern Pine Inspection Bureau.

- (2) WCLIB - West Coast Lumber Inspection Bureau.
- (3) WWPA - Western Wood Products Association.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
- D. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - (1) Provide dressed lumber, S4S, unless otherwise indicated.
 - (2) Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated wood is indicated, comply with applicable requirements of AWWPA C20 (lumber) and AWWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL; U.S. Testing; Timber Products Inspection, Inc.; or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - (1) Treatment Type: Exterior Type B.
- B. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.
- C. Treat indicated items and the following:
 - (1) Miscellaneous framing, blocking and grounds installed in the interior of the building.

2.3 DIMENSION LUMBER

- A. General: Provide dimension lumber of grades indicated according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.
- B. Miscellaneous Framing: Provide the following grades and species:
 - (1) Grade: No. 2.
 - (2) Species: Southern pine; SPIB, Douglas fir-larch; WCLIB or WWPA; or Hem-fir; WCLIB or WWPA.

2.4 BOARDS

- A. Concealed Boards: Where boards will be concealed by other work, provide lumber with 19 percent maximum moisture content and of following species and grade:

- (1) Species and Grade: Mixed southern pine, No. 2 per SPIB rules; Hem-fir, Standard per WCLIB rules or No. 3 Common per WWPA rules; or Western woods, Standard per WCLIB rules or No. 3 Common per WWPA rules.

2.5 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Moisture Content: 19 percent maximum for lumber items are not specified to receive wood preservative treatment.
- D. Miscellaneous Lumber: Provide the following grades and species:
 - (1) Grade: No. 3.
 - (2) Species: Southern pine; SPIB, Douglas fir-larch; WCLIB or WWPA; or Hem-fir; WCLIB or WWPA.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - (1) Where miscellaneous carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power-Driven Fasteners: CABO NER-272.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
- C. Fit carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.

- E. Use fasteners of appropriate type and length. Pre-drill members when necessary to avoid splitting wood.

3.2 INSTALLATION OF STRUCTURAL-USE PANELS

- A. General: Comply with applicable recommendations contained in APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

- (1) Comply with "Code Plus" provisions of above-referenced guide.

END OF SECTION 06 1050

SECTION 07 0150.61 - REPAIR OF BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes cutting, patching and repair of existing built-up bituminous membrane roofing systems, including insulation, installed over existing roof decks, as required to accommodate new roof penetrations for new mechanical equipment and repair abandoned penetrations for demolished or removed mechanical equipment.
- B. Types of existing roofing systems affected by this section includes the following:
 - (1) Multi-ply, built-up bituminous membrane with granule-surfaced cap sheet over insulation applied to concrete decks.
- C. Roof insulation related to roofing membranes is specified in this section.
- D. Wood nailers, blocking, and other related items are specified in Division 6.
- E. Flashing and sheet metal is specified in another Division 7 section.

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
- B. Hot Roofing Asphalt: Roofing asphalt heated to its equiviscous temperature, the temperature at which its viscosity is 125 centipoise for mopping application and 75 centipoise for mechanical application, within a range of plus or minus 25 deg F, measured at the mop cart or mechanical spreader immediately before application.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane repairs and flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another and with existing roofing materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

1.5 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data, including manufacturer's technical product data, installation instructions, and general recommendations for each type of roofing product required. Include data substantiating that materials comply with requirements.
- C. Samples of the following:
 - (1) 12" x 12" samples of each type of insulation required.
 - (2) 12" x 12" samples of each type of roof membrane ply required, including base sheet, ply sheet(s) and cap sheet as applicable.
- D. Shop drawings showing details at all repairs and special conditions.

1.6 QUALITY ASSURANCE

- A. Manufacturer - Existing Roofs: Obtain primary roofing membranes matching the existing roofing membranes as closely as possible. Provide secondary materials as recommended by manufacturer of primary materials.
- B. Installer - Existing Roofs: Engage an experienced Installer, certified by the manufacturer of the roofing membrane, to cut, patch and repair the existing membrane roofing who has specialized in roofing systems work similar to that required for this project.
 - (1) Installer's Field Supervision: Require Installer to maintain a full-time supervisor/foreman who is on job site during times that cutting and patching of existing roofing work is in progress and who is experienced in cutting, patching and repair of existing roofing systems similar to type and scope required for this Project.
- C. UL Listing: Provide complete roofing membrane system and component materials that have been tested for application and slopes indicated and are listed by Underwriters Laboratories, Inc. (UL) for Class A external fire exposure.
 - (1) Provide roof-covering materials bearing UL Classification Marking on bundle, package, or container indicating that materials have been produced under UL's Classification and Follow-up Service.
- D. FM Listing: Provide modified bitumen sheet roofing system and component materials that have been evaluated by Factory Mutual System for fire spread, wind uplift, and hail damage and that are listed in "Factory Mutual Approval Guide" for Class I construction.
 - (1) Roofing system shall comply with school district standards for wind-uplift resistance.

- (2) Provide roof-covering materials bearing FM approval marking on bundle, package, or container, indicating that material has been subjected to FM's examination and follow-up inspection service.
- E. Insulation Fire-Performance Characteristics: Provide insulation materials whose fire-performance characteristics comply with applicable regulations and school district standards, per test method listed below, by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- (1) Surface Burning Characteristics: ASTM E 84.
 - (2) Fire Resistance Ratings: ASTM E 119.
- F. Follow local, state and federal regulations, safety standards and codes governing the installation of roofing membrane systems.
- G. Preliminary Roofing Conference: Before starting cutting, patching and repair of existing roof membrane, conduct conference at Project site. Comply with requirements for conferences in Division 1 Section "Project Management and Coordination." Review methods and procedures related to roof membrane cutting, patching and repair, including, but not limited to, the following:
- (1) Meet with Owner, Architect, roofing Installer, roofing system manufacturer's representative, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
 - (2) Review methods and procedures related to roof membrane cutting, patching and repair, including manufacturer's written instructions.
 - (3) Review construction schedule and coordinate existing roof membrane cutting, patching and repair with other work, availability of materials and equipment, and conditions needed to make progress and avoid delays.
 - (4) Examine deck substrate conditions and finishes for compliance with requirements.
 - (5) Review structural loading limitations of roof deck during and after roofing.
 - (6) Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect existing roofing system.
 - (7) Review governing regulations and requirements for insurance and certificates if applicable.
 - (8) Review temporary protection requirements for roofing system during and after installation.
 - (9) Review roof observation and repair procedures after roofing installation.

1.7 PROJECT CONDITIONS

- A. Weather Condition Limitations: Proceed with roofing work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturers' recommendations and warranty requirements.
 - (1) Do not proceed with cutting, patching and repair work if adverse weather conditions will result in damage to exposed materials, building structure, interior finishes or building contents.
 - (2) Do not uncover existing insulation until ready to complete repair work and install new insulation and roofing materials.
- B. Substrate Conditions: Do not begin roofing repairs until substrates are determined to be in satisfactory condition.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle roofing materials in a manner that will ensure that there is no possibility of significant moisture pickup. Store in a dry, well-ventilated, weather-tight place. Unless protected from weather or other moisture sources, do not leave unused felts on the roof overnight or when roofing work is not in progress. Store rolls of felt and other sheet materials on end on pallets or other raised surface. Handle and store materials or equipment in a manner to avoid significant or permanent deflection of deck.

1.9 WARRANTY

- A. Manufacturer's Warranty: Perform all cutting, patching and repair operations on the existing roofing membrane in such a manner that the existing roof warranty remains in full force.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Performance: Provide roofing materials recognized to be of generic type indicated and tested to show compliance with indicated performances, or provide other similar materials certified in writing by manufacturer to be equal to, or better than, materials specified in every significant respect, and acceptable to Engineer.
- B. Compatibility: Provide products that are recommended by manufacturers to be fully compatible with indicated substrates, and existing roofing materials, where applicable. Provide separation materials as required to eliminate contact between incompatible materials.

2.2 ROOF INSULATION

- A. Perlite Board Roof Insulation: Rigid, noncombustible, perlite/ fiber boards of thicknesses indicated, with k-value of 0.36 at 75 deg F (24 deg C), integrally

skinned surfaces, complying with ASTM C 728. Provide in manufacturer's standard sizes in thickness indicated.

- (1) Provide tapered 24-inch by 48-inch boards to provide slope-to-drain where required, fabricated with taper of 1/4 inch per foot in the 24 inch dimension.
- B. Polyisocyanurate Foam Board Insulation: Rigid boards of minimum 2.0 lb./cu. ft. density polyisocyanurate based foam core, permanently bonded to roofing felt facer sheets. Provide in thickness indicated, with minimum aged K-value of 0.17 (when conditioned per RIC/TIMA Bulletin NO. 281-1).
- (1) Provide nominal thickness required to match existing.

2.3 ROOFING MEMBRANE PLIES

- A. Base Sheet, if required to match existing: ASTM D 4601, Type II, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.
- B. Ply Sheets: ASTM D 2178, Type IV, asphalt-impregnated, glass-fiber felt.
- C. Cap Sheet: ASTM D 6162, Type II, composite polyester- and glass-fiber-reinforced, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified and as follows:
- (1) Granule Color: White.
- D. Flashing Sheet: ASTM D 6221, Type I, composite polyester- and glass-fiber-reinforced, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified and as follows:
- (1) Granule Color: White.

2.4 AUXILIARY MATERIALS

- A. Interply Bitumen: Roofing asphalt, complying with ASTM D 312, Type III or IV.
- B. Asphaltic Primer: Comply with ASTM D 41.
- C. Roofing Cement: Asphalt cement, asbestos free; comply with ASTM D4586.
- D. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch thick.
- (1) Subject to compliance with requirements, provide one of the following:
 - (a) CertainTeed Corporation; GlasRoc Sheathing Type X
 - (b) Georgia-Pacific Corporation; Dens Deck DuraGuard.

- (c) National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.
 - (d) USG Corporation; Securock Glass Mat Roof Board.
- E. Mechanical Fasteners: Provide industry-standard types of mechanical fasteners for roofing system work, tested by manufacturer for required pull-out strength where applicable and compatible with deck type and roofing products used. Provide either 1-inch-diameter nail heads or 1-3/8-inch-diameter by 30-gage sheet metal caps for nails used to secure base sheets or insulation boards of roofing system.
- F. Roofing System Edge/penetration Materials:
 - (1) Glass Fiber Fabric: 1.5-pound (minimum) sheet, of woven glass fiber, impregnated with asphalt (ASTM D 1668).
 - (2) Preformed Edge Strips: Rigid insulation units matching roof insulation, or asphalt-impregnated organic fiber insulation units, molded to form 3-1/2-inch by 3-1/2-inch by 45-degree cant strips and 1-5/8-inch by 18-inch tapered edge strips to receive roofing ply-sheet courses and lift edges above main roofing surface.
 - (3) Zinc-Coated Steel: ASTM A 526/A 526M, with 0.20 percent copper, G90 hot-dip galvanized, mill phosphatized where indicated for painting; 0.0359 inches thick (20 gage), except as otherwise indicated.
 - (4) Solder for Sheet Metal: Except as otherwise indicated or recommended by metal manufacturer, provide 50/50 tin/lead type (ASTM B 32) for tinning and soldering joints; use rosin flux.
 - (5) SMACNA and NRCA Details: Fabricate roof penetration materials to conform with details shown and with applicable fabrication requirements of "Architectural Sheet Metal Manual" by SMACNA. Comply with installation details of "Roofing and Waterproofing Manual" by NRCA.
 - (a) Prefabricate units as indicated or provide standard manufactured units complying with requirements; fabricate from sheet metal indicated or, if not otherwise indicated, from lead-coated copper.
 - (b) Provide 4-inch-wide flanges for setting on built-up asphalt roofing system membrane with concealment by composition stripping.
 - (c) Fabricate penetration sleeves with minimum 8-inch-high stack, of diameter 1 inch larger than penetrating element. Counterflashing is specified as work of another section of these specifications.

2.5 EQUIPMENT

- A. Asphalt Heating Equipment: Provide asphalt heating kettle equipment with vapor recovery system in conjunction with the asphalt adhesive application. Locate kettle

considering wind direction, open windows, HVAC air intake louver locations, adjacent buildings, etc.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and surfaces requiring cutting, patching and repair of existing built-up roofing membranes and conditions under which roofing will be installed. Do not proceed with until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 PREPARATION

- A. Coordinate roofing repairs with flashings and sheet metal repair, plumbing, mechanical and electrical penetrations, roof-mounted mechanical equipment and other work associated or in contact with existing roofing membranes.
- B. Do not begin cutting and selective removal of existing roofing membrane until provisions for completing patching and repair work are in place. Coordinate with associated mechanical and electrical work involving new penetrations and repair and abandonment of existing penetrations.
- C. Provide adequate protection to prevent water and moisture entry into the building due to weather conditions.
- D. Remove existing roofing to the extent necessary to allow for the proper installation of new roof mounted equipment and necessary to complete a proper and serviceable repair of the existing roofing system. Remove existing roofing and insulation in stepped layers to permit repairs to lap existing by amounts recommended by material manufacturer's written recommendations. Discard removed materials properly.
- E. Clean substrate of dust, debris, and other substances detrimental to roof membrane installation. Remove sharp projections.
- F. Prime substrates where recommended by manufacturer of materials being installed.
- G. Prevent compounds from entering and clogging drains and conductors and from spilling or migrating onto surfaces of other work.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Protect other work from spillage of modified bitumen roofing materials, and prevent liquid materials from entering or clogging drains and conductors. Replace/restore other work damaged by installation of roofing system work.
- B. Insurance/Code Compliance: Install roofing system for (and test where required to show) compliance with governing regulations and with the following insurance requirements:

- (1) Factory Mutual requirements for "Class I" for fire resistance.
 - (2) Factory Mutual requirements for "Class I-90 Windstorm Rated" for wind uplift resistance.
 - (3) Underwriters Laboratories requirements for "Class A" fire resistance, per UL 790.
 - (4) Underwriters Laboratories classification requirements for wind uplift resistance per UL Subject 1897.
- C. Coordinate installing roofing system components so that insulation and roofing plies are not exposed to precipitation or left exposed overnight. Provide cut offs at end of each day's work to cover exposed ply sheets and insulation with a course of coated felt with joints and edges sealed with roofing cement. Remove cut offs immediately before resuming work.
- D. Asphalt Bitumen Heating: Heat and apply bitumen according to EVT Method as recommended by NRCA. Do not raise temperature above minimum normal fluid-holding temperature necessary to attain EVT (plus 5 deg F or 14 deg C, at point of application) more than 1 hour prior to time of application. Determine flash point, finished blowing temperature, EVT, and fire-safe handling temperature of bitumen either by information from manufacturer or by suitable tests. Do not exceed recommended temperature limits during bitumen heating. Do not heat bitumen to a temperature higher than 25 deg F (14 deg C) below flash point. Discard bitumen that has been held at temperature exceeding finished blowing temperature (FBT) for more than 3 hours. Use vapor recovery kettle and keep kettle lid closed except when adding bitumen.
- E. Bitumen Mopping Weights: For interply mopping, apply bitumen at the rate recommended by roofing material manufacturer (plus or minus 25 percent on a total-job average basis).
- F. Substrate Joint Penetrations: Prevent bitumen from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction. Where mopping is applied directly to substrate, tape substrate joints or, where steep asphalt is used, hold asphalt back 2 inches from both sides of the joint.

3.4 INSTALLING INSULATION

- A. General: Comply with insulation manufacturer's instructions and recommendations for the handling, installation, and bonding or anchorage of insulation to substrate.
- B. Existing Gypsum Concrete Substrates: Set insulation in hot solid mopping of Type III asphalt, applied within temperature range of EVT plus or minus 25 deg F (14 deg C) and at rate of 25 pounds (plus or minus 15 percent on the job, all-job average basis) per 100 sq. ft.

- (1) Two-Layer Installation: Install insulation in two layers with joints of second layer staggered from joints of first layer a minimum of 12 inches each direction. Install second layer in full mopping of hot Type III asphalt.
- C. Metal Deck Substrates: Secure substrate board to metal deck using mechanical fasteners specifically designed and sized for that purpose. Fasten insulation to deck through substrate board using mechanical fasteners specifically designed and sized for attaching specified board-type insulation to deck type shown. Fasten insulation over entire area of roofing at spacing as required by FM for specified Windstorm Resistance Classification. Run long joints for insulation in continuous straight lines, perpendicular to roof slope with end joints staggered between rows.
 - (1) Two-Layer Installation: Install required thickness in two layers with joints of second layer staggered from joints of first layer a minimum of 12 inches each direction. Install second layer in full mopping of hot Type III asphalt.
- D. Extend tapered insulation over surfaces indicated to slope toward drains as indicated, cutting and fitting tightly around obstructions. Form crickets, saddles, and tapered areas with material as shown and as required for proper drainage of membrane.
- E. Follow insulation and roof membrane manufacturer's current published application instructions.
- F. Do not install more insulation each day than can be covered with membrane before end of day or before start of inclement weather.

3.5 ROOF MEMBRANE INSTALLATION

- A. Shingling Plies: Install membrane with ply sheets shingled uniformly to achieve required number of membrane plies throughout. Shingle in proper direction to shed water on each large area of roofing.
- B. Cant Strips/Tapered Edge Strips: Install preformed 45-degree cant strips at junctures of roofing system membrane with vertical surface. Provide preformed, tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
- C. Base Sheet: If required to match existing roofing system, install one lapped course of base sheet. Mop to non-nailable substrate with steep asphalt, except use special adhesive where indicated.
- D. Ply Sheets: Install two or three ply sheets, as required to match existing roofing system, starting at low point of roofing. Align ply sheets without stretching. Shingle side laps of ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane. Shingle in direction to shed water. Extend ply sheets over and terminate beyond cants.
 - (1) Embed each ply sheet in a solid mopping of hot roofing asphalt applied at rate required by roofing manufacturer, to form a uniform membrane without ply sheets touching.

- E. Cap Sheet: Promptly after completing ply sheets (same day where possible), apply one lapped course of cap sheet of type indicated. Embed cap sheet in a solid mopping of hot roofing asphalt applied at rate required by built-up roofing manufacturer with 1/4-inch bitumen flow exposed along cap sheet edge. Lap edges 4 inches and sheet ends 6 inches minimum.
 - (1) Extend cap sheet to 2 inches above top edge of cant strip and terminate.
 - (2) Nail edges of membrane to wood blocking at perimeter edges of roof prior to installing metal gravel stops/fascias. Space nails at minimum 8 inches o.c.
- F. Set-On Accessories: Where small roof accessories are set on modified bituminous sheet roofing, set metal flanges in a bed of roofing cement and seal penetration of membrane with bead of roofing cement to prevent flow of bitumen from membrane.

3.6 MEMBRANE FLASHING AND STRIPPING

- A. Install modified bituminous flashing at cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof. Install one ply of flashing sheet material by mopping substrate and back of flashing sheet with Type III asphalt and embedding flashing solidly against substrate. Extend flashing a minimum of 6 inches onto modified bituminous sheet roofing.
- B. Install modified bituminous stripping where metal flanges are set on roofing. Install one ply of modified bituminous stripping in a continuous mopping of Type III asphalt and extend stripping a minimum of 6 inches out onto the roof membrane.
- C. Allow for expansion of running metal flashing and edge trim that adjoins roofing. Do not seal or bond membrane or modified bituminous flashing or stripping to metal flanges over 3 feet in length.
- D. Counter-Flashings: Counter-flashings, cap flashings, expansion joints, and similar work to be coordinated with modified bitumen roofing work are specified in other Sections.

3.7 PROTECTION OF ROOFING

- A. Upon completion of roofing (including associated work), institute appropriate procedures for surveillance and protection of roofing during remainder of construction period. At end of construction period, or at a time when remaining construction will in no way affect or endanger roofing, inspect roofing and prepare a written report, with copies to Engineer and Owner, describing nature and extent of deterioration or damage found.
- B. Repair or replace (as required) deteriorated or defective work found at time of above inspection to a condition free of damage and deterioration at time of Substantial Completion and in accordance with requirements of specified warranty.

END OF SECTION 07 0150.61

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following sheet metal flashing and trim:
 - (1) Manufactured through-wall flashing.
 - (2) Formed roof drainage system.
 - (3) Formed low-slope roof flashing and trim.
- B. Related Sections include the following:
 - (1) Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
 - (2) Division 7 Section "Repair of Bituminous Membrane Roofing" for installing sheet metal flashing and trim integral with membrane roofing.
 - (3) Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
 - (1) Wind Zone 2: For velocity pressures of 31 to 45 lbf/sq. ft.: 90-lbf/sq. ft. perimeter uplift force, 120-lbf/sq. ft. corner uplift force, and 45-lbf/sq. ft. outward force.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
- (1) Identify material, thickness, weight, and finish for each item and location in Project.
 - (2) Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - (3) Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
 - (4) Details of expansion-joint covers, including showing direction of expansion and contraction.
 - (5) Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 - (6) Details of special conditions.
 - (7) Details of connections to adjoining work.

1.5 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- B. Installer Qualifications: Engage an experienced Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality, mill phosphatized for field painting.
- B. Recycled Content of Steel Products: Provide products with an average recycled content so postconsumer plus one-half pre-consumer recycled content is not less than 25 percent.
- C. Galvanized Steel Sheet: ASTM A 526m G 90, commercial quality, or ASTM A 527, G 90, lock-forming quality, hot-dip galvanized steel sheet with 0.20 percent copper, mill phosphatized where indicated for painting; not less than 0.0396 inch thick, unless otherwise indicated.
- D. Coil-Coated Galvanized Steel Sheet: Zinc-coated, commercial-quality steel sheet conforming to ASTM A 755, G 90 coating designation, coil coated with high-performance fluoropolymer coating as specified in "Coil-Coated Galvanized Steel Sheet Finish" Article; not less than 0.0336 inch thick, unless otherwise indicated.

2.2 UNDERLAYMENT MATERIALS

- A. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- B. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
 - (1) Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
 - (2) Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
 - (3) Blind Fasteners: High-strength aluminum or stainless-steel rivets.
 - (4) Spikes and Ferrules: Same material as gutter; with spike and matching internal gutter width.
- C. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- D. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

2.4 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated.

- (1) Available Manufacturers:

- (a) Cheney Flashing Company, Inc.
- (b) Fry Reglet Corporation.
- (c) Heckmann Building Products Inc.
- (d) Hickman, W. P. Company.
- (e) Keystone Flashing Company, Inc.
- (f) Sandell Manufacturing Company, Inc.

- (2) Material: Galvanized steel, 0.022 inch thick.

- (3) Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

- (4) Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practical. Obtain field measurements for accurate fit before shop fabrication.
- B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
- C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

- E. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
 - (1) Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.6 SHEET METAL FABRICATIONS

- A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.
- B. Conductor Heads: Fabricate in the style indicated from the following material:
 - (1) Coil-Coated Galvanized Steel: 0.0359 inch thick.
 - (2) Style: SMACNA Figure 1-25F with overflow opening.
- C. Downspouts: Fabricate in the style indicated from the following material:
 - (1) Coil-Coated Galvanized Steel: 0.0359 inch thick; 0.1046 inch thick at standing seam metal roof.
 - (2) Style: SMACNA Figure 1-32 E.
- D. Exposed Trim: Fabricate from the following material:
 - (1) Coil-Coated Galvanized Steel: 0.0229 inch thick.
- E. Copings: Fabricate from the following material:
 - (1) Coil-Coated Galvanized Steel: 0.0299 inch thick.
 - (2) Style: SMACNA Figure 3-4A.
- F. Counterflashing: Fabricate from the following material:
 - (1) Coil-Coated Galvanized Steel: 0.0276 inch thick.
- G. Flashing Receivers: Fabricate from the following material:
 - (1) Coil-Coated Galvanized Steel: 0.0276 inch thick.
- H. Drip Edges: Fabricate from the following material:
 - (1) Coil-Coated Galvanized Steel: 0.0276 inch thick.
- I. Equipment Support Flashing: Fabricate from the following material:
 - (1) Galvanized Steel: 0.0276 inch thick.

J. Through Wall Scupper: Fabricate from the following material:

- (1) Coil coated galvanized steel 0.0276" thick joints riveted & soldered.

2.7 COIL-COATED GALVANIZED STEEL SHEET FINISH

A. High-Performance Organic Coating Finish: Apply the following system by coil-coating process on galvanized steel sheet as recommended by coating manufacturers and applicator.

- (1) Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.

- (a) Color and Gloss: To be selected by Architect from manufacturer's standard colors.

- (2) Coil-Coated Steel Sheet Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

- (a) MM Systems Corporation.
 - (b) Petersen Aluminum Corporation.
 - (c) Vincent Metals.
 - (d) Firestone Building Products.
 - (e) Englert, Inc.

2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

- (1) Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- (2) Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - (1) Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
 - (1) Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
 - (2) Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.
- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - (1) Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
 - (1) Galvanized or Aluminum-Zinc Alloy Coated Steel: Use stainless-steel fasteners.

- H. Seal joints with Elastomeric sealant as required for watertight construction.
 - (1) Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 - (2) Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Downspouts: Join sections with 1 ½ inch telescoping joints.
 - (1) Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
 - (2) Provide elbows and extensions at base of downspout to direct water away from building where they are not connected to underground drainage system.
 - (3) Provide concrete splashblocks at base of downspouts where they are not connected to underground drainage system.
- C. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 - (1) Anchor scupper closure trim flange to exterior wall and solder to scupper.
 - (2) Loosely lock front edge of scupper with conductor head.
 - (3) Solder exterior wall scupper flanges into back of conductor head.
- D. Conductor Heads: Anchor securely to wall with elevation of conductor head rim 1 inch below scupper discharge.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

- B. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant.
 - (1) Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.
- C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
 - (1) Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.
- D. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchor to substrate at staggered 3-inch centers.
- E. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- F. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant.
- G. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 6200

SECTION 07 8200 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes firestopping for the following:
 - (1) Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
 - (2) Sealant joints in fire-resistance-rated construction.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - (1) Division 7 Section "Joint Sealants" for non-fire-resistive-rated joint sealants.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.
- B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.
- C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E 814, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where the following conditions exist:
 - (1) Where firestop systems protect penetrations located outside of wall cavities.
 - (2) Where firestop systems protect penetrations located in construction containing doors required to have a temperature-rise rating.
 - (3) Where firestop systems protect penetrating items larger than a 4-inch-diameter nominal pipe or 16 sq. in. in overall cross-sectional area.

- D. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.
- E. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
 - (1) For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - (2) For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
 - (3) For openings and penetrations exposed to view, provide paintable products.
- F. For firestopping exposed to view, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of product specified.
 - (1) Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.
- C. Shop drawings detailing materials, installation methods, and relationships to adjoining construction for each through-penetration firestop system, and each kind of construction condition penetrated and kind of penetrating item. Include firestop design designation of qualified testing and inspecting agency evidencing compliance with requirements for each condition indicated.
 - (1) Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop configuration for construction and penetrating items.
- D. Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.
- E. Product test reports from, and based on tests performed by, a qualified testing and inspecting agency evidencing compliance of firestopping with requirements based on comprehensive testing of current products.
- F. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has completed through-penetration firestop systems similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. **Fire-Test-Response Characteristics:** Provide firestopping that complies with the following requirements and those specified under the "System Performance Requirements" article:
 - (1) Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.
 - (2) Through-penetration firestop systems are identical to those tested per ASTM E 814 under conditions where positive furnace pressure differential of at least 0.01 inch of water is maintained at a distance of 0.78 inch below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:
 - (a) Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - (b) Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in their "Fire Resistance Directory," by Warnock Hersey, or by another qualified testing and inspecting agency.
 - (3) Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics per ASTM E 119 under conditions where the positive furnace pressure differential is at least 0.01 inch of water, as measured 0.78 inch from the face exposed to furnace fire. Provide systems complying with the following requirements:
 - (a) **Fire-Resistance Ratings of Joint Sealants:** As indicated by reference to design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.
 - (b) Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.
- C. Information referring to specific design designations of through-penetration firestop systems is intended to establish requirements for performance based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Architect's prior approval. Submit documentation showing that the performance of proposed substitutions equals or exceeds that of the systems they would replace and are acceptable to authorities having jurisdiction.
- D. **Installer Qualifications:** Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary

experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

- E. Single-Source Responsibility: Obtain through-penetration firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.
- F. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."
- G. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.
- H. Preconstruction Laboratory Test:
 - (1) Submit substrate materials representative of actual joint surfaces to be sealed to manufacturer of firestopping products for laboratory testing of firestop materials for adhesion to primed and unprimed substrate joints and for compatibility with secondary seals, if required, as indicated below:
 - (a) Use test methods standard with manufacturer to determine if priming and other specific substrate preparation techniques are required to obtain rapid, optimum adhesion of firestopping to substrate joints under environmental conditions that will exist during actual installation.
 - (b) Testing will not be required when firestopping manufacturer is able to submit preparation data required above which is based on previous testing of current firestopping products for adhesion to, and compatibility with, substrates matching those submitted.
- I. Detectable Asbestos:
 - (1) Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
- B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilation: Ventilate firestopping per firestopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

1.8 WARRANTY

- A. Submit 2 Copies of written 2 year warranty agreeing to repair or replace firestopping which fails to perform as airtight and watertight joints; or fails in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability; or appears to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated.
- B. Provide warranty signed by the Installer and Contractor.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

- A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.
- B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" article in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:
 - (1) Permanent forming/damming/backing materials including the following:
 - (a) Semi-refractory fiber (mineral wool) insulation.
 - (b) Ceramic fiber.
 - (c) Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
 - (d) Fire-rated formboard.
 - (e) Joint fillers for joint sealants.
 - (2) Temporary forming materials.
 - (3) Substrate primers.

- (4) Collars.
- (5) Steel sleeves.
- C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

2.2 FILL MATERIALS FOR THROUGH-PENETRATION FIRESTOP SYSTEMS

- A. Endothermic, Latex Compound Sealant: Single-component, endothermic, latex formulation.
- B. Intumescent, Latex Sealant: Single-component, intumescent, latex formulation.
- C. Intumescent Putty: Nonhardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.
- D. Intumescent Wrap Strips: Single-component, elastomeric sheet with aluminum foil on one side.
- E. Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings of zero per ASTM E 84.
- F. Silicone Foam: Two-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, nonshrinking foam.
- G. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant of grade indicated below:
 - (1) Grade for Horizontal Surfaces: Pourable (self-leveling) grade for openings in floors and other horizontal surfaces.
 - (2) Grade for Vertical Surfaces: Nonsag grade for openings in vertical and other surfaces.
- H. Solvent-Release-Curing Intumescent Sealant: Solvent-release-curing, single-component, synthetic-polymer-based sealant of grade indicated below:
 - (1) Grade for Horizontal Surfaces: Pourable (self-leveling) grade for openings in floors and other horizontal surfaces.
 - (2) Grade for Vertical Surfaces: Nonsag grade for openings in vertical and other surfaces.
- I. Products: Subject to compliance with requirements, provide one of the following:
 - (1) Endothermic, Latex Sealant:
 - (a) Fyre-Shield, Tremco Inc.

- (2) Endothermic, Latex Compounds:
 - (a) Flame-Safe FS500/600 Series, International Protective Coatings Corp.
 - (b) Flame-Safe FS900/FST900 Series, International Protective Coatings Corp.
- (3) Intumescent Latex Sealant:
 - (a) Fire Barrier CP 25WB Caulk, 3M Fire Protection Products.
- (4) Intumescent Putty:
 - (a) Pensil 500 Intumescent Putty, General Electric Co.
 - (b) Flame-Safe FSP1000 Putty, International Protective Coatings Corp.
 - (c) Fire Barrier Moldable Putty, 3M Fire Protection Products.
 - (d) Fire Barrier Moldable Putty, 3M Fire Protection Products.
- (5) Intumescent Wrap Strips:
 - (a) CS2420 Intumescent Wrap, Hilti Construction Chemicals, Inc.
 - (b) Fire Barrier FS-195 Wrap/Strip, 3M Fire Protection Products.
- (6) Job-Mixed Vinyl Compound:
 - (a) USG Firecode Compound, United States Gypsum Co.
- (7) Silicone Sealants:
 - (a) Pensil 100 Firestop Sealant, General Electric Co.
 - (b) CS240 Firestop Sealant, Hilti Construction Chemicals, Inc.
 - (c) Fyre-Sil, Tremco Inc.
 - (d) Fyre-Sil S/L, Tremco Inc.
- (8) Solvent-Release-Curing Intumescent Sealants:
 - (a) Biostop 500 Intumescent Firestop Caulk, Bio Fireshield, Inc.
 - (b) Fire Barrier CP 25N/S Caulk, 3M Fire Protection Products.
 - (c) Fire Barrier CP 25S/L Caulk, 3M Fire Protection Products.

2.3 FIRE-RESISTIVE ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.
- B. Sealant Colors: Provide color of exposed joint sealants to comply with the following:
 - (1) Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.
- C. Single-Component, Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, G, A, and (as applicable to joint substrates indicated) O.
 - (1) Additional Movement Capability: Provide sealant with the capability to withstand the following percentage changes in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated:
 - (a) 50 percent movement in both extension and compression for a total of 100 percent movement.
- D. Single-Component, Nonsag, Urethane Sealant: Type S; Grade NS; Class 25; and Uses NT, M, A, and (as applicable to joint substrates indicated) O.
- E. Products: Subject to compliance with requirements, provide one of the following:
 - (1) Single-Component, Neutral-Curing, Silicone Sealant:
 - (a) Dow Corning 795, Dow Corning Corp.
 - (b) Silpruf, General Electric Co.
 - (c) Ultraglaze, General Electric Co.
 - (d) 864, Pecora Corp.
 - (2) Single-Component, Nonsag, Urethane Sealant:
 - (a) Isoflex 880 GB, Harry S. Peterson Co., Inc.
 - (b) Isoflex 881, Harry S. Peterson Co., Inc.
 - (c) Vulkem 921, Mameco International Inc.
 - (d) Sikaflex--15LM, Sika Corp.

(3) Acrylic Flexible Firestop Sealant:

(a) Hilti CP 606.

(4) Firestop Joint Spray:

(a) Hilti CP 672.

2.4 MIXING

- A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:
- (1) Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
 - (2) Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
 - (3) Remove laitance and form release agents from concrete.
- B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.3 INSTALLING THROUGH-PENETRATION FIRESTOPS

- A. General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.
- B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
 - (1) Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 - (2) Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - (3) For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

- A. General: Comply with the "System Performance Requirements" article in Part 1, with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.
- B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.
- C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.
- D. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.5 FIELD QUALITY CONTROL

- A. Inspecting agency employed and paid by Owner will examine completed firestopping to determine, in general, if it is being installed in compliance with requirements.
- B. Inspecting agency will report observations promptly and in writing to Contractor and Architect.
- C. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.
- D. Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

3.6 CLEANING

- A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.
- B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

3.7 FIRESTOPPING SCHEDULE

- A. Firestop all openings in fire-resistance-rated wall, floor and roof construction. Fire-rated assemblies are indicated on the drawings.

3.8 PENETRATION SCHEDULE

- A. General:
 - (1) Prepare a schedule showing typical penetrations of each penetrating material type and other information as follows:
 - (a) Project Name.
 - (b) Construction Type.
 - (c) Occupancy.
 - (d) Firestop Applicator.
- B. Construction Assemblies:
 - (1) Gypsum Board Walls.

- (2) Concrete Floors.
- (3) Floor/Ceiling Assemblies.
- (4) Roof/Ceiling Assemblies.
- (5) Shafts.
- (6) Chases.

C. Fire Resistive Rating Requirements:

- (1) Furnish the following information for each type of construction assembly listed above”
 - (a) Hourly fire rating.
 - (b) “F” Rating.
 - (c) “T” Rating.
 - (d) Qualified testing agency Design No.
 - (e) Penetrating item.
 - (f) Penetrating material and size.
 - (g) Minimum annular space.
 - (h) Maximum annular space.
 - (i) Architect’s detail and sheet number.
 - (j) Shop drawing detail or sheet number.

END OF SECTION 07 8200

SECTION 07 9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes joint sealants for the following locations:
 - (1) Exterior joints in vertical surfaces and nontraffic horizontal surfaces as indicated below.
 - (a) Control and expansion joints in unit masonry.
 - (b) Perimeter joints between materials listed above and frames of doors and windows.
 - (c) Control and expansion joints in ceiling and overhead surfaces.
 - (d) Joints between different materials listed above.
 - (e) Other joints as indicated.
 - (2) Exterior joints in horizontal traffic surfaces as indicated below:
 - (a) Control, expansion, and isolation joints in cast-in-place concrete slabs for floors and paving.
 - (b) Other joints as indicated.
 - (3) Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:
 - (a) Perimeter joints of exterior openings where indicated.
 - (b) Vertical control joints on exposed surfaces of interior unit masonry walls and partitions.
 - (c) Other joints as indicated.
 - (4) Interior joints in horizontal traffic surfaces as indicated below:
 - (a) Other joints as indicated.

1.3 SYSTEM PERFORMANCES

- A. Provide joint sealants that have been produced and installed to establish and maintain watertight and airtight continuous seals.

1.4 SUBMITTALS

- A. Product Data from manufacturers for each joint sealant product required, including instructions for joint preparation and joint sealant application. Manufacturer's product data for interior sealants, including printed statement of VOC content.
- B. Samples for Initial Selection Purposes: Manufacturer's standard bead samples consisting of strips of actual products showing full range of colors available, for each product exposed to view.
- C. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an Installer who has successfully completed within the last 3 years at least 3 joint sealant applications similar in type and size to that of this Project.
- B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
 - (1) When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F.
 - (2) When joint substrates are wet due to rain, frost, condensation, or other causes.
- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide color of exposed joint sealants indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.
- C. VOC Content: VOC limit 250 g/L.

2.2 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses.
- B. Multi-Part Nonsag Urethane Sealant for Use NT: Type M, Grade NS, Class 25, and complying with the following requirements for Uses:
 - (1) Uses NT, M, G, A, and, as applicable to joint substrates indicated, O.
- C. Multi-Part Nonsag Urethane Sealant for Use T: Type M, Grade NS, Class 25, and complying with the following requirements for Uses:
 - (1) Uses T, M, G, A, and, as applicable to joint substrates indicated, O.
- D. One-Part Nonsag Urethane Sealant for Use NT: Type S; Grade NS; Class 25; and Uses NT, M, A, and, as applicable to joint substrates indicated, O.
- E. One-Part Nonacid-Curing Silicone Sealant: Type S, Grade NS, Class 25, and complying with the following requirements for Uses and additional joint movement capability:
 - (1) Uses NT, M, G, A, and, as applicable to joint substrates indicated, O.
 - (2) Additional capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the following percentage changes in joint width as measured at time of application and remain in compliance with other requirements of ASTM C 920 for Uses indicated:
 - (a) 50 percent movement in both extension and compression for a total of 100 percent movement.
- F. Products: Subject to compliance with requirements, provide one of the following for each type of joint:
 - (1) Multi-Part Nonsag Urethane Sealant for Use NT:

- (a) "Vulkem 227"; Mameco. (b)
"Dynatrol II"; Pecora Corp.
 - (c) "Sikaflex-2c NS"; Sika Corp.
 - (d) "Sonolastic NP2"; Sonneborne Bldg. Prod. Div.
 - (e) "Dymeric"; Tremco Inc.
- (2) Multi-Part Nonsag Urethane Sealant for Use T:
- (a) "Vulkem 227"; Mameco.
 - (b) "Dynatred"; Pecora Corp.
 - (c) "Sikaflex-2c NS"; Sika Corp.
 - (d) "Sonolastic NP2"; Sonneborne Bldg. Prod. Div.
 - (e) "THC-901"; Tremco Inc.
- (3) One-Part Nonsag Urethane Sealant for Use NT:
- (a) "Vulkem 116"; Mameco.
 - (b) "Dynatrol I"; Pecora Corp.
 - (c) "Sikaflex-1a"; Sika Corp.
 - (d) "Sikaflex-15LM"; Sika Corp.
 - (e) "Sonolastic NP1"; Sonneborne Bldg. Prod. Div.
 - (f) "Dymonic"; Tremco Inc.
- (4) One-Part Nonsag Urethane Sealant for Use T:
- (a) "Vulkem 116"; Mameco.
 - (b) "Sikaflex-1a"; Sika Corp.
 - (c) "Sikaflex-15LM"; Sika Corp.
 - (d) "Sonolastic NP1"; Sonneborne Bldg. Prod. Div.
- (5) One-Part Nonacid-Curing Silicone Sealant:
- (a) "Dow Corning 790"; Dow Corning Corp.
 - (b) "Silpruf SCS 2000"; General Electric Co.
 - (c) "864"; Pecora Corp.

- (d) "Sonolastic Omniseal"; Sonneborne Bldg. Prod. Div.
- (e) "Spectrum 1"; Tremco, Inc.
- (f) "Spectrum 2"; Tremco, Inc.

2.3 LATEX JOINT SEALANTS

- A. Acrylic-Emulsion Sealant: Manufacturer's standard, one part, nonsag, mildew-resistant, acrylic-emulsion sealant complying with ASTM C 834, formulated to be paintable and recommended for exposed applications on interior and on protected exterior locations involving joint movement of not more than plus or minus 5 percent.
- B. Products: Subject to compliance with requirements, provide one of the following:
 - (1) Acrylic-Emulsion Sealant:
 - (a) "Chem-Calk 600"; Bostik Construction Products Div.
 - (b) "AC-20"; Pecora Corp.
 - (c) "Sonolac"; Sonneborn Building Products Div.; Rexnord Chemical Products, Inc.
 - (d) "Tremco Acrylic Latex 834"; Tremco Inc.

2.4 MISCELLANEOUS JOINT SEALANTS

- A. Butyl-Polyisobutylene Sealant: Manufacturer's standard, solvent-release-curing, butyl-polyisobutylene sealant complying with AAMA 809.2, recommended for concealed joints.
- B. Products: Subject to compliance with requirements, provide one of the following:
 - (1) Butyl-Polyisobutylene Sealant:
 - (a) "PTI 404"; Protective Treatments, Inc.

2.5 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type which are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonwaxing, nonextruding strips of flexible, nongassing plastic foam of material indicated below; nonabsorbent to water and gas; and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - (1) Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.

- (2) Proprietary, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 2.5 pcf and tensile strength of 35 psi per ASTM D 1623, and with water absorption less than 0.02 gms/cc per ASTM C 1083.
 - (3) Either material indicated above.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Provide type recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Provide nonstaining, chemical cleaners of type which are acceptable to manufacturers of sealants and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in-service performance.
- C. Masking Tape: Provide nonstaining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.

2.7 JOINT FILLERS FOR CONCRETE PAVING:

- A. General: Provide joint fillers of thickness and widths indicated.
- B. Sponge Rubber Joint Filler: Preformed strips complying with ASTM D 1752 for Type I.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturers and the following requirements:
 - (1) Remove all foreign material from joint substrates which could interfere with adhesion of joint sealant, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; old joint sealants; oil; grease; waterproofing; water repellents; water; surface dirt; and frost.

- (2) Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 - (3) Remove laitance and form release agents from concrete.
 - (4) Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile; and other nonporous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond, do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.
- C. Latex Sealant Installation Standard: Comply with requirements of ASTM C 790 for use of latex sealants.
- D. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
- (1) Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.
 - (a) Do not leave gaps between ends of joint fillers.
 - (b) Do not stretch, twist, puncture, or tear joint fillers.
 - (c) Remove absorbent joint fillers which have become wet prior to sealant application and replace with dry material.

- (2) Install bond breaker tape between sealants and joint fillers, compression seals, or back of joints where adhesion of sealant to surfaces at back of joints would result in sealant failure.
 - (3) Install compressible seals serving as sealant backings to comply with requirements indicated above for joint fillers. Choose diameter of seal to compress $\frac{1}{4}$ to $\frac{1}{2}$ of fully expanded size in opening.
- E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
- (1) Provide concave joint configuration per Figure 6A in ASTM C 962, unless otherwise indicated.
 - (2) Provide flush joint configuration per Figure 6B in ASTM C 962, where indicated.
 - (3) Use masking tape to protect adjacent surfaces of tooled joints.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and reseal joints with new materials to produce joint sealant installations with repaired areas indistinguishable from original work.

3.6 JOINT SEALANT SCHEDULE

- A. Multi-part or One-part Non Sag Urethane Sealant: Use in exterior joints and in interior joints subject to movement, in dimension stone masonry; between concrete and masonry; between metal and mortar, metal and stone masonry; and all other exterior locations not indicated otherwise.

- B. One-part Nonacid-Curing Silicone Sealant: Use in exterior and interior joints between metal and metal, and between metal and glass. Do not use silicone sealant on any masonry, CMU or concrete surface.
- C. Acrylic-Emulsion Sealant: Use in non-moving interior joints in field-painted vertical and overhead surfaces, at perimeter of hollow metal door frames, gypsum drywall, plaster, concrete or concrete masonry; and all other interior locations not indicated otherwise.

END OF SECTION 07 9200

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes custom-fabricated, commercial-quality steel doors and frames for doors and related openings, hollow metal panels, and louvers in these doors and frames.
- B. Building in of anchors and grouting of frames in masonry construction are specified in a Division 4 Section.
- C. Related Sections: The following sections contain requirements that relate to this Section:
 - (1) Division 8 Section "Door Hardware" for door hardware installed in doors and frames.
 - (2) Division 8 Section "Flush Wood Doors" for solid-core wood doors installed in steel frames.
 - (3) Division 9 Section "Painting" for field painting of doors and frames.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product Data: Manufacturer's specifications for fabrication and installation, including data substantiating that products comply with requirements.
 - (1) Manufacturer's certificate stating that each assembly required to be fire rated but exceeding sizes of tested assemblies has been constructed to conform to design, materials, and details of construction equivalent to requirements for labeled units.
- C. Shop Drawings: For fabrication and installation of custom steel doors and frames work. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections.
 - (1) Provide a schedule of doors and frames using same reference numbers for details and openings as those on the Contract Drawings.

1.4 QUALITY ASSURANCE

- A. Provide custom steel doors and frames manufactured by a single firm specializing in the production of this type of work, unless otherwise acceptable to the Architect.
- B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies whose fire resistance characteristics have been determined per ASTM E 152, and that are labeled and listed by UL, Warnock Hersey, or other testing and inspecting organization acceptable to authorities having jurisdiction.
 - (1) Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide manufacturer's certification that doors conform to all standard construction requirements of tested and labeled fire-rated door assemblies except for size.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palleted, wrapped, or crated to provide protection during transit and job storage.
- B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to the Architect; otherwise remove and replace damaged items as directed.
- C. Store doors and frames at the building site under cover. Place units on minimum 4-inch-high wood blocking. Avoid the use of nonvented plastic or canvas shelters that could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide 1/4-inch spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - (1) Amweld Building Products, Inc.
 - (2) Gateway Metal Products, Inc.
 - (3) NCS Manufacturing.
 - (4) Rocky Mountain Metals.
 - (5) Southwestern Hollow Metal Co.
 - (6) Steelcraft; Division of Ingersoll-Rand.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheets: Commercial-quality, level, carbon steel, complying with ASTM A 366.
- B. Hot-Rolled Steel Sheets and Strips: Commercial-quality carbon steel, pickled and oiled, complying with ASTM A 569, free of scale, pitting, or surface defects.
- C. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526 and ASTM A 525 with A60 or G60 coating designation, mill phosphatized.
- D. Supports and Anchors: Fabricate of not less than 16-gage sheet metal. Galvanize after fabrication units to be built into exterior walls, complying with ASTM A 153, Class B.
- E. Inserts, Bolts, and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.
- F. Shop-Applied Paint: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as base for specified finish paints on steel surfaces.
- G. Recycled Content: Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost) of the total value of the materials.
- H. Regional Materials: Use products that have been extracted, harvested or recovered, as well as manufactured within 500 miles of the project site for a minimum of 10% (based on cost) of the total materials value.

2.3 DOORS

- A. General: Provide flush design doors, 1-3/4 inches thick, seamless hollow construction, unless otherwise indicated.
 - (1) For single-acting swing doors, bevel both vertical edges 1/8 inch in 2 inches. For double-acting swing doors, round vertical edges with 2-1/8-inch radius.
 - (2) Unless otherwise required for acoustical or thermal doors, provide filler of mineral-wool board to fill voids between inner core reinforcing members.
 - (3) Reinforced doors with rigid tubular frame where stiles and rails are less than 8 inches (200 mm) wide. Form tubular frame with 0.0598-inch- (1.5 mm-) thick steel, welded to outer sheets.
- B. Painted Exterior Doors: Fabricate exterior doors of 2 outer, galvanized, stretcher-leveled steel sheets not less than 14 gage. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges, except around glazed or louvered panel inserts. Provide weep-hole openings in the bottom of doors to permit escape of entrapped moisture.

- (1) Reinforce inside of doors with vertical galvanized sheet steel sections not less than 20 gage. Space vertical reinforcing 6 inches o.c. and extend full door height. Spot weld at not more than 5 inches o.c. to both face sheets.
 - (2) Join door faces at their vertical edges with continuous welds, extending full height of door. Fill, dress and grind welds smooth to make them invisible and provide flush surface. Reinforce vertical edges with internal 8 gage edge strip, spot-welded to door face sheets, offset at hinge locations.
 - (3) Reinforce tops and bottoms of doors with 16-gage horizontal steel channels welded continuously to outer sheets. Close top and bottom edges to provide flush, waterproof weather seal, as integral part of door construction or by addition of inverted steel channels.
- C. Painted Interior Doors: Fabricate interior doors of 2 outer, cold-rolled, stretcher-leveled steel sheets not less than 16 gage. Construct doors with smooth, flush surfaces, without visible joints or seams on exposed faces or stile edges, except around glazed or louvered panel inserts.
- (1) Reinforce inside of doors with vertical, hot-rolled, not less than 20-gage steel sections. Space vertical reinforcing 6 inches o.c. and extend full door height. Spot weld at not more than 5 inches o.c. to both face sheets.
 - (2) Join door faces at their vertical edges with continuous welds, extending full height of door. Fill, dress and grind welds smooth to make them invisible and provide flush surface. Reinforce vertical edges with internal 8 gage edge strip, spot-welded to door face sheets, offset at hinge locations.
 - (3) Reinforce tops and bottoms of doors with 16-gage, horizontal steel channels, welded continuously to outer sheets.
- D. Finish Hardware Reinforcement: Minimum gages of steel reinforcing plates for the following hardware:
- (1) Hinges: 1/4 inch thick by 1-1/2 inches wide by 8 inches longer than hinge, secured by not less than 6 spot welds.
 - (2) Mortise Locksets and Dead Bolts: 12-gage steel sheet, secured with not less than 2 spot-welds.
 - (3) Surface-Applied Closers: 7-gage steel sheet, secured with not less than 6 spot-welds.
 - (4) Push Plates and Pull Bars: 12-gage steel sheet, (except when through bolts are shown or specified), secured with not less than 2 spot-welds.
 - (5) All Other Surface-Mounted Hardware: 12 gage.

2.4 FRAMES

- A. Fabricate frames of full-welded unit construction, with corners mitered, reinforced, continuously welded full depth and width of frame. Knock-down type frames are not acceptable.

- (1) Form frames of minimum 14-gage galvanized steel sheets for exterior, and either cold or hot-rolled sheet steel of the following minimum gages for interior:
 - (a) Openings up to and including 3'-6" wide: 16 gage.
 - (b) Openings over 3'-6" wide: 14 gage.
- B. Finish Hardware Reinforcement: Minimum gages of steel reinforcing plates for the following hardware:
 - (1) Hinges: Reinforce frames as described below:
 - (a) Frames for Wood Doors: 3/16 inch gage thick by full width by 8 inches longer than hinge, secured by not less than 8 spot welds.
 - (b) Frames for Steel Doors: Steel plate 1/4 inch thick by full width of jamb by 14 inches longer than hinge, secured by not less than 8 spot-welds.
 - (2) Strike Plate Clips: Steel plate 3/16" thick x 1/2" wide x 3" long.
 - (3) Surface-Applied Closers: 7-gage steel sheet, secured with not less than 6 spot-welds.
 - (4) Strikes and Flush Bolts: 12 gage.
 - (5) Surface-Mounted Hold-Open Arms and Panic Devices: 12 gage.
 - (6) Electrically Operated Hardware: Where electrically operated hardware is indicated, provide hardware enclosures and junction boxes. Interconnect junction boxes with UL approved 1/2" minimum conduit and connectors. Provide access plates, minimum 14-gage, where required to facilitate the proper installation of wiring. Secure access plates to frame with a minimum of (4) #8-32 fasteners.
- C. Mullions and Transom Bars: Provide closed or tubular mullions and transom bars where indicated. Fasten mullions and transom bars at crossings and to jambs by butt welding. Reinforce joints between frame members with concealed clip angles or sleeves of same metal and thickness as frame.
- D. Head Reinforcing: Where installed in masonry, leave vertical mullions in frames open at top for grouting.
- E. Jamb Anchors: Furnish jamb anchors as required to secure frames to adjacent construction, formed of not less than 18-gage galvanized steel.
 - (1) Masonry Construction: Adjustable, corrugated, or flat perforated, strap-and-stirrup type, with strap not less than 2-1/2 inches wide by 10 inches long by 16 gage. Furnish at least 3 anchors per jamb up to 7'-0" height; 4 anchors up to 8'-0" jamb height; one additional anchor for each 24 inches or fraction thereof over 8'-0" height.

- (2) Metal Stud Partitions: Insert type with notched clip to engage metal stud, welded to back of frames. Provide at least 4 anchors for each jamb for frames up to 7'-0" in height; 5 anchors up to 8'-0" jamb height; one additional anchor each 24 inches or fraction thereof over 8'-0" height.
 - (3) In-Place Concrete or Masonry: Anchor frame jambs with minimum 3/8-inch concealed bolts into expansion shields or inserts at 6 inches from top and bottom and 26 inches o.c., unless otherwise shown. Reinforce frames at anchor locations.
- F. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, formed of not less than 14-gage galvanized steel sheet, as follows:
 - (1) Monolithic Concrete Slabs: Clip-type anchors, with 2 holes to receive fasteners, welded to bottom of jambs and mullions.
 - G. Head Anchors: Provide 2 anchors at head of frames for frames mounted in steel stud walls.
 - H. Structural Reinforcing Members: Provide as part of frame assembly, where indicated at mullions, transoms, or other locations that are to be built into frame.
 - I. Head Reinforcing: For frames over 4'-0" wide in masonry wall openings, provide continuous steel channel or angle stiffener, not less than 12 gage for full width of opening, welded to back of frame at head.
 - J. Spreader Bars: Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.
 - K. Rubber Door Silencers: Except on weatherstripped doors, drill stop in strike jamb to receive 3 silencers on single-door frames and drill head jamb stop to receive 4 silencers on double-door frames. Install plastic plugs to keep holes clear during construction.
 - L. Plaster Guards: Provide 26-gage steel plaster guards or dust cover boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

2.5 STOPS AND MOLDINGS

- A. Provide stops and moldings around solid, glazed, and louvered panels where indicated.
- B. Form fixed stops and moldings integral with frame, unless otherwise indicated.
- C. Provide removable stops and moldings where indicated or required, formed of not less than 20-gage steel sheets matching steel of frames. Secure with countersunk flat or oval head machine screws spaced uniformly not more than 12 inches o.c. Form corners with butted hairline joints.
 - (1) Locate removable stops on inside or occupied side of openings.

- D. Coordinate width of rabbet between fixed and removable stops with type of glass or panel and type of installation indicated.

2.6 FABRICATION, GENERAL

- A. Fabricate hollow metal units to be rigid, neat in appearance, and free from defects, warp, or buckle. Accurately form metal to required sizes and profiles. Wherever practicable, fit and assemble units in the manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at the project site. Weld exposed joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
- B. Exposed Fasteners: Unless otherwise indicated, provide countersunk oval phillips heads for exposed screws and bolts.
- C. Finish Hardware Preparation: As follows:
 - (1) Prepare doors and frames to receive finish hardware, including cutouts, reinforcing, mortising, drilling, and tapping in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A 115 series specifications for door and frame preparation for hardware.
 - (2) Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.
 - (3) Locate finish hardware as shown on final shop drawings, or if not shown, in accordance with "Recommended Locations for Builder's Hardware for Custom Steel Doors and Frames," published by Door and Hardware Institute.
- D. Shop Painting: Clean, treat, and paint exposed surfaces of steel doors and frames, including galvanized surfaces, but excluding stainless steel surfaces.
 - (1) Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
 - (2) Apply pretreatment to cleaned metal surfaces, using cold phosphate solution (SSPC-PT2), hot phosphate solution (SSPC-PT4), or basic zinc chromate-vinyl butyryl solution (SSPC-PT3).
 - (3) Apply shop coat of prime paint within time limits recommended by pretreatment manufacturer. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.

2.7 SOURCE QUALITY CONTROL

- A. Maintain manufacturing tolerances within the following limits:
 - (1) Frames:

- (a) Opening Width: Nominal opening width $+1/16"$, $-1/32"$, measured between rabbets at the head of door openings and at the top and bottom of glazed openings.
 - (b) Opening Height: Nominal opening height $\pm 3/64"$ measured along the total length of the jamb rabbet for door openings; nominal opening height $+1/16"$, $-1/32"$, measured along the side rabbet of each glazed opening.
 - (c) Cross Section Profile dimensions:
 - Face: $\pm 1/32"$
 - Stop: $\pm 1/32"$
 - Rabbet: $\pm 1/32"$
 - Depth: $\pm 1/32"$
 - Throat: $\pm 1/32"$
- (2) Doors:
- (a) Width: $\pm 3/64"$.
 - (b) Height: $\pm 3/64"$.
 - (c) Thickness: $\pm 1/64"$.
 - (d) Hardware Cutout Dimensions: Template dimensions $+0.015"$, $- 0"$.
 - (e) Hardware Location: $\pm 1/64"$.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Frames: Provide custom steel frames for doors, transoms, side lights, borrowed lights, and other openings, of size and profile as indicated.
- (1) Install frames and accessories in accordance with shop drawings, manufacturer's data, and as herein specified.
 - (2) Setting Masonry Anchorage Devices: Provide masonry anchorage devices where required for securing frames to in-place concrete or masonry construction.
 - (a) Set anchorage devices opposite each anchor location, in accordance with details on final shop drawings and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed, and free from dust and debris.
 - (3) Floor anchors may be set with powder-actuated fasteners instead of masonry anchorage devices and machine screws, if so indicated on final shop drawings.

- (4) Placing Frames: Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 - (a) At in-place concrete or masonry construction, set frames and secure in place with machine screws and masonry anchorage devices.
 - (b) Place frames at fire-rated openings in accordance with NFPA Standard No. 80.
 - (c) Make field splices in frames as detailed on final shop drawings, welded and finished to match factory work.
 - (d) Remove spreader bars only after frames or bucks have been properly set and secured.
- B. Doors: Fit non-fire-rated doors accurately in their respective frames, with the following clearances:
 - (1) Jambs and Head: 3/32 inch.
 - (2) Meeting Edges, Pairs of Doors: 1/8 inch.
 - (3) Bottom: 3/8 inch, where no threshold or carpet.
 - (4) Bottom: 1/8 inch, at threshold or carpet.
- C. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.

3.2 ADJUST AND CLEAN

- A. Final Adjustments: Check and readjust operating hardware items just prior to final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames that are warped, bowed, or otherwise unacceptable.
- B. Prime Coat Touch-Up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

END OF SECTION 08 1113

SECTION 08 1416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY

- A. This Section includes the following:
 - (1) Factory finished solid-core doors with wood-veneer faces.
 - (2) Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Sections include the following:
 - (1) Division 8 Section "Finish Hardware" for door hardware installed in flush wood doors.
 - (2) Division 8 Section "Glazing" for glass view panels in flush wood doors.

1.3 SUBMITTALS

- A. Product Data: Submit door manufacturer's technical data for each type of door, including details of core and edge construction, trim for openings and louvers, and factory-finishing specifications.
- B. Shop Drawings: Submit shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for factory finishing and other pertinent data.
- C. Samples for initial selection in the form of color charts consisting of actual materials in small sections for the following:
 - (1) Faces of factory-finished doors with transparent finish. Show the full range of colors available for stained finishes.

1.4 QUALITY ASSURANCE

- A. Quality Standards: Comply with the following standards:
 - (1) NWWDA Quality Standard: I.S.1 "Industry Standard for Wood Flush Doors", of National Wood Window and Door Association (NWWDA).
 - (2) AWI Quality Standard: "Architectural Woodwork Quality Standards"; including Section 1300 "Architectural Flush Doors", of Architectural Woodwork Institute (AWI) for grade of door, core construction, finish and other requirements exceeding those of NWWDA quality standard.

- B. NWWMA Quality Marking: Mark each wood door with NWWDA Wood Flush Door Certification Hallmark certifying compliance with applicable requirements of NWWDA I.S.1 Series.
 - (1) For manufacturers not participating in NWWDA Hallmark Program, a certification of compliance may be substituted for marking of individual doors.
- C. Manufacturer: Obtain doors from a single manufacturer.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Protect doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with requirements of referenced standards and recommendations of NWWDA pamphlet "How to Store, Handle, Finish, Install, and Maintain Wood Doors", as well as with manufacturer's instructions.

1.6 PROJECT CONDITIONS

- A. Conditioning: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during remainder of construction period to comply with the following requirements applicable to project's geographical location:
 - (1) Referenced AWI quality standard including Section 100-S-3 "Moisture Content".

1.7 WARRANTY

- A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.
- B. Door Manufacturer's Warranty: Submit written agreement in door manufacturer's standard form signed by Manufacturer, Installer and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup or twist) or that show telegraphing of core construction in face veneers, or do not conform to tolerance limitations of referenced quality standards.
 - (1) Warranty shall also include reinstallation which may be required due to repair or replacement of defective doors where defect was not apparent prior to hanging.
 - (2) Warranty shall be in effect during following period of time after date of Final Acceptance.
 - (3) Solid Core Interior Doors:
 - (a) Life of installation.
- C. Contractor's Responsibilities: Replace or refinish doors where Contractor's work contributed to rejection or to voiding of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
- (1) Solid Core Doors with Wood Veneer Faces:
 - (a) Algoma Hardwoods, Inc.
 - (b) Eggers Industries, Architectural Door Division.
 - (c) Marshfield Door Division.
 - (d) V.T. Industries.
 - (e) Graham Wood Doors.

2.2 INTERIOR FLUSH WOOD DOORS

- A. Solid Core Doors for Transparent Finish: Comply with the following requirements:
- (1) Faces: White Birch. White birch veneer shall be clear, free of all heartwood discoloration, color streaks and irregular figure coloration.
 - (a) Thickness: 1/50 inch minimum.
 - (b) Veneer cut shall be plain sliced.
 - (c) Veneer match shall be running book match.
 - (2) AWI Grade: Premium.
 - (3) Construction: PC-5 (Particleboard core, 5-ply, fully bonded core). or PC-7 (Particleboard core, 7-ply fully bonded core).
 - (4) Bonding: Stiles and rails bonded to core, then entire unit abrasive planed before veneering.
 - (5) Vertical Edges: Hardwood edges to match face veneer species.
 - (6) Blocking: Provide solid particle board blocking or wide rails at locations of closers, magnetic hold open devices and exit devices.
- B. Composite Woods in this section must not contain any urea-formaldehyde.
- C. Fire Rated Construction: NFPA 80 and UL 1784.
- (1) 20 minute rated FD 1/3: Particle Board Core.
 - (a) 60 minute rated FD 1: Mineral Core; SLM Blocking at hardware locations.

- (b) 90 minute rated FD 1 ½: Mineral Core; SLM blocking at hardware locations.
- (c) Glazing Stops:
 - FD 1/3: Solid matching wood with clips.
 - FD 1 and FD 1 ½: Anemostadt Type BFL 75.
- (d) Attach fire rating label on hinge jamb.

2.3 FABRICATION

- A. Fabricate flush wood doors to produce doors complying with following requirements:
 - (1) Factory-prefit and premachine doors to fit frame opening sizes indicated with the following uniform clearances and bevels:
 - (a) Comply with tolerance requirements of AWI for prefitting. Comply with final hardware schedules and door frame shop drawings and with hardware templates.
 - (b) Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with factory premachining.
 - (2) AWI Grade: Custom.
- B. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of doors required.
 - (1) Light Openings: Trim openings with moldings of material and profile indicated.

2.4 FACTORY FINISHING

- A. General: Comply with referenced quality standard's requirements for factory finishing.
- B. Finished wood doors at factory.
- C. Transparent Finish: Comply with requirements indicated for grade, finish system, staining effect, and sheen.
 - (1) Grade: Custom.
 - (2) Finish: Manufacturer's standard AWI System TR-4 conversion varnish or AWI System TR-6 catalyzed polyurethane.
 - (3) Staining: Architect to select from manufacturer's standard colors.
 - (4) Effect: Open-grain finish.

- (5) Sheen: Semi-gloss.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine installed door frames prior to hanging door:
 - (1) Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
 - (2) Reject doors with defects.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation see Division-8 "Finish Hardware" section of these specifications.
- B. Manufacturer's Instructions: Install wood doors to comply with manufacturer's instructions and of referenced AWI standard and as indicated.
- C. Prefit Doors: Fit to frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation, if fitting or machining is required at the job site.

3.3 ADJUSTING AND PROTECTION

- A. Operation: Rehang or replace doors which do not swing or operate freely.
- B. Finished Doors: Refinish or replace doors damaged during installation.
- C. Protect doors as recommended by door manufacturer to ensure that wood doors will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 08 1416

SECTION 08 7100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.
- B. Hardware specified herein is to cover all necessary material required to fully complete the hardware requirements of specified openings. It is the intention that the hardware specified shall be of sufficient quantities necessary to complete the Work. Notify the Architect of omissions or discrepancies prior to bid date for clarifications or instructions. Adjustments to the Contract Sum will not be allowed for omissions not clarified prior to bid opening.
- C. This Section includes the following:
 - 1. Hinges.
 - 2. Lock cylinders and keys.
 - 3. Lock and latch sets.
 - 4. Flush Bolts, Surface Bolts.
 - 5. Exit devices.
 - 6. Push/pull units.
 - 7. Closers.
 - 8. Overhead holders.
 - 9. Door trim units.
 - 10. Protection plates.
 - 11. Weatherstripping for exterior doors.
 - 12. Astragals or meeting seals on pairs of doors.
 - 13. Thresholds.

1.2 SUBMITTALS

- A. Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
- B. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
 - a) Vertical format, horizontal format will not be reviewed and will be returned marked "not approved".
 - b) Type, style, function, size, and finish of each hardware item.
 - c) Maximum allowable degree of swing and door handing.
 - d) Fire rating.
 - e) Name and manufacturer of each item.
 - f) Fastenings and other pertinent information.
 - g) Location of each hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule. Identify each door by door number, specifically "From" (Key side) and "To", and the room and area names and number on the drawings.
 - h) Explanation of all abbreviations, symbols, and codes contained in schedule.
 - i) Mounting locations for hardware.
 - j) Door and frame sizes and materials.
 - k) Electronic file, CD or disc data format to Owner's operating system.
 2. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.
- C. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- D. Furnish three, (3), copies of maintenance manuals for each different hardware item, including operation and maintenance instructions, parts listing with sources indicated; recommended parts inventory listing, emergency instructions, and similar information. Include all diagnostic and repair information available to manufactures and installers maintenance personnel. Submit for Owners information at Project closeout as specified in Division 1.

1.3 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain each type of hardware (latch and locksets, hinges, closers, etc.) from a single manufacturer.
- B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that

indicated for this Project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.

- C. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by UL, Warnock Hersey, FM, or other testing and inspecting organization acceptable to authorities having jurisdiction for use on types and sizes of doors indicated in compliance with requirements of fire-rated door and door frame labels.

1.4 PRODUCT HANDLING

- A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.
- B. Packaging of door hardware is responsibility of supplier. As hardware supplier from various manufacturers receives material, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
- C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).
- E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

1.5 MAINTENANCE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware. Present special tools and maintenance instructions to Owner at time of testing and demonstration interval.
- B. Manufacturer's representatives of lock, cylinders, exit devices and door closers shall conduct two 8 hour training sessions for Owner personnel in the servicing and maintenance of hardware items.
- C. General Warranty: Warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- D. Provide the following special hardware warranty for the following items:
 - 1. Locksets 7 years.
 - 2. Door Closers 10 years.

3. Exit devices

3 years.

PART 2 - PRODUCTS

2.1 SCHEDULED HARDWARE

- A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of finish hardware are indicated in the "Hardware Schedule" at the end of this Section. Products are identified by using hardware designation numbers of the following:
1. **Manufacturer's Product Designations:** The product designation and name of one manufacturer are listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated or, where more than one manufacturer is specified under the Article "Manufacturers" in Part 2 for each hardware type, the comparable product of one of the other manufacturers that complies with requirements.

2.2 MATERIALS AND FABRICATION

- A. **Manufacturer's Name Plate:** Do not use manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise acceptable to Architect.
1. Manufacturer's identification will be permitted on rim of lock cylinders only.
- B. **Base Metals:** Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI/BHMA A156 series standards for each type of hardware item and with ANSI/BHMA A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.
- C. **Fasteners:** Provide hardware manufactured to conform to published templates generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.
- D. **Furnish screws for installation with each hardware item.** Provide Phillips flat-head screws except as otherwise indicated. Furnish stainless steel (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.
- E. **Provide concealed fasteners for hardware units that are exposed when door is closed** except to the extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely. Where thru-bolts are used as a means of reinforcing the work, provide sleeves for each thru-bolt or use sex screw fasteners.

2.3 HINGES

- A. Hinges shall be certified to exceed two million, five hundred thousand, 2,500,000, full load-operating cycles by a recognized independent testing laboratory. Templates: Except for

hinges and pivots to be installed entirely (both leaves) into wood doors and frames provide only template-produced units.

- B. Screws: Provide Phillips flat-head screws complying with the following requirements:
1. For metal doors and frames install machine screws into drilled and tapped holes.
 2. For wood doors and frames install wood screws.
 3. Finish screw heads to match surface of hinges or pivots.
- C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
1. Out-Swing Doors with Locks: Non-Removable Pins (NRP).
 2. Interior Doors: Non-rising pins.
 3. Tips: Flat button and matching plug, finished to match leaves.
 4. Number of Hinges: Provide number of hinges indicated but not less than 3 hinges for door leaf for doors 90 inches or less in height and one additional hinge for each 30 inches of additional height. Unless otherwise specified, hinge size for doors through 3'-0" shall be 4-1/2 inches x 4-1/2 inches.
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include:
1. Ives Hinge: 3CB1 3CB1HW.
 2. McKinney Hinge: TA714 T4A786.
 3. Stanley Hinge: CB1900 CB1901.

2.4 KEYING SYSTEMS

- A. Keying Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." In addition to Owner, Contractor and Architect. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 2. Preliminary key system schematic diagram.
 3. Requirements for key control system.
 4. Address for delivery of keys.
 5. Mechanical key override cylinders at electronic access openings.
 6. Equip locks and cylinders with small format, interchangeable core cylinders

7. General Contractor shall remove temporary construction cores, and install permanent keyed cores into locksets and cylinders. Temporary construction cores shall remain the property of the hardware supplier.
- B. Key Material: Provide manufacturers standard embossed keys of nickel silver to ensure accuracy in accuracy in keys and long cylinder wear. Key blanks shall be available only from factory-direct sources, not available from after-market key blank manufacturers.
 1. Visual stamped key control on keys with indelible markings on cylinder bodies. Architect and Owner shall approve stampings and markings prior to ordering of locksets and cylinders; furnish Owner's written approval of the system.
 - C. Do not package permanent cores or key blanks with locks. Package key blanks separately from locksets and permanent cores. Deliver all permanent cores and key blanks and other security keys direct to Owner from lock manufacturer by secure courier, return receipt requested. Failure to properly comply with these requirements may be cause to require replacement of all or any part of the cylinders and keys involved as deemed necessary at no additional cost to the Owner.
 - D. Key Quantity: Furnish keys in the following quantities:
 1. 25 each Temporary construction keys to General Contractor.
 2. 2 each Temporary construction core removable keys to General Contractor.
 3. 3 each Key blanks per cylinder to Owner.
 4. 3 each Permanent core removable keys to Owner.
 5. 1 each Bitting list to Owner.
 - E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include:
 1. Best Lock Co.: 7-Pin small format Interchangeable Core (Owner's Standard)

2.5 HEAVY-DUTY LOCKSETS AND LATCHSETS

- A. Locksets shall be certified to exceed three million, 3,000,000, full load operating cycles by a recognized independent testing laboratory. Locksets and latchsets shall be non-handed, heavy-duty cylindrical type, with 2-3/4 inch backset or greater, as specified, with 1/2 inch throw latchbolt.
- B. Lock chassis shall be made from cold rolled steel, with locking spindles of stainless steel. Spindles to be of interlocking design to resist deforming under sever torque. Outside Lever drivers shall be of cast stainless steel to improve torque resistance to forced entry.
- C. Lever trim shall be designed to increase resistance against vandalism and forced entry by over torquing of lock chassis. Disablement of secured levers shall not permit latchbolt retraction from secure side while allowing emergency egress.
- D. Lever handles shall be a minimum of 4 9/16 inch in length and shall provide a minimum of 2 inches of clearance from the door surface to the inside of the lever at its midpoint. Rosettes

shall be a minimum of 3 7/16-inch diameter to ensure complete coverage of the door preparation. Lever trim shall be available with tactile or knurled surface for identification of hazardous area.

- E. Furnish units with concealed through-bolts and threaded chassis hubs to prevent lever torque from rotating lock chassis and maintain correct alignment. Equip units with cast auxiliary spring cages with studs to prevent rotation attached directly to the lock chassis to assist in support of levers. Spring cage units shall contain coil compression springs to maintain life safety and provide extended service.
- F. Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.
- G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include:
 - 1. Best Lock Co.: 93K Series, 16L lever (Owner's Standard)

2.6 EXIT DEVICES AND MULLIONS

- A. Exit devices shall be certified to exceed three million, 3,000,000, full load operating cycles by a recognized independent testing laboratory.
- B. Provide exit devices of single manufacturer with specified functions, which can accept exterior and interior cylinders of specified cylinders. Where specified, furnish devices without dogging feature to maintain security and safety. Exit devices shall have smooth interior body to discourage vandalism and graffiti. Equip devices with roller type strikes and fluid dampers to reduce noise.
- C. Furnish through bolted fasteners for all devices. Where required, provide projecting glass stop kits to provide clearance when used with projecting glass stops.
- D. Lever handle trim shall be certified to exceed five hundred, 500,000, full load operating cycles by a recognized independent testing laboratory. Furnish lever trim with breakaway mechanism designed to disengage lever from operating should excessive force be applied, and allow lever to be re-set to its operating position. Lever design to match lock manufacturer's lever design.
- E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include:
 - 1. Von Duprin, Inc.: 35A/98 Series (Existing Facility Standard)

2.7 CLOSERS AND DOOR CONTROL DEVICES

- A. Closers shall be certified to exceed ten million, 10,000,000, full load, automated cycles by a recognized independent testing laboratory.
- B. Where manual closers are indicated for doors required to be accessible to the physically challenged, provide adjustable units complying with ANSI A117.1 provisions for door opening force and delayed action closing. Except as specifically indicated, comply with

manufacturer's recommendations for size of door control units, depending upon size of door, exposure to weather, and anticipated frequency of use.

- C. Closers shall be cast iron construction with forged lever arms, independent adjusting valves for closing, latching and back check. Hydraulic regulation controlled by tamper-proof, non-critical screw valves. All closer adjustments shall be shielded by high impact plastic, cover plate after installation. Furnish extra duty arms, EDA, to protect against excessive force. Provide special templated arms to allow clearance and applications of overhead stops and holders.
 - 1. Install closers to allow maximum degree of opening, position back check to activate well in advance of the stop position to cushion the opening swing and prevent door and frame damage. Unless specified, install closers with through bolt mounting method on metal and wood doors.
- D. Operating Voltages: Coordinate operating power requirements with Fire/Life Safety control systems.
- E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include:
 - 1. LCN: 4040XP Series (Existing Facility Standard)

2.1 OVERHEAD STOPS AND HOLDERS

- A. Overhead stops and holders shall be certified to exceed one million, five hundred, 1,500,000, full load operating cycles by a recognized independent testing laboratory.
- B. Furnish non-handed overhead stops and holders as listed in the hardware sets. Coordinate overhead holder and stop mounting with door closer to facilitate the optimum degree of door opening.
- C. Manufacture all major metal components from type 304, stainless steel to deter corrosion and to prevent stress related failures. Equip units with adjustable jamb bracket to allow adjustment after installation. Where required, furnish special templating application to prevent closer and overhead stop or holder from interfering with operation.
- D. Install overhead stops and holders with one piece sex bolts and machine screws. Do not install hold open devices on fire rated openings.
- E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include:
 - 1. Glynn Johnson 100 Series 90 Series.

2.2 THRESHOLDS, WEATHERSTRIPPING AND SEALS

- A. Provide continuous seal at jambs and heads and at door bottom. Where specified, provide threshold type with silicone gasket. Smoke, or sound seals shall be rated in accordance with surrounding wall rating respective to sound or fire rating or as required by code. Unless otherwise indicated, provide metal threshold units of type, size and profile as shown or scheduled. Provide noncorrosive fasteners for exterior and interior applications.

- B. Extruded aluminum with color anodized finish as selected by Architect from manufacturers standard color range; 0.062 inch minimum thickness of main walls and flanges. Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.
- C. Nylon brush filament weatherstripping, shall be wrapped around a core wire, locked in a metal spline and encased in an anodized aluminum flange for attachment. Nylon shall remain pliable within a temperature range of 400 degrees F to minimum -40 degrees F below zero. Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include:
 - 1. Pemko 255 3452CP S88D.
 - 2. National Guard 430E C627A 2525B.

2.3 HARDWARE FINISHES

- A. Match items to the manufacturer's standard color and texture finish for the latch and locksets (or push-pull units if no latch or locksets).
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- C. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18, "Materials and Finishes," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.
- D. The designations used in schedules and elsewhere to indicate hardware finishes are the industry-recognized standard commercial finishes, except as otherwise noted.
 - 1. Brushed Stainless Steel, no coating: US32D/ANSI 639.
 - 2. Satin Chrome, Clear Coated: US26D/ANSI 626, ANSI 652.
 - 3. Powder Coated Aluminum finish: ANSI 689.
 - 4. Thresholds and Weatherseal: Thresholds, mill aluminum finish. Weatherseal, clear anodized aluminum finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which hardware assemblies attach to hollow metal frames, doors and walls, with installer present, for compliance with requirements for installation tolerances, blocking and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Pre-installation conference shall be conducted prior to installation of hardware at Project site. Meet with the, Owner, Contractor, installer, and hardware supplier and manufacturer's representatives. Review catalogs, brochures, templates, installation instructions, and the approved hardware schedule. Survey installation procedures and workmanship, with special emphasis on unusual conditions, as to ensure correct technique of installation, and coordination with other work. Notify participants at least 5 working days before conference.
- B. Builder's Hardware Installation:
 - 1. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.
- C. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
 - 1. Exit devices, Finished Floor to Centerline: 39-13/16-inches.
 - a) Center exit device on mid-rail of door.
 - 2. Lever locksets, Finished Floor to Centerline: 38- inches.
 - 3. Americans with Disabilities Act, (ADA), of 1990 Guidelines.
- D. Door & Hardware Institute "Installation Guide for Doors and Hardware".
- E. Mount hardware units at heights indicated, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
- F. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- G. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- H. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section "Joint Sealers."
- I. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.3 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant: Architect will engage a qualified Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
- B. Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.4 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that can not be adjusted to operate freely and smoothly or as intended for the application made.
 - 1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.

3.5 HARDWARE SCHEDULE

- A. General: Provide hardware for each door to comply with requirements of Section "Door Hardware," hardware set numbers indicated in door schedule, and in the following schedule of hardware sets.
- B. Hardware sets indicate quantity, item, manufacturer and product designation, size, and finish or color, as applicable. Notify the Architect of omissions or discrepancies prior to bid date for clarifications or instructions. Adjustments to the Contract Sum will not be allowed for omissions not clarified prior to bid opening.

HW SET: 010

1	EA	INTERMEDIATE PIVOT	INT 7215	626	IVE
1	EA	PIVOT SET	SET 7215	626	IVE
1	EA	PANIC HARDWARE	98-NL-990	626	VON
1	EA	RIM CYLINDER	1E-62 STD (MATCH EXISTING)	626	BES
1	EA	OH STOP	100S ADJ	630	GLY
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
		BALANCE OF HARDWARE	RE-USE EXISTING		

- 1. Verify existing conditions and advise if hardware is not appropriate.
- 2. Cut, patch, repair, and paint existing door and frame as required.

HW SET: 020

1	EA	PANIC HARDWARE	98-NL-990	626	VON
1	EA	RIM CYLINDER	1E-62 STD (MATCH EXISTING)	626	BES
1	EA	OH STOP	100S ADJ	630	GLY
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
		BALANCE OF HARDWARE	RE-USE EXISTING		

1. Verify existing conditions and advise if hardware is not appropriate.
2. Cut, patch, repair, and paint existing door and frame as required.

HW SET: 030

1	EA	STOREROOM LOCK	93K-7-D-16L	626	BES
1	EA	PERMANENT CORE	1C7-2 (MATCH EXISTING)	626	BES
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	SET	SEALS	S88D	DKB	PEM
1	EA	DOOR SWEEP	3452CNB	AL	PEM
		BALANCE OF HARDWARE	RE-USE EXISTING		

1. Verify existing conditions and advise if hardware is not appropriate.
2. Cut, patch, repair, and paint existing door and frame as required.

HW SET: 040

3	EA	HINGE	3CB1 4.5 X 4.5 NRP	652	IVE
1	EA	ENTRY LOCK	93K-7-AB-16L	626	BES
1	EA	PERMANENT CORE	1C7-2 (MATCH EXISTING)	626	BES
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
1	SET	SEALS	S88D	DKB	PEM

HW SET: 050

1	EA	PRIVACY LATCH	93K-7-L-16L	626	BES
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
3	EA	SILENCER	SR64-1	GRY	IVE
		BALANCE OF HARDWARE	RE-USE EXISTING		

1. Verify existing conditions and advise if hardware is not appropriate.
2. Cut, patch, repair, and paint existing door and frame as required.

HW SET: 060

1	EA	ENTRY LOCK	93K-7-AB-16L	626	BES
1	EA	PERMANENT CORE	1C7-2 (MATCH EXISTING)	626	BES
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
3	EA	SILENCER	SR64-1	GRY	IVE
		BALANCE OF HARDWARE	RE-USE EXISTING		

1. Verify existing conditions and advise if hardware is not appropriate.
2. Cut, patch, repair, and paint existing door and frame as required.

HW SET: 070

1	EA	CLASSROOM LOCK	93K-7-R-16L	626	BES
1	EA	PERMANENT CORE	1C7-2 (MATCH EXISTING)	626	BES
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
3	EA	SILENCER	SR64-1	GRY	IVE
		BALANCE OF HARDWARE	RE-USE EXISTING		

1. Verify existing conditions and advise if hardware is not appropriate.
2. Cut, patch, repair, and paint existing door and frame as required.

HW SET: 080

1	EA	STOREROOM LOCK	93K-7-D-16L	626	BES
1	EA	PERMANENT CORE	1C7-2 (MATCH EXISTING)	626	BES
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
3	EA	SILENCER	SR64-1	GRY	IVE
		BALANCE OF HARDWARE	RE-USE EXISTING		

1. Verify existing conditions and advise if hardware is not appropriate.
2. Cut, patch, repair, and paint existing door and frame as required.

HW SET: 090

1	EA	STOREROOM LOCK	93K-7-D-16L	626	BES
1	EA	PERMANENT CORE	1C7-2 (MATCH EXISTING)	626	BES
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
3	EA	SILENCER	SR64-1	GRY	IVE
		BALANCE OF HARDWARE	RE-USE EXISTING		

1. Verify existing conditions and advise if hardware is not appropriate.
2. Cut, patch, repair, and paint existing door and frame as required.

HW SET: 100

6	EA	HINGE	3CB1 4.5 X 4.5 NRP	630	IVE
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	93K-7-D-16L	626	BES
1	EA	PERMANENT CORE	1C7-2 (MATCH EXISTING)	626	BES
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	SET	SEALS	S88D	DKB	PEM
1	EA	ASTRAGAL	139SP	600	NGP
2	EA	DOOR SWEEP	3452CNB	AL	PEM
1	EA	THRESHOLD	255A	AL	PEM

HW SET: 200

6	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	ENTRY LOCK	93K-7-AB-16L	626	BES
1	EA	PERMANENT CORE	1C7-2 (MATCH EXISTING)	626	BES
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
2	EA	WALL STOP	WS407CCV	630	IVE
1	EA	ASTRAGAL	139SP	600	NGP
2	EA	SILENCER	SR64-1	GRY	IVE

HW SET: 210

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE LATCH	93K-7-N-16L	626	BES
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
3	EA	SILENCER	SR64-1	GRY	IVE

HW SET: 220

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	ENTRY LOCK	93K-7-AB-16L	626	BES
1	EA	PERMANENT CORE	1C7-2 (MATCH EXISTING)	626	BES
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
3	EA	SILENCER	SR64-1	GRY	IVE

HW SET: 230

3	EA	HINGE	3CB1 4.5 X 4.5 NRP	652	IVE
1	EA	ENTRY LOCK	93K-7-AB-16L	626	BES
1	EA	PERMANENT CORE	1C7-2 (MATCH EXISTING)	626	BES
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
3	EA	SILENCER	SR64-1	GRY	IVE

HW SET: 240

3	EA	HINGE	3CB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	93K-7-D-16L	626	BES
1	EA	PERMANENT CORE	1C7-2 (MATCH EXISTING)	626	BES
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
3	EA	SILENCER	SR64-1	GRY	IVE

HW SET: 250

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	93K-7-D-16L	626	BES
1	EA	PERMANENT CORE	1C7-2 (MATCH EXISTING)	626	BES
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
3	EA	SILENCER	SR64-1	GRY	IVE

HW SET: 255

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	PUSHPLATE	8200 6"X16"	630	IVE
1	EA	PULL PLATE	8305 10" 4"X16" STD	630	IVE
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" L DW	630	IVE
3	EA	SILENCER	SR64-1	GRY	IVE

END OF SECTION 08 7100

SECTION088000-GLAZING

PART 1-GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY

- A. Extent of glass and glazing work is indicated on drawings and schedules.
- B. Types of work in this section include glass and glazing for:
 - (1) Interior sidelights.
- C. Related Sections: The following sections contain requirements that relate to this section.
 - (1) Division 8 Section "Hollow Metal Doors and Frames" for hollow metal doors and frames.

1.3 SYSTEM DESCRIPTION

- A. Provide glass and glazing that has been produced, fabricated and installed to withstand normal thermal movement, wind loading and impact loading (where applicable), without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glass and glazing materials and other defects in the work.
 - (1) Normal thermal movement is defined as that resulting from an ambient temperature range of 120 deg. F (67 deg. C) and from a consequent temperature range within glass and glass framing members of 180 deg. F (100 deg. C).
 - (2) Deterioration of insulating glass is defined as failure of hermetic seal due to other causes than breakage which results in intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coating, if any, resulting from seal failure, and any other visual evidence of seal failure or performance.
 - (3) Deterioration of coated glass is defined as the development of manufacturing defects including peeling, cracking or other indications of deterioration in metallic coating due to normal conditions of use.
 - (4) Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.4 SUBMITTALS

- A. **Product Data:** Submit manufacturer's technical data for each glazing material and fabricated glass product required, including installation and maintenance instructions.
- B. **Samples:** Submit, for verification purposes, 12" square samples of each type of glass indicated except for clear single pane units, and 12" long samples of each color required (except black) for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative of adjoining framing system in color.
- C. **Certificate:** Submit certificates from respective manufacturers attesting that glass and glazing materials furnished for project comply with requirements.
 - (1) Separate certification will not be required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authorities having jurisdiction.
 - (2) For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.
- D. **Compatibility and Adhesion Test Report:** Submit statement from sealant manufacturer indicating that glass and glazing materials have been tested for compatibility and adhesion with glazing sealants and interpreting test results relative to material performance, including recommendations for primers and substrate preparation needed to obtain adhesion.

1.5 QUALITY ASSURANCE

- A. **Glazing Standards:** Comply with recommendations of Flat Glass Marketing Association (FGMA) "Glazing Manual" and "Sealant Manual" except where more stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this section or other referenced standards.
 - (1) **Minimum Glass Thickness:** Unless otherwise indicated, determine glass thickness for single-glazed openings following the recommendations of the primary glass manufacturer or in compliance with ASTM E1300, but in no case less than 3/16".
- B. **Safety Glazing Standard:** Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials.
 - (1) Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.

- C. Single Source Responsibility for Glass: To ensure consistent quality of appearance and performance, provide materials produced by a single manufacturer or fabricator for each kind and condition of glass indicated and composed of primary glass obtained from a single source for each type and class required.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect glass and glazing materials during delivery, storage and handling to comply with manufacturer's directions and as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes.
 - (1) Where insulating glass units will be exposed to substantial altitude changes, avoid hermetic seal ruptures by complying with insulating glass fabricator's recommendations for venting and sealing.

1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer or when joint substrates are wet due to rain, frost, condensation or other causes.
 - (1) Install liquid sealants at ambient and substrate temperatures above 40 deg. F (4.4 deg. C).

1.8 WARRANTY

- A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.
- B. Manufacturer's Special Project Warranty on Coated Glass Products: Provide written warranty signed by manufacturer of coated glass agreeing to furnish f.o.b. point of manufacture, freight allowed project site, within specified warranty period indicated below, replacements for those coated glass units which develop manufacturing defects. Manufacturing defects are defined as peeling, cracking or deterioration in metallic coating due to normal conditions and not due to handling or installation or cleaning practices contrary to glass manufacturer's published instructions.
 - (1) Warranty Period: Manufacturer's standard but not less than 5 years after date of Substantial Completion.
- C. Manufacturers Special Project Warranty on Laminated (Heat-Treated) Glass: Manufacturer's standard form, made out to Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - (1) Warranty Period: Manufacturer's standard but not less than 5 years after date of Substantial Completion.

PART 2-PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include; but are not limited to, the following:
- (1) Manufacturers of Clear and Tinted Float Glass:
 - (a) Guardian Industries Corp.
 - (b) Pilkington Building Products.
 - (c) PPG Industries, Inc.
 - (2) Manufacturers of Heat-Treated Glass:
 - (a) General Glass.
 - (b) Guardian Industries Corp.
 - (c) Pilkington Building Products.
 - (d) PPG Industries, Inc.

2.2 GLASS PRODUCTS, GENERAL

- A. Primary Glass Standard: Provide primary glass which complies with ASTM C 1036 requirements, including those indicated by reference to type, class, quality, and, if applicable, form, finish, mesh and pattern.
- B. Heat-Treated Glass Standard: Provide heat-treated glass which complies with ASTM C 1048 requirements, including those indicated by reference to kind, condition, type, quality, class, and, if applicable, form, finish, and pattern.
- C. Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer. Provide thicknesses indicated or, if not otherwise indicated, as recommended by glass manufacturer for application indicated.

2.3 PRIMARY GLASS PRODUCTS

- A. Clear Float Glass: Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select).
- B. Tinted Float Glass: Type I (transparent glass, flat), Class 2 (tinted heat absorbing and light reducing), Quality q3 (glazing select), and as follows:
- (1) Manufacturer's standard clear.
 - (a) PPG Clear or approved equal

- (2) Refer to requirements for sealed insulating glass units for performance characteristics of assembled units composed of tinted glass, coated or uncoated, relative to visible light transmittance, U-values, shading coefficient and visible reflectance.

2.4 HEAT-TREATED GLASS PRODUCTS

- A. Manufacturing Process: Manufacture heat-treated glass as follows:
 - (1) By horizontal (roller hearth) process with roll wave distortion parallel with bottom edge of glass as installed, unless otherwise indicated.
- B. Uncoated Clear Heat-Treated Float Glass: Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), kind as indicated below.
 - (1) Kind FT (fully tempered) where indicated.
 - (2) Provide FT glass where required by code for "human impact" locations.
- C. Uncoated Tinted Heat-Treated Float Glass: Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 2 (tinted heat absorbing and light reducing), Quality q3 (glazing select), with tint color and performance characteristics for 1/4" thick glass matching those indicated for non-heat-treated tinted float glass; kind as indicated below:
 - (1) Kind: HS (heat strengthened) except where indicated.
 - (2) Kind: FT (fully tempered) where indicated.
 - (3) Provide FT glass where required by code for "human impact" locations.

2.5 ELASTOMERIC GLAZING SEALANTS AND PREFORMED GLAZING TAPES

- A. General: Provide products of type indicated and complying with the following requirements:
 - (1) Compatibility: Select glazing sealants and tapes of proven compatibility with other materials with which they will come into contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
 - (2) Suitability: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants and tapes which have performance characteristics suitable for applications indicated and conditions at time of installation.
 - (3) Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those for Type, Grade, Class and Uses.

- (4) Colors: Provide color of exposed sealants indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.
- B. One-Part Non-Acid-Curing Silicone Glazing Sealant: Type S; Grade NS, Class 25; Uses NT, G, A, and, as applicable to uses indicated, O; and complying with the following requirements for modulus and additional joint movement capability.
- (1) Medium Modulus: Tensile strength of not less than 45 nor more than 75 psi at 100 percent elongation when tested per ASTM D 412 after 14 days at 77 deg. F (20 deg. C) and 50 percent relative humidity.
 - (2) Additional capability, when tested per ASTM C 719 for adhesion and cohesion under maximum cyclic movement, to withstand the following percentage increase and decrease of joint width, as measured at time of application, and remain in compliance with other requirements of ASTM C 920.
 - (a) 50 percent.
- C. Preformed Butyl-Polyisobutylene Glazing Tape: Provide manufacturer's standard solvent-free butyl-polyisobutylene formulation with a solids content of 100 percent; complying with AAMA A 804.1; in extruded tape form; non-staining and non-migrating in contact with nonporous surfaces; packaged on rolls with a release paper on one side; with or without continuous spacer rod as recommended by manufacturers of tape and glass for application indicated.
- D. Available Products: Subject to compliance with requirements, glazing sealants which may be incorporated in the work include, but are not limited to, the following:
- (1) One-Part Non-Acid Curing Low-Modulus Silicone Glazing Sealant:
 - (a) "Chem-Calk 1200"; Bostik Construction Products Div.
 - (b) "Dow Corning 790"; Dow Corning Corp.
 - (c) 864NST; Pecora Corp.
 - (d) "Spectrum 1"; Tremco, Inc.
 - (2) Preformed Butyl-Polyisobutylene Glazing Tape Without Spacer Rod:
 - (a) "Extru-Seal"; Pecora Corp.
 - (b) "PTI 303" Glazing Tape; Protective Treatments, Inc.
 - (c) "Tremco 440 Tape"; Tremco Inc.
 - (3) Preformed Butyl-Polyisobutylene Glazing Tape With Spacer Rod:
 - (a) "Shim-Seal"; Pecora Corp.
 - (b) "PTI 303" Shim Tape; Protective Treatments, Inc.

- (c) "Pre-shimmed Tremco 440 Tape"; Tremco Inc.

2.6 GLAZING GASKETS

- A. Dense Elastomeric Compression Seal Gaskets: Molded or extruded gaskets of material indicated below, complying with ASTM C 864, of profile and hardness required to maintain watertight seal:
 - (1) Neoprene.
 - (2) EPDM.
 - (3) Any material indicated above.
- B. Cellular Elastomeric Preformed Gaskets: Extruded or molded closed cell, integral-skinned neoprene of profile and hardness required to maintain watertight seal; complying with ASTM C 509, Type II; black.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - (1) Manufacturers of Preformed Gaskets:
 - (a) D. S. Brown Co.
 - (b) Maloney Precision Products Co.
 - (c) Tremco.

2.7 MISCELLANEOUS GLAZING MATERIALS

- A. Compatibility: Provide materials with proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealants, 80 to 90 Shore A durometer hardness.

2.8 INTERIOR GLASS TYPE

- A. Glass Type GL-1: Glass type clear float glass annealed except where fully tempered (FT) is required by code for "Human Impact" locations.

PART 3-EXECUTION

3.1 EXAMINATION

- A. Require Glazier to inspect work of glass framing erector for compliance with manufacturing and installation tolerances, including those for size, squareness,

offsets at corners; for presence and functioning of weep system; for existence of minimum required face or edge clearances; and for effective sealing of joinery. Obtain Glazier's written report listing conditions detrimental to performance of glazing work. Do not allow glazing work to proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Pre-Installation Meeting: At Contractor's direction, Glazier, sealant and gasket manufacturers' technical representatives, glass framing erector and other trades whose work affects glass and glazing shall meet at project site to review procedures and time schedule proposed for glazing and coordination with other work.
- B. Clean glazing channels and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are indicated for use.

3.3 GLAZING, GENERAL

- A. Comply with combined printed recommendations of glass manufacturers, of manufacturers of sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.
- B. Glazing channel dimensions as indicated in details are intended to provide for necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by job conditions at time of installation.
- C. Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass with flares or bevels along one horizontal edge which would occur in vicinity of setting blocks so that these are located at top of opening. Remove from project and dispose of glass units with edge damage or other imperfections of kind that, when installed, weakens glass and impairs performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

3.4 GLAZING

- A. Install setting blocks of proper size in sill rabbet, located one quarter of glass width from each corner, but with edge nearest corner not closer than 6" from corner, unless otherwise required. Set blocks in thin course of sealant which is acceptable for heel bead use.
- B. Provide spacers inside and out, of correct size and spacing to preserve required face clearances, for glass sizes larger than 50 united inches (length plus height), except where gaskets or glazing tapes with continuous spacer rods are used for glazing. Provide 1/8" minimum bite of spacers on glass and use thickness equal to sealant

width, except with sealant tape use thickness slightly less than final compressed thickness of tape.

- C. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.
- D. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
- E. Provide compressible filler rods or equivalent back-up material, as recommended by sealant and glass manufacturers, to prevent sealant from extruding into glass channel weep systems and from adhering to joints back surface as well as to control depth of sealant for optimum performance, unless otherwise indicated.
- F. Force sealants into glazing channels to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
- G. Tool exposed surfaces of sealants to provide a substantial "wash" away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.
- H. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement.
- I. Miter cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent pull away at corners; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.5 PROTECTION AND CLEANING

- A. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.
- B. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.
- C. Wash glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Wash glass by method recommended by glass manufacturer.

END OF SECTION 08 8000

SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes non-load-bearing steel framing members for the following applications:
 - (1) Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
 - (2) Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).
- B. Related Sections include the following:
 - (1) Division 07 Section "Fire-Resistive Joint Systems" for head-of-wall joint systems installed with non-load-bearing steel framing.
 - (2) Division 09 Section "Gypsum Board."
 - (3) Division 09 Section "Acoustical Panel Ceilings."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - (1) Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.

- (2) Protective Coating: ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch- diameter wire.
- B. Hanger Attachments to Concrete:
 - (1) Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.37 mm) and minimum 1/2-inch- (12.7-mm-) wide flanges.
- E. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - (1) Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - (a) Armstrong World Industries, Inc.; Drywall Grid Systems.
 - (b) Chicago Metallic Corporation; Fire Front 650-C Drywall Furring System.
 - (c) USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Studs and Runners: ASTM C 645.
- C. Slip-Type Head Joints: Provide one of the following at all interior non-load bearing partitions:
 - (1) Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.

- (2) Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - (1) Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 - (1) Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 - (2) Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
 - (1) Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - (1) Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
 - (1) Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - (1) Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - (a) Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - (b) Where exposed to view, install suspension system components equal distance from each other, plumb and free from contact with all other systems.
 - Painted finish.
 - (2) Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - (3) Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - (4) Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - (5) Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

- (6) Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
 - (1) Space studs as follows:
 - (a) Single-Layer Application: 16 inches o.c., unless otherwise indicated.
 - (b) Multilayer Application: 16 inches o.c., unless otherwise indicated.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - (1) Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - (2) Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - (a) Install two studs at each jamb, unless otherwise indicated.
 - (b) Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
 - (c) Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - (3) Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - (a) Firestop Track: Install at top and sides of indicated fire walls to maintain continuity of fire-resistance-rated assembly indicated.

- D. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 09 2216

SECTION 092900-GYPSUM BOARD

PART 1-GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- (1) Interior gypsum board.
- (2) Tile backing panels.

- B. Related Requirements:

- (1) Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Samples: For the following products:

- (1) Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
- (2) Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

- (1) Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
- (2) Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 -PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content is the highest amount feasible.
- B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - (1) American Gypsum.
 - (2) CertainTeed Corp.
 - (3) Georgia-Pacific Gypsum LLC.
 - (4) Lafarge North America Inc.
 - (5) National Gypsum Company.
 - (6) PABCO Gypsum.
 - (7) Temple-Inland.
 - (8) USG Corporation.
- B. Gypsum Wallboard: ASTM C 1396/C 1396M.
 - (1) Thickness: ½ inch.
 - (2) Long Edges: Tapered.

- (a) Manufacturer's standard or square edge is acceptable for base layer in multi-layer applications.
- C. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - (1) Thickness: 5/8 inch.
 - (2) Long Edges: Tapered.
- D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 - (1) Thickness: 1/2 inch.
 - (2) Long Edges: Tapered.
- E. Cementitious Tile Backer Units: ANSI A118.9 and ASTM C 1288 or 1325.
 - (1) Thickness: 5/8 inch.
 - (2) Long Edges: Manufacturer's standard edges
 - (3) Mold Resistance: STM D3273, score of 10 as rated according to ASTM D 3274.

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - (1) Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 - (2) Shapes:
 - (a) Cornerbead.
 - (b) Bullnose bead.
 - (c) LC-Bead: J-shaped; exposed long flange receives joint compound.
 - (d) L-Bead: L-shaped; exposed long flange receives joint compound.
 - (e) U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - (f) Expansion (control) joint.
 - (g) Curved-Edge Cornerbead: With notched or flexible flanges.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.

- B. Joint Tape:
 - (1) Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - (1) Laminating adhesive shall have a VOC content of 50 or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - (2) Laminating adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - (1) Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - (2) For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

PART 3-EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - (1) Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - (2) Fit gypsum panels around ducts, pipes, and conduits.
 - (3) Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - (1) Wallboard Type: Only as base layer in multi-layer assemblies.
 - (2) Type X: At all exposed locations.
 - (3) Ceiling Type: As indicated on Drawings.
 - (4) Moisture- and Mold-Resistant Type: At all locations with wall tile.
- B. Single-Layer Application:
 - (1) On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.

- (2) On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - (a) Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - (b) At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
- (3) Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

- (1) On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
- (2) Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840.
- C. Interior Trim: Install in the following locations:
 - (1) Cornerbead: Use at outside corners unless otherwise indicated.
 - (2) LC-Bead: Use at exposed panel edges.
 - (3) L-Bead: Use where indicated.
 - (4) U-Bead: Use where indicated.
 - (5) Curved-Edge Cornerbead: Use at curved openings.

3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.

- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - (1) Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - (2) Level 2: Not used.
 - (3) Level 3: Not used.
 - (4) Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - (a) Primer and its application to surfaces are specified in other Division 09 Sections.
 - (5) Level 5: Not used.

3.6 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - (1) Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - (2) Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 2900

SECTION093000-TILING

PART 1-GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - (1) Porcelain floor tile.
 - (2) Glazed ceramic wall tile.
- B. Related Sections: The following sections contain requirements that relate to this Section:
 - (1) Division 3 Section "Cast-In-Place Concrete" for monolithic slab finishes specified for tile substrates.
 - (2) Division 7 Section "Joint Sealers" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - (3) Division 9 Section "Gypsum Board Assemblies" for water resistant gypsum wallboard installed as part of gypsum wallboard systems.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of product specified.
- C. Shop drawings indicating tile patterns and locations and widths of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- D. Tile Samples for Initial Selection: Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures and patterns available for each type and composition of tile indicated. Include samples of accessories involving color selection.
- E. Samples for verification purposes of each item listed below, prepared on samples of size and construction indicated, products involve color and texture variations, in sets showing full range of variations expected.
 - (1) Each type, composition, and size of tile and for each color and texture required.
 - (2) Full-size units of each type of trim and accessory for each color required.

- F. Master grade certificates for each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- G. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, plus other information specified.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- B. Single-Source Responsibility for Setting and Grouting Materials: Obtain ingredients of a uniform quality from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.
- C. Installer Qualifications: Engage an experienced Installer who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings".

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.
- B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.
- C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If despite these precautions coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.
- B. Vent temporary heaters, if used, to exterior to prevent damage to tile work from carbon dioxide buildup.
- C. Maintain temperatures at 50 deg F or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

1.7 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials that match products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.
 - (1) Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size.

PART 2-PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide tile and tile setting materials manufactured by one of the following:
 - (1) Porcelain Floor Tile:
 - (a) Royal Mosa: Global Collection
 - (2) Ceramic Wall Tile:
 - (a) Royal Mosa: Global Collection
 - (3) Latex-Portland Cement Dry Mortar Mix:
 - (a) C-Cure Chemical Co.
 - (b) DAP Inc., Div. USG Corp.
 - (c) Laticrete International Inc.
 - (d) Southern Grouts & Mortars, Inc.
 - (4) Latex-Portland Cement Prepackaged Dry Grout Mixes:
 - (a) C-Cure Chemical Co.
 - (b) DAP Inc., Div. USG Corp.
 - (c) Laticrete International Inc.
 - (d) Southern Grouts & Mortars, Inc.

2.2 PRODUCTS, GENERAL

- A. ANSI Standard for Ceramic Tile: Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types, compositions, and grades of tile indicated.
 - (1) Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.

- B. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.
- C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
 - (1) See color selections under tile products.
 - (2) Provide tile trim and accessories that match color and finish of adjoining flat tile, unless contrasting colors are selected by Architect.
- D. Factory Blending: For tile exhibiting color variations within the ranges selected during sample submittals, blend tile in factory and package accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.
- E. Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer unless another mounting method is indicated.
 - (1) Where tile is indicated for installation in swimming pools, on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies that this type of mounting is suitable for these kinds of uses and has been successfully used on other projects.
- F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, or where otherwise recommended by the tile and/or grout manufacturer, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE PRODUCTS

- A. Porcelain Floor Tile: Provide factory-mounted flat tile complying with the following requirements:
 - (1) Composition: Porcelain.
 - (2) Nominal Facial Dimensions: 12 inches x 12 inches.
 - (3) Nominal Thickness: 5/16 inch.
 - (4) Face: Pattern of design indicated, with cushion edges.
 - (5) Color: As indicated on drawings
- B. Ceramic Wall Tile: Provide flat tile complying with the following requirements:
 - (1) Nominal Facial Dimensions: 6 inches x 6 inches.
 - (2) Nominal Thickness: 5/16 inch.

- (3) Face: Pattern of design indicated, with cushion edges.
- (4) Color/Pattern: Patterns and colors as indicated on drawings.
- C. Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with following requirements:
 - (1) Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
 - (2) Shapes: As follows, selected from manufacturer's standard shapes:
 - (a) Wainscot Cap for Thinset Mortar Installations: Surface bullnose.
 - (b) External Corners for Thinset Installations: Surface bullnose.
 - (c) Internal Corners: Field-buttet square corners, except use coved base and cap angle pieces designed to member with stretcher shapes.
 - (d) Base for Thinset Mortar Installation: Built-up cove base; square top at tile wainscot, round top at walls without ceramic tile.

2.4 SETTING MATERIALS

- A. Portland Cement Mortar Installation Materials: Provide materials complying with ANSI A108.1 and as specified below.
 - (1) Portland Cement: ASTM C150, Type I.
 - (2) Aggregate: Sand complying with ASTM C144, Clean and Graded to pass 16-inch screen.
 - (3) Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.
 - (4) Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
 - (5) Latex Additive: Manufacturer's standard acrylic resin or styrene-butadiene-rubber water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
- B. Latex-Portland Cement Mortar: ANSI A118.4, composition as follows: (1)
 - Prepackaged dry mortar mix composed of portland cement, graded aggregate, and the following dry polymer additive in the form of a re-emulsifiable powder to which only water is added at job site.
 - (a) Dry Polymer Additive: Polyvinyl acetate or ethylene vinyl acetate.

2.5 GROUTING MATERIALS

- A. Latex-Portland Cement Grout: ANSI A118.6, color as indicated, composition as follows:
 - (1) Prepackaged dry grout mix composed of portland cement, graded aggregate, and the following dry polymer additive in the form of a re-emulsifiable powder to which only water is added at job site.
 - (a) Dry Polymer Additive: Polyvinyl acetate or ethylene vinyl acetate.

2.6 ELASTOMERIC SEALANTS

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with requirements of Division 7 Section "Joint Sealers," including ASTM C 920 as referenced by Type, Grade, Class, and Uses.
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
- C. One-Part Mildew-Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes.
- D. Products: Subject to compliance with requirements, provide one of the following:
 - (1) One-Part Mildew-Resistant Silicone Sealant:
 - (a) "Dow Corning 786"; Dow Corning Corp.
 - (b) "SCS 1702"; General Electric Co.
 - (c) "863 #345 White"; Pecora Corp.
 - (d) "Proglaze White"; Tremco Corp.

2.7 MISCELLANEOUS MATERIALS

- A. Metal Edge Strips: Zinc alloy or stainless steel terrazzo strips, 1/8-inch wide at top edge with integral provision for anchorage to mortar bed or substrate unless otherwise indicated.
- B. Temporary Protective Coating: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout, is compatible with tile and mortar/grout products, and is easily removable after grouting is completed without damaging grout or tile.
 - (1) Petroleum paraffin wax, fully refined, tasteless, odorless, containing at least 0.5 percent oil with a melting point of 120 deg F to 140 deg F per ASTM D 87.

2.8 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with requirements of referenced standards and manufacturers including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

PART 3-EXECUTION

3.1 EXAMINATION

- A. Examine substrates and areas where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - (1) Verify that substrates for setting tile are firm, dry, clean, and free from oil or waxy films and curing compounds.
 - (2) Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Blending: For tile exhibiting color variations within the ranges selected during sample submittals, verify that tile has been blended in factory and packaged accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standard: Comply with parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile" that apply to type of setting and grouting materials and methods indicated.
- B. TCA Installation Guidelines: TCA "Handbook for Ceramic Tile Installation"; comply with TCA installation methods indicated.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions except as otherwise shown. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim,

finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile.

- E. Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise shown.
 - (1) For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.
- F. Lay out tile wainscots to next full tile beyond dimensions indicated.
- G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installation of tiles.
 - (1) Locate joints in tile surfaces directly above joints in concrete substrates.
 - (2) Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealers."
- H. Grout tile to comply with the requirements of the following installation standards:
 - (1) For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts), comply with ANSI A108.10.

3.4 WALL TILE INSTALLATION METHODS

- A. Install types of tile designated for wall application to comply with requirements indicated below for setting-bed methods, TCA installation methods related to subsurface wall conditions, and grout types:
 - (1) Latex-Portland Cement Mortar: ANSI A108.5.
 - (a) Water-Resistant Gypsum Board, Interior: TCA W243.
 - (b) Grout: Latex-portland cement.

3.5 FLOOR INSTALLATION METHODS

- A. Porcelain Floor Tile: Install tile to comply with requirements indicated below for setting bed methods, at toilet rooms; TCA installation methods related to types of subfloor construction, and grout types:
 - (1) Latex-Portland Cement Mortar: ANSI A108.5.
 - (2) Concrete Subfloors, Interior: TCA F113.
 - (3) Grout: Latex-Portland cement.

3.6 CLEANING AND PROTECTION

- A. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - (1) Remove latex-portland cement grout residue from tile as soon as possible.
 - (2) Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but no sooner than 14 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
 - (3) Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
- B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.
- C. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensures that tile is without damage or deterioration at time of Final Acceptance.
 - (1) When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 09 3000

SECTION 09 5113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - (1) acoustical panels
 - (2) suspended acoustic ceilings with metal suspension system.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: Drawn to scale and coordinating acoustical panel ceiling installation with hanger attachment to building structure and ceiling mounted items:
- C. Samples: For each exposed finish.

1.4 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLAP-accredited laboratory.

1.5 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - (1) Acoustical Ceiling Panels: Full-size panels equal to 1.0 percent of quantity installed.
 - (2) Suspension System Components: Quantity of each exposed component equal to 1.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANEL CEILINGS, GENERAL

- A. Acoustical Panel Standard: Comply with ASTM E 1264.
- B. Metal Suspension System Standard: Comply with ASTM C 635.

- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - (1) Anchors in Concrete: Bonded anchors fabricated from corrosion-resistant materials, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - (2) Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
- D. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - (1) Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.
- E. Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

2.2 MINERAL-FIBER ACOUSTICAL PANELS

- A. Recycled content for Mineral -Fiber Acoustical Panels: Provide products with a minimum 5% post-consumer recycled content or minimum 20% pre-consumer recycled content.
- B. Products: Subject to compliance with requirements, provide one of the following:
 - (1) Armstrong World Industries, Inc.
 - (2) CertainTeed, Inc.
 - (3) USG Interiors, Inc.

2.3 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

- A. Recycled content for Metal Suspension System: Provide products with an average recycled content so post-consumer plus one-half pre-consumer recycled content is not less than 90%.
- B. Products: Subject to compliance with requirements, provide one of the following:
 - (1) Armstrong World Industries, Inc.

- (2) CertainTeed, Inc.
- (3) USG Interiors, Inc.
- C. Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished metal caps on flanges.
 - (1) Structural Classification: Intermediate-duty system.
 - (2) End Condition of Cross Runners: Butt-edge type.
 - (3) Cap Material: Steel or aluminum cold-rolled sheet.
 - (4) Cap Finish: Painted white.

2.4 ACOUSTICAL PANEL SYSTEM SCHEDULE

- A. Recycled content for Acoustical Panel System Schedule: Provide products with a minimum 5% post-consumer recycled content or minimum 20% pre-consumer recycled content.
- B. Acoustical Lay-In Tegular Panels Type 1:
 - (1) Basis of Design Product: USG "Radar Illusion" 2124.
 - (a) Edge: Angled tegular.
 - (b) Grid: Prelude 15/16 inch exposed tee.
 - (c) Size: 24 x 48 inch x 5/8", scored to 24 x 24 inch.
 - (d) NRC: 0.050, minimum.

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

- A. Manage construction waste in accordance with provisions of Section 017419. Documentation shall be submitted to satisfy the requirements of that section.

3.2 EXAMINATION

- A. Examine substrates and structural framing to which ceiling system attaches or abuts, with Installer present, for compliance with requirements specified in this and other sections that affect installation and anchorage of ceiling system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
- B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half-width units at borders, and comply with reflected ceiling plans.

3.4 INSTALLATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders.
- B. Arrange acoustical units and orient directionally patterned units in a manner shown by reflected ceiling plans.
- C. Suspend ceiling hangers from building's structural members, plumb and free from contact with insulation or other objects within ceiling plenum. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers, use trapezes or equivalent devices. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - (1) Do not support ceilings directly from permanent metal forms or floor deck; anchor into concrete slabs.
 - (2) Provide additional hangers at light fixtures located within 6 inches of each corner.
 - (3) Do not attach hangers to steel deck tabs or to steel roof deck.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
 - (1) Install hold-down clips in areas where required by governing regulations; space as recommended by panel manufacturer, unless otherwise indicated or required.

3.5 CLEANING

- A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5113

SECTION 096513-RESILIENT BASE AND ACCESSORIES

PART 1-GENERAL

1.1 SUMMARY

- A. Section Includes:
 - (1) Resilient base.
 - (2) Resilient molding accessories.
- B. Related Section: The following Sections contain requirements that relate to this Section:
 - (1) Division 9 Section "Resilient Tile Flooring."
 - (2) Division 9 Section "Tile Carpeting."

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - (1) Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - (1) Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
 - (2) Smoke Density: Less than 450 per ASTM E 662.
 - (3) Flame Spread: Less than 75 per ASTM E 84.
 - (4) Smoke Developed: Less than 450 per ASTM E89.

1.4 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.
 - (1) Maintain a minimum temperature of 70 deg F in spaces to receive products specified in this Section for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. After this period, maintain a temperature of not less than 55 deg F.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.

- (1) Do not install products until they are at the same temperature as that of the space where they are to be installed.
- C. Install resilient products after other finishing operations, including painting, have been completed.
 - (1) Close spaces to traffic during installation of products specified in this Section.

PART2-PRODUCTS

2.1 RESILIENT BASE

A. Resilient Base:

- (1) Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - (a) Johnsonite.
 - TightLock Carpet & Resilient / Topset Wall Bases.

B. Resilient Base Standard: ASTM F-1861

- (1) Material Requirement: Type TP (rubber, thermoplastic)
- (2) Manufacturing Method: Group 1 (solid, homogeneous)

C. Wall Base:

- (1) Physical Characteristics: TightLock Carpet Wall Base Rubber (TDC) and Vinyl (TCB):
 - (a) 1/4" wedge-shaped profile thickness.
 - (b) 3-1/4", 4-1/2", and 6-1/2" overall heights.
 - (c) 1/4" hidden spacer results in 3", 4-1/4", and 6-1/4" exposed face surfaces respectively.
 - (d) 4' straight and 75' coiled lengths.
 - (e) Straight (Toeless) profile only.
 - (f) Inside and outside corners with 4" returns available.
- (2) TightLock - Resilient/TopSet Wall Base Vinyl (TCBR):
 - (a) 1/4" wedge-shaped profile thickness.
 - (b) 3-1/8", 4-3/8", and 6-3/8" overall heights.

- (c) 4' straight and 75' coiled lengths.
- (d) Coved (Toe) profile only.
- (e) Outside corners with 4" returns available.

(3) Color: Toast 283

2.2 RESILIENT MOLDING ACCESSORY

A. Resilient Molding Accessory:

- (1) Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - (a) Armstrong World Industries, Inc.
 - (b) Johnsonite.
 - (c) Mondo Rubber International, Inc.
 - (d) Roppe Corporation, USA.
- (2) Recycled Content of Rubber: Provide products with an average recycled content so postconsumer plus one-half pre-consumer recycled content is not less than 60 percent.

B. Material: Rubber.

C. Profile and Dimensions:

- (1) Carpet edge for glue-down applications: To be determined.
- (2) Nosing for carpet: To be determined.
- (3) Nosing for resilient floor covering: To be determined.
- (4) Reducer strip for resilient floor covering: To be determined.
- (5) Joiner for tile and carpet: Schlliter.
- (6) Transition strips: To be determined.

D. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 - (1) Adhesives and Sealants in this section must comply with South Cost Air Quality Management District Rule 1168 and Green Seal Standard GS-36 if applied on site.
 - (2) Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - (a) Cove Base Adhesives: Not more than 50 g/L.
 - (b) Rubber Floor Adhesives: Not more than 60 g/L.
- C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART3-EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

- A. Manage construction waste in accordance with provisions of Section 017419. Documentation shall be submitted to satisfy the requirements of that section.

3.2 EXAMINATION

- A. Examine areas where installation of products specified in this Section will occur, with Installer present, to verify that substrates and conditions are satisfactory for installation and comply with manufacturer's requirements and those specified in this Section.

3.3 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
 - (1) Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - (2) Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - (3) Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are same temperature as the space where they are to be installed.

- (1) Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.4 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base. B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
- G. Install inside and exterior corners before installing straight pieces.

3.5 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet, resilient floor covering, tile and wood floors that would otherwise be exposed.

3.6 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing installation:
 - (1) Remove visible adhesive and other surface blemishes using cleaner recommended by manufacturers of resilient product involved.
 - (2) Cover resilient accessories on floors and stairs with undyed, untreated building paper until inspection for Final Acceptance.
- B. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- C. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.
 - (1) Apply two coat(s).

- D. Cover resilient products until Substantial Completion.
- E. Clean products specified in this Section not more than 4 days prior to dates scheduled for inspections intended to establish date of Final Acceptance in each area of Project. Clean products using method recommended by manufacturer.

END OF SECTION 09 6513

SECTION 09 6519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - (1) Vinyl composition floor tile.
- B. Resilient wall base, reducer strips, and other accessories installed with resilient floor tiles are specified in Division 9 Section "Resilient Wall Base and Accessories."

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of product specified.
- C. Samples for initial selection purposes in form of manufacturer's color charts consisting of actual tiles or sections of tiles showing full range of colors and patterns available for each type of resilient floor tile indicated.
- D. Maintenance data for resilient floor tile, to include in Operating and Maintenance Manual specified in Division 1.
- E. Indoor Air Quality: Submit manufacturer's product data that includes statement of VOC content. Highlight the VOC content and confirm the content meets the requirements in this specification prior to submission.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility for Floor Tile: Obtain each type, color, and pattern of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- B. Fire Performance Characteristics: Provide resilient floor tile with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - (1) Critical Radiant Flux: 0.45 watts per sq. cm or more per ASTM E 648.
 - (2) Smoke Density: Less than 450 per ASTM E 662.

- (3) Flame Spread: Less than 75 per ASTM E 84.
- (4) Smoke Developed: Less than 450 per ASTM E 84.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver tiles and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store flooring materials in dry spaces protected from the weather with ambient temperatures maintained between 50 deg F and 90 deg F.
- C. Store tiles on flat surfaces. Move tiles and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

1.6 PROJECT CONDITIONS

- A. Maintain a minimum temperature of 70 deg F in spaces to receive tiles for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. After this period, maintain a temperature of not less than 55 deg F.
- B. Do not install tiles until they are at the same temperature as the space where they are to be installed.
- C. Close spaces to traffic during tile installation.

1.7 SEQUENCING AND SCHEDULING

- A. Install tiles and accessories after other finishing operations, including painting, have been completed.
- B. Do not install tiles over concrete slabs until the slabs have cured and are sufficiently dry to bond with adhesive as determined by tile manufacturer's recommended bond and moisture test.

1.8 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.
 - (1) Furnish not less than one box of each color, pattern and size of resilient floor tile installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide products of one of the following:

- B. Vinyl Composition Floor Tile: Products complying with ASTM F 1066, Composition 1 (non-asbestos formulated), Class 2; 12" x 12", 1/8" thick:
 - (a) Armstrong World Industries, Inc., Basis-of-Design.
 - (b) Mannington Commercial
 - (c) Johnsonite: A Tarkett Company

2.2 RESILIENT FLOORING COLORS AND PATTERNS

- A. Provide colors and patterns as indicated, or if not otherwise indicated, as selected by Architect.
 - (1) Assume the selection of up to 6 additional colors of vinyl composition tile from the standard grade price group.

2.3 INSTALLATION ACCESSORIES

- A. Concrete Slab Primer: Nonstaining type as recommended by flooring manufacturer.
- B. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by tile manufacturer for applications indicated.
- C. Adhesives (Cements): Water-resistant type recommended by tile manufacturer to suit resilient floor tile products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. General: Examine areas where installation of tiles will occur, with Installer present, to verify that substrates and conditions are satisfactory for tile installation and comply with tile manufacturer's requirements and those specified in this Section.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - (1) Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by tile manufacturer.
 - (2) Finishes of subfloors comply with tolerances and other requirements specified in Division 3 Section "Cast-In-Place Concrete" for slabs receiving resilient flooring.
 - (3) Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.

- C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with manufacturer's installation specifications to prepare substrates indicated to receive tile.
- B. Use trowelable leveling and patching compounds per tile manufacturer's directions to fill cracks, holes, and depressions in substrates.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.
- D. Broom or vacuum clean substrates to be covered by tiles immediately before tile installation. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.
- E. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

3.3 INSTALLATION

- A. General: Comply with tile manufacturer's installation directions and other requirements indicated that are applicable to each type of tile installation included in Project.
- B. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths at perimeter that equal less than one-half of a tile. Install tiles square with room axis, unless otherwise indicated.
- C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.
 - (1) Lay tiles in basket weave pattern with grain direction alternating between reversed in adjacent tiles.
- D. Where demountable partitions and other items are indicated for installing on top of finished tile floor, install tile before these items are installed.
- E. Scribe, cut, and fit tiles to butt tightly to vertical surfaces, permanent fixtures, built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.
- F. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- G. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent marking device.

- H. Adhere tiles to flooring substrates without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed tile installation.
- I. Use full spread of adhesive applied to substrate in compliance with tile manufacturer's directions including those for trowel notching, adhesive mixing, and adhesive open and working times.
 - (1) Allow adhesive to set/cure according to manufacturer's recommendations.
- J. Hand roll tiles where required by tile manufacturer.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing tile installation:
 - (1) Remove visible adhesive and other surface blemishes using cleaner recommended by tile manufacturers.
 - (2) Sweep or vacuum floor thoroughly.
 - (3) Do not wash floor until after time period recommended by resilient floor tile manufacturer.
 - (4) Damp-mop tile to remove black marks and soil.
- B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by tile manufacturer.
 - (1) Apply protective floor polish to tile surfaces that are free from soil, visible adhesive, and surface blemishes.
 - (a) Coordinate selection of floor polish with Owner's maintenance service.
 - (2) Cover tiles with undyed, untreated building paper until final acceptance.
 - (3) Do not move heavy and sharp objects directly over tiles. Place plywood or hardboard panels over tiles and under objects while they are being moved. Slide or roll objects over panels without moving panels.
- C. Clean tiles not more than 4 days prior to dates scheduled for final acceptance in each area of Project. Clean tiles using method recommended by manufacturer.
 - (1) Strip protective floor polish that was applied after completing installation prior to cleaning.
 - (2) Reapply floor polish after cleaning.

END OF SECTION 09 6519

SECTION096813-CARPETTILE

PART 1-GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes carpet tile and installation.
- B. Related Sections include the following:
 - (1) Division 9 Section "Resilient Wall Base and Accessories", "Resilient Tile Flooring" for resilient wall base and accessories installed with carpet tile.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation methods.
- B. Shop Drawings: Show the following:
 - (1) Carpet tile type, color, and dye lot.
 - (2) Type of installation.
 - (3) Pattern of installation.
 - (4) Pattern type, location, and direction.
 - (5) Pile direction.
 - (6) Type, color, and location of insets and borders.
 - (7) Type, color, and location of edge, transition, and other accessory strips.
 - (8) Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - (1) Carpet Tile: Full-size Sample.
 - (2) Exposed Edge Stripping and Accessory: 12-inch- (300-mm-) long Samples.
- D. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.

- E. Maintenance Data: For carpet tile to include in maintenance manuals specified in Division 1. Include the following:
 - (1) Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - (2) Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
- B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Product Options: Products and manufacturers named in Part 2 establish requirements for product quality in terms of appearance, construction, and performance. Other manufacturers' products comparable in quality to named products and complying with requirements may be considered. Refer to Division 1 Section "Substitutions."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

- A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."
- B. Environmental Limitations: Do not install carpet tile until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- C. Do not install carpet tile over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tile, install carpet tile before installing these items.

1.7 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

- B. Special Carpet Tile Warranty: Written warranty, signed by carpet tile manufacturer agreeing to replace carpet tile that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.

- (1) Warranty Period: 10 years from date of Substantial Completion.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- (1) Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2-PRODUCTS

2.1 CARPET TILE

- A. Carpet tile must be Carpet and Rug Institute Green Label Plus Certified and carpet cushion must be Green Label Certified.
- B. Recycled Content of Carpet Tile: Provide products with an average recycled content so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 40%.

2.2 CARPET TILE MANUFACTURERS

- A. Manufacturers:

- (1) Shaw Industries (Shaw Commercial & Patcraft Designweave)

- B. Product Specifications

- (1) Collection Name: Infinite Wisdom
 - (2) Style Number: I0290
 - (3) Color: Epiphany
 - (4) Color Number: 00200
 - (5) Pile Construction: Multi-level Pattern Loop
 - (6) Pile Fiber & Type: Eco Solution Q[®] SD Nylon
 - (7) Dye Method: 100% Solution Dyed
 - (8) Gauge: 1/12

- (9) Stitches Per Inch: 9.5
- (10) Tufted Pile Height: 3/32" High, 5/32" Low
- (11) Tufted Yarn Weight: 17 oz.
- (12) Finished Pile Thickness: .095"
- (13) Density: 6442
- (14) Weight Density: 109,514
- (15) Protective Treatment: S.S.P. Shaw Soil Protection
- (16) Primary Backing: Non-Woven Synthetic
- (17) Secondary Backing: EcoWorx® Tile
- (18) Tile Size: 24" x 24"

C. Performance Specifications:

- (1) Flooring Radiant Panel: Class I (ASTM E-648)
- (2) Smoke Density: <450 (ASTM-E-662)
- (3) Static Control: <3.5 KV (AATCC-134)
- (4) CRI Green Label Plus: GLB9968
- (5) ADA Compliance: This product meets the guidelines as set forth in the American with Disabilities Act for minimum static coefficient of friction of 0.6 for accessible routes.

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and that is recommended by carpet tile manufacturer.
 - (1) Adhesives and Sealants in this section must comply with South Coast Air Quality Management District Rule 1168 and Green Seal Standard GS-36 if applied on site

PART 3-EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

- A. Manage construction waste in accordance with provisions of Section 017419. Documentation shall be submitted to satisfy the requirements of that section.

3.2 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Verify that substrates and conditions are satisfactory for carpet tile installation and comply with requirements specified.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - (1) Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
 - (2) Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet tile.
 - (3) Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 INSTALLATION

- A. General: Comply with CRI 104, Section 13, "Carpet Modules (Tiles)."
- B. Installation Method: As recommended in writing by carpet tile manufacturer.
- C. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

- D. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- F. Install pattern parallel to walls and borders.

3.5 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - (1) Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - (2) Remove yarns that protrude from carpet tile surface.
 - (3) Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 15, "Protection of Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 6813

SECTION 09 9080 - COATING SYSTEMS FOR EXTERIOR MASONRY

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Coating systems for exterior masonry.

1.2 RELATED SECTIONS

- A. Section 04 2000 - Concrete Masonry Units.

1.3 REFERENCES

- A. ASTM D 16 - Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ASTM D 4263 - Indicating Moisture in Concrete by the Plastic Sheet Method.
- C. SSPC-SP 13/NACE 6 - Surface Preparation of Concrete.

1.4 DEFINITIONS

- A. Definitions of Painting Terms: ASTM D 16, unless otherwise specified.
- B. Dry Film Thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000 inch).

1.5 SUBMITTALS

- A. Comply with Section 01 3300 - Submittal Procedures.
- B. Product Data: Submit manufacturer's product data for each coating, including generic description, complete technical data, surface preparation, and application instructions.
- C. Color Samples: Submit manufacturer's color samples showing full range of standard colors.
- D. Manufacturer's Quality Assurance: Submit manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.
- E. Applicator's Quality Assurance: Submit list of a minimum of 5 completed projects of similar size and complexity to this Work. Include for each project:
 - (1) Project name and location.
 - (2) Name of owner.
 - (3) Name of contractor.

- (4) Name of architect.
- (5) Name of coating manufacturer.
- (6) Approximate area of coatings applied.
- (7) Date of completion.

F. Warranty: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

- (1) Specialize in manufacture of coatings with a minimum of 10 years successful experience.
- (2) Able to demonstrate successful performance on comparable projects.
- (3) Single Source Responsibility: Coatings and coating application accessories shall be products of a single manufacturer.

B. Applicator's Qualifications:

- (1) Experienced in application of specified coatings for a minimum of 5 years on projects of similar size and complexity to this Work.
- (2) Applicator's Personnel: Employ persons trained for application of specified coatings.

C. Mock-Ups: Prepare 2 foot high x 8 foot wide mock-up for each coating system specified using same materials, tools, equipment, and procedures intended for actual surface preparation and application. Obtain Architect's approval of mock-ups. Retain mock-ups to establish intended standards by which coating systems will be judged.

D. Preapplication Meeting: Convene a preapplication meeting before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Owner, Contractor, Architect, applicator, and manufacturer's representative. Review the following:

- (1) Environmental requirements.
- (2) Protection of surfaces not scheduled to be coated.
- (3) Surface preparation.
- (4) Application.
- (5) Repair.
- (6) Field quality control.

- (7) Cleaning.
- (8) Protection of coating systems.
- (9) One-year inspection.
- (10) Coordination with other work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:

- (1) Coating or material name.
- (2) Manufacturer.
- (3) Color name and number.
- (4) Batch or lot number.
- (5) Date of manufacture.
- (6) Mixing and thinning instructions.

B. Storage:

- (1) Store materials in a clean dry area and within temperature range in accordance with manufacturer's instructions.
- (2) Keep containers sealed until ready for use.
- (3) Do not use materials beyond manufacturer's shelf life limits.

C. Handling: Protect materials during handling and application to prevent damage or contamination.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Weather:

- (1) Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
- (2) Surface Temperature: Minimum of 5 degrees F (3 degrees C) above dew point.
- (3) Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.

- (4) Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
- (5) Wind: Do not spray coatings if wind velocity is above manufacturer's limit.
- B. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with manufacturer's instructions.
- C. Dust and Contaminants:
 - (1) Schedule coating work to avoid excessive dust and airborne contaminants.
 - (2) Protect work areas from excessive dust and airborne contaminants during coating application and curing.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Tnemec Company Incorporated, 6800 Corporate Drive, Kansas City, Missouri 64120-1372. Toll Free (800) 863-6321. Phone (816) 483-3400. Fax (816) 483-3969. Web Site www.tnemec.com or approved alternate manufacturer.
 - (1) An additional coat may be applied for hiding or increased performance.
 - (2) Brush or roller application may require additional coats to achieve recommended film thickness. Film thickness for coatings applied to concrete and concrete masonry units are calculated from the square foot per gallon figures. There is no method for accurately measuring the film thickness of coatings applied over a rough masonry substrate.

2.2 COATING SYSTEMS FOR PRECAST CONCRETE, CAST-IN-PLACE CONCRETE, AND DENSE CONCRETE MASONRY UNITS

- A. Moderate to Severe Exposure:
 - (1) System Type: Acrylate.
 - (2) Surface Preparation: SSPC-SP 13/NACE 6. Clean and dry.
A, Block Filler for CMU: Series 130 Envirovill, 80-100 sq.ft./gal.
 - (3) Primer: Series 156 Enviro-Crete. DFT 4.0 to 8.0 mils
 - (4) Finish Coat: Series 156 Enviro-Crete. DFT 4.0 to 8.0 mils
 - (5) Total DFT: Series 156 Enviro-Crete, 8.0 to 16.0 mils
 - (6) Finish Color: As selected by Architect from manufacturer's standard colors

2.3 ACCESSORIES

- A. Coating Application Accessories:

- (1) Accessories required for application of specified coatings in accordance with manufacturer's instructions, including thinners.
- (2) Products of coating manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which coating systems are to be applied. Notify Architect of areas or conditions not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

3.2 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

- A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.
- B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.3 SURFACE PREPARATION OF CONCRETE AND MASONRY

- A. Prepare concrete and masonry surfaces in accordance with manufacturer's instructions and SSPC-SP 13/NACE 6.
- B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.
- C. Test concrete for moisture in accordance with ASTM D 4263.
- D. Allow concrete and mortar to cure for a minimum of 14 days before coating.
- E. Level protrusions and mortar spatter.

3.4 APPLICATION

- A. Apply coatings in accordance with manufacturer's instructions.
- B. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.
- C. Keep containers closed when not in use to avoid contamination.
- D. Do not use mixed coatings beyond pot life limits.
- E. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.
- F. Uniformly apply coatings at spreading rate required to achieve specified DFT.

- G. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.5 REPAIR

- A. Materials and Surfaces Not Scheduled To Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.
- B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.
- C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.6 FIELD QUALITY CONTROL

- A. Inspector's Services:
 - (1) Verify coatings and other materials are as specified.
 - (2) Verify surface preparation and application are as specified.
 - (3) Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges.
 - (4) Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.
 - (5) Report:
 - (a) Submit written reports describing inspections made and actions taken to correct nonconforming work.
 - (b) Report nonconforming work not corrected.
 - (c) Submit copies of report to Architect and Contractor.
- B. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

3.7 CLEANING

- A. Remove temporary coverings and protection of surrounding areas and surfaces.

3.8 PROTECTION OF COATING SYSTEMS

- A. Protect surfaces of coating systems from damage during construction.

3.9 ONE-YEAR INSPECTION

- A. Owner will set date for one-year inspection of coating systems.
- B. Inspection shall be attended by Owner, Contractor, Architect, and manufacturer's representative.
- C. Repair deficiencies in coating systems as determined by Architect in accordance with manufacturers instructions.

END OF SECTION 09 9080

SECTION 09 9100 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.
 - (1) Surface preparation, priming, and finish coats specified in this Section are in addition to shop-priming and surface treatment specified under other Sections.
- B. Paint exposed surfaces whether or not colors are designated in schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
 - (1) Painting includes field-painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
 - (2) Include painting of roof top penthouses, louver enclosures and mechanical equipment whether aluminum or sheet metal.
- C. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.
 - (1) Prefinished items not to be painted include the following factory-finished components:
 - (a) Metal toilet enclosures.
 - (b) Acoustic materials.
 - (c) Flush wood doors.
 - (d) Finished mechanical and electrical equipment (grey primer is not considered finished).
 - (e) Light fixtures.
 - (f) Switchgear.
 - (g) Prefinished louvers.

- (2) Concealed surfaces not to be painted include wall or ceiling surfaces in the following generally inaccessible areas:
 - (a) Furred areas.
 - (b) Pipe spaces.
- (3) Finished metal surfaces not to be painted include:
 - (a) Anodized aluminum.
 - (b) Stainless steel.
 - (c) Chromium plate.
 - (d) Copper.
 - (e) Bronze.
 - (f) Brass.
- (4) Operating parts not to be painted include moving parts of operating equipment, such as the following:
 - (a) Valve and damper operators.
 - (b) Linkages.
 - (c) Sensing devices.
 - (d) Motor and fan shafts.
- (5) Labels: Do not paint over Underwriters Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections: The following Sections contain requirements that relate to this Section:

- (1) Division 5 Section "Structural Steel" for shop-priming structural steel.
- (2) Division 5 Section "Metal Fabrications" for shop-priming ferrous metal.
- (3) Division 5 Section "Metal Deck" for galvanized metal deck in the gymnasium.
- (4) Division 8 Section "Custom Steel Doors and Frames" for factory priming steel doors and frames.

1.3 DEFINITIONS

- A. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as a prime, intermediate, or finish coats.
- B. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.

1.4 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each paint system specified, including block fillers and primers.
 - (1) Provide the manufacturer's technical information including label analysis and instructions for handling, storage, and application of each material proposed for use.
 - (2) List each material and cross-reference the specific coating, finish system, and application. Identify each material by the manufacturer's catalog number and general classification.
 - (3) Submit product data highlighting VOC content of paints, coatings and finishes on the interior of the building.
- C. Samples for initial color selection in the form of manufacturer's color charts.
 - (1) After color selection, the Architect will furnish color chips for surfaces to be coated.
- D. Samples for Verification Purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.
 - (1) Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
 - (2) Provide a list of material and application for each coat of each sample. Label each sample as to location and application.
 - (3) Submit samples on the following substrates for the Architect's review of color and texture only:
 - (a) Concrete: Provide two 8-inch square samples for each color and finish. Provide 48-inch by 48-inch field sample for review.
 - (b) Concrete Masonry: Provide two 8-inch square samples for each color and finish. Provide 48-inch by 48-inch field sample for review.

- (c) Stained or Natural Wood: Provide two 4-by-8-inch samples of natural and stained wood finish on actual wood surfaces.
- (d) Ferrous Metal: Provide two 12-inch square samples for each color and finish. Provide field sample of one Hollow Metal door frame or other metal surface for each color and finish.
- (e) Gypsum Wall Board: Provide two 12 inch-square samples of each color and finish.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to those indicated for the Project that have resulted in a construction record of successful in-service performance.
- B. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.
- C. Paints formulated with any of the following ingredients, in any amount, are prohibited:
 - (1) Lead, red lead.
 - (2) Basic lead silico chromate.
 - (3) Zinc chromate.
 - (4) Lead driers.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
 - (1) Product name or title of material.
 - (2) Product description (generic classification or binder type).
 - (3) Manufacturer's stock number and date of manufacture.
 - (4) Contents by volume, for pigment and vehicle constituents.
 - (5) Thinning instructions.
 - (6) Application instructions.
 - (7) Color name and number.

- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - (1) Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 JOB CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F and 90 deg F.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 deg F and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 - (1) Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
 - (1) Quantity: Furnish Owner with one gallon or 1%, whichever is greater, of each material and color applied. One or five gallon containers only.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - (1) KWAL Paint Company, a Professional Paint Company (KWAL).
 - (2) Benjamin Moore & Co. (Benjamin Moore).
 - (3) PPG Industries, Inc. (Pittsburgh Paints).
 - (4) Sherwin Williams (S-W).
 - (5) Glidden Professional, an AKZO Nobel Paint Company.

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.
- B. Material Quality: Provide the manufacturer's best-quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
- C. Colors: Match color selections made by the Architect.
- D. Paint VOC Limits: All interior paints, stains, and coatings shall comply with the requirements of Green Seal Standard GS-11. VOC weight in grams/liter of product minus water must not exceed 150 for non-flat coatings, or 50 for flat coatings. Refer to Green Seal Standard GS-11 for balance of requirements.

2.3 MASONRY BLOCK FILLER

- A. Filler Coat Materials: Provide the manufacturer's recommended factory-formulated, latex-type concrete masonry block fillers that are compatible with the finish materials indicated.
- B. High-Performance Latex Block Filler: Used for filling open textured interior concrete masonry block and concrete before application of top coats.
 - (1) ICI: Bloxfil 4000-1000 Interior/Exterior Acrylic Latex Block Filler.
 - (2) Moore: Moorcraft Interior & Exterior Block Filler #285.
 - (3) PPG: Speedhide 6-7 Latex Masonry Block Filler.
 - (4) Glidden Professional: GP3010-1200 Concrete Coatings Block Filler Interior Exterior Primer.

2.4 PRIMERS

- A. Primers: Provide the manufacturer's recommended factory-formulated primers that are compatible with the substrate and finish coats indicated.
- B. Interior Concrete Primer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.
 - (1) KWAL: 0800 Accu-Tone Hi-Hide PDQ Sealer: Applied at a dry film thickness of not less than 1.4 mils.
 - (2) Moore: Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils.
 - (3) PPG: 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil.

- (4) Glidden Professional: GP3210-1200, Gripper white primer and sealer. Applied at dry film thickness of not less than 1.8 mils.
- C. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.
- (1) KWAL: 0890 Accu-Pro Sandable Drywall Primer: Apply at a dry film thickness of not less than 1.5 mils.
 - (2) Moore: Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No.253: Applied at a dry film thickness of not less than 1.2 mils.
 - (3) PPG: 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil.
 - (4) Glidden Professional: BP1090-1200N, PVA drywall interior primer. Apply at a dry film thickness of not less than 0.8 mils.
- D. Ferrous Metal Primers: Factory-formulated acrylic primer for ferrous metal.
- (1) KWAL: #5860 All Purpose.
 - (2) Moore: Industrial Maintenance Coatings - M04 Acrylic Metal Primer.
 - (3) PPG: Pitt-Tech Int/Ext Primer/Finish DTM Industrial Enamel.
- E. Galvanized Metal Primers: Used to prime interior and exterior zinc-coated metal surfaces.
- (1) KWAL: X-I-M Gutter Primer.
 - (2) Moore: IronClad Galvanized Metal Latex Primer #155.
 - (3) PPG: 6-215/216 Speedhide Galvanized Steel Primer.
 - (4) Glidden Professional: GP3210-1200, Gripper white primer and sealer. Applied at dry film thickness of not less than 1.8 mils.

2.5 UNDERCOAT MATERIALS

- A. Undercoat Materials: Provide the manufacturer's recommended factory-formulated undercoat materials that are compatible with the substrate and finish coats indicated.
- B. Interior Enamel Undercoat: Ready-mixed enamel for use as an undercoat over wood and hardboard under an odorless alkyd semigloss enamel or full gloss alkyd enamel.
- (1) S-W: PrepRite 200 Latex Wall Primer B28W200.
 - (2) PPG: 6-6 Speedhide Quick Dry Enamel Undercoater.

2.6 EXTERIOR FINISH PAINT MATERIAL

- A. Finish Paint: Provide the manufacturer's recommended factory-formulated finish-coat materials that are compatible with the substrate and undercoats indicated.
- B. Exterior Gloss Alkyd Enamel: Factory-formulated full-gloss alkyd enamel for exterior application over smooth wood, ferrous and zinc-coated metal.
 - (1) KWAL: 9800 Accu-Pro Alkyd Gloss Enamel: Applied at a dry film thickness of not less than 1.5 mils.
 - (2) PPG: 2-814 Pittsburgh Paints Industrial Gloss-Oil Interior/Exterior Enamel: Applied at a dry film thickness of not less than 1.5 mils.
 - (3) S-W: Industrial Enamel B-S4 Series. Applied at a dry film thickness of not less than 2.0 mils.
 - (4) Glidden Professional: BP2416 Ultra-Hide 150 exterior gloss acrylic paint.

2.7 INTERIOR FINISH PAINT MATERIAL

- A. Finish Paint: Provide the manufacturer's recommended factory-formulated finish-coat materials that are compatible with the substrate and undercoats indicated.
- B. Interior Low-Luster Acrylic Enamel: Factory-formulated semi-gloss acrylic-latex interior enamel over interior concrete, gypsum board, wood and ferrous and zinc-coated metal.
 - (1) KWAL: 2000 Accu-Kraft Production Finishes - Latex Semi-Gloss. Applied at a dry film thickness of not less than 1.5 mils.
 - (2) PPG: Pure Performance Semi-Gloss Acrylic Latex Enamel: Applied at a dry film thickness of not less than 1.25 mils.
 - (3) Moore: Pristine Eco Spec Latex Semi-Gloss 224. Applied at a dry film thickness of not less than 1.3 mils.
 - (4) Glidden Professional: GP2900 Lifemaster No VOC interior semi-gloss acrylic. Applied at a dry film thickness of not less than 1.5 mils.
 - (5) Glidden Professional: GP1486 Waterborne Interior Semi-Gloss Acrylic Dry Fall. Applied at a dry film thickness of not less than 1.5 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions under which painting will be performed for compliance with paint application requirements. Surfaces receiving paint must be thoroughly dry before paint is applied.

- (1) Do not begin to apply paint until unsatisfactory conditions have been corrected.
 - (2) Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
- (1) Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items, if necessary, to completely paint the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease prior to cleaning. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to the manufacturer's instructions for each particular substrate condition and as specified.
- (1) Provide barrier coats over incompatible primers or remove and reprime. Notify Architect in writing about anticipated problems using the specified finish-coat material with substrates primed by others.
 - (2) Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen, as required, to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - (a) Use abrasive blast-cleaning methods if recommended by the paint manufacturer.
 - (b) Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
 - (3) Gypsum Wallboard: Clean surfaces of dirt, dust, oil and other foreign substances that may interfere with paint bond.

- (4) Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - (5) Ferrous Metals: Clean ungalvanized ferrous metal surfaces that have not been shop-coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council (SSPC).
 - (a) Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.
 - (6) Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Materials Preparation: Carefully mix and prepare paint materials according to manufacturer's directions.
- (1) Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 - (2) Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
 - (3) Use only thinners approved by the paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.
- F. Verify compatibility between shop primer on metal roof deck and top coats prior to installation.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 - (1) Paint colors, surface treatments, and finishes are indicated in the schedules.
 - (2) Provide finish coats that are compatible with primers used.

- (3) The number of coats and the film thickness required are the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce a smooth even surface according to the manufacturer's directions.
 - (4) Apply additional coats if undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
 - (5) The term exposed surfaces includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
 - (6) Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - (7) Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
 - (8) Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 - (9) Finish exterior doors on tops, bottoms, and side edges same as exterior faces.
 - (10) Sand lightly between each succeeding enamel or finish coat.
 - (11) Omit primer on metal surfaces that have been shop-primed and touch-up painted.
- C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
- (1) Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- D. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to the manufacturer's directions.
- (1) Brushes: Use brushes best suited for the material applied.
 - (2) Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

- (3) Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- E. Minimum Coating Thickness: Apply materials no thinner than the manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- F. Mechanical and Electrical Work: Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces.
- G. Mechanical items to be painted include, but are not limited to, the following:
 - (1) Piping, pipe hangers, and supports.
 - (2) Ductwork, duct hangers and supports.
 - (3) Pipe and duct insulation.
 - (4) Mechanical equipment.
 - (5) Rooftop mechanical units.
 - (6) Accessory items.
- H. Electrical items to be painted include, but are not limited to, the following:
 - (1) Conduit and fittings.
 - (2) Panels in occupied spaces.
- I. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- J. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime-coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- K. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections.
- L. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.
 - (1) Provide satin finish for final coats.
- M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with specified requirements.

3.4 CLEANING

- A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
 - (1) After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
 - (1) At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINT SCHEDULE

- A. General: Provide the following paint systems for the various substrates indicated.
- B. Ferrous Metal: Primer is not required on shop-primed items.
 - (1) Gloss Alkyd Enamel: 2 finish coats over primer.
 - (a) Primer: Synthetic Rust-Inhibiting Primer.
 - (b) First Finish Coat: Alkyd Gloss Enamel.
 - (c) Second Finish Coat: Alkyd Gloss Enamel.
- C. Zinc-Coated Metal:
 - (1) Gloss Alkyd Enamel: 2 finish coats over primer.
 - (a) Primer: Galvanized Metal Primer.
 - (b) First Finish Coat: Alkyd Gloss Enamel.
 - (c) Second Finish Coat: Alkyd Gloss Enamel.
- D. Concrete and Masonry:
 - (1) Acrylic-Latex: 2 finish coats over prepared and filled surface.
 - (a) Block Filler: High-Performance Latex Block Filler.
 - (b) First Finish Coat: Exterior Acrylic Latex.

(c) Second Finish Coat: Exterior Acrylic Latex.

3.7 INTERIOR PAINT SCHEDULE

- A. General: Provide the following paint systems for the various substrates, as indicated.
- B. Concrete and Concrete Masonry Units:
- (1) Enamel Finish: 2 finish coats with total dry film thickness not less than 3.5 mils, over prepared and filled surface.
 - (a) Block Filler: High-Performance Latex Block Filler.
 - (b) First Finish Coat: Interior, Semi-Gloss Acrylic Enamel.
 - (c) Second Finish Coat: Interior, Semi-Gloss Acrylic Enamel.
- C. Ferrous Metal:
- (1) Semi-Gloss Enamel Finish: 2 coats over primer with total dry film thickness not less than 3.5 mils.
 - (a) Primer: Synthetic, Quick-Drying, Rust-Inhibitive Primer.
 - (b) First Finish Coat: Interior Semi-Gloss Acrylic Enamel.
 - (c) Second Finish Coat: Interior Semi-Gloss Acrylic Enamel.
- D. Zinc-Coated Metal:
- (1) Semi-Gloss Enamel Finish: 2 coats over primer, with a total dry film thickness not less than 3.5 mils.
 - (a) Primer: Galvanized Metal Primer.
 - (b) First Finish Coat: Interior Semi-Gloss Acrylic Enamel.
 - (c) Second Finish Coat: Interior Semi-Gloss Acrylic Enamel.
- E. Gypsum Wallboard:
- (1) Semi-Gloss Enamel Finish: 2 finish coats with total dry film thickness not less than 3.5 mils, over primer.
 - (a) Prime Coat: Latex-Based Interior White Primer.
 - (b) First Finish Coat: Interior Semi-Gloss Acrylic Enamel.
 - (c) Second Finish Coat: Interior Semi-Gloss Acrylic Enamel.
- F. Covering over Pipe and Duct Insulation:

- (1) Semi-Gloss Enamel Finish: 2 finish coats with total dry film thickness not less than 3.5 mils, over primer.
 - (a) Prime Coat: Latex-Based Interior White Primer.
 - (b) First Finish Coat: Interior Semi-Gloss Acrylic Enamel.
 - (c) Second Finish Coat: Interior Semi-Gloss Acrylic Enamel.

END OF SECTION 09 9100

SECTION 101100-VISUAL DISPLAY SURFACES

PART 1-GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - (1) Framed porcelain enamel markerboards.

1.3 SUBMITTALS

- A. Product Data: For each type of visual display board indicated.
- B. Shop Drawings: For each type of visual display board required.
 - (1) Include dimensioned elevations. Show location of joints between individual panels where unit dimensions exceed maximum panel length.
 - (2) Include sections of typical trim members.
 - (3) Show anchors, grounds, reinforcement, accessories, layout, and installation details.
- C. Samples for Initial Selection: Manufacturer's actual physical samples showing the full range of colors and textures available for markerboards and tackboards.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who is experienced with the necessary skills for the installation of the units specified in this Section and required for this Project.
- B. Source Limitations: Obtain visual display boards through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide tackboards with the following surface-burning characteristics as determined by testing assembled materials composed of facings and backings identical to those required in this Section per ASTM E 84 by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify tackboards with appropriate markings of applicable testing and inspecting agency.
 - (1) Flame Spread: 25 or less.
 - (2) Smoke Developed: 10 or less.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify field measurements before preparation of Shop Drawings and before fabrication to ensure proper fitting. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- (1) Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.
 - (2) Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating chalkboards without field measurements. Coordinate wall construction to ensure actual dimensions correspond to established dimensions.

PART 2-PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
- (1) Porcelain Enamel Markerboards:
 - (a) Best Rite.
 - (b) Greensteel, Inc.
 - (c) Lemco, Inc.
 - (d) Claridge.

2.2 MATERIALS

- A. Porcelain Enamel Markerboards: Balanced, high-pressure-laminated, porcelain enamel markerboards of 3-ply construction consisting of face sheet, core material, and backing.
- (1) Face Sheet: 0.024-inch (24-gauge), enameling grade steel especially processed for temperatures used in coating porcelain on steel. Coat exposed face and edges with a 3-coat process consisting of primer, ground coat, and color cover coat. Coat concealed face with a 2-coat process consisting of primer and ground coat. Fuse cover and ground coats to steel at manufacturer's standard firing temperatures, but not less than 1200 deg F.
 - (a) Cover Coat: Provide manufacturer's standard, light-colored, special writing surface with gloss finish intended for use with erasable dry markers.
 - (2) Core: ½-inch- thick, particleboard core material complying with requirements of ANSI A208.1, Grade 1-M-1.

- (3) Backing Sheet: 0.005-inch- thick, aluminum-foil sheet backing.
- (4) Laminating Adhesive: Manufacturer's standard, moisture-resistant, thermoplastic-type adhesive.
- (5) Surface to accept magnetic aids.

2.3 ACCESSORIES

- A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062-inch-thick, extruded-aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units. Keep joints to a minimum. Miter corners to a neat, hairline closure.
- (1) Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.
 - (2) Field-Applied Trim: Manufacturer's standard screw-on trim with Phillips flat-head screws.
 - (3) Chalktray: Manufacturer's standard, continuous, solid, extrusion-type, aluminum chalktray with ribbed section and smoothly curved exposed ends for each markerboard.

2.4 FABRICATION

- A. Porcelain Enamel Markerboards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive. Cut joints straight and true. Space joints symmetrically. Fit and match panels before shipment to provide a continuous, uniform writing surface.
- (1) Length: Furnish panels approximately equal in length with permissible variation not more than 3 inches in either direction of equal spacing. Allow 1/4-inch clearance at trim in length and width for fitting. Provide lengths of panels in each space as follows:
 - (a) Up to 12 feet, 1 panel.
 - (b) More than 12 feet but less than 2 feet, 2 panels.
- B. Assembly: Provide factory-assembled markerboard combination units, unless field-assembled units are required.
- (1) Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
 - (2) Provide factory-assembled units in one piece up to 12 feet long. Where dimensions exceed 12 feet, provide two or more pieces of equal length.

- (3) Provide manufacturer's standard vertical joint system between abutting sections of markerboards.

2.5 FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- C. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

PART 3-EXECUTION

3.1 EXAMINATION

- A. Examine wall surfaces, with Installer present, for compliance with requirements and other conditions affecting installation of visual display boards.
 - (1) Surfaces to receive markerboards and tackboards shall be free of dirt, scaling paint, and projections or depressions that would affect smooth, finished surfaces of markerboards.
 - (2) Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Deliver factory-built visual display boards completely assembled in one piece without joints, where possible. If dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.
- B. Install units in locations and at mounting heights indicated and according to manufacturer's written instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- C. Coordinate Project-site-assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

3.3 ADJUSTING AND CLEANING

- A. Verify that accessories required for each unit have been properly installed and that operating units function properly.

B. Clean units according to manufacturer's written instructions.

END OF SECTION 10 1100

SECTION 101400-SIGNAGE

PART 1-GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following types of signs:
 - (1) Panel signs for the following:
 - (a) Occupant Load Posting: IBC 1004.3.
 - (b) Handicap Accessible Egress: IBC 1011.3 / 1007.7.
 - (c) Handicap Accessible General: IBC 1110.
 - (d) Premises Identification: IBC 501.2.
 - (e) Room Identification
 - (2) Vinyl adhesive letters.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.
- C. Shop Drawings: Provide shop drawings for fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, reinforcement, accessories, layout, and installation details.
 - (1) Provide message list for each sign required, including large-scale details of wording and layout of lettering.
 - (2) For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
 - (3) Furnish full-size spacing templates for individually mounted dimensional letters and numbers.
 - (4) Furnish full-size rubbings or CAD drawings for metal plaques.

D. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.

(1) Samples for initial selection of color, pattern, and texture:

(a) Cast Acrylic Sheet and Plastic Laminate: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: For each separate type of sign required, obtain signs from one source from a single manufacturer.

B. Design Criteria: The drawings indicate sizes, profiles, and dimensional requirements of signs. Other signs with deviations from indicated dimensions and profiles may be considered, provided deviations do not change the design concept. The burden of proof of equality is on the proposer.

1.5 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART2-PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

(1) Manufacturers of Panel Signs:

(a) Signage Inc.

(b) Kroy Signage Systems.

(c) Forum Engraving Co.

(d) Scott Sign Systems Inc.

(e) Communication Industries, Inc.

(f) ASI Sign Systems, Inc.

(g) Best Manufacturing Co.

(h) Artcraft Signs.

(2) Manufacturers of Vinyl Adhesive Letters:

- (a) Signage Inc.
- (b) Kroy Signage Systems.
- (c) Forum Engraving Co.
- (d) Scott Sign Systems Inc.
- (e) Communication Industries, Inc.
- (f) ASI Sign Systems, Inc.
- (g) Best Manufacturing Co.
- (h) Artcraft Signs.

2.2 MATERIALS

- A. Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested in accordance with ASTM D 790, a minimum allowable continuous service temperature of 176 deg F (80 deg C), and of the following general types:
- (1) Transparent Sheet: Where sheet material is indicated as "clear," provide colorless sheet in matte finish, with light transmittance of 92 percent, when tested in accordance with the requirements of ASTM D 1003.
 - (2) White Translucent Sheet: Where sheet material is indicated as "white," provide white translucent sheet of density required to produce uniform brightness and minimum halation effects.
 - (3) Opaque Sheet: Where sheet material is indicated as "opaque," provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.
- B. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.
- C. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
- D. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background colors, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.

2.3 PANEL SIGNS

- A. Panel Signs: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
 - (1) Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally.
- B. Signage Description: Flexible/removable insert in permanent fixed frame. Provide two changeable message slots. Material to be 1/4 inch thick monolithic molded polyester acrylate with integral body letters, graphics and color. Raised upper case sans serif characters 5/8 inch to 2 inches high. Characters shall contrast 70-100% with background with Grade II Braille.
- C. Graphic Content and Style: Provide sign copy that complies with ADA requirements for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, Grade II Braille, and other graphic devices.

2.4 FINISHES

- A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.

PART3-EXECUTION

3.1 INSTALLATION

- A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
 - (1) Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
- B. Wall Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:
 - (1) Vinyl-Tape Mounting: Use double-sided foam tape, of thickness indicated, to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
 - (2) Silicone-Adhesive Mounting: Use liquid silicone adhesive recommended by the sign manufacturer to attach sign units to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended by the sign manufacturer to hold the sign in place until the adhesive has fully cured.

3.2 CLEANING AND PROTECTION

- A. At completion of the installation, clean soiled sign surfaces in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

3.3 INTERIOR SIGNAGE SCHEDULE

- A. Panel Signs with Symbol: 9" x 9" with ½" radius corners. Standard DOT Symbol for gender and accessibility with Futura Copy.
 - (1) Provide (1) sign per toilet room door or opening.
 - (2) Provide (1) sign for each floor for elevator.
- B. Panel Signs with matte clear lens window for one line of copy. Provide one clear film insert with copy (copy to be provided later) for each sign. 6" x 6" with ½" radius corners. Copy: Futura. See attached for signage schedule.

END OF SECTION 10 1400

S. Jason Street Maintenance Facility

Date: 06/27/12

Door Mark (for reference)	Room Name (for reference)	Sign Type	Text (on sign)	Room Number (on sign)	Sign Placement
First Floor					
100	Lobby	A	Exit		Mount adjacent to existing exterior door 100
100	Lobby	A	Exit		Mount adjacent to existing exterior door 100C
100A	Men	B	Men (M/WC pict)		
100B	Women	B	Women (F/WC pict)		
103	Office	C		103	
105	Office	C		105	
107	Office	C		107	Mount on wall adjacent to sidelight
108	IT/Data	A	IDF		
109	Work Room	A	Work Room		
111	Office	C		111	Mount on wall adjacent to sidelight
112	Office	C		112	Mount on wall adjacent to sidelight
113	Office	C		113	Mount on wall adjacent to sidelight
114	Office	C		114	Mount on wall adjacent to sidelight
115	Storage	A	Storage		
116	Men	D	Men (M/WC pict)		
117	Break Room	A	Exit		Mount adjacent to existing exterior door east elevation
118	Women	D	Women (F/WC pict)		
121	Ballfield Storage	B		121	
123	Vehicle Storage	A	Exit		Mount adjacent to existing exterior door south elevation
125	Trails Storage	B		125	
127	Irrigation Storage	B		127	
130	Storage	B		130	
131	Office	C		131	Mount on wall adjacent to sidelight
132	Plans Room	B		132	
134	Women	D	Women (F/WC pict)		
136	Men	D	Men (M/WC pict)		
138	Wash Bays	B		138	
139	Storage	B		139	
140	Storage	B		140	
142	Work Room	B		142	
143	IT/Data	B	MDF		
144	Storage	B		144	

SECTION 10 2113 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes toilet compartments and screens as follows:
 - (1) Type: Solid-plastic, polymer resin.
 - (2) Compartment Style: Overhead braced and floor anchored.
 - (3) Screen Style: Wall hung.
- B. Related Sections include the following:
 - (1) Division 10 "Toilet and Bath Accessories" for toilet paper holders, grab bars, and similar accessories.

1.3 SUBMITTALS

- A. Product Data: For each type and style of toilet compartment and screen specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.
- B. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies. Include plans, elevations, sections, details, and attachments to other work.
 - (1) Show locations of reinforcement and cutouts for compartment-mounted toilet accessories.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of sections of actual units showing the full range of colors, textures, and patterns available for each type of compartment or screen indicated.
- D. Samples for Verification: Of each compartment or screen color and finish required, prepared on 6-inch- square Samples of same thickness and material indicated for Work.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

- (1) Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - (1) Accurate Partitions Corporation.
 - (2) Crane Plumbing; Sanymetal.
 - (3) Santana Plastic Products.
 - (4) Hadrian

2.2 MATERIALS

- A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.
- B. Solid-Plastic, Polymer Resin: High-density polyethylene (HDPE) with homogenous color throughout. Provide material not less than 1 inch thick with seamless construction and eased edges in color and pattern as follows:
 - (1) Color and Pattern Basis of Design: Hadrian - Canyon Granite
- C. Pilaster Shoes and Sleeves (Caps): ASTM A 666, Type 302 or 304 stainless steel, not less than 0.0312 inch thick and 3 inches high, finished to match hardware.
- D. Full-Height (Continuous) Brackets: Manufacturer's standard design for attaching panels and screens to walls and pilasters of the following material:
 - (1) Material: ASTM A 666, Type 302 or 304 stainless steel.
- E. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of the following material:
 - (1) Material: Stainless steel.
- F. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile in manufacturer's standard finish.
- G. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum strip in manufacturer's standard finish.

- H. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.3 FABRICATION

- A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated.
- B. Solid-Plastic, Polymer-Resin Compartments and Screens: Provide aluminum heat-sink strips at exposed bottom edges of HDPE units to prevent burning.
- C. Overhead-Braced-and-Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.
- D. Wall-Hung Screens: Provide units in sizes indicated of same construction and finish as compartment panels, unless otherwise indicated.
- E. Doors: Unless otherwise indicated, provide 24-inch- wide in-swinging doors for standard toilet compartments and 36-inch- wide out-swinging doors with a minimum 32-inch- wide clear opening for compartments indicated to be handicapped accessible.
 - (1) Hinges: Manufacturer's standard stainless steel self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
 - (2) Latch and Keeper: Manufacturer's standard surface-mounted latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
 - (3) Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
 - (4) Door Bumper: Manufacturer's standard rubber-tipped bumpers at out-swinging doors or entrance screen doors.
 - (5) Door Pull: Manufacturer's standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than ½ inch between pilasters and panels and not more than 1 inch between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.
- B. Overhead-Braced-and-Floor-Anchored Compartments: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than 2 fasteners. Hang doors and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Screens: Attach with anchoring devices according to manufacturer's written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.2 ADJUSTING AND CLEANING

- A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and swing doors in entrance screens to return to fully closed position.
- B. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10 2113

SECTION 10 2800 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Division 10 for toilet compartments and related accessories.

1.2 SUMMARY

- A. This Section includes toilet accessory items.
 - (1) Public-use washroom accessories.
- B. Products furnished and installed by Contractor:
 - (1) Mirror Units
 - (2) Grab Bars
- C. Products furnished by Owner and installed by Contractor:
 - (1) Waste Receptacles
- D. Vendor provided and installed:
 - (1) Soap Dispensers.
 - (2) Paper Towel Dispensers.
 - (3) Toilet Paper Dispensers.
 - (4) Sanitary Napkin Dispensers.

1.3 SUBMITTALS

- A. Product data for each toilet accessory item specified, including construction details relative to materials, dimensions, gages, profiles, mounting method, specified options, and finishes.
- B. Schedule indicating types, quantities, sizes, and installation locations (by room) for each toilet accessory item to be provided for project.
- C. Setting drawings where cutouts are required in other work, including templates, substrate preparation instructions, and directions for preparing cutouts and installing anchorage devices.
- D. Maintenance instructions including replaceable parts and service recommendations.

1.4 QUALITY ASSURANCE

- A. Inserts and Anchorages: Furnish accessory manufacturers' standard inserts and anchoring devices that must be set in concrete or built into masonry. Coordinate delivery with other work to avoid delay.
- B. Single-Source Responsibility: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Architect.

1.5 PROJECT CONDITIONS

- A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

1.6 WARRANTY

- A. Warranty: Submit a written warranty executed by mirror manufacturer, agreeing to replace any mirrors that develop visible silver spoilage defects within warranty period.
- B. Warranty Period: 15 years from date of Substantial Completion.
- C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering toilet accessories that may be incorporated in the Work include, but are not limited to, the following:
 - (1) Accessories:
 - a. American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. Bradley Corporation.
 - d. Kohler Co.
 - e. Hafele.

2.2 MATERIALS, GENERAL

- A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 0.034 inch minimum thickness.

- B. Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16; Castings, ASTM B 30.
- C. Sheet Steel: Cold-rolled, commercial quality ASTM A 366, 0.04 inch minimum. Surface preparation and metal pretreatment as required for applied finish.
- D. Galvanized Steel Sheet: ASTM A 527 G60.
- E. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.
- F. Baked Enamel Finish: Factory-applied, gloss white, baked acrylic enamel coating.
- G. Mirror Glass: Nominal 6.0 mm thick, conforming to ASTM C 1036, Type I, Class 1, Quality q2, and with silvering, electro-plated copper coating, and protective organic coating.
- H. Stainless Steel Mirror Surfaces: Not less than 0.04 inch AISI Type 302/304 stainless steel sheet, stretcher-leveled with No. 8 polished mirror finish. Bond to 1/4 inch minimum hardboard backing.
- I. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- J. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

2.3 MIRROR UNITS

- A. Framed Mirror:
 - (1) Material: 1/4 inch clear polished plate mirror with 20 gage galvanized steel back and stainless steel retainer angle.
 - (2) Mounting: Concealed wall hanger and theft resistant locking screws.
 - (3) Size: As indicated on the drawings

2.4 GRAB BARS

- A. Grab Bars:
 - (1) Material: 1-1/2" diameter, satin stainless steel.
 - (2) Construction: Concealed plates with no exposed fasteners.
 - (3) Length: As required.
- B. Stainless Steel Type: Provide grab bars with wall thickness not less than 0.05 inch and as follows:
 - (1) Mounting: Concealed, manufacturer's standard flanges and anchorages.

- (2) Clearance: 1-1/2 inch clearance between wall surface and inside face of bar.
 - (3) Gripping Surfaces: Smooth, satin finish.
- C. Straight grab bar:
- (1) Manufacturer: Bobrick
 - (2) Model: B-5806 x 36
 - (3) Length: 36"
- D. Straight grab bar:
- (1) Manufacturer: Bobrick
 - (2) Model: B-5806 x 42
 - (3) Length: 42"
- E. Vertical grab bar:
- (1) Manufacturer: Bobrick.
 - (2) Model: B-5806 x 18.
 - (3) Length: 18 inches.

2.5 FABRICATION

- A. Only a maximum 1-1/2 inch diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.
- B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.
- C. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors or access panels with full-length, stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.
- D. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent moisture accumulation, as follows:

- (1) Provide galvanized-steel backing sheet, not less than 0.034 inch and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.
- E. Mirror Unit Hangers: Provide system for mounting mirror units that will permit rigid, tamperproof, and theftproof installation, as follows:
 - (1) Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
- F. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

- A. Manage construction waste in accordance with provisions of Section 017419. Documentation shall be submitted to satisfy the requirements of that section.

3.2 INSTALLATION

- A. Install toilet accessory units according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.
- B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.
- C. Install grab bars to withstand a downward load of at least 250 lbf, complying with ASTM F 446.

3.3 ADJUSTING AND CLEANING

- A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
- B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION 10 2800

SECTION 10 4413 - FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - (1) Fire Extinguishers.
 - (2) Fire extinguisher cabinets.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of product specified. For fire extinguisher cabinets include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and materials.
- C. Samples for initial selection purposes in the form of manufacturer's color charts consisting of actual units or sections of units showing full range of colors, textures, and patterns available for each type of cabinet finish indicated or exposed to view.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain fire extinguishers and cabinets from one source from a single manufacturer.
- B. UL-Listed Products: Fire extinguisher cabinets UL-listed and bear UL "Listing Mark" for type, rating, and classification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - (1) Amorex Corporation.
 - (2) J.L. Industries.
 - (3) Larsen's Manufacturing Co.
 - (4) Modern Metal Products by Muckle.

- (5) Potter-Roemer, Inc.
- (6) Samson Metal Products, Inc.
- (7) Watrous Inc.

2.2 FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers for each cabinet and other locations indicated, in colors and finishes selected by Architect from manufacturer's standard, that comply with authorities having jurisdiction.
- B. Multipurpose Dry Chemical Type: UL-rated 2 A-10B:C, 5-lb nominal capacity, in enameled steel container.

2.3 FIRE EXTINGUISHER CABINETS

- A. General: Provide fire extinguisher cabinets where indicated, of suitable size to house specified extinguishers.
- B. Construction: Manufacturer's standard enameled steel box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld all joints and grind smooth. Miter and weld perimeter door frames.
- C. Fire-Rated Cabinets: U.L.-listed with UL Listing Mark with rating of wall wherever it is installed.
- D. Cabinet Type: Suitable for mounting conditions indicated, of the following types:
 - (1) Semi-recessed: Cabinet box (tub) partially recessed in walls of sufficient depth to suit style of trim indicated.
- E. Trim Style: Fabricate trim in one piece with corners mitered, welded, and ground smooth.
 - (1) Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - (a) Square-Edge Trim with 1/2- to 3/4-inch backbend depth.
 - (b) Trim Metal: Of same metal and finish as door.
- F. Door Material and Construction: Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.
 - (1) Aluminum: Manufacturer's optional color anodized finish, extruded aluminum with satin finish.
 - (2) Door Glazing: Clear float glass complying with ASTM C 1036, Type I, Class 1, Quality q3.

- G. Identify fire extinguisher in cabinet with lettering spelling "FIRE EXTINGUISHER" applied to door. Provide lettering to comply with requirements indicated for letter style, color, size, spacing, and location or, if not otherwise indicated, as selected by Architect from manufacturer's standard arrangements.
 - (1) Application Process: Silk screen.
- H. Door Style: Manufacturer's standard design.
 - (1) Duo-Panel: Float glass, 1/8-inch thick.
- I. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam action latch, or door pull, exposed or concealed, and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 deg.

2.4 FINISHES FOR FIRE EXTINGUISHER CABINETS, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by application of strippable, temporary protective covering prior to shipment.

2.5 ALUMINUM CABINET FINISHES

- A. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- B. Class I Color Anodized Finish: AA-M12C22A42/A44 (Mechanical finish: as fabricated, nonspecular; Chemical finish: etched, medium matt; Anodic Coating: Class I Architectural, film thickener than 0.7 mil with integral color or electrolytically deposited color) complying with AAMA 606.1 or AAMA 608.1.
 - (1) Color: As selected by Architect from within standard industry colors and color density range.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
 - (1) Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.
 - (2) Securely fasten fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.

- (3) Mounting height to finish floor:
 - (a) Bottom: 3'-0" minimum
 - (b) Top: 5'-0" maximum

END OF SECTION 10 4413

SECTION 105113-METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - (1) Wardrobe lockers, including the following:
 - (a) Single-tier lockers (12" wide by 72" high by 15" deep).
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - (1) Division 6 Section "Miscellaneous Carpentry" for wood furring and grounds.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data: Manufacturer's printed data including materials, accessories, construction, finishes, assembly, and installation instructions for lockers.
- C. Shop Drawings: Layout and dimensions of metal lockers. Indicate relationship to adjoining surfaces. Show locker elevations and details, fillers, trim, base, sloping tops, and accessories. Include locker numbering sequence. Indicate installation and anchorage requirements.
- D. Samples for Initial Color Selection: Manufacturer's color charts showing a full range of available colors.
- E. Samples for Color Verification: Samples showing actual colors prepared on same material to be used for the Work.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain locker units and accessories from one manufacturer.
- B. Installers Qualifications: Lockers to be installed by an experienced agent of the manufacturers.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver lockers until spaces to receive them are clean, dry, and ready for locker installation.
- B. Protect lockers from damage during delivery, handling, storage, and installation.

1.1 EXTRA MATERIALS

- A. Touch Up Paint: Provide 8 fluid ounces for each 100 lockers for each color installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products from the following manufacturers, or approved substitute:
 - (1) Interior Steel Equipment Co.
 - (2) Hadrian, Inc.
 - (3) List Industries, Inc.
 - (4) Lyon Metal Products, Inc.
- B. Basis of Design Manufacturers:
 - (1) Republic Storage Systems Co., Inc.
 - (2) Penco Products, Inc.

2.2 MATERIALS

- A. Steel Sheet: ASTM A 366 (A 366M), commercial-quality, stretcher-leveled, cold-rolled carbon steel sheet, stretcher leveled, free of buckling, scale, and surface imperfections.
- B. Hot-Dip Zinc-Coated Steel Sheet: ASTM A 526/A 526M, commercial-quality, zinc-coated, carbon-steel sheet, hot-dip galvanized according to ASTM A 525 (A 525M) with A 60 (ZF 180) or G 60 (Z 180) coating designation.
- C. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, with Class C zinc coating, mill phosphatized.
- D. Stainless-Steel Sheet: ASTM A 167, Type 302 or 304, stretcher-leveled stainless-steel sheet. Roller-apply texture to doors in manufacturer's standard pattern.
- E. Fasteners: Zinc- or nickel-plated steel; slotless-type exposed bolt heads; self-locking nuts or lock washers for nuts on moving parts.
- F. Equipment: Manufacturer's standard plated steel hooks or coat rods.

2.3 WARDROBE LOCKERS

- A. Body: Fabricate back and sides of minimum 24-gage steel, with double-flanged connections extending full height. Form top of not less than 24-gage steel, with flanged edges. Form bottoms of 20-gage steel.
- (1) Provide 24-gage steel sheet hat shelf in single-tier units.
 - (2) Form exposed ends of non-recessed lockers of minimum 16-gage steel.
- B. Door: One-piece, minimum 16-gage sheet steel, flanged at all edges, constructed to prevent springing when opening or closing. Fabricate to swing 180 degrees.
- (1) Ventilation: Provide stamped, louvered vents in door face, as follows:
 - (a) Not fewer than 3 louver openings top and bottom.
 - (2) Hinges: Steel, full-loop, 5-knuckle, tight pin. Weld to inside of frame and secure to door with not fewer than 2 factory-installed fasteners that are completely concealed and tamperproof when door is closed. Provide hinges of 18-gage minimum steel.
 - (a) Provide at least 3 hinges for each door over 42 inches high; at least 2 hinges for each door 42 inches high or less.
- C. Single-Tier Locker Multi-point latching:
- (1) Chrome-plated zinc alloy die-cast case and handle, 40,000 psi (276 MPa) maximum tensile strength.
 - (2) Attachment to latch bar concealed inside door and tamperproof; pulling handle out shall move latch bar up and open door in one motion.
 - (3) Padlock Eye: For use with 9/32 inch (7.1 mm) diameter padlock, integral with handle and located so that extension of handle forms padlock strike.
 - (4) Case: Kick-proof type shielding movable part and providing padlock strike to prevent scratching and marring the door.
 - (5) Provide lock hole cover plate for use with padlocks.
 - (6) Latch Clip: Glass-filled nylon engaging the door frame and holding the door shut. Not less than 3-point latching.
 - (7) Locking Device: Positive, automatic type, whereby locker may be locked when open, then closed without unlocking.
- D. Acoustical Treatment: Provide tamper resistant rubber silencers at all lockers.

2.4 LOCKER ACCESSORIES

- A. Equipment: Furnish each locker with the following items, unless otherwise shown:

- (1) Single-, Double-, and Triple-Tier Units: 1 double-prong ceiling hook, and not fewer than 2 single-prong wall hooks.
- B. Number Plates: Manufacturer's standard etched, embossed, or stamped, nonferrous-metal number plates with numerals not less than 3/8 inch (9 mm) high. Number lockers in sequence indicated. Attach plates to each locker door, near top, centered, with at least 2 fasteners of same finish as number plate.
- C. Continuously Sloping Tops: Manufacturer's standard continuously sloped top, not less than 0.0359-inch (0.91-mm) steel sheet. Provide closures at ends and sloped corner fillers.
- D. Recess Trim: Manufacturer's standard 0.0478-inch (1.2-mm) minimum steel sheet trim with concealed fastening clips.
- E. Filler Panels: 0.0478-inch (1.2-mm) minimum steel sheet, factory fabricated.
- F. Boxed End Panels: Manufacturer's standard 0.0598-inch (1.5-mm) minimum steel sheet end-finishing panels to conceal exposed ends of non-recessed lockers.
- G. Closed Bases: 18 gauge closed metal front and end bases, finished to match lockers.

2.5 FABRICATION

- A. Fabricate lockers square, rigid, and without warp, with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch. Weld frame members together to form a rigid, 1-piece structure.
 - (1) Preassemble lockers by welding all joints, seams, and connections. Grind exposed welds flush.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
- B. Finish all steel surfaces and accessories, except prefinished stainless-steel and chrome-plated surfaces.
- C. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering prior to shipment.
- D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within 1/2 of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved samples and they are assembled or installed to minimize contrast.

2.7 STEEL SHEET FINISHES

- A. Surface Preparation: Solvent-clean surfaces complying with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill

scale and rust, if present, from uncoated steel complying with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP 8 (Pickling), and phosphatize surfaces.

- B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-enamel finish consisting of a thermosetting topcoat. Comply with paint manufacturer's instructions for application and baking to achieve a minimum dry film thickness of 1.1 mils (0.028 mm) on doors, frames, and legs, and 0.7 mil (0.018 mm) elsewhere.
 - (1) Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.

2.8 GALVANIZED-STEEL SHEET FINISHES

- A. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants followed by a conversion coating of type suited to organic coating applied over it. Clean welds, mechanical connections, and abraded areas and follow with an application of the galvanizing repair paint, specified below, to comply with ASTM A 780.
 - (1) Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-enamel finish consisting of a thermosetting topcoat. Comply with paint manufacturer's instructions for application and baking to achieve a minimum dry film thickness of 1.1 mils (0.028 mm) on doors, frames, and legs, and 0.7 mil (0.018 mm) elsewhere.
 - (1) Color and Gloss: As selected by Architect from manufacturer's standard choices for color and gloss.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install metal lockers complete with accessories according to manufacturer's recommendations. Install plumb, level, rigid, and flush.
- B. Assemble knock-down lockers with standard fasteners according to manufacturer's recommendations with no exposed fasteners on door faces and face frames.
- C. Connect together welded locker groups with standard fasteners according to manufacturer's recommendations, with no exposed fasteners on face frames.
- D. Anchor lockers to floors and walls at intervals recommended by manufacturer but no greater than 36 inches (910 mm). Install anchors through back-up reinforcing plates where necessary to avoid metal distortion, using concealed fasteners.
- E. Install recess trim to recessed lockers using concealed fasteners. Provide hairline joints and concealed splice plates.
- F. Install sloping top units to lockers using concealed fasteners. Provide hairline joints and concealed splice plates.

- G. Install boxed end panels to conceal exposed ends of nonrecessed lockers.

3.2 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust doors and latches to operate easily without binding. Verify that integral locking devices are operating properly.
- B. Clean interior and exposed exterior surfaces and polish stainless-steel and nonferrous metal surfaces.
- C. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit locker use during construction.
- D. Touch up marred finishes, or replace locker units that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 10505

SECTION 12 2413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - (1) Manually operated sun screen roller shades.
- B. Related Sections include the following:
 - (1) Division 6 Section "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.3 SUBMITTALS

- A. Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other Work, operational clearances, and relationship to adjoining work.
- B. Samples for Verification:
 - (1) For the following products:
 - (a) Shade Material: Not less than 3 inches square sample of each type required, with specified treatments applied. Mark face of material.
- C. Window Treatment Schedule: Include roller shades in schedule using same room designations indicated on Drawings.
- D. Product Test Reports: For each type of roller shade product.
- E. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:
 - (1) Methods for maintaining roller shades and finishes.
 - (2) Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
- F. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - (1) Ceiling suspension system members and attachment to building structure.

- (2) Ceiling-mounted or penetrating items including light fixtures, air outlets and inlets, speakers, sprinklers, recessed shades, and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
 - (3) Shade mounting assembly and attachment.
 - (4) Size and location of access to shade operator and adjustable components.
 - (5) Minimum Drawing Scale: 1/8 inch - 1 foot (1:96).
- G. Samples for Initial Selection: For each colored components of each type of shade indicated.
- (1) Include similar samples of accessories involving color selection.
- H. Samples for Verification:
- (1) Complete, full-size operating unit not less than 16 inches wide for each type of roller shade indicated.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed installation of roller shades similar in material, design, and extent to that indicated for this Project.
- B. Source Limitations: Obtain roller shades through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - (1) Flame-Resistance Ratings: Passes NFPA 701.
 - (2) Surface-Burning Characteristics: ASTM E84, Flamespread of 25 or less, Smoke Developed of 450 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in factory packages, marked with manufacturer and product name, and location of installation using same room designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 WARRANTY

- A. Roller Shade Hardware, Chain and Shadecloth: Manufacturer's standard non-depreciating twenty-five year limited warranty.
- B. Roller Shade Installation: One year from date of substantial completion, not including scaffolding, lifts or other means to reach inaccessible areas.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: MechoShade Systems Inc., Classic Mecho/5 roller shade system.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - (1) Hunter Douglas Window Fashions.
 - (2) Insolroll, Inc.
 - (3) Levolor Contract; a Newell Company; Joanna.
 - (4) MechoShade Systems, Inc.
 - (5) Shade Technologies, Inc.

2.2 ROLLER SHADES

- A. Schedule: Manual operating interior, chain drive, sun screen roller shades in all exterior windows of rooms and spaces shown on the drawings.
- B. Shade Cloth Basis of Design: MechoShade Systems., EuroTwill Reversible Twill Weave Shadecloth 6000 Series.
- C. Shade Band Material: PVC-coated polyester.
 - (1) Material Width: Fabricate Units to completely fill existing openings from head to sill and jamb to jamb.
 - (2) Bottom Hem: Straight.

- (3) Material Openness Factor:
 - (a) 3%
- (4) Material Color:
 - (a) 6018 Stone.
- D. Rollers: Electrogalvanized steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with manufacturer's standard method for attaching shade material.
- E. Direction of Roll: Regular, from back of roller.
- F. Mounting Brackets: Galvanized or zinc-plated steel.
- G. Bottom Bar: Extruded aluminum, with plastic or metal capped ends. Provide concealed, by pocket of shade material, internal-type, bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.
- H. Shade Operation: Manual; with rear mounted continuous loop bead chain, clutch, and cord tensioner and bracket lift operator.
 - (1) Position of Clutch Operator: On operable opening side of window as determined by user facing shade from inside.
 - (2) Loop Length: Length required to make operation convenient from floor level.
 - (3) Bead Chain: Nickel-plated metal.
 - (4) Operating Function: Stop and hold shade at any position in ascending or descending travel.
 - (5) Cord Tensioner Mounting: Wall or sill, but not jamb.
- I. Mounting: As indicated on drawings, permitting easy removal and replacement without damaging roller, shade or adjacent surfaces and finishes.

2.3 ROLLER SHADE FABRICATION

- A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.
- B. Fabricate shade cloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or reveling. Fabricate unguided shade cloth to roll true and straight without shifting sideways more than 1/8 inch in either direction per 8 feet of shade height due to warp distortion or weave design. Fabricate hem as follows:

- (1) Concealed hemtube.
- C. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - (1) Lifting Mechanism: With permanently lubricated moving parts.
- D. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.
- E. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting fascia, roller, and operating hardware and for hardware position and shade mounting method indicated.
- F. Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.
- G. Color-Coated Finish: For metal components exposed to view, clear anodized aluminum.
- H. Colors of Metal Components Exposed to View: Clear, anodized aluminum.

2.4 ACCESSORIES

- A. Fascia:
 - (1) Continuous removable extruded aluminum fascias that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
 - (2) Fascia shall be able to be installed across two or more shade bands in one piece.
 - (3) Fascia shall fully conceal brackets, shade roller and fabric on the tube.
 - (4) Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.
 - (5) Notching of fascia for manual chain shall not be acceptable.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean surfaces thoroughly prior to installation.

- B. Prepare surface using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.2 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow clearances for window operation hardware.
- B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems. Refer to Division 1 Section "Closeout Procedures".

END OF SECTION 12 2413

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Escutcheons.
 - 5. Plumbing demolition.
 - 6. Equipment installation requirements common to equipment sections.
 - 7. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.

2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Solvent Cements for Joining Plastic Piping:
 - 1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- D. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 - 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.

3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
1. Manufacturers:
 - a. Eslon Thermoplastics.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
1. Manufacturers:
 - a. Thompson Plastics, Inc.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
1. Manufacturers:
 - a. NIBCO INC.
 - b. NIBCO, Inc.; Chemtrol Div.
- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Company.
 - d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Manufacturers:

- a. Capitol Manufacturing Co.
- b. Central Plastics Company.
- c. Eclipse, Inc.
- d. Epco Sales, Inc.
- e. Hart Industries, International, Inc.
- f. Watts Industries, Inc.; Water Products Div.
- g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

- a. Calpico, Inc.
- b. Lochinvar Corp.

E. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

- a. Perfection Corp.
- b. Precision Plumbing Products, Inc.
- c. Sioux Chief Manufacturing Co., Inc.
- d. Victaulic Co. of America.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.

C. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.

2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed hinge and set screw.
- M. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- N. Verify final equipment locations for roughing-in.
- O. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Nonpressure Piping: Join according to ASTM D 2855.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

END OF SECTION 220500

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Bronze ball valves.
 - 2. Bronze swing check valves.
 - 3. Bronze gate valves.
 - 4. Chainwheels.
- B. Related Sections:
 - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
 - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. SWP: Steam working pressure.

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 4. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Handwheel: For valves other than quarter-turn types.
 - 2. Handlever: For quarter-turn valves NPS 6 and smaller.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:

1. Solder Joint: With sockets according to ASME B16.18.
2. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Crane Co.; Crane Valve Group; Crane Valves.
 - d. Hammond Valve.
 - e. Lance Valves; a division of Advanced Thermal Systems, Inc.
 - f. Legend Valve.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Red-White Valve Corporation.
 - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.3 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.

- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Division.
- e. Hammond Valve.
- f. Kitz Corporation.
- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Powell Valves.
- j. Red-White Valve Corporation.
- k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- l. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 3.
- b. CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

2.4 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Valve, Inc.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Division.
- e. Hammond Valve.
- f. Kitz Corporation.
- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Powell Valves.
- j. Red-White Valve Corporation.
- k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- l. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded or solder joint.

- e. Stem: Bronze.
- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball valves or gate valves on service entrance only.
 2. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
 - b. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
 2. Ball Valves: Two piece, full port, bronze with bronze trim.
 3. Bronze Swing Check Valves: Class 125, bronze disc.

END OF SECTION 220523

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following hangers and supports for plumbing system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Pipe positioning systems.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Pipe positioning systems.

- B. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
 - 1. AAA Technology & Specialties Co., Inc.
 - 2. Bergen-Power Pipe Supports.
 - 3. B-Line Systems, Inc.; a division of Cooper Industries.
 - 4. Carpenter & Paterson, Inc.
 - 5. Empire Industries, Inc.
 - 6. ERICO/Michigan Hanger Co.
 - 7. Globe Pipe Hanger Products, Inc.
 - 8. Grinnell Corp.
 - 9. GS Metals Corp.
 - 10. National Pipe Hanger Corporation.
 - 11. PHD Manufacturing, Inc.
 - 12. PHS Industries, Inc.
 - 13. Piping Technology & Products, Inc.
 - 14. Tolco Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 - 3. GS Metals Corp.
 - 4. Power-Strut Div.; Tyco International, Ltd.
 - 5. Thomas & Betts Corporation.
 - 6. Tolco Inc.
 - 7. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Manufacturers:
 - 1. C & S Mfg. Corp.
 - 2. HOLDRITE Corp.; Hubbard Enterprises.
 - 3. Samco Stamping, Inc.

2.6 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 - 3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
 - 4. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
 - 6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
 - 9. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
 - 10. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
 - 11. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
- F. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- G. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
 2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 4. C-Clamps (MSS Type 23): For structural shapes.
 5. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 6. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 7. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 8. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 9. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 10. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- H. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- I. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- J. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow thermal movement of piping systems. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- K. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

- b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
- a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
- a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

END OF SECTION 220529

SECTION 22 0533 - HEAT TRACING FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes plumbing piping heat tracing for freeze prevention with the following electric heating cables:
 - 1. Self-regulating, parallel resistance.

1.2 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
 - 1. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.
- B. Shop Drawings: For electric heating cable. Include plans, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.
- E. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. BH Thermal Corporation.
 2. Chromalox, Inc.; Wiegard Industrial Division; Emerson Electric Company.
 3. Delta-Therm Corporation.
 4. Easy Heat Inc.
 5. Nelson Heat Trace.
 6. Pyrotenax; a division of Tyco Thermal Controls.
 7. Raychem; a division of Tyco Thermal Controls.
 8. Thermon Manufacturing Co.
 9. Trasor Corp.
- B. Heating Element: Pair of parallel stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.
- C. Electrical Insulating Jacket: Flame-retardant polyolefin.
- D. Cable Cover: Stainless-steel braid, and polyolefin outer jacket with UV inhibitor].
- E. Maximum Operating Temperature (Power On): 150 deg F.
- F. Maximum Exposure Temperature (Power Off): 185 deg F.
- G. Maximum Operating Temperature: 300 deg F.

2.2 CONTROLS

- A. Pipe-Mounting Thermostats for Freeze Protection:
 1. Remote bulb unit with adjustable temperature range from 30 to 50 deg F.
 2. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
 3. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.
 4. Corrosion-resistant, waterproof control enclosure.

B. Precipitation and Temperature Sensor for Snow Melting on Roofs and in Gutters:

1. Microprocessor-based control with manual on, automatic, and standby/reset switch.
2. Precipitation and temperature sensors shall sense the surface conditions of roof and gutters and shall be programmed to energize the cable as follows:
 - a. Temperature Span: 34 to 44 deg F.
 - b. Adjustable Delay Off Span: 30 to 90 minutes.
 - c. Energize Cables: Following two-minute delay if ambient temperature is below set point and precipitation is detected.
 - d. De-Energize Cables: On detection of a dry surface plus time delay.
3. Corrosion-proof and waterproof enclosure suitable for outdoor mounting, for controls and precipitation and temperature sensors.
4. Minimum 30-A contactor to energize cable or close other contactors.
5. Precipitation sensor shall be freestanding.
6. Provide relay with contacts to indicate operational status, on or off, for interface with central HVAC control system workstation.

C. Programmable Timer for Domestic Hot-Water-Temperature Maintenance:

1. Microprocessor based.
2. Minimum of four separate schedules.
3. Minimum 24-hour battery carryover.
4. On-off-auto switch.
5. 365-day calendar with 20 programmable holidays.
6. Relays with contacts to indicate operational status, on or off, and for interface with central HVAC control system workstation.

2.3 ACCESSORIES

- A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.
- B. Warning Labels: Refer to Division 22 Section "Identification for Plumbing Piping and Equipment."
- C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.
 1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
 2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Install the following types of electric heating cable for the applications described:
 - 1. Snow and Ice Melting on Roofs and in Gutters and Downspouts: Self-regulating, parallel-resistance heating cable.
 - 2. Temperature Maintenance for Domestic Hot Water: Self-regulating, parallel-resistance heating cable.

3.3 INSTALLATION

- A. Install electric heating cable across expansion, construction, and control joints according to manufacturer's written recommendations using cable protection conduit and slack cable to allow movement without damage to cable.
- B. Electric Heating Cable Installation for Snow and Ice Melting on Roofs and in Gutters and Downspouts: Install on roof and in gutters and downspouts with clips furnished by manufacturer that are compatible with roof, gutters, and downspouts.
- C. Electric Heating Cable Installation for Freeze Protection for Piping:
 - 1. Install electric heating cables after piping has been tested and before insulation is installed.
 - 2. Install electric heating cables according to IEEE 515.1.
 - 3. Install insulation over piping with electric cables according to Division 22 Section "Plumbing Insulation."
 - 4. Install warning tape on piping insulation where piping is equipped with electric heating cables.
- D. Electric Heating Cable Installation for Temperature Maintenance for Domestic Hot Water:
 - 1. Install electric heating cables after piping has been tested and before insulation is installed.

2. Install insulation over piping with electric heating cables according to Division 22 Section "Plumbing Insulation."
 3. Install warning tape on piping insulation where piping is equipped with electric heating cables.
- E. Set field-adjustable switches and circuit-breaker trip ranges.
- F. Protect installed heating cables, including nonheating leads, from damage.

3.4 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

- A. Testing: Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
1. Test cables for electrical continuity and insulation integrity before energizing.
 2. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
- B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounting cables.
- C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 22 0533

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
 - 2. Escutcheons.
 - 3. Sleeves and sleeve seals.

1.3 SUBMITTALS

- A. Product Data: For the following products:
 - 1. Backflow preventers.
- B. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic, potable domestic water piping and components.
- C. Comply with NSF 61 for potable domestic water piping and components.

1.5 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.
 - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve inside the building at each domestic water service entrance. Install domestic water piping level and plumb.
- D. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- G. Install piping adjacent to equipment and specialties to allow service and maintenance.
- H. Install piping to permit valve servicing.
- I. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- J. Install piping free of sags and bends.
- K. Install fittings for changes in direction and branch connections.
- L. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

- B. Install shutoff valve close to water main on each branch serving plumbing fixtures.
- C. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
- C. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
- D. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.

3.6 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.

3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

- B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

- C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate

- test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.9 ADJUSTING

- A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
 2. Open shutoff valves to fully open position.
 3. Open throttling valves to proper setting.
 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:

- 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
- c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

- A. Unions may be used for aboveground piping joints unless otherwise indicated.
- B. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
1. Hard copper tube, ASTM B 88, Type L; cast- or wrought- copper solder-joint fittings; soldered joints.

3.12 VALVE SCHEDULE

- A. The following requirements apply:
1. Shutoff Duty: Use ball or gate valves for service entrance only for piping NPS 2 and smaller.
 2. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
 3. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Backflow preventers.
 - 2. Balancing valves.
 - 3. Outlet boxes.
 - 4. Hose bibbs.
 - 5. Wall hydrants.
 - 6. Drain valves.
 - 7. Water hammer arresters.
 - 8. Trap-seal primer valves.
 - 9. Trap-seal primer systems.
- B. Related Sections include the following:
 - 1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
 - 2. Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

- A. Reduced-Pressure-Principle Backflow Preventers (BFD-1)
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1013.
 - 3. Operation: Continuous-pressure applications.
 - 4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
 - 5. Size: See Plans.
 - 6. Body: Bronze for NPS 2 and smaller.
 - 7. End Connections: Threaded for NPS 2 and smaller.
 - 8. Configuration: Designed for horizontal, straight through flow.
 - 9. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.2 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Flo Fab Inc.
 - c. ITT Industries; Bell & Gossett Div.
 - d. NIBCO INC.
 - e. TAC Americas.
 - f. Taco, Inc.
 - g. Watts Industries, Inc.; Water Products Div.
2. Type: Ball valve with two readout ports and memory setting indicator.
3. Body: Brass
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.3 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. Honeywell Water Controls.
 - d. Lawler Manufacturing Company, Inc.
 - e. Leonard Valve Company.
 - f. Powers; a Watts Industries Co.
 - g. Watts Industries, Inc.; Water Products Div.
 - h. Zurn Plumbing Products Group; Wilkins Div.
 - i.
2. Description: Refer to Fixture Schedule Plans

2.4 OUTLET BOXES

A. Icemaker Outlet Boxes (IB-1):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Acorn Engineering Company.
- b. IPS Corporation.
- c. LSP Products Group, Inc.
- d. Oatey.
- e. Plastic Oddities; a division of Diverse Corporate Technologies.

2. Description: Refer to Fixture Schedule Plans

2.5 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.6 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.7 TRAP-SEAL PRIMER VALVES

- A. Supply-Type, Trap-Seal Primer Valves TP-1:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MIFAB, Inc.
 - b. PPP Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Watts Industries, Inc.; Water Products Div.
 - 2. Standard: ASSE 1018.
 - 3. Pressure Rating: 125 psig minimum.
 - 4. Body: Bronze.
 - 5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
 - 6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
 - 7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- C. Install balancing valves in locations where they can easily be adjusted.
- D. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

- E. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."
- F. Install water hammer arresters in water piping according to PDI-WH 201.
- G. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- H. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 - 1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.4 ADJUSTING

- A. Set field-adjustable flow set points of balancing valves.
 - B. Set field-adjustable temperature set points of temperature-actuated water mixing valves.
- END OF SECTION 221119

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following for soil, waste, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. LLDPE: Linear, low-density polyethylene plastic.
- C. NBR: Acrylonitrile-butadiene rubber.
- D. PE: Polyethylene plastic.
- E. PVC: Polyvinyl chloride plastic.
- F. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
- C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - a. Manufacturers:
 - 1) ANACO.
 - 2) Fernco, Inc.
 - 3) Ideal Div.; Stant Corp.
 - 4) Mission Rubber Co.
 - 5) Tyler Pipe; Soil Pipe Div.

2.4 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

2.5 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
 - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
- B. Solvent Cement and Adhesive Primer:
 - 1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 SPECIAL PIPE FITTINGS

- A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Manufacturers:
 - a. Dallas Specialty & Mfg. Co.
 - b. Fernco, Inc.
 - c. Logan Clay Products Company (The).
 - d. Mission Rubber Co.
 - e. NDS, Inc.
 - f. Plastic Oddities, Inc.
 - 2. Sleeve Materials:
 - a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Mission Rubber Co.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:
 1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 2. Copper DWV tube, copper drainage fittings, and soldered joints.
 3. Dissimilar Pipe-Material Couplings: Shielded, or Rigid, unshielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- B. Aboveground, vent piping NPS 4 and smaller shall be the following:
 1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 2. Copper DWV tube, copper drainage fittings, and soldered joints.
 3. Dissimilar Pipe-Material Couplings: Shielded, or Rigid, unshielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- C. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:
 1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 2. Dissimilar Pipe-Material Couplings: Shielded, or Rigid, unshielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

3.3 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- C. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

- D. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- E. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- F. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- G. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- H. Install underground soil and waste drainage piping according to ASTM D 2321.
- I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- D. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- E. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

- F. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- G. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Install individual, straight, horizontal piping runs according to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- D. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
- F. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system

and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316

SECTION 221323 - SANITARY WASTE INTERCEPTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Oil interceptors.

1.3 SUBMITTALS

- A. Product Data: For each type of interceptor indicated. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, based on input from Installers of the items involved:
 - 1. Interceptors.
 - 2. Piping connections. Include size, location, and elevation of each.
 - 3. Interface with underground structures and utility services.

1.5 PROJECT CONDITIONS

- A. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services according to requirements indicated:
 - 1. Notify **Architect** no fewer than **[seven]** days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of sewer services without **Architect's** written permission.

PART 2 - PRODUCTS

2.1 OIL INTERCEPTORS

- A. Oil Interceptors: Precast concrete comply with **ASTM C 913**.
1. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain oil and to permit wastewater flow.
 2. Structural Design Loads:
 - a. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
 3. Resilient Pipe Connectors: **ASTM C 923 (ASTM C 923M)**, cast or fitted into interceptor walls, for each pipe connection.
 4. Steps: **ASTM A 615/A 615M, deformed, 1/2-inch**, wide enough to allow worker to place both feet on one rung and designed to prevent lateral slippage. Anchor ladder into sidewalls at **12- to 16-inch (300- to 400-mm)** intervals.
- B. Oil Interceptors: Factory-fabricated, cast-iron or steel body; with removable sediment bucket or strainer, baffles, vents, and flow-control fitting on inlet.
1. Manufacturers: Subject to compliance with requirements, **[provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **[product indicated on Drawings] <Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Parkson Corporation.
 - d. Rockford Sanitary Systems, Inc.
 - e. Schier Products Company.
 - f. Smith, Jay R. Mfg. Co.
 - g. Tyler Pipe, Inc.
 - h. Watts Water Technologies, Inc.
 - i. Zurn Plumbing Products Group; Zurn Specification Drainage Products.
 - j. **<Insert manufacturer's name>**.
 3. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.
 4. Extension: Cast-iron or steel shroud, full size of interceptor, extending from top of interceptor to grade.
 5. Cover: Cast iron or steel, with steel reinforcement to provide ASTM C 890, **[A-03, walkway] <Insert type loading>** load.

6. Comply with requirements in Division 23 Section "Facility Fuel-Oil Piping" for waste-oil storage tank and piping
- C. Oil Interceptors: Plastic body; with removable sediment bucket or strainer, baffles, vents, and flow-control fitting on inlet.
1. Manufacturers: Subject to compliance with requirements, **[provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **[product indicated on Drawings] <Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. Green Turtle (USA).
 - b. Parkson Corporation.
 - c. Schier Products Company.
 - d. Town & Country Plastics, Inc.
 - e. **<Insert manufacturer's name>**.
 3. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.
 4. Extension: Plastic shroud, full size of interceptor, extending from top of interceptor to grade.
 5. Cover: Plastic **[with steel reinforcement to provide ASTM C 890,] [A-03, walkway] <Insert type loading>** load.
 6. Waste-oil storage tank and piping are specified in Division 23 Section "Facility Fuel-Oil Piping."
- D. Capacities and Characteristics:
1. Capacity: **[Not applicable] <Insert gal. (L)>**.
 2. Overall Dimensions: **<Insert inches (mm)>**.
 3. Inlet and Outlet Pipe Size: **<Insert NPS (DN)>**.
 - a. Centerline of Inlet to Floor: **<Insert inches (mm)>**.
 - b. Centerline of Outlet to Floor: **<Insert inches (mm)>**.
 4. Waste-Oil-Outlet Pipe Size: **<Insert NPS (DN)>**.
 - a. Centerline of Outlet to Floor: **<Insert inches (mm)>**.
 5. Trapped Outlet Required: **[Integral] [No] [Yes]**.
 6. Vent Pipe Size: **<Insert NPS (DN)>**.
 7. Installation Position: **[Top flush with grade] [Underground with extension to grade] [Underground with manhole riser to grade] <Insert position>**.

2.2 PRECAST-CONCRETE MANHOLE RISERS

- A. Precast-Concrete Manhole Risers: **ASTM C 478 (ASTM C 478M)**, with rubber-gasket joints.
1. Structural Design Loads:
 - a. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
 2. Length: From top of underground concrete structure to grade.
 3. Riser Sections: **3-inch** minimum thickness and **36-inch** diameter.
 4. Top Section: Eccentric cone, unless otherwise indicated. Include top of cone to match grade ring size.
 5. Gaskets: **ASTM C 443 (ASTM C 443M)**, rubber.
 6. Steps: **ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods**, wide enough to allow worker to place both feet on one rung and designed to prevent lateral slippage. Cast or anchor ladder into sidewalls at **12- to 16-inch (300- to 400-mm)** intervals.
- B. Grade Rings: Reinforced-concrete rings, **6- to 9-inch (150- to 225-mm)** total thickness, diameter matching manhole frame and cover, and height as required to adjust the manhole frame and cover to indicated elevation and slope.
- C. Manhole Frames and Covers: Ferrous; **24-inch (610-mm)** ID by **7- to 9-inch (175- to 225-mm)** riser with **4-inch- (100-mm-)** minimum width flange and **26-inch- (660-mm-)** diameter cover.
1. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
 2. Include indented top design with lettering cast into cover, using wording equivalent to the following:
 - a. Oil Interceptors in Sanitary Sewerage System: "**OIL INTERCEPTOR.**"

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 INSTALLATION

- A. Install precast-concrete interceptors according to ASTM C 891. Set level and plumb.
- B. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.

- C. Set tops of manhole frames and covers flush with finished surface in pavements.
- D. Set tops of grating frames and grates flush with finished surface.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Make piping connections between interceptors and piping systems.

END OF SECTION 221323

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following conventional plumbing fixtures and related components:
 - 1. Faucets for lavatories.
 - 2. Toilet seats.
 - 3. Protective shielding guards.
 - 4. Fixture supports.
 - 5. Disposers.
 - 6. Water closets.
 - 7. Urinals.
 - 8. Lavatories.
 - 9. Kitchen sinks.
 - 10. Service basins.
- B. Related Sections include the following:
 - 1. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
 - 2. Division 22 Section "Drinking Fountains and Water Coolers."

1.3 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- C. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- C. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - 2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
 - 3. Stainless-Steel Residential Sinks: ASME A112.19.3.
 - 4. Vitreous-China Fixtures: ASME A112.19.2M.
 - 5. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
- G. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.

2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucets: ASME A112.18.1.
5. NSF Potable-Water Materials: NSF 61.
6. Pipe Threads: ASME B1.20.1.
7. Supply Fittings: ASME A112.18.1.
8. Brass Waste Fittings: ASME A112.18.2.

H. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
2. Floor Drains: ASME A112.6.3.
3. Off-Floor Fixture Supports: ASME A112.6.1M.
4. Pipe Threads: ASME B1.20.1.
5. Plastic Toilet Seats: ANSI Z124.5.
6. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

A. Lavatory Faucets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Delta Faucet Company.
 - c. Eljer.
 - d. Elkay Manufacturing Co.
 - e. Fisher Manufacturing Co.
 - f. Just Manufacturing Company.
 - g. Kohler Co.
 - h. Moen, Inc.
2. Description: Refer to Fixture Schedule Plans

2.2 SINK FAUCETS

A. Sink Faucets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Standard Companies, Inc.
- b. Delta Faucet Company.
- c. Eljer.
- d. Elkay Manufacturing Co.
- e. Fisher Manufacturing Co.
- f. Just Manufacturing Company.
- g. Kohler Co.
- h. Moen, Inc.

2. Description: Refer to Fixture Schedule Plans

2.3 FLUSHOMETERS

A. Flushometers, F-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Coyne & Delany Co.
 - b. Delta Faucet Company.
 - c. Sloan Valve Company.
 - d. Zurn Plumbing Products Group; Commercial Brass Operation.
2. Description: Refer to Fixture Schedule Plans

2.4 TOILET SEATS

A. Toilet Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Bemis Manufacturing Company.
 - c. Centoco Manufacturing Corp.
 - d. Church Seats.
 - e. Eljer.
 - f. Kohler Co.
 - g. Olsonite Corp.
 - h. Sanderson Plumbing Products, Inc.; Beneke Div.
 - i. Sperzel.
2. Description: Refer to Fixture Schedule Plans

2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Engineered Brass Co.
 - b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
 - c. McGuire Manufacturing Co., Inc.
 - d. Plumberex Specialty Products Inc.
 - e. TCI Products.
 - f. TRUEBRO, Inc.
 - g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.6 FIXTURE SUPPORTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. MIFAB Manufacturing Inc.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
6. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Urinal Supports:

1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

C. Lavatory Supports,:

1. Description: Type I, lavatory carrier with exposed arms and tie rods for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

2.7 DISPOSERS

A. Disposers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Franke Consumer Products, Inc.; Kitchen Systems Div.
 - c. In-Sink-Erator; a div. of Emerson Electric Co.
 - d. KitchenAid.
 - e. Maytag Co.
2. Description: Batch-feed household, food-waste disposer. Include reset button; wall switch; corrosion-resistant chamber with jam-resistant, cutlery- or stainless-steel grinder or shredder; NPS 1-1/2 outlet; quick-mounting, stainless-steel sink flange; antisplash guard; and combination cover/stopper.
 - a. Type: Batch-feed household.
 - b. Model: **[Not applicable] [Sound-insulated chamber] [Sound-insulated chamber and stainless-steel outer shell].**
 - c. Motor: 115-V ac, 1725 rpm, **[1/3] [1/2] [3/4] [1]** hp with overload protection.

B. WATER CLOSETS

2.8 Manufacturers: Subject

A. Water Closets, WC-1:

1. Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Barclay Products, Ltd.
 - c. Briggs Plumbing Products, Inc.
 - d. Crane Plumbing, L.L.C./Fiat Products.
 - e. Duravit USA, Inc.
 - f. Eljer.
 - g. Gerber Plumbing Fixtures LLC.
 - h. Kohler Co.
 - i. Mansfield Plumbing Products, Inc.
2. Description: Refer to Fixture Schedule Plans

2.9 URINALS

A. Urinals, U-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Briggs Plumbing Products, Inc.
 - c. Capizzi.
 - d. Crane Plumbing, L.L.C./Fiat Products.
 - e. Duravit USA, Inc.
 - f. Eljer.
 - g. Kohler Co.
 - h. Mansfield Plumbing Products, Inc.
 - i. Peerless Pottery, Inc.
 - j. Sanitarios Azteca, S.A. de C.V.
 - k. St. Thomas Creations.
 - l. TOTO USA, Inc.
2. Description: Refer to Fixture Schedule Plans

2.10 LAVATORIES

A. Lavatories, L-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard Companies, Inc.
 - b. Commercial Enameling Company.
 - c. Eljer.
 - d. Kohler Co.
 - e. American Standard Companies, Inc.
 - f. Barclay Products, Ltd.
 - g. Briggs Plumbing Products, Inc.
 - h. Crane Plumbing, L.L.C./Fiat Products.
 - i. Eljer.
 - j. Gerber Plumbing Fixtures LLC.
2. Description: Refer to Fixture Schedule Plans

2.11 COMMERCIAL SINKS

A. Commercial Sinks, S-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Advance Tabco.
- b. Elkay Manufacturing Co.
- c. Just Manufacturing Company.
- d. Metal Masters Foodservice Equipment Co., Inc.

2. Description: Refer to Fixture Schedule Plans

2.12 SERVICE BASINS

A. Service Basins, MB-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Acorn Engineering Company.
- b. Crane Plumbing, L.L.C./Fiat Products.
- c. Florestone Products Co., Inc.
- d. Precast Terrazzo Enterprises, Inc.
- e. Stern-Williams Co., Inc.
- f. Crane Plumbing, L.L.C./Fiat Products.
- g. Florestone Products Co., Inc.
- h. Mustee, E. L. & Sons, Inc.
- i. Swan Corporation (The).
- j. Zurn Plumbing Products Group; Light Commercial Operation.

2. Description: Refer to Fixture Schedule Plans

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install counter-mounting fixtures in and attached to casework.
- G. Install fixtures level and plumb according to roughing-in drawings.
- H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- J. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- K. Install toilet seats on water closets.
- L. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- M. Install traps on fixture outlets.
1. Exception: Omit trap on fixtures with integral traps.
- N. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- O. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- P. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers. Replace damaged and malfunctioning units.
- C. Adjust water pressure at faucets to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.

2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following drinking fountains and related components:
 - 1. Drinking fountains.
 - 2. Electronic water coolers.
 - 3. Fixture supports.

1.3 SUBMITTALS

- A. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For fixtures to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act" ; and Public Law 101-336, "Americans with Disabilities Act" ; for fixtures for people with disabilities.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- D. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.

- E. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAINS AND ELECTRIC WATER COOLERS

- A. Drinking Fountains and Electric Water Coolers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Filtrine Manufacturing Company; Drinking Water Division.
 - b. Halsey Taylor.
 - c. Haws Corporation.
 - d. Most Dependable Fountains, Inc.
 - e. Murdock, Inc.
 - f. Oasis Corporation.
 - g. Stern-Williams Co., Inc.
 - h. Sunroc Corp.
 - 2. Description: Refer to the Fixture Schedule on the Drawings.

2.2 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Josam Co.
 - 2. MIFAB Manufacturing, Inc.
 - 3. Smith, Jay R. Mfg. Co.
 - 4. Tyler Pipe; Wade Div.
 - 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 - 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
 - 1. Type I: Hanger-type carrier with two vertical uprights.

2. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.
- B. Examine walls and floors for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.
- B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

3.3 INSTALLATION

- A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.
- B. Install fixtures level and plumb.
- C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- E. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- F. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

- A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
 - 1. Remove and replace malfunctioning units and retest as specified above.
 - 2. Report test results in writing.

3.6 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust water cooler temperature settings.

3.7 CLEANING

- A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 224700

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. HVAC demolition.
 - 3. Equipment installation requirements common to equipment sections.
 - 4. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 - 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Permanent sleeves are not required for holes formed by removable PE sleeves.
- M. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- N. Verify final equipment locations for roughing-in.
- O. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

END OF SECTION 230500

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 5,500feet above sea level.

- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.

- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following hangers and supports for HVAC system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Pipe positioning systems.
- B. Related Section include the following:
 - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Fiberglass pipe hangers.

2. Pipe positioning systems.

B. Welding certificates.

1.6 QUALITY ASSURANCE

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
3. B-Line Systems, Inc.; a division of Cooper Industries.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
10. National Pipe Hanger Corporation.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.

- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
- G. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
- H. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- C. Install lateral bracing with pipe hangers and supports to prevent swaying.
- D. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- E. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

END OF SECTION 230529

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - b. Dual-duct systems.
 - c. Variable-air-volume systems.
 - d. Multizone systems.
 - e. Induction-unit systems.
 - 2. Balancing Piping Systems:
 - a. Constant-flow systems.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

- A. Certified TAB reports.
- B. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.

4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by TABB.
 1. TAB Field Supervisor: Employee of the TAB contractor and certified by NEBB or TABB.
 2. TAB Technician: Employee of the TAB contractor and who is certified by TABB as a TAB technician.
- B. Certify TAB field data reports and perform the following:
 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard TAB contractor's forms,
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.6 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests have been satisfactorily completed.

PART 2 - EXECUTION

2.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- K. Examine system pumps to ensure absence of entrained air in the suction piping.

- L. Examine operating safety interlocks and controls on HVAC equipment.
- M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

2.2 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
 - 1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

2.3 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

2.4 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 - 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.
- 2.5 GENERAL PROCEDURES FOR DOMESTIC HOT WATER CIRCULATION SYSTEMS
- A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
 - B. Prepare schematic diagrams of systems' "as-built" piping layouts.

- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
1. Open all manual valves for maximum flow.
 2. Check liquid level in expansion tank.
 3. Check makeup water-station pressure gage for adequate pressure for highest vent.
 4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
 5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
 6. Set system controls so automatic valves are wide open to heat exchangers.
 7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
 8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

2.6 PROCEDURES FOR DOMESTIC HOT WATER CIRCULATION SYSTEMS

- A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Architect and comply with requirements in Division 23 Section "Hydronic Pumps."
 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 - a. Monitor motor performance during procedures and do not operate motors in overload conditions.
 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 4. Report flow rates that are not within plus or minus 10 percent of design.
- B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

- C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.
- D. Set calibrated balancing valves, if installed, at calculated presettings.
- E. Measure flow at all stations and adjust, where necessary, to obtain first balance.
 - 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
 - 1. Determine the balancing station with the highest percentage over indicated flow.
 - 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 - 3. Record settings and mark balancing devices.
- H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
- J. Check settings and operation of each safety valve. Record settings.

2.7 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer's name, model number, and serial number.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove

proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

2.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Air pressure drop.
4. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

2.9 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.

2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

2.10 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 1. Pump curves.
 2. Fan curves.
 3. Manufacturers' test data.
 4. Field test reports prepared by system and equipment installers.
 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 1. Title page.
 2. Name and address of the TAB contractor.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans and pump performance forms including the following:

- a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.

- f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
- a. Total air flow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f. Preheat-coil static-pressure differential in inches wg.
 - g. Cooling-coil static-pressure differential in inches wg.
 - h. Heating-coil static-pressure differential in inches wg.
 - i. Outdoor airflow in cfm.
 - j. Return airflow in cfm.
 - k. Outdoor-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:
- a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch o.c.
 - f. Make and model number.
 - g. Face area in sq. ft..
 - h. Tube size in NPS.
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
- a. Air flow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.
 - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
 - e. Return-air, wet- and dry-bulb temperatures in deg F.
 - f. Entering-air, wet- and dry-bulb temperatures in deg F.
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
 - h. Water flow rate in gpm.
 - i. Water pressure differential in feet of head or psig.
 - j. Entering-water temperature in deg F.
 - k. Leaving-water temperature in deg F.

- l. Refrigerant expansion valve and refrigerant types.
 - m. Refrigerant suction pressure in psig.
 - n. Refrigerant suction temperature in deg F.
 - o. Inlet steam pressure in psig.
- G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
 1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Fuel type in input data.
 - g. Output capacity in Btu/h.
 - h. Ignition type.
 - i. Burner-control types.
 - j. Motor horsepower and rpm.
 - k. Motor volts, phase, and hertz.
 - l. Motor full-load amperage and service factor.
 - m. Sheave make, size in inches, and bore.
 - n. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 2. Test Data (Indicated and Actual Values):
 - a. Total air flow rate in cfm.
 - b. Entering-air temperature in deg F.
 - c. Leaving-air temperature in deg F.
 - d. Air temperature differential in deg F.
 - e. Entering-air static pressure in inches wg.
 - f. Leaving-air static pressure in inches wg.
 - g. Air static-pressure differential in inches wg.
 - h. Low-fire fuel input in Btu/h.
 - i. High-fire fuel input in Btu/h.
 - j. Manifold pressure in psig.
 - k. High-temperature-limit setting in deg F.
 - l. Operating set point in Btu/h.
 - m. Motor voltage at each connection.
 - n. Motor amperage for each phase.
 - o. Heating value of fuel in Btu/h.
- H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
 1. Fan Data:

- a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.
 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..
 - g. Indicated air flow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual air flow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
- J. Air-Terminal-Device Reports:

1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Apparatus used for test.
 - d. Area served.
 - e. Make.
 - f. Number from system diagram.
 - g. Type and model number.
 - h. Size.
 - i. Effective area in sq. ft..
2. Test Data (Indicated and Actual Values):
 - a. Air flow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary air flow rate as needed in cfm.
 - d. Preliminary velocity as needed in fpm.
 - e. Final air flow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg F.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:
 - a. System and air-handling-unit identification.
 - b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - e. Flowmeter type.
2. Test Data (Indicated and Actual Values):
 - a. Air flow rate in cfm.
 - b. Entering-water temperature in deg F.
 - c. Leaving-water temperature in deg F.
 - d. Water pressure drop in feet of head or psig.
 - e. Entering-air temperature in deg F.
 - f. Leaving-air temperature in deg F.

L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:
 - a. Unit identification.

- b. Location.
- c. Service.
- d. Make and size.
- e. Model number and serial number.
- f. Water flow rate in gpm.
- g. Water pressure differential in feet of head or psig.
- h. Required net positive suction head in feet of head or psig.
- i. Pump rpm.
- j. Impeller diameter in inches.
- k. Motor make and frame size.
- l. Motor horsepower and rpm.
- m. Voltage at each connection.
- n. Amperage for each phase.
- o. Full-load amperage and service factor.
- p. Seal type.

2. Test Data (Indicated and Actual Values):

- a. Static head in feet of head or psig.
- b. Pump shutoff pressure in feet of head or psig.
- c. Actual impeller size in inches.
- d. Full-open flow rate in gpm.
- e. Full-open pressure in feet of head or psig.
- f. Final discharge pressure in feet of head or psig.
- g. Final suction pressure in feet of head or psig.
- h. Final total pressure in feet of head or psig.
- i. Final water flow rate in gpm.
- j. Voltage at each connection.
- k. Amperage for each phase.

M. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

2.11 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Insulation Materials:
 - a. Mineral fiber.
 - 2. Insulating cements.
 - 3. Adhesives.
 - 4. Mastics.
 - 5. Lagging adhesives.
 - 6. Sealants.
 - 7. Factory-applied jackets.
 - 8. Tapes.
 - 9. Securements.
- B. Related Sections:
 - 1. Division 23 Section "Metal Ducts" for duct liners.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 1. Products: Subject to compliance with requirements, provide one of the following:

- a. CertainTeed Corp.; Duct Wrap.
- b. Johns Manville; Microlite.
- c. Knauf Insulation; Duct Wrap.
- d. Manson Insulation Inc.; Alley Wrap.
- e. Owens Corning; All-Service Duct Wrap.

D. Mineral-Fiber, Preformed Pipe Insulation:

- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000 Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Insulco, Division of MFS, Inc.; Triple I.
 - b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
- 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Speedline Vinyl Adhesive.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.

4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-52.
 - b. Foster Products Corporation, H. B. Fuller Company; 81-42.
 - c. Marathon Industries, Inc.; 130.
 - d. Mon-Eco Industries, Inc.; 11-30.
 - e. Vimasco Corporation; 136.
 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
 4. Service Temperature Range: Minus 50 to plus 180 deg F.
 5. Color: White.

2.6 SEALANTS

- A. FSK Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 5. Color: Aluminum.
 6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Products, Division of ITW; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
 3. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.9 SECUREMENTS

- A. Insulation Pins and Hangers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- F. Keep insulation materials dry during application and finishing.

- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at **[2 inches] [4 inches]** o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" firestopping and fire-resistive joint sealers.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe

insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
6. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
7. Install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
8. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

- C. Insulate instrument connections for pressure temperature taps and test connections on insulated pipes, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

D. Blanket Insulation Installation on Ducts: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

- a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.7 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Supply air

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Flexible connectors.
4. Factory-insulated access panels and doors.

3.8 DUCT INSULATION SCHEDULE

A. Round and Rectangular supply-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.

3.9 PIPING INSULATION SCHEDULE, GENERAL

- #### A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Cold Water:

1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral Fiber ASJ: 1 inch thick.

END OF SECTION 230700

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes control equipment for HVAC systems and components.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with ASHRAE 135 for DDC system components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONTROL SYSTEM

- A. Manufacturers:
 - 1. Carrier.
 - 2. Honeywell International Inc.; Home & Building Control.
 - 3. Trane; Worldwide Applied Systems Group
 - 4. York
- B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.

2.3 TIME CLOCKS

A. Manufacturers:

1. ATC-Diversified Electronics.
2. Grasslin Controls Corporation.
3. Paragon Electric Co., Inc.
4. Precision Multiple Controls, Inc.
5. SSAC Inc.; ABB USA.
6. TCS/Basys Controls.
7. Theben AG - Lumilite Control Technology, Inc.
8. Time Mark Corporation.

- B. Seven-day, programming-switch timer with synchronous-timing motor and seven-day dial; continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover; multiple-switch trippers; minimum of two and maximum of eight signals per day with two normally open and two normally closed output contacts.

2.4 GAS DETECTION EQUIPMENT

A. Manufacturers:

1. B. W. Technologies.
2. CEA Instruments, Inc.
3. Ebtron, Inc.
4. Gems Sensors Inc.
5. Greystone Energy Systems Inc.
6. Honeywell International Inc.; Home & Building Control.
7. INTEC Controls, Inc.
8. I.T.M. Instruments Inc.
9. MSA Canada Inc.
10. QEL/Quatrosense Environmental Limited.
11. Sauter Controls Corporation.
12. Sensidyne, Inc.
13. TSI Incorporated.
14. Vaisala.
15. Vulcain Inc.

- B. Carbon Monoxide Detectors: Single or multichannel, dual-level detectors using solid-state plug-in sensors with a 3-year minimum life; suitable over a temperature range of **32 to 104 deg F (0 to 40 deg C)**; with 2 factory-calibrated alarm levels at **[50 and 100] [35 and 200]** ppm.

- C. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.

2.5 THERMOSTATS

A. Manufacturers:

1. Erie Controls.
2. Danfoss Inc.; Air-Conditioning and Refrigeration Div.
3. Heat-Timer Corporation.
4. Sauter Controls Corporation.
5. tekmar Control Systems, Inc.
6. Theben AG - Lumilite Control Technology, Inc.
7. Honeywell

B. Electric, solid-state, microcomputer-based room thermostat.

1. Automatic switching from heating to cooling.
2. Preferential rate control to minimize overshoot and deviation from set point.
3. Set up for four separate temperatures per day.
4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
5. Short-cycle protection.
6. Programming based on every day of the week.
7. Selection features include degree F or degree C display, 12- or 24-hour clock, keyboard disable, and fan on-auto.
8. Battery replacement without program loss.
9. Thermostat display features include the following:
 - a. Time of day.
 - b. Actual room temperature.
 - c. Programmed temperature.
 - d. Programmed time.
 - e. Duration of timed override.
 - f. Day of week.
 - g. System mode indications include "heating," "off," "fan auto," and "fan on."

C. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, **55 to 85 deg F (13 to 30 deg C)** set-point range, and **2 deg F (1 deg C)** maximum differential.

1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
2. Selector Switch: Integral, manual on-off-auto.

2.6 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
2. Nonspring-Return Motors for Dampers Larger Than **25 Sq. Ft.:** Size for running torque of **150 in. x lbf** and breakaway torque of **300 in. x lbf**.

- B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
1. Manufacturers:
 - a. Belimo Aircontrols (USA), Inc.
 2. Dampers: Size for running torque calculated as follows:
 - a. Parallel-Blade Damper with Edge Seals: **7 inch-lb/sq. ft. (86.8 kg-cm/sq. m)** of damper.
 3. Coupling: V-bolt and V-shaped, toothed cradle.
 4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 5. Fail-Safe Operation: Provide external, manual gear release on nonspring-return actuators.
 6. Power Requirements (Two-Position Spring Return): **[24] [120] [230]**-V ac.
 7. Temperature Rating: **Minus 22 to plus 122 deg F (Minus 30 to plus 50 deg C)**.
 8. Run Time: **12 seconds open, 5 seconds closed.**

2.7 DAMPERS

- A. Manufacturers:
1. Air Balance Inc.
 2. Don Park Inc.; Autodamp Div.
 3. TAMCO (T. A. Morrison & Co. Inc.).
 4. United Enertech Corp.
 5. Vent Products Company, Inc.
- B. Dampers: AMCA-rated, **parallel**-blade design; **0.108-inch**- minimum thick, galvanized-steel or **0.125-inch**- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than **0.064-inch**- thick galvanized steel with maximum blade width of **8 inches** and length of **48 inches**.
1. Secure blades to **1/2-inch**- diameter, zinc-plated axles using zinc-plated hardware, with **[oil-impregnated sintered bronze]** blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
 2. Operating Temperature Range: From **minus 40 to plus 200 deg F (minus 40 to plus 93 deg C)**.
 3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Connect and configure equipment to achieve sequence of operation specified.

- B. Verify location of thermostats, and other exposed control sensors with Drawings and room details before installation. Install devices **48 inches** above the floor.
- C. Install automatic dampers according to Division 23 Section "Air Duct Accessories."
- D. Install damper motors on outside of duct.
- E. Install labels and nameplates to identify control components.

3.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Connect thermostats and CO sensors to their respective devices.

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 2. Test and adjust controls and safeties.
 3. Test each system for compliance with sequence of operation.

3.4 ADJUSTING

- A. Calibrating and Adjusting:
 1. Calibrate instruments.
 2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
 3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
 4. Stroke and adjust dampers, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
- B. Adjust initial temperature set points.

3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 230900

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Valves.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

1.5 SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Piping specialties.
 - 2. Corrugated, stainless-steel tubing with associated components.

3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others only after arranging to provide purging and startup of natural-gas supply

1.8 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.

3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

2.4 MANUAL GAS SHUTOFF VALVES

- ### A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
1. CWP Rating: 125 psig.
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.

6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- B. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
1. CWP Rating: 125 psig.
 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated brass.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Separate packnut with adjustable-stem packing threaded ends.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 INDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- L. Verify final equipment locations for roughing-in.

- M. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- N. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- Q. Connect branch piping from top or side of horizontal piping.
- R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- S. Do not use natural-gas piping as grounding electrode.
- T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

3.4 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

3.5 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.

5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
- C. Install hangers for horizontal drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
 1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
 2. NPS 1/2 and NPS 5/8: Maximum span, 72 inches; minimum rod size, 3/8 inch.
 3. NPS 3/4 and NPS 7/8: Maximum span, 84 inches; minimum rod size, 3/8 inch.
 4. NPS 1: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.7 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.9 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

- A. Aboveground, distribution piping shall be the following:
 1. Steel pipe with malleable-iron fittings and threaded joints.
 2. Steel pipe with wrought-steel fittings and welded joints.
 3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.

END OF SECTION 231123

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Single-wall rectangular ducts and fittings.
- 2. Single-wall round ducts and fittings.
- 3. Sheet metal materials.
- 4. Duct liner.
- 5. Sealants and gaskets.
- 6. Hangers and supports.

- B. Related Sections:

- 1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
- 2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

1.4 SUBMITTALS

- A. Product Data: For each type of the following products:

- 1. Liners and adhesives.
- 2. Sealants and gaskets.

1.5 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Lindab Inc.
 - b. McGill AirFlow LLC.
 - c. SEMCO Incorporated.
 - d. Sheet Metal Connectors, Inc.
 - e. Spiral Manufacturing Co., Inc.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials

involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Galvanized Coating Designation: G90.
 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation; Insulation Group.
 - b. Johns Manville.
 - c. Knauf Insulation.
 - d. Owens Corning.
2. Maximum Thermal Conductivity:
 - a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
 1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class C.
 - 4. Outdoor, Return-Air Ducts: Seal Class C.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
 - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
 - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
 - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

- B. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Duct system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.7 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

- A. Supply Ducts:
 - 1. Pressure Class: Positive 2-inch wg.
 - a. Minimum SMACNA Seal Class: A.
- B. Exhaust Ducts:
 - 1. Pressure Class: Negative 1-inch wg.
 - a. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
- C. Liner:

1. Return Air Ducts: Fibrous glass, Type I, 1 inch thick.
2. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.

D. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible,"

Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

- 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
- 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
- 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
- 4) Radius-to Diameter Ratio: 1.5.

- b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
- c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

E. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Backdraft dampers.
2. Manual volume dampers.
3. Fire dampers.
4. Smoke dampers.
5. Combination fire and smoke dampers.
6. Duct-mounted access doors.
7. Flexible connectors.
8. Flexible ducts.

- B. Related Sections:

1. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

1.5 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fusible Links: Furnish quantity equal to [10] <Insert number> percent of amount installed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.

2.2 BACKDRAFT DAMPERS

- A. Description: Motorized.
- B. Maximum Air Velocity: 2000 fpm.
- C. Maximum System Pressure: 1-inch wg.
- D. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners.
- E. Blades: Multiple single-piece blades, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with sealed edges.
- F. Blade Action: Parallel.
- G. Blade Seals: Extruded vinyl, mechanically locked.
- H. Blade Axles:
 - 1. Material: Nonferrous metal.
 - 2. Diameter: 0.20 inch.
- I. Tie Bars and Brackets: Aluminum.

- J. Return Spring: Adjustable tension.
- K. Bearings: Synthetic pivot bushings.
- L. Accessories:
 - 1. Electric actuators.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. METALAIRE, Inc.
 - f. Nailor Industries Inc.
 - g. Pottorff; a division of PCI Industries, Inc.
 - h. Ruskin Company.
 - i. Trox USA Inc.
 - j. Vent Products Company, Inc.
 - k. Hercules
- 2. Standard leakage rating.
- 3. Suitable for horizontal or vertical applications.
- 4. Frames:
 - a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
- 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
- 6. Blade Axles: Galvanized steel.
- 7. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

2.4 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Air Balance Inc.; a division of Mestek, Inc.
 2. Arrow United Industries; a division of Mestek, Inc.
 3. Greenheck Fan Corporation.
 4. McGill AirFlow LLC.
 5. METALAIRE, Inc.
 6. Nailor Industries Inc.
- B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.
- D. Fire Rating: 1-1/2 hours.
- E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.5 SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
 2. Cesco Products; a division of Mestek, Inc.
 3. Greenheck Fan Corporation.
 4. Nailor Industries Inc.
 5. PHL, Inc.
 6. Ruskin Company.
- B. General Requirements: Label according to UL 555S by an NRTL.
- C. Smoke Detector: Integral, factory wired for single-point connection.
- D. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- E. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- F. Leakage: Class I .
- G. Rated pressure and velocity to exceed design airflow conditions.
- H. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application.
- I. Damper Motors: two-position action.
- J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
 5. Electrical Connection: 24 volt.

2.6 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. Cesco Products; a division of Mestek, Inc.
 - 3. Greenheck Fan Corporation.
 - 4. Nailor Industries Inc.
 - 5. Ruskin Company.
- B. Type: Static and dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.
- D. Fire Rating: 1-1/2 hours.
- E. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- F. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.
- G. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.
- H. Smoke Detector: Integral, factory wired for single-point connection.
- I. Frame: Multiple-blade type fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- J. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- K. Leakage: Class I.
- L. Rated pressure and velocity to exceed design airflow conditions.
- M. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application.
- N. Master control panel for use in dynamic smoke-management systems.
- O. Damper Motors: two-position action.

P. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Electrical Connection: 24V.

2.7 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.8 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Flexmaster U.S.A., Inc.
5. Greenheck Fan Corporation.
6. McGill AirFlow LLC.
7. Nailor Industries Inc.
8. Pottorff; a division of PCI Industries, Inc.

9. Ventfabrics, Inc.
 10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.
 - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.9 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. Ventfabrics, Inc.
 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd..

2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

2.10 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Flexmaster U.S.A., Inc.
 2. McGill AirFlow LLC.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 10 to plus 160 deg F.
 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2007.

2.11 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Install duct security bars. Construct duct security bars from 0.164-inch steel sleeve, continuously welded at all joints and 1/2-inch- diameter steel bars, 6 inches o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 2-1/2-by-2-1/2-by-1/4-inch steel angle to 4 sides and both ends of sleeve. Connect duct security bars to ducts with flexible connections. Provide 12-by-12-inch hinged access panel with cam lock in duct in each side of sleeve.
- I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
- J. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.
- K. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- L. Install flexible connectors to connect ducts to equipment.
- M. Connect diffusers to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- N. Connect flexible ducts to metal ducts with draw bands.
- O. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Utility set fans.
 - 2. Centrifugal roof ventilators.
 - 3. Axial roof ventilators.
 - 4. Upblast propeller roof exhaust fans.
 - 5. Centrifugal wall ventilators.
 - 6. Ceiling-mounting ventilators.
 - 7. In-line centrifugal fans.
 - 8. Propeller fans.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on actual Project site elevations.
- B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Roof curbs.
 - 7. Fan speed controllers.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.
 2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
- C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
1. Roof framing and support members relative to duct penetrations.
 2. Ceiling suspension assembly members.
 3. Size and location of initial access modules for acoustical tile.
 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Acme Engineering & Mfg. Corp.
 - 2. Aerovent; a Twin City Fan Company
 - 3. American Coolair Corp.
 - 4. Ammerman; General Resource Corp.
 - 5. Breidert Air Products.
 - 6. Broan Mfg. Co., Inc.
 - 7. Carnes Company HVAC.
 - 8. Central Blower Co.
 - 9. Dayton Electric Manufacturing Co.; a division of W. W. Grainger, Inc.
 - 10. Delhi Industries Inc.
 - 11. Greenheck.
 - 12. Hartzell Fan, Inc.
 - 13. JencoFan; Div. of Breidert Air Products.
 - 14. Loren Cook Company.
 - 15. Penn Ventilation.
- B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.
- C. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
 - 1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.
 - 2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.
- D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

E. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
4. Fan and motor isolated from exhaust airstream.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

G. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in cant and mounting flange.
2. Overall Height: 16 inches.
3. Sound Curb: Curb with sound-absorbing insulation matrix.
4. Pitch Mounting: Manufacture curb for roof slope.
5. Metal Liner: Galvanized steel.

2.2 CEILING-MOUNTING VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Coolair Corp.
2. Ammerman; General Resource Corp.
3. Breidert Air Products.
4. Broan Mfg. Co., Inc.
5. Carnes Company HVAC.
6. Dayton Electric Manufacturing Co.; a division of W. W. Grainger, Inc.
7. FloAire.
8. Greenheck.
9. JencoFan; Div. of Breidert Air Products.
10. Loren Cook Company.
11. Penn Ventilation.

- B. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.
- C. Housing: Steel, lined with acoustical insulation.
- D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- E. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- G. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
 - 3. Isolation: Rubber-in-shear vibration isolators.
 - 4. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.3 MOTORS

- A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
- B. Enclosure Type: Totally enclosed, fan cooled.

2.4 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.
- C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- D. Support suspended units from structure using threaded steel rods and elastomeric hangers. Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- E. Install units with clearances for service and maintenance.
- F. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 5. Adjust belt tension.
 6. Adjust damper linkages for proper damper operation.
 7. Verify lubrication for bearings and other moving parts.
 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 10. Shut unit down and reconnect automatic temperature-control operators.
 11. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 233423

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Louver face diffusers.
 - 2. Continuous tubular diffusers.
 - 3. Adjustable bar registers and grilles.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

- A. Louver Face Diffuser:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A-J Manufacturing Co., Inc.
 - b. Anemostat Products; a Mestek company.
 - c. Carnes.
 - d. METALAIRE, Inc.
 - e. Nailor Industries Inc.
 - f. Price Industries.
 - g. Titus.
 - h. Tuttle & Bailey.

2. Description: Refer to Schedule on Plans

2.2 REGISTERS AND GRILLES

A. Adjustable Bar Register:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A-J Manufacturing Co., Inc.
 - b. Anemostat Products; a Mestek company.
 - c. Carnes.
 - d. Dayus Register & Grille Inc.
 - e. Hart & Cooley Inc.
 - f. Krueger.
 - g. METALAIRE, Inc.
 - h. Nailor Industries Inc.
 - i. Price Industries.
 - j. Titus.
 - k. Tuttle & Bailey.

2. Description: Refer to Schedule on Plans

B. Adjustable Bar Grille:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A-J Manufacturing Co., Inc.
 - b. Anemostat Products; a Mestek company.
 - c. Carnes.
 - d. Dayus Register & Grille Inc.
 - e. Hart & Cooley Inc.
 - f. Krueger.
 - g. METALAIRE, Inc.
 - h. Nailor Industries Inc.
 - i. Price Industries.
 - j. Titus.
 - k. Tuttle & Bailey.

2. Description: Refer to Schedule on Plans

2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Listed double-wall vents.
- B. Related Sections include the following:
 - 1. Division 23 Section "Draft Control Devices" for induced-draft and mechanical fans and for motorized and barometric dampers.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Type B and BW vents.
- B. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, methods of field assembly, components, hangers and seismic restraints, and location and size of each field connection.
- C. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain listed system components through one source from a single manufacturer.
- B. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

1.5 COORDINATION

- A. Coordinate installation of roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of venting system that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, structural failures caused by expansion and contraction.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LISTED TYPE B AND BW VENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Metal Products; MASCO Corporation.
2. Cleaver-Brooks; Div. of Aqua-Chem Inc.
3. FAMCO.
4. Hart & Cooley, Inc.
5. Heat-Fab, Inc.
6. Industrial Chimney Company.
7. LSP Products Group, Inc.
8. Metal-Fab, Inc.
9. Schebler Co. (The).
10. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
11. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
12. Tru-Flex Metal Hose Corp.
13. Van-Packer Company, Inc.

- B. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F continuously for Type B, or 550 deg F continuously for Type BW; with neutral or negative flue pressure complying with NFPA 211.

- C. Construction: Inner shell and outer jacket separated by at least a 1/4-inch airspace.

- D. Inner Shell: ASTM B 209, Type 1100 aluminum.

- E. Outer Jacket: Galvanized steel.

- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
 - 1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

- A. Listed Type B and BW Vents: Vents for certified gas appliances.

3.3 INSTALLATION OF LISTED VENTS AND CHIMNEYS

- A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.
- B. Seal between sections of positive-pressure vents and grease exhaust ducts according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
- C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
- D. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.
- E. Lap joints in direction of flow.
- F. Join sections with acid-resistant joint cement to provide continuous joint and smooth interior finish.
- G. Erect stacks plumb to finished tolerance of no more than 1 inch out of plumb from top to bottom.

3.4 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.
- B. Clean internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film.
- C. Provide temporary closures on vents that are not completed or connected to equipment.

END OF SECTION 235100

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes gas-fired, tubular infrared radiant heaters.

1.3 SUBMITTALS

- A. Product Data: For each type of gas-fired radiant heater indicated. Include rated capacities, operating characteristics, and accessories.
- B. Operation and Maintenance Data: For gas-fired radiant heaters to include in emergency, operation, and maintenance manuals.
- C. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of gas-fired radiant heater that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TUBULAR INFRARED HEATERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Calcana Industries Ltd.
 2. Combustion Research Corporation.
 3. Gas-Fired Products Inc.; Space-Ray Div.
 4. Reznor/Thomas & Betts Corporation.
 5. Roberts-Gordon, Inc.
 6. Schwank Inc.
 7. Solaronics, Inc.
 8. Sterling HVAC Products; Div. of Mestek Technology Inc.
- B. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.20/CSA 2.34.
- C. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.
- D. Combustion Tubing: 4-inch- diameter stainless steel with high-emissivity, high-temperature, corrosion-resistant external finish.
- E. Tubing Connections: Stainless-steel couplings or flared joints with stainless-steel draw bolts.
- F. Reflector: Polished aluminum, 97 percent minimum reflectivity, with end caps. Shape to control radiation from tubing for uniform intensity at floor level with 100 percent cutoff above centerline of tubing. Provide for rotating reflector or heater around a horizontal axis for minimum 30-degree tilt from vertical.
1. Reflector Extension Shields: Same material as reflectors, arranged for fixed connection to lower reflector lip and rigid support to provide 100 percent cutoff of direct radiation from tubing at angles greater than 30 degrees from vertical.
 2. Include hanger kit.
- G. Burner Safety Controls:
1. Gas Control Valve: Single-stage, regulated redundant 24-V ac gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
 2. Blocked Vent Safety: Differential pressure switch in burner safety circuit to stop burner operation with high discharge or suction pressure.
 3. Control Panel Interlock: Stops burner if panel is open.
 4. Indicator Lights: Burner-on indicator light.
- H. Burner and Emitter Type: Vacuum-vented burner, with the following features:
1. Emitter Tube: 4-inch- diameter, aluminized-steel tubing with sight glass for burner and pilot flame observation.
 2. Burner/Ignition: Electronic spark and electronic flame safety.
 - a. Venting: Burner exhaust tubing connected at exit end to vacuum-fan inlet.

- b. Venting: Balancing damper at exit end of burner exhaust tubing and at connection to manifold tube.
- 3. Vacuum Fan: Dynamically balanced, direct-driven, cast-aluminum-alloy impeller in an aluminized-steel housing, isolated from system by flexible connector with a minimum temperature rating of 450 deg F.
 - a. General requirements for motors are specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 1) Motor: Resilient-mounted, capacitor-start-capacitor-run type with sealed ball bearings; totally enclosed, nonventilated type with internal thermal protection.
 - 2) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 3) Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.
- 4. Balancing Dampers: Plate type, mounted in cast, double-flange fitting with vacuum test plug.
- 5. Filter: Cartridge type for mounting on burner housing.
- 6. Combustion-Air Connection: Duct connection to burner for combustion air to be drawn directly from outside.
- 7. Outdoor-Air Connection: Dynamically balanced, direct-driven, forward-curved fan with duct connection to each burner.
 - a. General requirements for motors are specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 1) Motor: Resilient-mounted, capacitor-start-capacitor-run type, thermally protected with sealed ball bearings.
 - 2) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 3) Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

2.2 CONTROLS

- A. Thermostat: Single-stage, wall-mounting type with 50 to 90 deg F operating range and fan on switch.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and connect gas-fired radiant heaters and associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written installation instructions.
- B. Suspended Units: Suspend from substrate using chain hanger kits and building attachments.
- C. Maintain manufacturers' recommended clearances to combustibles.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to gas-fired radiant heaters to allow service and maintenance.
- C. Gas Piping: Comply with Division 23 Section "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.
- D. Vent Connections: Comply with Division 23 Section "Breechings, Chimneys, and Stacks."
- E. Electrical Connections: Comply with applicable requirements in Division 26 Sections.
 - 1. Install electrical devices furnished with heaters but not specified to be factory mounted.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
- C. Tests and Inspections:
 - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 2. Verify bearing lubrication.
 - 3. Verify proper motor rotation.

D. Remove and replace malfunctioning units and retest as specified above.

3.4 ADJUSTING

A. Adjust initial temperature set points.

B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.5 DEMONSTRATION

END OF SECTION 235523

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes gas-fired unit heaters.

1.3 SUBMITTALS

- A. Product Data: For each type of fuel-fired unit heater indicated. Include rated capacities, operating characteristics, and accessories.
- B. Operation and Maintenance Data: For fuel-fired unit heaters to include in emergency, operation, and maintenance manuals.
- C. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace heat exchanger of fuel-fired unit heater that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GAS-FIRED UNIT HEATERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Lennox Industries, Inc.
 - 2. Modine Manufacturing Company.
 - 3. Reznor/Thomas & Betts Corporation.
 - 4. Sterling HVAC Products; Div. of Mestek Technology Inc.
- B. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.
- C. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.
- D. Type of Venting: Combined combustion-air inlet and power-vent outlet with roof caps. Include concentric combustion adapter assembly for connection to inlet and outlet pipes, and flashing for roof penetration, with power venter.
- E. External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.
- F. Suspension Attachments: Ceiling suspension with 3/8"-16 threads at 2 and 4-point locations.
- G. Heat Exchanger: Aluminized steel.
- H. Burner Material: Aluminized steel with stainless-steel inserts.
- I. Unit Fan: Formed-steel propeller blades riveted to heavy-gage steel spider bolted to cast-iron hub, dynamically balanced, and resiliently mounted.
 - 1. Fan-Blade Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
 - 2. General requirements for motors are specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - a. Motors: Open drip proof (ODP) with internal thermal-overload protection and complying with Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - b. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

- J. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff enclosed in one body.
 - 1. Gas Control Valve: Two stage.
 - 2. Ignition: Electronically controlled direct electric spark with flame sensor.
 - 3. Fan Thermal Switch: Operates fan on heat-exchanger temperature.
 - 4. Vent Flow Verification: Differential pressure switch to verify open vent.
 - 5. Control transformer.
 - 6. High Limit: Thermal switch or fuse to stop burner.
 - 7. Thermostat: Single-stage, wall-mounting type with 50 to 90 deg F operating range and fan on switch.

- K. Discharge Louvers: Independently adjustable horizontal blades.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and connect gas-fired unit heaters and associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written installation instructions.

- B. Install and connect oil-fired unit heaters and associated fuel and vent piping according to NFPA 31, applicable local codes and regulations, and manufacturer's written installation instructions.

- C. Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Install piping adjacent to fuel-fired unit heater to allow service and maintenance.

- C. Gas Piping: Comply with Division 23 Section "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.

- D. Vent Connections: Comply with Division 23 Section "Breechings, Chimneys, and Stacks."

- E. Electrical Connections: Comply with applicable requirements in Division 26 Sections.

1. Install electrical devices furnished with heaters but not specified to be factory mounted.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 2. Verify bearing lubrication.
 3. Verify proper motor rotation.
 4. Test Reports: Prepare a written report to record the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

3.4 ADJUSTING

- A. Adjust initial temperature set points.
- B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fuel-fired unit heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 235533

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section covers cleaning and startup of existing rooftop air units:
 1. Direct-expansion cooling.
 2. Heat-pump refrigeration components.
 3. Hot-gas reheat.
 4. Electric-heating coils.
 5. Gas furnace.
 6. Economizer outdoor- and return-air damper section.
 7. Integral, space temperature controls.
 8. Roof curbs.

1.3 SUBMITTALS

- A. Reports: Prepare report documenting cleaning and commissioning of existing rooftop units. Report shall include checklist as well as pictures of interior units before and after cleaning.

PART 2 - PRODUCTS

2.1 AIR FILTRATION

- A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 1. Glass Fiber: Minimum 80 percent arrestance, and MERV 5.

2.2 CONTROLS

- A. Furnish and install new programmable thermostats for each RTU. refer to section 230900.

PART 3 - EXECUTION

3.1 CONNECTIONS

- A. Install condensate drain, minimum connection size, with trap and drain to roof.
- B. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination at top of roof curb.
 - 2. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."
 - 3. Install return-air duct continuously through roof structure.

3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Tests and Inspections:
 - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - 1. Inspect for visible damage to unit casing.
 - 2. Inspect for visible damage to furnace combustion chamber.
 - 3. Inspect for visible damage to compressor, coils, and fans.
 - 4. Inspect internal insulation.
 - 5. Verify that labels are clearly visible.
 - 6. Verify that clearances have been provided for servicing.
 - 7. Verify that controls are connected and operable.
 - 8. Verify that filters are installed.
 - 9. Clean condenser coil and inspect for construction debris.

10. Clean furnace flue and inspect for construction debris.
11. Connect and purge gas line.
12. Remove packing from vibration isolators.
13. Inspect operation of barometric relief dampers.
14. Verify lubrication on fan and motor bearings.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit according to manufacturer's written instructions.
 - a. Start refrigeration system.
 - b. Do not operate below recommended low-ambient temperature.
 - c. Complete startup sheets and attach copy with Contractor's startup report.
18. Inspect and record performance of interlocks and protective devices; verify sequences.
19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.
 - a. Measure gas pressure on manifold.
 - b. Inspect operation of power vents.
 - c. Measure combustion-air temperature at inlet to combustion chamber.
 - d. Measure flue-gas temperature at furnace discharge.
 - e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
24. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outdoor-air, dry-bulb temperature.
 - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Relief-air volume.
 - d. Outdoor-air intake volume.
27. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.

- b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
- 28. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
 - a. High-temperature limit on gas-fired heat exchanger.
 - b. Low-temperature safety operation.
 - c. Filter high-pressure differential alarm.
 - d. Economizer to minimum outdoor-air changeover.
 - e. Relief-air fan operation.
 - f. Smoke and firestat alarms.
- 29. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.4 CLEANING AND ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.
- B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 237413

SECTION 26 0500

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Division 26 of the specifications covers the electrical systems of the project. Provide all items and work indicated on the Drawings and all items and work called for in these Specifications. Include all incidentals, equipment, appliances, services, hoisting, scaffolding, supports, tools, supervision, labor, consumable items, fees, permits, licenses, etc., necessary to provide complete and working electrical systems.
- B. The work of Division 26 includes but is not limited to:
 - 1. Grounding and bonding.
 - 2. Hangers and Supports.
 - 3. Electrical Identification
 - 4. Raceway Systems.
 - 5. Wiring Systems.
 - 6. Branch circuit wiring.

1.02 RELATED WORK

- A. General Conditions: Division 1.
- B. Mechanical Requirements: Division 23.

1.03 REFERENCES

- A. National Electrical Code: NFPA 70.
- B. National Electric Safety Code: ANSI/IEEE C2.
- C. Life Safety Code: NFPA 101.
- D. Conform to the Building Code of the local jurisdiction.
- E. Obtain all required permits and pay all required fees.

1.04 QUALITY ASSURANCE

- A. Qualified Contractor with at least three years successful installation experience on projects of similar type and scope.
- B. Accomplish work in a manner which is compatible with industry standards and practices. Provide skilled electricians as workmen, licensed where required. Upon request, workmen shall provide proof of license.
- C. Provide a foreman or lead electrician with prior experience as a job foreman or lead electrician. Provide documentation and history of performance as foreman or lead electrician if so directed by Architect/Engineer.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store materials and equipment in manufacturers' unopened and undamaged

containers fully identified with manufacturer's name, trade name, type, class, grade, size and color.

- B. Store materials and equipment in a safe manner outside of facilities to protect from damage.

1.06 PERMITS AND FEES

- A. Contractor shall arrange for and pay for all inspections, licenses and certificates required in connection with the work.

1.07 SEQUENCING/SCHEDULING

- A. Due to the type of installation, a fixed sequence of steps may be required to properly install the complete systems. Coordinate and schedule work with other trades in accordance with the construction sequence.
- B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations.

1.08 COORDINATION

- A. The Drawings and Specifications are complimentary. What is called for by one shall be as if required by both.
- B. Drawings are diagrammatic and indicate general design, layout, and arrangement of equipment and systems. Drawings do not show all details such as junctions boxes, pull boxes, conduit runs or sizes, wiring, etc. necessary for a complete and operable system.
- C. Examine and compare the Electrical Drawings and Specifications with the Drawings and Specifications of other trades. Report any discrepancies between them to the Architect/Engineer prior to bidding. Obtain written instructions for changes necessary in the electrical work.
- D. Install and coordinate the electrical work in cooperation with other trades installing interrelated work. Make proper provisions to avoid interference in a manner approved by the Architect/Engineer. All changes required in the work of the Contractor, caused by his neglect to coordinate the work, shall be made by him at his own expense.
- E. Wiring Diagrams: Provide wiring diagrams indicating field installed electrical power and control wiring and cabling layouts, overcurrent protective devices, equipment, and equipment connections.
- F. Coordinate the installation of electrical materials and equipment above and below suspended ceilings, luminaires and other building components. Ductwork and piping shall not be installed above electrical panelboards, switchboards, motor control centers, and transformers.

G. CUTTING AND PATCHING

1. This Article specifies the cutting and patching of electrical equipment, components, and materials to include removal and legal disposal of selected materials, components, and equipment.
2. Refer to Division 1 Section covering cutting and patching for general requirements.
3. Do not endanger or damage Work through procedures and processes of cutting and patching.
4. Arrange for repairs required to restore other work, because of damage caused as a result of electrical installations.
5. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.
6. Perform cutting, fitting, and patching of electrical equipment and materials required to:
 - a. Uncover Work to provide for installation of ill-timed Work;
 - b. Remove and replace defective Work;
 - c. Remove and replace Work not conforming to requirements of the Contract Documents;
 - d. Remove samples of installed Work as specified for testing;
 - e. Install equipment and materials in existing structures;
 - f. Upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
7. Cut, remove and legally dispose of selected electrical equipment, components, and materials as indicated, including, but not limited to removal of conductors, conduit, luminaires, boxes, devices and other electrical items made obsolete by the new Work.
8. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
9. Maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
10. Locate, identify, and protect mechanical and electrical services passing through remodel or demolition area and serving other areas required to be maintained operational.

1.09 CONTRACT CLOSEOUT

- A. Remove all materials, scrap, etc. relative to the electrical installation. Leave the premises in a clean and orderly condition. Clean electrical equipment and materials of foreign matter. Clean light fixtures using methods and materials recommended by the manufacturer. Replace all burned out lamps.
- B. Demonstrate to the Owner the operation of the entire electrical installation. Special systems shall be demonstrated by manufacturer's representative as required in the sections that follow and at no additional cost to the Owner.
- C. Submit keys for electrical switches, panels, etc. to the General Contractor.

1.10 RECORD CONSTRUCTION DRAWINGS

- A. Maintain a complete set of Drawings and Specifications at the project site with all addenda, change orders, field orders, or deviations from the Drawings during construction recorded thereon. Do not use this for any other purpose.
- B. Drawings shall be maintained up-to-date and indicate actual routing of all concealed feeder conduits, all spare conduits, spare or unused circuitry, and buried work.
- C. Indicate actual routing of all concealed feeder conduits, all spare conduits, spare or unused circuitry, and buried work. Update all panel schedules with revised circuit numbers and loads. Accurately reconcile and total all panel loads.
- D. Upon completion of the work, submit drawings to the Architect/Engineer. This contract will not be considered completed until these record documents have been received and reviewed by the Architect/Engineer.

1.11 TESTING

- A. Submit test reports as outlined in Division 1 Sections on Quality Control Services and each Division 16 Section.
- B. Testing as required by these specifications shall pertain to all equipment, wiring, devices, etc. installed under this contract and being reused.
- C. General Scope:
 - 1. Perform all tests and operational checks to assure that all electrical equipment, both Contractor and Owner-supplied, is operational within industry and manufacturer's tolerances and is installed in accordance with design specifications.
 - 2. The tests and operational checks shall determine the suitability for energization.
 - 3. Schedule tests and give a minimum of two weeks advance notice to the Architect. Reschedule testing for Owner convenience if required.
 - 4. Test Report: Submit three (3) copies of the completed report to the Architect no later than fifteen (15) days after completion of test unless directed otherwise. The test report shall be bound and its contents certified.
 - a. The test report shall include the following:
 - 1) Project information including: Building name, address, date, and other pertinent information.
 - 2) List of equipment tested.
 - 3) Description of test.
 - 4) List of test equipment used and calibration date.
 - 5) Baseline, acceptable, or published target value for test within code or standard reference indicating where value was derived.
 - 6) Test results that summarize all measured values with baseline values.
 - 7) Conclusions and recommendations.
 - 8) Appendix, including appropriate test forms that show all measured values.
 - 5. Failure to meet test:
 - a. Any system material or workmanship which is found defective on the basis of performance tests shall be reported directly to the Architect.
 - b. All failed tests shall be sent immediately by fax to Engineer with proposed corrective action and proposed re-test date and time.

- c. Contractor shall replace the defective material or equipment as necessary, and have test repeated until test proved satisfactory without additional cost to the Owner.
- d. The Contractor or testing agency shall have a calibration program which maintains all applicable test instrumentation within rated accuracy. The accuracy shall be traceable to the National Institute of Standards and Technology (NIST) in an unbroken chain. Instruments shall be calibrated in accordance with the following frequency schedule:
 - 1) Field Instruments: 6 months.
 - 2) Laboratory Instruments: 12 months.
 - 3) Leased specialty equipment: 12 months.
- e. Dated calibration labels shall be visible on all test equipment.

1.12 CLEANING

- A. Refer to the Division 1 Section on project closeout or final cleaning for general requirements for final cleaning.
- B. Clean luminaires, lamps and lenses prior to final acceptance. Replace inoperative lamps.

1.13 PROJECT CLOSEOUT LIST

- A. The Contractor shall be responsible for providing the items listed on the checklist prior to final observation. Required test reports shall be included in the O&M Manuals.
- B. Additional Submittal Requirements:
 - 1. Identification nomenclature for all equipment being furnished.
 - 2. Completed record drawings.
 - 3. Training list of all training required with Owner sign-offs that training is completed for each requirement.
 - 4. Walkdown data sheet index showing all walkdown composite data sheets signed-off as submitted.
 - 5. Spare parts list with sign-offs by Owners Representative for each item.
 - 6. Signed-off observation reports and punch lists.

1.14 CONSTRUCTION REQUIREMENTS

- A. The Contractor shall maintain and have available at the jobsite current information on the following at all times:
 - 1. Up to date record drawings.
 - 2. Submittals.
 - 3. Site observation reports with current status of all action items.
 - 4. Test results - including recorded values, procedures, and other findings.
 - 5. Outage information.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL

- A. The Drawings indicate the general design and arrangement of circuits, outlets, equipment, systems, etc. Information shown is diagrammatic. Do not scale the

drawings for dimensions. Take dimensions, locations, and levels, etc. from the Architectural Drawings and from manufacturer's installation drawings for the equipment being furnished.

- B. Comply with state and local code requirements which exceed the requirements of the National Electrical Code as interpreted by the local inspection authority who has final jurisdiction.
- C. Comply with requirements of the utility company.

3.02 PRODUCTS

- A. Equipment and materials shall comply with the latest standards of National Electrical Manufacturers' Association (NEMA), Underwriters' Laboratories (UL), Institute of Electrical Electronic Engineers (IEEE), and the American National Standards Institute (ANSI). Equipment and materials shall be UL Listed and Labeled for the purpose intended and bear the UL label.

END OF SECTION

SECTION 26 0519

BUILDING WIRE AND CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Armored cable.
- C. Metal-clad cable.
- D. Wiring connectors.
- E. Electrical tape.
- F. Oxide inhibiting compound.
- G. Wire pulling lubricant.

1.02 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2001 (Reapproved 2007).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.
- C. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2009).
- D. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005.
- E. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy Wire for Subsequent Covering of Insulation; 2007.
- F. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- H. NECA 104 - Recommended Practice for Installing Aluminum Building Wire and Cable; National Electrical Contractors Association; 2006 (NECA/AA 104).
- I. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); National Electrical Contractors Association; 2006.
- J. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; National Electrical Manufacturers Association; 2009 (ANSI/NEMA WC 70/ICEA S-95-658).
- K. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent

Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

- L. UL 4 - Armored Cable; Current Edition, Including All Revisions.
- M. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- N. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- O. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- P. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- Q. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
- R. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.03 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Nonmetallic-sheathed cable is not permitted.
- D. Armored/Metal Clad cable is permitted only as follows:
 - 1. Where not otherwise restricted, may be used:
 - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
 - 1) Maximum Length: 6 feet (1.8 m).
 - b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
 - 1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
 - 2. In addition to other applicable restrictions, may not be used:
 - a. Where not approved for use by the authority having jurisdiction.
 - b. Where exposed to damage.
 - c. For damp, wet, or corrosive locations.

2.02 ALL CONDUCTORS AND CABLES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose indicated.

- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductor Material:
 - 1. Provide copper conductors except where aluminum conductors are specifically indicated. Substitution of aluminum conductors for copper is not permitted. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 - 3. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.
- H. Minimum Conductor Size:
 - 1. Branch Circuits: 12 AWG.
 - a. Exceptions:
 - 1) 20 A, 120 V circuits longer than 75 feet (23 m): 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 150 feet (46 m): 8 AWG, for voltage drop.
- I. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
 - 3. Color Code:
 - a. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - b. Equipment Ground, All Systems: Green.

2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor Stranding:

1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation:
 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

2.04 ARMORED CABLE

- A. Description: NFPA 70, Type AC cable listed and labeled as complying with UL 4, and listed for use in classified firestop systems to be used.
- B. Conductor Stranding:
 1. Size 10 AWG and Smaller: Solid.
 2. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation: Type THHN.
- E. Grounding: Combination of interlocking armor and integral bonding wire.
- F. Armor: Steel, interlocked tape.

2.05 METAL-CLAD CABLE

- A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
- B. Conductor Stranding:
 1. Size 10 AWG and Smaller: Solid.
 2. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- E. Grounding: Full-size integral equipment grounding conductor.
- F. Armor: Steel, interlocked tape.

2.06 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

2.07 WIRING ACCESSORIES

- A. Electrical Tape:
 1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).

2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
- B. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
 - C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as shown on the drawings.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
- B. Install products in accordance with manufacturer's instructions.
- C. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.
- D. Install aluminum conductors in accordance with NECA 104.
- E. Install armored cable (Type AC) in accordance with NECA 120.
- F. Install metal-clad cable (Type MC) in accordance with NECA 120.
- G. Installation in Raceway:
 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 2. Pull all conductors and cables together into raceway at same time.
 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- H. Paralleled Conductors: Install conductors of the same length and terminate in the same

manner.

- I. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
- J. Terminate cables using suitable fittings.
 - 1. Armored Cable (Type AC):
 - a. Use listed fittings and anti-short, insulating bushings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
 - 2. Metal-Clad Cable (Type MC):
 - a. Use listed fittings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- K. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.
- L. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- M. Make wiring connections using specified wiring connectors.
 - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 - 3. Do not remove conductor strands to facilitate insertion into connector.
 - 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
 - 5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
- N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
- O. Insulate ends of spare conductors using vinyl insulating electrical tape.

- P. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- R. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding components.
- B. Provide all components necessary to complete the grounding system(s) consisting of:
 - 1. Existing metal underground water pipe.
 - 2. Metal frame of the building.
 - 3. Rod electrodes.

1.02 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
 - 1. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
- B. Connectors for Grounding and Bonding:
 - 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 - 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.

2.02 ELECTRODES

- A. Rod Electrodes: Copper.
 - 1. Diameter: 5/8 inch (___ mm).
 - 2. Length: 10 feet (3000 mm).

2.03 CONNECTORS AND ACCESSORIES

- A. Mechanical Connectors: Bronze.
- B. Wire: Stranded copper.
- C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been

completed.

- B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
- B. Install ground electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
- C. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond steel together.
- D. Provide bonding to meet requirements described in Quality Assurance.
- E. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

END OF SECTION

SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
 - 2. Steel Components: Use corrosion resistant materials suitable for the environment where installed.

2.02 MATERIALS

- A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Supports: Fabricated of structural steel or formed steel members; galvanized.
- C. Anchors and Fasteners:

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from

suspended ceiling support system or ceiling grid.

- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

3.02 FIELD QUALITY CONTROL

- A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
 - 1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- B. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- C. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- D. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch (25 mm) off wall.
- E. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

SECTION 26 0534

CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Intermediate metal conduit (IMC).
- C. PVC-coated galvanized steel rigid metal conduit (RMC).
- D. Flexible metal conduit (FMC).
- E. Liquidtight flexible metal conduit (LFMC).
- F. Electrical metallic tubing (EMT).
- G. Rigid polyvinyl chloride (PVC) conduit.
- H. Conduit fittings.
- I. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0535 - Surface Raceways.
- D. Section 26 0537 - Boxes.
- E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 2701 - Electrical Service Entrance: Additional requirements for electrical service conduits.
- G. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
- B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); National

Electrical Contractors Association; 2006.

- F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); National Electrical Contractors Association; 2003.
- G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2007.
- H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; National Electrical Manufacturers Association; 2005.
- I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; National Electrical Manufacturers Association; 2003.
- J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2004.
- K. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- M. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- N. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
- O. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- P. UL 651 - Schedule 40 and 80 Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- Q. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- R. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
 - 4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
 - 5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not begin installation of conductors and cables until installation of conduit is

complete between outlet, junction and splicing points.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
 - 1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
 - 2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
 - 3. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
 - 4. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
 - 5. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
- D. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- E. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- F. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- H. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- I. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- J. Connections to Vibrating Equipment:
 - 1. Dry Locations: Use flexible metal conduit.
 - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
 - 3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.

4. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.

2.02 CONDUIT REQUIREMENTS

- A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.
- B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- C. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
- D. Minimum Conduit Size, Unless Otherwise Indicated:
 1. Branch Circuits: 1/2 inch (16 mm) trade size.
 2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
 3. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
 4. Underground, Exterior: 1 inch (27 mm) trade size.
- E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- B. Fittings:
 1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.
 3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

- A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- B. Fittings:

1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil (1.02 mm).
- C. PVC-Coated Fittings:
 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
 2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil (1.02 mm).
- D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil (0.38 mm).

2.06 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- B. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.

2.07 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- B. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.

2.08 ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use compression (gland) or set-screw type.
 - a. Do not use indenter type connectors and couplings.

2.09 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- B. Fittings:
 1. Manufacturer: Same as manufacturer of conduit to be connected.
 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.10 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil (0.51 mm).
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
- F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- G. Conduit Routing:
 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 2. When conduit destination is indicated and routing is not shown, determine exact routing required.
 3. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Mechanical equipment rooms.
 - c. Within joists in areas with no ceiling.
 4. Unless otherwise approved, do not route conduits exposed:
 - a. Across floors.
 - b. Across building exterior surfaces.
 5. Conduits installed underground or embedded in concrete may be routed in the

shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.

- a. Contractor shall indicate exact routing of all underground raceways on as-built drawings.

H. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

I. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

J. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.

8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

K. Underground Installation:

1. Provide trenching and backfilling in accordance with Section 31 2316.13.
2. Minimum Cover, Unless Otherwise Indicated or Required:
 - a. Underground, Exterior: 24 inches (610 mm).
 - b. Under Slab on Grade: 12 inches (300 mm) to bottom of slab.
3. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length for service entrance where not concrete-encased.

L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where conduits are subject to earth movement by settlement or frost.

M. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:

1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

N. Provide grounding and bonding in accordance with Section 26 0526.

3.02 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

END OF SECTION

SECTION 26 0535

SURFACE RACEWAYS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface raceway systems.
- B. Wireways.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0534 - Conduit.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 5 - Surface Metal Raceways and Fittings; Current Edition, Including All Revisions.
- D. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 RACEWAY REQUIREMENTS

- A. Provide all components, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
- C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.02 SURFACE RACEWAY SYSTEMS

- A. Surface Metal Raceways: Listed and labeled as complying with UL 5.

2.03 WIREWAYS

- A. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.
- B. Wireway Type, Unless Otherwise Indicated:
- C. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install raceways in a neat and workmanlike manner in accordance with NECA 1.
- C. Install raceways plumb and level.
- D. Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.
- E. Secure and support raceways in accordance with Section 26 0529 at intervals complying with NFPA 70 and manufacturer's requirements.
- F. Close unused raceway openings.
- G. Provide grounding and bonding in accordance with Section 26 0526.

3.02 PROTECTION

- A. Protect installed raceways from subsequent construction operations.

END OF SECTION

SECTION 26 0537

BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).
- C. Underground handhole enclosures.
- D. Wall and ceiling outlet boxes.
- E. Pull and junction boxes.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0534 - Conduit:
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 2701 - Electrical Service Entrance: Metering transformer cabinets.
- F. Section 26 2726 - Wiring Devices:
 - 1. Wall plates.
- G. Section 26 2716 - Electrical Cabinets and Enclosures.
- H. Section 26 2726 - Wiring Devices: Wall plates in finished areas.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2008.
- C. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical Manufacturers Association; 2008.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2008.
- E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

PART 2 PRODUCTS

2.01 BOXES

- A. General Requirements:
 - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 - 3. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
 - 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 - 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

- B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
 - 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 - 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 - 3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit, or exposed intermediate metal conduit (IMC) is used.
 - 4. Use suitable masonry type boxes where flush-mounted in masonry walls.
 - 5. Use raised covers suitable for the type of wall construction and device configuration where required.
 - 6. Use shallow boxes where required by the type of wall construction.
 - 7. Do not use "through-wall" boxes designed for access from both sides of wall.
 - 8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 - 9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 - 10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 - 11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
 - 12. Wall Plates: Comply with Section 26 2726.

- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
 - 1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 - 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
 - 3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

- D. Underground Handhole Enclosures:
 - 1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
 - 2. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches (300 mm).
 - 3. Applications:
 - a. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.

2.02 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
- B. Nonmetallic Outlet Boxes: NEMA OS 2.
- C. Wall Plates for Finished Areas: As specified in Section 26 2726.

2.03 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Hinged Enclosures: As specified in Section 26 2716.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- F. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- G. Box Locations:
 - 1. Unless dimensioned, box locations indicated are approximate.
 - 2. Locate boxes as required for devices installed under other sections or by others.
 - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
 - 3. Locate boxes so that wall plates do not cross masonry joints.
 - 4. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 - 5. Do not install flush-mounted boxes on opposite sides of walls back-to-back.

Provide minimum 6 inches (150 mm) horizontal separation unless otherwise indicated.

- H. Flush-Mounted Boxes:
 - 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
 - 2. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.
- I. Underground Handhole Enclosures:
 - 1. Install enclosure on gravel base, minimum 6 inches (150 mm) deep.
 - 2. Flush-mount enclosures located in concrete or paved areas.
- J. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- K. Close unused box openings.
- L. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- M. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.
- N. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.
- O. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
- P. Orient boxes to accommodate wiring devices oriented as specified in Section 26 2726.
- Q. Maintain headroom and present neat mechanical appearance.
- R. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- S. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- T. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- U. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches (305 mm) of box.
- V. Use gang box where more than one device is mounted together. Do not use sectional box.

END OF SECTION

SECTION 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Underground warning tape.
- E. Warning signs and labels.

1.02 RELATED REQUIREMENTS

- A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- B. Section 26 2726 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2007.
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2007.
- C. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Panelboards:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number. Include location when not within sight of equipment.
 - 3) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
 - 4) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - b. Enclosed switches, circuit breakers, and motor controllers:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number. Include location when not within sight of equipment.

2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
 - b. Use identification nameplate at each piece of service equipment to identify the available fault current and the date calculations were performed.
 3. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
 - a. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
- B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
 2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
- C. Identification for Raceways:
1. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
 2. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
 3. Use underground warning tape to identify underground raceways.
- D. Identification for Boxes:
1. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
- E. Identification for Devices:
1. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
1. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.

- b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 - 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
 - 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
 - 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
 - 5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.
- B. Identification Labels:
- 1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 - 2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
- 1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
 - 2. Legend:
 - a. Equipment designation or other approved description.
 - b. Other information as indicated.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height:
 - a. Equipment Designation: 1/2 inch (13 mm).
 - b. Other Information: 1/4 inch (6 mm).
 - 5. Color:
 - a. Normal Power System: White text on black background.

2.03 WIRE AND CABLE MARKERS

- A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- C. Legend: Power source and circuit number or other designation indicated.
- D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- E. Minimum Text Height: 1/8 inch (3 mm).
- F. Color: Black text on white background unless otherwise indicated.

2.04 UNDERGROUND WARNING TAPE

- A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
 - 1. Exception: Use foil-backed detectable type tape where required by serving utility or where directed by Owner.
- B. Non-detectable Type Tape: 6 inches (152 mm) wide, with minimum thickness of 4 mil (0.1 mm).
- C. Foil-backed Detectable Type Tape: 3 inches (76 mm) wide, with minimum thickness of 5 mil (0.1 mm), unless otherwise required for proper detection.
- D. Legend: Type of service, continuously repeated over full length of tape.
- E. Color:
 - 1. Tape for Buried Power Lines: Black text on red background.
 - 2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.05 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
 - 1. Materials:
 - 2. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.
- C. Warning Labels:
 - 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester, or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 - 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 - 3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 - 1. Surface-Mounted Equipment: Enclosure front.
 - 2. Flush-Mounted Equipment: Inside of equipment door.
 - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 - 4. Elevated Equipment: Legible from the floor or working platform.
 - 5. Branch Devices: Adjacent to device.
 - 6. Interior Components: Legible from the point of access.
 - 7. Conduits: Legible from the floor.
 - 8. Boxes: Outside face of cover.
 - 9. Conductors and Cables: Legible from the point of access.
 - 10. Devices: Outside face of cover.

- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing, or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches (75 mm) below finished grade.
- G. Mark all handwritten text, where permitted, to be neat and legible.

END OF SECTION

SECTION 26 0914

ELECTRICAL POWER MONITORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Instrument transformers.

1.02 REFERENCE STANDARDS

- A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; Institute of Electrical and Electronic Engineers; 2008.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. Xcel Energy standard for installation and use, 2008 edition.

1.03 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 METERING TRANSFORMERS

- A. Current Transformers: IEEE C57.13; 5 ampere secondary, wound type, with single secondary winding and secondary shorting device, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 26 0919

ENCLOSED CONTACTORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Lighting contactors.

1.02 REFERENCE STANDARDS

- A. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association; 2000 (R2005).
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 LIGHTING CONTACTORS

- A. Description: NEMA ICS 2, magnetic lighting contactor.
- B. Configuration: Electrically held.
- C. Coil operating voltage: 120 volts, 60 Hertz.
- D. Poles: As required to match circuit configuration and control function.
- E. Contact Rating: Match branch circuit overcurrent protection, considering derating for continuous loads.
 - 1. Provide 30A-rated contactors for all 20A lighting branch circuits.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install enclosed contactors where indicated, in accordance with manufacturer's instructions.
- B. Install enclosed contactors plumb. Provide supports in accordance with Section 26 0529.

END OF SECTION

SECTION 26 0923

LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Occupancy sensors.
- B. Time switches.
- C. In-wall interval timers.
- D. Outdoor photo controls.

1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.
- E. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.
- F. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
 - 1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 ALL LIGHTING CONTROL DEVICES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 OCCUPANCY SENSORS

- A. Manufacturers:

1. Hubbell Building Automation, Inc: www.hubbellautomation.com
2. Sensor Switch Inc: www.sensorswitch.com.
3. WattStopper: www.wattstopper.com.
4. Note: Plan layouts of occupancy sensors are based on a single specification, and that specification is noted on the plans. If an alternate manufacturer is selected, ensure that sensors provided meet or exceed the original specification, or provide a sensor layout which ensures complete area coverage for all affected areas.
5. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy Sensors:

1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
2. Sensor Technology:
 - a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
 - b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
 - c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
 - d. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing technologies.
3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Turn-Off Delay: Field adjustable, up to a maximum time delay setting of not less than 15 minutes and not more than 30 minutes.
7. Compatibility: Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
8. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on the drawings.

C. Wall Switch Occupancy Sensors:

1. All Wall Switch Occupancy Sensors:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.

- b. Unless otherwise indicated or required to control the load indicated on the drawings, provide line voltage units with self-contained relay.
 - c. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
 - d. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
- 2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet (83.6 sq m).
 - 3. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet (83.6 sq m).
- D. Ceiling Mounted Occupancy Sensors:
- 1. All Ceiling Mounted Occupancy Sensors:
 - a. Description: Low profile occupancy sensors designed for ceiling installation.
 - 2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet (41.8 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
- E. Power Packs for Low Voltage Occupancy Sensors:
- 1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
 - 2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on the drawings.
 - 3. Input Supply Voltage: Dual rated for 120/277 V ac.
 - 4. Load Rating: As required to control the load indicated on the drawings.

2.03 TIME SWITCHES

- A. Manufacturers:
- 1. Intermatic, Inc: www.intermatic.com.
 - 2. Tork, a division of NSI Industries LLC: www.tork.com.
- B. Digital Electronic Time Switches:
- 1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
 - 2. Internal backup of programs and functions shall function for a minimum of (10) Hours.
 - 3. Internal backup shall be super-capacitor type only. Battery backup is not acceptable.
 - 4. Program Capability:
 - a. Astronomic Time Switches: Two channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
 - 5. Provide automatic daylight savings time and leap year compensation.
 - 6. Provide power outage backup to retain programming and maintain clock.

7. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
8. Provide remote photocell input.
9. Input Supply Voltage: As indicated on the drawings.
10. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:

2.04 IN-WALL INTERVAL TIMERS

- A. Manufacturers:
 1. As indicated on the drawings.
- B. Digital Electronic In-Wall Interval Timers:
 1. Program Capability: Designed to turn load off at end of preset time interval.
 2. Time Interval: Field selectable range of presets available up to 2 Hours.
 3. Contact Ratings: As required to control the load indicated on the drawings.

2.05 OUTDOOR PHOTO CONTROLS

- A. Manufacturers:
 1. Intermatic, Inc: www.intermatic.com.
 2. Tork, a division of NSI Industries LLC: www.tork.com.
- B. Stem-Mounted Outdoor Photo Controls:
 1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
 2. Housing: Weatherproof, impact resistant polycarbonate.
 3. Photo Sensor: Cadmium sulfide.
 4. Provide external sliding shield for field adjustment of light level activation.
 5. Light Level Activation: 1 to 5 footcandles (10.8 to 53.8 lux) turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
 6. Voltage: As required to control the load indicated on the drawings.
 7. Failure Mode: Fails to the on position.
 8. Load Rating: As required to control the load indicated on the drawings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of lighting control devices provided under this section.
- C. Install lighting control devices in accordance with manufacturer's instructions.
- D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- E. Install lighting control devices plumb and level, and held securely in place.

- F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.
- G. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- H. Occupancy Sensor Locations:
 - 1. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet (1.2 m) from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
- I. Outdoor Photo Control Locations:
 - 1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
 - 2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.
- J. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

END OF SECTION

SECTION 26 2416

PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Lighting and appliance panelboards.
- B. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 2813 - Fuses: Fuses for fusible switches and spare fuse cabinets.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision D, 2006.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; National Electrical Contractors Association; 2009.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.
- E. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).
- F. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2011.
- G. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007.
- H. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.
- I. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- K. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

- L. UL 67 - Panelboards; Current Edition, Including All Revisions.
- M. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.
- N. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Siemens Industry, Inc: www.sea.siemens.com.
- B. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.
- C. General Electric Company: www.geindustrial.com.
- D. Schneider Electric; Square D Products: www.schneider-electric.us.

2.02 ALL PANELBOARDS

- A. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet (2,000 m).
 - 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
- C. Short Circuit Current Rating:
- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 - 1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

2.03 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 - 2. Phase and Neutral Bus Material: Aluminum.
 - 3. Ground Bus Material: Aluminum.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
 - 1. Provide surface-mounted or flush-mounted enclosures as indicated.
 - 2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 - 3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 OVERCURRENT PROTECTIVE DEVICES

- A. Fusible Switches:

1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
 2. Fuse Clips: As required to accept indicated fuses.
 3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
 4. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
- B. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
 - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 3. Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install panelboards securely, in a neat and workmanlike manner in accordance with NECA 1 (general workmanship), NECA 407 (panelboards), and NEMA PB 1.1.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required supports in accordance with Section 26 0529.
- E. Install panelboards plumb.

- F. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.
- H. Provide minimum of six spare 1 inch (27 mm) trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- I. Provide grounding and bonding in accordance with Section 26 0526.
- J. Install all field-installed branch devices, components, and accessories.
- K. Provide fuses complying with Section 26 2813 for fusible switches as indicated.
- L. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- M. Provide filler plates to cover unused spaces in panelboards.

3.02 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA STD ATS, except Section 4.
- B. Fusible Switches: Perform inspections and tests listed in NETA STD ATS, Section 7.5.1.1.
- C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA STD ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.
- D. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.03 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 2701

ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metering transformer cabinets.
- B. Meter bases.

1.02 RELATED REQUIREMENTS

- A. Section 26 0914 - Electrical Power Monitoring: Electric meters.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SYSTEM DESCRIPTION

- A. System Characteristics: 208Y/120 volts, three phase, two-wire, 60 Hertz.

1.05 QUALITY ASSURANCE

PART 2 PRODUCTS

2.01 COMPONENTS

- A. Metering Transformer Cabinets: Sheet metal cabinet with hinged door, conforming to utility company requirements, with provisions for locking and sealing.
 - 1. Size: As required by utility.
- B. Meter Base: Provided by contractor, to meet all requirements as set forth by utility company (Xcel energy).

PART 3 EXECUTION

3.01 PREPARATION

- A. Arrange with utility company to obtain permanent electric service to the Project.

3.02 INSTALLATION

- A. Install metering transformer cabinets and meter base as required by utility company.
- B. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

END OF SECTION

SECTION 262716

ELECTRICAL CABINETS AND ENCLOSURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hinged cover enclosures.

1.02 RELATED REQUIREMENTS

- A. Section 26 0529 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2008.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

PART 2 PRODUCTS

2.01 HINGED COVER ENCLOSURES

- A. Construction: NEMA 250, Type 1 steel enclosure.
- B. Covers: Continuous hinge, held closed by flush latch operable by screwdriver.
- C. Provide interior plywood panel for mounting terminal blocks and electrical components; finish with white enamel.
- D. Enclosure Finish: Manufacturer's standard enamel.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install securely, in a neat and workmanlike manner, as specified in NECA 1.
- B. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner under the provisions of Section 26 0529.

3.02 CLEANING

- A. Clean electrical parts to remove conductive and harmful materials.
- B. Remove dirt and debris from enclosure.
- C. Clean finishes and touch up damage.

END OF SECTION

EQUIPMENT WIRING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

- A. Section 26 0534 - Conduit.
- B. Section 26 0537 - Boxes.
- C. Section 26 2818 - Enclosed Switches.

1.03 REFERENCE STANDARDS

- A. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).
- B. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
 - 1. Colors: Conform to NEMA WD 1.
 - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
 - 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
- B. Wiring Devices: As specified in Section 26 2726.
- C. Flexible Conduit: As specified in Section 26 0534.
- D. Wire and Cable: As specified in Section 26 0519.

2.02 EQUIPMENT CONNECTIONS

PART 3 EXECUTION

3.01 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Receptacles.
- C. Wall plates.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0537 - Boxes.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 0923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors.
- E. Section 26 0943 - Network Lighting Controls - Lutron: Lighting controls, to match accessory receptacles and wallplates specified in this section.

1.03 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- D. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).
- E. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).
- F. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
- H. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- I. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- J. UL 943 - Ground-Fault Circuit-Interruption; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- B. Operation and Maintenance Data:
 - 1. GFI Receptacles: Include information on status indicators and testing procedures and intervals.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hubbell Incorporated: www.hubbell-wiring.com.
- B. Leviton Manufacturing Company, Inc: www.leviton.com.
- C. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
- D. Source Limitations: Where possible, for each type of wiring device furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFI receptacles with specified weatherproof covers for all receptacles installed outdoors or in damp or wet locations.
- D. Provide GFI protection for all receptacles installed within 6 feet (1.8 m) of sinks.
- E. Provide GFI protection for all receptacles serving electric drinking fountains.

2.03 ALL WIRING DEVICES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- B. Finishes:
 - 1. All Wiring Devices: White with white nylon wall plate unless otherwise indicated.
 - 2. Wiring Devices Installed in Finished Spaces: White with white nylon wall plate unless otherwise indicated.
 - 3. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate unless otherwise indicated.

4. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover unless otherwise indicated.

2.04 WALL SWITCHES

- A. Manufacturers:
 1. Hubbell Incorporated: www.hubbell-wiring.com.
 2. Leviton Manufacturing Company, Inc: www.leviton.com.
 3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
- B. All Wall Switches: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- C. Standard Wall Switches: Industrial specification grade, 20 A, 120 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.05 RECEPTACLES

- A. Manufacturers:
 1. Hubbell Incorporated: www.hubbell-wiring.com.
 2. Leviton Manufacturing Company, Inc: www.leviton.com.
 3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
 4. Source Limitations: Where wall controls are furnished as part of lighting control system as specified in Section 26 0943, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.
- B. All Receptacles: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 2. NEMA configurations specified are according to NEMA WD 6.
- C. Convenience Receptacles:
 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
- D. GFI Receptacles:
 1. All GFI Receptacles: Provide with feed-through protection, light to indicate ground fault tripped condition and loss of protection, and list as complying with UL 943, class A.
 2. Standard GFI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
 3. Weather Resistant GFI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather

resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.06 WALL PLATES

- A. All Wall Plates: Comply with UL 514D.
 - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 - 2. Size: Standard; _____.
 - 3. Screws: Metal with slotted heads finished to match wall plate finish.
- B. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- D. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of wiring devices provided under this section.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.

- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. Provide GFI receptacles with integral GFI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- I. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- J. Install wall switches with OFF position down.
- K. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- L. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- M. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

3.03 FIELD QUALITY CONTROL

- A. Inspect each wiring device for damage and defects.
- B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- C. Test each receptacle to verify operation and proper polarity.
- D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 2813

FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fuses.

1.02 RELATED REQUIREMENTS

- A. Section 26 2818 - Enclosed Switches: Fusible switches.

1.03 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2002 (R2007).
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.
- D. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cooper Bussmann, a division of Cooper Industries: www.cooperindustries.com.
- B. Mersen (formerly Ferraz Shawmut): ferrazshawmut.mersen.com.
- C. Littelfuse, Inc: www.littelfuse.com.

2.02 APPLICATIONS

- A. Service Entrance:
 - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
- B. Individual Motor Branch Circuits: Class RK1, time-delay.

2.03 FUSES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose indicated.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

SECTION 26 2818

ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 2813 - Fuses.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.
- C. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- G. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Siemens Industry, Inc: www.sea.siemens.com.

- B. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.
- C. General Electric Company: www.geindustrial.com.
- D. Schneider Electric; Square D Products: www.schneider-electric.us.

2.02 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break, enclosed safety switches complying with NEMA KS 1, type HD (heavy duty), and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet (2,000 m).
 - 2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
 - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- G. Provide with switch blade contact position that is visible when the cover is open.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- J. Enclosures: Comply with NEMA KS 1 and NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
- K. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- L. Heavy Duty Switches:
 - 1. Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

2. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install enclosed switches in accordance with manufacturer's instructions.
- B. Install enclosed switches securely, in a neat and workmanlike manner in accordance with NECA 1.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required supports in accordance with Section 26 0529.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 26 0526.

3.02 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 5100

INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Ballasts.
- E. Lamps.
- F. Luminaire accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 0537 - Boxes.
- B. Section 26 5600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

- A. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type); 2002.
- B. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; Consolidated-2002.
- C. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (R2008).
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- E. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.
- F. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.
- G. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; National Electrical Manufacturers Association; 2006.
- H. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2012.

- J. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- K. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.
- L. UL 1029 - High-Intensity-Discharge Lamp Ballasts; Current Edition, Including All Revisions.
- M. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.07 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY

- A. Provide two year manufacturer warranty for all linear fluorescent ballasts.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Furnish luminaires from the manufacturers specified in the drawings.
- B. Substitutions:
 - 1. Any substitutions made from the specifications on the drawings shall be submitted to the design team for review and pre-approval during the bidding process. Any substitutions made to the specified fixtures submitted after the bidding process will be rejected.

2.02 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions:
 - 1. Any substitutions made from the specifications on the drawings shall be submitted to the design team for review and pre-approval during the bidding process. Any substitutions made to the specified fixtures submitted after the bidding process will be rejected.

2.03 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Recessed Luminaires:
 - 1. Ceiling Compatibility: Comply with NEMA LE 4.
 - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
- H. Fluorescent Luminaires:
 - 1. Provide ballast disconnecting means complying with NFPA 70 where required.
 - 2. Fluorescent Luminaires Controlled by Occupancy Sensors: Provide programmed start ballasts.

2.04 EMERGENCY LIGHTING UNITS

- A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- C. Battery:

1. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.05 EXIT SIGNS

- A. All Exit Signs: Internally illuminated with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
 1. Number of Faces: Single or double as indicated or as required for the installed location.
 2. Directional Arrows: As indicated or as required for the installed location.
- B. Self-Powered Exit Signs:
 1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
 2. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
 3. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.06 BALLASTS

- A. All Ballasts:
 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
- B. Fluorescent Ballasts:
 1. All Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.
 - a. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
 - b. Total Harmonic Distortion: Not greater than 20 percent.
 - c. Power Factor: Not less than 0.95.
 - d. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
 - e. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
 - f. Lamp Compatibility: Specifically designed for use with the specified lamp, with no visible flicker.
 - g. Lamp Operating Frequency: Greater than 20 kHz, except as specified below.
 - h. Lamp Current Crest Factor: Not greater than 1.7.
 - i. Provide automatic restart capability to restart replaced lamp(s) without

- requiring resetting of power.
 - j. Provide end of lamp life automatic shut down circuitry for T5 and smaller diameter lamp ballasts.
 - k. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.
 - l. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer application.
 - m. Ballast Marking: Include wiring diagrams with lamp connections.
- C. High Intensity Discharge (HID) Ballasts: Complying with ANSI C82.4 and listed and labeled as complying with UL 1029.
- 1. Electronic Metal Halide Ballasts:
 - a. All Electronic Metal Halide Ballasts:
 - 1) Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
 - 2) Total Harmonic Distortion: Not greater than 15 percent.
 - 3) Power Factor: Not less than 0.90.
 - 4) Provide thermal protection with automatic reset.
 - 5) Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
 - 6) Lamp Operating Frequency: Less than 200 Hz or as required to avoid acoustic resonance in lamp arc tube.
 - 7) Lamp Current Crest Factor: Not greater than 1.5.
 - 8) Provide end of lamp life automatic shut down circuitry.
 - 9) Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.
 - 10) Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer application.

2.07 LAMPS

- A. Manufacturers:
 - 1. General Electric Company/GE Lighting; _____: www.gelighting.com.
 - 2. Osram Sylvania; _____: www.sylvania.com.
 - 3. Philips Lighting Company; _____: www.lighting.philips.com.
 - 4. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.
- B. All Lamps:
 - 1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.

2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
 3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
 4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.
- C. Linear Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
1. T8 Linear Fluorescent Lamps:
 - a. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.
- D. High Intensity Discharge (HID) Lamps: Wattage as indicated, with bulb type, burning position, and base type as required for luminaire.
1. Metal Halide Lamps:
 - a. Non-Reflector Type Metal Halide Lamps: Phosphor coated lamp finish unless otherwise indicated.

2.08 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting).
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Install accessories furnished with each luminaire.
- F. Bond products and metal accessories to branch circuit equipment grounding conductor.
- G. Emergency Lighting Units:
- H. Exit Signs:
- I. Install lamps in each luminaire.

3.04 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 26 5600

EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires.
- B. Poles and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0537 - Boxes.
- C. Section 26 0919 - Enclosed Contactors: Lighting contactors.
- D. Section 26 0923 - Lighting Control Devices: Automatic controls for lighting including time switches and outdoor photo controls.
- E. Section 26 5100 - Interior Lighting.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; 2006.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the Drawings.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

2.03 POLES

- A. All Poles:
 - 1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
 - 2. Structural Design Criteria:
 - a. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
 - 1) Design Wind Speed: 120 miles per hour (_____ kph), with gust factor of 1.3.
 - 3. Material: Steel, unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA/IESNA 501 (exterior lighting).
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Install accessories furnished with each luminaire.
- F. Bond products and metal accessories to branch circuit equipment grounding conductor.
- G. Install lamps in each luminaire.

3.02 CLEANING

- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.03 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 28 3100

FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Transmitters for communication with supervising station.

1.02 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; 2010; (ADA Standards for Accessible Design).
- B. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits; 2002 (R2008).
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 72 - National Fire Alarm Code and Signaling Code; 2010.

1.03 SUBMITTALS

- A. Evidence of designer qualifications.
- B. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
 - 1. Copy (if any) of list of data required by authority having jurisdiction.
 - 2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
 - 3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
 - 4. System zone boundaries and interfaces to fire safety systems.
 - 5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
 - 6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
 - 7. List of all devices on each signaling line circuit, with spare capacity indicated.
 - 8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
 - 9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
 - 10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
 - 11. Certification by the manufacturer of the control unit that the system design complies with the contract documents.

12. Certification by Contractor that the system design complies with the contract documents.
- C. Evidence of installer qualifications.
 - D. Evidence of instructor qualifications; training lesson plan outline.
 - E. Evidence of maintenance contractor qualifications, if different from installer.
 - F. Inspection and Test Reports:
 1. Submit inspection and test plan prior to closeout demonstration.
 2. Submit documentation of satisfactory inspections and tests.
 3. Submit NFPA 72 "Inspection and Test Form," filled out.
 - G. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
 1. Complete set of specified design documents, as approved by authority having jurisdiction.
 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
 3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
 4. List of recommended spare parts, tools, and instruments for testing.
 5. Replacement parts list with current prices, and source of supply.
 6. Detailed troubleshooting guide and large scale input/output matrix.
 7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
 8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.
 - H. Project Record Documents: See Section 01 7800 for additional requirements; have one set available during closeout demonstration:
 1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
 - I. Closeout Documents:
 1. Certification by manufacturer that the system has been installed in compliance with his installation requirements, is complete, and is in satisfactory operating condition.

2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.

1.04 QUALITY ASSURANCE

- A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.
- B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
 1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
 2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
 3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
- C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
- D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Alarm Control Units - Basis of Design: SimplexGrinnell ; _____ :
www.simplexgrinnell.com.
- B. Fire Alarm Control Units - Other Acceptable Manufacturers: Provided their products meet or exceed the performance of the basis of design product, products of the following are acceptable:
 1. Honeywell Security & Fire Solutions/Gamewell-FCI: www.gamewell-fci.com.
 2. Honeywell Security & Fire Solutions/Notifier: www.notifier.com.
 3. Provide all control units made by the same manufacturer.

2.02 FIRE ALARM SYSTEM

- A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
 1. Provide all components necessary, regardless of whether shown in the contract documents or not.
 2. Protected Premises: Entire building shown on drawings.
 3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
 - a. ADA Standards for Accessible Design.
 - b. The requirements of the local authority having jurisdiction, which is _____.

- c. Applicable local codes.
 - d. The contract documents (drawings and specifications).
 - e. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
 5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
 6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
 7. Program notification zones and voice messages as directed by Owner.
 8. Fire Command Center: Location indicated on drawings.
 9. Master Control Unit (Panel): New, located at fire command center.
- B. Supervising Stations and Fire Department Connections:
1. Public Fire Department Notification: By on-premises supervising station.
 2. On-Premises Supervising Station: Existing proprietary station operated by Owner, located at _____.
 3. Means of Transmission to On-Premises Supervising Station: Directly connected noncoded system.
- C. Circuits:
1. Initiating Device Circuits (IDC): Class B, Style A.
 2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
 3. Notification Appliance Circuits (NAC): Class B, Style W.
- D. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
 2. Secondary: Storage batteries.
 3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
 4. Each Computer System: Provide uninterruptible power supply (UPS).

2.03 FIRE SAFETY SYSTEMS INTERFACES

- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:

2.04 COMPONENTS

- A. General:
 1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
 2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
- B. Fire Alarm Control Units, Initiating Devices, and Notification Appliances: Analog,

addressable type; listed by Underwriters Laboratories as suitable for the purpose intended.

- C. Master Control Unit: As specified for Basis of Design above, or equivalent.
- D. Initiating Devices:
 - 1. Smoke Detectors: _____.
 - a. Provide 1 extra.
- E. Notification Appliances:
 - 1. Speakers: _____.
 - a. Provide 1 extra.
 - 2. Strobes: _____.
 - a. Provide 1 extra.
- F. Circuit Conductors: Copper or optical fiber; provide 200 feet (60 m) extra; color code and label.
- G. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
- H. Locks and Keys: Deliver keys to Owner.
- I. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
 - 1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
 - 2. Provide one for each control unit where operations are to be performed.
 - 3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
 - 4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.
- B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- C. Obtain Owner's approval of locations of devices, before installation.
- D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

- C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.03 Owner PERSONNEL INSTRUCTION

- A. Provide the following instruction to designated Owner personnel:
 - 1. Hands-On Instruction: On-site, using operational system.
 - 2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
- B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
 - 1. Initial Training: 1 session pre-closeout.
- C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
 - 1. Initial Training: 1 session pre-closeout.
- D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.04 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
 - 1. Be prepared to conduct any of the required tests.
 - 2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
 - 3. Have authorized technical representative of control unit manufacturer present during demonstration.
 - 4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
 - 5. Repeat demonstration until successful.

3.05 MAINTENANCE

- A. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:

1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
 2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
 3. Record keeping required by NFPA 72 and authorities having jurisdiction.
- B. Provide trouble call-back service upon notification by Owner:
1. Provide on-site response within 2 hours of notification.
 2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
 3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- C. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
- D. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.
- E. Comply with Owner's requirements for access to facility and security.

END OF SECTION

SECTION 31 0100 – EARTHWORK CONTRACTOR QUALIFICATIONS

NOTICE:

The earthwork contractor must be a Colorado Certified General Abatement Contractor. A current list of certified contractors can be found at: <http://www.colorado.gov/cs/Satellite/CDPHE-AP/CBON/1251594679141>

END OF SECTION 31 0100

SECTION 31 1000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 1. Protecting existing vegetation to remain.
 2. Removing existing vegetation.
 3. Clearing and grubbing.
 4. Stripping and stockpiling topsoil.
 5. Removing above- and below-grade site improvements.
 6. Disconnecting, capping or sealing site utilities.
 7. Temporary erosion- and sedimentation-control measures.

1.3 MATERIAL OWNERSHIP

- A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.4 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

- D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.
- E. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving."
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

- B. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

- A. General: Protect trees and plants remaining on-site according to requirements in Division 01 Section "Temporary Tree and Plant Protection."
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

3.4 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
 - 1. Arrange with utility companies to shut off indicated utilities.
- B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.

3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
 - 1. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
 - 2. Use only hand methods for grubbing within protection zones.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 1000

SECTION 31 2000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Refer to the geotechnical report entitled, "XXX, for earthwork recommendations.

1.2 SUMMARY

- A. Section Includes:
 - 1. Preparing subgrades for slabs-on-grade, walks and pavements.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Drainage course for concrete slabs-on-grade.
 - 4. Subbase course for concrete walks and pavements.
 - 5. Subbase course for asphalt paving.
 - 6. Excavating and backfilling for utility trenches.

1.3 DEFINITIONS

- A. Backfill: Soil material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
 - H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
 - I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
 - J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
 - K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
 1. Gradation analysis testing: For each soil material proposed for the Work.
 2. Physical properties: For each soil material proposed for the Work.
- B. Material Certificates: Gradation for each soil material, from supplier.

1.5 QUALITY ASSURANCE

- A. Pre-excavation Conference: Conduct conference at Project site.
- B. During all soil excavation activities, Contractor shall ensure the Environmental Oversight Inspector is present to observe potentially contaminated soils.
- C. Codes and Standards: Comply with all applicable local, state and Federal rules, regulations and ordinances concerning sloping of excavation, trenching and safety of workers, including the latest version of OSHA requirement.
- D. Testing Agency: All testing required to determine compliance for the work of this section will be done by the County's testing agency and as specified in Section 01400. Correct deficiencies before placing additional embankment.
- E. Referenced Standards: Comply with the requirements of the reference standards noted herein, except where more stringent requirements are listed herein or otherwise required by the Contract Documents, to include specifications of local agencies exercising

jurisdiction over this project.

1.6 PROJECT CONDITIONS

- A. Utility Locator Service: The Contractor shall contact all public utility companies and determine the location of all existing underground utilities prior to proceeding with construction. All work performed in the area of public utilities shall be performed according to the requirements of these agencies. The Contractor shall be responsible for locating any existing utility (including depth) which may conflict with the proposed construction. The Contractor shall contact Utility Notification Center of Colorado (800) 922-1987 and other local utilities for existing utility locations. The Contractor shall protect, at his own expense, all existing utilities and be responsible for their repair if they are damaged during construction.
- B. Use of Explosives: Use of explosives is not permitted.
- C. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.
- D. Operate warning lights as recommended by authorities having jurisdiction.
- E. Protect structures, utilities, walkways, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- F. Environmental Requirements: Blasting is not permitted. Employ jack hammering and other loud noises and methods sparingly; comply with all applicable noise abatement ordinances or regulations. Onsite burning is not allowed.
- G. Existing Benchmarks: Carefully preserve and maintain existing benchmarks, vertical/horizontal control, monuments, property line pipes and pins, and other reference points. If disturbed or destroyed, restore or replace at no additional cost to the City.
- H. Do not commence earth moving operations until plant-protection measures specified in Division 01 Section "Temporary Tree and Plant Protection" are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: : ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of

optimum moisture content at time of compaction.

- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored to comply with local practice or requirements of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may

include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
 1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 2. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
 1. Clearance: 12 inches each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.
- D. Trenches in Tree- and Plant-Protection Zones:
 1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop

exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.6 SUBGRADE INSPECTION

- A. Proof-roll subgrade with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.7 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.8 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."
- D. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."

- E. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.

3.11 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12

inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.

2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.
5. Compaction of Fill for Hardscape Areas:
 - a. Select fill material shall be placed and mixed in evenly spread layers. After each fill layer has been placed, it shall be uniformly compacted. Fill materials shall be placed such that the thickness of loose material does not exceed 8 inches and the compacted lift thickness does not exceed 6 inches.
 - b. Compaction shall be obtained by the use of sheepsfoot rollers, multiple-wheel pneumatic-tired rollers, or other equipment approved by the Project Manager. Granular fill shall be compacted using vibratory equipment or other equipment approved by the Project Manager. Compaction of each layer shall be continuous over the entire area. Compaction equipment shall make sufficient passes to ensure that the required density is obtained.
6. Compaction of Landscape Slope Areas:
 - a. Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compaction operations shall be continued until slopes are stable, but not too dense for planting, and there is not appreciable amount of loose soils on the slopes. Permanent fill slopes shall not exceed 4:1 (horizontal to vertical).
 - b. Where natural slopes are steeper than 20 percent in grade and the placement of fill is required, cut benches shall be provided at the rate of one bench for each 5 feet in height (minimum of two benches). Benches shall be at least 10 feet in width. Larger bench widths may be required by the Project Manager. Fill shall be placed on completed benches as outlined within this specification.

3.13 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Turf or Unpaved Areas: Plus or minus 1 inch.
 2. Walks: Plus or minus 1 inch.
 3. Pavements: Plus or minus 1/2 inch.

- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (when tested with a 10-foot straightedge).

3.14 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course under pavements and walks as follows:
 1. Shape subbase course to required crown elevations and cross-slope grades.
 2. Place subbase course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 3. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 69.

3.15 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.16 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.17 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion.

Keep free of trash and debris.

- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Existing Utilities: Locate existing underground utilities in areas of the work. If utilities are to remain in-place, provide protection during earthwork operations. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult Project Manager immediately for direction. Cooperate with utility companies in keeping respective permanent and temporary utility services and facilities in operation. Repair damaged utilities to the satisfaction of the appropriate utility company.
- D. Protect of Persons and Property: Provide all necessary measures to protect workmen and passersby. Barricade open excavations occurring as part of the work, as required by municipal or other authorities having jurisdiction.
- E. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Removal from City's Property: Remove waste materials, including materials not allowed for fill, backfill or site grading as specified within, trash, and debris, and legally dispose of it off City's property at Contractor's expense.
- B. Remove any excess fill material from the site, unless otherwise directed by the Project Manager.

END OF SECTION 31 2000

SECTION 31 2316.13

TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Backfilling and compacting for utilities outside the building to utility main connections.

PART 3 EXECUTION

2.01 EXAMINATION

2.02 TRENCHING

- A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- B. Slope banks of excavations deeper than 4 feet (1.2 meters) to angle of repose or less until shored.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Cut trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.
- F. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
- G. Remove excavated material that is unsuitable for re-use from site.
- H. Remove excess excavated material from site.

2.03 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

2.04 BACKFILLING

- A. Backfill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.
- E. Correct areas that are over-excavated.

1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.
- F. Compaction Density Unless Otherwise Specified or Indicated:
1. Under paving, slabs-on-grade, and similar construction: 97 percent of maximum dry density.
- G. Reshape and re-compact fills subjected to vehicular traffic.

2.05 FIELD QUALITY CONTROL

- A. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.
- B. If tests indicate work does not meet specified requirements, remove work, replace and retest.

2.06 CLEANING

- A. Leave unused materials in a neat, compact stockpile.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 32 1216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. City and County of Denver Standards and Details for Engineering Division, Volume 1 – Minor Projects.
<http://www.denvergov.org/Portals/487/documents/StandardsandDetailsUpdated20071505.pdf>
- C. City and County of Denver, Public Works Rules and Regulations, For the Construction of Curbs, Gutters, Sidewalks, Driveways, Street Paving, and Other Public Right-of-Way Improvements. <http://denvergov.org/Portals/486/documents/rowimprove.PDF>

1.2 SUMMARY

- A. Section Includes:
 - 1. Cold milling of existing hot-mix asphalt pavement.
 - 2. Hot-mix asphalt patching.
 - 3. Hot-mix asphalt paving.
 - 4. Hot-mix asphalt paving overlay.
 - 5. Pavement-marking paint.
- B. Related Sections:
 - 1. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
 - 2. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
 - 1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

2. Job-Mix Designs: For each job mix proposed for the Work.

B. Material Certificates: For each paving material, from manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by City and County of Denver.

B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of City and County of Denver for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

C. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Tack Coat: Minimum surface temperature of 60 deg F.

2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement (for lift of 3 inches or more).

3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement (for lift of 3 inches or more).

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials or 55 deg F for water-based materials], and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 Refer to City and County of Denver detail drawings and specifications.

2.2 A paving-mix designed and approved for use by City and County of Denver.

PART 3 - EXECUTION

3.1 Refer to City and County of Denver Transportation Standard detail drawings and specifications for operations including examination, patching, repairs, surface preparation, hot-mix asphalt placing, joints, compaction, and installation tolerances.

PART 4 - DISPOSAL

4.1 Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

A. Do not allow excavated materials to accumulate on-site.

END OF SECTION 32 1216

PART 1: GENERAL

- 1.1 RELATED DOCUMENTS: The General Contract Conditions, Drawings, and Division - 1 Specification sections apply to Work of this section.
- 1.2 SUMMARY:
- A. Work Includes: Constructing concrete flatwork, including walks, curbs and gutters, ramps, and pans.
 - B. Related Work:
 - 1. Cast In Place Concrete – Section 033000
- 1.3 SUBMITTALS: As specified in Section 01300.
- A. In compliance with Paragraph 5.3.2 of ASTM C94, furnish statement of composition of concrete mix and ad mixtures and evidence that mix meets specified quality.
 - B. Test reports as indicated below.
- 1.4 QUALITY ASSURANCE
- A. All concrete for flatwork shall be Class P (4200 PSI) unless otherwise requested by the Project Manager.
 - B. Sample Panel: If requested by the Project Manager, prior to starting any concrete paving, provide a sample panel using materials indicated for project work. Build panel at the site of full thickness and approximately 10 feet by 10 feet, including expansion joints, control joint, scales, fillers, etc. Provide the workmanship proposed for the work. Correct and replace sample panel until Project Manager's acceptance of the work. Retain panel during construction as a standard for completed paving work.
 - C. The approved sample panel may be a portion of the work and remain in place. Locations as directed by the Project Manager.
- 1.5 PROJECT CONDITIONS:
- A. Place concrete only when ambient air temperatures are above 45 degrees F and rising, unless it is protected from freezing. Do not place concrete on frozen ground. Refer to Section 03300 for hot weather and cold weather placement procedures.

PART 2: PRODUCTS

- 2.1 SUBGRADE MATERIAL: Dense, readily compactible material, free from vegetable matter and lumps of clay. Material excavated from on-site that meets this requirement may be used if approved.

2.2 CONCRETE:

- A. Materials: Materials, including cement, aggregates, water, and admixtures, shall meet the requirements of ASTM C94. Refer to Section 03300 for additional requirements.
 - 1. Cement: Type II, complying with ASTM C 150.
 - 2. Coarse Aggregate: Maximum size 3/4 inch, complying with ASTM C33.
 - 3. Fly Ash: Shall be Type C or F, in compliance with CDOT 701.02.
 - 4. Water: Potable
 - 5. Air Entraining Admixture: ASTM C260. No chlorides will be permitted.
 - 6. Water Reducing Admixture: ASTM C494 Type A. Provide for all flatwork. No chlorides will be permitted.
- B. Quality of Concrete: Concrete shall be furnished under Option C, ASTM C94, whereby the manufacturer assumes full responsibility for the selection of the proportions for the concrete mixture. Submit statement of composition as called for in Part 1 of this section.
- C. Total Average Air Content: 5 to 7 percent.
- D. Minimum Cement Content: 6 sacks per cubic yard.
- E. Water Cement Ratio: Max. (.44 ±).
- F. Slump: Maximum 4 inches.
- G. Compressive Strength: 4,500 PSI minimum at twenty-eight days.
- H. Manufacture and Delivery: Measurement of materials, batching, mixing, transporting, and delivery shall be as specified in ASTM C94. Discharge concrete into forms within 1-1/2 hours after introduction of water to cement. When temperature of concrete is 85 degrees F or above, the time between introduction of water to cement and complete discharge of concrete into forms shall not exceed 45 minutes.

2.3 FIBROUS CONCRETE REINFORCEMENT: Shall be 100% virgin polypropylene, fibrillated fibers containing no reprocessed olefin materials and specifically manufactured to an optimum gradation utilizing 25 individual fiber designs for use as concrete secondary reinforcement. Volume per cubic yard shall equal a minimum of 0.1% (1.5 pounds). Fiber manufacturer must document evidence of 5 year satisfactory performance history, compliance with applicable building codes and ASTM C1116 Type III 4.1.3 and ASTM C1116 Performance Level I. Acceptable manufacturer: Fibermesh Company, 4019 Industry Drive, Chattanooga, Tennessee, USA, 37416 or approved equal. Fibrous concrete reinforcement shall be utilized in all trail and walk applications.

2.4 EXPANSION JOINT FILLERS: Pre-molded closed cell polyethylene foam, equal to "Sonoflex F" by Sonneborn, Minneapolis, Minnesota. Provide 1/2-inch thick by depth of the slab material, allow 1/2 thickness for joint sealer.

2.5 EXPANSION JOINT SEALANT: Shall be a silicone material that is on CDOT's approved silicone sealant list. Where color additive is used, color to match.

- 2.6 CURING COMPOUND: Clear Spray Applied Membrane Forming Liquid conforming to ASTM C309, Type 1. Curing Compound shall not reduce bonding or adhesion of finish materials applied to concrete surfaces.
- 2.7 TRUNCATED DOME INSERTS FOR RAMPS: Shall be in conformance with current Public Works standards.

PART 3: EXECUTION

- 3.1 PREPARATION OF SUBGRADE: Excavate to required depth. Remove soft, yielding material and replace with select fill. Compact to min. 95% Standard Proctor within 2% of optimum moisture.
- 3.2 MAINTENANCE OF SUBGRADE: Maintain subgrade in a compacted condition until concrete is placed.
- 3.3 FORMS: Metal or uniform warp free lumber, coated with form release agent. Slope forms to give slabs positive drainage and stake securely. Obtain approval of Project Manager for alignment and grade before placing concrete. Radii shall be continuous and flowing to avoid angular intersections in the horizontal alignment.
- 3.4 PLACING:
- A. Concrete shall be formed, placed, vibrated and finished by hand using conventional methods. Concrete shall be placed at the line and grade shown on plans.
 - B. Place concrete on moistened subgrade monolithically between construction joints. Deposit to full depth in one operation. Consolidate immediately. After depositing concrete, screed and darby or bullfloat.
- 3.5 CONCRETE FINISHING:
- A. After darbying or bullfloating, stop finishing until bleeding has ceased and until concrete can support foot pressure with only about 1/8-inch indentation. During or after the first floating, check planeness of surface with a 10-foot straightedge applied at not less than two different angles, and then cut down all high spots and fill all low spots to achieve a true plane within 1/8 inch in 10 feet.
 - B. Refloat slab immediately to a uniform sandy texture. Use steel trowel to densify surface, then apply medium broom finish to slab perpendicular to line of traffic.
 - C. Handicap Ramps:
 - 1. Provide score joints in handicap ramps, heavily tooled in a 12" x 12" pattern in accordance with standard City of Denver detail.
 - 2. Install truncated dome inserts flush with the adjacent ramp surface, taking care to achieve a tight bond with the concrete, free of air pockets.

- 3.6 FORM REMOVAL: Remove forms after concrete surface is hard enough so as not to be injured in any way. Reasonable care is to be used in removing forms. Repair minor defects with mortar. Plastering will not be permitted on exposed faces.
- 3.7 JOINTS: Construct joints true to line with faces perpendicular to surface.
- A. Expansion Joints: Expansion joint material shall be provided at the following locations and shall be in place prior to the placing of concrete: 1) at each end of curb return; 2) between sidewalk and driveway slabs or service walks; 3) between new concrete and existing concrete; 4) as shown on the plans; 5) between new concrete and fixed vertical objects, 5) at max. 120 foot spacing, or 6) as directed by the Project Manager.
1. Thoroughly clean all surfaces prior to installation of caulking material.
- B. Contraction (Control) Joints in Walks: Install tooled joints a minimum of $\frac{1}{4}$ of the total slab thickness. All joints must be uniform and straight or curved to the radii shown on the plans. Kinked, non-uniform, incorrectly curved, or otherwise unsightly joints will be removed and replaced at the owner's sole discretion and at the contractors expense. Joints shall match the appearance of joints in the existing pavement in the park.
- C. Curb and Gutter Contraction (Control) Joints: Space curb and gutter joints not more than 12 feet 6 inches on center, and align them with sidewalk joints. Contraction joints shall be tooled. Form plane of weakness by inserting and later removing a metal divider, finish with an edger or groover, or by saw cutting a previously tooled joint.
- 3.8 CURING: Thoroughly cure and protect concrete by keeping the surface moist for 7 calendar days or by use of curing compound applied in accordance with manufacturer's written instructions. Cure slabs with integral color in accordance with instructions of the pigment manufacturer using a pigmented membrane-forming curing compound with integral color to match concrete pigment. On exposed slabs with integral color, do not use polyethylene or paper sheeting.
- 3.9 FIELD QUALITY CONTROL: Surfaces shall not vary more than 1/8-inch when tested with a 10 foot straightedge.
- 3.10 PROTECTION: Contractor shall be responsible for protecting the concrete flatwork until it is sufficiently hard. Concrete that is damaged by footprints, writing implements, or weather conditions is subject to replacement at no cost to the City.

END OF SECTION 32 13 13

SECTION 32 1373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. City and County of Denver Standards and Details for Engineering Division, Volume 1 – Minor Projects.
<http://www.denvergov.org/Portals/487/documents/StandardsandDetailsUpdated20071505.pdf>

1.2 SUMMARY

- A. Section Includes:
 - 1. Cold-applied joint sealants.
 - 2. Cold-applied, jet-fuel-resistant joint sealants.
 - 3. Hot-applied joint sealants.
 - 4. Hot-applied, jet-fuel-resistant joint sealants.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, eight, Samples of materials that will contact or affect joint sealants. Use manufacturer's standard test method to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples: For each kind and color of joint sealant required.
- C. Pavement-Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.
- D. Product certificates.
- E. Product test reports.

- F. Preconstruction compatibility and adhesion test reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021.
- B. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

2.2 COLD-APPLIED JOINT SEALANTS

- B. Single-Component, Nonsag, Silicone Joint Sealant for Concrete: ASTM D 5893, Type NS.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crafcoc Inc., an ERGON company; RoadSaver Silicone.
 - b. Dow Corning Corporation; 888.
 - c. Pecora Corporation; 301 NS.
- C. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crafcoc Inc., an ERGON company; RoadSaver Silicone SL.
 - b. Dow Corning Corporation; 890-SL.
 - c. Pecora Corporation; 300 SL.
- D. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pecora Corporation; Urexpan NR-200.

2.3 HOT-APPLIED JOINT SEALANTS

- A. Hot-Applied, Single-Component Joint Sealant for Concrete: ASTM D 3406.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crafcoc Inc., an ERGON company; Superseal 444/777.
- B. Hot-Applied, Single-Component Joint Sealant for Concrete and Asphalt: ASTM D 6690, Types I, II, and III.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Meadows, W. R., Inc.; Sealtight Hi-Spec
 - b. Right Pointe; D-3405 Hot Applied Sealant.

2.4 JOINT-SEALANT BACKER MATERIALS

- A. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- B. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.
- C. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.5 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Cleaning of Joints: Clean out joints immediately before installing joint sealants.
- C. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- D. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of joint-sealant backings.
 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
 3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place joint sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
1. Remove excess joint sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- G. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.
- H. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

END OF SECTION 32 1373

SECTION 32 3113 – CHAIN LINK FENCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 1-Specifications section, apply to work of this section.

1.2 RELATED SECTIONS AND DOCUMENTS

- A. Chain link fencing as shown on the drawings for site fencing
- B. Drawings and general provisions of the Construction Contract, and Division-1 Specification sections apply to work of this section.

1.3 SUBMITTALS

- A. Submit manufacturer's technical data, and installation instructions for metal fencing.

1.4 QUALITY ASSURANCE

- A. Provide chain link fences as complete units produced by a single manufacturer including necessary erection accessories, fittings, fastenings and gates.
- B. Except where higher standards are indicated conform to "Product Manual" published by CLMFI for materials and ASTM F567 for installation.

PART 2 - PRODUCTS

2.1 STEEL FENCING

- A. Fence Fabric: No. 9 ga. (0.148" steel wires, 2" mesh, with both selvages twisted or barbed
 - 1. Furnish one-piece fabric widths for fencing up to 8' high.
 - 2. Fabric finish, galvanized, ASTM A392, Class I, with not less than 1.2 oz. zinc per sq.ft.
- B. Framework: Galvanized steel, ASTM A12, with not less than 1.8 oz. zinc per sq. ft. for galvanized fence.

- C. Barbed Wire: 1.6mm steel wire (minimum size)
 - 1. Wire finish, galvanized, ASTM A392, Class I, with not less than 1.2 oz. zinc per sq.ft.
- D. Hardware and Accessories: Galvanized, ASTM A153, with zinc weights per Table I for galvanized fence.

2.2 FRAMING AND ACCESSORIES

- A. Provide full shop drawings for review and approval of spacing and layout
- B. Line Posts: For 6' or 8' -2.5" OD steel pipe, 3.65 lbs per linear foot
- C. Terminal Posts: All posts to be 2.875" OD steel pipe. Post to be Schedule 40.
- D. Horizontal Center Rail and Mid Rail: For 6' height chain link fencing and above- 1.66" OD steel pipe, 2.27 lbs. per linear foot.
- E. Bottom Rail: 1.66" OD steel pipe, 2.27lbs per linear foot.
- F. Gate Posts: 3.5" OD steel pipe.
- G. Truss Rods: 3/8" diameter with anchor and turnbuckle
- H. Gate Frames: 1.9" OD steel pipe
- I. Tension Wire: 9 gauge galvanized steel. Locate at bottom of fabric and 24" above bottom edge of fabric. Weave continuous strand between terminal posts for entire length.
- J. Wire Ties: For tying fabric to posts and rails, use 9 gauge steel wire ties spaced 12" o.c. For tying fabric to tension wire, use hog rings spaced 24" o.c. Galvanized to match fence fabric.
- K. Manufacturer's standard procedure will be accepted if of equal strength and durability. Check with Architect prior to beginning work.
- L. Post Brace Assembly: Manufacturer's standard adjustable brace at both sides of corners and pull posts, with horizontal brace located at mid-height of fabric.
- M. Horizontal Brace: Use 1.66" OD steel pipe.
- N. Post Tops: 3 wire, 45 degree barb wire arm post cap with loop to receive top rail, one cap for each post.

- O. Stretcher Bars and Bands: One piece stretcher bars in lengths equal to full height of fabric, with minimum cross-section of 0.188" x 0.75". Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into post.
- P. Space stretcher bar bands not over 12" o.c., to secure stretcher bars to end, corner, pull, and gate posts.
- Q. Mounting: reference structural and architecture for post mounting and conditions and concrete specification.
- R. Refinishing: Following any damage to post coating, immediately refinish with two coats of Fustoleum aluminum paint at galvanized fencing.
- S. Gate Accessories: Industrial malleable ball and socket, double swing hinge. Malleable gate fork latch for man gates. Industrial latch pressed steel latch assembly for double gates including plunger rod. Industrial gate ells.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Do not begin installation and erection before flood wall and flood gates are installed and final grading is complete, unless otherwise permitted.
- B. For fencing attached to concrete, do not begin work before these materials have been completed, cured and have attained their design strengths.
- C. Excavation: Drill holes for post foundations of diameters and depths provided by architect and structural engineer. Core drill masonry wall cap as directed by architect and structural engineer.
- D. Framework: Setting Posts: Center and align posts in holes 3" above bottom of excavation.
- E. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations. Bring top elevation of concrete to 5" below pavement grade except where otherwise shown and trowel smooth with wash away from post. Consult Architect and Structural Engineer on wall mounting prior to installation.
- F. Top Rails: Run rail continuously through barbed wire arm post caps.
- G. Center Rails: Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.

- H. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
- I. Gate Frames: Welded construction only.
- J. Tension Wire: Install tension wires by weaving through the fabric and tying to each post with 5 gauge galvanized wire, or by securing the wire to the fabric.
- K. Fabric: Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence and anchor to framework so that fabric remains in tension after pulling force is released.
- L. Stretcher Bars: Thread through or clamp to fabric 4" o.c., and secure to posts with metal bands spaced 12' o.c.
- M. Tie Wires: use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least 2 full turns. Bend and put wire to minimize hazard to persons or clothing. Leave no ends exposed past fabric thickness.
- N. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts; file smooth.
- O. Latches: Set double gate plunger bar strike in concrete.
- P. Curved fence sections: For fence sections installed on radii, post spacing may need to be closer to create and accommodate curve. Do not bend rails.

END OF SECTION 32 3113

SECTION 32 9300 - PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plants.
2. Planting soils.
3. Tree stabilization.
4. Mulch

B. Related Sections:

1. Section 129300 "Site Furnishings" for exterior unit planters.
2. Section 311000 "Site Clearing" for protection of existing trees and plantings, topsoil stripping and stockpiling, and site clearing.
3. Section 312000 "Earth Moving" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
4. Section 329200 "Turf and Grasses" for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.
5. Section 334600 "Subdrainage" for below-grade drainage of landscaped areas, paved areas, and wall perimeters.

1.3 UNIT PRICES

- A. Work of this Section is affected by unit prices specified in Section 012200 "Unit Prices."

1. Unit prices apply to authorized work covered by quantity allowances.
2. Unit prices apply to additions to and deletions from Work as authorized by Change Orders.

1.4 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

- B. **Balled and Burlapped Stock:** Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than sizes indicated and diameter and depth required by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1 and the Colorado Nursery Act.
- C. **Container-Grown Stock:** Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
- D. **Duff Layer:** The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- E. **Finish Grade:** Elevation of finished surface of planting soil.
- F. **Manufactured Topsoil:** Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- G. **Pesticide:** A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- H. **Pests:** Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- I. **Planting Area:** Areas to be planted.
- J. **Planting Soil:** Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- K. **Plant; Plants; Plant Material:** These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- L. **Root Flare:** Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- M. **Stem Girdling Roots:** Roots that encircle the stems (trunks) of trees below the soil surface.

- N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- O. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- P. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including soils.
 - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
 - 2. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.
 - 3. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.
- B. Samples for Verification: For each of the following:
 - 1. Mineral Mulch: 1 gallon size zip-loc of mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on the site; provide an accurate indication of color, texture, and makeup of the material.
 - 2. Weed Control Barrier: 12 by 12 inches (300 by 300 mm).

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
 - 1. Manufacturer's certified analysis of standard products.
 - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

- C. Material Test Reports: For standardized ASTM D 5268 topsoil, existing native surface topsoil, existing in-place surface soil, and imported or manufactured topsoil.
- D. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.
- E. Warranty: Sample of special warranty.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.
 - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 - 2. Experience: Five years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
 - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 4. Personnel Certifications: Installer's field supervisor shall have certification in all of the following categories from the Professional Landcare Network:
 - a. Certified Landscape Technician - Exterior, with installation specialty area(s), designated CLT-Exterior.
 - 5. Pesticide Applicator: State licensed, commercial.
- B. Soil-Testing Laboratory Qualifications: An independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.
 - 1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
 - 2. The soil-testing laboratory shall oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Architect. A minimum of ten representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
 - 3. Report suitability of tested soil for plant growth.

- a. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. (92.9 sq. m) or volume per cu. yd. (0.76 cu. m) for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.
- D. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1 and the Colorado Nursery Act.
 - 1. Selection of plants purchased under allowances will be made by Architect, who will tag plants at their place of growth before they are prepared for transplanting.
- E. Measurements: Measure according to ANSI Z60.1 and the Colorado Nursery Act. Do not prune to obtain required sizes.
 - 1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches (150 mm) above the root flare for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above the root flare for larger sizes.
 - 2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- F. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
 - 1. Notify Architect of sources of planting materials three weeks in advance of delivery to site.
- G. Preinstallation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.
- B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.
- C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- D. Handle planting stock by root ball.
- E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F (16 to 18 deg C) until planting.
- F. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 2. Do not remove container-grown stock from containers before time of planting.
 3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
1. Notify Architect and Construction Manager no fewer than seven days in advance of proposed interruption of each service or utility.
 2. Do not proceed with interruption of services or utilities without Owner's written permission.

- C. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
 - 1. Spring Planting: April 1 to June 31. Adjust for weather limitations, freezing conditions.
 - 2. Fall Planting: September 1 to October 31. Adjust for weather limitations and freezing conditions.
- D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
- E. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
 - 1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.10 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
 - c. Faulty performance of tree stabilization, edgings, tree grates.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Periods from Date of Substantial Completion:
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
 - c. Annuals: Two months.
 - 3. Include the following remedial actions as a minimum:
 - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
 - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.

- c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
- d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

1.11 MAINTENANCE SERVICE

- A. Initial Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
 - 1. Maintenance Period: 12 months from date of Substantial Completion.
- B. Initial Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
 - 1. Maintenance Period: Six months from date of Substantial Completion.
- C. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
 - 1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch (19 mm) in diameter; or with stem girdling roots will be rejected.
 - 2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1 and the Colorado Nursery Act. Root flare shall be visible before planting.
- D. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.
- E. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.2 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: Class O, with a minimum 95 percent passing through No. 8 sieve and a minimum 55 percent passing through No. 60 sieve.
 - 2. If magnesium is required provide lime in form of dolomitic limestone.
- B. Sulfur: Sulfur compound for Agricultural applications, soil amendment grade and as recommended from manufacturer/supplier.
- C. Perlite: Horticultural perlite, soil amendment grade.
- D. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate. as recommended by manufacturer/supplier for soil amendments.
- E. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

2.3 ORGANIC SOIL AMENDMENTS

- A. The mixture shall be free from clay subsoil, stones, lumps, plants and their roots, sticks, weed stolons and seeds, high salt content and other materials harmful to plant life. Verification of source and test results from an approved soils testing laboratory is required prior to delivery.
- B. Compost: Class 1, STA certified, fully-composted, stable, mature and weed-free organic matter, pH range of 5.5 to 8.0; moisture content 30 to 60 percent by weight; 70 percent passing through 3/4-inch sieve; soluble salt content of a maximum 5

mmhos/cm; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 25 to 65 percent of dry weight.
 2. Peat (Acidic pH requirement): Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.
- C. Peat (Acidic): Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.
- D. Peat (neutral pH): Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

2.4 FERTILIZER

- A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid. Adjust percentages to suit site soil conditions.
- B. Commercial Fertilizer: Prior to landscape installation adjust composition to suit site soil conditions. If used as a soil amendment, revise fertilizer mix to remedy deficiencies found in soil tests.
- C. Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
1. Composition: 3-lb/1000 sq. ft. of Nitrogen, phosphorous, and potassium, Adjust amounts recommended in soil reports from a qualified soil-testing agency.
- D. Slow-Release Fertilizer: Adjust composition to suit site soil conditions. If used as a soil amendment, revise fertilizer mix to remedy deficiencies found in soil tests. Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
1. Composition: 3-lb/1000 sq. ft. of Nitrogen, phosphorous, and potassium, Adjust amounts recommended in soil reports from a qualified soil-testing agency.

2.5 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a range of 2 to 20 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth. Confirm topsoil source and refer to appropriate clause below.
1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally

well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.

2. Topsoil Source: Amend existing in-place surface soil to produce topsoil. Verify suitability of surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - a. Surface soil may be supplemented with imported or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.

2.6 MULCHES

- A. Mineral Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of following type, size range, and color:
 1. Type: Rounded riverbed cobble.
 2. Size Range: 3 inches maximum
 3. Color: Uniform tan-beige color range approved by Architect.

2.7 WEED-CONTROL BARRIERS

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. (101g/sq. m) minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally-encountered chemicals, alkalis, and acids.

2.8 PESTICIDES

- A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.9 TREE STABILIZATION MATERIALS

- A. Stakes and Guys:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal (38-by-38-mm actual) by length indicated, pointed at one end.
2. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes or turnbuckles.
3. Guys and Tie Wires: ASTM A 641/A 641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch (2.7 mm) in diameter.
4. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.
5. Guy Cables: Five-strand, 3/16-inch- (4.8-mm-) diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches (75 mm) long, with two 3/8-inch (10-mm) galvanized eyebolts.
6. Flags: Standard surveyor's plastic flagging tape, white, 6 inches (150 mm) long.

2.10 MISCELLANEOUS PRODUCTS

- A. Wood Pressure-Preservative Treatment: AWWA C2, with waterborne preservative for soil and freshwater use, acceptable to authorities having jurisdiction, and containing no arsenic; including ammoniacal copper arsenate, ammoniacal copper zinc arsenate, and chromated copper arsenate.
- B. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.
- C. Burlap: Non-synthetic, biodegradable.
- D. Planter Drainage Gravel: Washed, sound crushed stone or gravel complying with ASTM D 448 for Size No. 8.
- E. Planter Filter Fabric: Woven geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them.
- F. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb (0.45 kg) of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb (0.45 kg) of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.
- E. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.
- F. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

3.3 PLANTING AREA ESTABLISHMENT

- A. Loosen subgrade of planting areas to a minimum depth of 12 inches (300 mm). Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply superphosphate fertilizer directly to subgrade before loosening.
 - 2. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
 - b. Mix lime with dry soil before mixing fertilizer.
 - 3. Spread planting soil at a rate of 4 cy/1,000 sf but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Spread approximately one-half the thickness of planting soil over loosened subgrade. Mix thoroughly into top 4 inches (100 mm) of subgrade. Spread remainder of planting soil.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.
- D. Application of Mycorrhizal Fungi: At time directed by Architect, broadcast dry product uniformly over prepared soil

3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
 - 1. Excavate approximately three times as wide as ball diameter for balled and burlapped container-grown stock.
 - 2. Excavate at least 12 inches (300 mm) wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 - 3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.

4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
 5. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 6. Maintain supervision of excavations during working hours.
 7. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
 8. If drain tile is shown on Drawings or required under planting areas, excavate to top of porous backfill over tile.
- B. Subsoil and topsoil removed from excavations may be used as planting soil after mixed with suitable amendments to create specified planting soil.
- C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
1. Hardpan Layer: Drill 6-inch- (150-mm-) diameter holes, 24 inches (600 mm) apart, into free-draining strata or to a depth of 10 feet (3 m), whichever is less, and backfill with free-draining material.
- D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Percolation Test: Contractor shall perform a percolation test on approximately 25 tree planting pits at various locations spread uniformly throughout the site and approved by Architect. Upon excavation of existing soil from the tree pit the Contractor shall dig or auger a hole 24" deep by 12" wide. Contractor shall take care to avoid existing utilities while excavating the trench and digging the percolation hole. The hole shall then be filled with water and the amount of time to completely drain shall be recorded Contractor shall document each percolation test drainage time in increments of 4 hours. Contractor to notify Project Manager/Architect of results of percolation test a minimum of three (3) days prior to tree planting.
1. If the hole drains in 24 hours the pit is suitable for planting of most trees. If the hole takes substantially longer than 24 hours to drain a subsurface drainage solution be proposed by the Contractor. Contractor shall note if the drainage takes only 12 hours- irrigation requirements may need to be increased on the proposed species in that area.

3.5 TREE, SHRUB, AND VINE PLANTING

- A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

- B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare 2 inches (50 mm) above adjacent finish grades.
 - 1. Use appropriate planting soil mix discussed with Architect for backfill.
 - 2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 - 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 - 4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
 - 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Set container-grown stock plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent finish grades.
 - 1. Use appropriate planting soil mix discussed with Architect for backfill.
 - 2. Carefully remove root ball from container without damaging root ball or plant.
 - 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 - 4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
 - 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- E. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 TREE, SHRUB, AND VINE PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.
- C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- D. Do not apply pruning paint to wounds.

3.7 TREE STABILIZATION

- A. Staking and Guying: Stake and guy trees more than 14 feet (4.2 m) in height and more than 3 inches (75 mm) in caliper unless otherwise indicated. Securely attach no fewer than three guys to stakes 30 inches (760 mm) long, driven to grade.
 - 1. Site-Fabricated Staking-and-Guying Method:
 - a. Support trees with bands of flexible ties at contact points with tree trunk and reaching to turnbuckle. Allow enough slack to avoid rigid restraint of tree.
 - b. Support trees with strands of cable or multiple strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk and reaching to turnbuckle. Allow enough slack to avoid rigid restraint of tree.
 - c. Attach flags to each guy wire, 30 inches (760 mm) above finish grade.

3.8 PLANTING IN PLANTERS

- A. Place a layer of drainage gravel at least 4 inches (100 mm) thick in bottom of planter. Cover bottom with filter fabric and wrap filter fabric 6 inches (150 mm) up on all sides. Duct tape along the entire top edge of the filter fabric, to secure the filter fabric against the sides during the soil-filling process.
- B. Fill planter with appropriate planting soil. Place soil in lightly compacted layers to an elevation of 1-1/2 inches (38 mm) below top of planter, allowing natural settlement.

3.9 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as noted on drawings in even rows with triangular spacing.
- B. Use planting soil for backfill.

- C. Dig holes large enough to allow spreading of roots.
- D. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.10 PLANTING AREA MULCHING

- A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 12 inches (300mm) and secure seams with galvanized pins.
- B. Mulch backfilled surfaces of planting areas and other areas indicated.
 - 1. Trees in Turf Areas: Apply organic mulch ring of 3-inch (75-mm) average thickness, with 24-inch (600-mm) diameter around trunks or stems. Do not place mulch within 3 inches (75 mm) of trunks or stems.
 - 2. Organic Mulch in Planting Areas: Apply 3-inch (75-mm) average thickness of organic mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches (75 mm) of trunks or stems.
 - 3. Mineral Mulch: Apply 3-inch (75-mm) average thickness of mineral mulch as identified on plans, and finish level with adjacent finish grades.

3.11 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.12 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.
- C. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.13 CLEANUP AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.
- B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- C. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.14 DISPOSAL

- A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 329300

SECTION 33 4100 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. City and County of Denver Wastewater Management Division Standard detail drawings and specifications.
<http://www.denvergov.org/Portals/487/documents/Standard%20Details%20no%20Steps%202009.pdf>
- C. CITY AND COUNTY OF DENVER - DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION, Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.
<http://www.denvergov.org/WMDDesign/StormDrainSantConstrDetailTechSpecs/tabid/395956/Default.aspx>

1.2 SUMMARY

- A. This section includes the following:
 - 1. Pipe and fittings.
 - 2. Channel drainage systems.
 - 3. Encasement for piping.
 - 4. Manholes.
 - 5. Cleanouts.
 - 6. Nonpressure transition couplings.
 - 7. Catch basins.
 - 8. Stormwater inlets.
 - 9. Pipe outlets.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 - 1. Manholes: Include plans, elevations, sections, details, frames, and covers.
 - 2. Catch basins Include plans, elevations, sections, details, frames, covers, and grates.

PART 2 - PRODUCTS

- 2.0 Refer to City and County of Denver Wastewater Management Division Standard detail drawings and specifications.

PART 3 - EXECUTION

- 3.0 Refer to REQUIREMENTS INCLUDING INSTALLATION, JOINT CONSTRUCTION, CONNECTIONS, AND IDENTIFICATION

- A. Refer to City and County of Denver Wastewater Management Division Standard detail drawings and specifications.

END OF SECTION 33 4100

APPENDIX A

REVISION OF SECTION 208 EROSION CONTROL

Section 208 of the Standard Construction Specifications is hereby removed in its entirety and replaced with the following:

PART I: 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", 1999 edition.

Definitions used for this Section hereby incorporate those identified within the City and County of Denver Construction Activities Stormwater Manual (CASM).

Additional Definitions applicable to this Section are listed heretofore:

Basis of Payment: The terms under which "Work" is paid, as a designated "Pay Item" in accordance with the quantity measured and the "Pay Unit."

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).

Colorado Department of Health and Environment (CDPHE): State of Colorado, Water Quality Control Division responsible for issuance of State Construction Stormwater Permit.

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).

Construction Activities Stormwater Manual (CASM): City and County of Denver Construction Activities Stormwater Manual (CASM), 2010 edition.

Colorado Department of Transportation (CDOT): State agency that has published standards for Erosion Control with accompanying Erosion Control Supervisor certification courses.

Erosion Control Supervisor (ECS): The Erosion Control Supervisor is assigned by the Contractor 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).

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.

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 Stormwater 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.

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.

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 stormwater 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 stormwater;
- c) which is not a combined sewer; and
- d) which is not part of a Publicly Owned Treatment Works (POTW).

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.

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.

State Construction Stormwater Permit: Colorado Revised Statutes 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

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.

Stormwater Management Plan (SWMP): The Stormwater Management Plan contains the requirements necessary to accomplish all the following:

The 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. 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.

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.

PART II: DESCRIPTION

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 shall 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.

PART III: MATERIALS

Materials to be used for BMPs shall conform to each specific detail as set forth within the Project SWMP or as noted on the Contract Drawings.

PART IV: EROSION CONTROL PERMIT STATUS

The current SWMP status for the Project is as follows:

“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.

PART V: CONSTRUCTION REQUIREMENTS

A) SCHEDULES:

At least 10 working days prior to the beginning of any construction work, the Contractor shall submit for approval a schedule for accomplishment of temporary and permanent BMPs shown in the SWMP. This schedule shall specifically indicate the sequence of clearing and grubbing, earthwork operations, and construction of temporary and permanent BMPs. The schedule shall include BMPs for all areas within the Project boundaries, including but not limited to, haul roads, borrow pits, and storage and other staging sites. Work shall not be started until the BMP schedule has been approved in writing by the Project Manager. Once the work has started, and during the active construction period, the Contractor shall update the schedule for all BMPs on a regular basis, and as required to keep the SWMP in compliance.

B) CONSTRUCTION IMPLEMENTATION: The Contractor shall incorporate into the Project all BMPs as outlined in the accepted schedule.

C) UNFORSEEN CONDITIONS: The Contractor shall direct the ECS (under the supervision of a Professional Engineer licensed in the State of Colorado) to design and implement BMPs for correcting 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 CDOT’s “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 Manager 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, and shall notify the Permit Enforcement Authority and ECS of the emergency situation and BMPs

employed in response as soon as practical after installation.

D) 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.

E) 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 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:

- 1) Ensure compliance with all water quality permits or certifications in effect during the construction work.
- 2) Supervise the installation, construction, and maintenance of all BMPs specified in the Contract and coordinate the construction of BMPs with all other construction operations.
- 3) 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.
- 4) 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.
- 5) 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.
- 6) 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.
- 7) Coordinate with the Contractor to implement necessary actions to reduce anticipated or presently existing water quality or erosion problems resulting from construction activities.
- 8) Coordinate with the Contractor to ensure all labor, material, and equipment deployed to meet SWMP requirements is judged appropriately.
- 9) 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

The ECS shall start a new site map before the current one becomes illegible. All site maps shall remain with the SWMP paperwork.

10) 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.

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.

11) Modify the site map with arrows to indicate direction of surface and storm water flowing across the Project site.

12) 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.

13) 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.

14) Record on the SWMP, and implement the approved plan for concrete and asphalt saw cutting, grinding, and milling containment and removal.

15) Update the potential pollutants list in the SWMP throughout construction meeting CASDP requirements.

16) 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 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.

17) 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.

F) APPLYING BMPs TO STABILIZE SITE:

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 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.

G) 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.

H) 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:

- (i) 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.
- (ii) All inspection sediment removal, and BMP maintenance activities to comply with all Federal, State & Local erosion control permit requirements until Final Stabilization is reached.
- (iii) 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.
- (iv) All required mechanical and/ or manual street sweeping.
- (v) 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.

I) MINOR SWMP MODIFICATIONS: 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.

J) MAJOR SWMP MODIFICATION: 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):

- (i) Make required revisions to comply with changing federal or state rulemaking if occurs within timeframe of Project
- (ii) Make required revisions due to unforeseen or unplanned conditions leading to deficient Drawings/ SWMP (hazardous materials encountered, landfills, expansion of work limits, etc.)
- (iii) Prepare revised SWMP elements endorsed by a Professional Engineer licensed in the State of Colorado.

K) 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".

L) 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 Project Manager and Permit Enforcement Authority.

The Contractor may reach Final Stabilization via the following procedures:

- (i) The Contractor shall file Inactivation Request for Construction Activities Stormwater Discharge Permit (available within CASDP guidance documents) with the Permit Enforcement Authority.
- (ii) The Contractor shall coordinate with the Permit Enforcement Authority to hold a Final Inactivation Inspection.
- (iii) If passing, the Permit Enforcement Authority transmits a letter of approval for Final Stabilization.
- (iv) If not passing, the Permit Enforcement Authority transmits a letter of denial for Final Stabilization with associated inspection report to Contractor.
- (v) 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".

M) 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.

PART VI: 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.

PART VII: METHOD OF MEASUREMENT

Not applicable.

PART VIII: BASIS OF PAYMENT

Work to furnish, install, maintain, replace, remove, and dispose of BMPs specified in the SWMP and/or required for the CASDP and/or State Construction Stormwater Permit shall be included in the Add Alternate 1 price.

END OF REVISION OF SECTION 208



DENVER
THE MILE HIGH CITY

Department of Public Works
Wastewater Management Division
2000 West 3rd Ave
Denver, CO 80223
www.denvergov.org/PublicWorks

CERTIFICATE OF SUBSTANTIAL COMPLETION OF EROSION CONTROL

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.

Date: Date
Contract No.: Number
Project Name: Entire Project Name
Contractor: Name of Contractor
Address: Contractor's Address

Your Notification of Substantial Completion of Erosion Control for the above referenced project was received on date. The project was inspected by the Permit Enforcement Authority on date and was determined to have reached Substantial Completion of Erosion Control.

This Certificate of Substantial Completion of Erosion Control is being issued, effective as of Date. All additional maintenance, monitoring, and SWMP modifications must be maintained until all disturbed areas at site have achieved "final stabilization" as defined in Section 208 of the Standard Construction Specifications.

Permit Enforcement Authority Agent

Department of Public Works, Wastewater Management Division

cc: Contractor
Project Manager
Darren Mollendor, WMD
Chris McFarland, Project Controls Office

File, Certificate of Substantial Completion



Protecting the Present & Building the Future
Accountability, Innovation, Empowerment, Performance, Integrity,
Diversity, Teamwork, Respect, Excellence, Safety



DENVER
THE MILE HIGH CITY

Department of Public Works
Wastewater Management Division
2000 West 3rd Ave
Denver, CO 80223
www.denvergov.org/PublicWorks

CERTIFICATE OF FINAL STABILIZATION & PERMIT INACTIVATION

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.

Date: Date
Contract No.: Number
Project Name: Entire Project Name
Contractor: Name of Contractor
Address: Contractor's Address
CASDP No.: CASDP Permit Number

Your request for inactivation of the above referenced stormwater discharge permit was received on date. The project was inspected by the Permit Enforcement Authority on date and the work was determined to be completed in accordance with the permitting requirements of the City and County of Denver for Final Stabilization.

This Certificate of Final Stabilization is being issued, effective as of Date.

No further clearing, grading, grubbing, or other such land disturbing activity is allowed under the original CASDP permit. Any additional demolition, excavation, clearing, grading, or grubbing required for this project or in regards to any warranty services to be provided must abide by the permitting policies of the City and County of Denver.

Permit Enforcement Authority Agent
Department of Public Works, Wastewater Management Division

cc: Contractor
Project Manager
Darren Mollendor, WMD
Chris McFarland, Project Controls Office

File, Certificate of Final Stabilization



Protecting the Present & Building the Future
Accountability, Innovation, Empowerment, Performance, Integrity,
Diversity, Teamwork, Respect, Excellence, Safety

APPENDIX B

ASBESTOS-CONTAMINATED SOIL MANAGEMENT STANDARD OPERATING PROCEDURE For City and County of Denver

December 3, 2010



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

Table of Contents

ACRONYMS.....	III
DEFINITIONS.....	IV
1 INTRODUCTION.....	1
2 SITE INFORMATION, CONDITIONS AND PLANNED SOIL DISTURBING ACTIVITIES.....	2
2.1 SITE INFORMATION BACKGROUND.....	2
2.2 REVIEW OF ENVIRONMENTAL AND HISTORICAL CONDITIONS.....	2
2.3 ACS POTENTIAL CLASSIFICATION.....	2
2.3.1 Known ACS.....	2
2.3.2 Reason to Believe.....	3
2.3.3 No Reason to Know or Believe.....	3
3 PRIMARY CONTACTS, ROLES AND RESPONSIBILITIES.....	5
3.1 ASBESTOS BUILDING INSPECTOR REQUIREMENTS.....	5
3.2 CONTRACTOR REQUIREMENTS.....	6
4 REGULATORY SUMMARY AND REGULATORY REFERENCES.....	7
4.1 CDPHE HAZARDOUS MATERIALS WASTE MANAGEMENT DIVISION (HMWMD) – “ASBESTOS-CONTAMINATED SOILS” NOT ASSOCIATED WITH THE “BUILT ENVIRONMENT”.....	7
4.2 FEDERAL AND STATE AGENCIES.....	8
4.3 FACILITY COMPONENTS.....	8
5 TRAINING REQUIREMENTS.....	10
5.1 SOP CIRCULATION.....	10
5.2 AWARENESS TRAINING.....	10
5.3 ACS SOIL DISTURBANCE TRAINING.....	10
5.4 ACS INSPECTION, SOP PREPARATION, AND AIR MONITORING TRAINING.....	11
5.5 ADDITIONAL CONSIDERATIONS.....	11
6 IMMEDIATE AND INTERIM ACTIONS UPON DISCOVERY OF SUSPECTED ACM.....	12
6.1 IMMEDIATE ACTIONS UPON DISCOVERY OF SUSPECTED ACM.....	12
6.2 INTERIM ACTIONS UPON DISCOVERY OF SUSPECTED ACM.....	16
6.2.1 Site Characterization.....	16
7 REMOVAL OF ASBESTOS-CONTAMINATED SOIL.....	17
7.1 ACS MANAGEMENT PROCEDURES.....	17
7.1.1 Minimum Engineering Controls for Known or Reason to Believe Sites.....	17
7.2 NOTIFICATIONS FOR PLANNED ACS OR ACM DISTURBANCE.....	17
7.3 REMOVAL BY HAND - LIMITED QUANTITY ACM DISCOVERY MANAGEMENT AND DISPOSAL “PICK AND Go”.....	17
7.4 EXCAVATION AND EARTHMOVING, KNOWN ACS OR ACM.....	18
7.4.1 Site Control, Demarcation, Fencing and Wind Screening.....	18
7.4.2 Protection of Adjacent Structures.....	18
7.4.3 Soil Wetting and Stabilization.....	19
7.4.4 Dust and Emissions Control.....	19
7.4.5 Personal Protective Equipment.....	19
7.4.6 Removal/Excavation.....	19
7.4.7 Soil Stockpiling.....	20
7.4.8 Truck/Container Staging/Lining and Waste Loading.....	20
7.4.9 Waste Transportation and Disposal.....	21

7.4.10	Personnel Decontamination.....	22
7.4.11	Equipment Decontamination.....	22
7.5	WIND AND WORK STOPPAGE CONDITIONS.....	22
7.6	AIR MONITORING REQUIREMENTS ASSOCIATED WITH ENGINEERING CONTROLS	23
7.6.1	Personal Air Monitoring Associated with OSHA.....	23
7.6.2	Perimeter Air Monitoring	24
7.6.3	Air Sample Analysis.....	24
7.6.3.1	Sampling Media.....	24
7.6.3.2	Sample Analysis	24
7.6.3.3	Reporting	24
7.7	FINAL INSPECTION PROCEDURES.....	25
7.8	MANAGING ACS LEFT IN PLACE.....	25
7.9	SPILL CONTROL.....	25
7.10	EROSION CONTROL	25
8	SPECIAL CONSIDERATIONS	26
8.1	IMPORTING AND EXPORTING SOIL.....	26
8.2	SOIL STOCKPILING MANAGEMENT PROCEDURES	26
8.3	EMERGENCY BURIED UTILITY REPAIR PROJECTS.....	26
9	REFERENCES.....	27

TABLES

Table 1: Air Monitoring Requirements

FIGURES

Figure 1: Site Review and ACS Potential Classification Flowchart

Figure 2: Unanticipated Discovery of Asbestos in Soil Flowchart

APPENDIX A

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 slab¹
- Brick – other than fire brick²

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

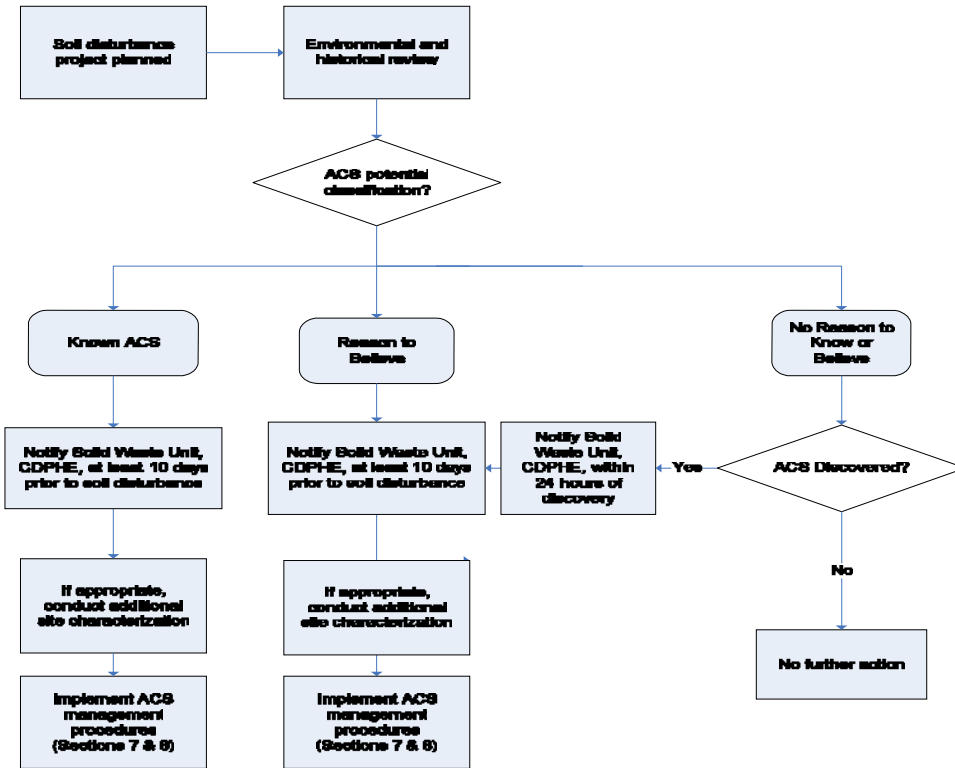
A site that is classified as having No Reason to Know or Believe is one where environmental and historical reviews do not identify the potential for asbestos containing materials to be on site even though waste material identified above and not typically associated with asbestos may be present.

Procedures in Section 7.0 of this SOP would not be implemented at a site classified as No Reason to Know or Believe.

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 Phone: 720.865.5447 Email: steve.gonzales@denvergov.org
CDPHE Hazardous Materials and Waste Management Division (HMWMD)	Regulatory Agency	CDPHE Project Manager Solid Waste Unit Phone: 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.hmwmnd@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 and then placing the potentially contaminated soil directly on the poly.
- Generate no visible emissions (dust) during characterization activities.

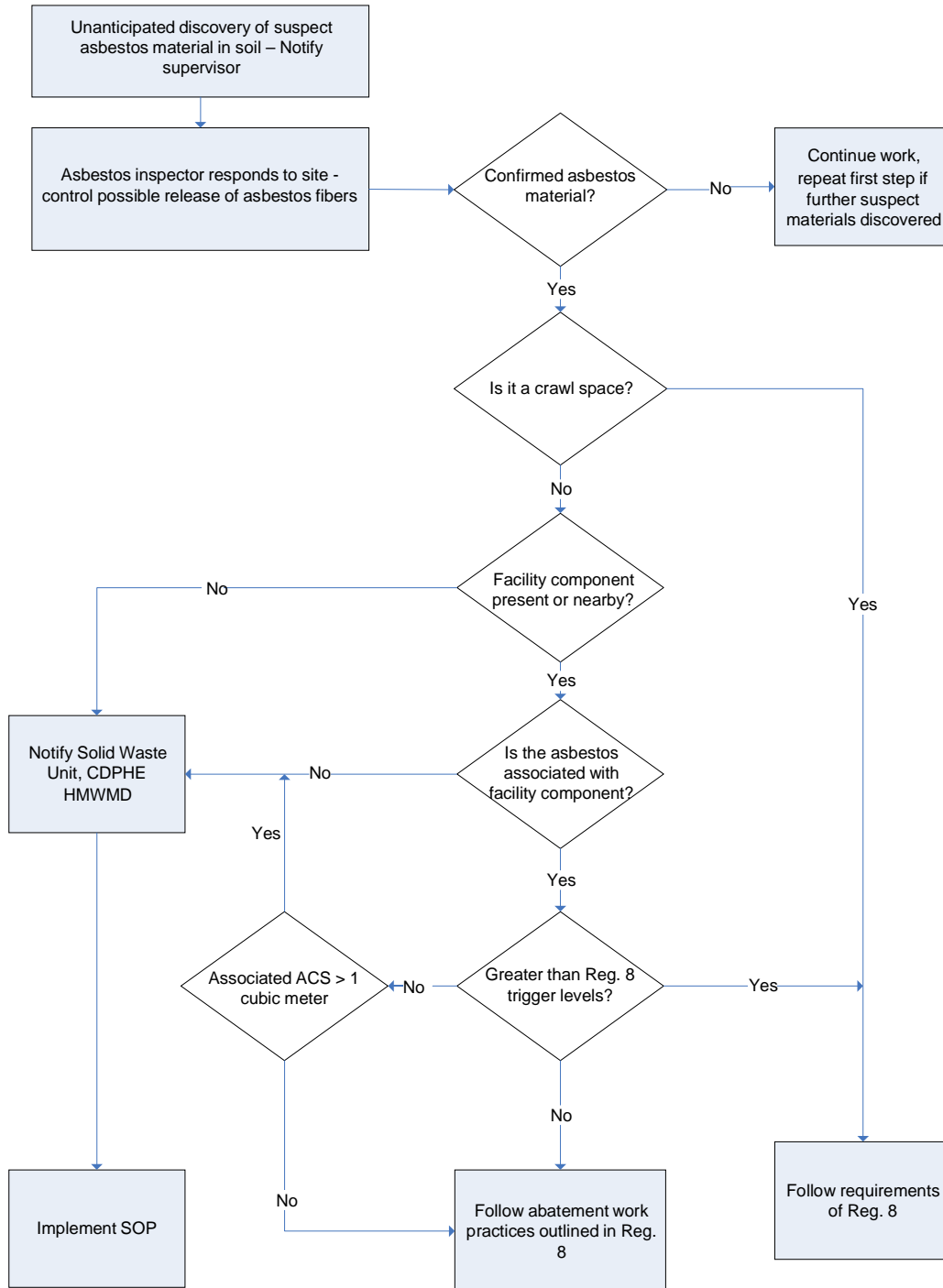
The ABI will collect samples of the suspect asbestos materials according to procedures provided in Section 6.2. The samples will be analyzed using polarized light microscopy (PLM) to identify the presence of asbestos fibers.

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.hmwmnd@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
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	(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

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 $\frac{1}{4}$ 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 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? <input type="radio"/> yes <input type="radio"/> 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 SoU 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.lnnwmdCCV.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: _____
General Site Description:	County: _____ City: _____ Zip: _____
Description of planned soil-disturbing activities:	
Description of material that will be disturbed:	
Has the Division pre-approved standard procedures that will be implemented? <input type="checkbox"/> Yes <input type="checkbox"/> 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

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:

2.3ACS 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 brick²

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.

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 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

STATE OF COLORADO



DEPARTMENT OF PUBLIC WORKS/ PARKS AND RECREATION DIVISION

Drawings

Contract No. 201416785

678 S. JASON ST.

June 13, 2014

SHEET INDEX

GENERAL INFORMATION			
6-001	GENERAL INFORMATION	A-121	FIRST FLOOR REFLECTED CEILING PLAN
6-100	CODE PLAN	A-131	ROOF PLAN
	SITE SURVEY	A-141	FIRST FLOOR FINISH PLAN
CIVIL			
C1-1	SITE PLAN	A-201	EXTERIOR ELEVATIONS
C1-2	OVERALL UTILITY PLAN	A-421	ENLARGED PLANS & INTERIOR ELEVATIONS
C2-1	GRADING PLAN	A-520	WALL DETAILS
C2-2	EROSION CONTROL PLAN	A-521	DETAILS
C2-3	EROSION CONTROL DETAILS	A-611	DOOR SCHEDULE & DETAILS
C3-1	STORM DRAIN PLAN	MECHANICAL	
C3-2	STORM DRAIN DETAILS	M-001	MECH & PLUMB LEGEND AND NOTES
C4-1	SANITARY SEWER PLAN	M-110	FIRST FLOOR MECHANICAL PLAN
		M-120	ROOF MECHANICAL PLAN
LANDSCAPE			
L-001	LANDSCAPE COVER SHEET	M-501	MECHANICAL DETAILS
L-101	MATERIALS AND LAYOUT PLAN	M-502	MECHANICAL SCHEDULES
L-102	SITE ENLARGEMENTS	PLUMBING	
L-201	PLANTING PLAN	P-110	FIRST FLOOR PLUMBING PLAN
L-301	LANDSCAPE SITE DETAILS	P-501	PLUMBING SCHEDULES & DETAILS
L-302	LANDSCAPE SITE DETAILS	ELECTRICAL	
METHANE CONTROL SYSTEM			
MCS-1	METHANE CONTROL SYSTEM	E-001	GENERAL NOTES, LEGEND, ONE-LINE
		ED-110	FIRST FLOOR ELECTRICAL DEMO PLAN
		E-100	ELECTRICAL SITE PLAN & DETAILS
STRUCTURAL			
S-101	GENERAL NOTES	E-101	PHOTOMETRIC PLAN & DETAILS
S-102	FIRST FLOOR PLAN	E-110	FIRST FLOOR POWER PLAN
		E-120	FIRST FLOOR LIGHTING PLAN
ARCHITECTURAL			
A-100	SITE PLAN	E-130	ROOF ELECTRICAL PLAN
A-111	FIRST FLOOR PLAN	E-601	ELECTRICAL SCHEDULES
		E-602	ELECTRICAL SCHEDULES

APPROVAL SIGNATURES

PCO TRACKING #PRC2012-7004
PILAR #2012-0163-01

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS

APPROVED BY:

<i>Jane B. Sorman</i> MANAGER OF PUBLIC WORKS	3-24-14 DATE
<i>Kelly B. Sorman</i> CITY ENGINEER	3-24-14 DATE
<i>Daniel H. ...</i> DIRECTOR OF ENGINEERING CAPITAL PROJECTS	3/24/14 DATE
<i>Will R. ...</i> CITY TRAFFIC ENGINEER	4/6/2014 DATE
<i>Chris ...</i> DIRECTOR OF SMALL BUSINESS OPPORTUNITY	3-24-14 DATE

SOUTH JASON STREET MAINTENANCE FACILITY

678 SOUTH JASON STREET
DENVER, CO 80223

City and County of Denver
Department of Parks and Recreation

Tenant Finish Package
Issue for Bidding & Construction
November 11, 2013

ARCHITECTURAL ABBREVIATIONS

(A) AC UNIT ABV ABOVE ACST ACOUSTIC, ACOUSTICAL ADA AMERICANS WITH DISABILITIES ACT ADJUSTABLE ADJ ADJUSTMENT ADJT ABOVE FINISHED FLOOR ALT ALTERNATE ALUM ALUMINUM ANOD ANODIZE ARCH ARCHITECT, ARCHITECTURAL ASPH ASPHALT ASSY ASSEMBLY AUTO AUTOMATIC	(B) BATT INSULATION BKR BACKER ROD BOB BOARD BF BOTH FACES BLDG BUILDING BLKG BLOCKING BLN BELOW BN BEAM BOL BULLDOSE BOS BOTTOM OF STEEL BOT BOTTOM BRD BOARD BRG PL BEARING PLATE BS BOTH SIDES BSMT BASEMENT BTN BETWEEN BUR BUILT UP ROOFING BH BOTH HATS BYND BEYOND	(C) CS CORNER GUARD CIP CAST IN PLACE CL CENTER LINE CLS CEILING CLST CLOSET CLR CLEAR CLR-1 CLASSROOM CMU CONCRETE MASONRY UNIT COMP COMPARTMENT COL COLUMN CONC CONCRETE CONT CONTINUOUS CONTR CONTRACTOR COORD COORDINATE CORR CORROSION CFT CARPET CRS COURSE(S) CSNK CASEWORK CT CERAMIC TILE CTR CENTER CTV CABLE TELEVISION CU FT CUBIC FOOT CU YD CUBIC YARD CUH CABINET UNIT HEATER CBL COLD WATER PIPING	(D) DBL DOUBLE DEPT DEPARTMENT DTL DETAIL DF DRINKING FOUNTAIN DIA DIAMETER DIM DIMENSION DISP DISPENSE DL DEAD LOAD DMPF DAMP-PROOFING DN DOWN DR DOOR DR OPNG DOOR OPENING DS DOWNSTAIR DH DRAIN DNG DRAWING	(E) EA EACH ED EDUCATION EJ EXPANSION JOINT ELE ELEVATOR ELEC ELECTRIC, ELECTRICAL ELEV ELEVATOR ENCL ENCLOSURE ENGR ENGINEER EPDM ETHYLENE PROPYLENE TEREPHTHALE MONOMER EQ EQUAL EQUIP EQUIPMENT EWC ELECTRIC WATER COOLER EWH ELECTRIC WATER HEATER EXC EXCAVATE EXIST EXISTING EXH EXHAUST FAN EXP EXPANSION EXPOSED EXP BT EXPANSION BOLT EXP SURF EXPOSED SURFACE EXT EXTERIOR	(F) F/F FACE TO FACE FA FIRE ALARM FALP FIRE ALARM ANNUNCIATOR FACP FIRE ALARM CONTROL PANEL FD FLOOR DRAIN FDN FIRE DEPARTMENT CONNECTION FDR FLOOR DRAIN FE FIRE EXTINGUISHER FEC FIRE EXTINGUISHER CABINET FFC FINISH FACE FFE FINISH FLOOR ELEVATION FH FIRE HYDRANT FHC FIRE HOSE CABINET FIN FINISH FIXT FIXTURE FLR FLOOR FOP FACE OF FINISH FOS FACE OF STUD FR FRAME FRP FIBERGLASS REINFORCED PLASTIC OR POLYESTER FT FEET, FOOT FTS FOOTING FURS FURRING	(G) GA GALVANIZED GB GRAB BAR GL GLASS GL BLK GLASS BLOCK GLU LAM GLUED LAMINATED WOOD GLZ GLAZING GYP BD GYPSUM BOARD	(H) HB HOSE BIB HR HEAD HDN HARDWARE HDND HARDWOOD HM HOLLOW METAL HNDL HANDRAIL HORIZ HORIZONTAL HSPK HORSERACKER HT HEIGHT HVAC HEATING, VENTILATING AND AIR CONDITIONING HM HOT WATER HYD HYDRANT	(I) ID INSIDE DIAMETER INCL INCLUDED INSUL INSULATION INT INTERIOR	(J) JST JOIST	(K) K KELVIN KH KILOWATT	(L) L ANGLE LAV LAVATORY LBR LUMBER LF LINEAR FEET (FOOT) LIB LIBRARY LINO LINOLEUM LKR LOCKER LL LIVE LOAD LLH LONG LEG HORIZONTAL LLV LONG LEG VERTICAL LT LIGHT LW LOWER	(M) MAX MAXIMUM MECH MECHANICAL MEB MENSERINE MFD MANUFACTURED MFR MANUFACTURER MIR MIRROR MISC MISCELLANEOUS MOLD MOLDING MO MASONRY OPENING MNT MOUNTED MTL METAL	(N) NA NOT APPLICABLE NCONC NONCONCRETE NIC NOT IN CONTRACT NO NUMBER NOM NOMINAL NRC NOISE REDUCTION COEFFICIENT NTS NOT TO SCALE	(O) OVERALL OC ON CENTER OD OUTSIDE DIAMETER OF/CI OWNER FURNISHED/ OF/CI CONTRACTOR INSTALLED OF/CI OWNER INSTALLED OH DR OVERHEAD (COLING) DOOR OPNG OPENING OPP OPPOSITE ORD OVERFLOW ROOF DRAIN	(P) PBD PARTICLEBOARD PCF POUNDS PER CUBIC FOOT PCP PORTLAND CEMENT PLASTER PLM PLUMBING PLPB PLYWOOD PLTP PREFABRICATED PREFIN PREFINISH PREFIN PARKING PSF POUNDS PER SQUARE FOOT PSI POUNDS PER SQUARE INCH PNT PAINT PTD PAPER TOWEL DISPENSER PTN PARTITION PVC POLYVINYL CHLORIDE	(Q) QT QUARRY TILE GTB GRANITE TILE BASE QTY QUANTITY	(R) R RADIUS, RISER R- THERMAL RESISTANCE RA RETURN AIR RIBB RIBBING BASE RD ROOF DRAIN RDL ROOF DRAIN LEADER RE REFER TO	(S) SECT SECTION SF SQUARE FOOT, FEET SFA SUPPLY AIR SAT SUSPENDED ACOUSTICAL TILE SB SPLASH BLOCK SCFD SCHEDULE SCP SCUPPER SD SMOKE DETECTOR SD SLAB ON GRADE SOS SCHEDULE SSEFT STRUCTURAL GLAZED FACED TILE	(T & @) TONGUE AND GROOVE TD TOWEL DISPENSER TEL TELEPHONE THK THICKNESS TO TOP OF TOC TOP OF CONCRETE TOH TOP OF MASONRY TOS TOP OF STEEL TON TOP OF HALL TTP TYPICAL TYP TYPICAL	(U) UNFIN UNFINISHED UN UNLESS OTHERWISE NOTED UR URINAL	(V) VAR VARIES VCT VINYL COMPOSITION TILE VERT VERTICAL VEST VESTIBULE VIF VERIFY IN FIELD VTR VENT THROUGH ROOF VVC VINYL WALL COVERING	(W) W WEST W/ WITHOUT WB WOOD BASE WBL WOOD BLOCKING WCL WATER-CLOSED WCO WALL CLEAN OUT WHD WOOD WF WOOD FLANGE WSP WORKING POINT WVSC WAINSCOT WVF WELDED WIRE FABRIC	(Y) YD YARD	REINFORCE REQD REQUIRED REV REVISION ROOF ROOF RO ROUGH OPENING RPM REVOLUTIONS PER MINUTE RTU ROOF TOP UNIT	SECTION SF SQUARE FOOT, FEET SFA SUPPLY AIR SAT SUSPENDED ACOUSTICAL TILE SB SPLASH BLOCK SCFD SCHEDULE SCP SCUPPER SD SMOKE DETECTOR SD SLAB ON GRADE SOS SCHEDULE SSEFT STRUCTURAL GLAZED FACED TILE	SHT SHEATHING SHTNG SHEATHING SIM SIMILAR SLIP JOINT SLDNG SLIDING SLT SEALANT SNZ SANITARY NAPKIN DISPENSER SNDU SANITARY NAPKIN DISPOSAL UNIT SPEC SPECIFICATION SQ SQUARE SST STAINLESS STEEL STD STANDARD STD STD STL STEEL STOR STORAGE STRUCT STRUCTURAL SUSP SUSPEND SYMM SYMMETRICAL SYS SYSTEM
--	--	---	---	--	--	---	--	--	----------------------	------------------------------------	---	--	---	---	---	--	--	--	---	---	---	--	--------------------	---	---	--

PROJECT TEAM

OWNER:
CITY & COUNTY OF DENVER
DEPT. OF PARKS AND RECREATION
201 W. COLFAX AVENUE, DEPT. 615
DENVER, COLORADO 80202

ARCHITECT:
SLATERPAULL ARCHITECTS
1331 NINETEENTH STREET
DENVER, COLORADO 80202
(303) 601-0411

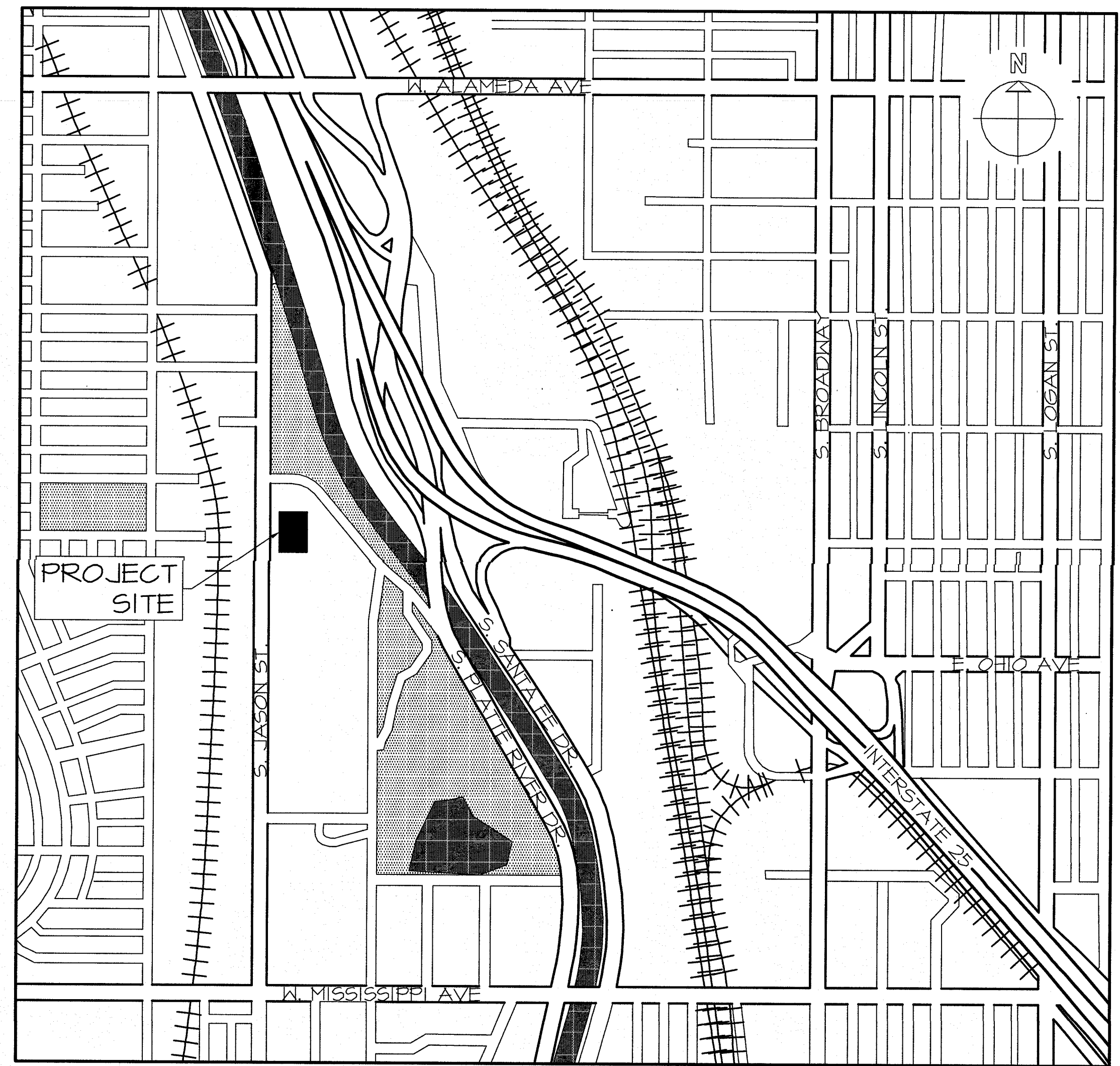
LANDSCAPE ARCHITECT:
STUDIO INSITE
3451 RINGSBY COURT, UNIT 223
DENVER, COLORADO 80216
(303) 433-1100

STRUCTURAL ENGINEER:
ANDERSON & HASTINGS CONSULTANTS, INC.
12546 WEST BAYAUD AVENUE
UNION TERRACE, SUITE 350
LAKEWOOD, COLORADO 80228
(303) 433-8486

MECHANICAL ENGINEER:
ME GROUP, INC.
107 17TH STREET, SUITE 3000
DENVER, COLORADO 80202
(303) 382-1920

ELECTRICAL ENGINEER:
COREY ELECTRICAL ENGINEERING, INC.
7822 SOUTH WHEELING COURT, SUITE B
ENGLEWOOD, COLORADO 80112
(303) 304-6440

CIVIL ENGINEER:
LUND PARTNERSHIP, INC.
12265 WEST BAYAUD AVENUE
LAKEWOOD COLORADO 80228
(303) 984-1461



ARCHITECTURAL LEGEND

CONCRETE	BRICK	DETAIL NUMBER XXX	DOOR IDENTIFICATION MARK
CONCRETE MAS. UNIT	ROUGH LUMBER	SECTION MARK (A-XXX)	KEYNOTE MARK
PLYWOOD	FINISH LUMBER	SHEET NUMBER	WINDOW TREATMENT IDENTIFICATION MARK
GYPSUM WALL BOARD	RIGID INSULATION	DETAIL NUMBER XX	DETAIL NUMBER
METAL STUD WALL	BATT INSULATION	DETAIL MARK (A-XXX)	ELEVATION MARK
		ELEVATION NUMBER	

DENVER
THE MILE HIGH CITY

SLATERPAULL
ARCHITECTS
1331 Nineteenth Street
Denver, CO 80202
P 303.607.0977
www.slaterpaull.com

CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

GENERAL INFORMATION
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

ISSUE
11/11/13 - ISSUE FOR
BIDDING & CONSTRUCTION

DRAWN BY: LDG
REVIEWED BY: JCP
Date: 11/11/2013
SHEET

G-001
SPA PROJECT NO.
10842.210

PLAN LEGEND

- 2 HOUR FIRE BARRIER - UL DESIGN U414
- 3 HOUR FIRE BARRIER - UL DESIGN U414

CODE ANALYSIS

A. GENERAL CODE SUMMARY

THE CONSTRUCTION TYPE WILL BE CLASSIFIED AS TYPE VB. THE EXISTING BUILDING WILL NOT BE EQUIPPED WITH AN AUTOMATIC SPRINKLER SYSTEM. THE FOLLOWING PARAGRAPHS OUTLINE THE DETAILED CODE ANALYSIS COMPLETED TO REACH THESE CONCLUSIONS BASED ON THE 2004 INTERNATIONAL BUILDING CODE.

B. OCCUPANCY GROUPS (IBC CHAPTER 3 AND TABLE 302.1.1)

SECTION 311 - STORAGE GROUP S
 311.2 - MODERATE-HAZARD STORAGE, GROUP S-1; BUILDINGS OCCUPIED FOR STORAGE USES THAT ARE NOT CLASSIFIED AS GROUP S-2, INCLUDING, BUT NOT LIMITED TO, STORAGE OF THE FOLLOWING: MOTOR VEHICLE REPAIR GARAGES COMPLYING WITH THE MAXIMUM ALLOWABLE QUANTITIES OF HAZARDOUS MATERIALS LISTED IN TABLE 307.1 (1).

311.3 - LOW-HAZARD STORAGE, GROUP S-2; INCLUDES, AMONG OTHERS, BUILDINGS USED FOR THE STORAGE OF NON-COMBUSTIBLE MATERIALS...

SECTION 304 - BUSINESS GROUP B
 304.1 - BUSINESS GROUP B, BUSINESS GROUP B OCCUPANCY INCLUDING THE USE OF A BUILDING OR STRUCTURE, OR PORTION THEREOF, FOR OFFICE, PROFESSIONAL OR SERVICE TYPE TRANSACTIONS, INCLUDING STORAGE OF RECORDS AND ACCOUNTS.

TABLE 508.4 - REQUIRED SEPARATION OF OCCUPANCIES (HOURS)
 NO SEPARATION IS REQUIRED BETWEEN OCCUPANCIES S-1 AND B.
 REQUIRED SEPARATION BETWEEN OCCUPANCIES S-1 AND S-2 IS 2 HOURS.

CONCLUSION
 THE MAINTENANCE BUILDING WILL BE CLASSIFIED AS GROUP S-1 MODERATE HAZARD STORAGE. OCCUPANCY GROUP B WILL BE A NON-SEPARATED USE TO STORAGE S-1 PER SECTION 508.3 AND DOES NOT REQUIRE ANY SEPARATION PER TABLE 508.4.
 OCCUPANCY GROUP S-2 WILL HAVE 2-HOUR FIRE SEPARATION TO OCCUPANCY GROUP S-1 PER TABLE 508.4.

C. CONSTRUCTION TYPES & FIRE-RESISTANCE REQUIREMENTS (IBC CHAPTER 6 AND TABLE 601 AND 602)

1. TABLE 601 - FIRE-RESISTANCE RATING REQUIREMENT FOR BUILDING ELEMENTS

BUILDING ELEMENT	TYPE VB
STRUCTURAL FRAME INCLUDING COLUMNS, GIRDERS, AND TRUSSES	0 HOURS
BEARING WALLS - EXTERIOR	0 HOURS
BEARING WALLS - INTERIOR	0 HOURS
NON-BEARING WALLS & PARTITIONS - EXTERIOR	0 HOURS
NON-BEARING WALLS & PARTITIONS - INTERIOR	0 HOURS
FLOOR CONSTRUCTION INCLUDING SUPPORTING BEAMS AND JOISTS	0 HOURS
ROOF CONSTRUCTION INCLUDING SUPPORTING BEAMS AND JOISTS	0 HOURS

2. TABLE 602 - FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE

FIRE SEPARATION DISTANCE X 5'	TYPE OF CONSTRUCTION	GROUP S-1 RATING	GROUP B RATING
5' ≤ X < 10'	VB	1	1
10' ≤ X < 30'	VB	0	0
X ≥ 30'	VB	0	0

D. ALLOWABLE FLOOR AREA, NUMBER OF STORIES, AND MAXIMUM HEIGHT (SECTIONS 504 AND 506)

- PER TABLE 503, GROUP S-1 OCCUPANCIES OF TYPE VB CONSTRUCTION ARE ALLOWED 9,000 SQUARE FEET PER FLOOR AND 1 STORY (40 FEET MAXIMUM HEIGHT).
- SQUARE FOOTAGE INCREASE DUE TO FRONTAGE (SECTION 506.2) ALLOWS: 100 [(F/P) - 25] W/30 = 100 [(523/523) - 25] (30/30) = 75
- TOTAL SQUARE FOOTAGE INCREASE = 9,000 + [(9,000 + 75)/100] = 15,750 SQUARE FEET PER FLOOR.
- ACTUAL SQUARE FOOTAGE: 14,196 SF

E. FIRE PROTECTION SYSTEM (CHAPTER 9)

SECTION 903.2.1 - GROUP S-1. AN AUTOMATIC SPRINKLER SYSTEM SHALL BE PROVIDED THROUGHOUT ALL BUILDINGS CONTAINING A GROUP S-1 OCCUPANCY WHERE ONE OF THE FOLLOWING CONDITIONS EXIST:
 1. A GROUP S-1 FIRE AREA EXCEEDS 12,000 SF

SECTION 903.2.1.1 - REPAIR GARAGES. AN AUTOMATIC SPRINKLER SYSTEM SHALL BE PROVIDED THROUGHOUT ALL BUILDINGS USED AS REPAIR GARAGES IN ACCORDANCE WITH SECTION 406 AS SHOWN:
 2. BUILDING NO MORE THAN ONE STORY ABOVE GRADE PLANE WITH A FIRE AREA CONTAINING A REPAIR GARAGE EXCEEDING 12,000 SF.

CONCLUSION. THE S-1 FIRE AREA IS 11,446 SF AND THEREFORE, PER SECTION 903, DOES NOT REQUIRE AN AUTOMATIC SPRINKLER SYSTEM. THE BUILDING WILL BE FULLY DETECTED.

F. OCCUPANT LOAD AND EXIT REQUIREMENTS (CHAPTER 10)

- OCCUPANT LOADS WILL BE CALCULATED IN ACCORDANCE WITH IBC TABLE 1004.1.1. USING ALL THE OCCUPIED SPACES TO CALCULATE THE MAXIMUM OCCUPANCY, THE CODE DETERMINED OCCUPANT LOAD IS 77 OCCUPANTS (SEE OCCUPANT LOAD TABLE THIS SHEET).
- ALL S-1 OCCUPANCIES UNDER 29 OCCUPANTS REQUIRE ONE EXIT. S-1 OCCUPANCIES GREATER THAN 29 OCCUPANTS REQUIRE TWO EXITS. EXIT DOORS SWING IN THE DIRECTION OF EGRESS AND ARE EQUIPPED WITH PANIC HARDWARE WHEN SERVING AN OCCUPANCY GREATER THAN 29 (SECTION 1008.1.2). THE MAXIMUM LENGTH OF EXIT ACCESS MEASURED FROM THE MOST REMOTE POINT TO AN EXIT OR EXIT DISCHARGE IN A BUILDING IS 200' (PER TABLE 1016.1)

G. PLUMBING FIXTURE COUNT (IBC CHAPTER 24)

- SECTION 419.2 OF THE INTERNATIONAL PLUMBING CODE ALLOWS UP TO 2/3 OF REQUIRED WATER CLOSETS TO BE REPLACED BY URINALS FOR MALE OCCUPANTS.
- USING ALL SPACES TO CALCULATE THE OCCUPANT LOAD FOR TOILET FIXTURES, THE CODE DETERMINED OCCUPANT LOAD IS 78 OCCUPANTS (39 MALES AND 39 FEMALES) - SEE PLUMBING FIXTURE COUNT TABLE THIS SHEET.

H. CODES AND REGULATIONS

- 2004 INTERNATIONAL BUILDING CODE - IBC
- 2004 INTERNATIONAL FIRE CODE - IFC
- 2004 INTERNATIONAL MECHANICAL CODE - IMC
- 2012 NATIONAL ELECTRIC CODE - NEC
- 2004 INTERNATIONAL PLUMBING CODE
- THE AMERICANS WITH DISABILITIES ACT OF 1990, TITLE II
- ICC/ANSI A117.1 - 2003 AMERICAN NATIONAL STANDARD - ACCESSIBLE AND USABLE BUILDINGS AND FACILITIES

I. REGULATORY AGENCIES
 CITY AND COUNTY OF DENVER
 DENVER FIRE DEPARTMENT
 DENVER WASTEWATER

OCCUPANT LOAD TABLE

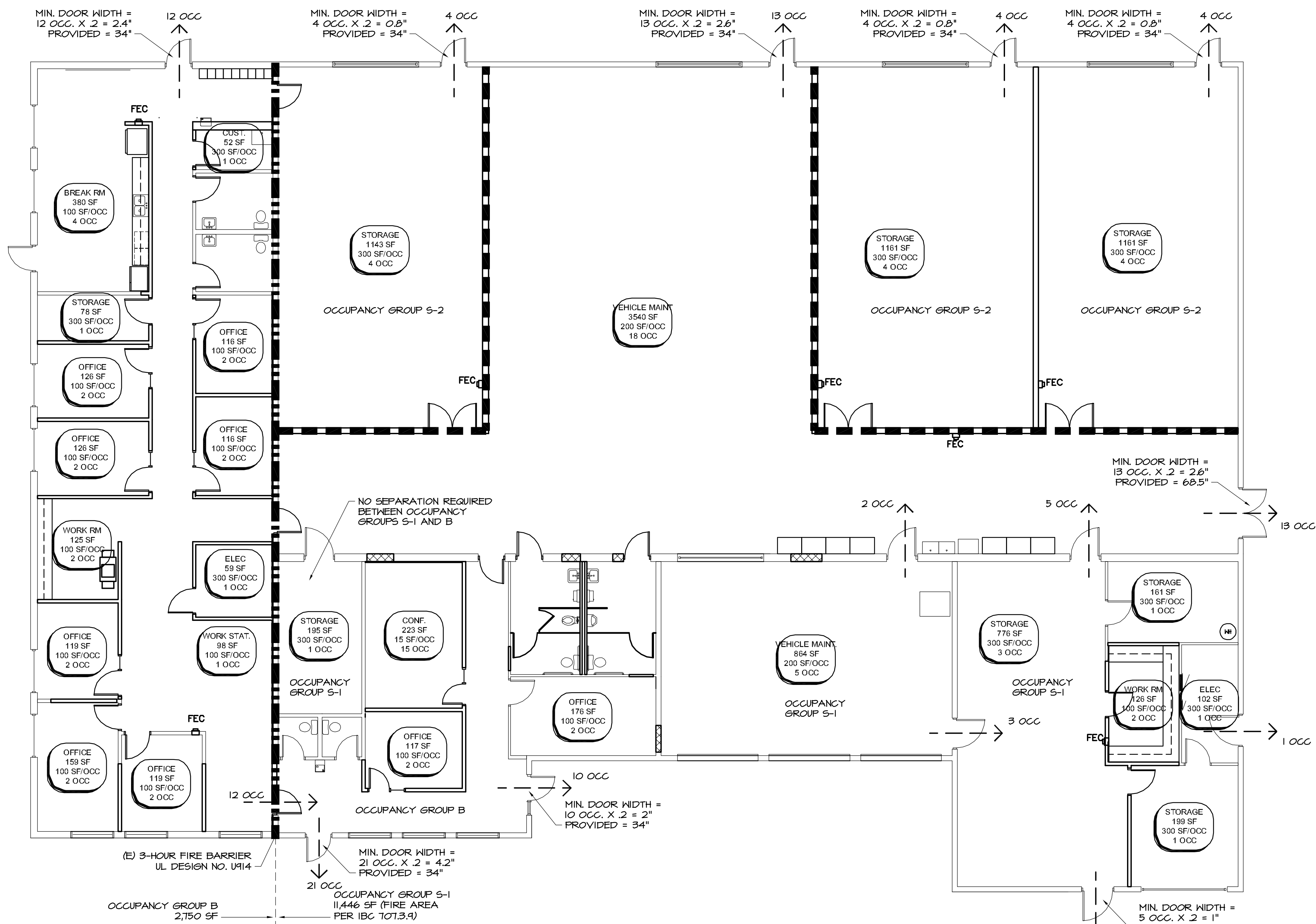
Room Name	Square Footage	Occ Load Factor	Occupant Load	Occupant Load for Toilet Fixture Count
Storage	4549	300	16	16
Administration	1903	100	20	20
Vehicle Maintenance	4904	200	23	23
Conference	223	15	15	15
Mech/Elec/Custodial	213	300	3	3
Total Occupant Load - Exiting			77	
Total Occ. Load - Fixture Count				77

PLUMBING FIXTURE COUNT TABLES

IBC Table 2902.1

Use Group	Description	Water Closets			Lavatories			Drinking Fountains	Other	
		Male	Female	Unisex	Male	Female	Unisex			
B	Business	Design load calculations in parentheses							1 per 100	1 service sink
		1 per 25 for first 50		1 per 40 for first 80						
		Calculated Occupancy - 24 (12 Males/12 Females)								
		Male	Female	Unisex	Male	Female	Unisex			
	Required Fixtures:	1	1	0	1	1	0	1	1 service sink	
	Provided Fixtures:	2	2	0	2	2	0	1	1 service sink	

Use Group	Description	Calculated Occupancy - 54 (27 Males/27 Females)			Drinking Fountains	Other			
		Male	Female	Unisex					
S-1	Mod. Hazard Storage	1 per 100				1 per 1,000	1 service sink		
		1 per 100							
		Calculated Occupancy - 509 (255 Males/255 Females)							
		Male	Female	Unisex	Male	Female	Unisex		
	Required Fixtures:	1	1	1	1	1	1	1	1 service sink
	Provided Fixtures:	2 [1 is urinal]	2	1	1	1	1	1	1 service sink



A1 CODE PLAN
 SCALE: 1/8"=1'-0"



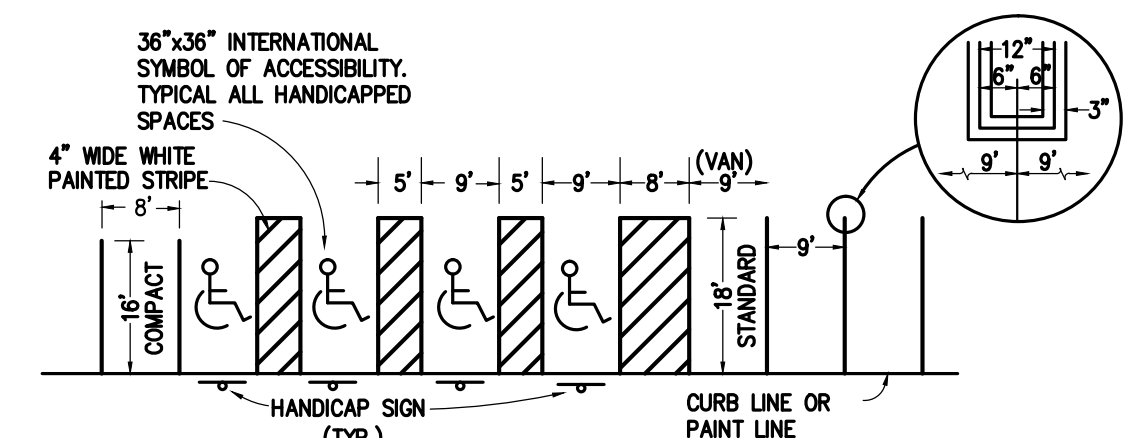
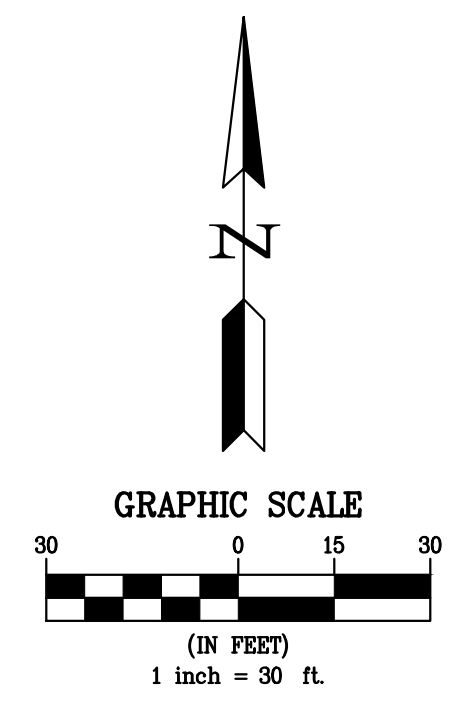
CITY AND COUNTY OF DENVER
 DEPARTMENT OF
 PARKS & RECREATION
 201 West Colfax Avenue, Dept. 613
 Denver, Colorado 80202

CODE PLAN
 S. JASON STREET
 MAINTENANCE FACILITY
 678 S. Jason Street
 Denver, Colorado 80223

ISSUE
 1. 11/13 - ISSUE FOR
 BIDDING & CONSTRUCTION

DRAWN BY: LDG
 REVIEWED BY: JCP
 Date: 11/11/2013

G-100
 SPA PROJECT NO.
 10842.110



NOTES:
1. MINIMUM STALL SHALL BE 9'-0". HANDICAP SPACES SHALL BE 14'-0" (9' STALL W/ 5' STRIPED MEDIAN) AND VAN HANDICAP SPACES SHALL BE 17'-0" (9' STALL W/ 8' STRIPED MEDIAN).
2. STRIPING SHALL BE 4" WIDE AND SHALL BE PAINTED WITH A NON-REFLECTORIZED WHITE PAINT.

TYPICAL 90° AND HANDICAP PARKING DETAIL
NO SCALE

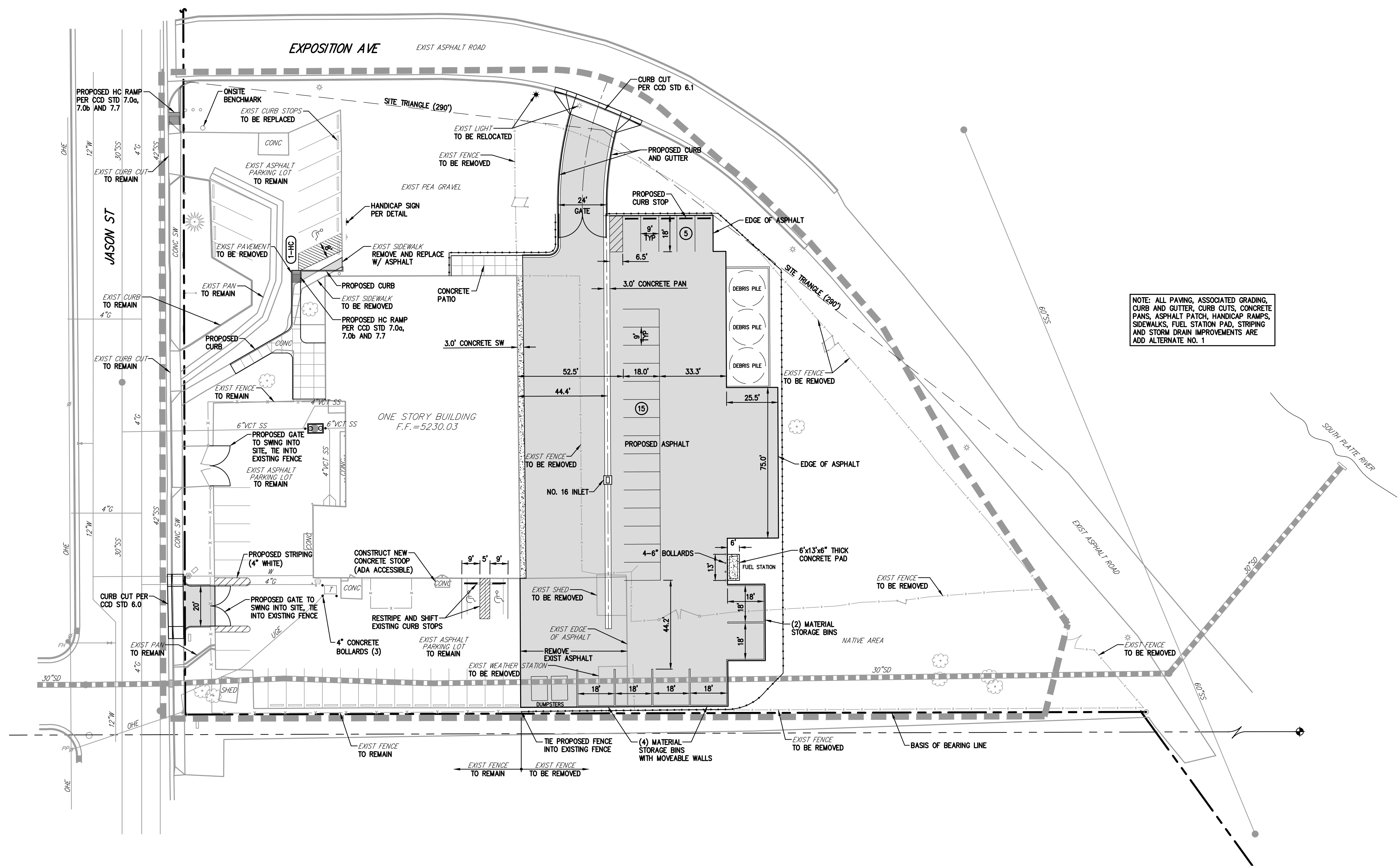
LEGEND:

---	LOT LINE / RIGHT-OF-WAY
-x-x-	EXISTING FENCE
*	EXISTING LIGHT
●	EXISTING MANHOLE
□	EXISTING INLET
12"W	EXISTING WATER
42"SS	EXISTING SANITARY SEWER
4"G	EXISTING GAS
OHE	EXISTING OVERHEAD ELECTRIC
30"SD	EXISTING STORM DRAIN
*	PROPOSED LIGHT
→	TRAFFIC FLOW DIRECTION
-o-o-	PROPOSED FENCE
---	EXCEPT WHERE NOTED, PROPOSED 6" VERTICAL CURB AND GUTTER
▨	PROPOSED ASPHALT (PER GEOTECHNICAL REPORT)
---	LIMITS OF WORK

NOTES:

- DRIVES ARE ASPHALT WITH 6" VERTICAL CURB AND GUTTER UNLESS OTHERWISE NOTED.
- REFER TO ARCHITECT DRAWING A-100 FOR DEMOLITION SCOPE.

NOTE: ALL PAVING, ASSOCIATED GRADING, CURB AND GUTTER, CURB CUTS, CONCRETE PANS, ASPHALT PATCH, HANDICAP RAMPS, SIDEWALKS, FUEL STATION PAD, STRIPING AND STORM DRAIN IMPROVEMENTS ARE ADD ALTERNATE NO. 1



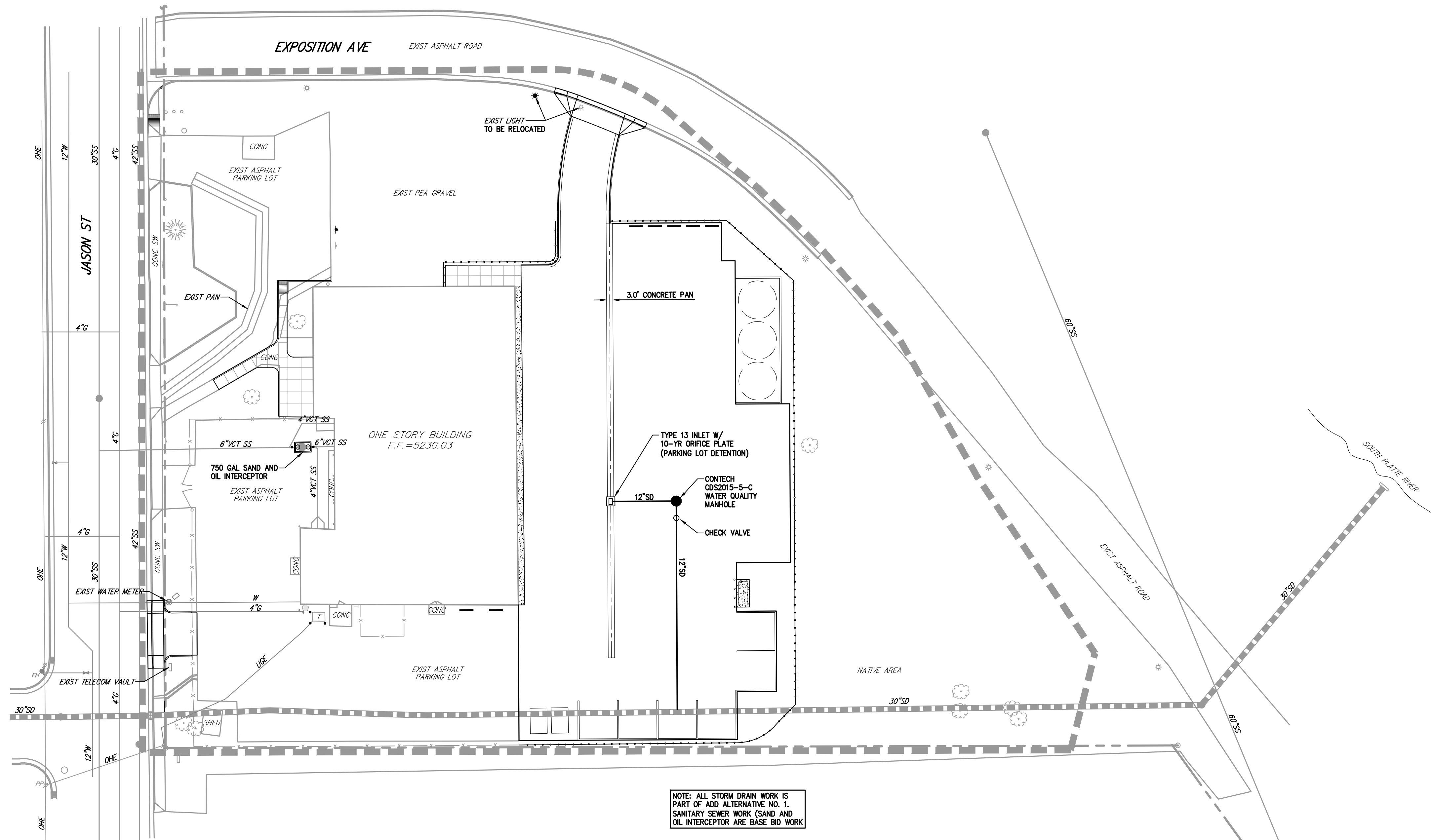
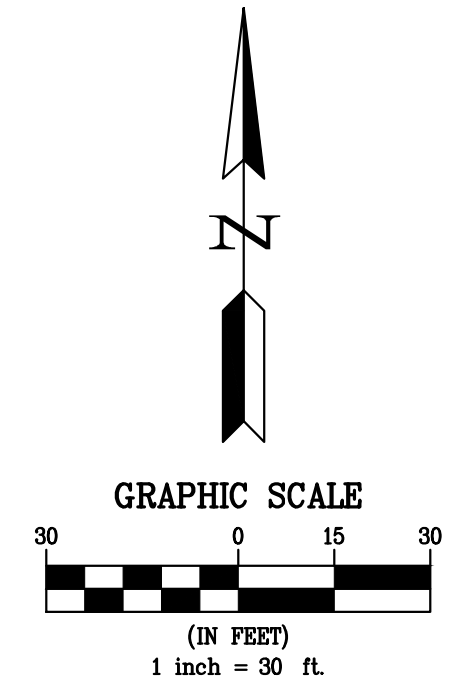
P:\057\0201\Drawings\Plan\CD\1-1 Site.dwg, Arch, 5/16/2014 9:15:10 AM, 1:1, JKO, JKO

ISSUE

1. 11/11/13 BIDDING AND CONSTRUCTION

DRAWN BY:
REVIEWED BY:
Date: 4/20/2012
SHEET
















C1-1



EARTHWORK NOTES:

1. DUE TO ASBESTOS CONTAMINATED SOILS ON SITE, THE CONTRACTOR MUST AT ALL TIMES FULLY COMPLY WITH THE CITY'S ASBESTOS-CONTAMINATED SOIL MANAGEMENT STANDARD OPERATING PROCEDURE, DATED DECEMBER 3, 2010. THE CONTRACTOR MUST PREPARE AND SUBMIT TO THE PROJECT MANAGER A MATERIALS MANAGEMENT PLAN FOR REVIEW BY THE CITY'S DEPARTMENT OF ENVIRONMENTAL HEALTH. THE CONTRACTOR MAY NOT COMMENCE ANY EXCAVATION, EARTHWORK, OR ANY OPERATIONS THAT COULD POTENTIALLY DISTURB THE ON-SITE SOILS, UNTIL THE CITY'S DEPARTMENT OF ENVIRONMENTAL HEALTH HAS REVIEWED AND APPROVED THE MATERIALS MANAGEMENT PLAN. THE CONTRACTOR MUST AT ALL TIMES COMPLY WITH THE APPROVED MATERIALS MANAGEMENT PLAN.
2. EARTHWORK SHALL INCLUDE THE REMOVAL AND REPLACEMENT OF ANY ONSITE SOIL FOR:
 - A. PARKING LOT AND SIDEWALKS
 - B. TRENCHING FOR UTILITIES AND APPURTANANCES
 - C. FOUNDATIONS FOR FLOOD WALLS AND FLOOD GATES
 - D. BUILDING FOUNDATIONS

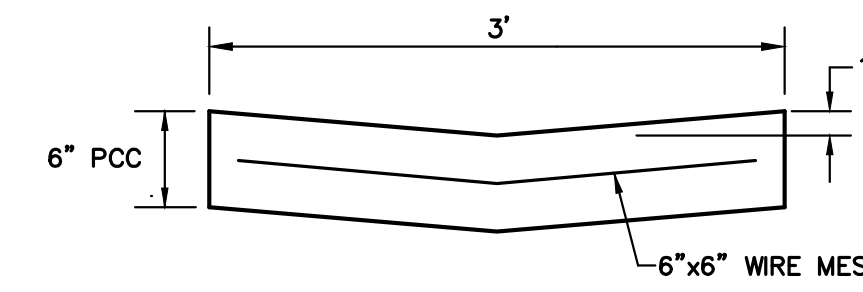
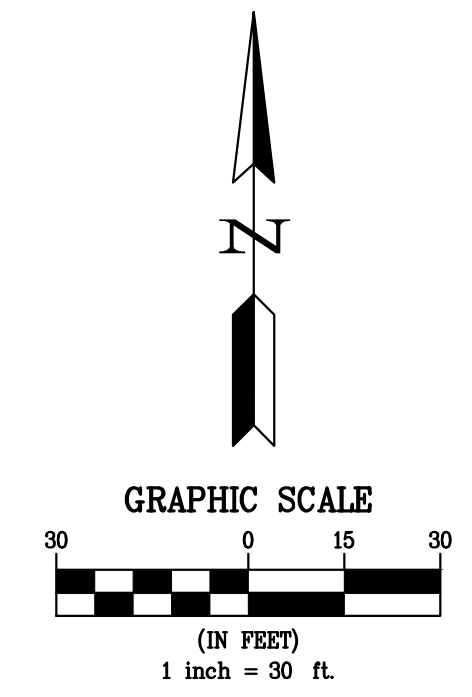
LEGEND:

-  EXISTING LIGHT
-  EXISTING MANHOLE
-  EXISTING INLET
-  EXISTING GATE VALVE
-  EXISTING WATER
-  EXISTING SANITARY SEWER
-  EXISTING GAS
-  EXISTING OVERHEAD ELECTRIC
-  EXISTING UNDERGROUND ELECTRIC
-  EXISTING STORM DRAIN
-  PROPOSED LIGHT
-  PROPOSED MANHOLE
-  PROPOSED INLET
-  PROPOSED STORM DRAIN (PVC)
-  LIMITS OF WORK

P:\357\0201\Draw\Plan\CD\1-2 Overall Utility.dwg, Arch: 5/16/2014 9:24:15 AM, 1:1, JKO, JKO

CONSTRUCTION NOTES:

- ① CONSTRUCT 6" CURB AND GUTTER (CATCH)
PER CCD STD DWG 5.3a
- ② CONSTRUCT 6" CURB AND GUTTER (SPILL)
PER CCD STD DWG 5.3a
- ③ CONSTRUCT CURB CUTS
PER CCD STD DWG 6.1
- ④ CONSTRUCT 3' CONCRETE PAN PER DETAIL
THIS SHEET
- ⑤ CONSTRUCT ASPHALT PATCH
PER CCD STD DWG 12.3a AND 12.3b
- ⑥ CONSTRUCT HANDICAP RAMP
PER CCD STD DWG 7.1 TYPE 1
- ⑦ CONSTRUCT ASPHALT PAVEMENT
PER GEOTECHNICAL REPORT
- ⑧ CONSTRUCT CONCRETE SIDEWALK
PER CCD STD DWG 5.2 AND 5.4
AND GEOTECHNICAL REPORT



3-FOOT WIDE CONCRETE PAN
NO SCALE

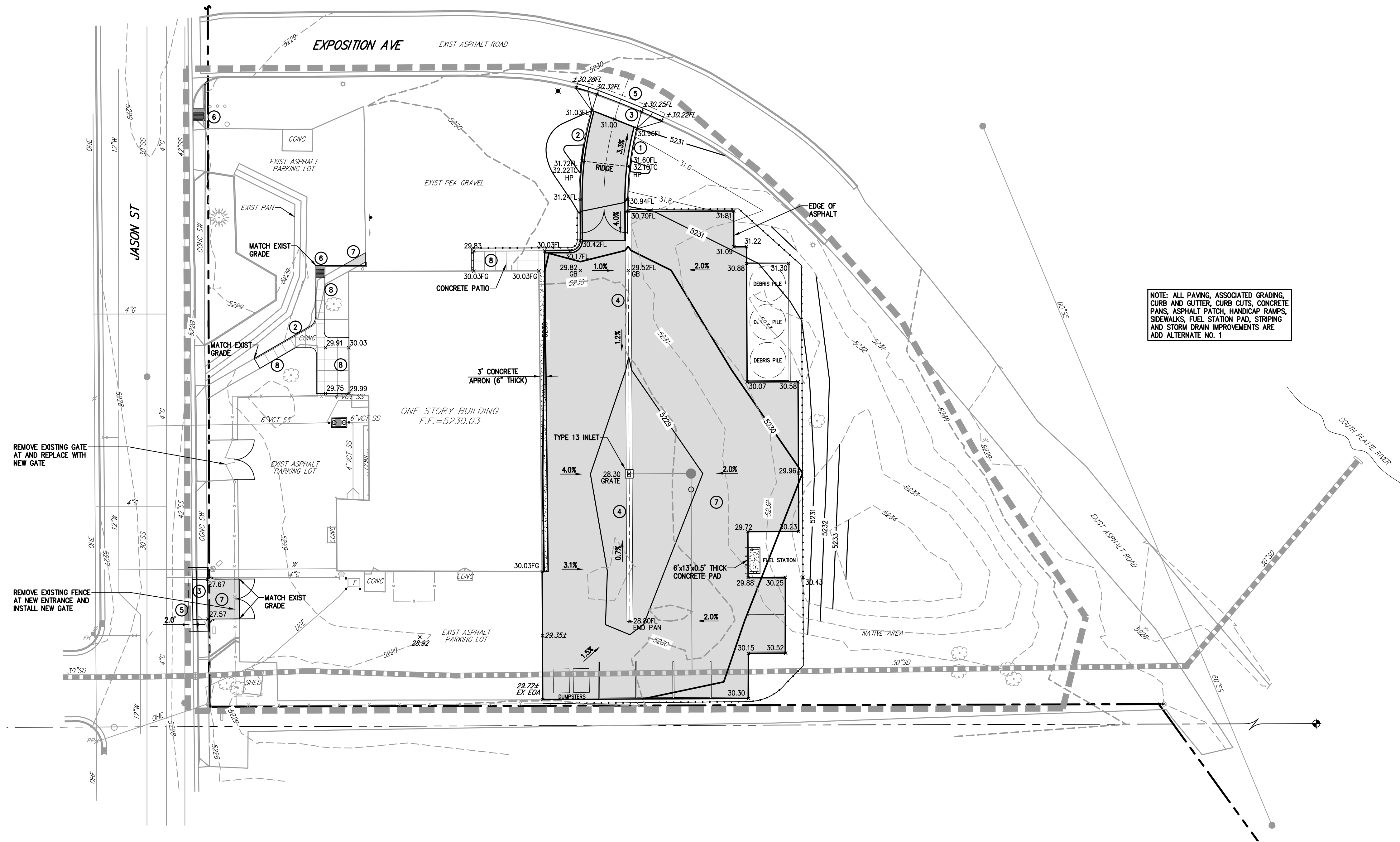
GENERAL NOTES:

1. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH CITY AND COUNTY OF DENVER STANDARDS.
2. VERIFY EXISTING UTILITY LOCATIONS PRIOR TO CONSTRUCTION AND NOTIFY THE ENGINEER IF ANY CONFLICTS WITH THE DRAWINGS OCCUR.
3. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROTECT EXISTING UTILITY LINES SHOWN ON THE PLANS AND THOSE UTILITY LINES WHICH MAY NOT BE SHOWN. THE CONTRACTOR SHALL NOTIFY ALL UTILITY COMPANIES FORTY-EIGHT (48) HOURS PRIOR TO CONSTRUCTION.
4. PROPOSED SPOT ELEVATIONS AT CURB LINE ARE FLOWLINE ELEVATION.
5. WALKS SHALL NOT EXCEED 5% WITH A MAXIMUM CROSS SLOPE OF 2%.
6. CONTOURS ARE FINISHED GRADE.
7. ALL EXISTING UTILITIES IN THE REVISED GRADED AREA ARE TO BE BROUGHT TO FINISHED GRADE. (I.E. MANHOLE RIMS, VALVES, ETC.)
8. IF THERE ARE ANY CONFLICTS WITH GRADES PLEASE NOTIFY THE ENGINEER AS SOON AS POSSIBLE.
9. BASED ON THE 1985 FHAD STUDY THE FLOODWAY IS CONFINED TO THE SOUTH PLATTE RIVER CHANNEL.
10. SEE GEOTECHNICAL REPORT PREPARED BY SHANNON & WILSON, DATED OCTOBER 2, 2012 FOR SIDEWALK AND PAVEMENT DESIGN.

EARTHWORK NOTES:

1. DUE TO ASBESTOS CONTAMINATED SOILS ON SITE, THE CONTRACTOR MUST AT ALL TIMES FULLY COMPLY WITH THE CITY'S ASBESTOS-CONTAMINATED SOIL MANAGEMENT STANDARD OPERATING PROCEDURE, DATED DECEMBER 3, 2010. THE CONTRACTOR MUST PREPARE AND SUBMIT TO THE PROJECT MANAGER A MATERIALS MANAGEMENT PLAN FOR REVIEW BY THE CITY'S DEPARTMENT OF ENVIRONMENTAL HEALTH. THE CONTRACTOR MAY NOT COMMENCE ANY EXCAVATION, EARTHWORK, OR ANY OPERATIONS THAT COULD POTENTIALLY DISTURB THE ON-SITE SOILS, UNTIL THE CITY'S DEPARTMENT OF ENVIRONMENTAL HEALTH HAS REVIEWED AND APPROVED THE MATERIALS MANAGEMENT PLAN. THE CONTRACTOR MUST AT ALL TIMES COMPLY WITH THE APPROVED MATERIALS MANAGEMENT PLAN.
2. EARTHWORK SHALL INCLUDE THE REMOVAL AND REPLACEMENT OF ANY ONSITE SOIL FOR:
 - A. PARKING LOT AND SIDEWALKS
 - B. TRENCHING FOR UTILITIES AND APPURTANANCES
 - C. FOUNDATIONS FOR FLOOD WALLS AND FLOOD GATES
 - D. BUILDING FOUNDATIONS
3. CONTRACTOR IS RESPONSIBLE FOR PREPARING THE STORMWATER MANAGEMENT PLAN (SWMP). CONTRACTOR IS RESPONSIBLE FOR OBTAINING THE CONSTRUCTION ACTIVITIES STORMWATER DISCHARGE PERMIT (CASDP) AND THE STATE CONSTRUCTION STORMWATER PERMIT. SEE SECTION 208 IN THE SPECIFICATIONS.

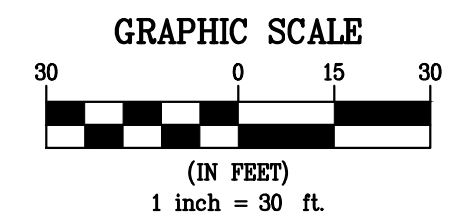
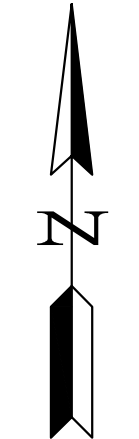
NOTE: ALL PAVING, ASSOCIATED GRADING, CURB AND GUTTER, CURB CUTS, CONCRETE PANS, ASPHALT PATCH, HANDICAP RAMPS, SIDEWALKS, FUEL STATION PAD, STRIPING AND STORM DRAIN IMPROVEMENTS ARE ADD ALTERNATE NO. 1



LEGEND:

	EXISTING CONTOUR	5230.10LP	PROPOSED SPOT ELEVATION LOW POINT
	EXISTING STORM DRAIN	5230.10FL	PROPOSED SPOT ELEVATION FLOWLINE
	EXISTING INLET	5230.10GB	PROPOSED SPOT ELEVATION GRADE BREAK
	EXISTING MANHOLE	5230.10TC	PROPOSED SPOT ELEVATION TOP OF CURB
	PROPOSED CONTOUR		PROPOSED FENCE
	PROPOSED STORM DRAIN		PROPOSED ASPHALT (PER GEOTECHNICAL REPORT)
	PROPOSED INLET		LIMITS OF WORK
	PROPOSED SLOPE		
	PROPOSED SPOT ELEVATION FINISH GRADE		

P:\057\0201\Draw\Plan\CD\02-1 Grading.dwg, Arch, 5/6/2014 9:25:23 AM, L1, .dwg, .dwg



GENERAL NOTES:

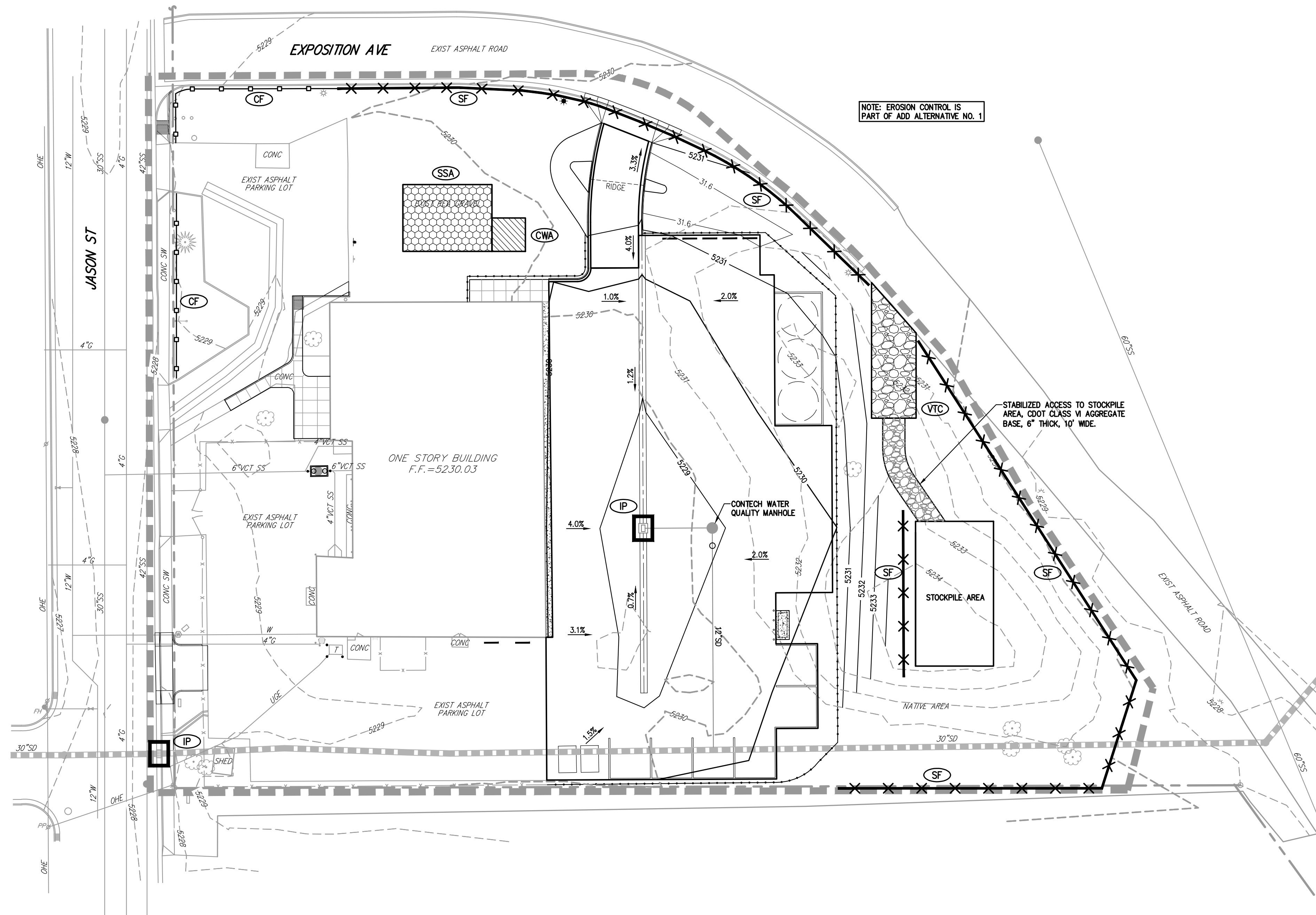
1. ALL DISTURBED AREAS THAT WILL NOT BE PAVED SHALL BE SEEDED AND MULCHED OR LANDSCAPED.
2. SEE SHEET C2-3 FOR EROSION CONTROL DETAILS.

EROSION CONTROL NOTES (CITY AND COUNTY OF DENVER):

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 SUCH 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 SWEEPED 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)

EARTHWORK NOTES:

1. DUE TO ASBESTOS CONTAMINATED SOILS ON SITE, THE CONTRACTOR MUST AT ALL TIMES FULLY COMPLY WITH THE CITY'S ASBESTOS-CONTAMINATED SOIL MANAGEMENT STANDARD OPERATING PROCEDURE, DATED DECEMBER 3, 2010. THE CONTRACTOR MUST PREPARE AND SUBMIT TO THE PROJECT MANAGER A MATERIALS MANAGEMENT PLAN FOR REVIEW BY THE CITY'S DEPARTMENT OF ENVIRONMENTAL HEALTH. THE CONTRACTOR MAY NOT COMMENCE ANY EXCAVATION, EARTHWORK, OR ANY OPERATIONS THAT COULD POTENTIALLY DISTURB THE ON-SITE SOILS, UNTIL THE CITY'S DEPARTMENT OF ENVIRONMENTAL HEALTH HAS REVIEWED AND APPROVED THE MATERIALS MANAGEMENT PLAN. THE CONTRACTOR MUST AT ALL TIMES COMPLY WITH THE APPROVED MATERIALS MANAGEMENT PLAN.
2. EARTHWORK SHALL INCLUDE THE REMOVAL AND REPLACEMENT OF ANY ONSITE SOIL FOR:
 - A. PARKING LOT AND SIDEWALKS
 - B. TRENCHING FOR UTILITIES AND APPURTENANCES
 - C. FOUNDATIONS FOR FLOOD WALLS AND FLOOD GATES
 - D. BUILDING FOUNDATIONS
3. CONTRACTOR IS RESPONSIBLE FOR PREPARING THE STORMWATER MANAGEMENT PLAN (SWMP). CONTRACTOR IS RESPONSIBLE FOR OBTAINING THE CONSTRUCTION ACTIVITIES STORMWATER DISCHARGE PERMIT (CASDP) AND THE STATE CONSTRUCTION STORMWATER PERMIT. SEE SECTION 208 IN THE SPECIFICATIONS.



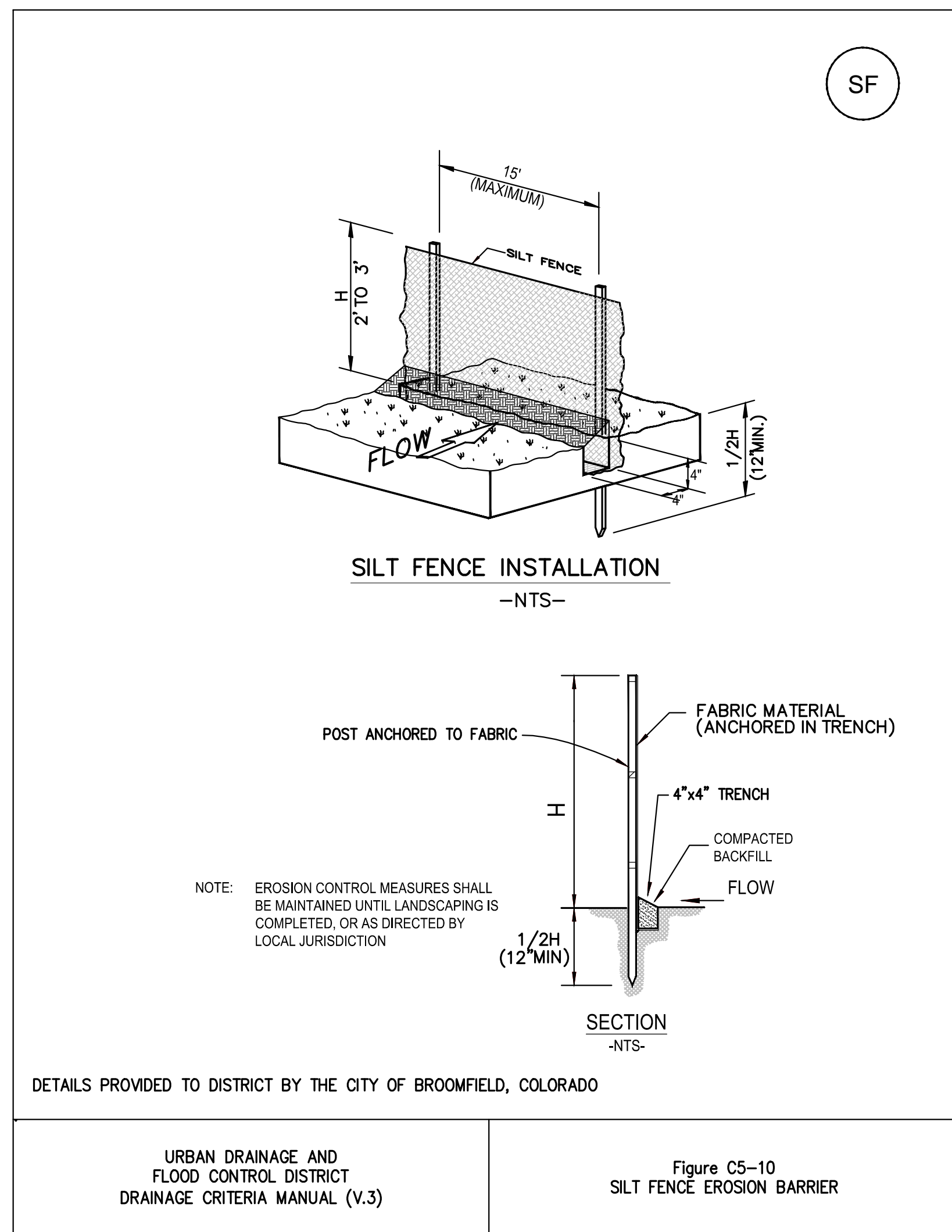
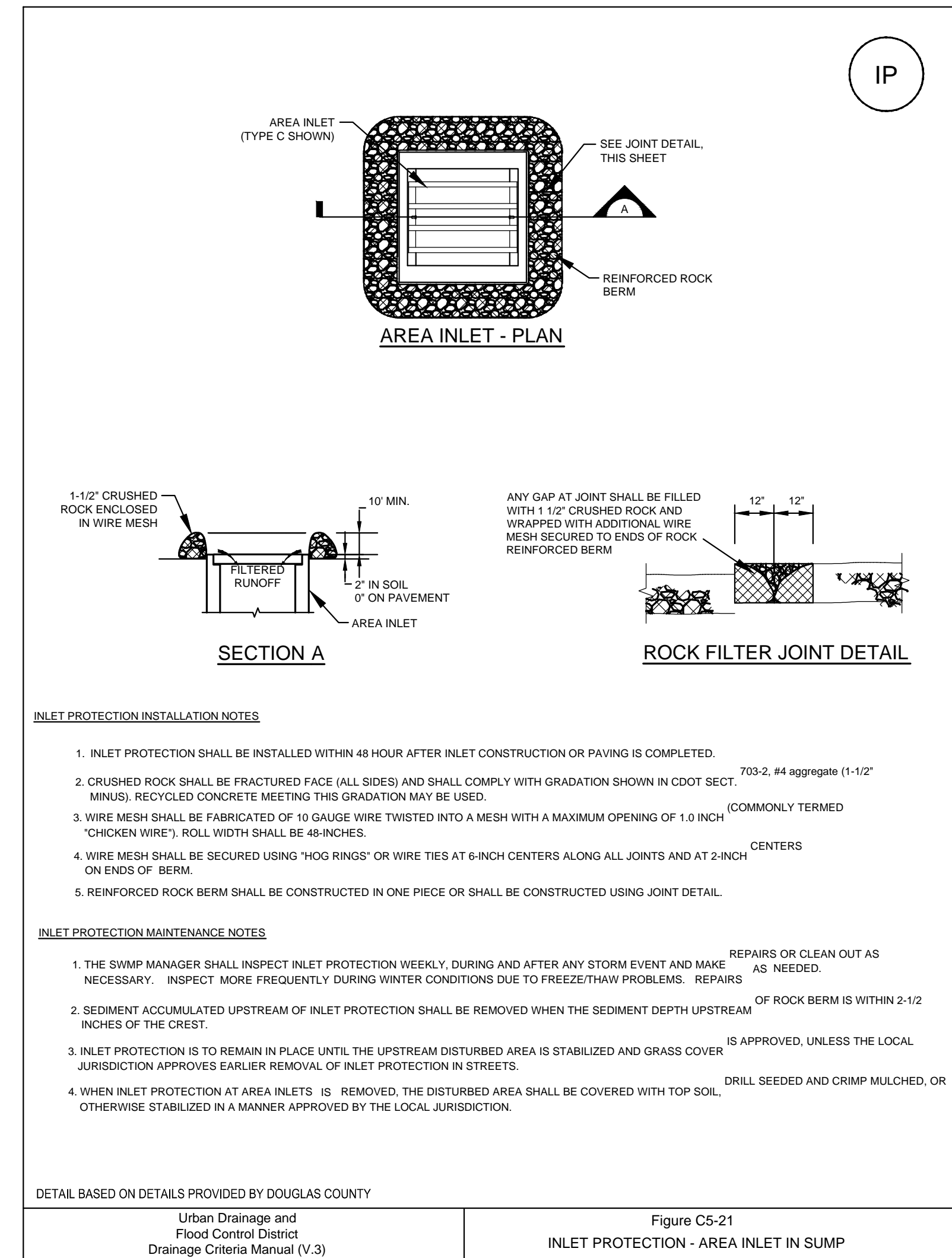
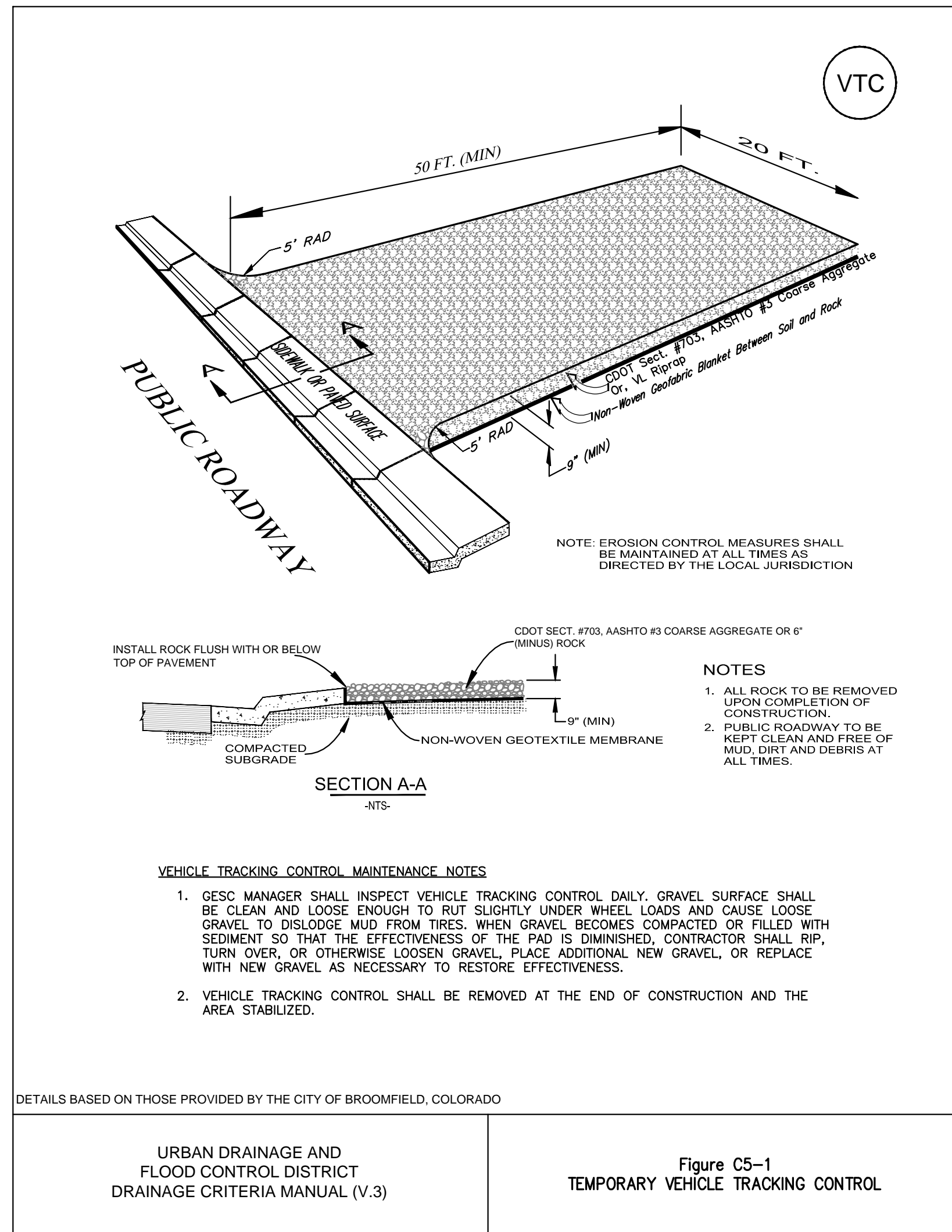
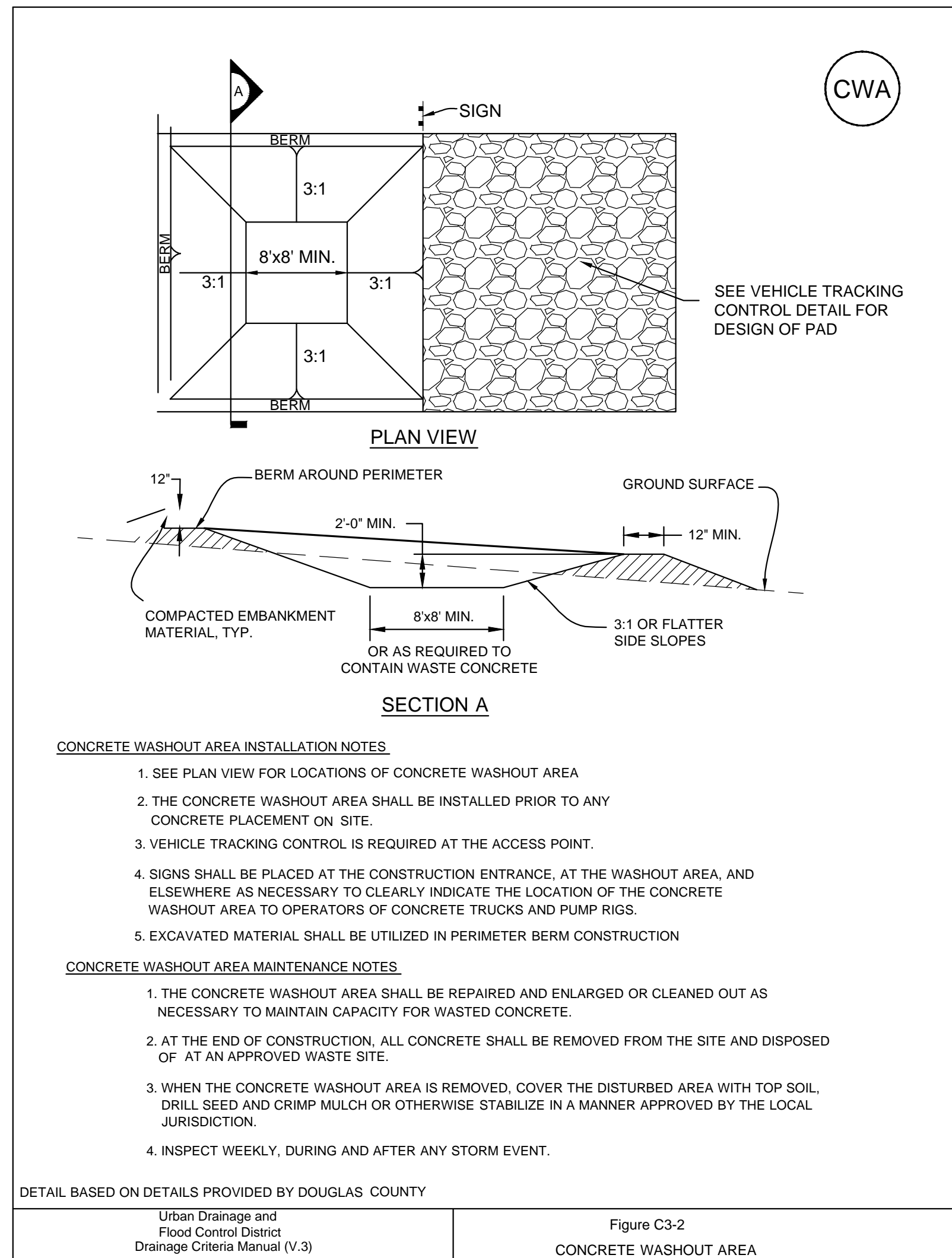
NOTE: EROSION CONTROL IS PART OF ADD ALTERNATIVE NO. 1

LEGEND:

- 5340 --- EXISTING CONTOUR
- 5340 — PROPOSED CONTOUR
- 24\"/>

EROSION CONTROL PHASING SCHEDULE	
INITIAL PLAN (INITIAL)	<ul style="list-style-type: none"> - VEHICLE TRACKING CONTROL - SILT FENCE - CONSTRUCTION FENCE - STABILIZED STAGING AREA - INLET PROTECTION ON EXISTING INLETS - REINFORCED ROCK BERMS AT EXISTING DRIVEWAYS
INTERIM PLAN (INTERIM)	<ul style="list-style-type: none"> - MAINTAIN INITIAL EROSION CONTROL DEVICES - CONCRETE WASHOUT AREA - INLET PROTECTION ON NEW INLETS
FINAL PLAN (FINAL)	<ul style="list-style-type: none"> - SEEDING AND MULCHING - FINAL LANDSCAPING

P:\057\0201\Draw\Plan\Plan\CD\02-2 Erosion.dwg, Arch, 5/6/2014 9:25:51 AM, 1:1, wcl, 400



SLATERPAULL ARCHITECTS
1331 Nineteenth Street
Denver, CO 80202
P 303.607.0977
www.slaterpaul.com

CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

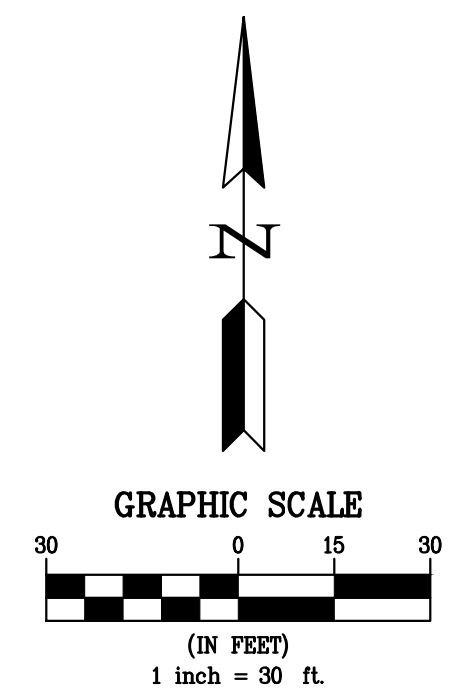
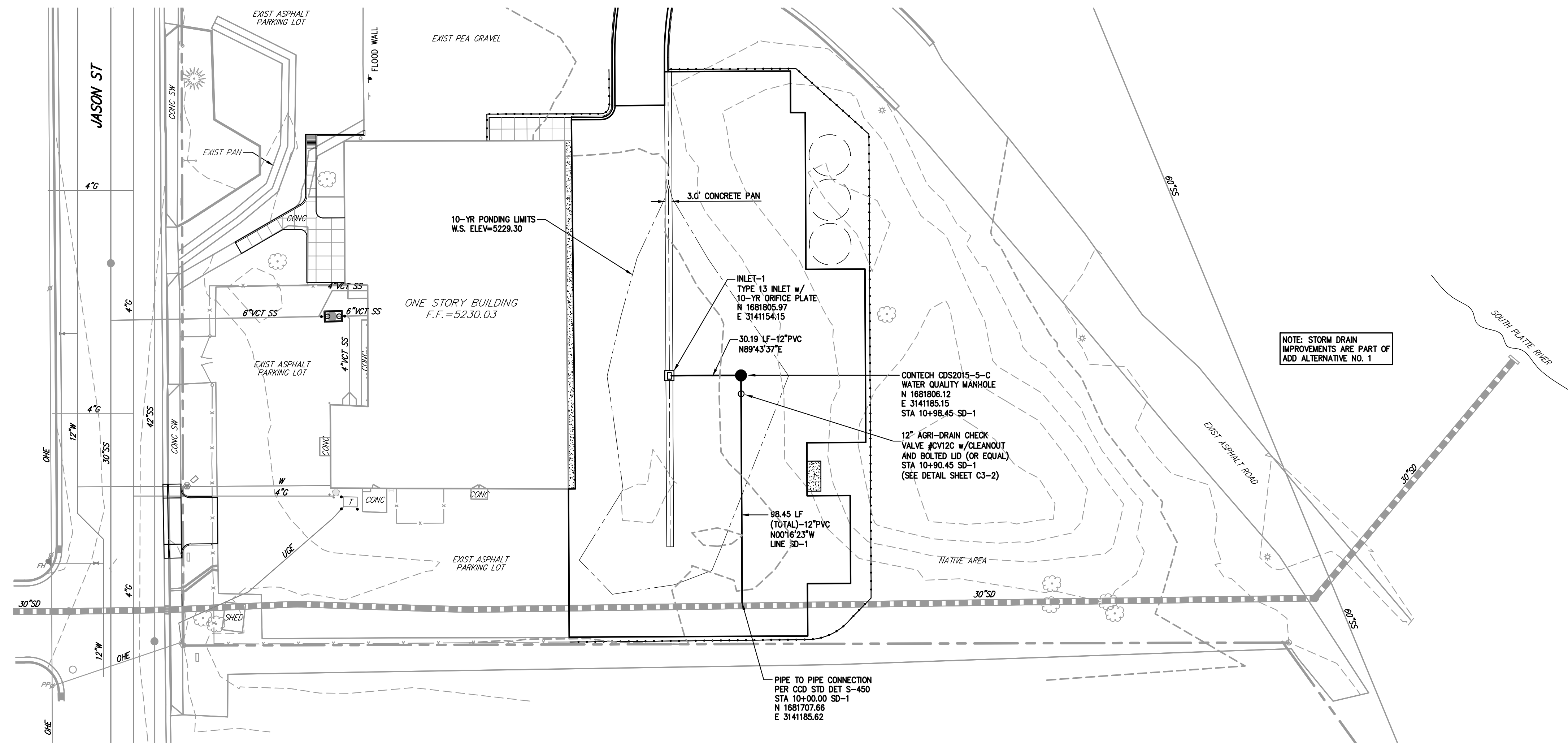
EROSION CONTROL DETAILS
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

ISSUE
1. 11/11/13 BIDDING AND CONSTRUCTION

DRAWN BY:
REVIEWED BY:
Date: 4/20/2012
SHEET

C2-3

P:\357\0201\Drawings\Plan\CD\CD-C2-3 Erosion Details.dwg, Rev. 5/17/2014 9:26:19 AM, 1:1, JKO, JKO

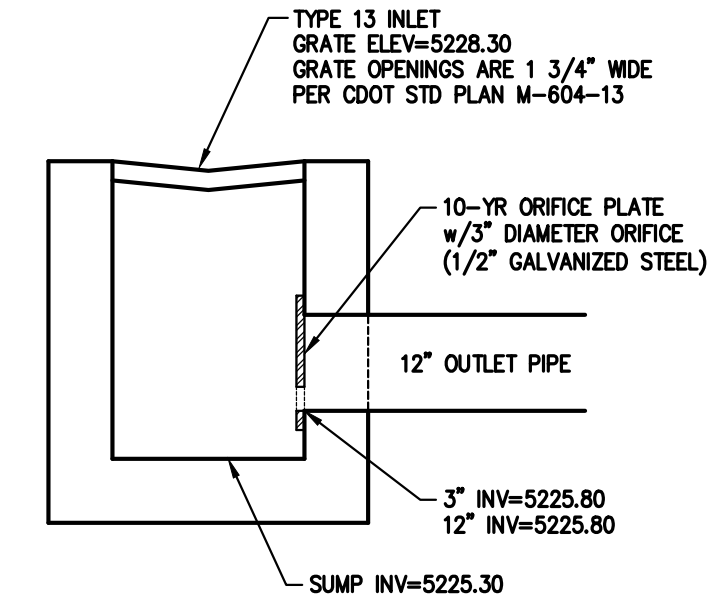


- LEGEND:**
- EXISTING LIGHT
 - EXISTING MANHOLE
 - EXISTING INLET
 - EXISTING GATE VALVE
 - EXISTING WATER
 - EXISTING SANITARY SEWER
 - EXISTING GAS
 - EXISTING OVERHEAD ELECTRIC
 - EXISTING UNDERGROUND ELECTRIC
 - EXISTING STORM DRAIN
 - PROPOSED LIGHT
 - PROPOSED MANHOLE
 - PROPOSED INLET
 - PROPOSED STORM DRAIN

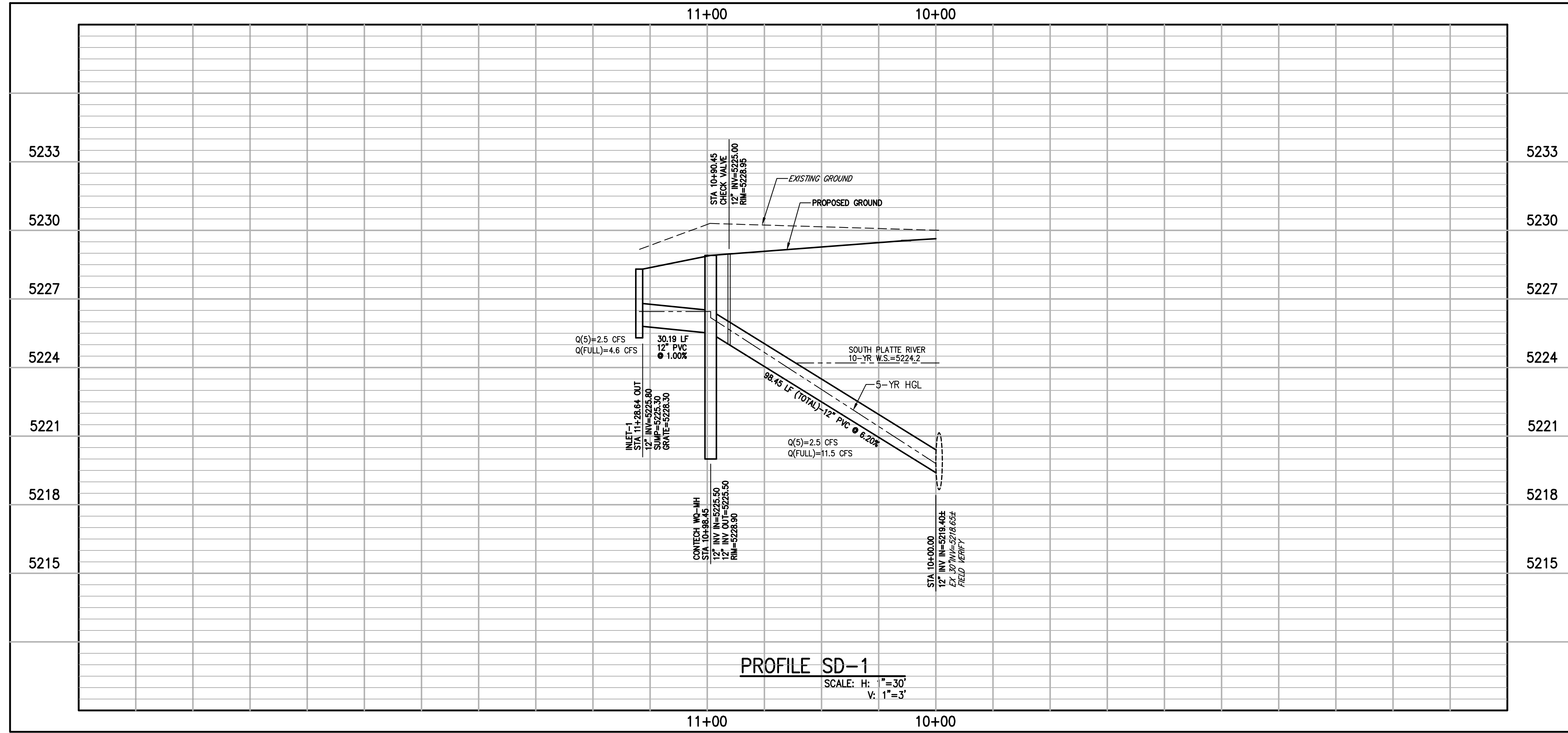
- EARTHWORK NOTES:**
- DUE TO ASBESTOS CONTAMINATED SOILS ON SITE, THE CONTRACTOR MUST AT ALL TIMES FULLY COMPLY WITH THE CITY'S ASBESTOS-CONTAMINATED SOIL MANAGEMENT STANDARD OPERATING PROCEDURE, DATED DECEMBER 3, 2010. THE CONTRACTOR MUST PREPARE AND SUBMIT TO THE PROJECT MANAGER A MATERIALS MANAGEMENT PLAN FOR REVIEW BY THE CITY'S DEPARTMENT OF ENVIRONMENTAL HEALTH. THE CONTRACTOR MAY NOT COMMENCE ANY EXCAVATION, EARTHWORK, OR ANY OPERATIONS THAT COULD POTENTIALLY DISTURB THE ON-SITE SOILS, UNTIL THE CITY'S DEPARTMENT OF ENVIRONMENTAL HEALTH HAS REVIEWED AND APPROVED THE MATERIALS MANAGEMENT PLAN. THE CONTRACTOR MUST AT ALL TIMES COMPLY WITH THE APPROVED MATERIALS MANAGEMENT PLAN.
 - EARTHWORK SHALL INCLUDE THE REMOVAL AND REPLACEMENT OF ANY ONSITE SOIL FOR:
 - PARKING LOT AND SIDEWALKS
 - TRENCHING FOR UTILITIES AND APPURTANANCES
 - FOUNDATIONS FOR FLOOD WALLS AND FLOOD GATES
 - BUILDING FOUNDATIONS

- GENERAL NOTES:**
- ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH CITY AND COUNTY OF DENVER STANDARDS.
 - VERIFY EXISTING UTILITY LOCATIONS PRIOR TO CONSTRUCTION AND NOTIFY THE ENGINEER IF ANY CONFLICTS WITH THE DRAWINGS OCCUR.
 - IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROTECT EXISTING UTILITY LINES SHOWN ON THE PLANS AND THOSE UTILITY LINES WHICH MAY NOT BE SHOWN. THE CONTRACTOR SHALL NOTIFY ALL UTILITY COMPANIES FORTY-EIGHT (48) HOURS PRIOR TO CONSTRUCTION.

- STORM NOTES:**
- CONSTRUCT TYPE 13 INLET PER CDD STD PLAN M-604-13.
 - POLYVINYL CHLORIDE PIPE (PVC) SHALL BE CLASS SDR 35.



**INLET-1 WITH ORIFICE PLATE
PARKING LOT DETENTION CONTROL**
1"=2'



SLATERPAULL
ARCHITECTS
1351 Nineteenth Street
Denver, CO 80202
P 303.607.0977
www.slaterpaul.com

CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

STORM DRAIN PLAN
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

ISSUE
1. 11/11/13 BIDDING
AND CONSTRUCTION

DRAWN BY:
REVIEWED BY:
Date: 4/20/2012
SHEET

C3-1

P:\057\0201\Draw\Plan\CD\C3-1 Storm PD.dwg, Arch, 5/6/2014 9:26:54 AM, 1:1, 0/0, JKO

PLAN VIEW

SECTION A-A

ELEVATION VIEW

MATERIAL LIST - PROVIDED BY CONTECH

COUNT	DESCRIPTION	INSTALLED BY
1	FIBERGLASS INLET AND CYLINDER	CONTECH
NA	CYLINDER EXTENSION	CONTRACTOR
NA	STABILIZATION COLLAR	CONTRACTOR
1	HYDRAULIC SHEAR PLATE	CONTECH
1	2400 micron SEP. SCREEN	CONTECH
NA	DEFLECTOR PAN	CONTRACTOR
NA	SEDIMENT WEIR	CONTECH
1	SEALANT FOR JOINTS	CONTRACTOR
1	Ø30" x 4' EJ #41600484, OR EQUIVALENT	CONTRACTOR

SITE DESIGN DATA

WATER QUALITY FLOW RATE	0.7 CFS
PEAK FLOW RATE	4.7 CFS
RETURN PERIOD OF PEAK FLOW	100 YRS

GENERAL NOTES

- CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
- FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
- CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
- STRUCTURE SHALL MEET AASHTO HS-20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' AND GROUNDWATER ELEVATION AT OR BELOW THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
- IF REQUIRED, PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.
- CDS STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.

INSTALLATION NOTES

- ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE.
- CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
- CONTRACTOR TO PROVIDE, INSTALL AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
- CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

STRUCTURE WEIGHT
APPROXIMATE HEAVIEST PICK = 8000 LBS.
STRUCTURE IS DELIVERED IN 3 PIECES

MAX FOOTPRINT = 7'

CONTECH DRAWING

CCLT 2015-5-FG15
1 OF 1

PART NO. CV12C REV. B CD. AGRICORP MATERIAL:

REVISIONS

REV	DESCRIPTION	DATE	BY
B	CHG. UPDATE DRAWING & BOM	03/06/2013	TH

DETAIL A
4 X SCALE TYP.

Agri Drain CORPORATION
America's Most Complete Supplier of Water Management Products.
P.O. Box 468 • 1402 South St. • Aurora, IL 60003 • Ph: 630-332-4745 • Fax: 630-332-5333 • www.agridrain.com

12" PVC CHECK VALVE W/CO

DATE: 27 SEP 02 DRAWN BY: D. CLAUSSEN PART NO. CV12C REV. B

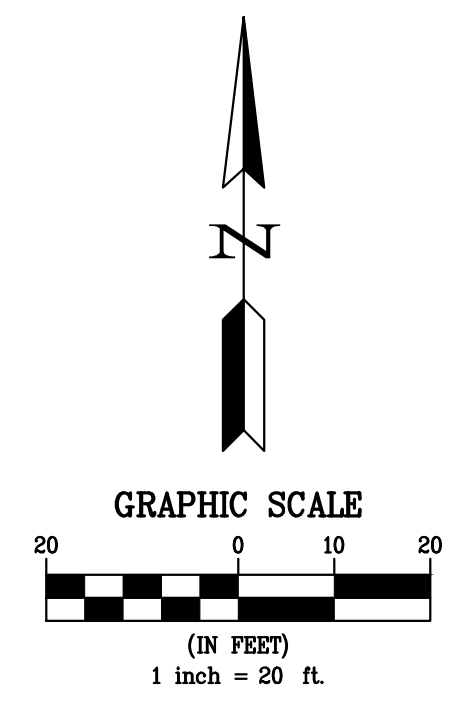
NOTE: STORM DRAIN IMPROVEMENTS ARE PART OF ADD ALTERNATIVE NO. 1

LEGEND:

- EXISTING LIGHT
- EXISTING MANHOLE
- EXISTING INLET
- EXISTING GATE VALVE
- 12"W EXISTING WATER
- 42"SS EXISTING SANITARY SEWER
- 4"G EXISTING GAS
- EXISTING OVERHEAD ELECTRIC
- EXISTING UNDERGROUND ELECTRIC
- EXISTING STORM DRAIN
- PROPOSED LIGHT
- PROPOSED MANHOLE
- PROPOSED INLET
- 18"SD PROPOSED STORM DRAIN (RCP)
- 4"SD PROPOSED STORM DRAIN (PVC)

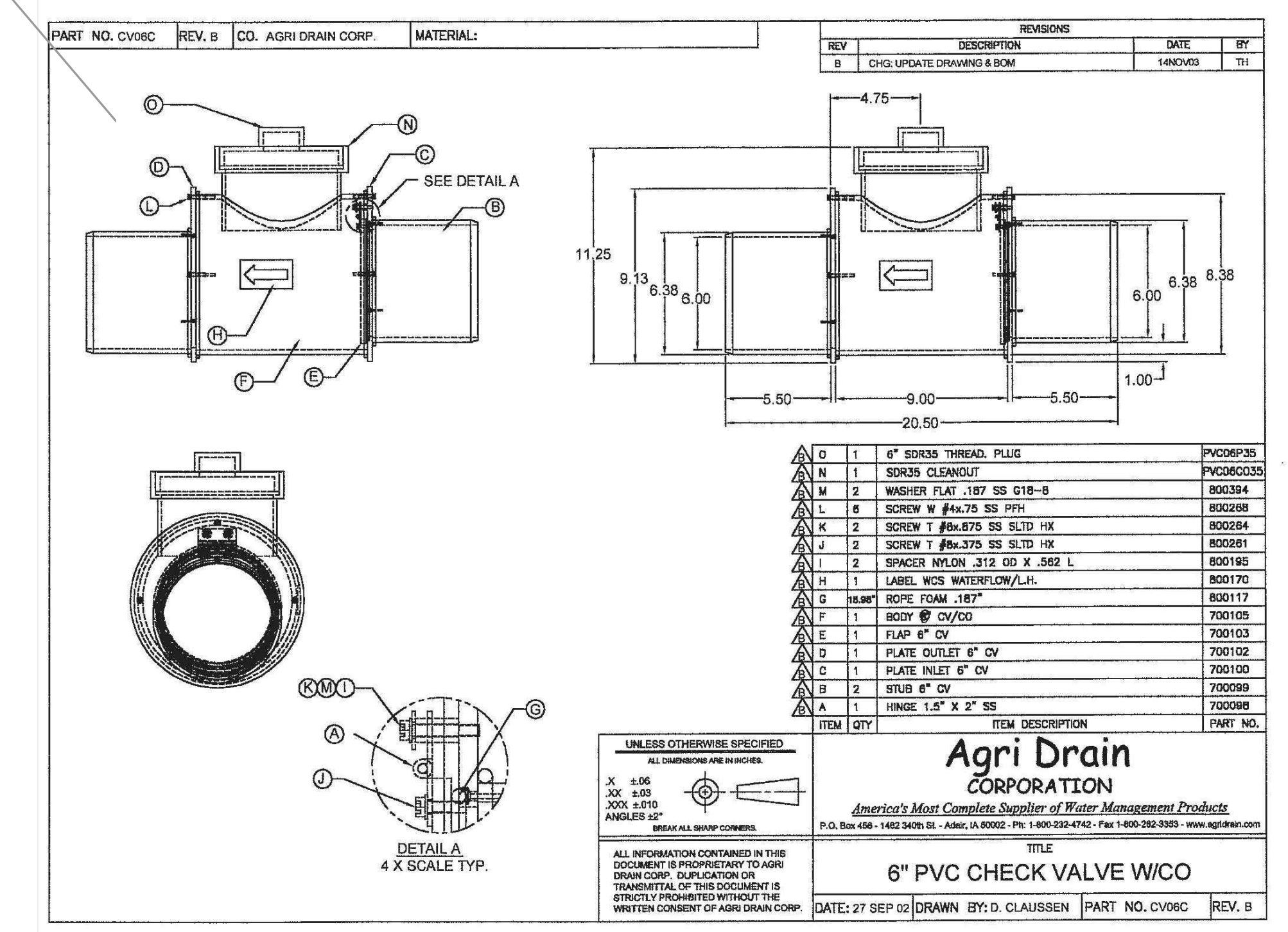
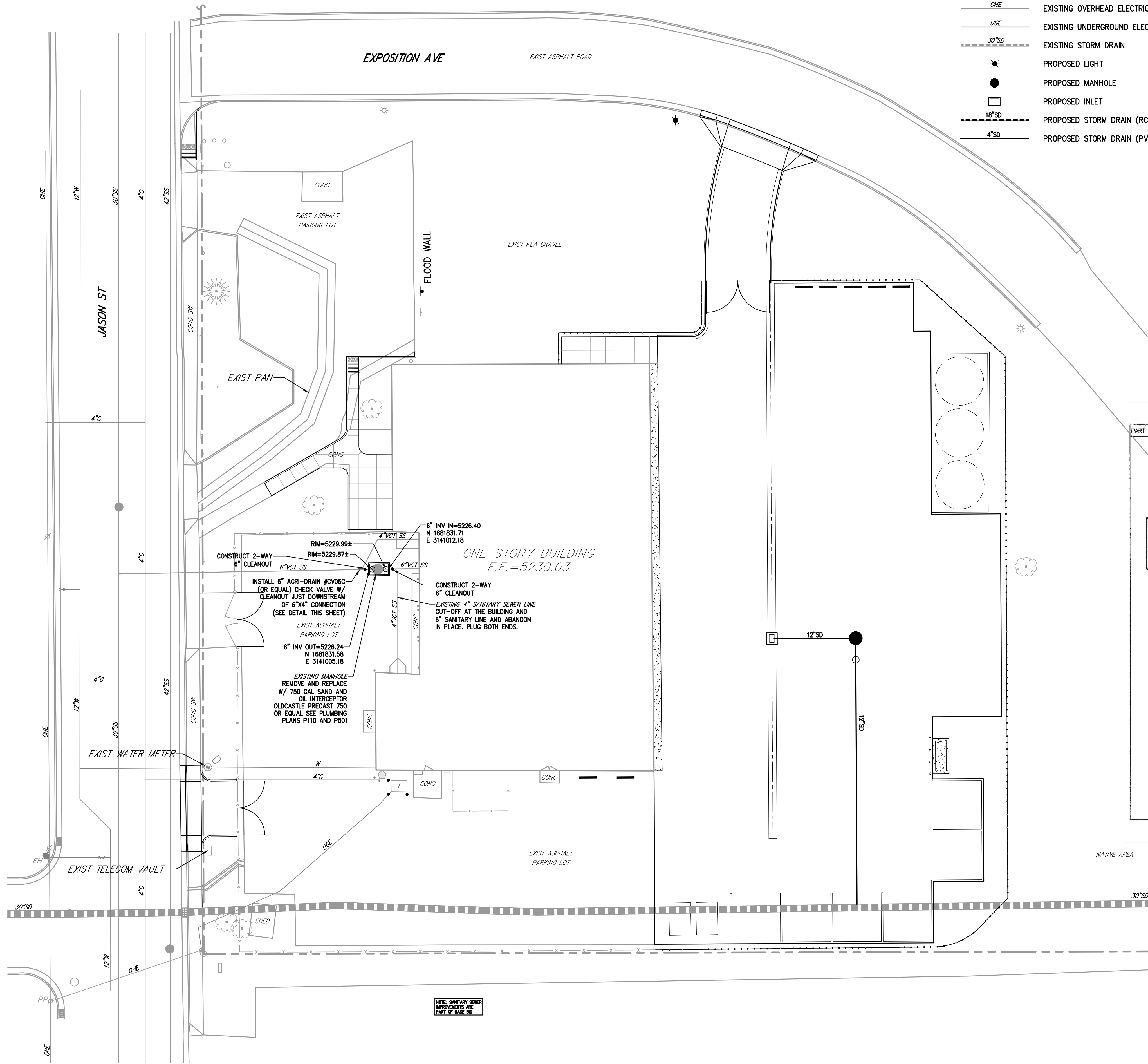
GENERAL NOTES:

- ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH CITY AND COUNTY OF DENVER DES STANDARDS.
- CONTRACTOR TO VERIFY EXISTING UTILITY LOCATIONS PRIOR TO CONSTRUCTION AND NOTIFY THE ENGINEER IF ANY CONFLICTS WITH THE DRAWINGS OCCUR. THE CONTRACTOR SHALL ENGAGE A QUALIFIED FIRM TO LOCATE ALL BURIED UTILITIES PRIOR TO TRENCHING.
- IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROTECT EXISTING UTILITY LINES SHOWN ON THE PLANS AND THOSE UTILITY LINES WHICH MAY NOT BE SHOWN. THE CONTRACTOR SHALL NOTIFY ALL UTILITY COMPANIES FORTY-EIGHT (48) HOURS PRIOR TO CONSTRUCTION.



EARTHWORK NOTES:

- DUE TO ASBESTOS CONTAMINATED SOILS ON SITE, THE CONTRACTOR MUST AT ALL TIMES FULLY COMPLY WITH THE CITY'S ASBESTOS-CONTAMINATED SOIL MANAGEMENT STANDARDS OPERATING PROCEDURE, DATED DECEMBER 3, 2010. THE CONTRACTOR MUST PREPARE AND SUBMIT TO THE PROJECT MANAGER A MATERIALS MANAGEMENT PLAN FOR REVIEW BY THE CITY'S DEPARTMENT OF ENVIRONMENTAL HEALTH. THE CONTRACTOR MAY NOT COMMENCE ANY EXCAVATION, EARTHWORK, OR ANY OPERATION THAT COULD POTENTIALLY DISTURB THE ON-SITE SOILS, UNTIL THE CITY'S DEPARTMENT OF ENVIRONMENTAL HEALTH HAS REVIEWED AND APPROVED THE MATERIALS MANAGEMENT PLAN. THE CONTRACTOR MUST AT ALL TIMES COMPLY WITH THE APPROVED MATERIALS MANAGEMENT PLAN.
- EARTHWORK SHALL INCLUDE THE REMOVAL AND REPLACEMENT OF ANY ON-SITE SOIL FOR:
 - PARKING LOT AND SIDEWALKS
 - TRENCHING FOR UTILITIES AND APPURTANANCES
 - FOUNDATIONS FOR FLOOD WALLS AND FLOOD GATES
 - BUILDING FOUNDATIONS



SLATERPAULL
 ARCHITECTS
 1331 Nineteenth Street
 Denver, CO 80202
 P: 303.697.0977
 www.slaterpaul.com

CITY AND COUNTY OF DENVER
 DEPARTMENT OF
 PARKS & RECREATION
 201 West Colfax Avenue, Dept. 613
 Denver, Colorado 80202

SANITARY SEWER PLAN
 S. JASON STREET
 MAINTENANCE FACILITY
 678 S. Jason Street
 Denver, Colorado 80223

ISSUE
 1. 11/11/13 BIDDING
 AND CONSTRUCTION

DRAWN BY:
 REVIEWED BY:
 Date: 4/20/2012
 SHEET

C4-1

P:\057\0201\Draw\Plan\CD\04-1 Sanitary.swp, Arch, 5/5/2014 9:28:33 AM, 1:1, JAC, JAC

JASON STREET MAINTENANCE FACILITY

DENVER, COLORADO



CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202



LANDSCAPE COVER SHEET
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

ISSUE:
1.11/13 BIDDING AND
CONSTRUCTION

DRAWN BY:DM
REVIEWED BY :WTB
Date: NOV 11, 2013
SHEET

L-001

ABBREVIATIONS (landscape sheets only)

APROX	APPROXIMATE	GA	GAUGE	R	RADIUS
ARCH	ARCHITECT	GAL	GALLON	RE	REFERENCE
AVG	AVERAGE	GALV	GALVANIZED	REINF	REINFORCE(D), (ING)
		GB	GRADE BREAK	REQ'D	REQUIRED
B&B	BALLED AND BURLAPPED	GC	GENERAL CONTRACT(OR)	REV	REVISION(S), REVISED
BLDG	BUILDING	GPM	GALLON PER MINUTE	RIM	RIM ELEVATION
BM	BENCHMARK			ROW	RIGHT-OF-WAY
BOC	BACK OF CURB	HORIZ	HORIZONTAL	RP	RADIUS POINT
BR	BOTTOM OF RAMP	HP	HIGH POINT		
BS	BOTTOM OF STEP	HT	HEIGHT	SAN	SANITARY
BW	BOTTOM OF WALL			SCH	SCHEDULE
		ID	INSIDE DIAMETER	SD	STORM DRAIN
CAL	CALIPER	INV	INVERT ELEVATION	SEC	SECTION
CF	CUBIC FEET	IN	INCHES	SF	SQUARE FOOT (FEET)
CIP	CAST-IN-PLACE	INCL	INCLUDE(D)	SHT	SHEET
CJ	CONTROL JOINT	IRR	IRRIGATION	SIM	SIMILAR
CL	CENTERLINE			SPECS	SPECIFICATIONS
CLR	CLEAR(ANCE)	JT	JOINT(S)	SQ	SQUARE
COMP	COMPACTED			STA	STATION
CONC	CONCRETE	LIN	LINEAR	STD	STANDARD
CONSTR	CONSTRUCTION	LP	LOW POINT	STL	STEEL
CONT	CONTINUOUS	LT	LIGHT	STRUCT	STRUCTURAL
CONTR	CONTRACTOR			SYM	SYMMETRICAL
CP	CENTER POINT				
CU	CUBIC	MATL	MATERIAL	TBC	TOP OF BACK OF CURB
		MAX	MAXIMUM	TC	TOP OF CURB
		MECH	MECHANICAL	THK	THICK
DBL	DOUBLE	MH	MANHOLE	TLF	TOP OF LIGHT FOOTING
DEG	DEGREE	MIN	MINIMUM	TO	TOP OF
DEMO	DEMOLISH, DEMOLITION	MISC	MISCELLANEOUS	TOPO	TOPOGRAPHY
DIA	DIAMETER			TP	TOP OF PIER
DIM	DIMENSION	NIC	NOT IN CONTRACT	TR	TOP OF RAMP
DN	DOWN	NOM	NOMINAL	TRANS	TRANSFORMER
DTL	DETAIL	NTS	NOT TO SCALE	TS	TOP OF STEP
DWG	DRAWING			TW	TOP OF WALL
		OC	ON CENTER(S)	TYP	TYPICAL
EA	EACH	OD	OUTSIDE DIAMETER		
EF	EACH FACE	OPP	OPPOSITE	UNFIN	UNFINISHED
EJ	EXPANSION JOINT				
ELEV	ELEVATION	PA	PLANTING AREA	VAR	VARIES
ELECT	ELECTRICAL	PC	POINT OF CURVATURE	VERT	VERTICAL
ENG	ENGINEER	PERF	PERFORATE(D)	VEH	VEHICLE
EQ	EQUAL	PED	PEDESTRIAN	VOL	VOLUME
EST	ESTIMATE	PERM	PERIMETER		
EW	EACH WAY	PL	PROPERTY LINE	W/	WITH
EXIST	EXISTING	PSF	POUNDS PER SQUARE FOOT	W/O	WITHOUT
		PSI	POUNDS PER SQUARE INCH	WT	WEIGHT
FG	FINISHED GRADE	PT	POINT, POINT OF TANGENCY	WWF	WELDED WIRE FABRIC
FL	FLOW LINE	PVC	POLYVINYL CHLORIDE		
FOB	FACE OF BUILDING	PVMT	PAVEMENT		
FOW	FACE OF WALL	PVR	PAVER(S)	YD	YARD
FS	FINISH SURFACE				
FT	FOOT (FEET)	QTY	QUANTITY		
FTG	FOOTING				
FV	FIELD VERIFY				

GENERAL NOTES

- THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING ALL CONCURRENT WORK BY OTHER TRADES. PROVIDE SLEEVES AS REQUIRED FOR DRAINAGE, IRRIGATION AND ELECTRICAL LINES. IRRIGATION AND ELECTRICAL SLEEVES AND SUBSURFACE DRAINAGE SYSTEMS SHALL BE CONSTRUCTED PRIOR TO PAVING AND LANDSCAPE WORK.
- EXISTING BUILDINGS, GRADING, EASEMENTS AND UTILITIES ARE BASED ON SURVEY INFORMATION PROVIDED BY THE CIVIL ENGINEER.
- VERIFY ALL CONDITIONS AT JOB SITE AND NOTIFY GENERAL CONTRACTOR OF DIMENSIONAL ERRORS, OMISSIONS OR DISCREPANCIES BEFORE BEGINNING WORK.
- THE LANDSCAPE ARCHITECT ASSUMES NO RESPONSIBILITY FOR THE UTILITIES OR STRUCTURES NOT SHOWN ON THE DRAWINGS. CONTRACTOR SHALL USE EXTREME CAUTION WHEN WORKING OVER OR NEAR EXISTING GAS MAINS AND ELECTRICAL LINES. CONTRACTOR IS TO VERIFY HORIZONTAL AND VERTICAL LOCATION OF ALL UTILITIES, ABOVE AND BELOW GRADE, PRIOR TO EXCAVATION OR TRENCHING. NOTIFY GC OF ANY DISCREPANCIES OR CONFLICTS. DAMAGE SHALL BE REPAIRED BY THE CONTRACTOR AT NO COST TO THE OWNER.
- A SYSTEM OF DIAGRAMMATIC SYMBOLS AND NOTATIONS IS USED IN THESE DRAWINGS. REVIEW NOTATION CAREFULLY AND NOTIFY LANDSCAPE ARCHITECT AND REQUEST CLARIFICATION OF ANY UNCLEAR NOTATION OR DISCREPANCY PRIOR TO COMMENCING WORK.
- ALL SYMBOLS ARE SHOWN DIAGRAMMATIC ALLY ILLUSTRATING APPROXIMATE LOCATION OF EXISTING AND PROPOSED MATERIALS. ANY DISCREPANCIES OR CONFLICTS BETWEEN EXISTING AND PROPOSED CONDITIONS SHALL BE REPORTED TO THE LANDSCAPE ARCHITECT.
- LIMIT OF WORK LINE FOR CONSTRUCTION IS SHOWN DIAGRAMMATICALLY AND OCCURS AT BACK OF CURB , EDGE OF ROAD, FACE OF BUILDING WALL OR PROPERTY LINE EXCEPT WHERE OTHERWISE NOTED. WHERE LIMIT OF WORK IS SHOWN IN LANDSCAPE AREAS, LIMIT DISTURBANCE TO UNDISTURBED AREAS AND REINSTATE LANDSCAPE AS SHOWN ON PLANS.
- ALL LAYOUT DIMENSIONS ARE TO BACK OF CURB, (BOC), FACE OF WALL, (FOW) OR FACE OF BUILDING(FOB) UNLESS OTHERWISE NOTED.
- ALL LAYOUT DIMENSIONS ARE FROM PLAN VIEW CALCULATIONS. ACTUAL FIELD DIMENSIONS MAY VARY FROM PLAN DUE TO ACTUAL LENGTHS ALONG A SLOPED SURFACE.
- WRITTEN DIMENSIONS TAKE PRECEDENCE OVER SCALED DIMENSIONS.
- DIMENSIONS MARKED FV ARE TO BE FIELD MEASURED. ANY FIELD DISCREPANCIES FROM THE NOTED DIMENSIONS ARE TO BE BROUGHT TO THE ATTENTION OF THE GC AND ARCHITECT PRIOR TO FURTHER WORK.
- SPECIAL CONSIDERATION HAS BEEN GIVEN TO THE DESIGN AND INTENDED RELATIONSHIP BETWEEN LANDSCAPE MATERIALS, FINISHES AND LAYOUT IN RELATIONSHIP TO THE ARCHITECTURE AND/OR STREET, CURB & GUTTER AND SIDEWALK SYSTEMS, PAVEMENT JOINTING, FINISHES, COLOR AND GRADES HAVE BEEN STRICTLY COORDINATED. CONSTRUCTION OF THESE SYSTEMS SHALL ALSO BE STRICTLY COORDINATED.
- REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION PERTAINING TO THE PROJECT MATERIALS, PROCEDURES AND INSTALLATION. WORK INSTALLED NOT IN COMPLIANCE WITH THE SPECIFICATIONS IS SUBJECT TO REMOVAL AT CONTRACTOR'S EXPENSE.
- THE CONTRACTOR SHALL TAKE PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING IMPROVEMENTS FROM DAMAGE. ALL SUCH IMPROVEMENTS AND STRUCTURES DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED OR RECONSTRUCTED SATISFACTORY TO THE ARCHITECT AT NO ADDITIONAL COST TO THE OWNER.
- CONTRACTOR IS TO VERIFY ALL QUANTITIES. IN CASE OF ANY DISCREPANCIES, GRAPHICALLY SHOWN MATERIAL QUANTITIES SHALL TAKE PRECEDENCE.
- CONTOUR LINES ARE SHOWN ON LANDSCAPE PLANS FOR REFERENCE ONLY. REFER TO CIVIL DRAWINGS FOR ACTUAL GRADING AND DRAINAGE INFORMATION. NOTIFY LANDSCAPE ARCHITECT OF ANY DISCREPANCIES PRIOR TO COMPLETION OF ROUGH GRADING WORK.
- ARCHITECTURAL ELEMENTS ARE SHOWN ON LANDSCAPE PLANS FOR REFERENCE ONLY. REFER TO ARCHITECTURAL DRAWINGS FOR ACTUAL ARCHITECTURAL INFORMATION. NOTIFY ARCHITECT OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.
- NOTHING IN THE CONTRACT DOCUMENTS SHALL CREATE, NOR SHALL BE CONSTRUED TO CREATE, ANY CONTRACTUAL RELATIONSHIP BETWEEN THE LANDSCAPE ARCHITECT AND THE CONTRACTOR OR ANY SUBCONTRACTOR.
- THE LANDSCAPE ARCHITECT IS NOT RESPONSIBLE FOR THE CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES OR FOR SAFETY PRECAUTIONS OR PROBLEMS UTILIZED IN CONNECTION WITH THE WORK, AND HE WILL NOT BE RESPONSIBLE FOR THE CONTRACTOR'S FAILURE TO CARRY OUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.

GRADING NOTES

- MAXIMUM SLOPE 3:1, MINIMUM SLOPE 2% IN LANDSCAPE AREAS UNLESS OTHERWISE NOTED.
- FINAL GRADING TO BE FIELD REVIEWED AND APPROVED BY ARCHITECT PRIOR TO SEEDING OR PLANTING.
- PROVIDE SMOOTH, CONTINUOUS TRANSITIONS BETWEEN SLOPES UNLESS OTHERWISE NOTED OR INDICATED IN THE DRAWINGS.
- PROVIDE 2%-MAX CROSS SLOPE ON ALL CONCRETE WALKS UNLESS OTHERWISE NOTED.
- ALL FINISHED GRADES ARE TO MEET AND BLEND SMOOTHLY WITH EXISTING GRADES AT THE PROJECT LIMIT OF WORK.

PLANTING NOTES

- FIELD STAKE ALL TREE AND SHRUB LOCATIONS BASED UPON THESE PLANS. OBTAIN ARCHITECTS OR OWNER APPROVAL OF STAKED LOCATIONS PRIOR TO PLANTING.
- PROVIDE MATCHING SIZES AND FORMS FOR EACH TREE TO BE INSTALLED.
- PLANT MATERIAL TO BE HEALTHY SPECIMENS, FREE FROM DISEASE OR DAMAGE. PLANTS NOT MEETING MIN. STANDARD WILL BE REJECTED AND REPLACED W/ SATISFACTORY MATERIAL. PLANTS LARGER THAN SPECIFIED MAY BE USED AS APPROVED BY PM AND AT NO ADDITIONAL COST TO OWNER.
- ALL PLANT MATERIAL SHALL CONFORM TO THE GUIDELINES ESTABLISHED BY THE AMERICAN STANDARDS FOR NURSERY STOCK PUBLISHED BY THE AMERICAN ASSOCIATION OF NURSERYMAN.
- ALL ROOT WRAPPING MADE OF SYNTHETIC OR PLASTIC MATERIAL SHALL BE REMOVED AT TIME OF PLANTING.
- ALL PLANT MATERIAL IS SUBJECT TO REVIEW AND APPROVAL BY LANDSCAPE ARCHITECT AND OWNER BEFORE INSTALLATION.
- ALL PLANT AND STAKES SHALL BE SET PLUMB UNLESS OTHERWISE NOTED.
- THE CONTRACTOR SHALL REFER TO THE CONTRACT SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
- PLANT QUANTITIES ARE PROVIDED FOR CONTRACTOR'S CONVENIENCE ONLY AND SHALL BE VERIFIED BY CONTRACTOR BY REVIEWING PLANTING PLAN SYMBOLS AND PLANT SPACING. PLANT SYMBOL QUANTITY TAKE PRECEDENCE OVER PLANT LEGEND QUANTITY.
- ALL DECIDUOUS TREES SHALL BE WRAPPED. REFER TO SPECIFICATIONS FOR WRAP TYPE AND TIMING.
- PLANT AND EDGING LAYOUT SHALL TAKE PRECEDENCE OVER IRRIGATION EQUIPMENT LOCATIONS. INSTALLED VALVE BOXES WHICH CONFLICT WITH ACCEPTED PLANT AND EDGING LAYOUT SHALL BE MOVED TO A LOCATION BETWEEN PLANTS AS DIRECTED BY GC AT NO ADDITIONAL COST TO OWNER.
- CONTRACTOR SHALL BE RESPONSIBLE TO MAINTAIN ALL PLANT MATERIALS INCLUDING SOD/SEED AREAS IN A HEALTHY STATE DURING CONSTRUCTION. ANY DAMAGE TO PLANT MATERIAL DUE TO NEGLIGENCE BY THE CONTRACTOR SHALL BE REPAIRED OR REPLACED AT THE CONTRACTOR'S EXPENSE.
- PROJECT INCLUDES EXTENSIVE IRRIGATION AND UTILITY SYSTEMS, MANY OF WHICH ARE CLOSE TO THE FINISHED SURFACE. VERIFY LOCATION AND DEPTH OF ALL UTILITIES PRIOR TO PLANTING. ANY CONFLICTS SHALL BE RESOLVED IN THE FIELD BY THE LANDSCAPE ARCHITECT.
- ALL SHRUB AREAS ARE TO BE PREPARED AS CONTINUOUS BEDS.
- PERFORM PERCOLATION TEST ON ALL TREE HOLES AND PLANTING BEDS PRIOR TO PLANTING. INFORM LANDSCAPE ARCHITECT OF RESULTS. REFER TO CONTRACT SPECIFICATIONS FOR FURTHER INFORMATION.
- REFER TO LAYOUT DRAWINGS FOR STEEL EDGER LAYOUT. STAKE AND REVIEW LAYOUT WITH LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.

SHEET INDEX (landscape sheets only)

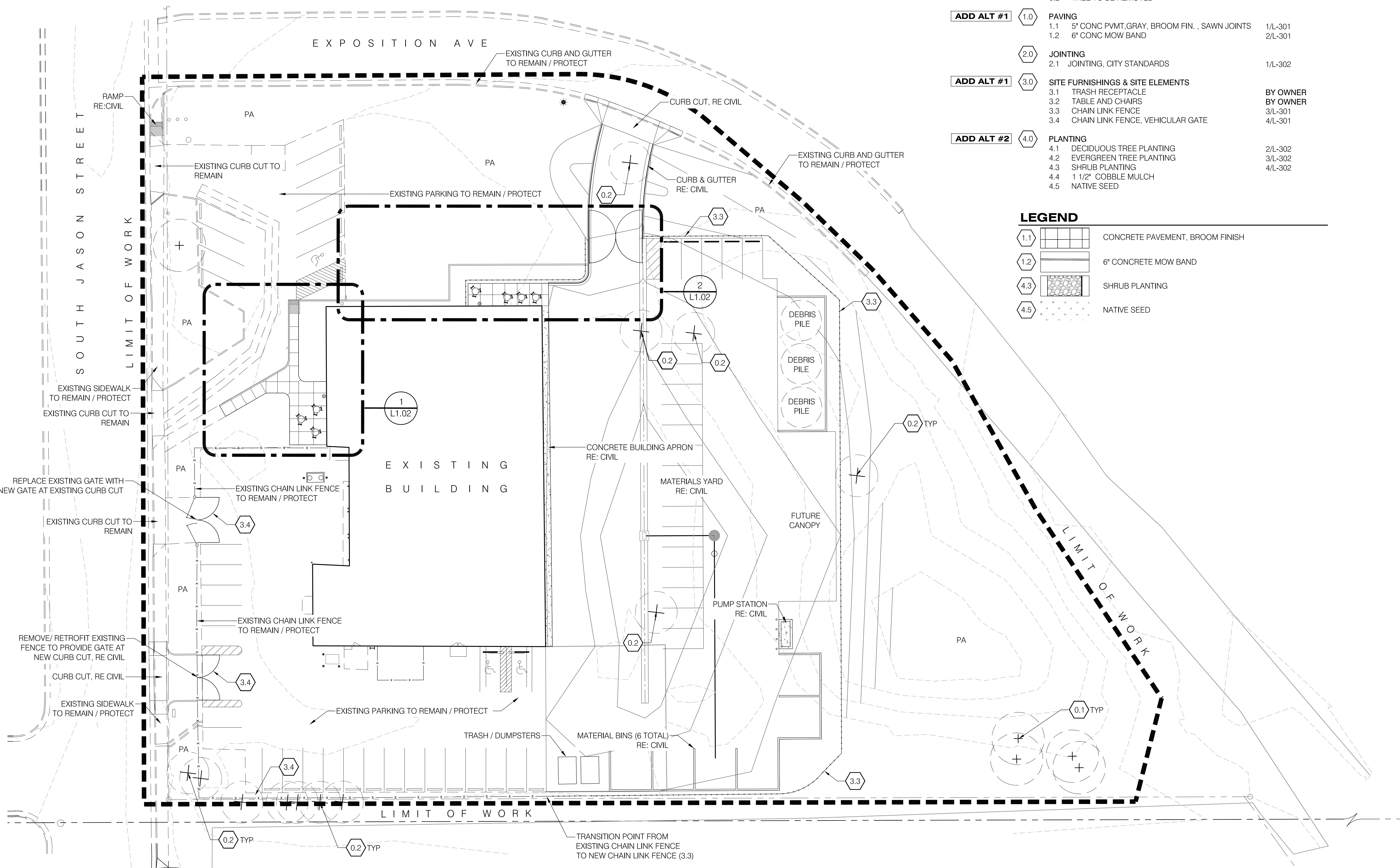
SHT#	DWG#	TITLE
1	L-001	LANDSCAPE COVER SHEET
2	L-101	MATERIALS AND LAYOUT PLAN
3	L-102	SITE ENLARGEMENTS
4	L-201	PLANTING PLAN
5	L-301	LANDSCAPE SITE DETAILS
6	L-302	LANDSCAPE SITE DETAILS

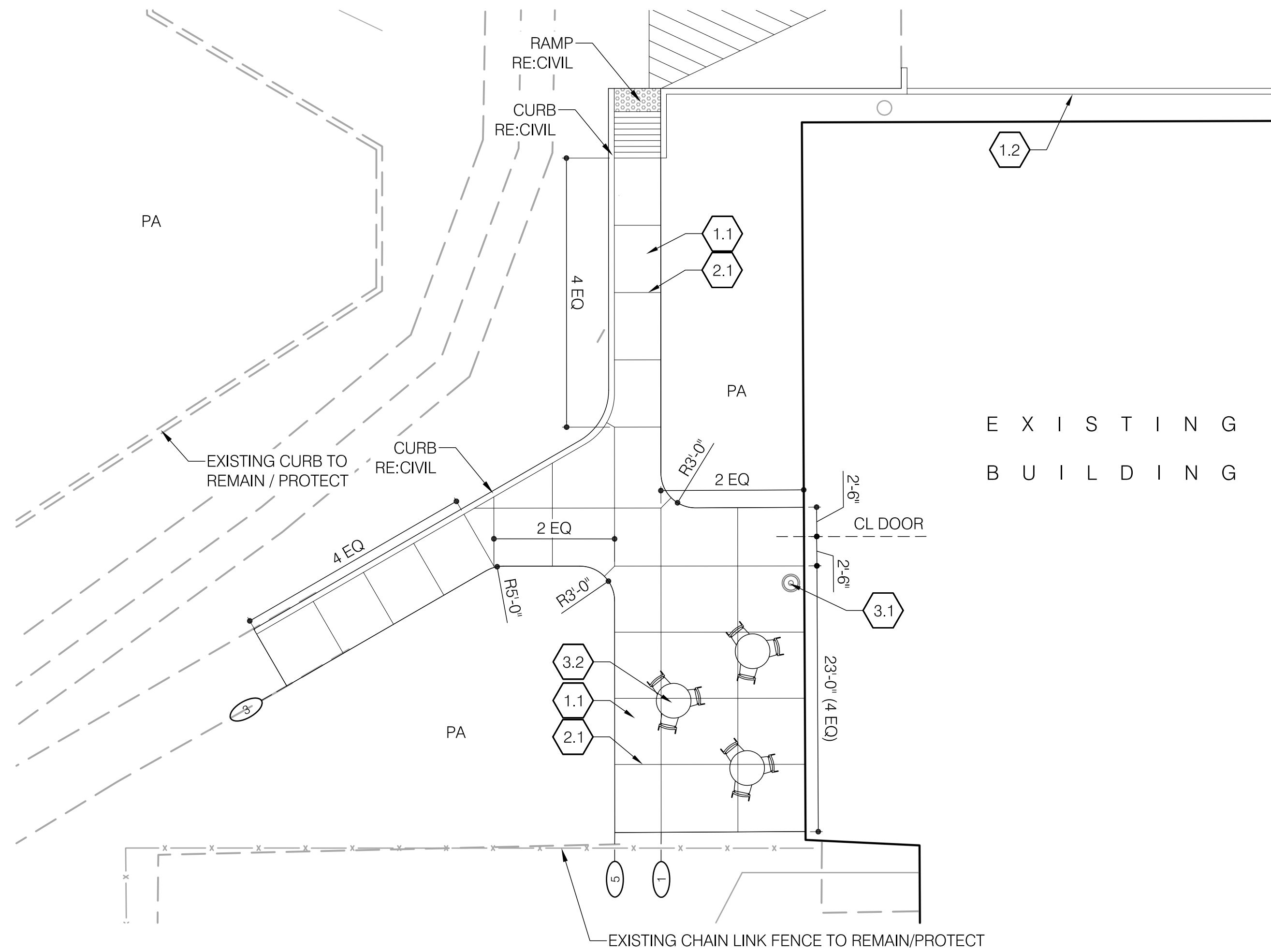
MATERIAL KEYNOTES

- 0.0 EXISTING CONDITIONS
 - 0.1 TREE TO REMAIN AND PROTECT
 - 0.2 TREE TO BE REMOVED
- ADD ALT #1 1.0 PAVING
 - 1.1 5" CONC PVMT, GRAY, BROOM FIN., SAWN JOINTS 1/L-301
 - 1.2 6" CONC MOW BAND 2/L-301
- 2.0 JOINTING
 - 2.1 JOINTING, CITY STANDARDS 1/L-302
- ADD ALT #1 3.0 SITE FURNISHINGS & SITE ELEMENTS
 - 3.1 TRASH RECEPTACLE BY OWNER
 - 3.2 TABLE AND CHAIRS BY OWNER
 - 3.3 CHAIN LINK FENCE 3/L-301
 - 3.4 CHAIN LINK FENCE, VEHICULAR GATE 4/L-301
- ADD ALT #2 4.0 PLANTING
 - 4.1 DECIDUOUS TREE PLANTING 2/L-302
 - 4.2 EVERGREEN TREE PLANTING 3/L-302
 - 4.3 SHRUB PLANTING 4/L-302
 - 4.4 1 1/2" COBBLE MULCH
 - 4.5 NATIVE SEED

LEGEND

- 1.1 CONCRETE PAVEMENT, BROOM FINISH
- 1.2 6" CONCRETE MOW BAND
- 4.3 SHRUB PLANTING
- 4.5 NATIVE SEED





MATERIAL KEYNOTES

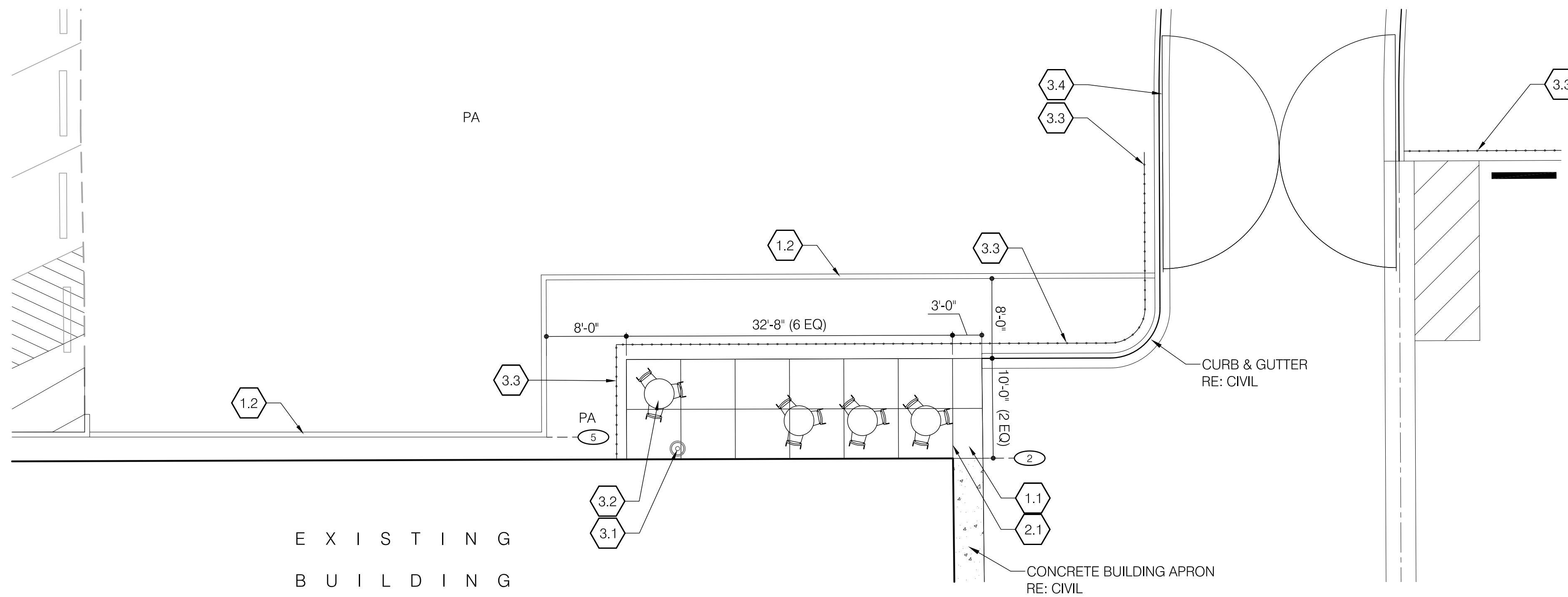
- 0.0 EXISTING CONDITIONS
 - 0.1 TREE TO REMAIN AND PROTECT
 - 0.2 TREE TO BE REMOVED
- ADD ALT #1** 1.0 PAVING
 - 1.1 5" CONC PVMT GRAY, BROOM FIN., SAWN JOINTS 1/L-301
 - 1.2 6" CONC MOW BAND 2/L-301
- 2.0 JOINTING
 - 2.1 JOINTING, CITY STANDARDS 1/L-302
- ADD ALT #1** 3.0 SITE FURNISHINGS & SITE ELEMENTS
 - 3.1 TRASH RECEPTACLE BY OWNER
 - 3.2 TABLE AND CHAIRS BY OWNER
 - 3.3 CHAIN LINK FENCE 3/L-301
 - 3.4 CHAIN LINK FENCE, VEHICULAR GATE 4/L-301
- ADD ALT #2** 4.0 PLANTING
 - 4.1 DECIDUOUS TREE PLANTING 2/L-302
 - 4.2 EVERGREEN TREE PLANTING 3/L-302
 - 4.3 SHRUB PLANTING 4/L-302
 - 4.4 1 1/2" COBBLE MULCH 4/L-301
 - 4.5 NATIVE SEED

LAYOUT NOTES

- 1 ALIGN W/ CURB RAMP
- 2 ALIGN JT W/ FOB
- 3 ALIGN SIDEWALK W/ EXISTING WALK
- 4 ALIGN W/ FACE OF WALL
- 5 ALIGN W/ BOC

1 ENTRY ENLARGEMENT

SCALE: 1" = 8'-0"



2 PATIO ENLARGEMENT

SCALE: 1" = 8'-0"



SLATERPAULL
ARCHITECTS
1331 Nineteenth Street
Denver, CO 80202
P 303.697.0977
www.slaterpaul.com

CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202



SITE ENLARGEMENTS
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

ISSUE:
1.11/13 BIDDING AND
CONSTRUCTION

DRAWN BY:DM
REVIEWED BY :WTB
Date: NOV 11, 2013
SHEET

L-102

ADD ALT #2

PLANT LIST

SYM	QTY	COMMON NAME	BOTANICAL NAME	PLANTING SIZE
DECIDUOUS & ORNAMENTAL TREES				
SSM	1	State Street Maple	Acer miyabei 'State Street'	2" Cal.
EVERGREEN TREES				
RMJ	7	Rocky Mountain Juniper	Juniperus scopulorum	8' Ht.
PP	6	Pinon Pine	Pinus edulis	8' Ht.
DECIDUOUS SHRUBS				
BC	12	Black Chokeberry	Aronia melanocarpa elata	5 gal.
LMM	13	Littleleaf Mountain Mahogany	Cercocarpus ledifolius intricatus	5 gal.
GLS	11	Gro Low Sumac	Rhus aromatica 'Gro-Low'	5 gal.
DN	7	Diablo Ninebark	Physocarpus opulifolius Diablo	5 gal.
GMC	27	Green Mound Currant	Ribes alpinum 'Green Mound'	5 gal.

MATERIAL KEYNOTES

0.0	EXISTING CONDITIONS	
0.1	TREE TO REMAIN AND PROTECT	
0.2	TREE TO BE REMOVED	
ADD ALT #1	1.0 PAVING	
	1.1 5" CONC PVMT, GRAY, BROOM FIN., SAWN JOINTS	1/L-301
	1.2 6" CONC MOW BAND	2/L-301
	2.0 JOINTING	
	2.1 JOINTING, CITY STANDARDS	1/L-302
ADD ALT #1	3.0 SITE FURNISHINGS & SITE ELEMENTS	
	3.1 TRASH RECEPTACLE	BY OWNER
	3.2 TABLE AND CHAIRS	BY OWNER
	3.3 CHAIN LINK FENCE	3/L-301
	3.4 CHAIN LINK FENCE, VEHICULAR GATE	4/L-301
ADD ALT #2	4.0 PLANTING	
	4.1 DECIDUOUS TREE PLANTING	2/L-302
	4.2 EVERGREEN TREE PLANTING	3/L-302
	4.3 SHRUB PLANTING	4/L-302
	4.4 1 1/2" COBBLE MULCH	
	4.5 NATIVE SEED	

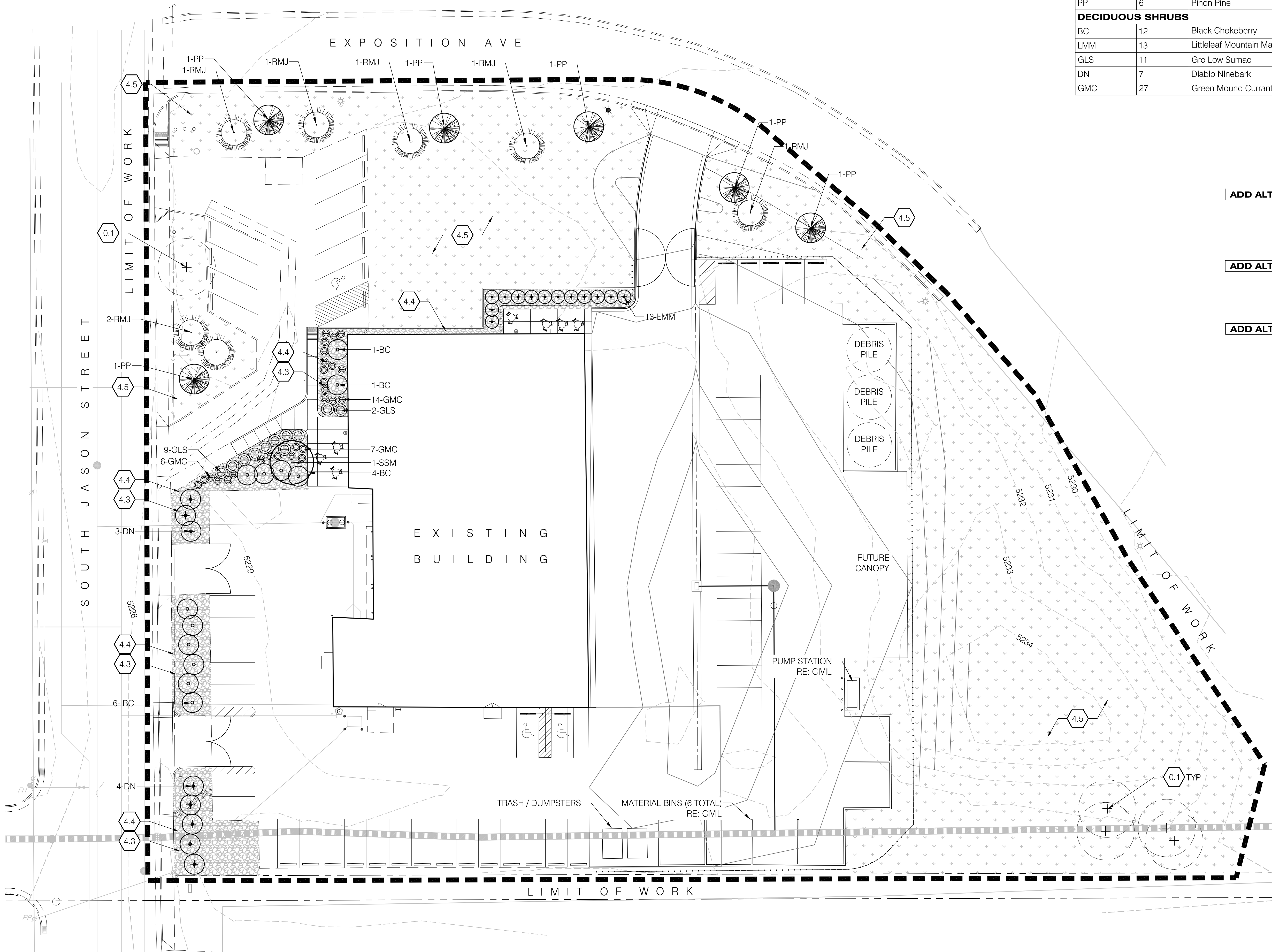
LANDSCAPE LEGEND

0.1		TREE TO REMAIN / PROTECT
0.2		TREE TO BE REMOVED
4.1		DECIDUOUS TREE PLANTING
4.2		EVERGREEN TREE PLANTING
4.3 4.4		PLANTING AREA / COBBLE MULCH
4.5		NATIVE SEED

NOTES

1) LANDSCAPE CONTRACTOR TO PROVIDE DESIGN/BUILD SERVICES FOR THE IRRIGATION SYSTEM. IRRIGATION SYSTEM TO BE INSTALLED PER PARKS AND RECREATION STANDARDS. SOIL AMENDMENTS TO BE PROVIDED PER DENVER WATER STANDARDS.

ADD ALT #2



SLATERPAULL ARCHITECTS
 1331 Nineteenth Street
 Denver, CO 80202
 P 303.607.0977
 www.slaterpaull.com

CITY AND COUNTY OF DENVER
 DEPARTMENT OF
 PARKS & RECREATION
 201 West Colfax Avenue, Dept. 613
 Denver, Colorado 80202

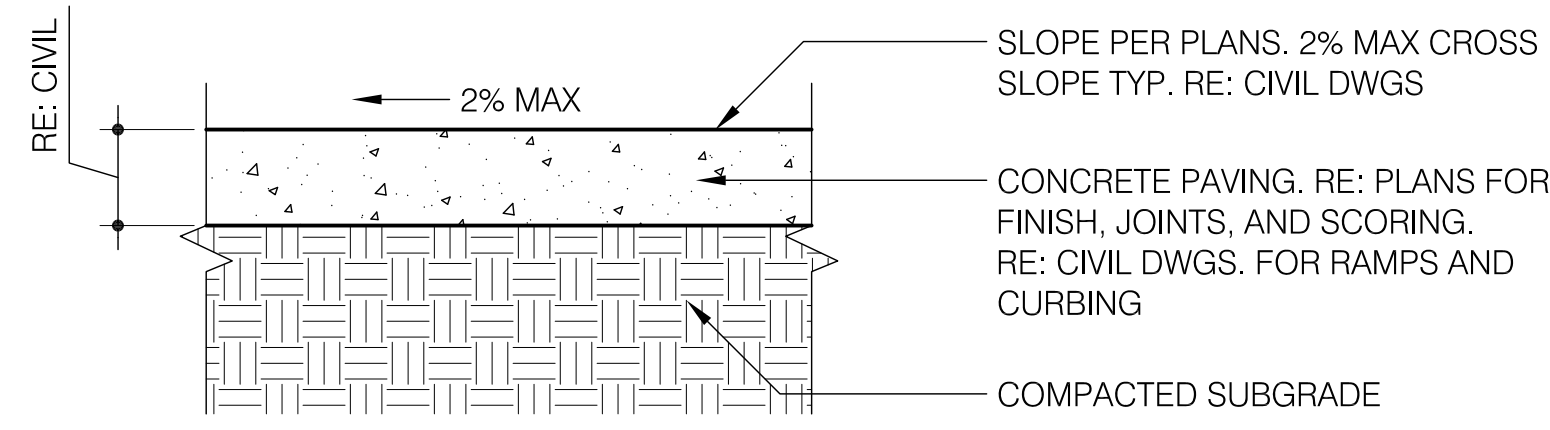


PLANTING PLAN
 S. JASON STREET
 MAINTENANCE FACILITY
 678 S. Jason Street
 Denver, Colorado 80223

ISSUE:
 1.11/13 BIDDING AND
 CONSTRUCTION

DRAWN BY: DM
 REVIEWED BY: WTB
 Date: NOV 11, 2013
 SHEET

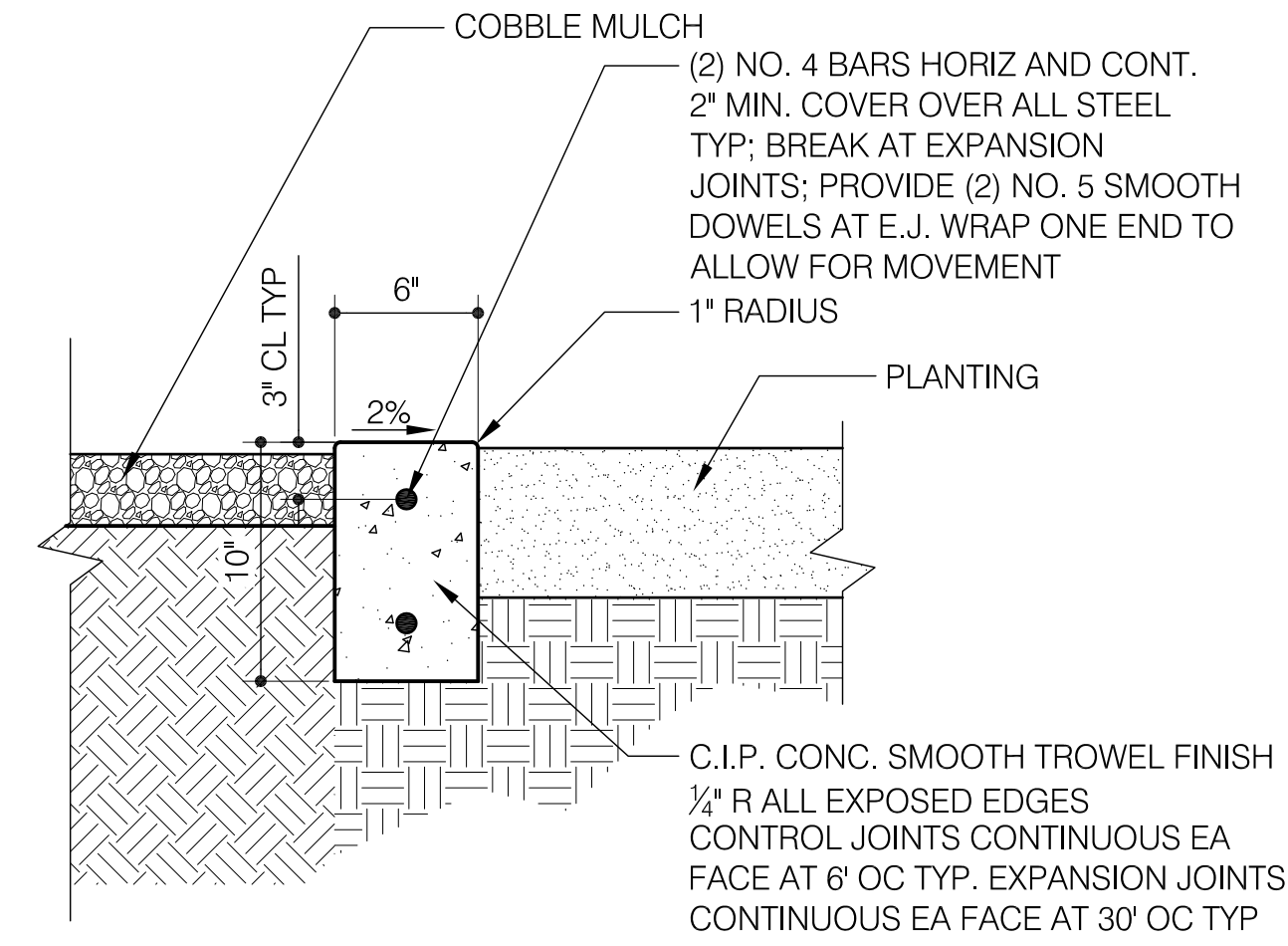
L-201



1 CONCRETE PAVING

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

ADD ALT #1

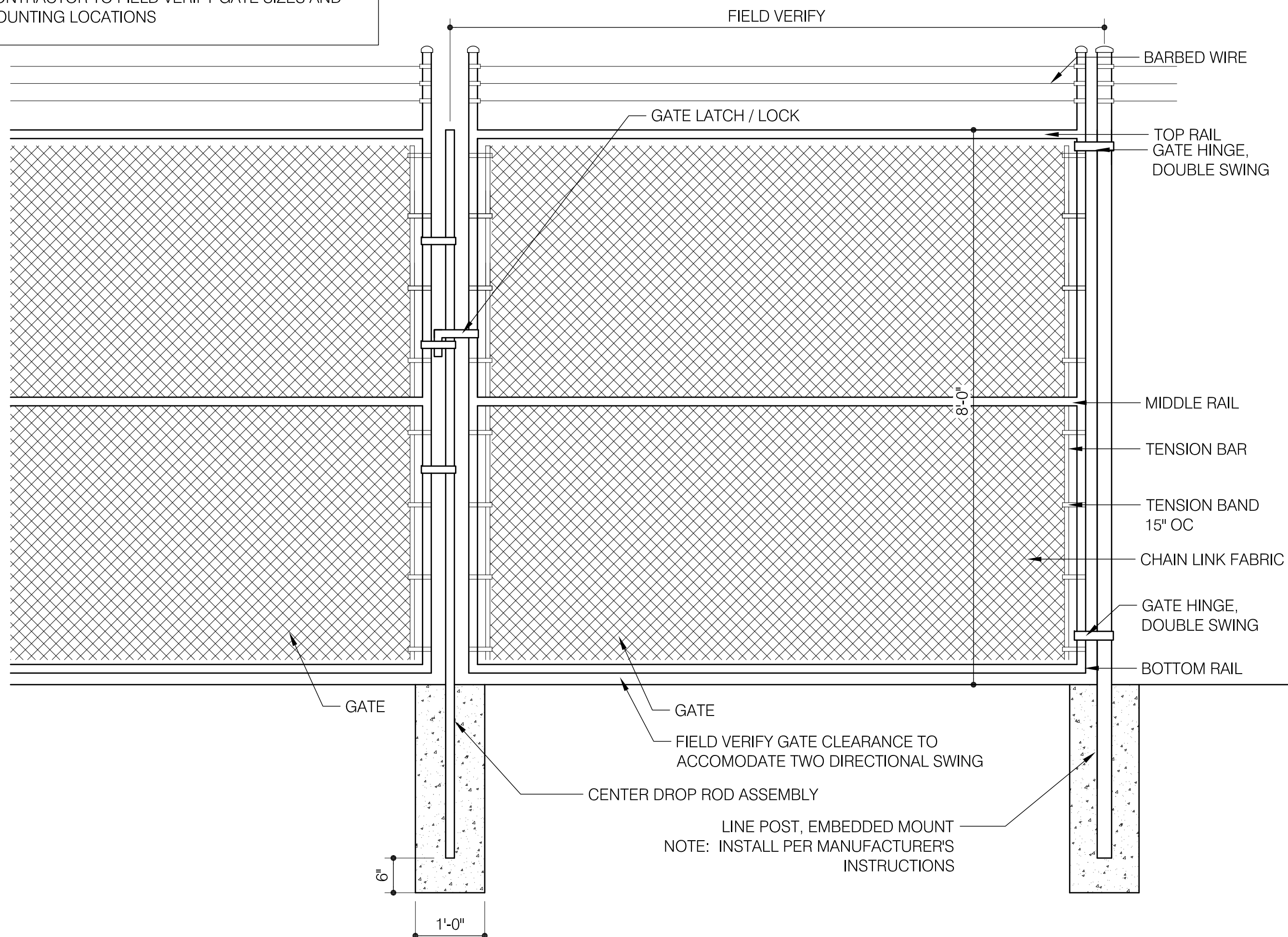


2 6" CONCRETE MOW BAND

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

ADD ALT #1

NOTE: CONTRACTOR TO PROVIDE FULL SHOP DRAWINGS FOR APPROVAL PRIOR TO INSTALLATION. CONTRACTOR TO FIELD VERIFY GATE SIZES AND MOUNTING LOCATIONS

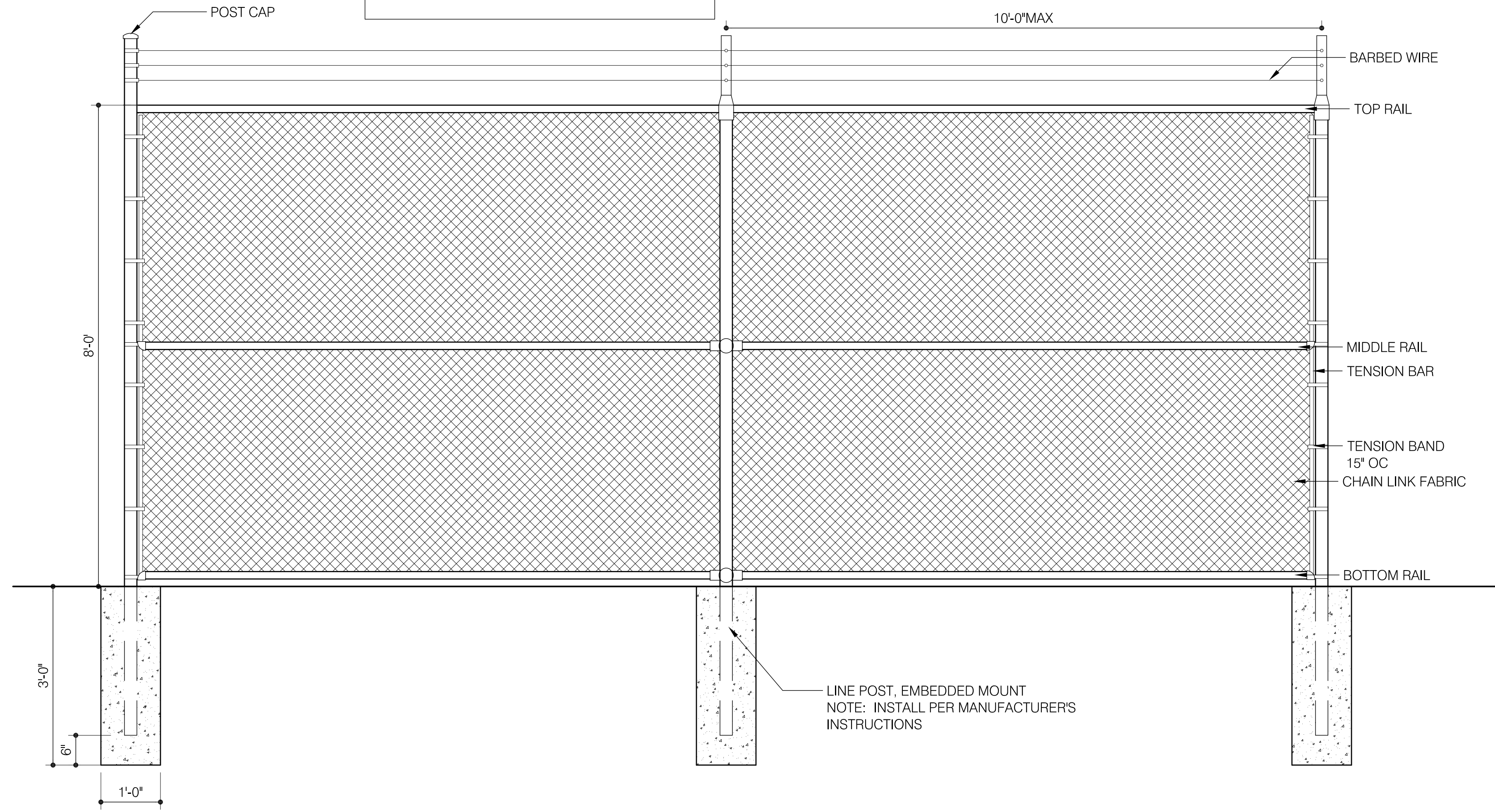


4 CHAIN LINK FENCE, VEHICULAR GATE

SCALE: 3/4" = 1'-0"

ADD ALT #1

NOTE: CONTRACTOR TO PROVIDE FULL SHOP DRAWINGS FOR APPROVAL PRIOR TO INSTALLATION



3 CHAIN LINK FENCE, TYPE 1

SCALE: 3/4" = 1'-0"

ADD ALT #1



CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

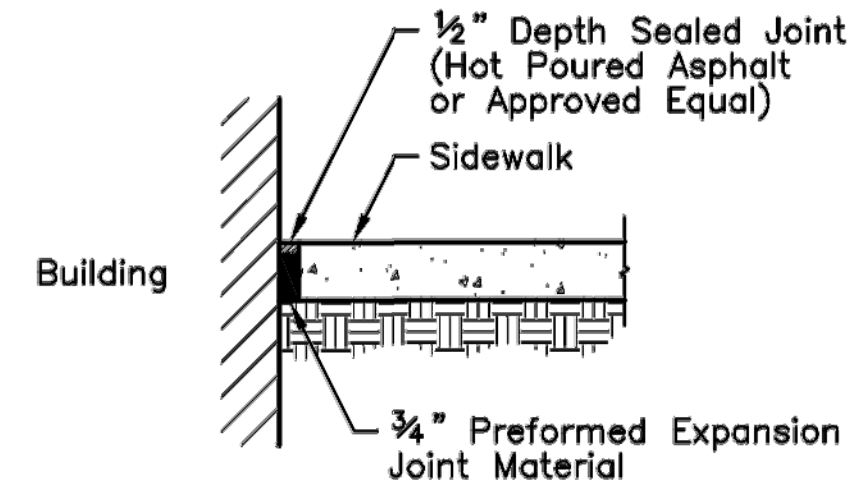


LANDSCAPE SITE DETAILS
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

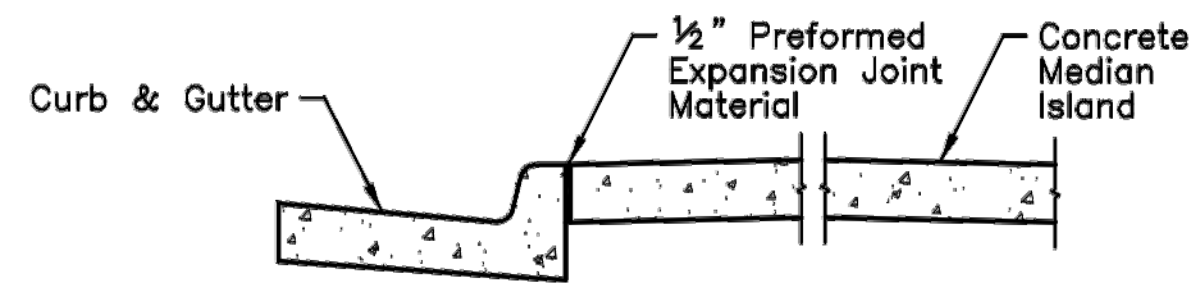
ISSUE:
1.11/13 BIDDING AND
CONSTRUCTION

DRAWN BY:DM
REVIEWED BY :WTB
Date: NOV 11, 2013

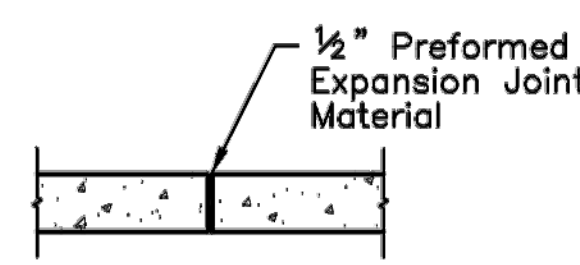
SHEET
L-301



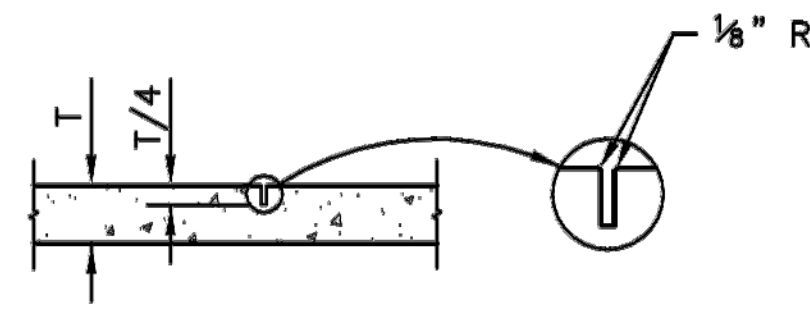
SIDEWALK EXPANSION JOINT AT BUILDINGS



CURB & GUTTER/CONCRETE MEDIAN ISLAND EXPANSION JOINT



SIDEWALK EXPANSION JOINT



CURB & GUTTER/SIDEWALK TOOLED JOINT

Notes:

- Concrete sidewalk tooled joint spacing:
10' - combination curb & gutter sidewalks
10' - curb & gutter, curb head, or mountable curb
5' - detached and attached sidewalks
- For sidewalks, expansion joints shall be provided every 100' to 120' and shall extend the full depth of the concrete walk.
- Expansion joint material shall be installed between new sidewalk and existing buildings (see detail above).
- Expansion joint material shall be installed between new sidewalk and existing concrete slabs, inlets, fire hydrants, poles, and other fixed objects.
- Expansion joint material between curb and sidewalk is required when sidewalk abuts back of curb on concrete streets.
- These details and notes do not apply to bike paths - See Parks & Recreation Standards.

1 JOINTING, CCD STANDARD

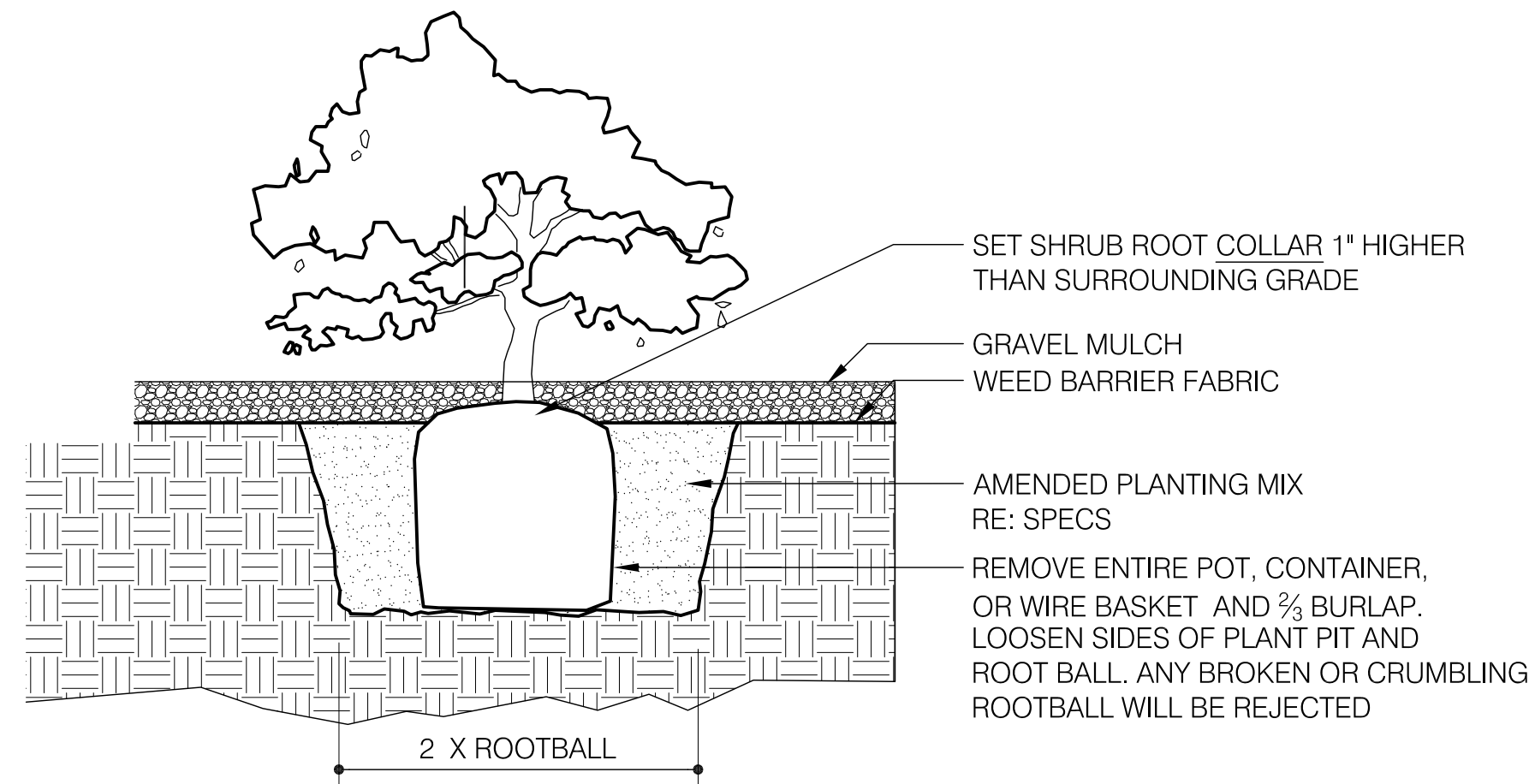
SCALE: NTS

ADD ALT #1

4 SHRUB PLANTING

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

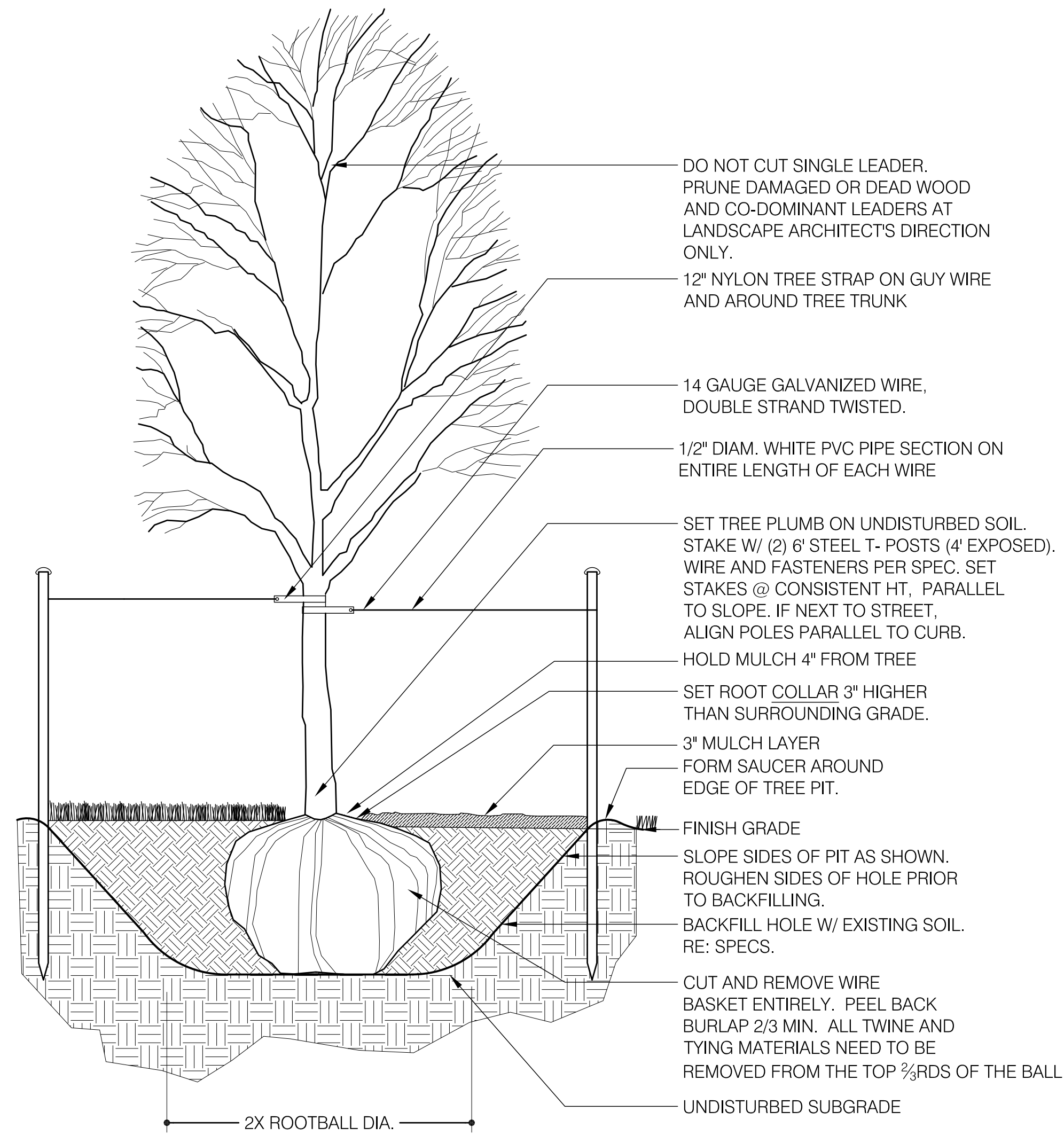
ADD ALT #2



2 DECIDUOUS TREE PLANTING

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

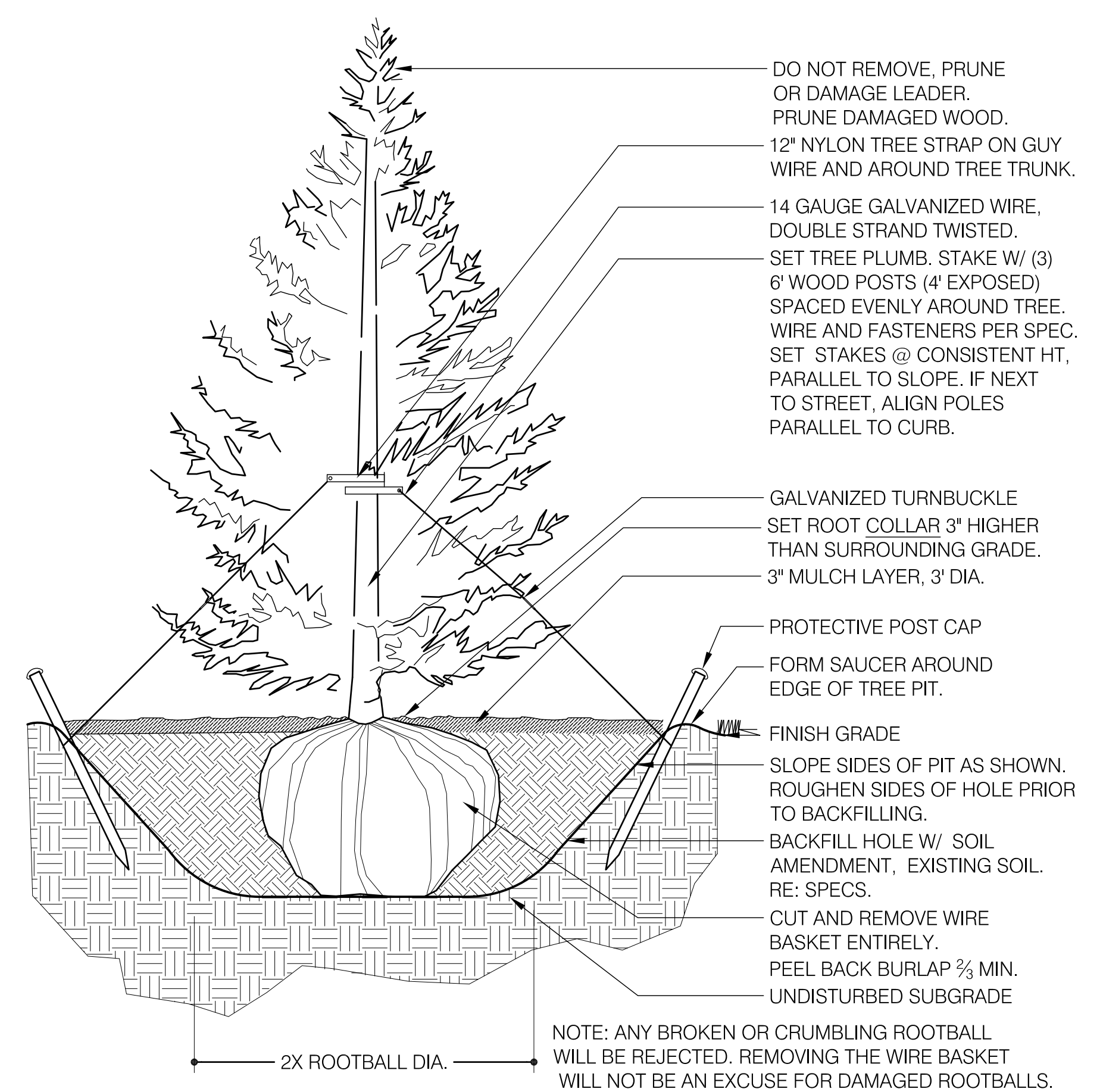
ADD ALT #2



3 EVERGREEN TREE PLANTING

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

ADD ALT #2



CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

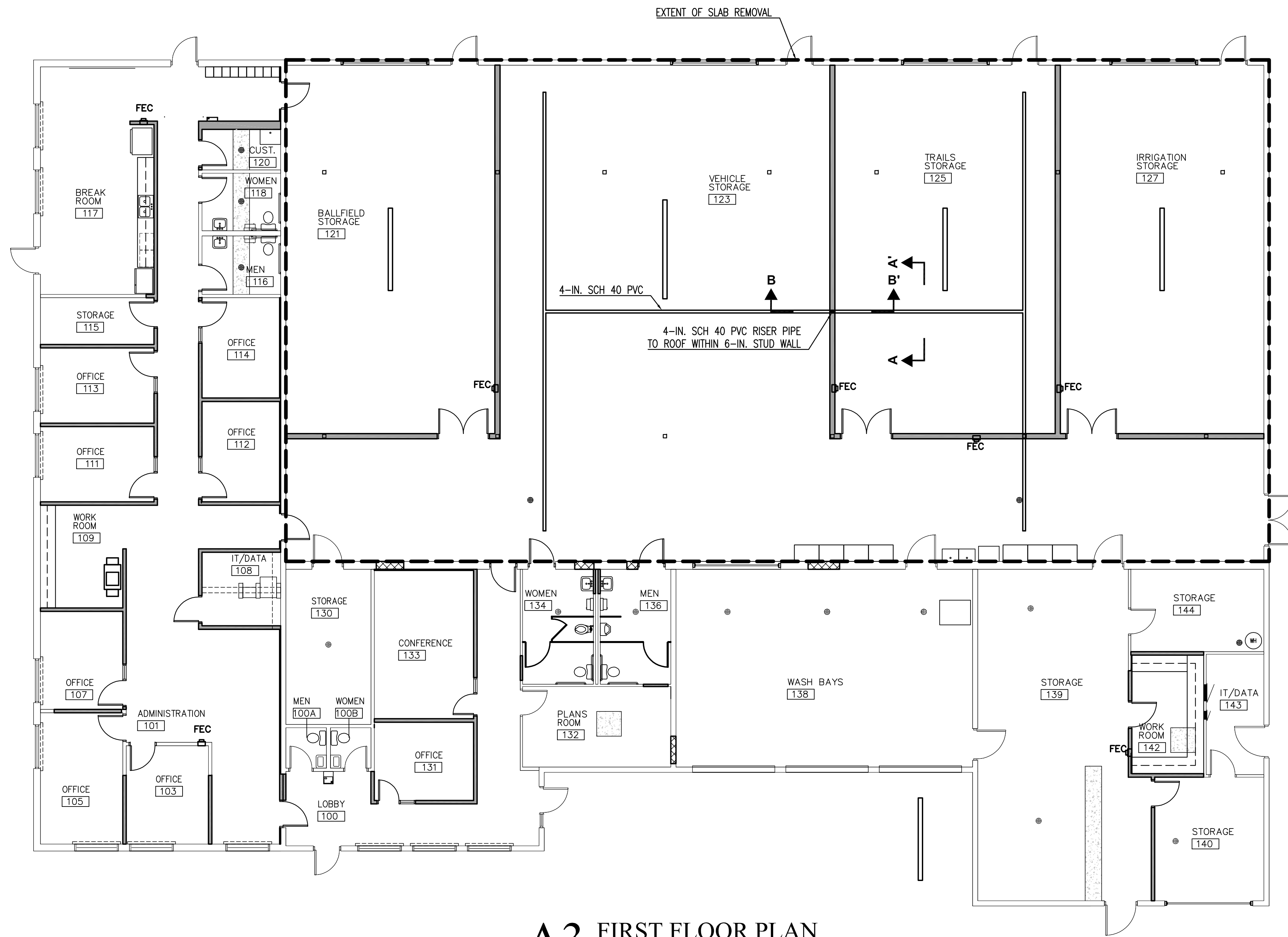


LANDSCAPE SITE DETAILS
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

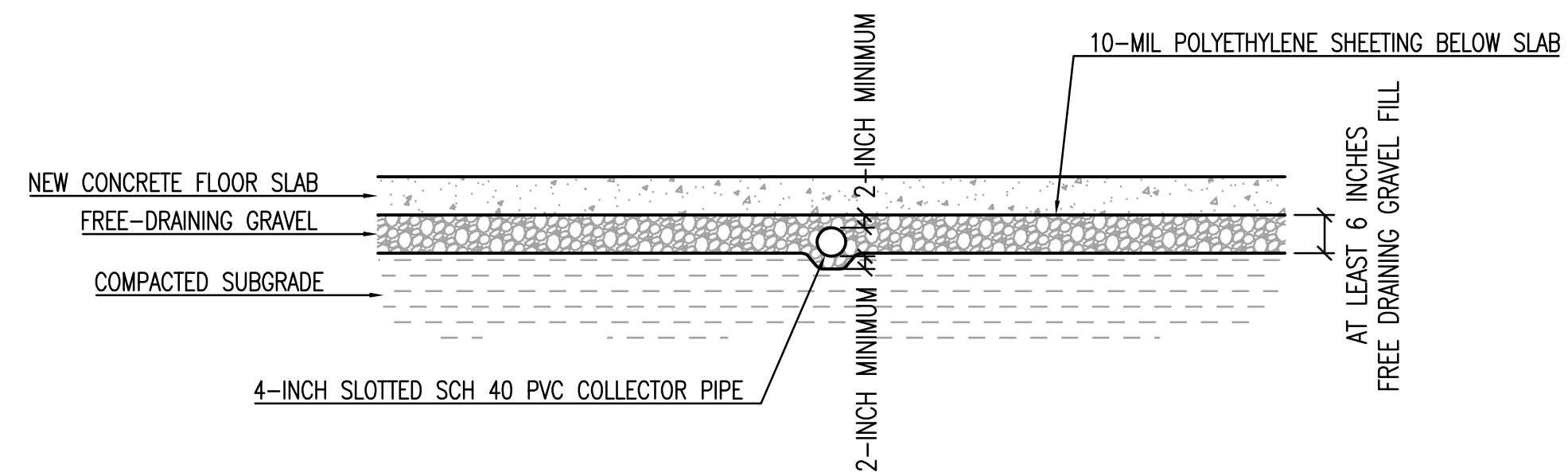
ISSUE:
1.11/13 BIDDING AND
CONSTRUCTION

DRAWN BY:DM
REVIEWED BY :WTB
Date: NOV 11, 2013
SHEET

L-302

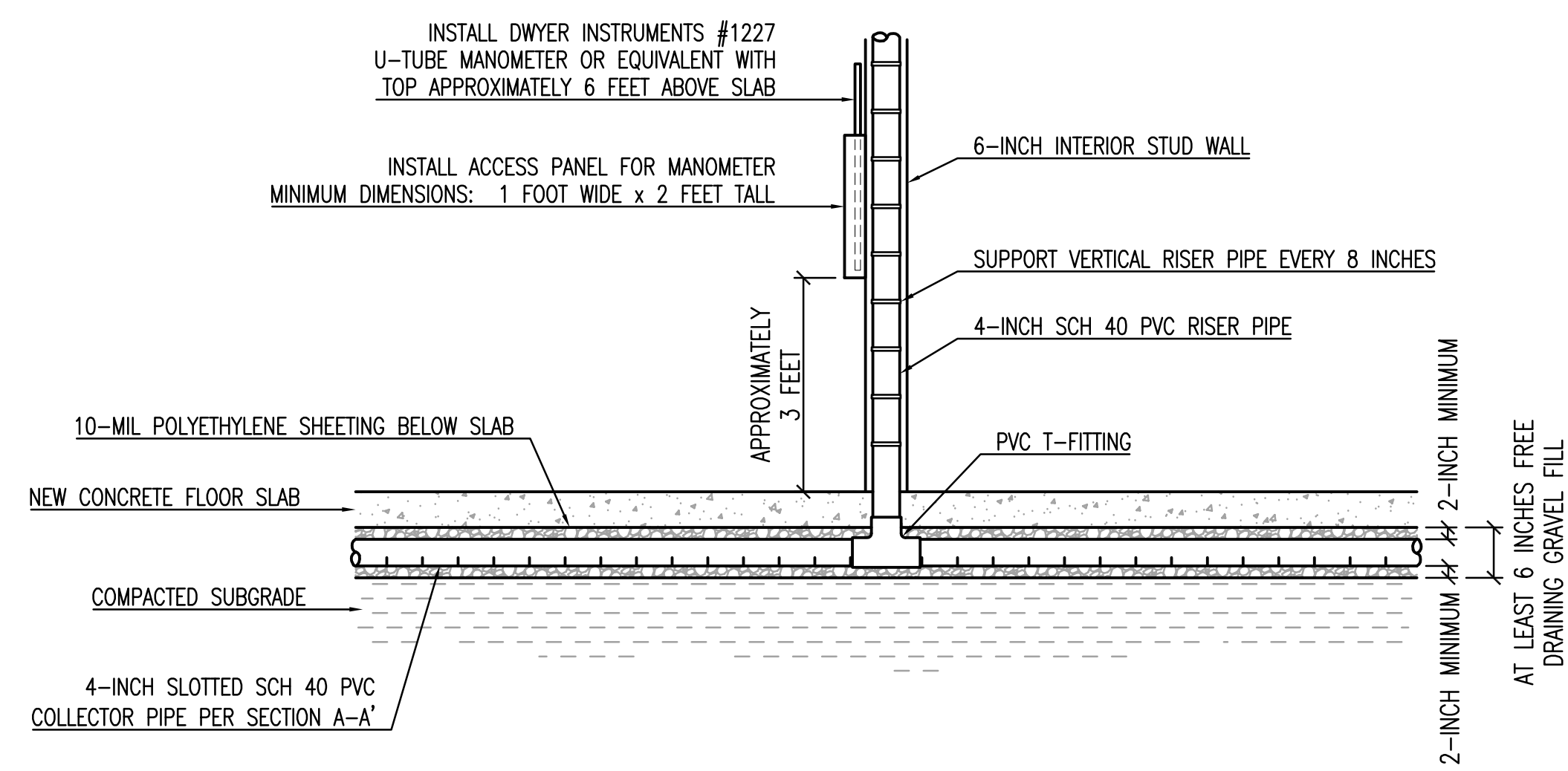
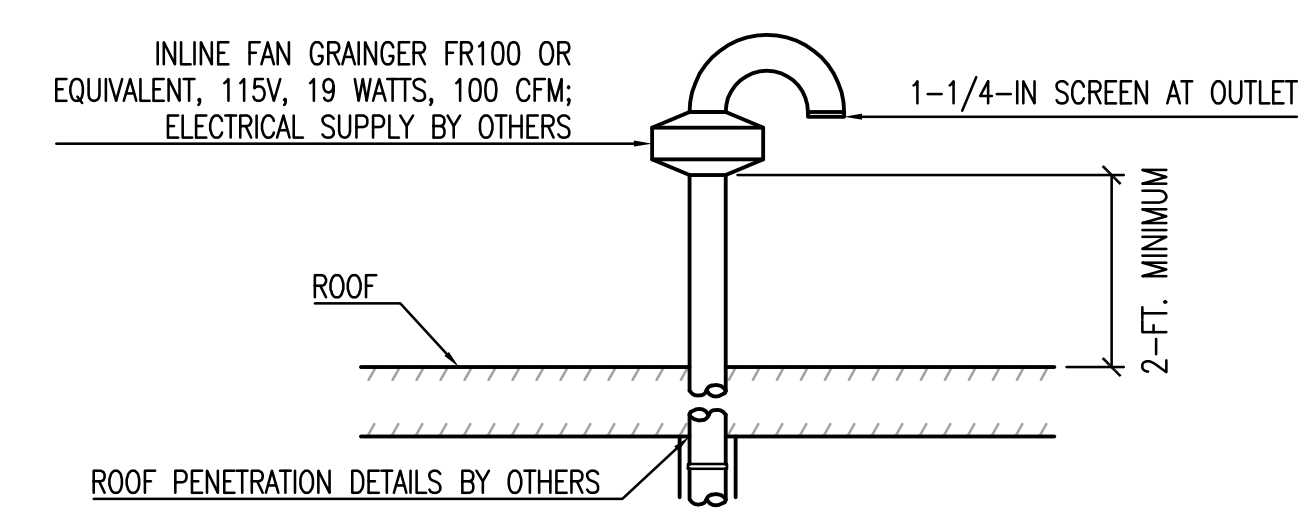


A3 FIRST FLOOR PLAN
SCALE: 1/8" = 1'-0"



SECTION A-A' METHANE COLLECTION TRENCH DETAIL
SCALE: 1/2" = 1'-0"

- METHANE CONTROL SYSTEM NOTES**
- DO NOT UNDERCUT FOOTINGS. MAINTAIN EXCAVATIONS AT LEAST 1 FOOT AWAY FROM FOOTING PERIMETER.
 - HORIZONTAL COLLECTION PIPING TO BE 4-INCH SCHEDULE 40 PVC WITH 0.62-INCH SLOT WIDTH AT 1/4-IN. SPACING.
 - POLYETHYLENE SHEETING TO BE 10 MIL THICK. OVERLAP AT LEAST 12 INCHES AT SEAMS. SEAL SEAMS AND PENETRATIONS WITH 3M 8087 CONSTRUCTION SEAMING TYPE OR EQUIVALENT.
 - VERTICAL VENT PIPE TO BE 4-INCH SCHEDULE 40 PVC BRACED EVERY 8 INCHES.
 - FREE-DRAINING GRAVEL TO BE PER SPECIFICATION SECTION 31 2000 (2.1, H).



SECTION B-B' VERTICAL RISER PIPE
SCALE: 1/2" = 1'-0"



CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

METHANE CONTROL SYSTEM
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

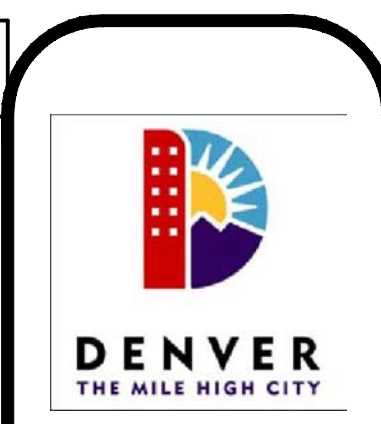
ISSUE
1. 11/11/13 - ISSUE FOR
BIDDING & CONSTRUCTION
DRAWN BY: LCR
REVIEWED BY: CMJ
Date: 11/12/2012
SHEET



MCS-1
S&W PROJECT NO.
23-1-01285-104

SPECIAL INSPECTION REQUIREMENTS		
MATERIAL	CONTINUOUS OR PERIODIC INSPECTION	INSPECTION TASKS
CONCRETE	PERIODIC (PER IBC TABLE 1704.4)	DURING THE TAKING OF TEST SPECIMENS. DURING THE PLACING OF REINFORCED CONCRETE, EXCEPT SITE WORK AND INTERIOR SLAB-ON-GRADE, INCLUDING THE TAKING OF TEST CYLINDERS AND SLUMP TEST. INSPECT FOR MAINTENANCE OF SPECIFIED CURING TEMPERATURE AND TECHNIQUES.
MASONRY	PERIODIC (PER IBC TABLE 1704.5.1)	PRIOR TO START OF WORK: 1. DURING THE TAKING OF GROUT SAMPLES FOR TESTING. 2. DURING THE PREPARATION OF MASONRY PRISMS. PROTECTION OF MASONRY DURING COLD WEATHER OR HOT WEATHER. DURING PREPARATION OF ANY REQUIRED PRISMS DURING CONSTRUCTION. DURING THE TAKING OF GROUT SAMPLES FOR TESTING IF REQUIRED DURING CONSTRUCTION. AT THE START OF LAYING MASONRY UNITS: ITEMS INSPECTED SHALL INCLUDE, BUT NOT BE LIMITED TO: 1. MASONRY UNITS, REINFORCEMENT, CEMENT, LIME, AGGREGATE, AND ALL OTHER MATERIALS MEET THE REQUIREMENTS OF THE DRAWINGS AND SPECIFICATIONS. 2. MORTAR MIXING USING SPECIFIED MATERIALS AND PROPORTIONS OF INGREDIENTS. 3. METHODS OF MEASURING MATERIALS FOR MORTAR. 4. USE OF OPEN END UNITS AT STACK BOND CONDITIONS AT CORNERS OR ABUTTING TO CONCRETE. AFTER THE PLACEMENT OF REINFORCING STEEL PRIOR TO GROUTING. ITEMS INSPECTED SHALL INCLUDE, BUT NOT BE LIMITED TO: REINFORCEMENT SIZES, PLACEMENT, LAP LENGTHS, CLEAR DISTANCES, REINFORCING STEEL AROUND OPENINGS. PRIOR TO GROUTING TO INSPECT EMBEDDED PLATES, BOLTS, BASE PLATES, AND OTHER ANCHORAGES. PRIOR TO GROUTING TO INSPECT THE GROUT SPACE. DURING ALL GROUTING OPERATIONS.
NOTES: 1. OWNER WILL EMPLOY SPECIAL INSPECTOR, QUALIFIED PER IBC SECTION 1704.1.		

GENERAL NOTES									
1. DESIGN CODES: A. INTERNATIONAL BUILDING CODE (IBC 2009) & 2011 CITY OF DENVER AMENDMENTS. B. REFERENCE IBC CHAPTER 35 FOR ADDITIONAL CODES USED IN DESIGN.									
2. DESIGN LOADS: A. ROOF: 1. SNOW DRIFTING CRITERIA: a) GROUND SNOW LOAD $P_g = 25$ psf. b) ROOF SNOW LOAD $P_f = 25$ psf. c) EXPOSURE $C_e = 1.0$. d) IMPORTANCE $I_s = 1.0$. 1.) OCCUPANCY CATEGORY $I_l = II$. e) THERMAL $C_r = 1.0$. 3. DEAD LOAD* $P_d =$ psf. B. WIND: 1. BASIC WIND SPEED (3 SECOND GUST) $V = 90$ mph. 2. EXPOSURE $C_e = 1.0$. 3. IMPORTANCE FACTOR $I_w = 1.0$. a) OCCUPANCY CATEGORY $I_l = II$. C. SEISMIC: 1. SPECTRAL RESPONSE ACCELERATIONS: $S_s = 0.212$, $S_1 = 0.060$, $S_{ps} = 0.226$, $S_{p1} = 0.096$. 2. SPECTRAL RESPONSE COEFFICIENTS: $S_{ps} = 0.226$, $S_{p1} = 0.096$. 3. IMPORTANCE FACTOR $I_e = 1.0$. a) OCCUPANCY CATEGORY $I_l = II$. 4. SITE CLASS D . 5. DESIGN CATEGORY B . 6. BASIC FORCE RESISTING SYSTEM $A.9$. (ASCE 7-05, TABLE 12.2.1) 7. RESPONSE COEFFICIENT $C_s = 0.0823$. 8. RESPONSE MODIFICATION FACTOR $R = 2.0$. 9. DESIGN BASE SHEAR $V = 0.0823 W$. 10. ANALYSIS PROCEDURE USED $EQUVALENT LATERAL FORCE PROCEDURE$.									
2. CONCRETE: A. ALL CONCRETE SHALL CONFORM TO THE SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS, ACI 301, AND BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE, ACI 318. B. CONCRETE MIX DESIGNS:									
TYPE	USE	STRENGTH	CONC. TYPE	CEMENT CONTENT	W/C RATIO	SLUMP	ADMIX-TURES	MAX. AGGR. SIZE	AIR
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(7)
A	ALL NOT OTHERWISE SPECIFIED	4000	NW	611	-	3-5	-	.75"	4-8
B	INTERIOR FLATWORK	4000	NW	611	-	3-5	FR 1.5	.75"	1-3
C	NON-SHRINK GROUT	7000 (MIN.)	-	-	-	-	-	-	-
1. 28-DAY COMPRESSIVE STRENGTH, PSI. 2. NORMAL WEIGHT STONE AGGREGATE (NW). 3. MINIMUM POUNDS PER CUBIC YARD WITHOUT WATER REDUCING ADMIXTURE. SUBTRACT 47.0 lbs/c.y. WITH WATER REDUCING ADMIXTURE. FLY ASH MAXIMUM 20% CEMENTITIOUS MATERIAL. USE TYPE II CEMENT, WHERE CONCRETE IS EXPOSED TO EARTH. 4. MINIMUM WATER/CEMENT RATIO PER ACI. 5. RANGE IN INCHES. 6. FR 1.5 POUNDS PER CUBIC YARD OF POLYPROPYLENE FIBERS IN SLABS ON GRADE. WRA = WATER REDUCING ADMIXTURES. 7. TOTAL AIR CONTENT, PERCENTAGE RANGE. C. ALL REINFORCING SHALL BE HIGH STRENGTH DEFORMED BARS, GRADE 60, ASTM A615, WITH 60,000 psi MINIMUM YIELD POINT EXCEPT: a. COLUMN TIES AND BEAM STIRRUPS $\dots \dots \dots$ GRADE 40 b. FIELD-BENT BARS $\dots \dots \dots$ GRADE 40 c. FIELD-WELDED BARS $\dots \dots \dots$ GRADE 40 OR GRADE 60 ASTM A706 D. REINFORCEMENT PROTECTION: 1. CONCRETE POURED AGAINST EARTH $\dots \dots \dots$ 3" 2. CONCRETE POURED IN FORMS BUT EXPOSED TO WEATHER OR EARTH: a. IF BARS ARE LARGER THAN No. 5 $\dots \dots \dots$ 2" b. IF BARS ARE No. 5 OR SMALLER $\dots \dots \dots$ 1 1/2" E. ALL BAR LENGTHS ARE DRAWN TO SCALE UNLESS NOTED. NO SPLICES OF REINFORCEMENT SHALL BE MADE EXCEPT AS DETAILED OR AS AUTHORIZED BY ANDERSON & HASTINGS. LAP SPLICES, WHERE PERMITTED, SHALL BE A MINIMUM OF 48 BAR DIAMETERS UNLESS OTHERWISE NOTED. MAKE ALL BARS CONTINUOUS AROUND CORNERS. F. DETAIL BARS IN ACCORDANCE WITH ACI DETAILING MANUAL AND ACI BUILDING CODE REQUIREMENT FOR REINFORCED CONCRETE. G. PROVIDE ALL ACCESSORIES NECESSARY TO SUPPORT REINFORCING AT POSITIONS SHOWN ON THE PLANS. H. NO WELDING OF REINFORCING SHALL BE PERMITTED UNLESS SPECIFICALLY DETAILED OR APPROVED BY ANDERSON AND HASTINGS.									
3. STEEL: A. STRUCTURAL STEEL SHALL CONFORM TO THE FOLLOWING: 1. WIDE FLANGE $\dots \dots \dots$ ASTM A992/A572-50 2. HOLLOW STRUCTURAL SECTIONS (HSS) $\dots \dots$ ASTM A500, GRADE B 3. ANGLES, CHANNELS, PLATES, ETC. $\dots \dots$ ASTM A36 4. WELDS $\dots \dots \dots$ E70, LOW HYDROGEN ELECTRODES 5. ANCHOR RODS $\dots \dots \dots$ ASTM A36 OR ASTM F1554, GR. 36 B. STRUCTURAL STEEL SHALL BE DETAILED AND FABRICATED IN ACCORDANCE WITH THE 13th EDITION OF AISC MANUAL OF STEEL CONSTRUCTION AND CODE OF STANDARD PRACTICE. C. CONNECTIONS MADE WITH HIGH STRENGTH STEEL BOLTS SHALL CONFORM IN ALL RESPECTS TO THE 2004 SPECIFICATIONS FOR STRUCTURAL JOINTS USING ASTM A325 BOLTS AS ENDORSED BY THE AISC. USE TENSION CONTROL BOLTS (TCB). D. ALL WELDERS SHALL HAVE EVIDENCE OF PASSING THE AWS STANDARD QUALIFICATION TESTS.									
4. MASONRY: A. CONCRETE MASONRY UNITS (CMU) SHALL COMPLY WITH ASTM-C90 TYPE 1 AND HAVE A MINIMUM COMPRESSIVE STRENGTH OF 1,900 psi. B. MORTAR SHALL BE TYPE S CONFORMING WITH IBC SECTION 2103.11 AND ASTM C-270, WITH A MINIMUM COMPRESSIVE STRENGTH OF 1,800 psi. C. GROUT SHALL COMPLY WITH IBC SECTION 2103.12, AND ASTM C-476. D. MASONRY (CONCRETE MASONRY UNITS, MORTAR, AND GROUT) SHALL DEVELOP 1,500 psi MINIMUM COMPRESSIVE STRENGTH IN 28 DAYS, AS VERIFIED BY PRISM TESTING.									
5. PROVIDE TEMPORARY BRACING AND PRECAUTIONS NECESSARY TO WITHSTAND ALL CONSTRUCTION AND/OR WIND LOADS UNTIL ALL FIELD CONNECTIONS ARE COMPLETED. 6. NOTCHING OR CUTTING OF ANY STRUCTURAL MEMBER IS PROHIBITED UNLESS SPECIFICALLY DETAILED ON THE STRUCTURAL DRAWINGS. 7. NOTIFY ARCHITECT AND ANDERSON & HASTINGS IMMEDIATELY IF CONDITIONS NOT COVERED BY THESE DRAWINGS ARE EXPOSED DURING CONSTRUCTION. 8. CONTRACTOR MUST VERIFY ALL EXISTING BUILDING DIMENSIONS AND DETAILS PRIOR TO FABRICATION AND CONSTRUCTION. 9. SUBSTITUTIONS: ALL SUBSTITUTIONS FOR SPECIFIED PRODUCTS MUST BE SUBMITTED IN WRITING TO THE ARCHITECT AND ANDERSON & HASTINGS. APPROVAL IS REQUIRED FOR ALL SUBSTITUTIONS. 10. OSHA STANDARDS: A. THE STRUCTURE IS DESIGNED TO PERFORM WITH ALL PERMANENT ELEMENTS IN PLACE PER IBC CODE AND CORRESPONDING STRUCTURAL REQUIREMENTS UPON COMPLETION OF CONSTRUCTION. THE STRUCTURAL DRAWINGS DO NOT ELIMINATE THE NEED FOR THE CONTRACTOR TO COMPLY WITH ALL OSHA REQUIREMENTS. B. THE STRUCTURAL DRAWINGS REPRESENT FINAL CONSTRUCTION CONDITIONS ONLY. WHERE THE STRUCTURAL DRAWINGS APPEAR TO CONFLICT WITH OSHA, THE CONTRACTOR SHALL SUPPLY ALL ERECTION FRAMING AS REQUIRED TO MEET OSHA COMPLIANCE.									



SLATERPAULL ARCHITECTS
 1331 Nineteenth Street
 Denver, CO 80202
 P: 303.607.0977
 www.slaterpaull.com

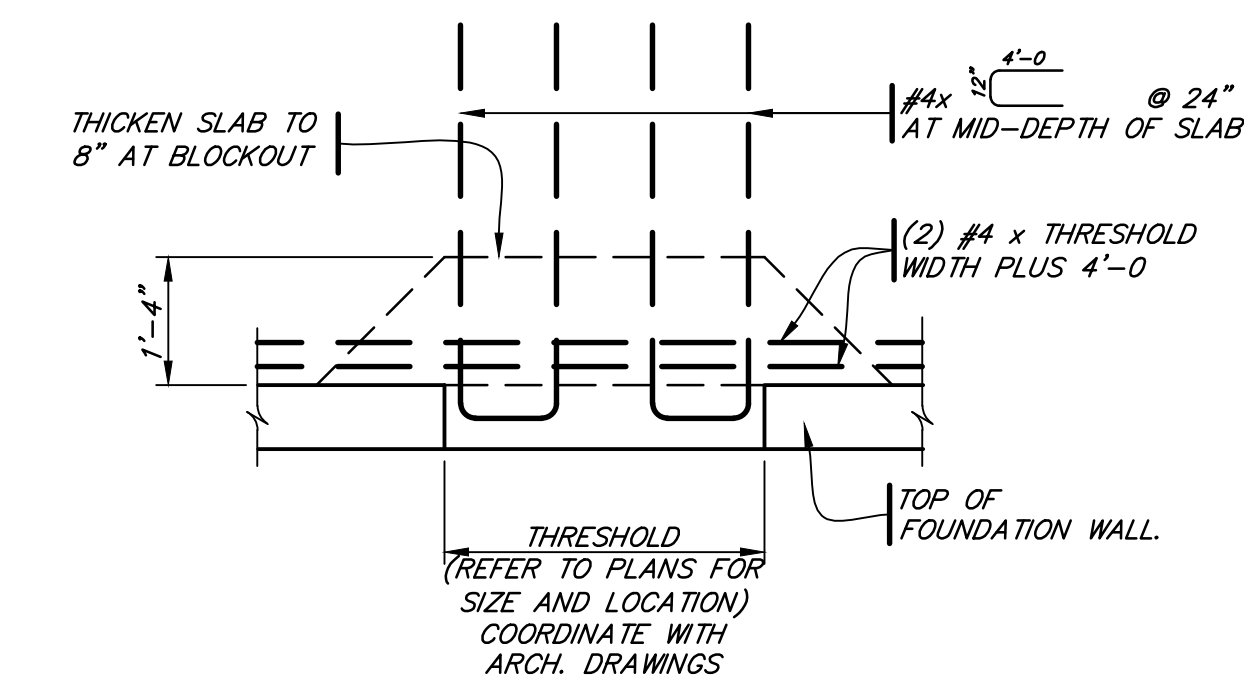
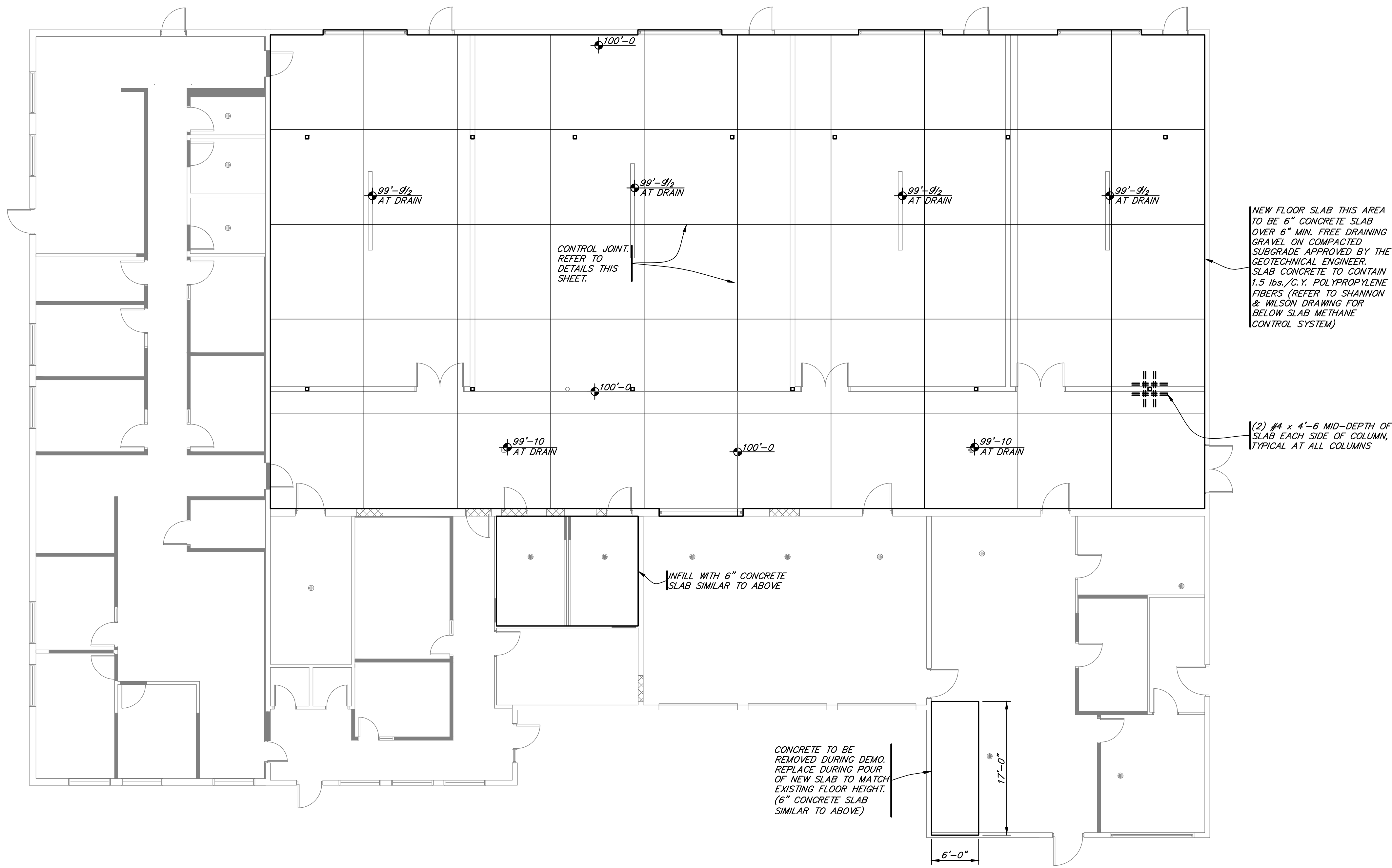
CITY AND COUNTY OF DENVER
 DEPARTMENT OF
 PARKS & RECREATION
 201 West Colfax Avenue, Dept. 613
 Denver, Colorado 80202

GENERAL NOTES
 S. JASON STREET
 MAINTENANCE FACILITY
 678 S. Jason Street
 Denver, Colorado 80223

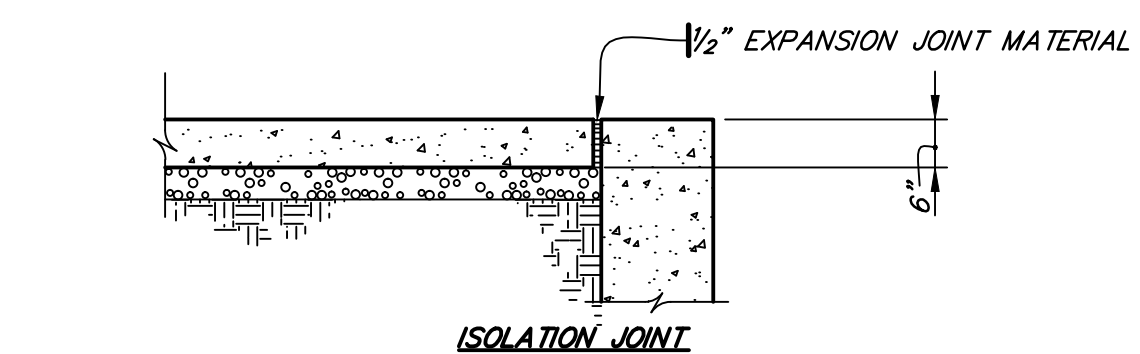
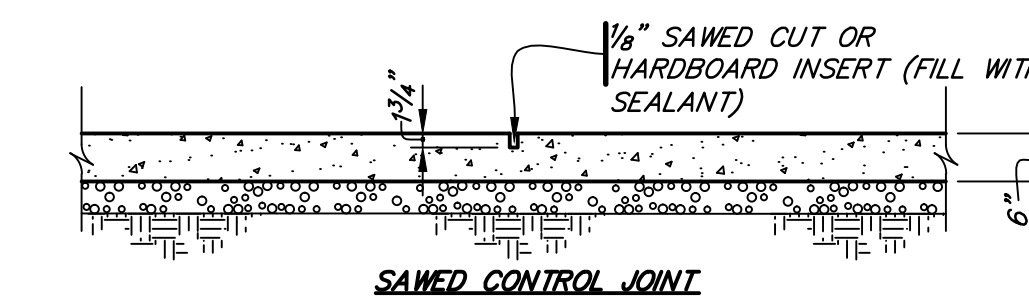
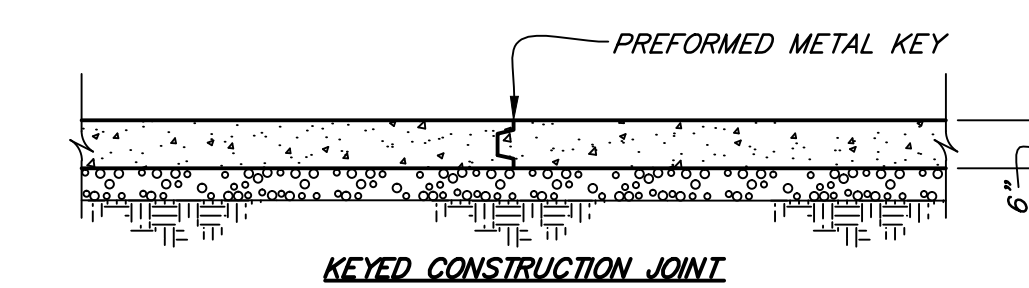
ISSUE:
 1. 11/11/13 BIDDING & CONST.

DRAWN BY: LGM
 REVIEWED BY: RVL
 Date: NOV. 11, 2013
 SHEET
S-101
 1644-S101.dwg

ANDERSON & HASTINGS
 GENERAL CONTRACTORS
 Job No. 090-12-1644



TYPICAL DETAIL AT DOOR THRESHOLDS NO SCALE
(INCLUDING OVERHEAD DOOR OPENINGS)



SLAB ON GRADE JOINT DETAILS

NOTES:

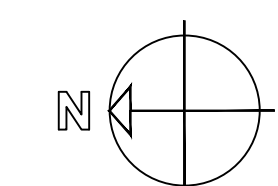
1. PROVIDE KEYED CONSTRUCTION JOINT OR SAWED CONTROL JOINT, TYPE AT CONTRACTOR'S OPTION. SAWED JOINTS SHALL BE COMPLETED WITHIN 18 HOURS OF POUR.
2. JOINT LOCATIONS ARE SHOWN ON PLAN. MAXIMUM SPACING = 15 FT. UNLESS OTHERWISE SHOWN.

FIRST LEVEL PLAN

1/8" = 1'-0"

NOTES:

1. PROVIDE CONNECTION AT TOP OF NEW PARTITIONS TO ALLOW FOR 2" MINIMUM ROOF DEFLECTION.
2. ELEVATION TOP OF NEW SLAB = 100'-0" UNLESS OTHERWISE NOTED THUS: 99'-10". (SLOPE CONCRETE TO DRAINS). REFER TO ARCH DRAWINGS FOR ADDITIONAL INFORMATION.



AMERICAN ENGINEERING & ARCHITECTURE, INC.
Job No. 090-12-1644

PARKING SUMMARY

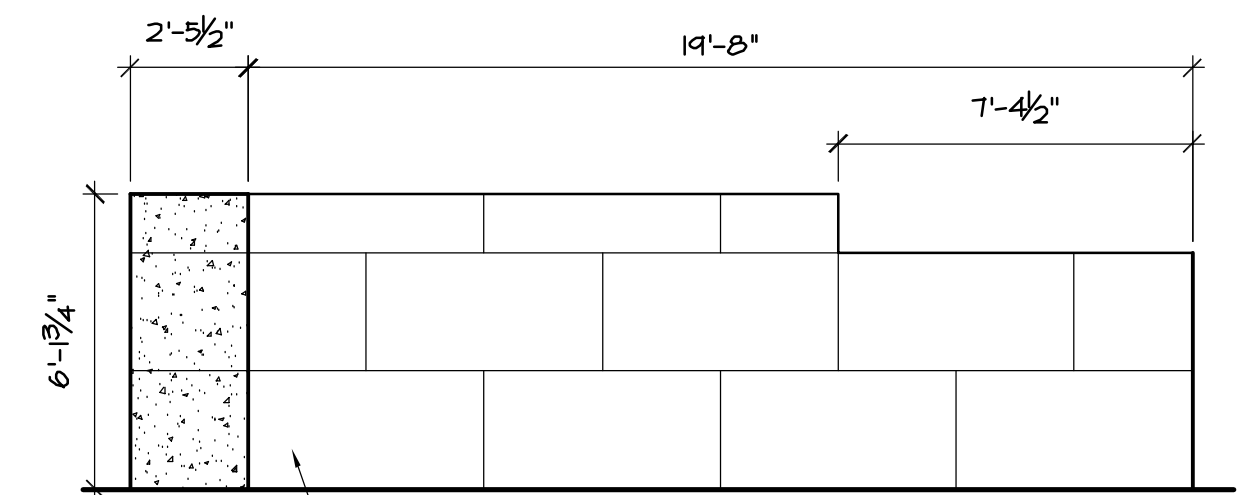
ZONING DISTRICT: I-A INDUSTRIAL COMMERCIAL
USE CATEGORY: OFFICE
PARKING REQUIREMENT 2 PER 1000 SF
BUILDING AREA: 2,750 SF = 6 SPACES
INDUSTRIAL SERVICES (SERVICE/REPAIR, COMMERCIAL)
PARKING REQUIREMENT 3 PER 1000 SF
BUILDING AREA: 11,446 SF = 30 SPACES

TOTAL SPACES REQUIRED: 44
REGD MIN NUMBER OF ADA SPACES: 2

TOTAL SPACES PROVIDED: 49
TOTAL ADA SPACES PROV.: 3

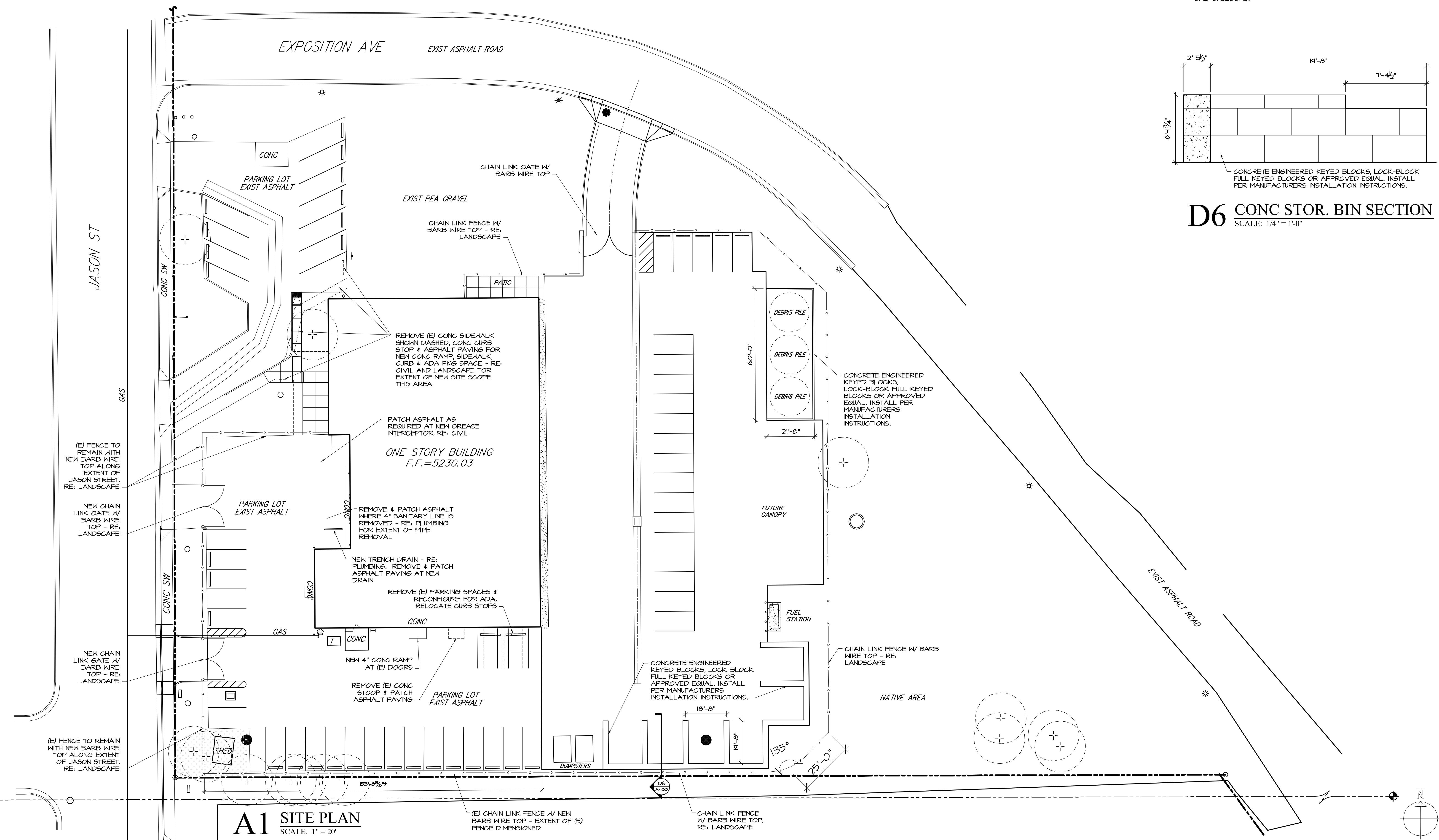
SITE PLAN GENERAL NOTES

1. REFER CIVIL & LANDSCAPE FOR ADDITIONAL SITE WORK SCOPE.
2. ALL SITE WORK TO BE ADD ALTERNATE #1 EXCEPT FOR NEW SANITARY AND STORM PIPING AND CONNECTIONS, TO BE BASE BID. RE: CIVIL
3. ALL GRADING WORK AND PAVING DEMOLITION TO BE COMPLETED BY ABATEMENT CONTRACTOR DUE TO CONTAMINATED SOILS.
4. ALL LANDSCAPING AND IRRIGATION SCOPE TO BE ADD ALTERNATE #1. RE LANDSCAPE FOR EXTENT OF SCOPE AND ADDITIONAL REQUIREMENTS.
5. REFER TO SHEET A-131 FOR LOCATIONS OF NEW CONCRETE SPLASHELOCKS.



CONCRETE ENGINEERED KEYED BLOCKS, LOCK-BLOCK FULL KEYED BLOCKS OR APPROVED EQUAL. INSTALL PER MANUFACTURERS INSTALLATION INSTRUCTIONS.

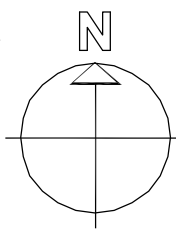
D6 CONC STOR. BIN SECTION
SCALE: 1/4" = 1'-0"



A1 SITE PLAN
SCALE: 1" = 20'

(E) CHAIN LINK FENCE W/ NEW BARB WIRE TOP - EXTENT OF (E) FENCE DIMENSIONED

CHAIN LINK FENCE W/ BARB WIRE TOP, RE: LANDSCAPE

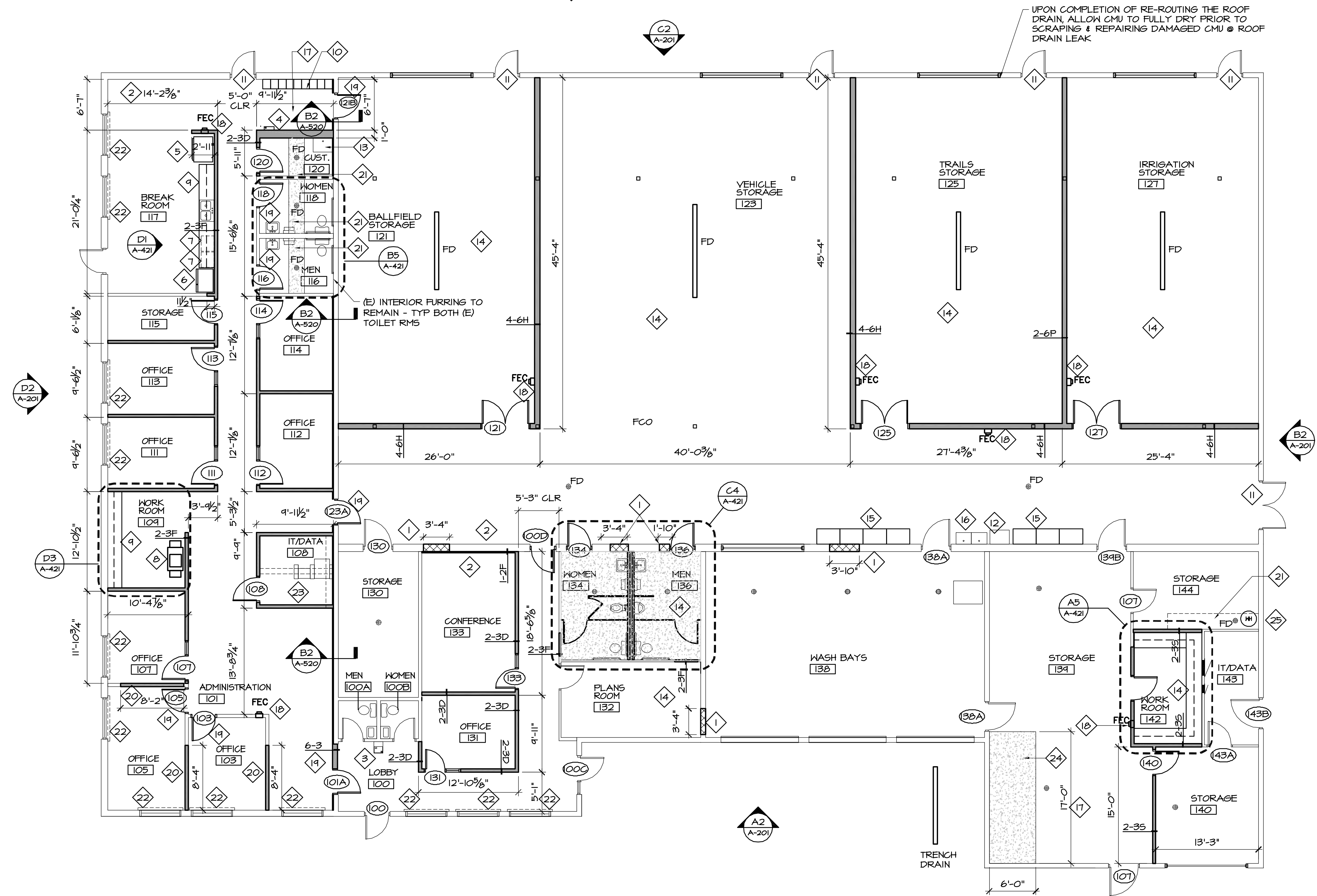


FLOOR PLAN KEYNOTES

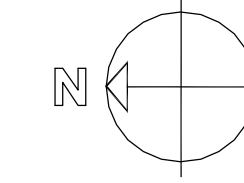
- 1 ALIGN NEW CMU INFILL W/ EXISTING ADJACENT CMU
- 2 4' X 8' MARKERBOARD
- 3 PROVIDE NEW ADA COMPLIANT DRINKING FOUNTAIN, RE: PLUMBING
- 4 DRINKING FOUNTAIN, RE: C3/A-520 & PLUMBING
- 5 VENDOR PROVIDED & INSTALLED VENDING MACHINE
- 6 OWNER PROVIDED / GC INSTALLED REFRIGERATOR
- 7 OWNER PROVIDED / GC INSTALLED MICROWAVE
- 8 OWNER PROVIDED COPY MACHINE
- 9 UPPER & LOWER PLAM CASEWORK, RE: INTERIOR ELEVATIONS
- 10 FULL HEIGHT LOCKERS
- 11 EXISTING DOOR & HARDWARE TO REMAIN
- 12 UTILITY SINK, RE: PLUMBING
- 13 MOP SINK, RE: PLUMBING
- 14 NEW CONCRETE FLOOR SLAB INFILL PATCH, RE: STRUCTURAL
- 15 OWNER PROVIDED HAZARDOUS MATERIALS STORAGE CABINETS
- 16 OWNER PROVIDED ICE/WATER DISPENSER
- 17 PROVIDE THINSET CONCRETE COATING TO LEVEL EXISTING CONCRETE FLOOR. (E) FLOOR DRAIN PREVIOUSLY PLUGGED, INFILL TOP OF DRAIN W/ NEW CONCRETE
- 18 PROVIDE SEMI-RECESSED FIRE EXTINGUISHER CABINET AND 2-A FIRE EXTINGUISHER.
- 19 REMOVE (E) DOOR & FRAME & PROVIDE NEW DOOR & FRAME. RE: DOOR SCHEDULE
- 20 INFILL (E) WINDOW OPNS WITH 2X MTL STUD FRAMING & ALIGN FINISH FACES
- 21 SAWCUT (E) CONCRETE SLAB FOR NEW PLUMBING. PATCH SLAB & PREP FOR NEW FLOOR FINISH - RE: PLUMBING FOR LOCATION OF NEW PIPING
- 22 PROVIDE MANUAL OPERATED VERTICAL WINDOW SHADE. RE: A-521/B5
- 23 OWNER PROVIDED IT EQUIPMENT
- 24 REMOVE AND REPLACE CONCRETE SLAB AT EXTENT SHOWN. T.O. SLAB TO ALIGN TO EXISTING ADJACENT SLAB. RE: STRUCTURAL
- 25 NEW WATER HEATER, RE: PLUMBING

FLOOR PLAN GENERAL NOTES

- 1. ALL EXISTING DOORS TO REMAIN. PROVIDE NEW DOOR HARDWARE U.O.N.
- 2. AT ALL LOCATIONS WHERE A NEW GYPSUM BOARD WALL ABUTS AN EXISTING WALL, ALIGN FINISH FACES OF WALLS.
- 3. ALL NEW GYPSUM BOARD WALL ASSEMBLIES TO BE WALL TYPE 2-3F UNLESS NOTES OTHERWISE. RE: SHEET A-520 FOR PARTITION TYPES.
- 4. REFER TO A-521 FOR SIGNAGE TYPES.
- 5. ALL NEW WALLS SHOWN HATCHED.



A3 FIRST FLOOR PLAN
SCALE: 1/8" = 1'-0"



SLATERPAULL
ARCHITECTS
1331 Nineteenth Street
Denver, CO 80202
P. 303.607.0977
www.slaterpaull.com

CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

FIRST FLOOR PLAN
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

ISSUE
1. 11/11/13 - ISSUE FOR
BIDDING & CONSTRUCTION

DRAWN BY: LDG
REVIEWED BY: JCP
Date: 11/11/2013

SHEET
A-111
SPA PROJECT NO.
10842.210

CEILING FINISH NOTES

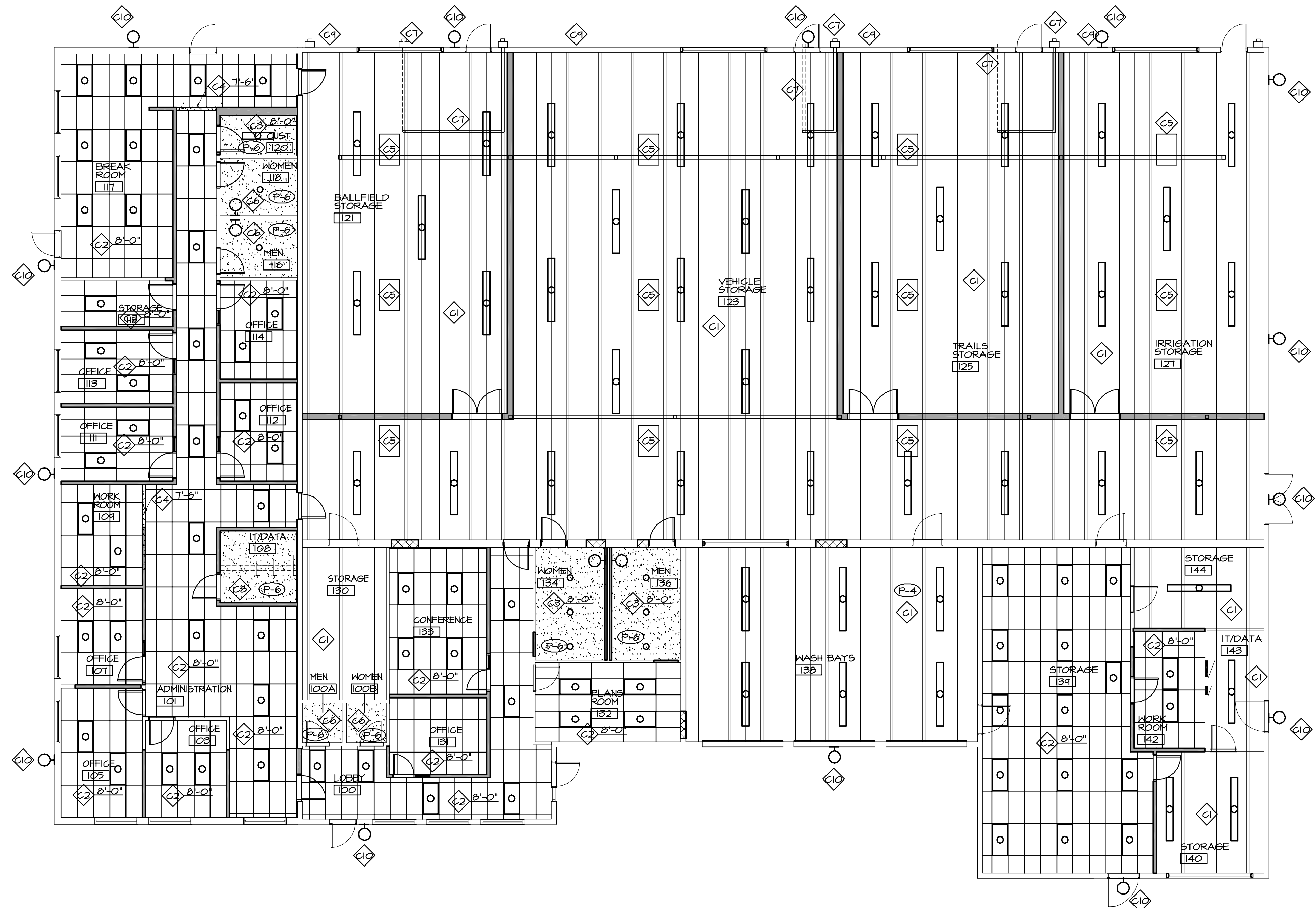
(P-6) FIELD PAINT: SUGARED ALMOND #A0074

CEILING PLAN LEGEND

- (C1) (E) CONCRETE TEE ROOF STRUCTURE - NO CEILING
- (C2) 2X4 SUSPENDED ACOUSTIC GRID AND TILE
- (C3) 5/8" GYPSUM BOARD CEILING ON 3-5/8" METAL STUD FRAMING
- (C4) 5/8" GYPSUM BOARD SOFFIT ON 3-5/8" METAL STUD FRAMING
- (C5) (E) SKYLIGHT TO REMAIN
- (C6) (E) GYPSUM BOARD CEILING TO REMAIN - PAINT
- (C7) REMOVE EXISTING HORIZONTAL ROOF DRAIN AND RE-ROUTE AS SHOWN. FILL PREVIOUS WALL PENETRATION. RE: A-521/A3 FOR NEW WALL PENETRATION DETAIL
- (C8) 5/8" GYPSUM BOARD CEILING ATTACHED TO UNDERSIDE OF ROOF FRAMING
- (C9) REMOVE (E) WALL & INSTALL NEW STEEL LINTEL FOR NEW MECHANICAL LOUVER - RE: STRUCTURAL FOR LINTEL SCHEDULE & A-201 FOR OPENING LOCATIONS
- (C10) (E) WALL PACK LIGHT FIXTURE TO REMAIN - RE: ELEC FOR CONNECTION REQUIREMENTS

CEILING PLAN GENERAL NOTES

1. REPLACE ALL DAMAGED & MISSING ROOF INSULATION @ WOOD FRAMED ROOF. ASSUME 10% OF ROOF AREA. PROVIDE FOIL FACED BATT INSULATION WITH R-VALUE OF 30.
2. REFER TO FINISH PLAN FOR CEILING PAINT FINISHES
3. LIGHTING FIXTURES SHOWN ARE FOR REFERENCE ONLY. REFER TO ELECTRICAL DRAWINGS FOR COMPLETE LIGHTING INFO



A3 FIRST FLOOR REFLECTED CEILING PLAN
SCALE: 1/8" = 1'-0"



SLATERPAULL
ARCHITECTS
1331 Nineteenth Street
Denver, CO 80202
P. 303.607.0977
www.slaterpaull.com

CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

FIRST FLOOR REFLECTED CEILING PLAN
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

ISSUE
1. 11/13 - ISSUE FOR
BIDDING & CONSTRUCTION

DRAWN BY: LDG
REVIEWED BY: JCP
Date: 11/11/2013

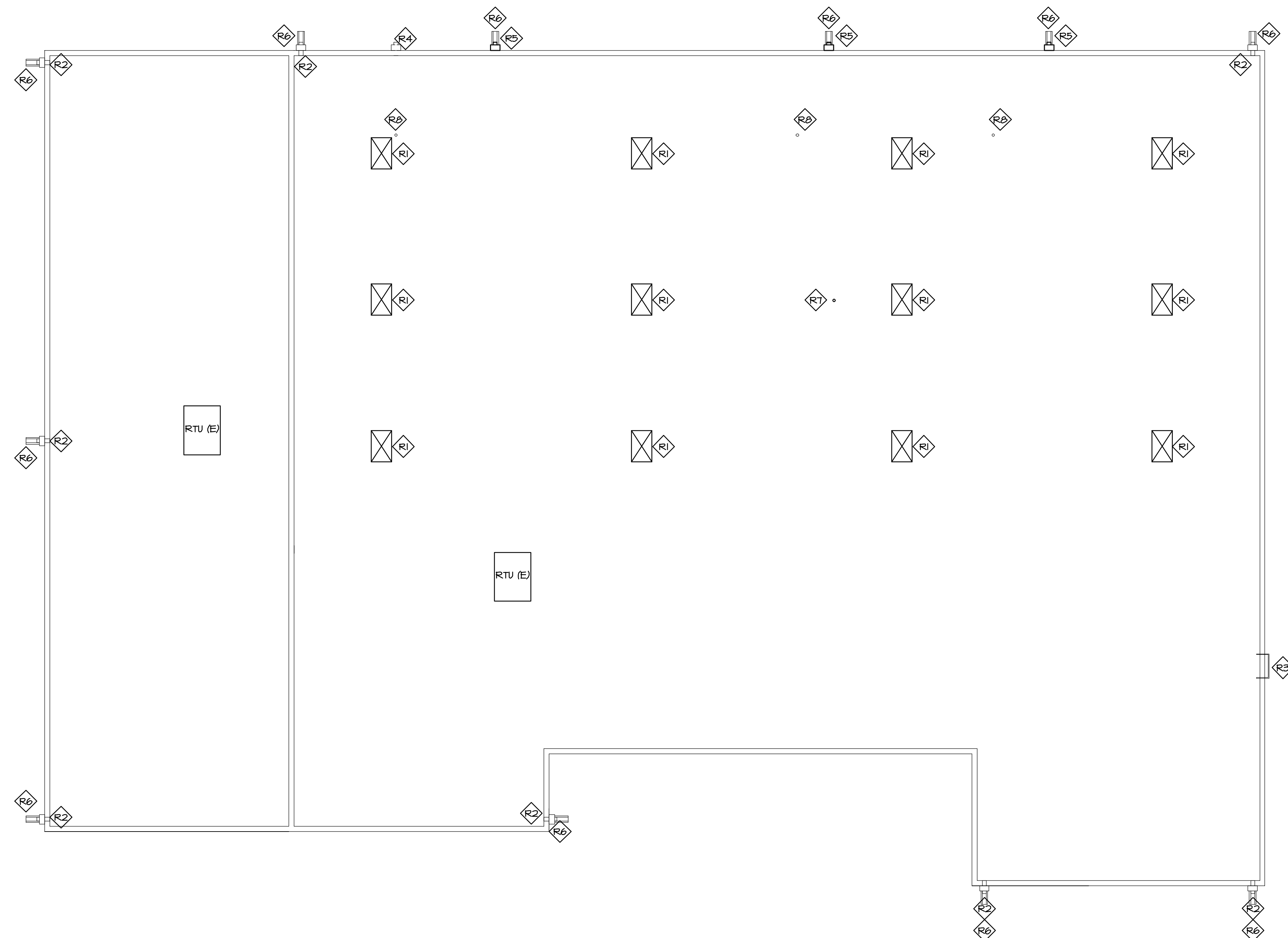
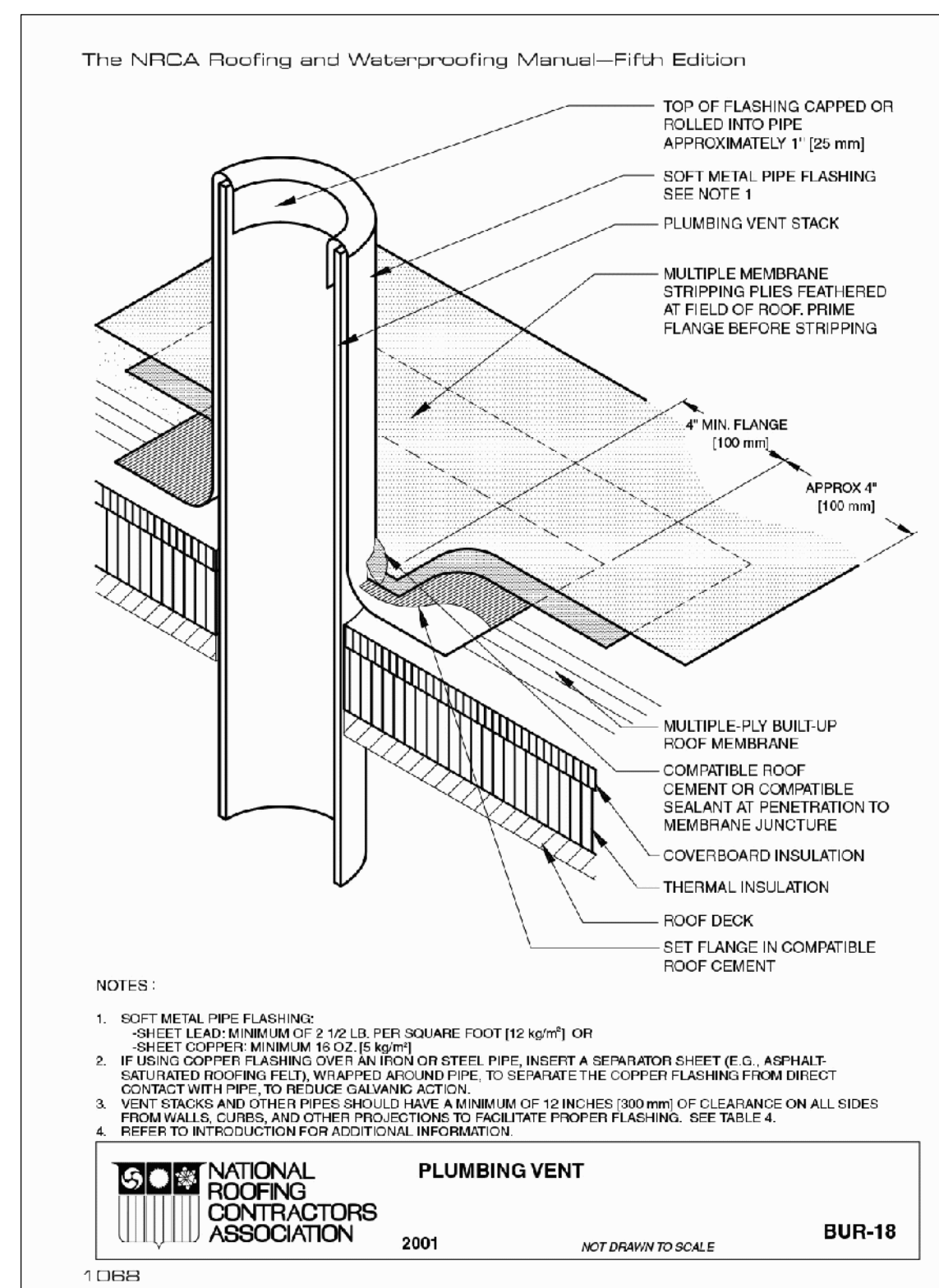
SHEET
A-121
SPA PROJECT NO.
10842.210

ROOF PLAN KEYNOTES

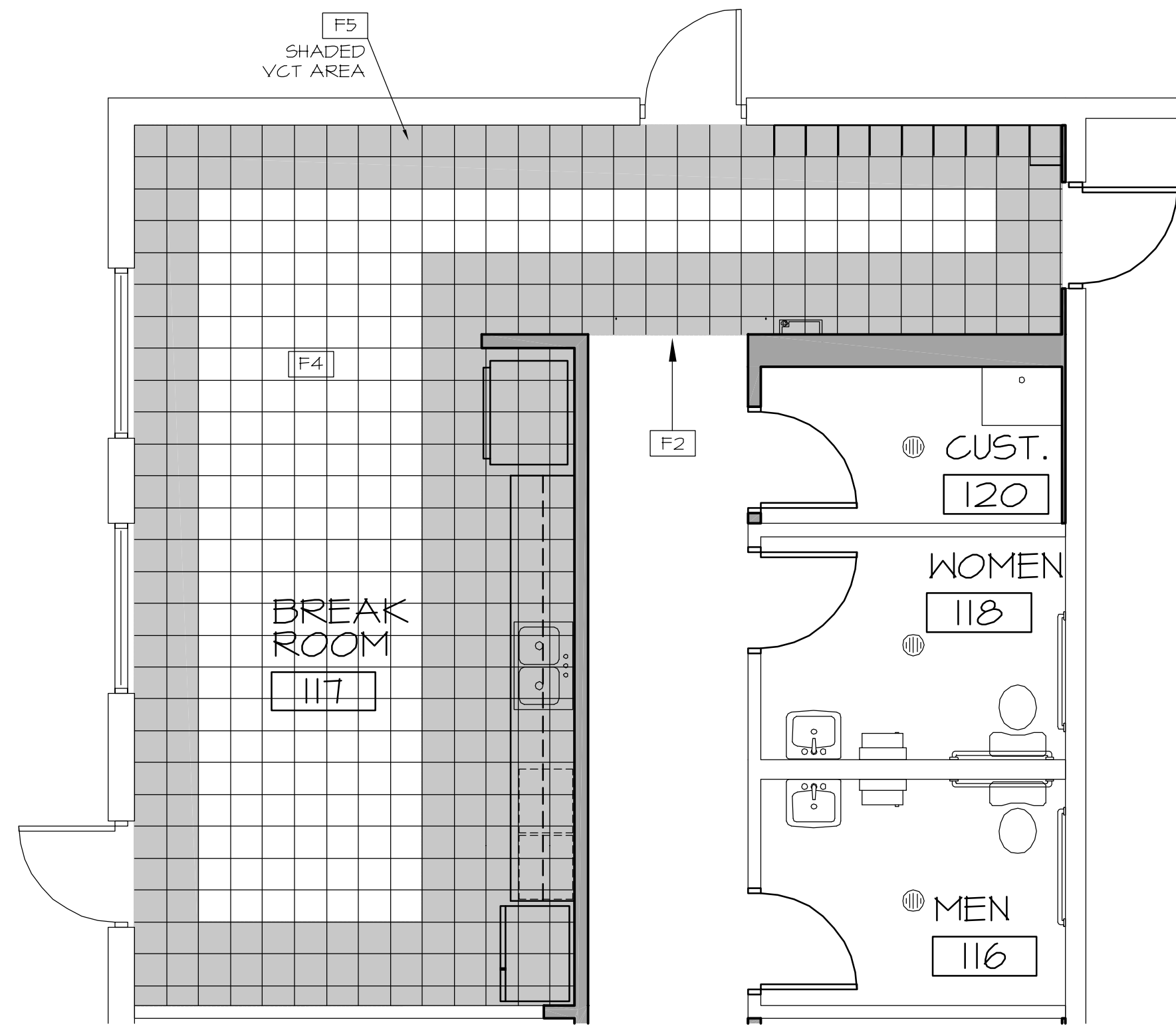
- R1 (E) SKYLIGHT TO REMAIN
- R2 (E) THRU-WALL SCUPPER, CONDUCTOR HEAD & DOWNSPOUT TO REMAIN. CLEAR AWAY DEBRIS FROM SCUPPER
- R3 (E) ROOF LADDER
- R4 REMOVE EXISTING CONDUCTOR HEAD, DOWNSPOUT & FASTENERS
- R5 PROVIDE NEW CONDUCTOR HEAD, DOWNSPOUT AND CONCRETE SPLASH BLOCK FOR THROUGH-WALL ROOF DRAIN
- R6 PROVIDE NEW CONCRETE SPLASH BLOCK AT EXISTING DOWNSPOUT
- R7 NEW 4" ROOF VENT FOR METHANE SYSTEM. INSTALL VENT & PATCH (E) BUR PER "NRCA ROOFING & WATERPROOFING MANUAL" PLUMBING VENT DETAIL BUR-18
- R8 (E) ROOF DRAIN TO REMAIN

ROOF PLAN GENERAL NOTES

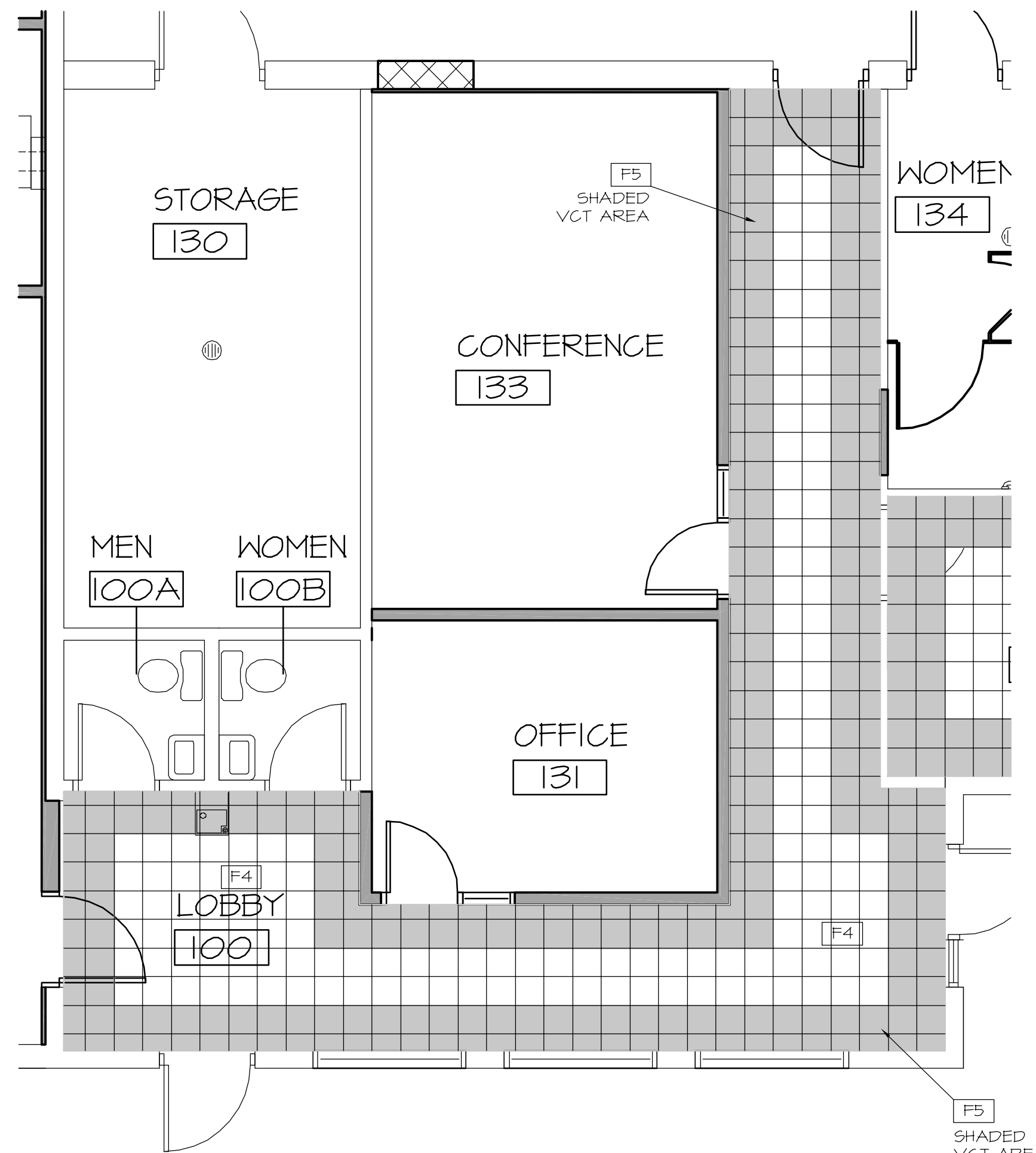
1. PATCH ROOF AS REQ'D AT NEW MECHANICAL WORK. RE: M-120.
2. REFER TO M-120 FOR MECHANICAL ROOF SCOPE OF WORK.



A3 ROOF PLAN
SCALE: 1/8" = 1'-0"



C1 KITCHEN FLOOR FINISHES
SCALE: 1/4" = 1'-0"



A1 LOBBY FLOOR FINISHES
SCALE: 1/4" = 1'-0"

GENERAL NOTES

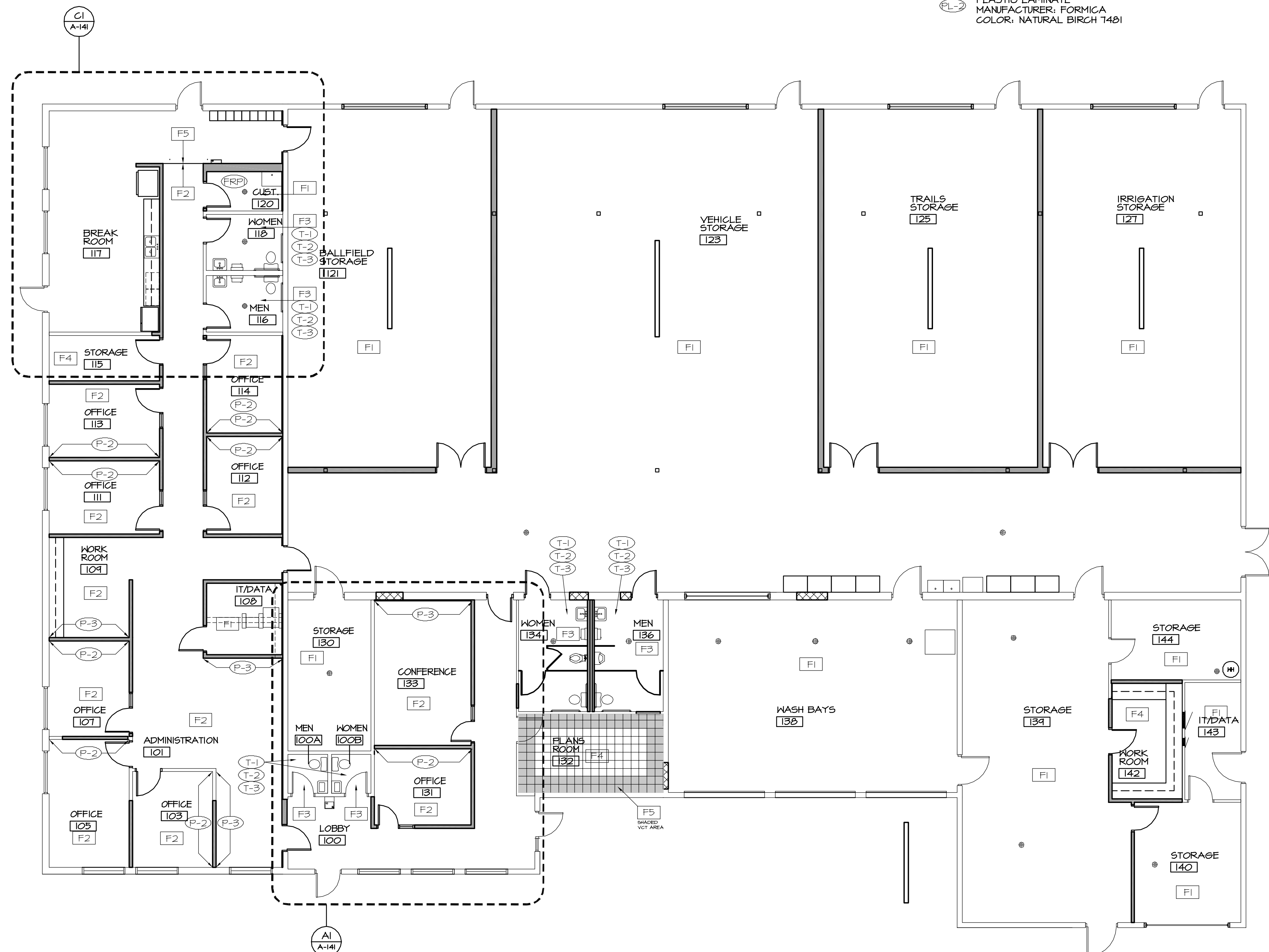
1. PROVIDE TRANSITION STRIPS WHERE FLOOR FINISHES CHANGE.
2. ALL WALLS TO BE (P-1) UN. REFER TO FINISH PLAN FOR ACCENT PAINT LOCATION.
3. EXPOSED CONCRETE ROOF STRUCTURE TO BE PAINTED (P-4) REFER TO A-121 FOR CEILING PAINT FINISH LOCATIONS.
4. INTERIOR DOOR FRAMES TO BE PAINTED (P-5)
5. REFER TO REFLECTED CEILING PLANS FOR CEILING AND SOFFIT FINISH COLORS.
6. REFER TO A-521 FOR SIGNAGE ELEVATIONS
7. CHANGE OF FLOORING MATERIAL TO OCCUR UNDER DOOR WHEN IT IS IN CLOSED POSITION. WHERE NO DOOR EXISTS, REFER TO FINISH PLAN FOR TRANSITION LOCATIONS.
8. REFER TO B3/A-421 FOR CERAMIC WALL TILE PATTERN.
9. RUBBER WALL BASE (RB1) AT ALL LOCATIONS UN

FLOOR FINISH NOTES

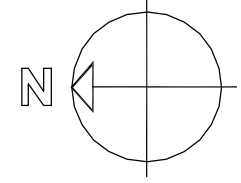
- (F1) SEALED CONCRETE (NO STAIN) BASE: RB1
- (F2) CARPET TILE MANUFACTURER: PATCRAFT STYLE: INFINITE WISDOM. THOUGHT: EPIPHANY - 00200 BASE: RB1
- (F3) PORCELAIN FLOOR TILE - 12"x12" MANUFACTURER: ROYAL MOSA COLOR: LARGE SPECKLED WARM GREY BASE: TILE
- (F4) VINYL COMPOSITE TILE 12" X12" MANUFACTURER: MANNINGTON STYLE: BISQUE #107 BASE: RB1
- (F5) VINYL COMPOSITE TILE 12" X12" MANUFACTURER: MANNINGTON STYLE: BRONZE #246 BASE: RB1
- (RB1) 4" RUBBER BASE MANUFACTURER: JOHNSONITE COLOR: TOAST 283

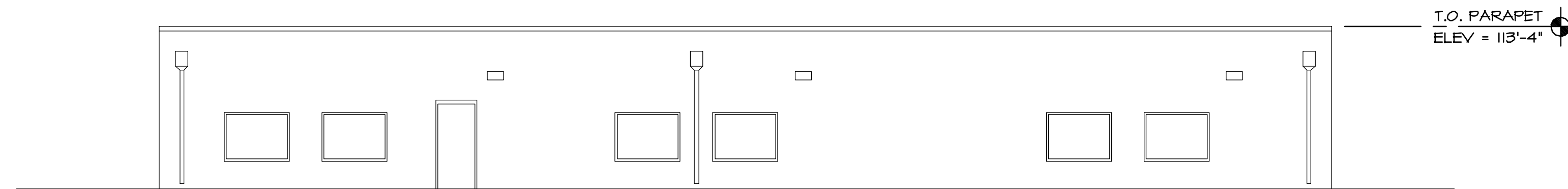
WALL FINISH NOTES

- (P-1) FIELD PAINT: IVORY SAMPLER #A0766
- (P-2) ACCENT PAINT COLOR 1: SURREY BEIGE #A0769
- (P-3) ACCENT PAINT COLOR 2: HONEYSHEET # A0649
- (P-5) HOLLOW METAL DOOR AND FRAME PAINT COLOR: MONTEREY CLIFFS #A1785
- (T-1) CERAMIC TILE MAINSCOT, FIELD COLOR - 6"x6" MANUFACTURER: ROYAL MOSA COLOR: PLAIN GREY BEIGE -16630 015015 BASE: 6"x4" COVE
- (T-2) CERAMIC TILE ACCENT COLOR 1 - 6"x6" MANUFACTURER: ROYAL MOSA - GLOBAL COLLECTION COLOR: NAPLES YELLOW - 15060 015015
- (T-3) CERAMIC TILE ACCENT COLOR 2 - 6"x6" MANUFACTURER: ROYAL MOSA - GLOBAL COLLECTION COLOR: PLAIN AGATE GREY - 15050 015015
- (FRP) FIBRE REINFORCED PLASTIC MANUFACTURER: KEMITE - GLASBORD -P COLOR: 84 IVORY
- (PL-1) PLASTIC LAMINATE MANUFACTURER: PIONITE COLOR: TOWN SQUARE WF101
- (PL-2) PLASTIC LAMINATE MANUFACTURER: FORMICA COLOR: NATURAL BIRCH 7481



A3 FIRST FLOOR FINISH PLAN
SCALE: 1/8" = 1'-0"





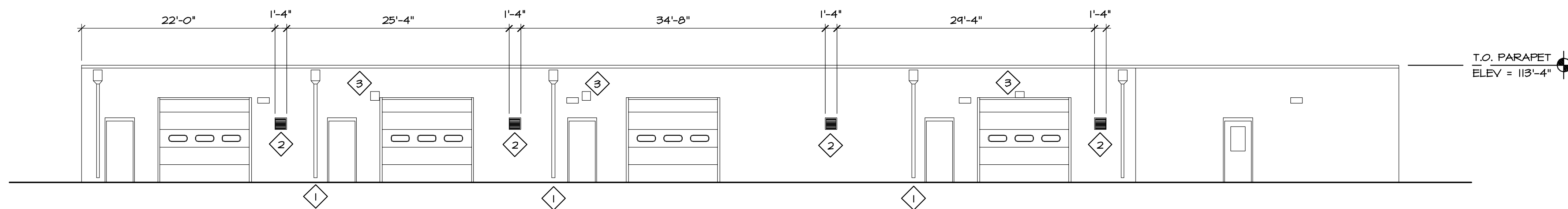
D2 NORTH ELEVATION
SCALE: 1/8"=1'-0"

ELEVATION KEY NOTES

- 1 NEW CONDUCTOR HEAD AND DOWNSPOUT W/ CONCRETE SPLASH BLOCK
- 2 NEW 16" X 16" MECHANICAL LOUVER
- 3 PATCH MASONRY WITH MATCHING CMU BLOCK WHERE ROOF DRAINS ARE REMOVED
- 4 (E) ROOF LADDER TO REMAIN

ELEVATION GENERAL NOTES

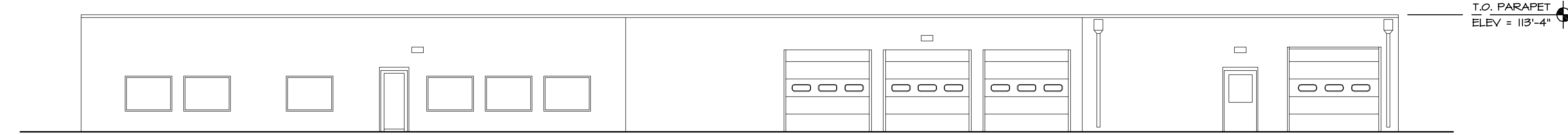
1. ALL ITEMS SHOWN ON EXTERIOR ELEVATIONS EXISTING TO REMAIN UNLESS OTHERWISE NOTED.
2. REFER TO ELECTRICAL FOR EXTERIOR BUILDING LIGHTING REQUIREMENTS.
3. ADD ALTERNATE NO 3. PAINT EXTERIOR OF BUILDING. RE: SPEC FOR SCOPE.



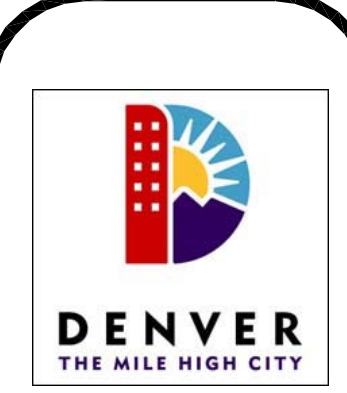
C2 EAST ELEVATION
SCALE: 1/8"=1'-0"



B2 SOUTH ELEVATION
SCALE: 1/8"=1'-0"



A2 WEST ELEVATION
SCALE: 1/8"=1'-0"



SLATERPAULL
ARCHITECTS
1331 Nineteenth Street
Denver, CO 80202
P 303.607.0677
www.slaterpaull.com

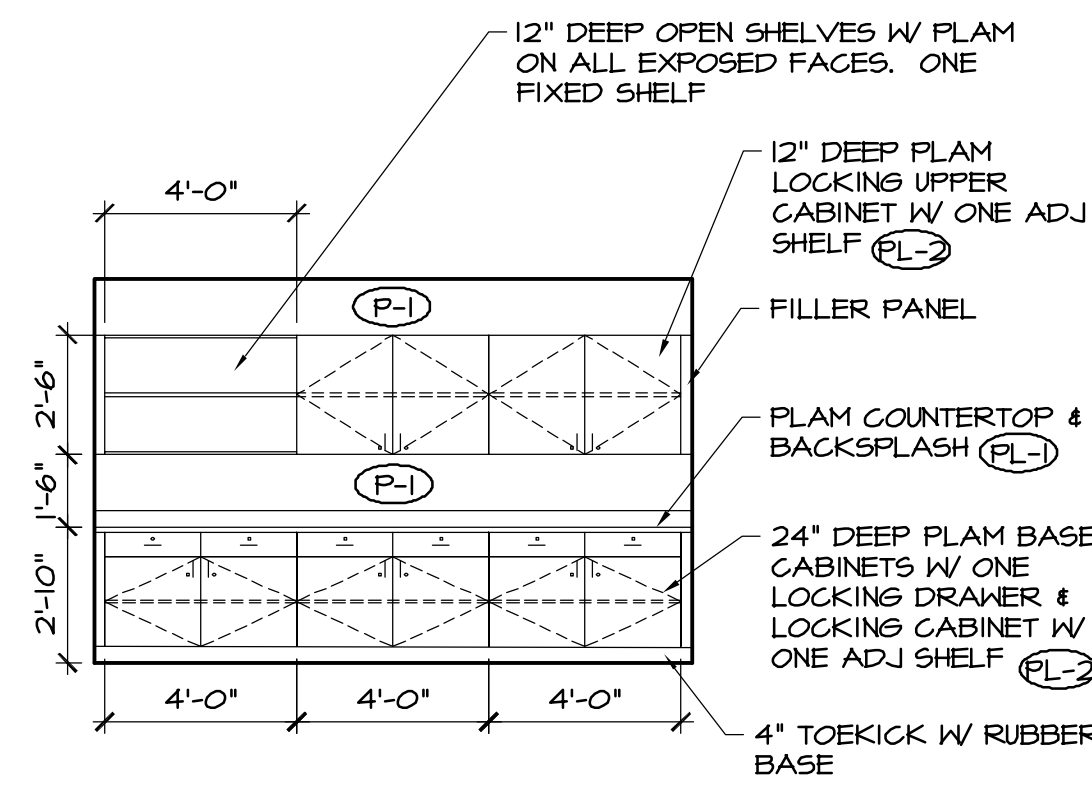
CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

EXTERIOR ELEVATIONS
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

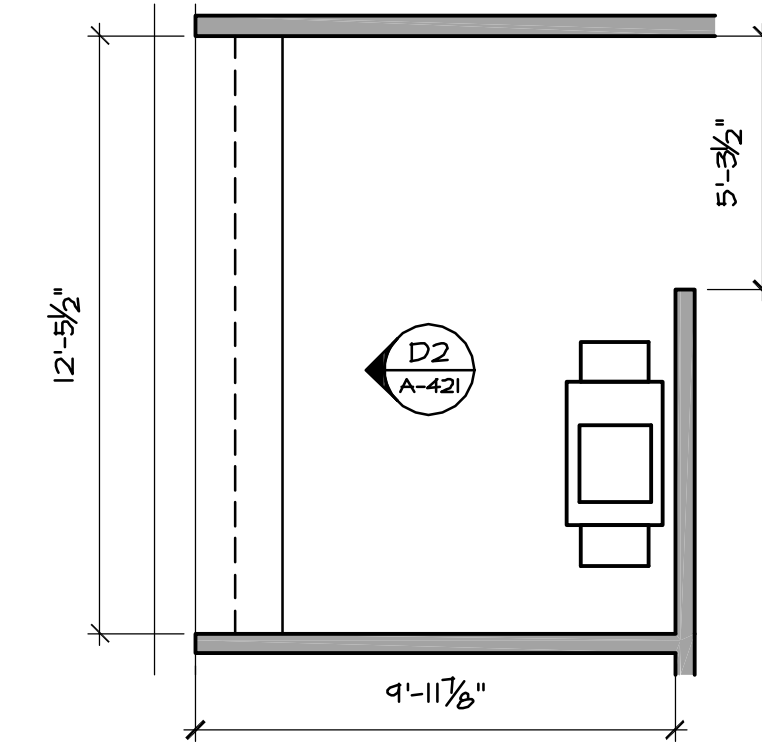
ISSUE:
1. 11/13 ISSUE FOR
BIDDING & CONSTRUCTION

DRAWN BY:LDG
REVIEWED BY:JCP
Date: 11/11/2013
SHEET

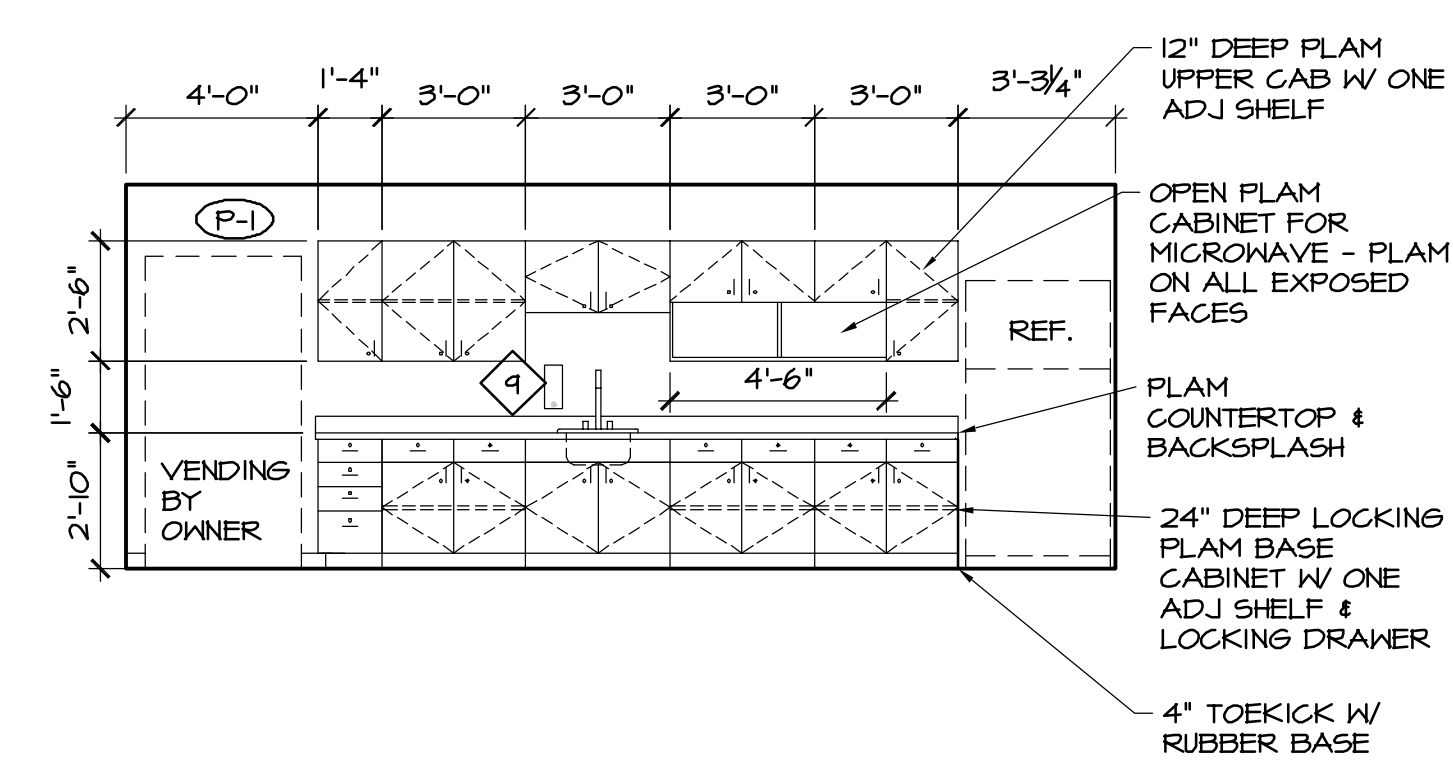
A-201
SPA PROJECT NO.
10842.210



D2 WORK ROOM ELEVATION
SCALE: 1/4" = 1'-0"



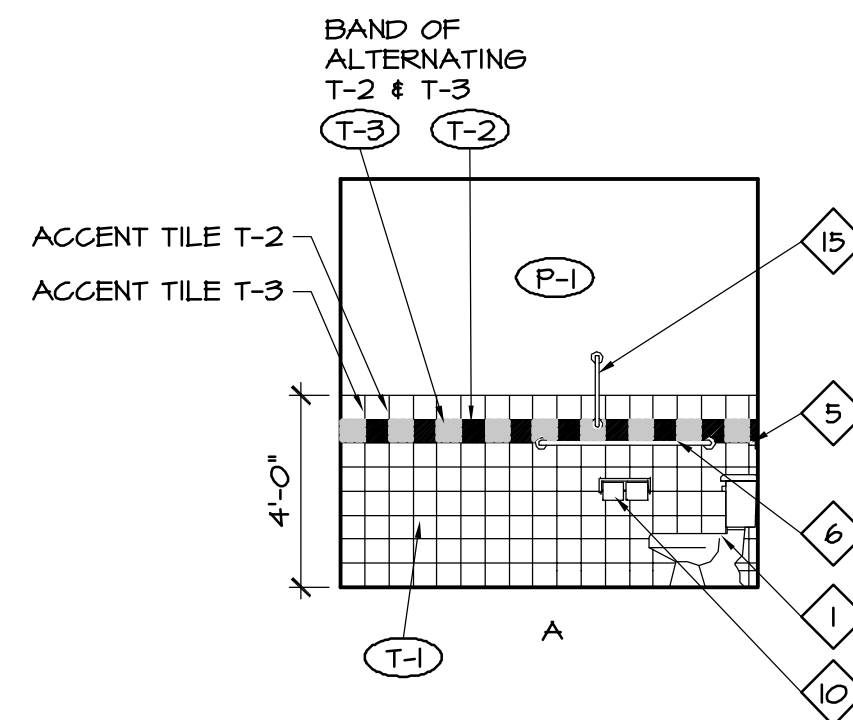
D3 ENL. WORK ROOM PLAN
SCALE: 1/4" = 1'-0"



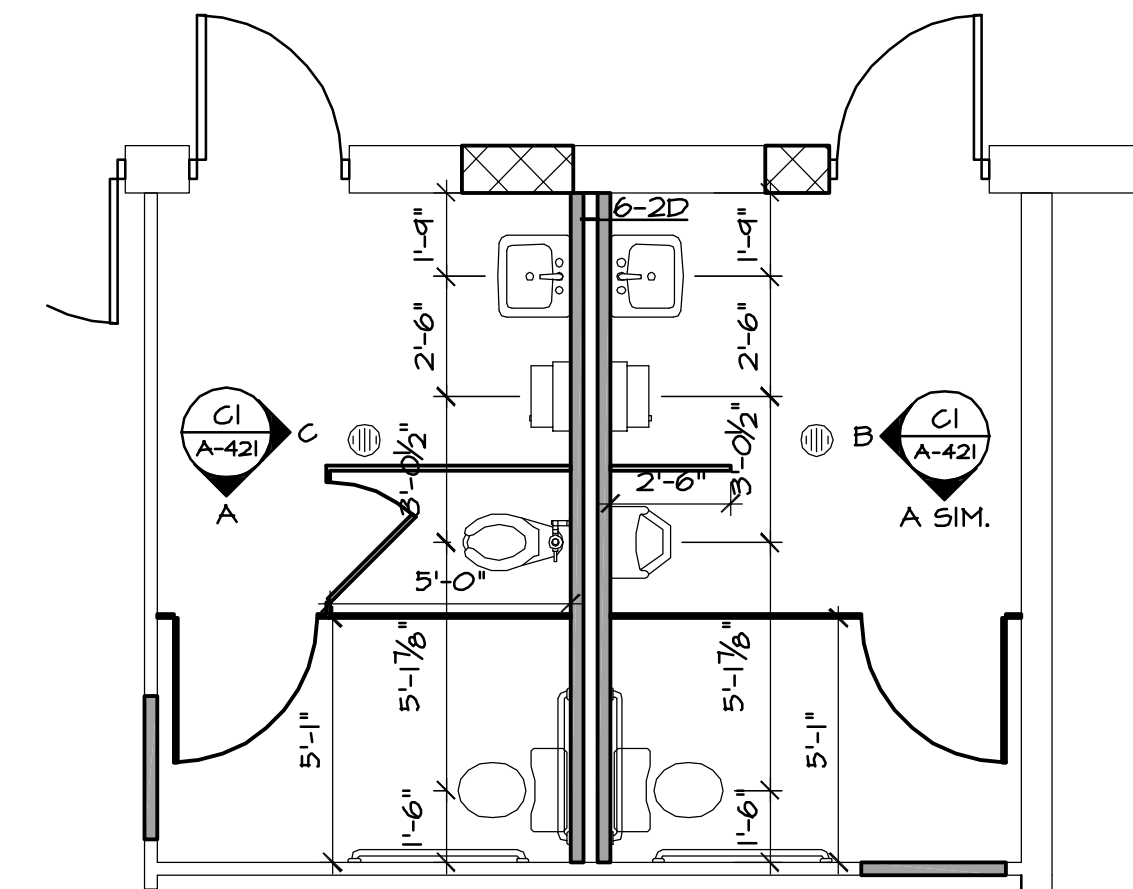
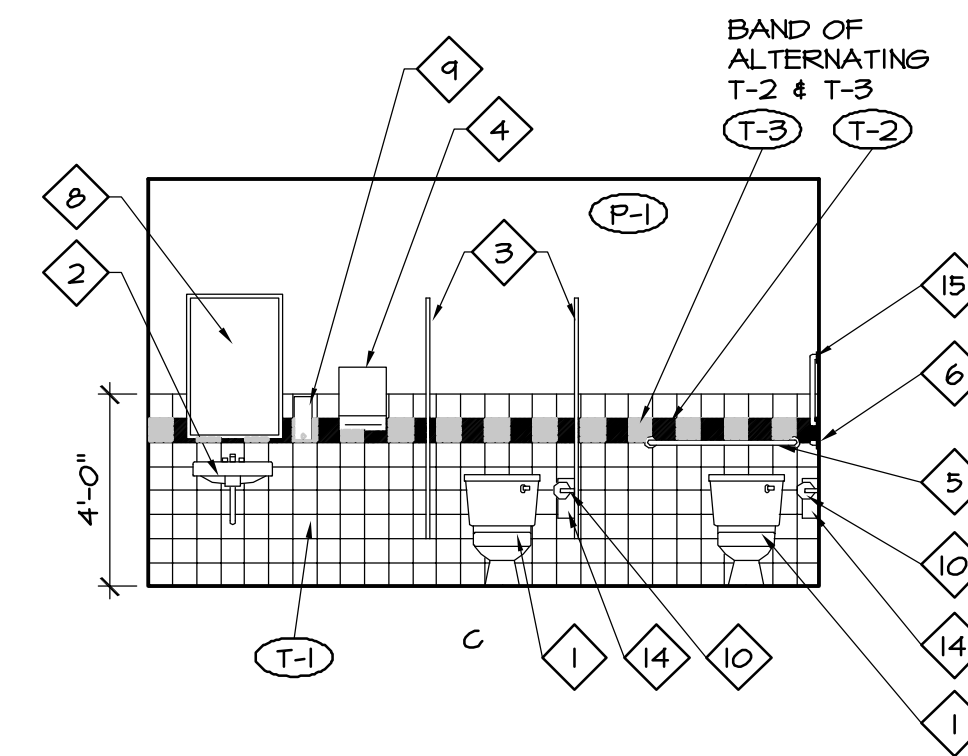
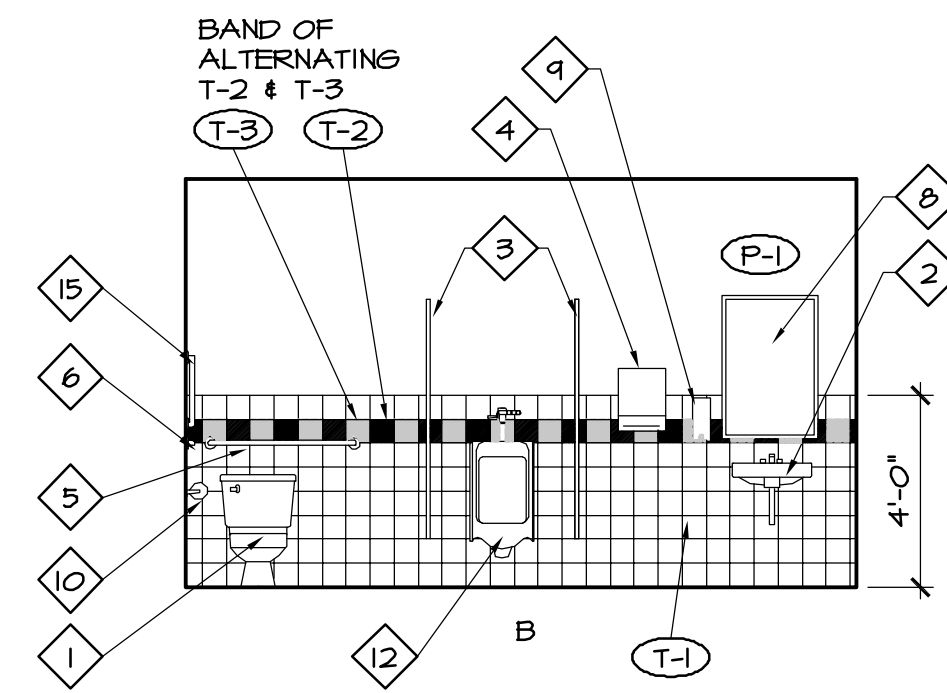
D4 BREAK RM ELEVATION
SCALE: 1/4" = 1'-0"

TOILET ACCESSORIES LEGEND

- 1 FLOOR MOUNTED TOILET
- 2 LAVATORY
- 3 TOILET PARTITION - SCRANTON PRODUCTS, SANDCASTLE
- 4 PAPER TOWEL DISPENSER - VENDOR PROVIDED
- 5 36" GRAB BAR
- 6 42" GRAB BAR
- 7 DRINKING FOUNTAIN
- 8 24" X 36" FRAMED MIRROR
- 9 SOAP DISPENSER - VENDOR PROVIDED
- 10 TOILET PAPER DISPENSER - VENDOR PROVIDED
- 11 SANITARY NAPKIN DISPENSER - VENDOR PROVIDED
- 12 URINAL
- 13 FLOOR DRAIN, RE. PLUMB.
- 14 SANITARY NAPKIN DISPOSAL UNIT
- 15 18" VERTICAL GRAB BAR



C1 MEN'S & WOMENS ROOMS 134 & 136
SCALE: 1/4" = 1'-0"



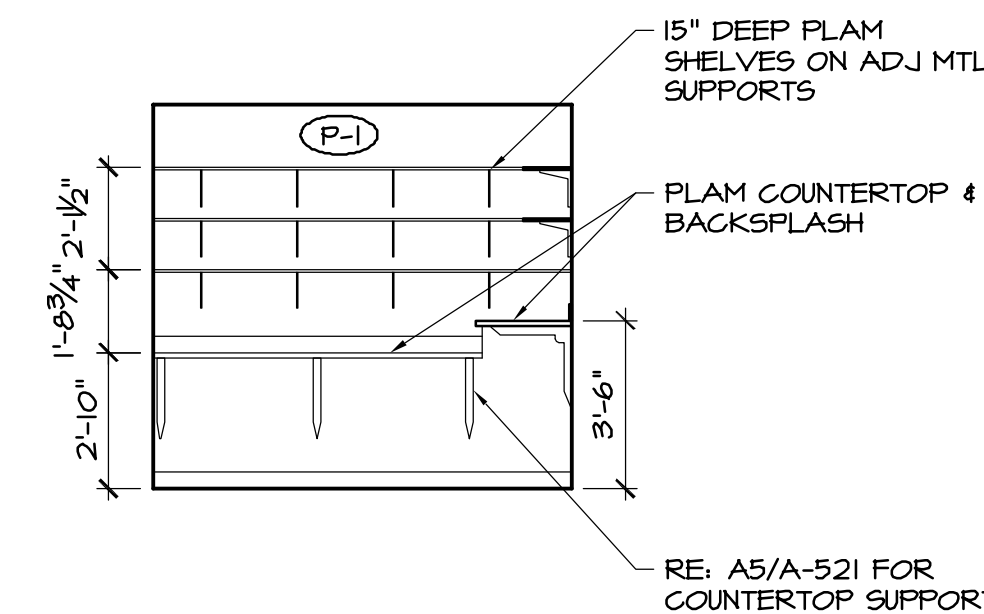
C4 ENL. TOILET ROOM PLAN
SCALE: 1/4" = 1'-0"

WATER CLOSET (WC)	URINAL	LAVATORY	PAPER TOWEL DISPENSER (PTD)	SOAP DISPENSER (SD)	SANITARY NAPKIN DISPENSER
RE. ARCH PLAN FOR HORIZONTAL PLACEMENT NON-ACCESSIBLE MOUNTING HEIGHT IS @ 15" AFF	RE. ARCH PLAN FOR HORIZONTAL PLACEMENT NON-ACCESSIBLE MOUNTING HEIGHT IS @ 24" AFF	HOT WATER PIPE AND DRAIN MUST BE INSULATED	MOUNT 48" TO OPERATING MECHANISM FOR FRONT APPROACH	MOUNT 40" AFF TO OPERATING MECHANISM	MOUNT TOP OF DISPENSER AT 5'-8" - 6'-2" A.F.F.

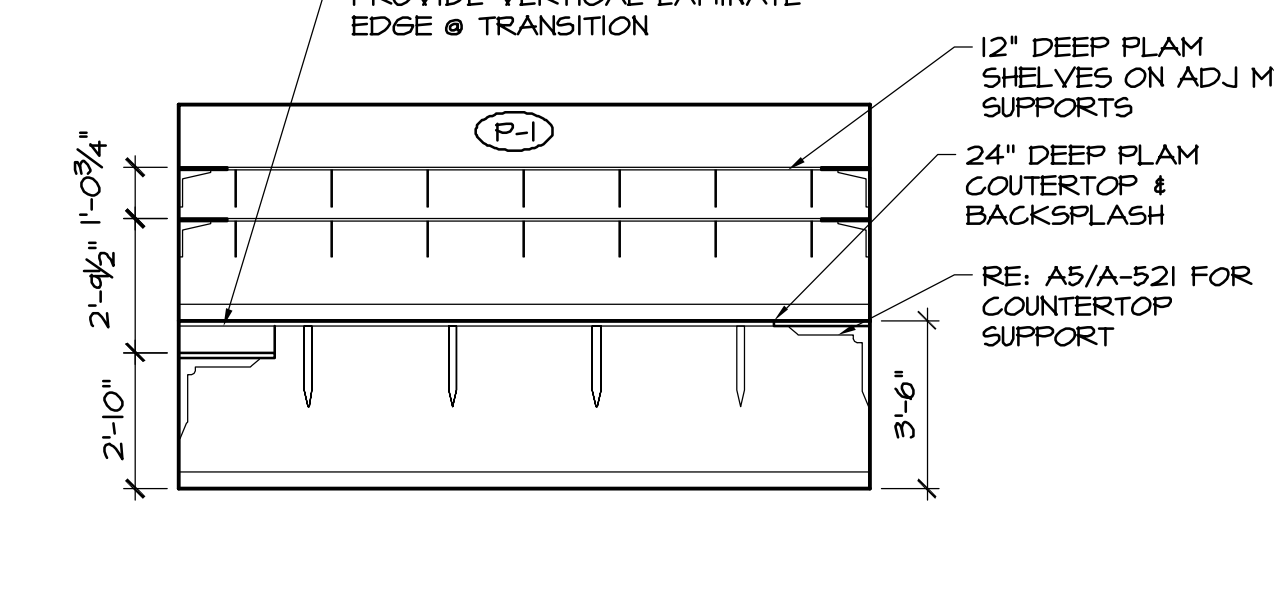
NOTE: MOUNT ALL FIXTURES AND ACCESSORIES AT HEIGHTS SHOWN AND WHERE INDICATED ON PLAN UNLESS OTHERWISE NOTED

MIRROR	TOILET PAPER DISPENSER (TPD) SANITARY NAPKIN DISPOSAL (SND)	18" VERTICAL GRAB BAR 42" HORIZONTAL GRAB BAR	36" HORIZONTAL GRAB BAR	DRINKING FOUNTAIN
24" X 36" MIRROR. MIRRORS NOT LOCATED ABOVE LAVS OR COUNTERTOPS SHOULD BE INSTALLED WITH BOTTOM EDGE OF REFLECTING SURFACE AT 35" AFF.	SURFACE MOUNT TOILET TISSUE DISPENSER. MOUNT 7" MIN TO 9" MAX IN FRONT OF WC MEASURED TO THE CENTER LINE OF THE DISPENSER.	SIDE WALL: 42" MIN LENGTH, MOUNT 12" MAX FROM REAR WALL. 18" MIN VERTICAL BAR: MOUNT 40" FROM REAR WALL AND 40" (FROM BOTTOM OF BAR) AFF.	REAR WALL: 36" MIN LENGTH, EXTEND FROM CENTERLINE OF WC 12" MIN ON SIDE CLOSEST TO WALL & 24" MIN ON TRANSFER SIDE.	RE. ARCH PLAN FOR HORIZONTAL PLACEMENT

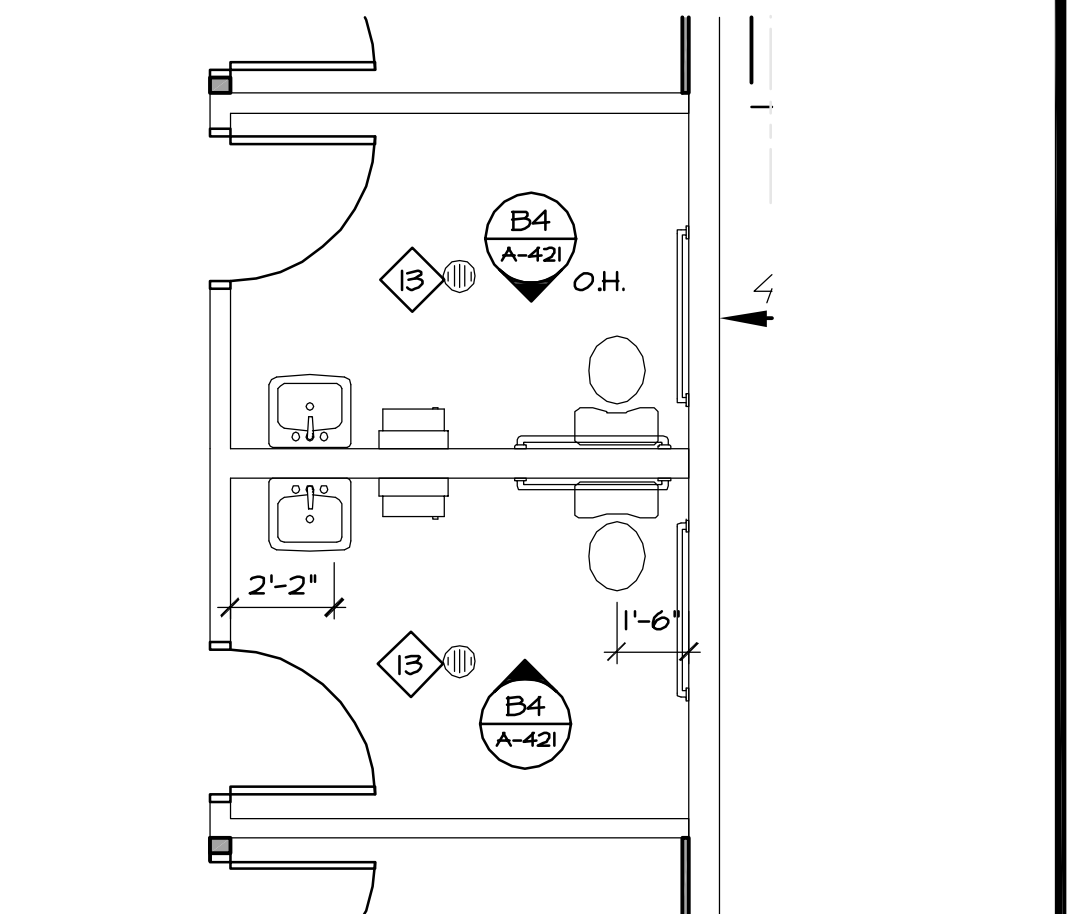
NOTE: MOUNT ALL FIXTURES AND ACCESSORIES AT HEIGHTS SHOWN AND WHERE INDICATED ON PLAN UNLESS OTHERWISE NOTED



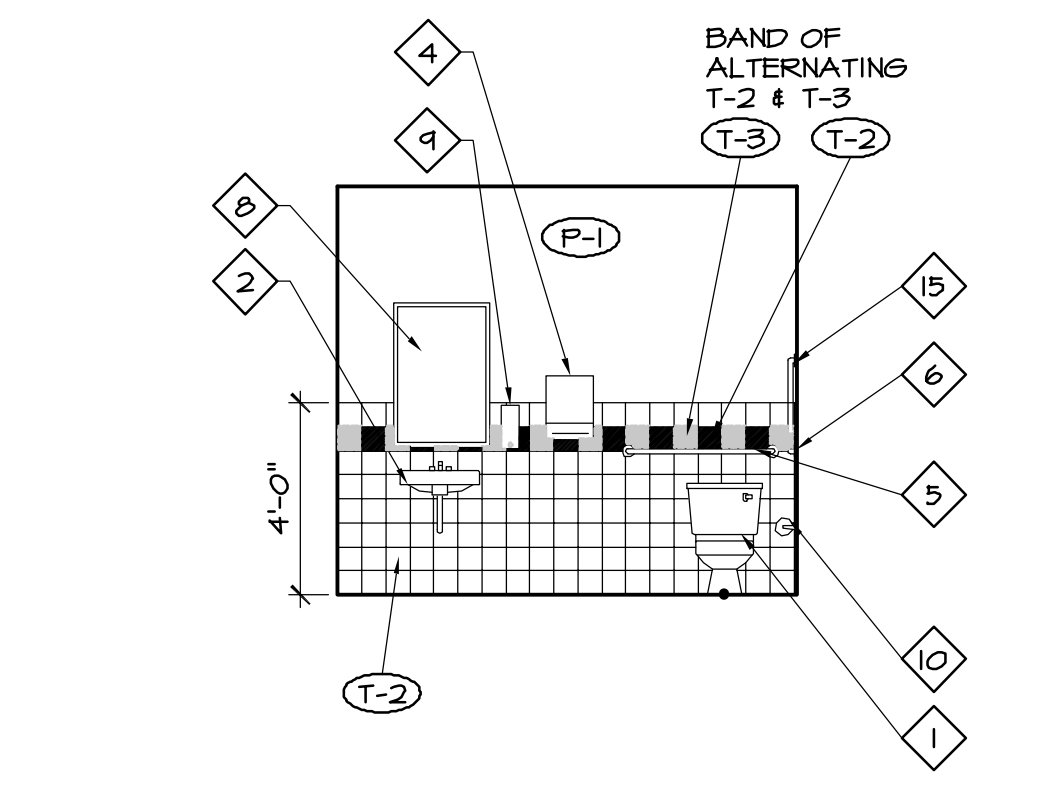
A3 WK ROOM ELEVATION
SCALE: 1/4" = 1'-0"



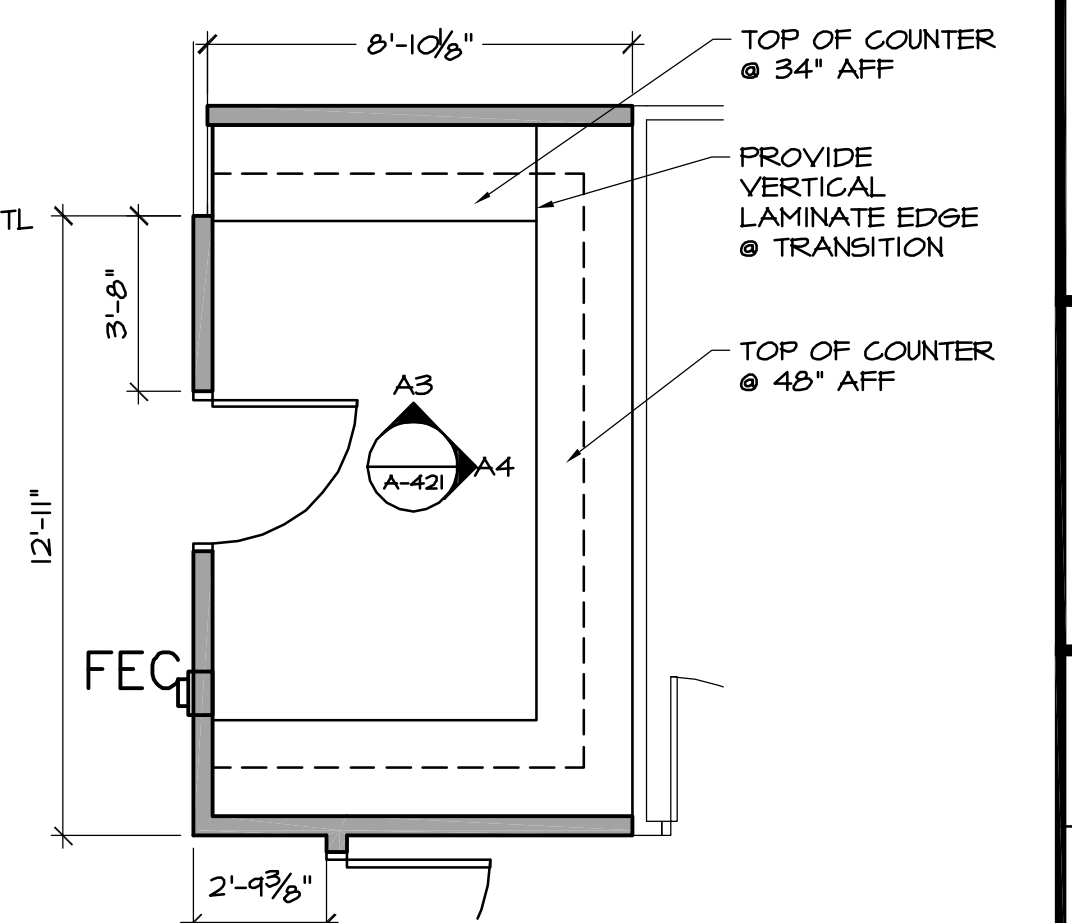
A4 WK. ROOM ELEVATION
SCALE: 1/4" = 1'-0"



B5 ENL. TOILET ROOM PLAN
SCALE: 1/4" = 1'-0"



B4 MENS ROOM 116 ELEV.
SCALE: 1/4" = 1'-0"



A5 ENL. WORK ROOM PLAN
SCALE: 1/4" = 1'-0"



SLATERPAULL
ARCHITECTS
1331 Nineteenth Street
Denver, CO 80202
P 303.607.0977
www.slaterpaull.com

CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

ENLARGED PLANS & INTERIOR ELEVATIONS
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

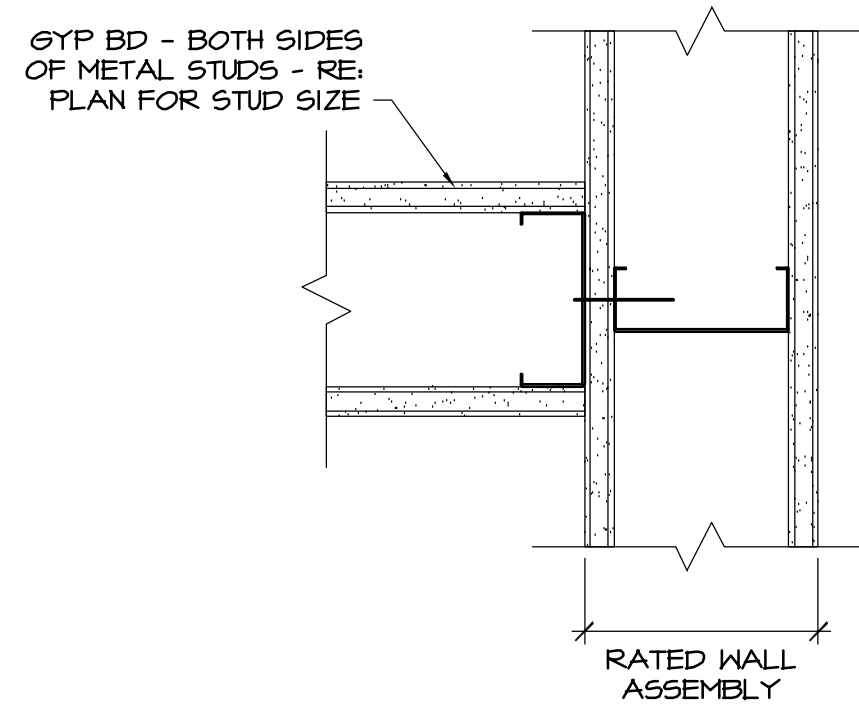
ISSUE
1.11/11/13 - ISSUE FOR
BIDDING & CONSTRUCTION

DRAWN BY: LDG
REVIEWED BY: JCP
Date: 11/11/2013

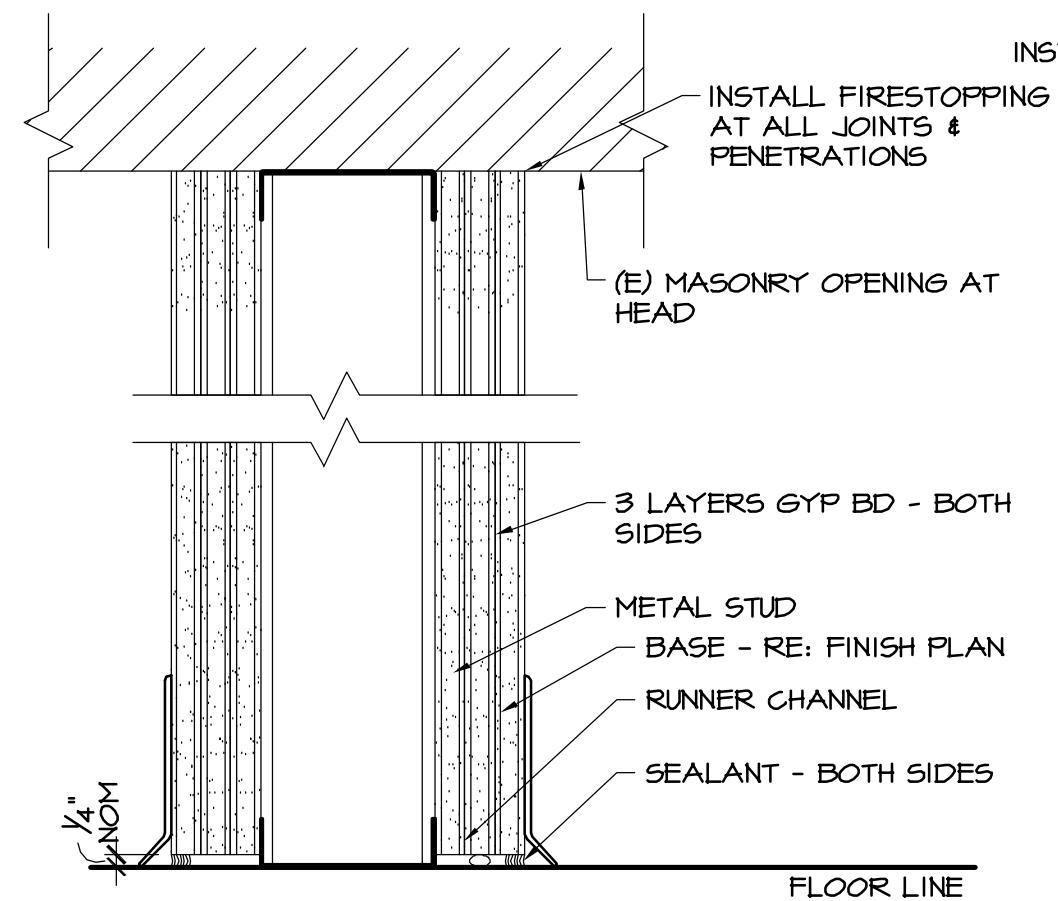
SHEET

A-421

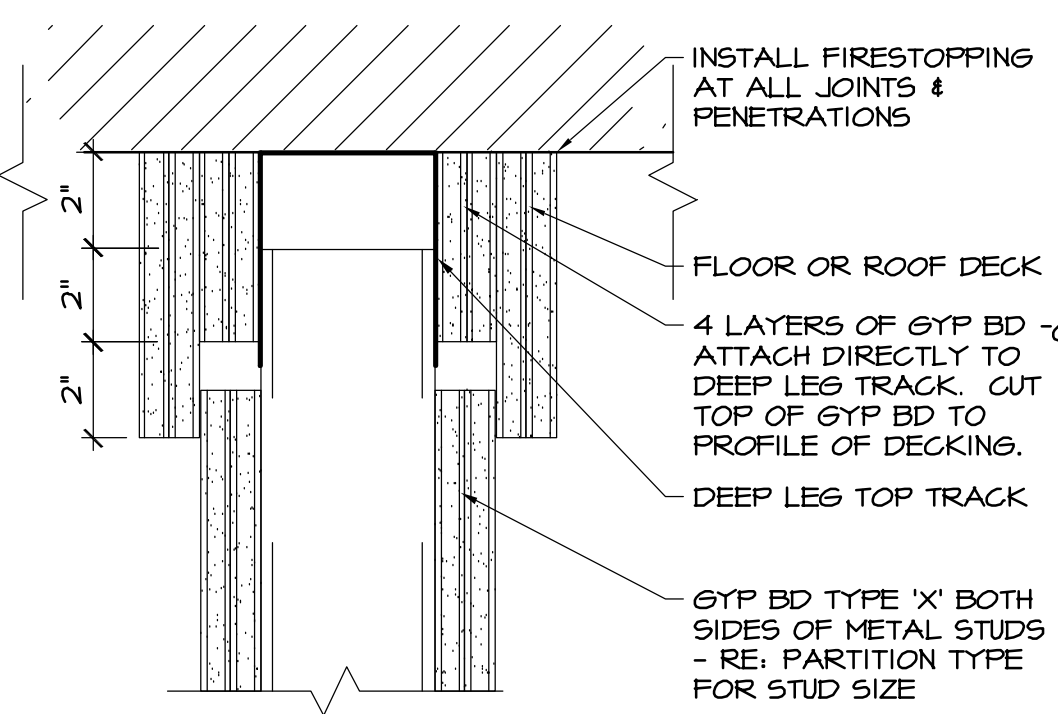
SPA PROJECT NO.
10842.210



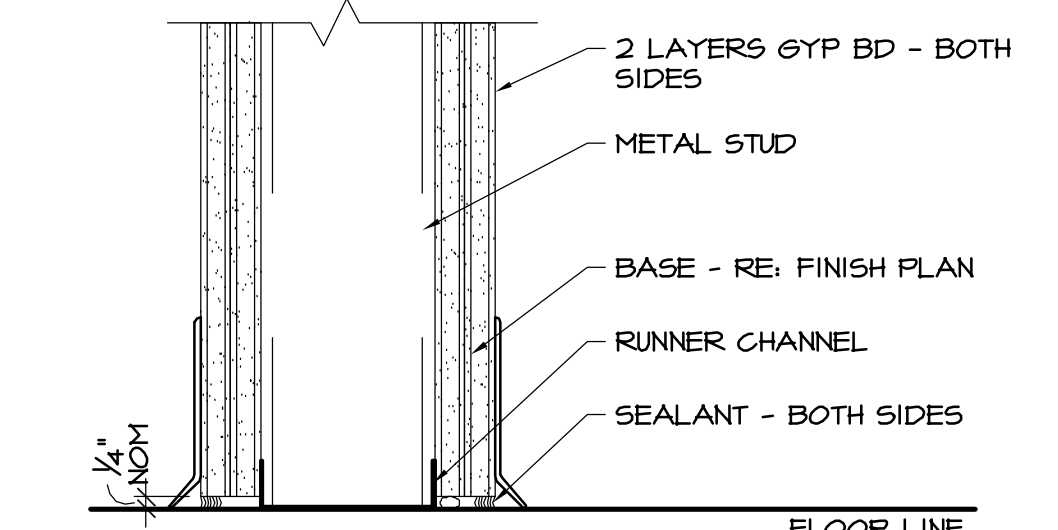
PLAN DETAIL OF PARTITION INTERSECTION



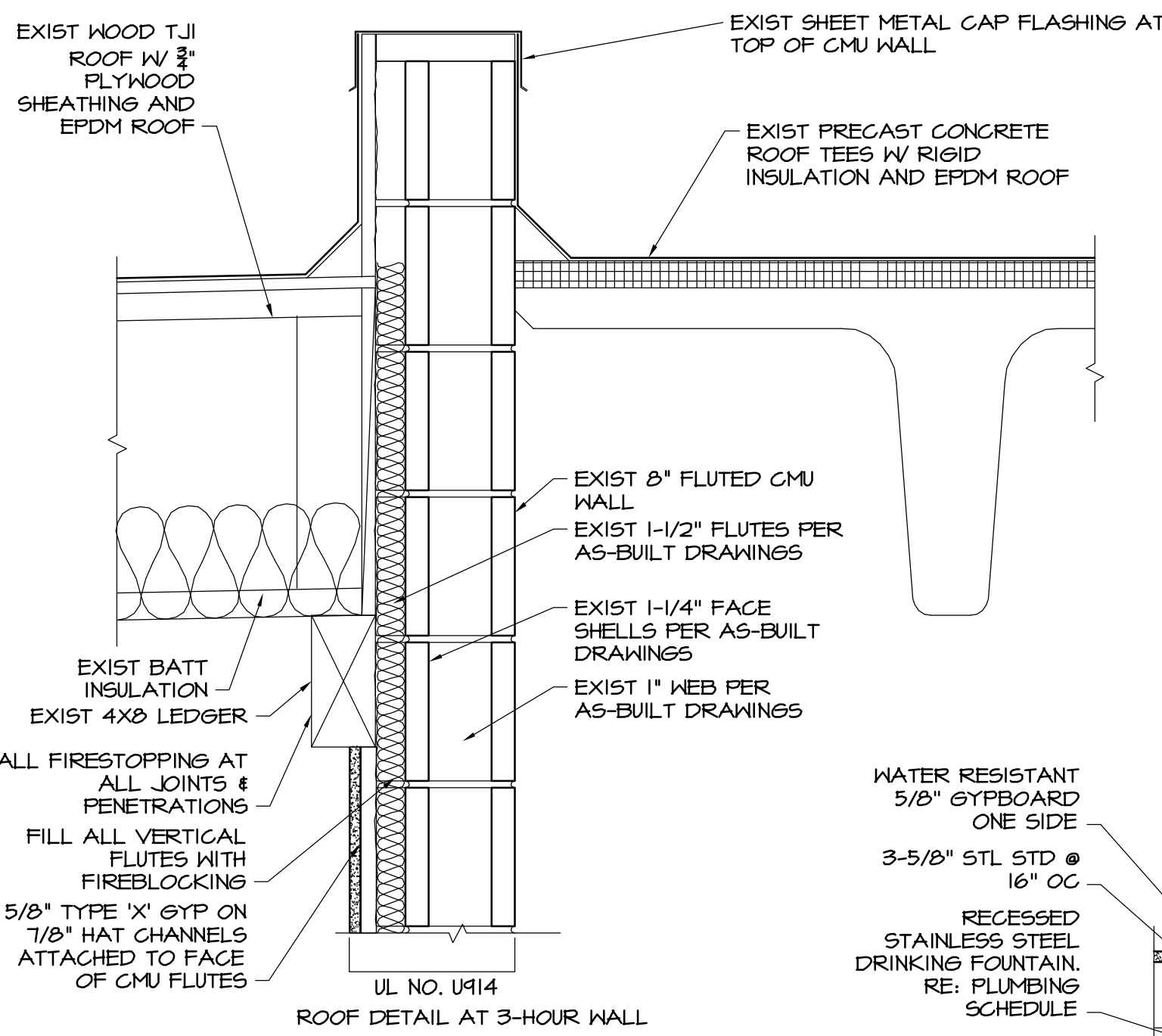
6-3
PARTITION
WITH 3 5/8" STUD
PARTITION WIDTH = 9 3/8"
UL. DESIGN = U419



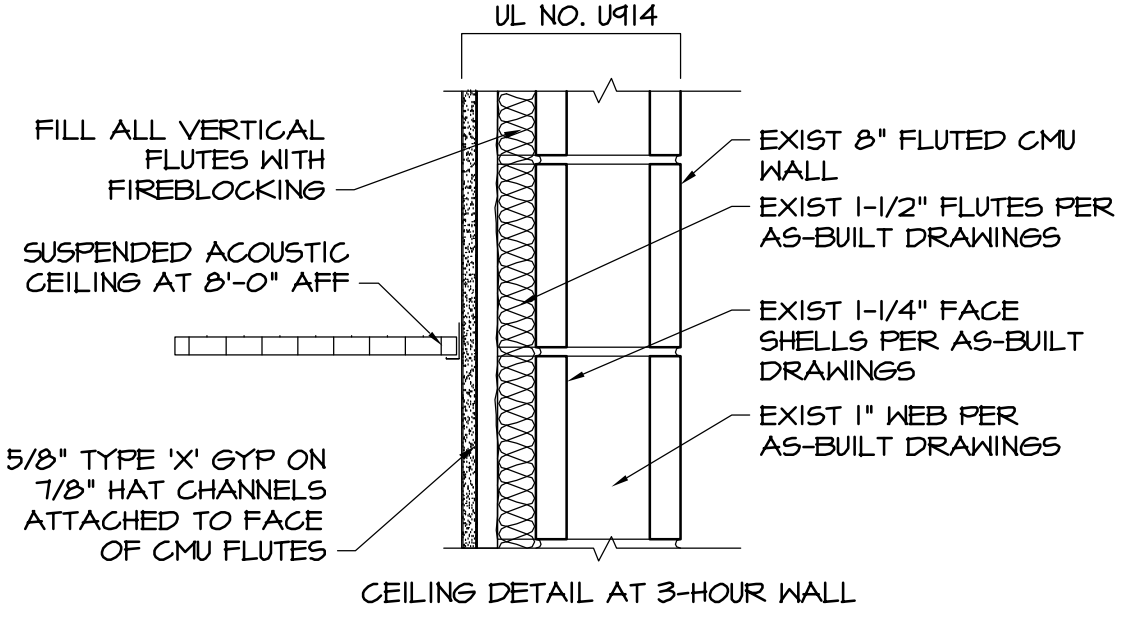
H
2 HOUR RATED PARTITION HEAD
SEE GENERAL PARTITION TYPE FOR REQUIRED STUD SIZE AND LAYERS OF GYP. BD. (4 LAYERS SHOWN)



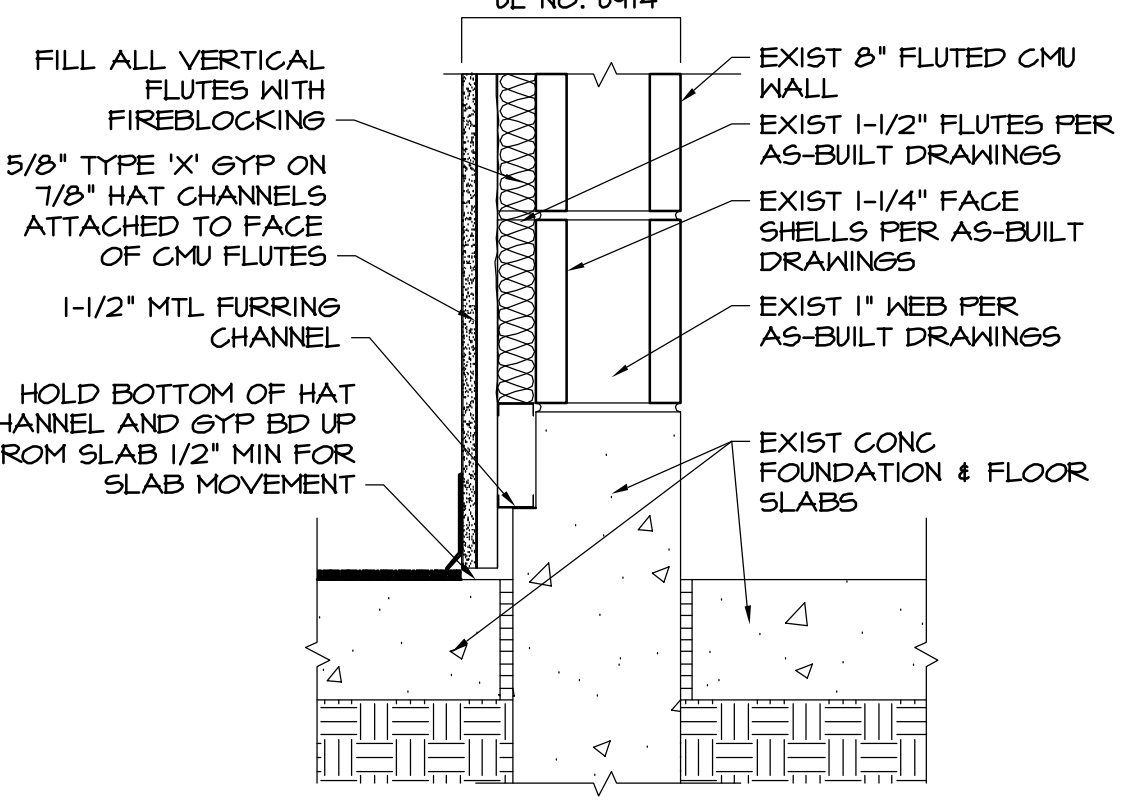
4-6
PARTITION
WITH 6" STUD
PARTITION WIDTH = 6 1/2"
UL. DESIGN = U419



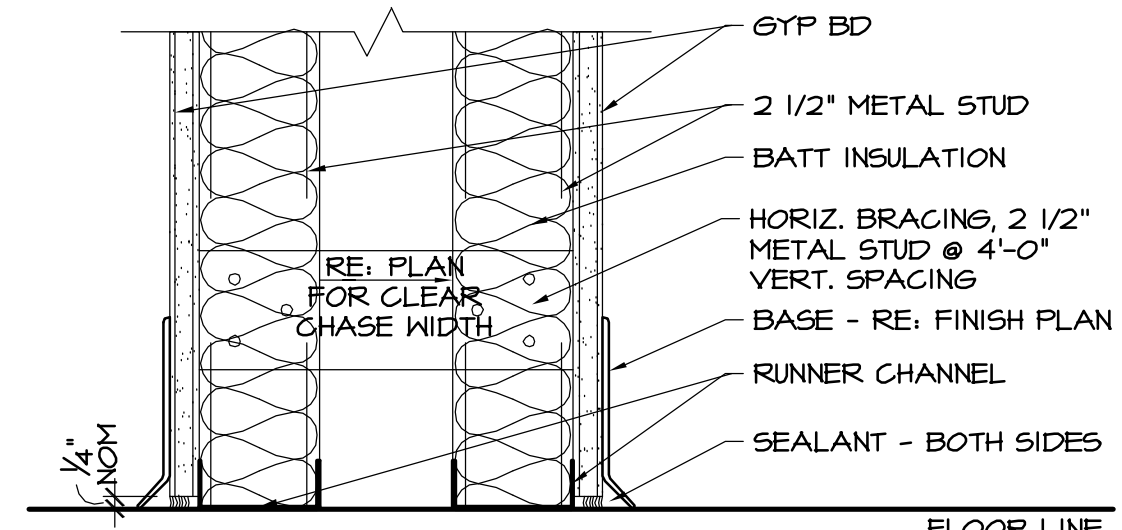
ROOF DETAIL AT 3-HOUR WALL



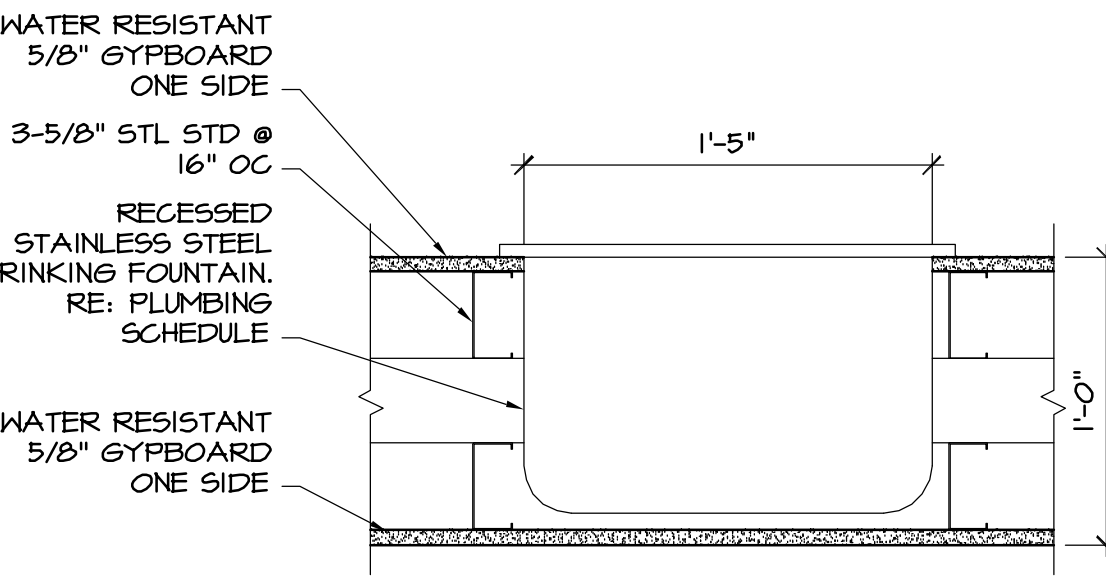
CEILING DETAIL AT 3-HOUR WALL



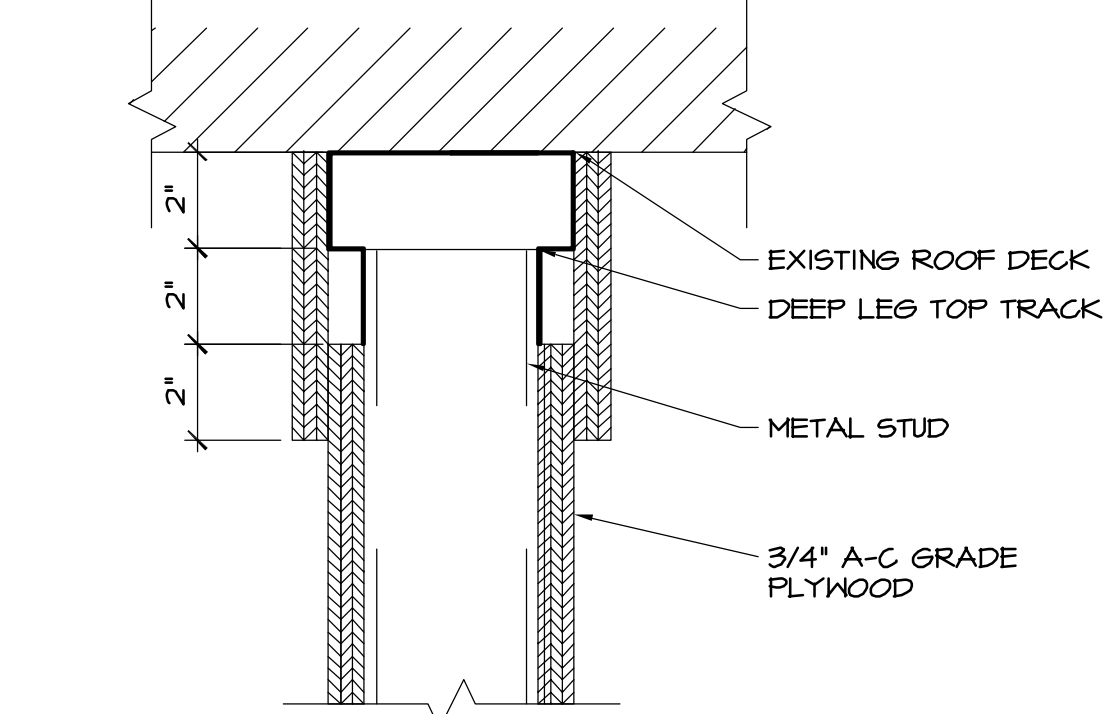
B2 3-HR FIRE BARRIER
SCALE: 1-1/2" = 1'-0"



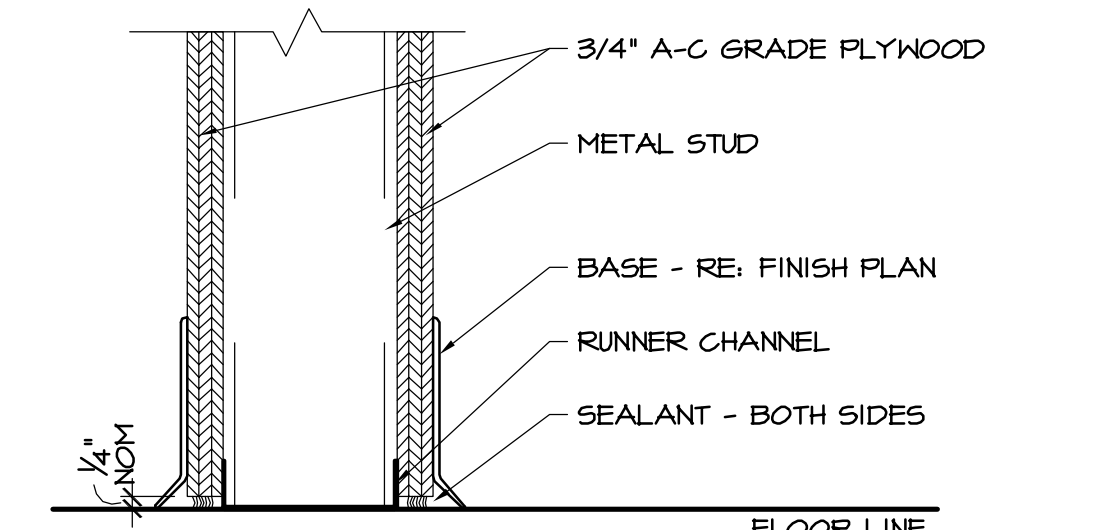
6-2 PLUMBING CHASE
WITH 2 1/2" STUD
PARTITION WIDTH = 6 1/4" + CLEAR CHASE WIDTH



C3 12" WALL AT RECESSED DRINKING FOUNTAIN
SCALE: 1-1/2" = 1'-0"



P PLYWOOD PARTITION SLIP HEAD

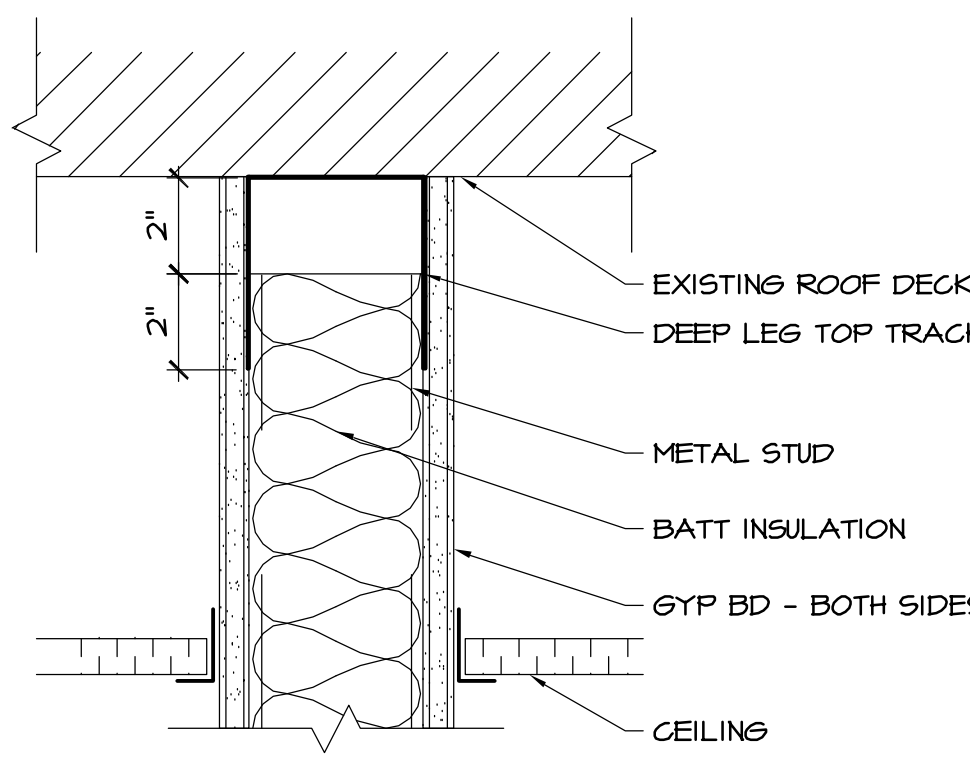
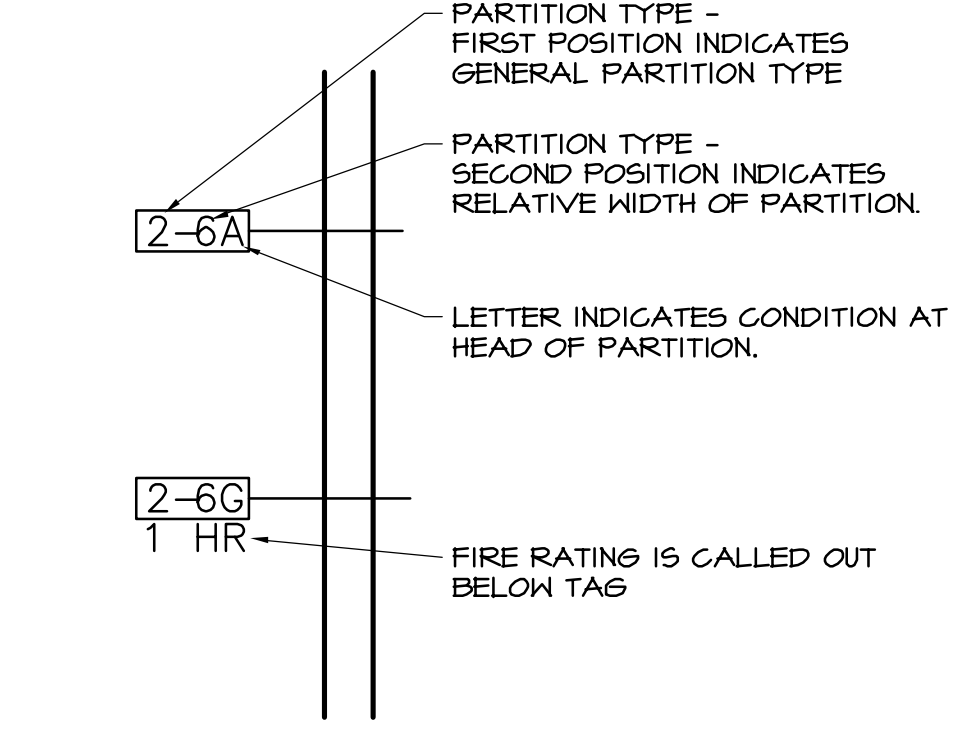


2-6 PLYWOOD PARTITION
WITH 6" STUD
PARTITION WIDTH = 7 1/4"

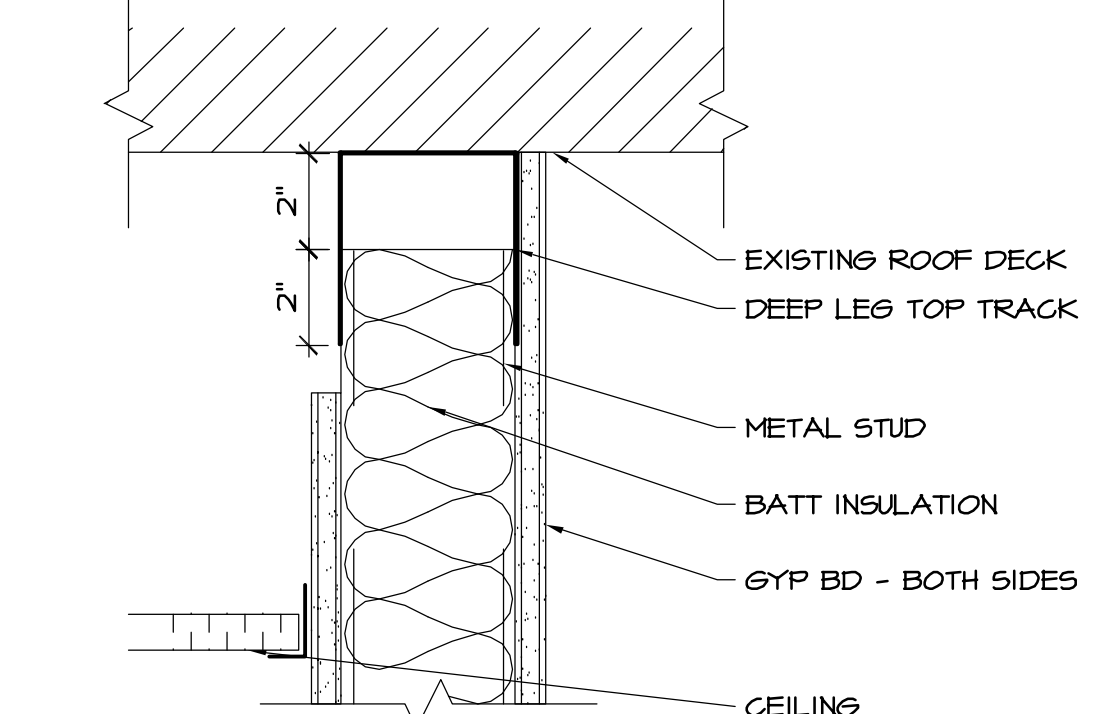
PARTITION TYPES NOTES

- PARTITION TYPES ARE INDICATED ON THE FLOOR PLANS.
- ALL PARTITIONS SHALL EXTEND STRUCTURE TO STRUCTURE UNLESS NOTED OTHERWISE.
- CONSTRUCTION OF FIRE-RATED PARTITIONS, INCLUDING TAPING AND FINISHING OF GYP. BD. FOR FULL HEIGHT TO STRUCTURE ABOVE, SHALL BE IN ACCORDANCE WITH MANUFACTURER'S DIRECTIONS TO ACHIEVE THE RATING INDICATED.
- SOUND ISOLATION PARTITIONS SHALL BE SEALED AIRTIGHT FOR FULL HEIGHT TO PREVENT PASSAGE OF AIRBORNE SOUND. TAPE AND FINISH ALL GYP. BD. JOINTS AND FASTENERS. PROVIDE SEALANT AT PERIMETER AND AT ALL PENETRATIONS.
- PROVIDE FIRE-RETARDANT TREATED WOOD BLOCKING FOR PARTITION MOUNTED EQUIPMENT AND CASEWORK.
- PARTITION TYPES DESCRIBE THE PRIMARY MEMBER AND SHEATHING. REFER TO FINISH SCHEDULE FOR ALL PARTITION FINISH DESIGNATIONS.
- PROVIDE TYPE 'WR' WATER RESISTANT GYP. BD. IN ALL WET AREAS SUCH AS TOILET, LOCKER, AND SHOWER ROOMS. PROVIDE 5/8" CONCRETE BACKER BOARD AT ALL CERAMIC TILE FINISHES TO ALIGN WITH 5/8" TYPE 'WR' GYP. BD. ABOVE.
- PROVIDE SLIP JOINT CONNECTIONS AT THE TOPS OF ALL PARTITIONS WHICH INTERSECT THE STRUCTURE ABOVE. PROVIDE FIRE SAFING AT ALL SLIP JOINT CONNECTIONS IN FIRE RATED PARTITIONS.
- ALL PARTITIONS TO BE PARTITION TYPE **2-3A** (3-5/8" METAL STUD WITH SOUND ATTENUATION INSULATION AND (1) LAYER OF 5/8" GYP. BD. ON BOTH SIDES) AND SHALL EXTEND STRUCTURE TO STRUCTURE UNLESS NOTED OTHERWISE WITH A PARTITION TYPE TAG. THIS DEFAULT PARTITION TYPE IS NON-RATED. THIS SAME PARTITION TYPE IN A RATED CONDITION IS TAGGED ON THE FLOOR PLANS.
- PROVIDE GYPSUM BOARD CONTROL JOINTS WHERE DESIGNATED ON THE INTERIOR ELEVATIONS (A400 SHEETS) AND ANYWHERE THERE IS A CONTINUOUS RUN OF GYP. BD. THAT IS GREATER THAN 30'-0" IN LENGTH. CONFIRM THE LOCATION OF ADDITIONAL CONTROL JOINTS WITH THE ARCHITECT, PRIOR TO INSTALLATION.

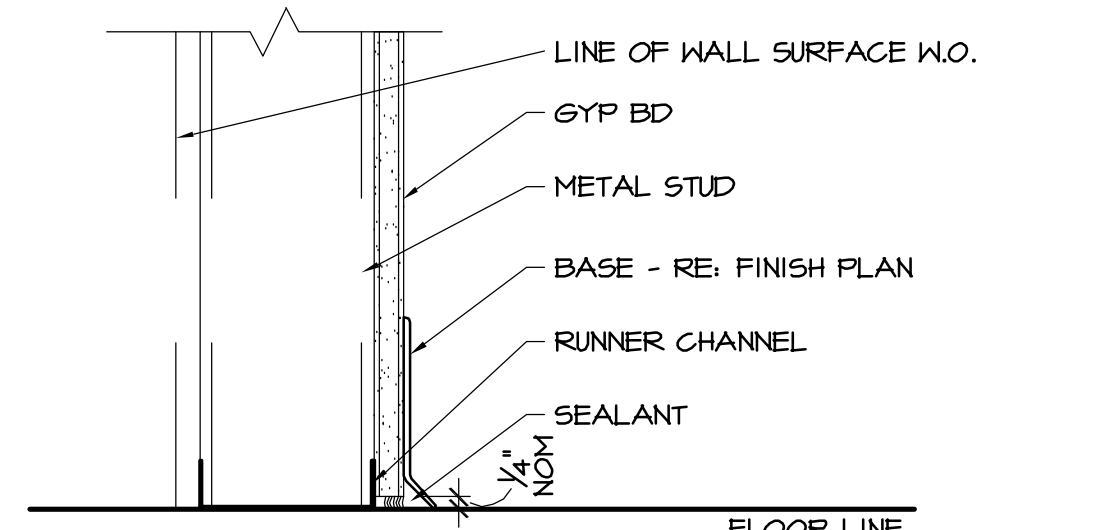
PARTITION TYPES LEGEND



D NON-RATED PARTITION HEAD
SEE GENERAL PARTITION TYPE FOR REQUIRED STUD SIZE AND LAYERS OF GYP. BD. (2 LAYERS SHOWN)

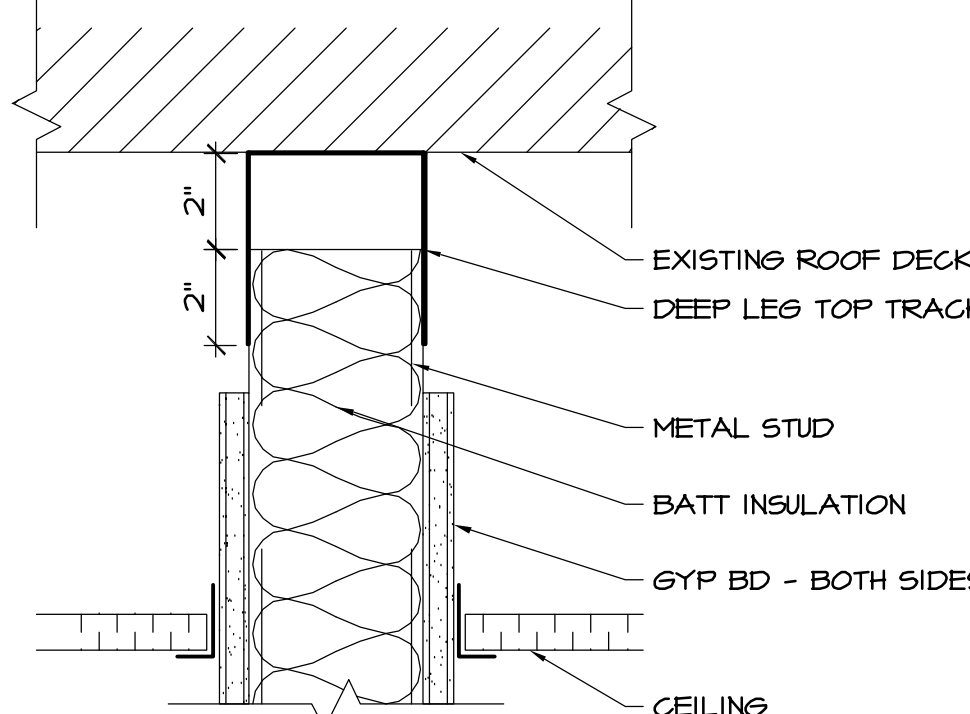


S NON-RATED PARTITION HEAD
SEE GENERAL PARTITION TYPE FOR REQUIRED STUD SIZE AND LAYERS OF GYP. BD. (2 LAYERS SHOWN)

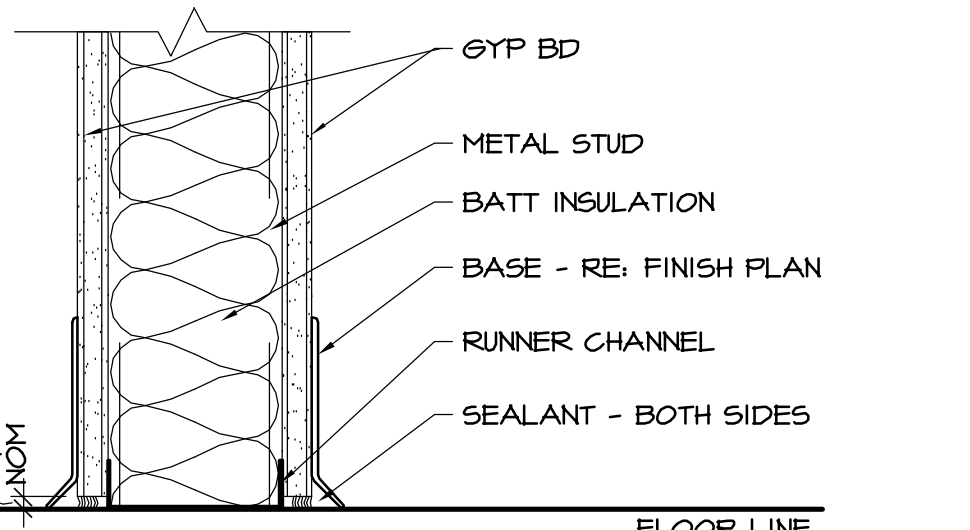


1-2 PARTITION
WITH 2 1/2" STUD
PARTITION WIDTH = 3 1/8"

1-3 PARTITION
WITH 3 5/8" STUD
PARTITION WIDTH = 4 1/4"

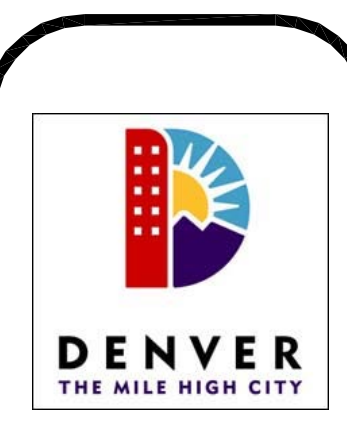


F NON-RATED PARTITION HEAD
SEE GENERAL PARTITION TYPE FOR REQUIRED STUD SIZE AND LAYERS OF GYP. BD. (2 LAYERS SHOWN)



2-3 PARTITION
WITH 3 5/8" STUD
PARTITION WIDTH = 4 1/8"

2-X PARTITION
WITH STUD AS INDICATED
UL. DESIGN = U419



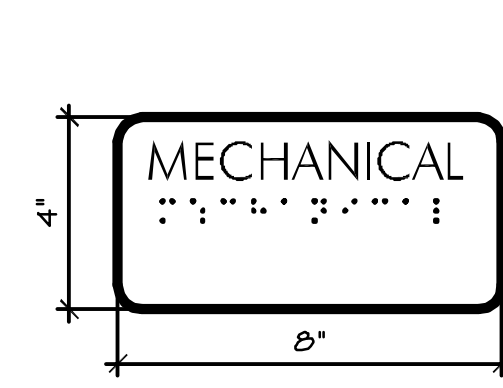
CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

DETAILS
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

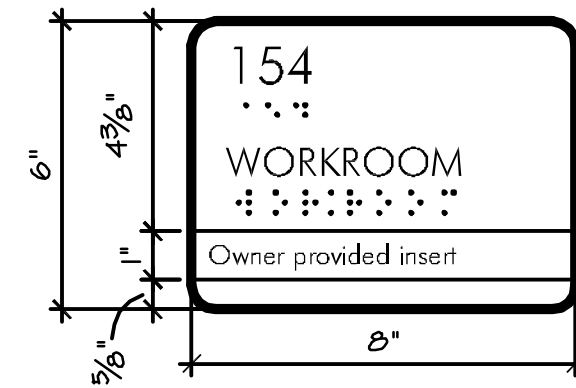
ISSUE
1.11/13 - ISSUE FOR
BIDDING & CONSTRUCTION

DRAWN BY: LDG
REVIEWED BY: JCP
Date: 11/11/2013
SHEET

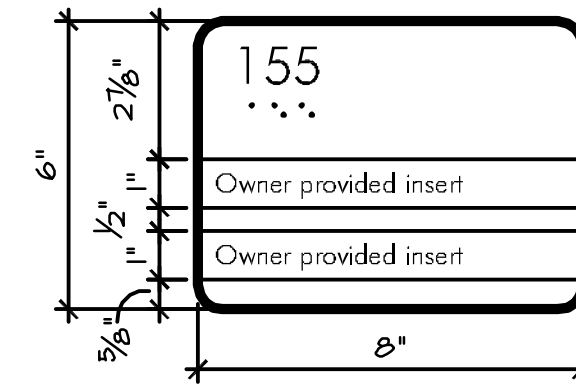
A-520
SPA PROJECT NO.
10842.210



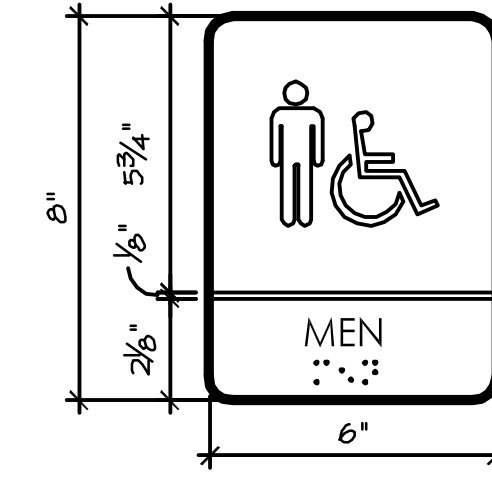
A.



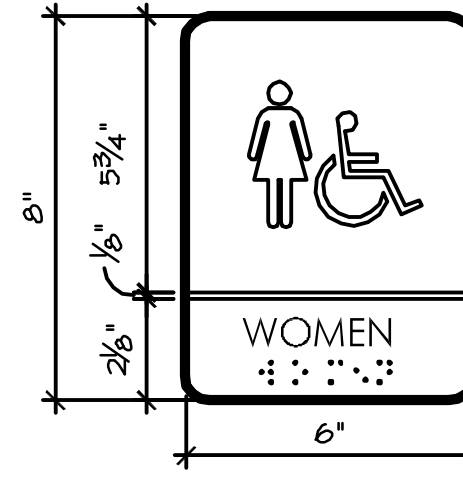
B.



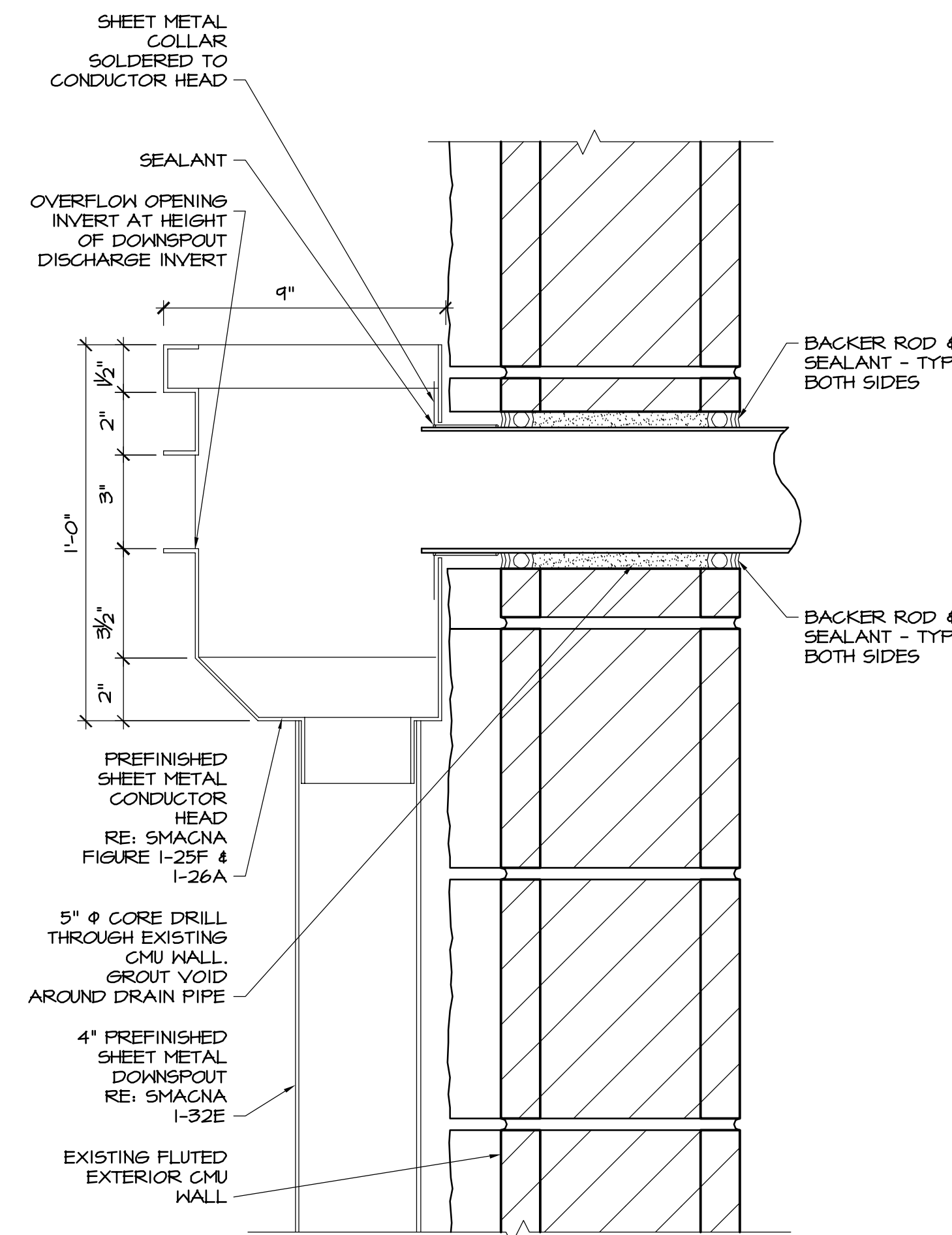
C.



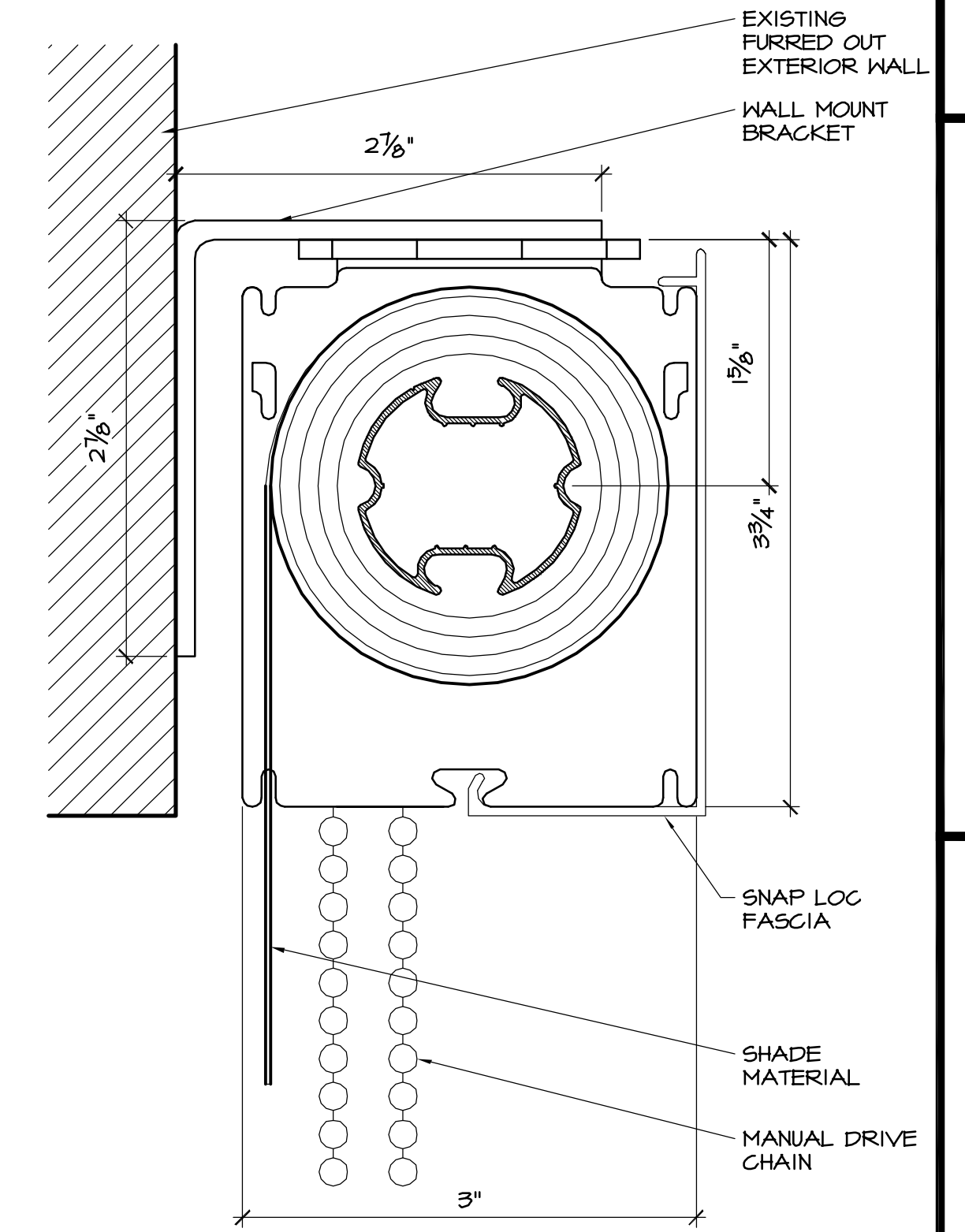
D.



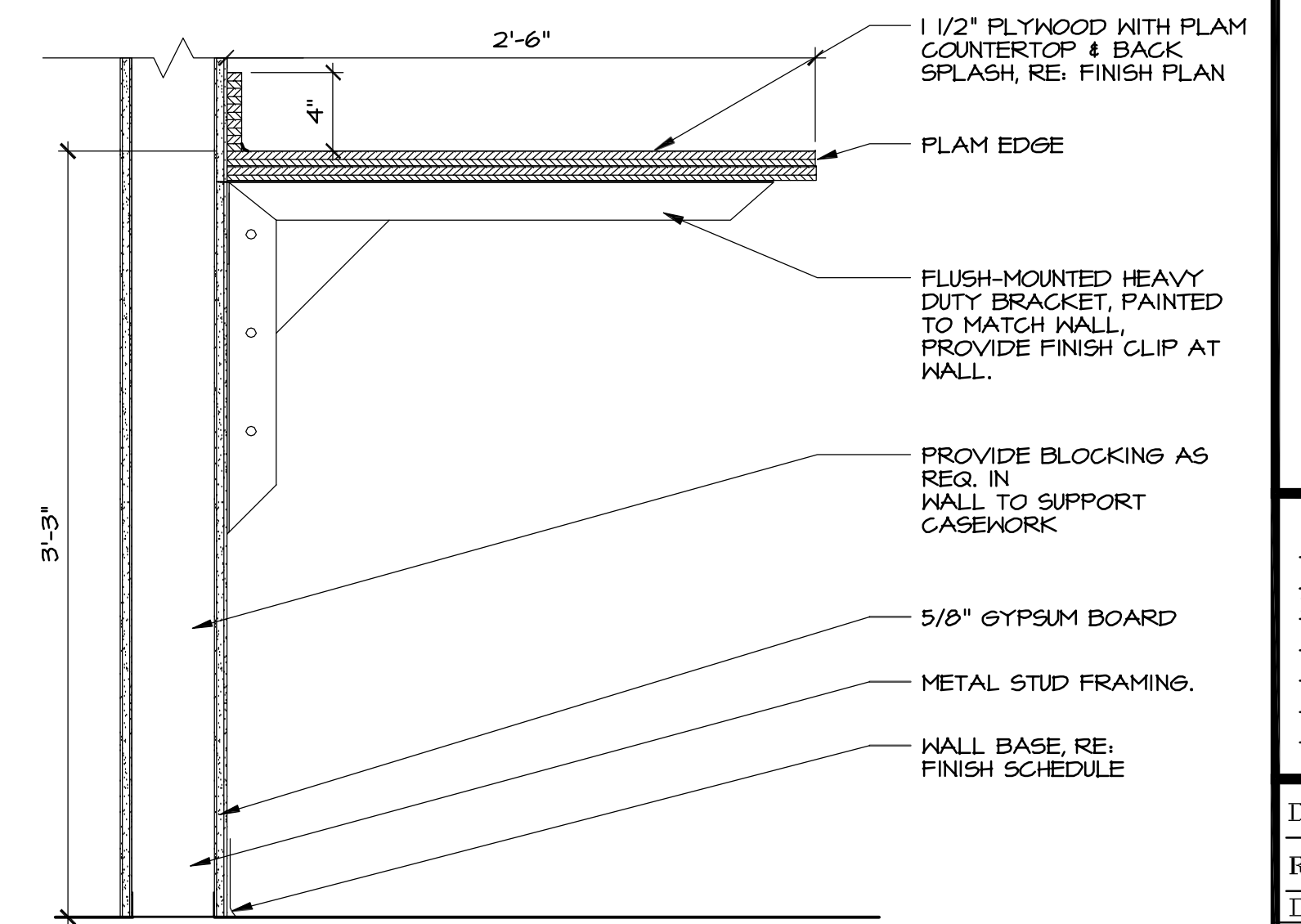
D3 SIGNAGE TYPES
SCALE: 3" = 1'-0"



A3 WALL PIPE PENETRATION
SCALE: 3" = 1'-0"



B5 WINDOW SHADE DETAIL
SCALE: 1'-0" = 1'-0"



A5 TYP COUNTERTOP DETAIL
SCALE: 1-1/2" = 1'-0"



CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

DETAILS
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

ISSUE
1. 1/1/13 - ISSUE FOR
BIDDING & CONSTRUCTION

DRAWN BY: LDG
REVIEWED BY: JCP
Date: 08/10/2012

SHEET

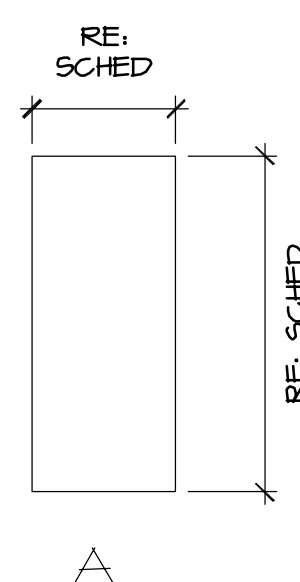
A-521

SPA PROJECT NO.
10842.210

Door Schedule

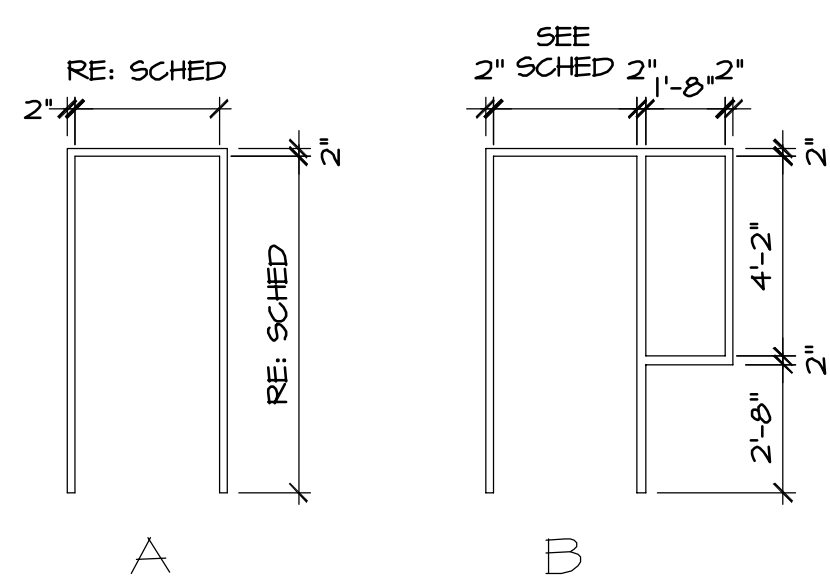
Door No	Room Name	Room No	Door Info			No. Required / Size	Frame Info			Details			Hdwr. No.	Remarks
			Type	Mat'l	Label		Type	Mat'l	Label	Head	Jamb	Sill		
100	LOBBY	100	EXIST	EXIST	-	3'-0" x 7'-0"	EXIST	EXIST	-	EXIST	EXIST	-	010	NEW HARDWARE ONLY
100A	MEN	100A	EXIST	EXIST	-	2'-8" x 7'-0"	EXIST	EXIST	-	EXIST	EXIST	-	050	NEW HARDWARE ONLY
100B	WOMEN	100B	EXIST	EXIST	-	2'-8" x 7'-0"	EXIST	EXIST	-	EXIST	EXIST	-	050	NEW HARDWARE ONLY
100C	LOBBY	100	EXIST	EXIST	-	3'-0" x 7'-0"	EXIST	EXIST	-	EXIST	EXIST	-	020	REPLACE CRACKED SIDELIGHT GLASS & NEW HARDWARE
100D	LOBBY	100D	A	HM	-	3'-0" x 7'-0"	A	HM	-	B5/A-611	A5/A-611	-	230	
101A	ADMINISTRATION	101	A	WD	3 HR	3'-0" x 7'-0"	A	HM	3 HR	B3/A-611	A2/A-611 & A3/A-611	-	060	
103	OFFICE	103	A	WD	-	3'-0" x 7'-0"	B	HM	-	B4/A-611	A4/A-611	-	220	
105	OFFICE	105	A	WD	-	3'-0" x 7'-0"	B	HM	-	B4/A-611	A4/A-611	-	220	
107	OFFICE	107	A	WD	-	3'-0" x 7'-0"	B	HM	-	B4/A-611	A4/A-611, A1/A-611	-	220	
108	IT/DATA	108	A	WD	-	3'-0" x 7'-0"	A	HM	-	B4/A-611	A4/A-611	-	240	
111	OFFICE	111	A	WD	-	3'-0" x 7'-0"	B	HM	-	B4/A-611	A4/A-611, A1/A-611	-	220	
112	OFFICE	112	A	WD	-	3'-0" x 7'-0"	B	HM	-	B4/A-611	A4/A-611, A1/A-611	-	220	
113	OFFICE	113	A	WD	-	3'-0" x 7'-0"	B	HM	-	B4/A-611	A4/A-611, A1/A-611	-	220	
114	OFFICE	114	A	WD	-	3'-0" x 7'-0"	B	HM	-	B4/A-611	A4/A-611, A1/A-611	-	220	
115	STORAGE	115	A	WD	-	3'-0" x 7'-0"	A	HM	-	B4/A-611	A4/A-611	-	250	
116	MEN	116	A	WD	-	3'-0" x 7'-0"	A	HM	-	B4/A-611	A4/A-611	-	050	
117	BREAK ROOM	117	EXIST	EXIST	-	3'-0" x 7'-0"	EXIST	EXIST	-	EXIST	EXIST	-	030	
118	WOMEN	118	A	WD	-	3'-0" x 7'-0"	A	HM	-	B4/A-611	A4/A-611	-	050	
120	CUSTODIAL	120	A	WD	-	3'-0" x 7'-0"	A	HM	-	B4/A-611	A4/A-611	-	250	
121	BALLFIELD STORAGE	121	A	WD	90 MIN	2 @ 3'-0" x 7'-0"	B	HM	90 MIN	B4/A-611	A4/A-611	-	200	
121B	BALLFIELD STORAGE	121	A	WD	3 HR	3'-0" x 7'-0"	A	HM	3 HR	B3/A-611	A3/A-611	-	040	
123A	VEHICLE STORAGE	123	A	WD	3 HR	3'-0" x 7'-0"	A	HM	3 HR	B3/A-611	A3/A-611	-	040	
125	TRAILS STORAGE	125	A	WD	90 MIN	2 @ 3'-0" x 7'-0"	B	HM	90 MIN	B4/A-611	A4/A-611	-	200	
127	IRRIGATION STORAGE	127	A	WD	90 MIN	2 @ 3'-0" x 7'-0"	B	HM	90 MIN	B4/A-611	A4/A-611	-	200	
130	STORAGE	130	EXIST	EXIST	-	3'-6" x 7'-0"	EXIST	EXIST	-	EXIST	EXIST	-	080	NEW HARDWARE ONLY
131	OFFICE	131	A	WD	-	2'-6" x 7'-0"	B	HM	-	B4/A-611	A4/A-611, A1/A-611	-	220	
132	PLAN ROOMS	132	EXIST	EXIST	-	3'-0" x 7'-0"	EXIST	EXIST	-	EXIST	EXIST	-	070	NEW HARDWARE ONLY
133	CONFERENCE	133	A	WD	-	2'-6" x 7'-0"	B	HM	-	B4/A-611	A4/A-611, A1/A-611	-	210	
134	WOMEN	134	A	HM	-	3'-0" x 7'-0"	A	HM	-	B5/A-611	A5/A-611	-	255	
136	MEN	136	A	HM	-	3'-0" x 7'-0"	A	HM	-	B5/A-611	A5/A-611	-	255	
138A	WASH BAYS	138	EXIST	EXIST	-	3'-6" x 7'-0"	EXIST	EXIST	-	EXIST	EXIST	-	060	NEW HARDWARE ONLY
138B	WASH BAYS	138	EXIST	EXIST	-	3'-6" x 7'-0"	EXIST	EXIST	-	EXIST	EXIST	-	090	NEW HARDWARE ONLY
139A	STORAGE	139	EXIST	EXIST	-	3'-8" x 7'-0"	EXIST	EXIST	-	EXIST	EXIST	-	030	NEW HARDWARE ONLY
139B	STORAGE	139	EXIST	EXIST	-	3'-6" x 7'-0"	EXIST	EXIST	-	EXIST	EXIST	-	080	NEW HARDWARE ONLY
140	STORAGE	140	A	WD	-	3'-0" x 7'-0"	A	HM	-	B4/A-611	A4/A-611	-	250	
142	WORKROOM	142	A	WD	-	3'-0" x 7'-0"	A	HM	-	B4/A-611	A4/A-611	-	220	
143A	IT/DATA	143	EXIST	EXIST	-	3'-0" x 7'-0"	EXIST	EXIST	-	EXIST	EXIST	-	090	NEW HARDWARE ONLY
143B	IT/DATA	143	EXIST	EXIST	-	3'-8" x 7'-0"	EXIST	EXIST	-	EXIST	EXIST	-	030	NEW HARDWARE ONLY
144	STORAGE	144	EXIST	EXIST	-	3'-0" x 7'-0"	EXIST	EXIST	-	EXIST	EXIST	-	090	NEW HARDWARE ONLY

DOOR TYPES

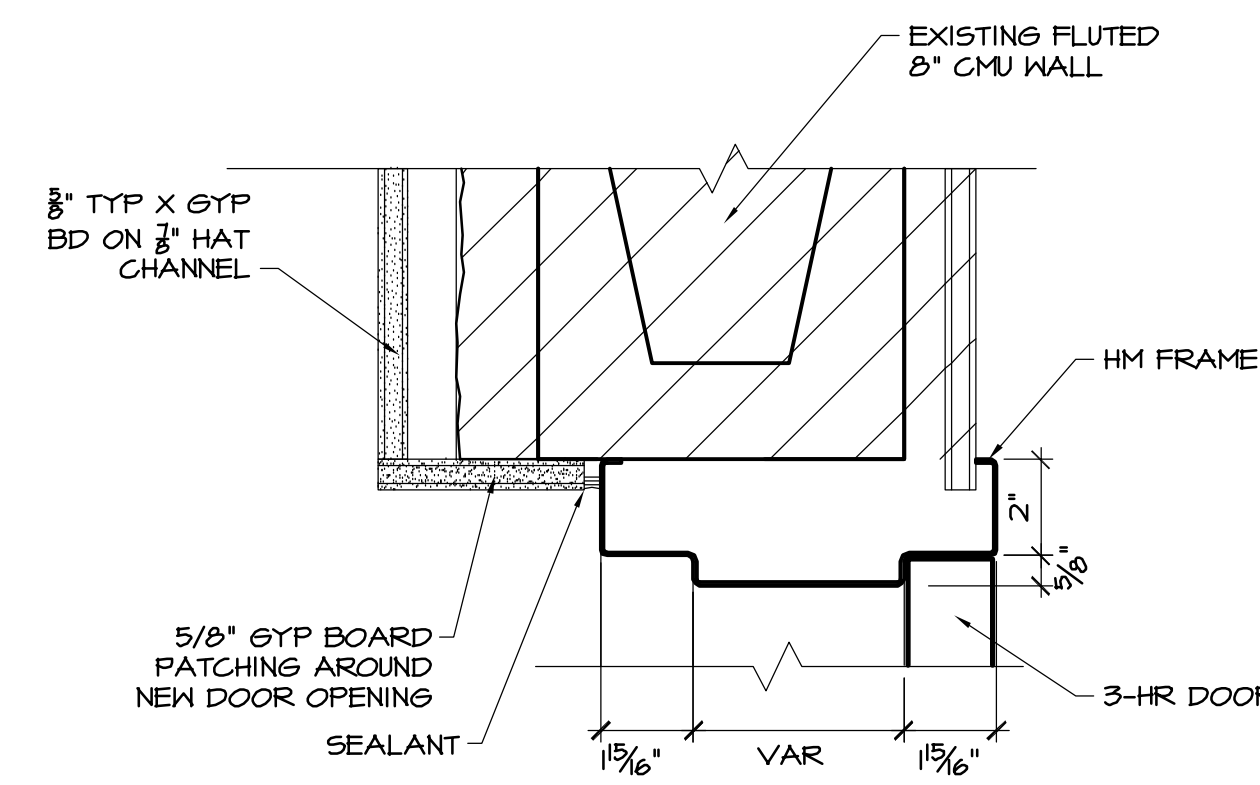


A1 DOOR JAMB DETAIL
SCALE: 3" = 1'-0"

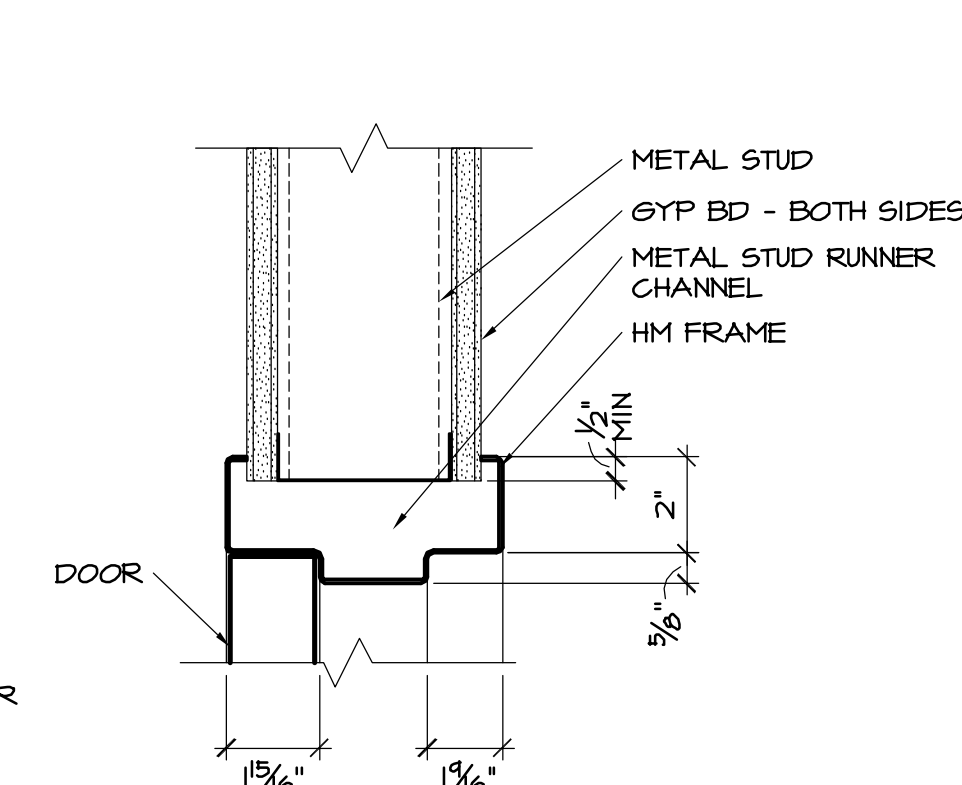
FRAME TYPES



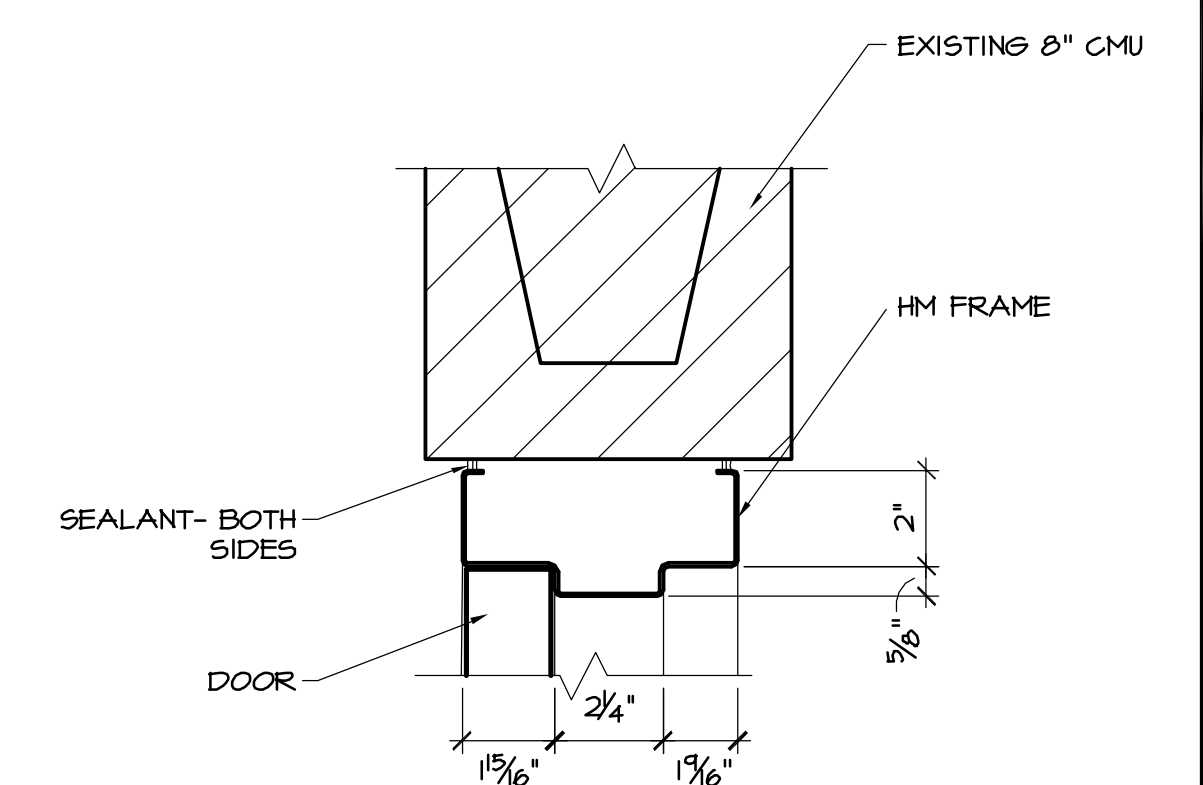
A2 3-HR DOOR JAMB DETAIL
SCALE: 3" = 1'-0"



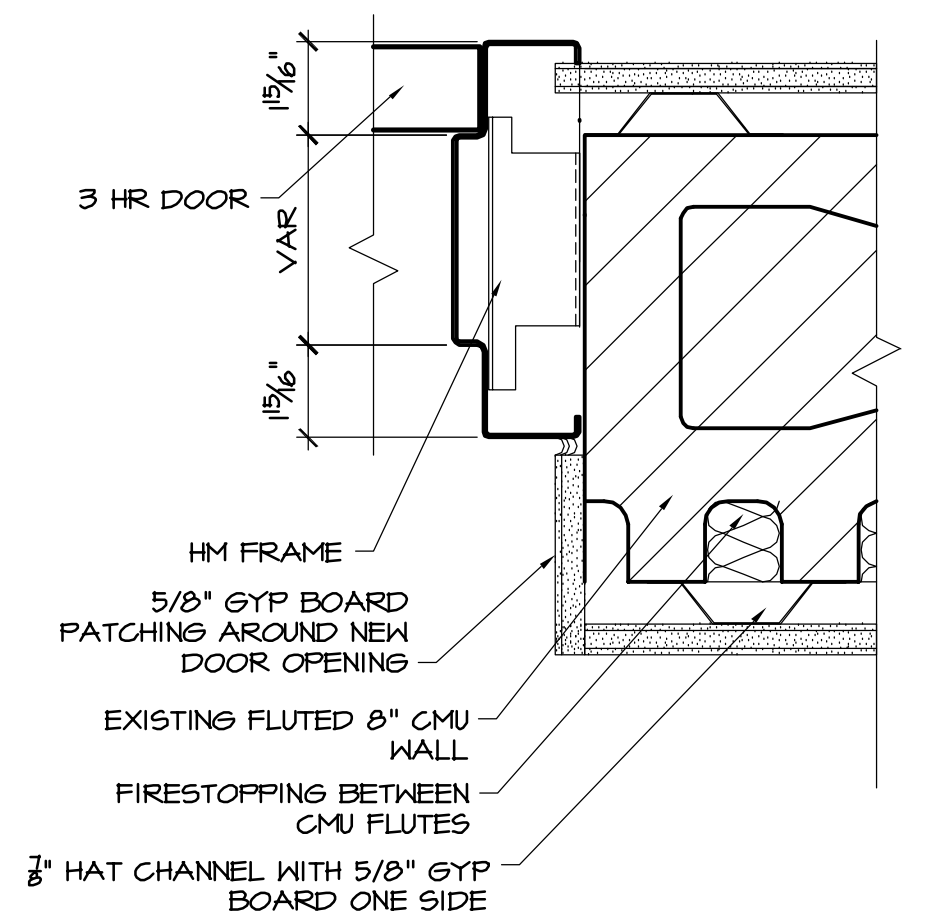
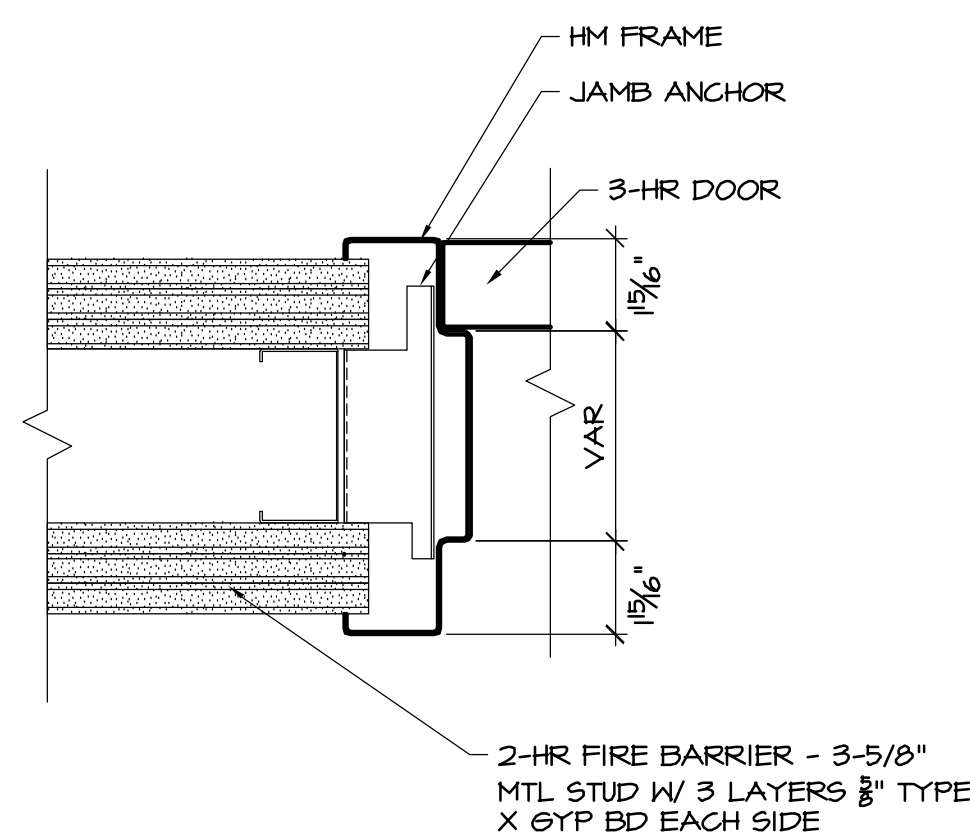
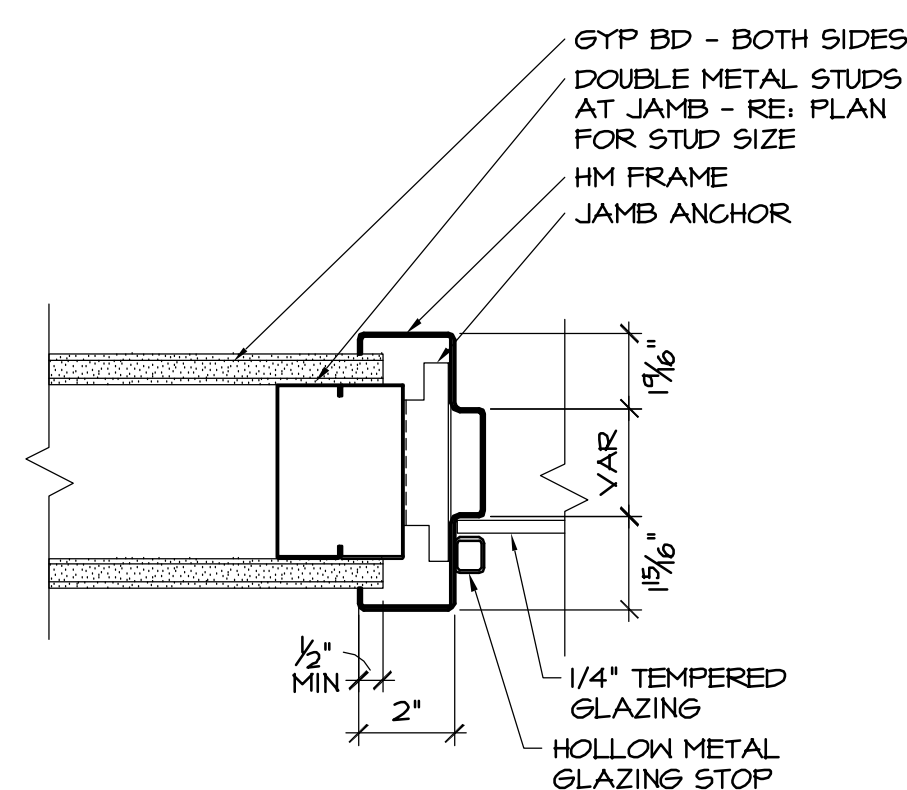
B3 3-HR DOOR HEAD DETAIL
SCALE: 3" = 1'-0"



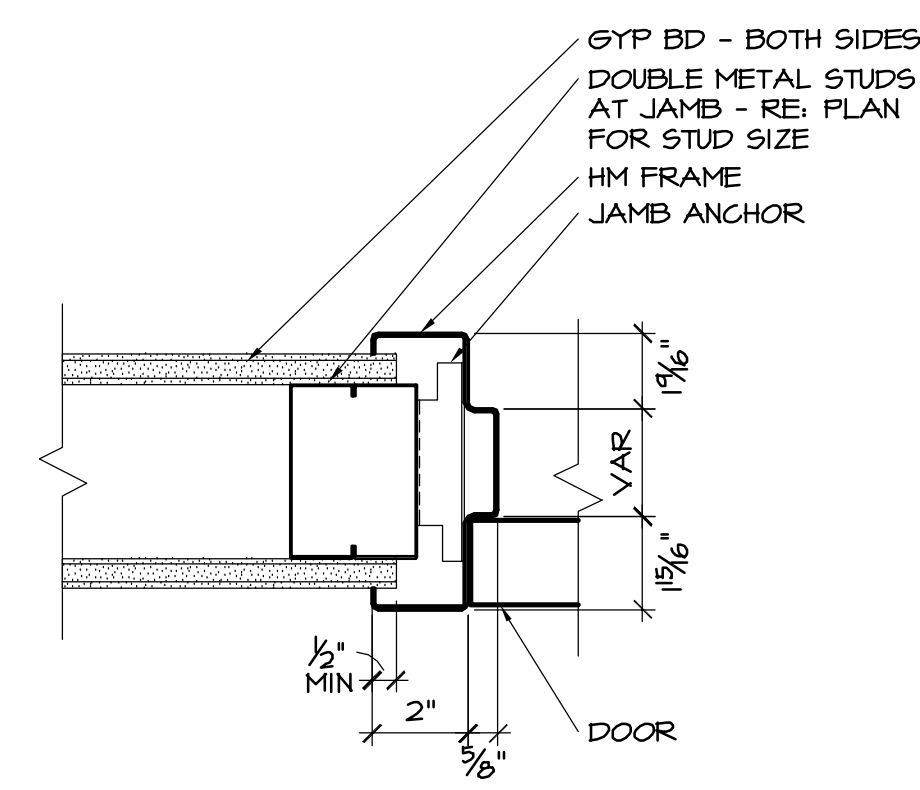
B4 DOOR HEAD DETAIL
SCALE: 3" = 1'-0"



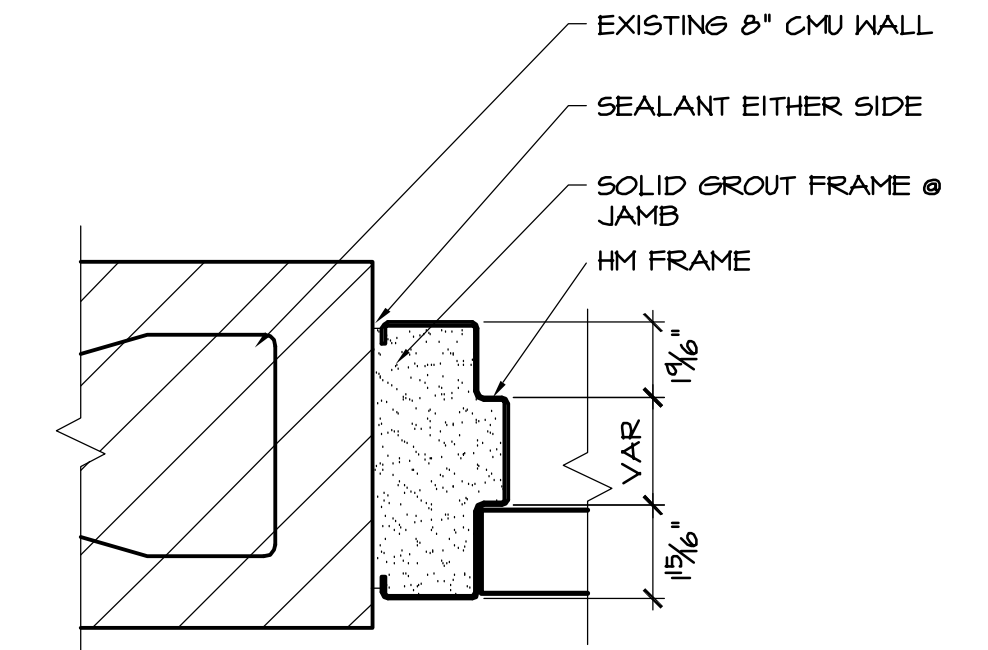
B5 DOOR HEAD DETAIL
SCALE: 3" = 1'-0"



A3 3-HR DOOR JAMB DETAIL
SCALE: 3" = 1'-0"



A4 DOOR JAMB DETAIL
SCALE: 3" = 1'-0"



A5 DOOR JAMB DETAIL
SCALE: 3" = 1'-0"



CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

DOOR SCHEDULE & DETAILS
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

ISSUE
1. 11/11/13 - ISSUE FOR
BIDDING & CONSTRUCTION

DRAWN BY: LDG
REVIEWED BY: JCP
Date: 11/11/2013

SHEET

A-611

SPA PROJECT NO.
10842.210

MECHANICAL SYMBOLS		ABBREVIATIONS		MECHANICAL/PLUMBING GENERAL NOTES	
PIPING / PLUMBING		HVAC EQUIP. AND DUCTWORK		<p>C CUBIC FEET PER MINUTE</p> <p>CFM CUBIC FEET PER MINUTE</p> <p>D DRY BULB</p> <p>E EXISTING</p> <p>EAT ENTERING AIR TEMPERATURE</p> <p>EF EXHAUST FAN</p> <p>ESP EXTERNAL STATIC PRESSURE</p> <p>ET EXPANSION TANK</p> <p>F FEET</p> <p>FT FEET PER MINUTE</p> <p>FPM FEET PER MINUTE</p> <p>G GALLONS PER MINUTE</p> <p>GPM GALLONS PER MINUTE</p> <p>I INVERT ELEVATION</p> <p>IE INFARED HEATER</p> <p>IN. WC INCHES OF WATER COLUMN</p> <p>L LOUVER</p> <p>LAT LEAVING AIR TEMPERATURE</p> <p>M 1000 BTU PER HOUR</p> <p>MBH MINIMUM CIRCUIT AMPACITY</p> <p>MCA MAXIMUM OVERCURRENT PROTECTION</p> <p>MOCP</p> <p>R RETURN GRILLE</p> <p>RG REVOLUTIONS PER MINUTE</p> <p>RPM ROOF TOP UNIT</p> <p>RTU</p> <p>S SUPPLY DIFFUSER</p> <p>SD SUPPLY GRILLE</p> <p>SG</p> <p>T TRANSFER FAN</p> <p>TF THERMOSTAT</p> <p>TSTAT TYPICAL</p> <p>U UNIT HEATER</p> <p>UH</p> <p>V VENT THROUGH ROOF</p> <p>VTR</p> <p>W WET BULB</p> <p>WB</p>	
<p>PLUMBING</p> <p>--- DOMESTIC COLD WATER PIPING</p> <p>--- DOMESTIC HOT WATER PIPING</p> <p>--- DOMESTIC HOT WATER RECIRC. PIPING</p> <p>--- SAN --- SANITARY PIPING</p> <p>--- V --- VENT PIPING</p> <p>--- G --- NATURAL GAS PIPING</p> <p>VALVES</p> <p>--- GATE (SHUT OFF) VALVE</p> <p>--- CALIBRATED BALANCING VALVE</p> <p>--- CHECK VALVE</p> <p>--- RELIEF/SAFETY VALVE</p> <p>--- BALANCING VALVE WITH PRESSURE PORTS</p> <p>--- GAS COCK</p> <p>--- BALL VALVE</p> <p>--- UNION</p> <p>--- PIPING ELBOW UP</p> <p>--- PIPING ELBOW DOWN</p> <p>--- PIPING TEE UP</p> <p>--- PIPING TEE DOWN</p> <p>--- PIPING CAP</p> <p>--- WATER HAMMER ARRESTOR</p> <p>--- VENT THRU ROOF</p> <p>3"FS-1 FLOOR SINK, SIZE AND TYPE</p> <p>3"FD-1 FLOOR DRAIN, SIZE AND TYPE</p> <p>--- HB --- HOSE BIBB / WALL HYDRANT</p> <p>--- WH --- MANUAL AIR VENT</p> <p>--- CO --- LINE CLEANOUT / WALL CLEANOUT</p> <p>--- WCO --- FLOOR CLEANOUT</p> <p>FCO FLOOR CLEANOUT</p> <p>--- PUMP</p>		<p>NOTE: ALL DUCT DIMENSIONS SHOWN ON DRAWINGS ARE INSIDE DIMENSIONS.</p> <p>--- INSULATED FLEXIBLE DUCT (MAXIMUM 5'-0" LONG)</p> <p>--- BRANCH DUCT WITH 45° TAP AND MANUAL VCD</p> <p>--- BRANCH DUCT WITH CONICAL FITTING AND MANUAL VCD</p> <p>--- BRANCH DUCT WITH 45° TAP AND MANUAL VOLUME CONTROL DAMPER</p> <p>--- ELBOW WITH TURNING VANES</p> <p>--- RETURN AIR DUCT UP</p> <p>--- RETURN AIR DUCT DOWN</p> <p>--- SUPPLY AIR DUCT UP</p> <p>--- SUPPLY AIR DUCT DOWN</p> <p>--- EXHAUST AIR DUCT UP</p> <p>--- EXHAUST AIR DUCT DOWN</p> <p>--- TYPE, NECK SIZE, CFM AT DIFFUSER OR GRILLE</p> <p>--- BELLMOUTH</p> <p>--- MANUAL VOLUME CONTROL DAMPER</p> <p>--- THERMOSTAT</p> <p>--- FD FIRE DAMPER</p> <p>--- FSD FIRE/SMOKE DAMPER</p> <p>--- SD SMOKE DAMPER</p> <p>--- M MOTORIZED DAMPER</p> <p>--- ROUND DUCT RISER</p> <p>12/6 RECTANGULAR DUCT (1ST FIG. SIDE SHOWN)</p> <p>12"Ø ROUND DUCT (1ST FIG. = DIAMETER)</p> <p>--- OPPOSED BLADE DAMPER</p>			
<p>MISCELLANEOUS</p> <p>--- CONNECTION POINT OF NEW WORK TO EXISTING</p>					

- THE PLANS ARE DIAGRAMMATIC IN NATURE. THE CONTRACTOR SHALL OBTAIN EXACT LOCATION, MEASUREMENTS LEVELS, ETC. AT THE SITE AND SHALL SATISFACTORILY ADAPT THE WORK TO THE ACTUAL CONDITIONS AT THE PROJECT SITE.
- CONTRACTOR SHALL VISIT THE JOB SITE PRIOR TO SUBMITTING A BID TO BECOME FAMILIAR WITH EXISTING CONDITIONS.
- WORK SHALL COMPLY WITH APPLICABLE FEDERAL, STATE AND LOCAL CODES, LAWS, ACTS AND ORDINANCES, AND AUTHORITIES HAVING JURISDICTION.
- RECORD DRAWINGS - PREPARE AND SUBMIT TO THE OWNER RECORD DRAWINGS INDICATING THE EXACT LOCATION OF ALL EQUIPMENT INCLUDING THE EQUIPMENT'S "AS INSTALLED" SIZE(S), MANUFACTURER, MODEL NUMBERS, AND PERFORMANCE RATINGS.
- SUPPORTS - EQUIPMENT, PIPING, DUCTWORK OR ANY OTHER ACCESSORY SHALL NOT BE SUPPORTED FROM OTHER PIPING, DUCTWORK, METAL ROOF DECK, LATERAL BRACING BRIDGING, OR CONDUIT. ITEMS SHALL ONLY BE SUPPORTED FROM BUILDING STRUCTURE.
- WHERE MOUNTING HEIGHTS ARE NOT DETAILED OR DIMENSIONED, INSTALL MECHANICAL SERVICES AND OVERHEAD EQUIPMENT TO PROVIDE THE MAXIMUM HEADROOM POSSIBLE.
- OWNER TO HAVE CHOICE SALVAGE OF ALL PLUMBING FIXTURES AND MECHANICAL EQUIPMENT WHICH ARE PLANNED TO BE REMOVED BY CONTRACTOR. EQUIPMENT NOT SALVAGED BY OWNER SHALL BE REMOVED FROM SITE AND PROPERLY DISPOSED OF BY THE CONTRACTOR.
- BEFORE REMOVAL OF ANY MECHANICAL EQUIPMENT, CONTRACTOR SHALL RECOVER USED REFRIGERANT IN A PROPERLY LABELED D.O.T. APPROVED REFILLABLE CYLINDER TO MEET E.P.A. STANDARDS. RECOVERED REFRIGERANT MUST BE CHEMICALLY ANALYZED AND REPROCESSED OR DISPOSED OF PER E.P.A. REQUIREMENTS, SECTION 608 OF THE CLEAN AIR ACT AND A.R.I. STANDARD 700.
- THE LOCATION OF EXISTING UNDERGROUND UTILITIES IS SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK.
- CONTRACTOR TO COORDINATE DUCTWORK WITH FIRE RATED WALLS AND FLOORS SHOWN ON ARCHITECTURAL DRAWINGS, MAINTAINING NECESSARY RATING OF WALLS. CONTRACTOR IS RESPONSIBLE FOR ALL CONNECTIONS TO SMOKE-FIRE DAMPERS.
- ALL SA DUCT BRANCH TAKE-OFFS TO DIFFUSER TO BE SAME SIZE AS DIFFUSER NECK UNLESS OTHERWISE NOTED.
- CONTRACTOR SHALL COORDINATE LOCATION OF ALL DIFFUSERS AND GRILLES WITH STRUCTURAL, ELECTRICAL, AND ARCHITECTURAL REFLECTED CEILING PLANS.
- ACCESS PANELS ARE REQUIRED (MIN. 18"x18") FOR ACCESS TO EVERY VALVE, DAMPER, AIR TERMINAL UNIT, AND CONTROL SENSOR IF NOT OTHERWISE ACCESSIBLE.
- SMOKE DETECTORS SHALL BE FURNISHED AND WIRED BY THE ELECTRICAL CONTRACTOR. THE MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR MOUNTING THE SMOKE DETECTOR IN DUCTWORK AS SHOWN ON THE ELECTRICAL DRAWINGS AND IN ACCORDANCE WITH MANUFACTURER'S PRINTED INSTRUCTIONS. PROVIDE RTU-2 WITH SMOKE DETECTION.



SLATERPAULL
 ARCHITECTS
 P 303.607.0977
 www.slaterpaul.com
 1331 Nineteenth Street
 Denver, CO 80202

CITY AND COUNTY OF DENVER
 DEPARTMENT OF
 PARKS & RECREATION
 201 West Colfax Avenue, Dept. 613
 Denver, Colorado 80202

MECH AND PLUMB LEGEND AND NOTES
 S. JASON STREET
 MAINTENANCE FACILITY
 678 S. Jason Street
 Denver, Colorado 80223

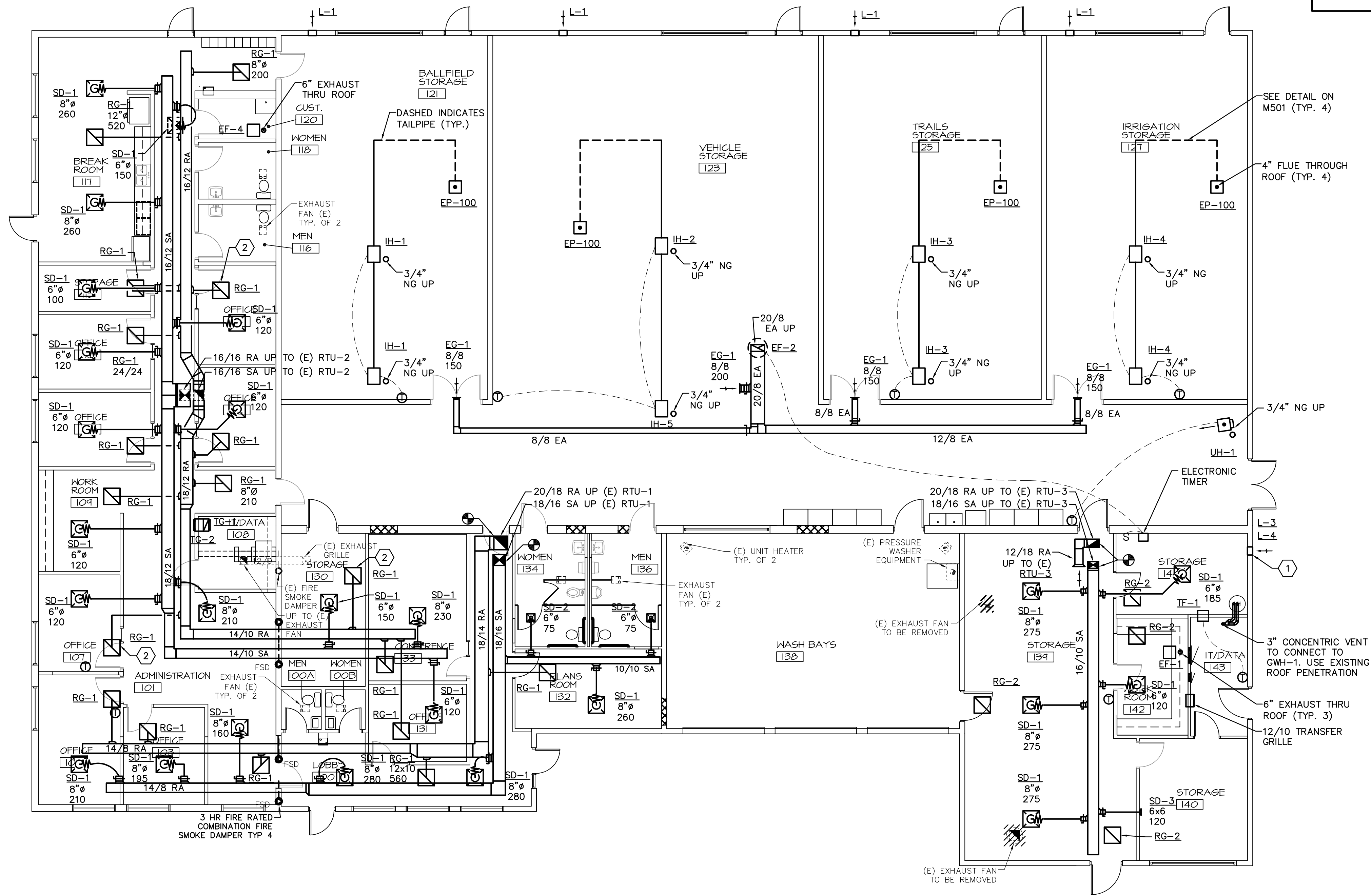
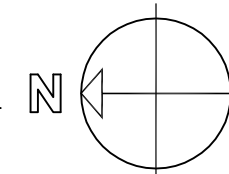
ISSUE:
 1. 11/11/13 BIDDING
 AND CONSTRUCTION

DRAWN BY: MLD
 REVIEWED BY: HDY
 Date: NOV 11, 2013
 SHEET

M001
 M001.dwg

Drawing name: N:\497940\110.dwg
 Updated by: miles.dake Feb 07, 2014 - 3:51pm

M1 FIRST FLOOR MECHANICAL PLAN
 SCALE: 1/8"=1'-0"



KEY NOTES (THIS SHEET)

1. PROVIDE WALL CAP MOUNTED 1'-0" FROM CEILING WITH 6" ELBOW THAT OPENS UP. PROVIDE WALL CAP MOUNTED 6" ELBOW THAT OPENS DOWN 1'-0" FROM FLOOR. WRAP BOTH ELBOWS WITH 1.5" BLANKET INSULATION.
2. RETURN GRILLE DUCT SIZE SHALL BE THE SAME SIZE AS THE DUCT PROVIDED TO SUPPLY GRILLE WITHIN THE SAME ROOM. TYPICAL FOR ALL DUCTED RETURN GRILLES. UNLESS OTHERWISE SPECIFIED. ALL RETURN DUCTS SHALL NOT BE FLEXIBLE DUCTWORK.

EF-2 CONTROL SEQUENCE (THIS SHEET)

1. 7 DAY 24 HOUR PROGRAMMABLE ELECTRONIC TIMER FROM GRAINGER, ITEM NUMBER 3FXA1 OR EQUIVALENT. PROGRAM FAN TO BE TURNED ON 8-5, M-F, DURING REGULARLY OCCUPIED HOURS.
2. CONNECT WALL MOUNTED SWITCH IN SERIES WITH PROGRAMMABLE TIMER. PROVIDE WITH PLASTIC LAMINATE SIGN LABELED "VEHICLE STORAGE GENERAL EXHAUST". LOCATE SWITCH AND TIMER IN ROOM STORAGE 144.



SLATERPAULL
 ARCHITECTS
 P 303.607.0977
 www.slaterpaull.com
 1331 Nineteenth Street
 Denver, CO 80202

CITY AND COUNTY OF DENVER
 DEPARTMENT OF
 PARKS & RECREATION
 201 West Colfax Avenue, Dept. 613
 Denver, Colorado 80202

FIRST FLOOR MECHANICAL PLAN
 S. JASON STREET
 MAINTENANCE FACILITY
 678 S. Jason Street
 Denver, Colorado 80223

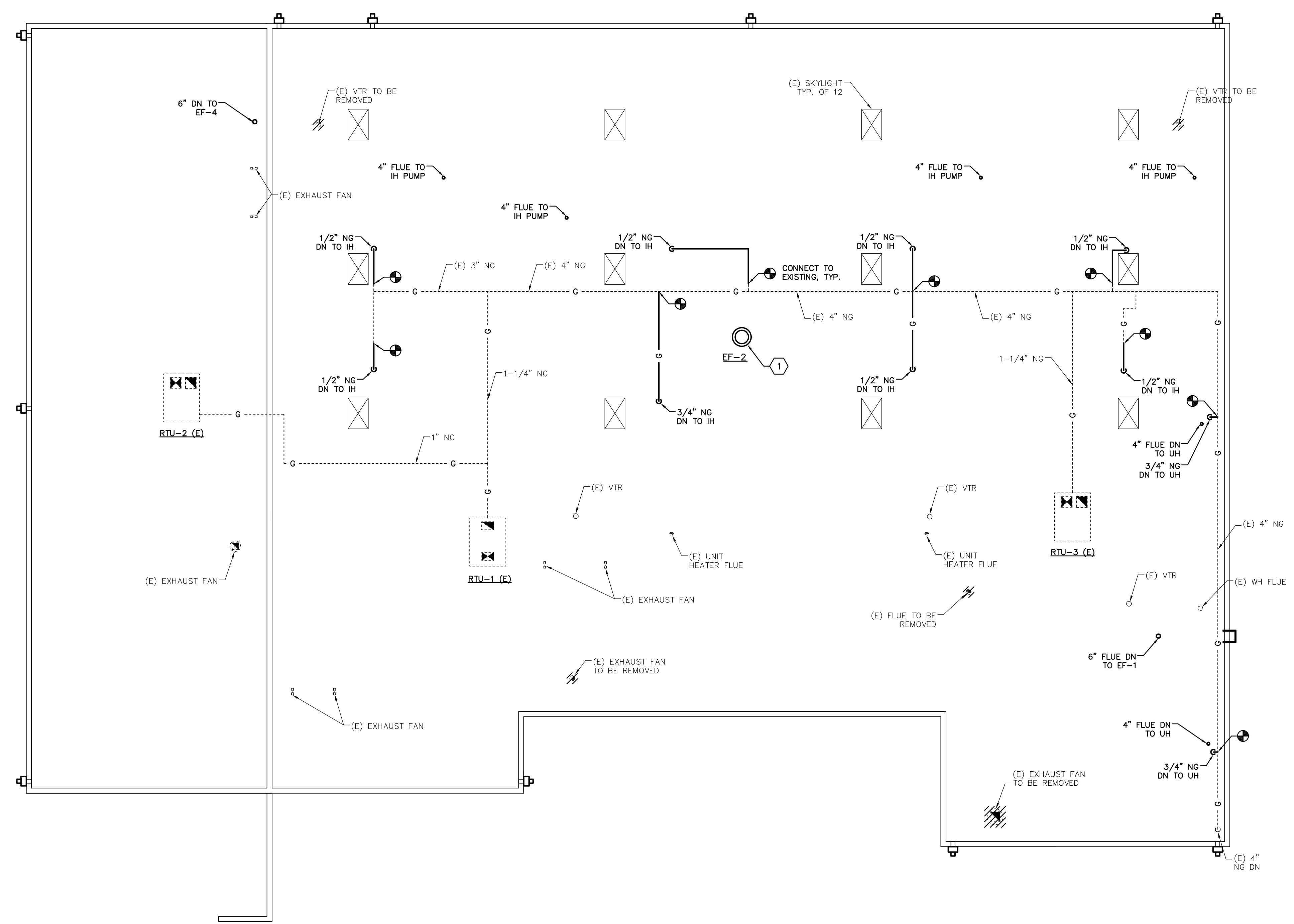
ISSUE:
 1.11/11/13 BIDDING
 AND CONSTRUCTION

 DRAWN BY: MLD
 REVIEWED BY: HDY
 Date: NOV 11, 2013
 SHEET

M110
 M110.dwg

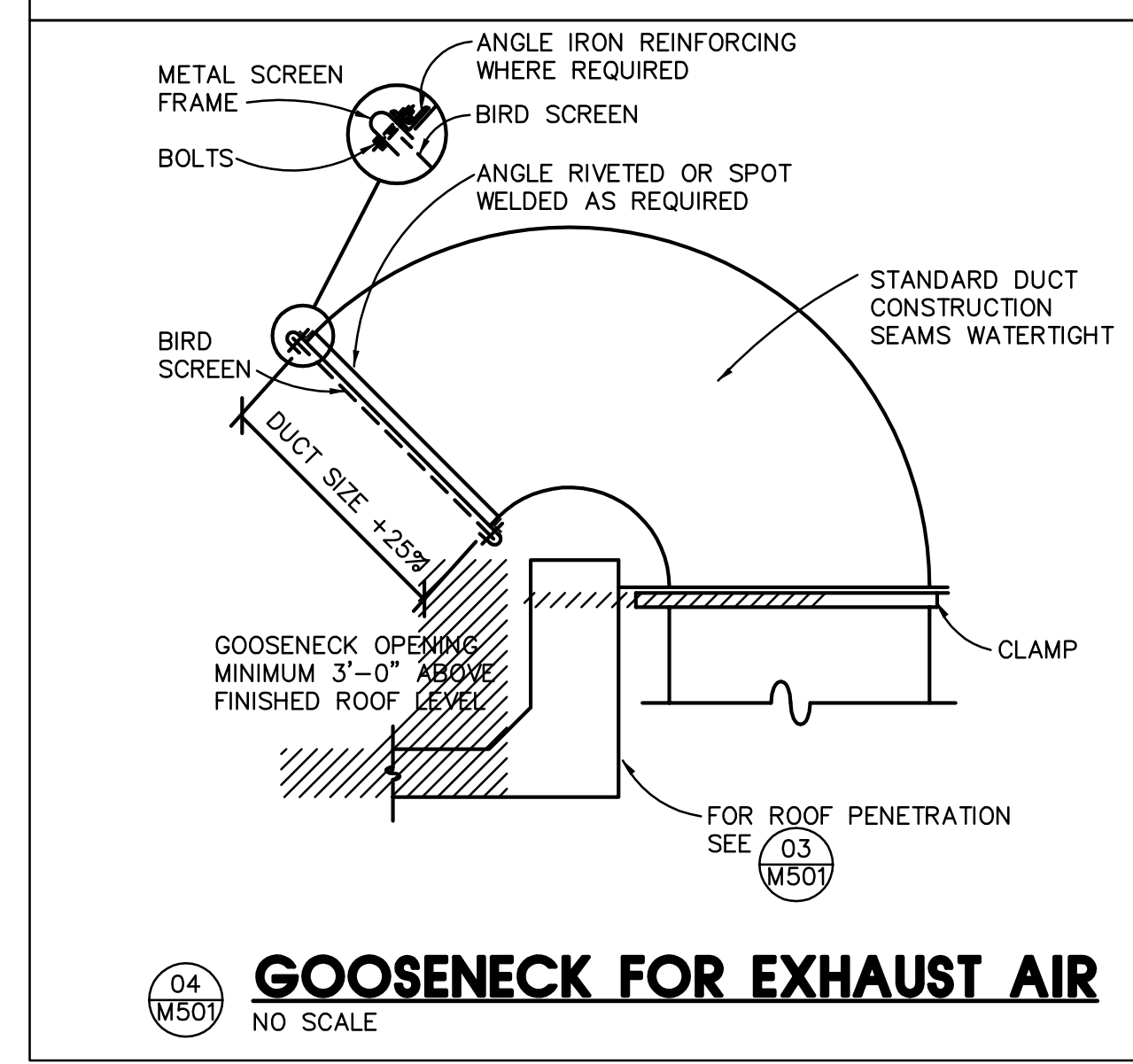
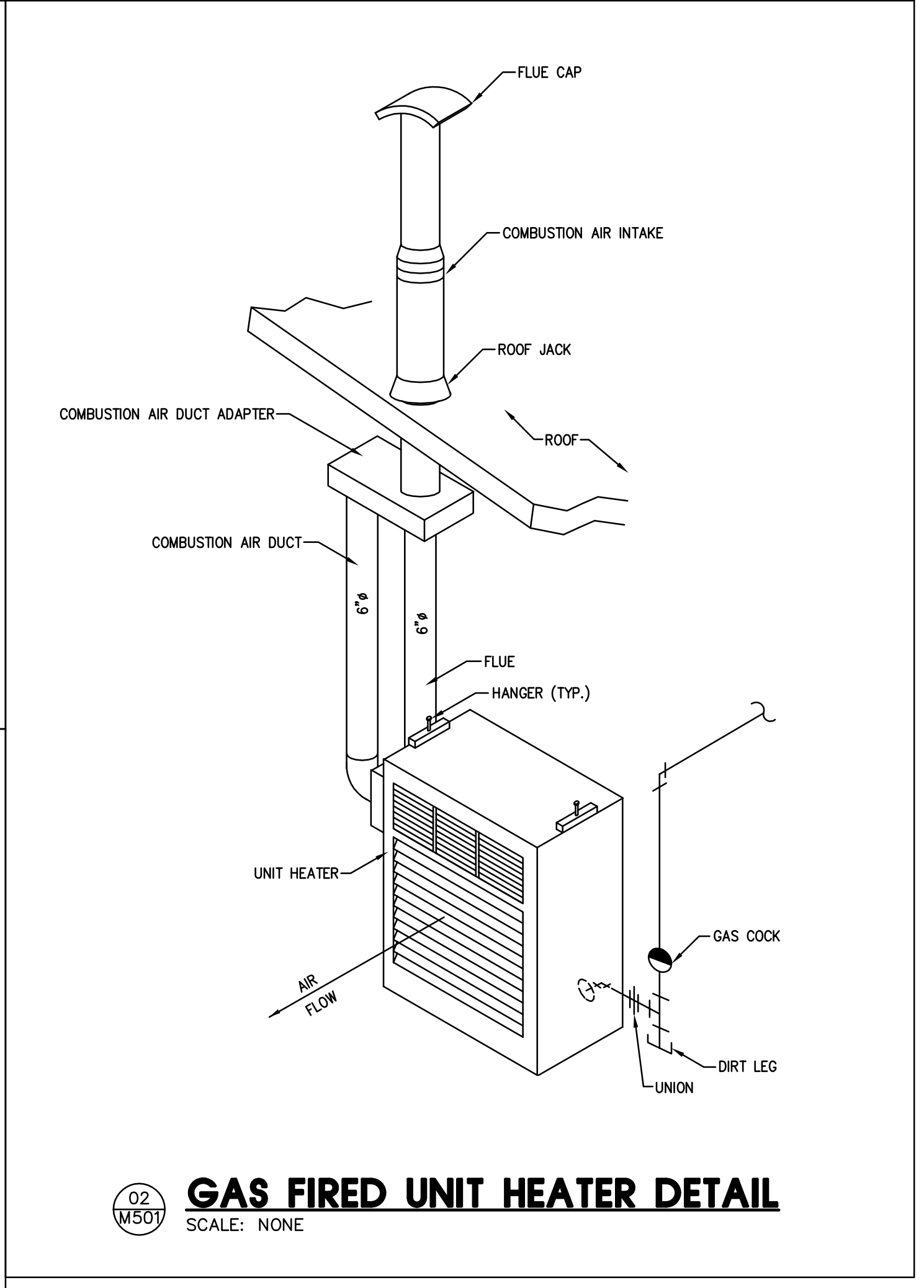
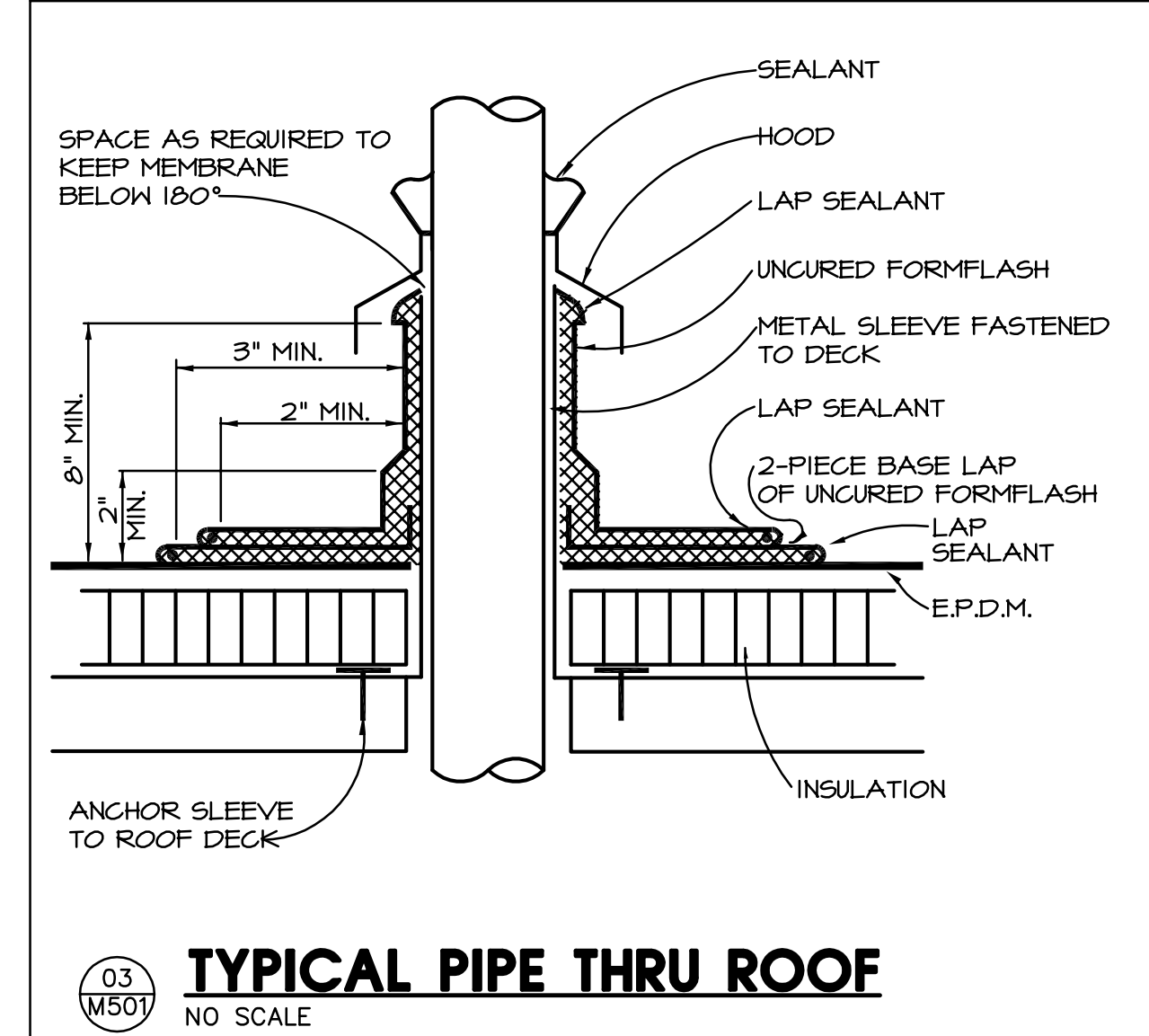
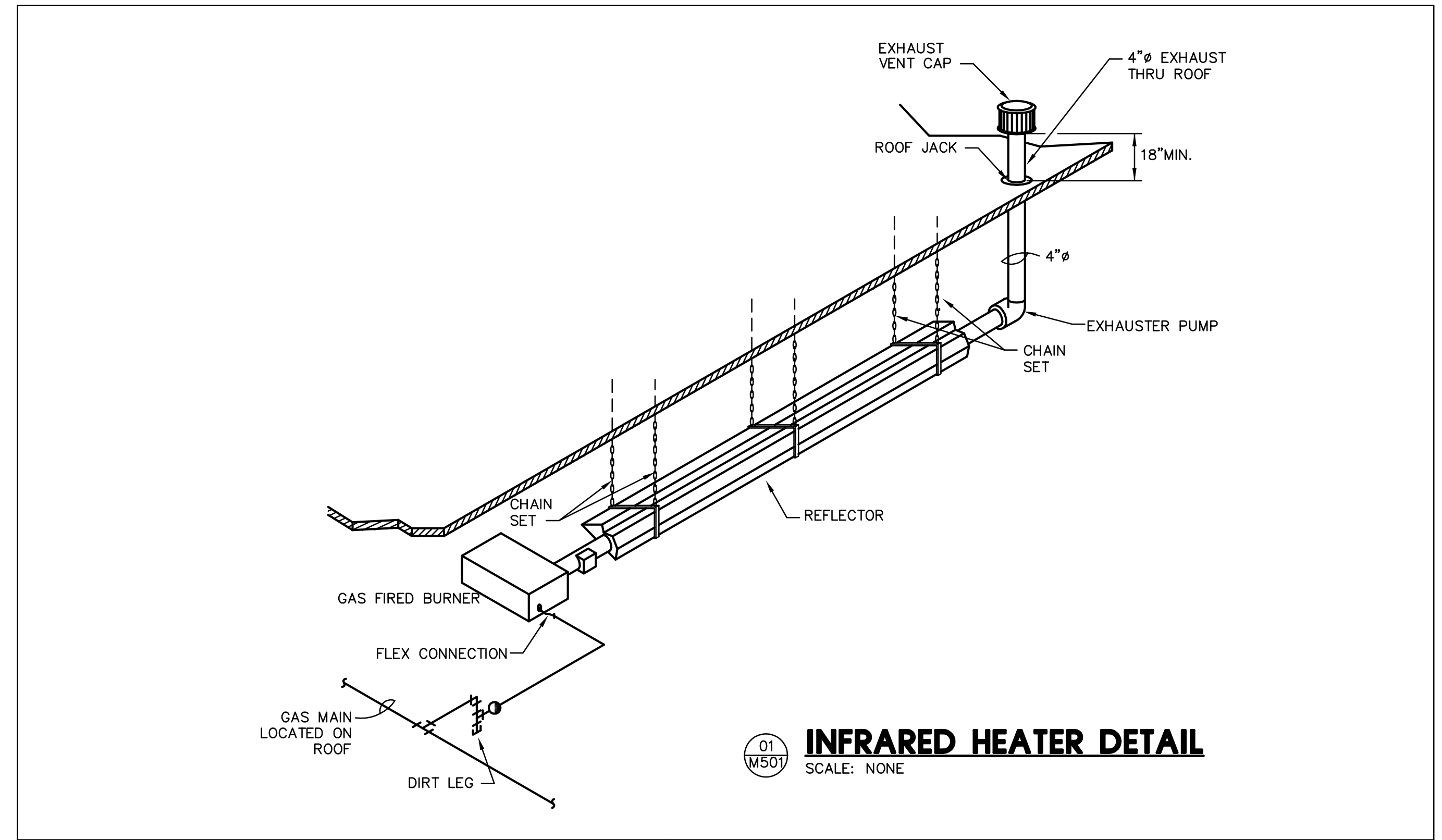
KEY NOTES (X) (THIS SHEET)

1. ROOF MOUNTED EXHAUST FAN TO BE PLACE ABOVE EXISTING OPENING IN ROOF. CAP AND SEAL UNCOVERED OPENING IN ROOF.



Drawing name: N:\497940\120.dwg
Updated by: miles.dake Feb 07, 2014 -- 2:09pm

Drawing name: N:\497940\501.dwg
 Updated by: miles.dake Feb 07, 2014 - 2:09pm



CITY AND COUNTY OF DENVER
 DEPARTMENT OF
 PARKS & RECREATION
 201 West Colfax Avenue, Dept. 613
 Denver, Colorado 80202

MECHANICAL DETAILS
 S. JASON STREET
 MAINTENANCE FACILITY
 678 S. Jason Street
 Denver, Colorado 80223

ISSUE:
 1. 11/11/13 BIDDING
 AND CONSTRUCTION

DRAWN BY: MLD
 REVIEWED BY: HDY
 Date: NOV 11, 2013
 SHEET

M501
 M501.dwg

EXISTING ROOF TOP UNIT SCHEDULE

MARK	MANUF. & MODEL OR EQUAL	SERVES	FAN INFORMATION				COOLING				HEATING				ELECTRICAL DATA			NOTES:	
			TYPE	CFM	MAX E.S.P. " wc.	MIN. OUTSIDE AIR (CFM)	CAPACITY TOTAL (MBH)	SENS. (MBH)	EAT (DEG F)		LAT (DEG F)		TYPE	INPUT CAPACITY (MBH)	OUTPUT CAPACITY (MBH)	MCA	MOCP		VOLTS/PH/Hz
									DB	WB	DB	WB							
RTU-1	(E) YORK D7C0048	LOBBY	SUPPLY	1470	0.34	120	48	N/A	94.3	60.3	55	35	GAS	75	60	15.3	20	208/3/60	1
RTU-2	(E) CARRIER 48TF004-014	N. OFFICES	SUPPLY	2115	0.34	330	60	N/A	94.3	60.3	55	35	GAS	115	101.2	27	26	208/3/60	1
RTU-3	(E) YORK D1NA036	SW STORAGE	SUPPLY	1250	0.35	300	36	N/A	94.3	60.3	55	35	GAS	45	31.7	18.2	25	208/3/60	1

NOTES:
1. ROOF TOP UNIT WITH NATURAL GAS HEAT, 2" FILTERS, SERVICE OUTLET, DISCONNECT, GAS REGULATORS AND PHASE AND BROWN OUT PROTECTION.
2. ALL EXISTING ROOF TOP UNITS TO BE CLEANED INCLUDING FANS, FILTER COMPARTMENTS, COOLING COILS, AND EXISTING DUCTS.

GAS UNIT HEATER SCHEDULE

MARK	MANUFACTURER & MODEL OR EQUAL	SERVES	MOUNTING TYPE	MBH INPUT	MBH OUTPUT	FAN INFORMATION	GAS INFORMATION		FLUE SIZE	WEIGHT	NOTES		
						MOTOR HP	CFM	VOLTS/PH/Hz	GAS TYPE	GAS INLET			
UH-1	REZNOR UDAS	MAINTENANCE CORRIDOR	HORIZONTAL	30	21	1/50	456	115/1/60	NATURAL GAS	1/2"	4" RND	55	1,2

NOTES:
1. PROVIDE REMOTE THERMOSTAT PROGRAMMABLE FOR DAILY SCHEDULE.
2. PROVIDE WITH VERTICAL COMBUSTION AIR/VENT KIT INCLUDING CONCENTRIC ADAPTER

INFRARED HEATER SYSTEM SCHEDULE

MARK	MANUFACTURER & MODEL OR EQUAL	QUANTITY	SERVES	MBH INPUT (EA)	MBH OUTPUT (EA)	ACTIVE LENGTH (FT)	GAS CONNECTION	PIPE MATERIAL	TAILPIPE LENGTH (FT)	TAILPIPE MATERIAL	REFLECTOR TYPE	MOUNTING HEIGHT	PUMP MODEL	VOLTS/PH/Hz	NOTES
IH-1	RG B-2	2	BALLFIELD STORAGE	20	16	13	1/2"	ALUMINIZED	15	PORCELAIN	STANDARD	13'-0"	EP-100	120/1/60	1,2
IH-2	RG B-2	1	VEHICLE STORAGE	20	16	13	1/2"	ALUMINIZED	20	PORCELAIN	STANDARD	13'-0"	EP-100	120/1/60	1,2
IH-3	RG B-2	2	TRAIL STORAGE	20	16	14	1/2"	ALUMINIZED	15	PORCELAIN	STANDARD	13'-0"	EP-100	120/1/60	1,2
IH-4	RG B-2	2	IRRIGATION STORAGE	20	16	13	1/2"	ALUMINIZED	15	PORCELAIN	STANDARD	13'-0"	EP-100	120/1/60	1,2
IH-5	RG B-4	1	VEHICLE STORAGE	40	32	19	1/2"	ALUMINIZED	20	PORCELAIN	STANDARD	13'-0"	EP-100	120/1/60	1,2

NOTES:
1. MOUNT HEATER FROM ROOF STRUCTURE ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.
2. PROVIDE REMOTE THERMOSTAT PROGRAMMABLE FOR OCCUPANCY SCHEDULE.

DIFFUSER, REGISTER, AND GRILLE SCHEDULE

MARK	MANUFACTURER & MODEL OR EQUAL	TYPE	MODULE SIZE	FINISH	NOTES
SD-1	TITUS TMSA	SUPPLY DIFFUSER	24x24	WHITE	
SD-2	TITUS TMSA	SUPPLY DIFFUSER	12x12	WHITE	
SD-3	TITUS 271RS	SUPPLY GRILLE	SEE PLANS	WHITE	
RG-1	TITUS PAR-AA	RETURN GRILLE	24x24	WHITE	1,2
RG-2	TITUS PAR-AA	RETURN GRILLE	24x24	WHITE	
EG-1	TITUS 23RL	EXHAUST GRILLE	SEE PLANS	WHITE	

NOTES:
1. GRILLE TO BE PROVIDE WITH DUCTED CONNECTION
2. PROVIDE WITH OBD

FAN SCHEDULE

MARK	MANUFACTURER & MODEL OR EQUAL	SERVES	FAN INFORMATION				ELECTRICAL DATA				NOTES
			TYPE	CFM	E.S.P. (" wc)	RPM	SIZE (WxH)	POWER	VOLTS/PH/Hz	DRIVE	
TF-1	GREENHECK CBF	SOUTH IT/DATA	TRANSFER	390	0.025	3300	16x8	4/25 HP	115/1/60	DIRECT	
EF-1	GREENHECK SP-B110	SOUTH WORK ROOM	EXHAUST	133	0.025	950	13.875x11.5	80 W	115/1/60	DIRECT	1
EF-2	GREENHECK CSP-A510	MAINTENANCE STO.	EXHAUST	650	.05	1070	18x14.375	217 W	115/1/60	DIRECT	
EF-3	NOT USED										
EF-4	GREENHECK SP-A50	JANITOR CLOSET	EXHAUST	68	.025	700	10.625x13.25	18 W	115/1/60	DIRECT	1

NOTES:
1. TO BE MOUNTED FROM CEILING USING MANUFACTURER HANGING KIT

LOUVER SCHEDULE

MARK	MANUFACTURER	MODEL	SERVES	QUANTITY	FINISH	MOUNTING HEIGHT	SIZE W/H (INCH)	AIRFLOW (CFM)	FREE AREA VEL (FPM)	FREE AREA (SQ. FT)	NOTES:
L-1	RUSKIN	ELF 6375	MAINT. BAY STORAGE RMS.	4	SEE NOTE 3	8'-0"	12/12	150	600	0.25	1
L-2	NOT USED										
L-3	BROAN	641 WALL CAP	STORAGE 144	1	ALUMINUM	1'-0" BELOW CEILING	6" RND	30	< 300	0.196	1
L-4	BROAN	641 WALL CAP	STORAGE 144	1	ALUMINUM	1'-0" ABOVE FLOOR	6" RND	30	< 300	0.196	1

NOTES:
1. PROVIDE WITH BIRDSCREEN.
2. ANODIZED FINISH COLOR SELECTION BY ARCHITECT FROM STANDARD COLOR SELECTION.

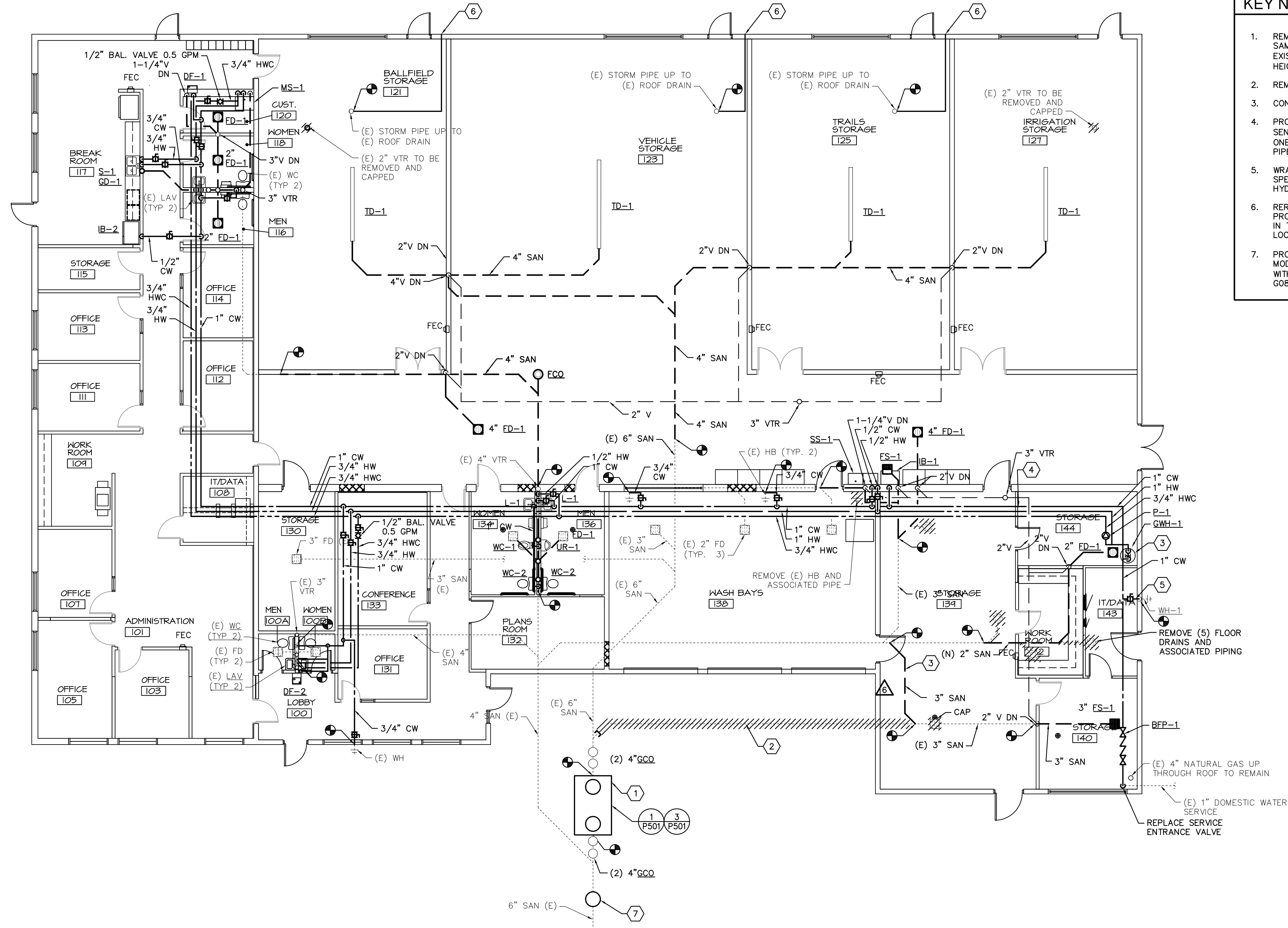
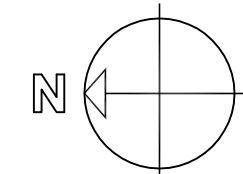
GAS-FIRED WATER HEATER SCHEDULE

PLAN CODE	MANUFACTURER & MODEL OR EQUAL	SERVES	TYPE	GPH RECOVERY @ 90°F RISE	HEATING CAPACITY (BTU/H)	RATED EFFICIENCY	CAPACITY (GAL)	FLUE SIZE	CONTROL VOLTAGE	DIMENSIONS		WEIGHT (LBS)	NOTES
										HEIGHT	WIDTH		
CWH-1	STATE OS6 40 YBPD	DOMESTIC HOT WATER	GAS FIRED STORAGE TANK	41	40	96%	40	(2) 3"	120/1/60	57	21	560	1,2,3

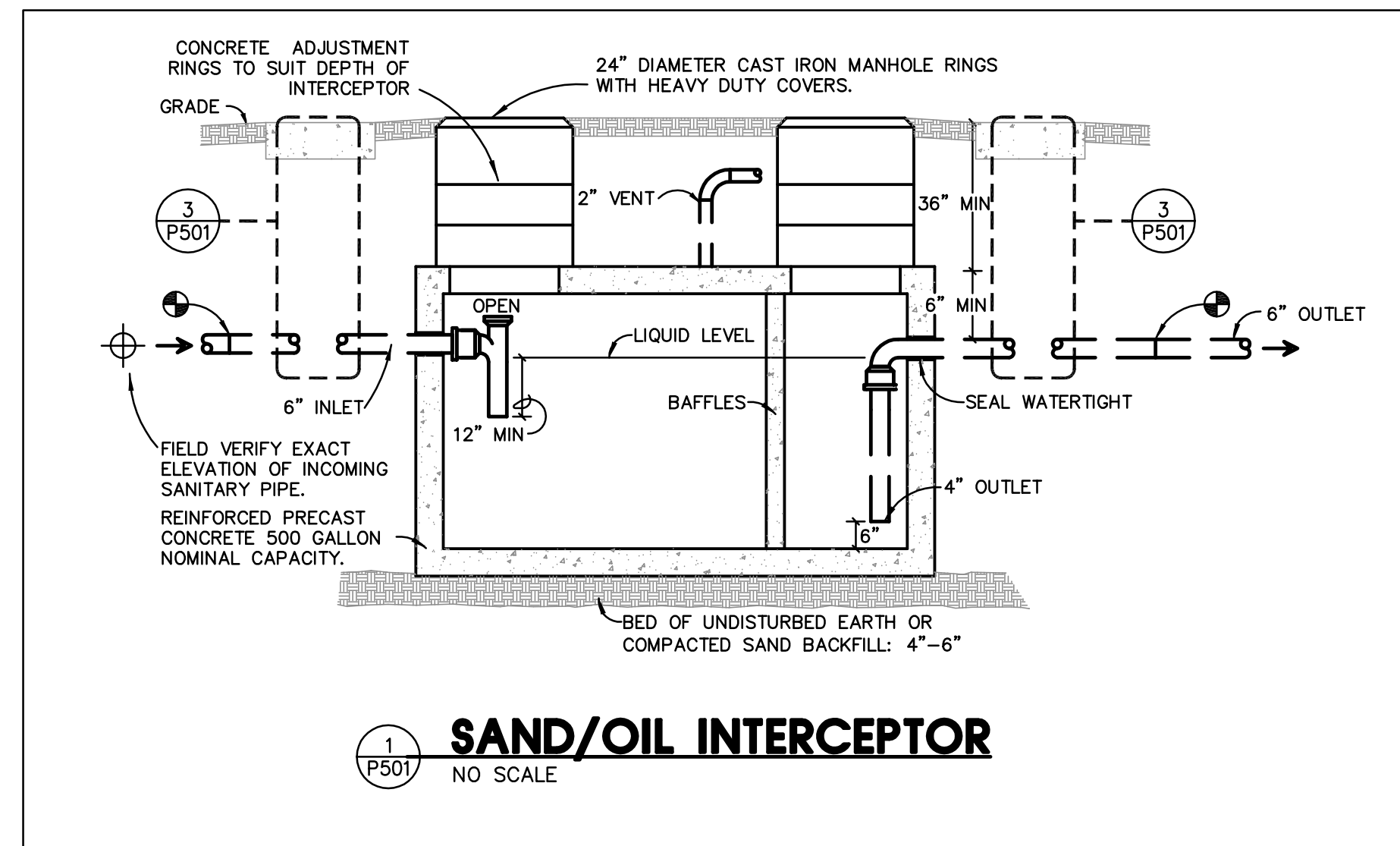
NOTES:
1. REFER TO HVAC DRAWINGS FOR FLUE AND COMBUSTION AIR ROUTING. PROVIDE WITH VERTICAL CONCENTRIC FLUE/VENT KIT.
2. LOCATE ON 6" HOUSE KEEPING PAD. ASME RATED.
3. PROVIDE WITH GRUNDFOS UP-10BNS AT/C HW CIRC. PUMP WITH AQUASTAT, CORD AND PLUG. PUMPS REQUIRES 120/1/60 RECEPTACLE FOR 25W MOTOR.

Drawing name: N:\497940\110.dwg
 Updated by: miles.dake Feb 07, 2014 - 2:09pm

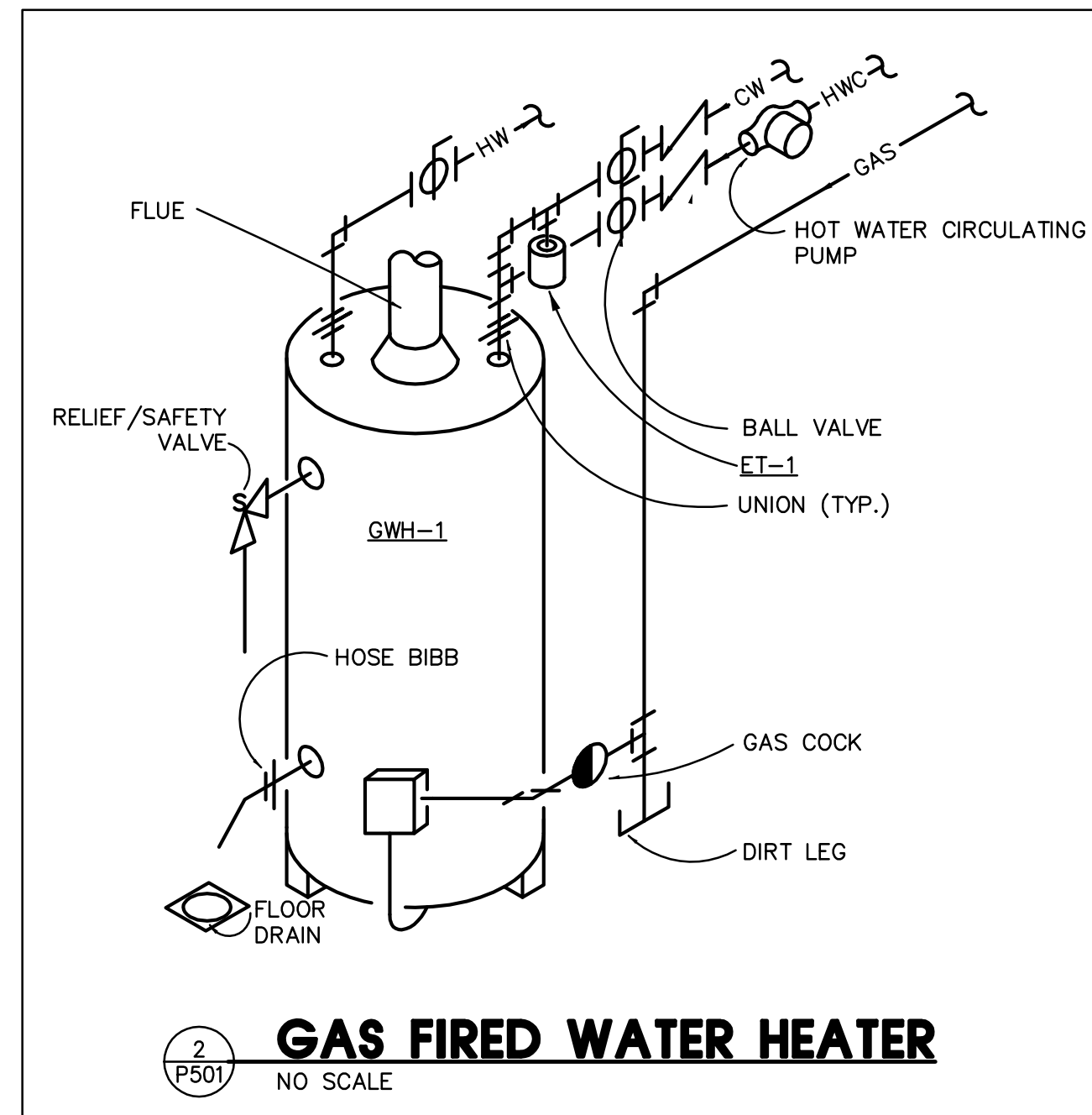
P1 FIRST FLOOR PLUMBING PLAN
 SCALE: 1/8"=1'-0"



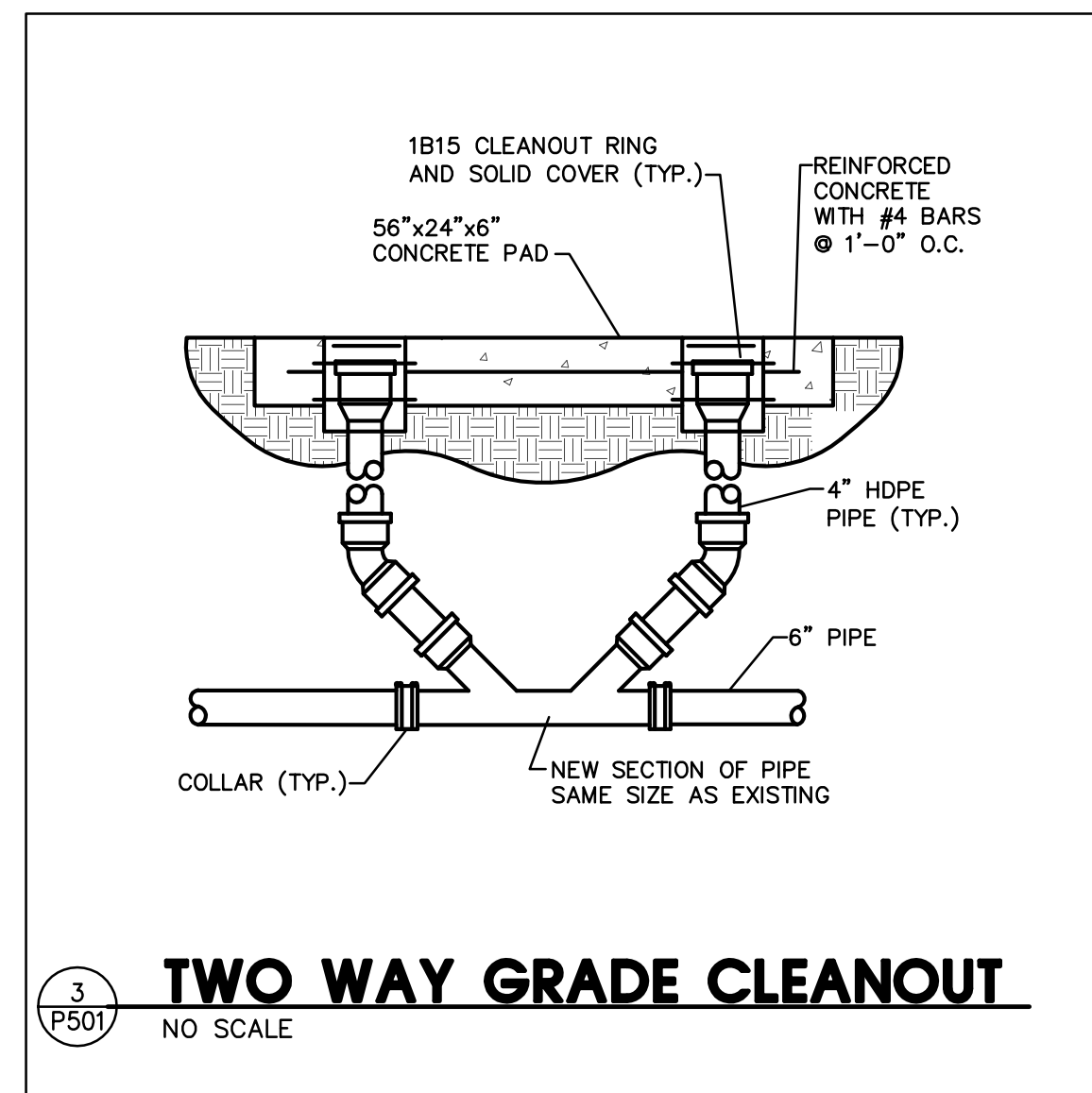
- KEY NOTES** (THIS SHEET)
1. REMOVE EXISTING MANHOLE. PLACE NEW INTERCEPTOR BASIN AT SAME LOCATION. SANITARY PIPE INVERT ON UPSTREAM SIDE OF EXISTING MANHOLE, 3'-7" FROM TOP OF MANHOLE, DOWNSTREAM HEIGHT IS AT 3'-8" FROM TOP OF EXISTING MANHOLE.
 2. REMOVE EXISTING SANITARY PIPE. CAP AT THE MAIN.
 3. CONNECT NEW SANITARY PIPE TO EXISTING BRANCH.
 4. PROVIDE SELF REGULATING HEATING CABLE WITH PIPEWALL SENSING DEVICE (ONE PER ROOM) FROM MANUF. THERMON, MODEL: ONE PASS 3-FLX AND 1" INSULATION JACKET ON COLD WATER PIPE FROM THIS POINT BACK TO WATER ENTRY LOCATION.
 5. WRAP WITH SELF REGULATING HEATING CABLE AND INSULATION AS SPECIFIED IN NOTE 4 FROM TRANSITION DOWN TO VALVE AT WALL HYDRANT.
 6. REROUTE DRAIN PIPE AND CONNECT WITH NEW DOWNSPOUT. PROVIDE PIPE SIZE THAT IS EQUAL TO EXISTING ROOF DRAIN PIPE IN THIS LOCATION. REFER TO ARCHITECTURAL DRAWING A-121 FOR LOCATIONS.
 7. PROVIDE 6" BACKWATER VALVE FROM MANUFACTURER JOSAM MODEL 67600 IN THIS LOCATION. PROVIDE WITH CONCRETE VAULT WITH 12" MANHOLE ACCESS MANUFACTURER OLDCASTLE MODEL G08T.



1 SAND/OIL INTERCEPTOR
NO SCALE



2 GAS FIRED WATER HEATER
NO SCALE



3 TWO WAY GRADE CLEANOUT
NO SCALE

SAND/OIL INTERCEPTOR

MARK	MANUFACTURER	MODEL	INLET PIPE DIAMETER (IN)	OUTLET PIPE DIAMETER (IN)	VOLUME CAPACITY (GAL)	SIZE LxWxH (IN)	WEIGHT (LBS)
GI-1	OLDCASTLE PRECAST	750	6	6	750	84x48x56	14,587

PLUMBING FIXTURE SCHEDULE

CODE	FIXTURE	DESCRIPTION	CW CONN.	HW CONN.	SAN CONN.	VENT CONN.	MANUFACTURER MODEL NO.	FAUCET/FLUSH VALVE
BFP-1	BACK FLOW PREVENTOR	REDUCED PRESSURE ZONE ASSEMBLY, BRONZE BODY, STAINLESS STEEL CHECK ASSEMBLIES, QUARTER TURN BALL VALVES, 120 GPM @ 11 PSI LOSS MAX.	1"	-	-	-	WATTS 957	-
DF-1	DRINKING FOUNTAIN	18 GAUGE, TYPE 304, NICKEL BEARING STAINLESS STEEL, EMBOSSED BUBBLER PAD AND BUILT IN STREAM SPLITTER, FRONT PUSH BAR.	3/8"	-	1-1/4"	1-1/4"	ELKAY EDFB12C	-
DF-2	DRINKING FOUNTAIN	SELF CONTAINED, WALL HUNG, LEAD FREE, ELECTRIC REFRIGERATE WATER COOLER.	3/8"	-	1-1/4"	1-1/4"	ELKAY EZ4	-
ET-1	EXPANSION TANK	4.4 GAL CAPACITY WELDED STEEL DOMES, CORROSION RESISTANT, WITH BRASS SYSTEM CONNECTION AND BUTYL DIAPHRAGM. 3/4" CONNECTION.	-	-	-	-	AMTROL ST-12	-
FCO	FLOOR CLEANOUT	COATED CAST IRON LEVELZE FLOOR CLEANOUT, INTERNAL GASKET, NO-HUB BOTTOM CONNECTION, SCORIATED SPECIAL DUTY NICKALOY COVER, COORDINATE WITH FLOOR TYPE.	-	-	PER PLAN	-	JOSAM 5700-Z	-
FD-1	FLOOR DRAIN	SIZED PER PLANS, 2 PIECE CAST IRON BODY WITH DOUBLE FLANGE, CLAMP RING, ROUND ADJUSTABLE NICKALOY STRAINER, WEEPHOLES, BOTTOM OUTLET, 1/2" TRAP PRIMER CONNECTION, OR EQUIVALENT	-	-	PER PLAN	PER PLAN	JOSAM 30000-A	-
FS-1	FLOOR SINK	CAST IRON 12" ROUND FLOOR SINK WITH 8" DEEP SUMP, A.R.E. COATED INTERIOR, PLASTIC DOME BOTTOM STRAINER PROVIDE WITH 1/2 GRATE, OR EQUIVALENT	-	-	PER PLAN	PER PLAN	WADE 9130-LF-27	-
GCO	GROUND CLEANOUT	SIZED PER PLANS, ROUND COATED CAST IRON ACCESS FRAME WITH ANCHOR FLANGES AND HEAVY-DUTY SCORIATED SECURED COVER AND NO-HUB CLEANOUT, OR EQUIVALENT	-	-	SEE PLANS	-	JOSAM 58680-CO	-
GD-1	GARBAGE DISPOSAL	1/2 HP INSINKERATOR DISPOSER WITH 120V ELECTRICAL OUTLET POWER CONNECTION.	-	-	1-1/2"	-	WHIRLPOOL GC2000XE	-
HB-1	HOSE BIB	CAST BRONZE MAIN VALVE BODY, NEOPRENE ELASTOMERS, STAINLESS STEEL, 300 SERIES FASTENERS. 3/4" THREADED ANSI B1.20.1 END CONNECTION WITH WHEEL HANDLE.	3/4"	-	-	-	ZURN 195	-
IB-1	ICE MAKER BOX	PLASTIC BOX WITH PAINTABLE FACEPLATE AND 1/4 TURN VALVE WITH WATER HAMMER ARRESTOR.	3/8"	-	-	-	SIoux CHIEF 696-10	-
L-1	LAVATORY-WALL HUNG	WHITE VITREOUS CHINA, WALL HUNG, 4" CENTERS. MANUALLY OPERATED FACET WITH WRIST BLADE HANDLES, PROVIDE GRID DRAIN, 17 GAUGE P-TRAP, PROVIDE CARRIER, PROVIDE WITH TMV-1 LOCATED BENEATH SINK AND SET TO 100"	3/4"	3/4"	1-1/2"	1-1/2"	KOHLER K-2805	KOHLER TRITON K-7401-5A
L-2	LAVATORY-WALL HUNG (ADA)	WHITE VITREOUS CHINA, WALL HUNG, 4" CENTERS. MANUALLY OPERATED FACET WITH WRIST BLADE HANDLES, PROVIDE GRID DRAIN, 17 GAUGE P-TRAP, PROVIDE CARRIER, PROVIDE WITH TMV-1 LOCATED BENEATH SINK AND SET TO 100"	3/4"	3/4"	1-1/2"	1-1/2"	KOHLER K-2805	KOHLER TRITON K-7401-5A
MS-1	MOP SINK BASIN	WHITE MOLDED STONE, 24"x24"x10" MOP SERVICE BASIN. FAUCET TO INCLUDE VACUUM BREAKER, PAIL HOOK AND WALL BRACKET. SINK TO INCLUDE 24" STAINLESS STEEL BUMPER GUARD AND 24" STAINLESS STEEL WALL GUARD.	3/4"	3/4"	3"	2"	FLORESTONE MSR-2424	CHICAGO 540-LD897SWXF
SA-1	SHOCK ARRESTOR	PISTON STYLE EXTRUDED COPPER WITHOUT SEEMS. SHALL BE ANSI/ASSE 101 2004 CERTIFIED.	-	-	-	-	SIoux CHIEF 660-H	-
S-1	TWO COMPARTMENT SINK	18 GAUGE, TYPE 304 STAINLESS STEEL SINK, 33"x21", SELF RIMMING, 8" CENTERS, FULLY UNDERCOATED, 6-1/2" DEEP, DOUBLE COMPARTMENT. MANUALLY OPERATED CHROME FAUCET WITH ADA HANDLES, 1.5 GPM AERATOR. PROVIDE 17 GAUGE P-TRAP, ANGLE .	1/2"	1/2"	2"	2"	MOEN 22122	ELKAY LRA01918-6-1/2"
SS-1	UTILITY SINK	76 LITER, WHITE, MOLDED PLASTIC POLYMER PROVIDED WITH ANGLE LEGS AND FLOOR MOUNTED BRACKETS. PROVIDE WITH DOUBLE HANDLES AND FAUCET, WITH A CHROME FINISH.	1/2"	1/2"	2"	1-1/2"	SWAN MF40000FM	ELEMENTS OF DESIGN EB481
TD-1	TRENCH DRAIN	HDPE DRAIN WITH HDPE DECORATIVE GRATE, 2.5" WIDE AND 48" LONG CHANNEL, RATED FOR VEHICLE TRAFFIC WITH SIDE OUTLET.	-	-	4"	-	ZURN Z880	-
TMV-1	THERMOSTATIC MIXING VALVE	LEAD FREE THERMOSTATIC MIXING VALVE. ASSE 1070 LISTED. POINT OF USE.	1/2"	-	-	-	WATTS LFMMV	-
UR-1	URINAL (ADA)	WHITE VITREOUS CHINA, SIPHON JET, TOP SPUD, 0.125 GPF AUTOMATIC SENSOR TYPE BATTERY OPERATED FLUSH VALVE, CHROME, PROVIDE CARRIER, COORDINATE WITH WALL THICKNESS. REFER TO ARCHITECTURAL DRAWINGS FOR MOUNTING HEIGHT.	3/4"	-	2"	1-1/2"	SLOAN WEUS 1000.1001-0.125	INTEGRAL
WC-1	WATER CLOSET	TWO PIECE TOILET TANK SYSTEM WITH VITREOUS CHINA FLOOR MOUNTED ELONGATED WATER CLOSET AND COMPACT TANK. SIPHON JET GRAVITY FLUSHING, ELONGATED BOWL 12" ROUGH-IN WITH INTEGRAL TRAP. ASME A1112.19.2 COMPLIANT.	1"	-	4"	2"	SLOAN WETS 9000-1.28	SEAT BEMIS 1955CT
WC-2	WATER CLOSET (ADA)	TWO PIECE TOILET TANK SYSTEM WITH VITREOUS CHINA FLOOR MOUNTED ELONGATED WATER CLOSET AND COMPACT TANK. SIPHON JET GRAVITY FLUSHING, ELONGATED BOWL 15-17" ROUGH-IN WITH INTEGRAL TRAP. ASME A1112.19.2 COMPLIANT.	1"	-	4"	2"	SLOAN WETS 9020-1.28	SEAT BEMIS 1955CT
WH-1	WALL HYDRANT	STAINLESS STEEL RECESSED HOLD BOX WALL FLANGE, LOCKABLE DOOR WITH KEY, REMOVABLE LOOSE KEY HANDLE, VACUUM BREAKER, COORDINATE ROD DEPTH WHEN ORDERING.	1/2"	-	-	-	WOODFORD MODEL B67	-

1. ALL EXPOSED TRAP AND PIPING SERVING PLUMBING FIXTURES THAT MAY BE USED FOR ADA PURPOSES SHALL BE INSULATED PER ADA REQUIREMENTS.



CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

PLUMBING SCHEDULES AND DETAILS
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

ISSUE:
1.11/13 BIDDING
AND CONSTRUCTION

DRAWN BY: MLD
REVIEWED BY: HDY
Date: NOV 11, 2013
SHEET

P501

ELECTRICAL GENERAL NOTES

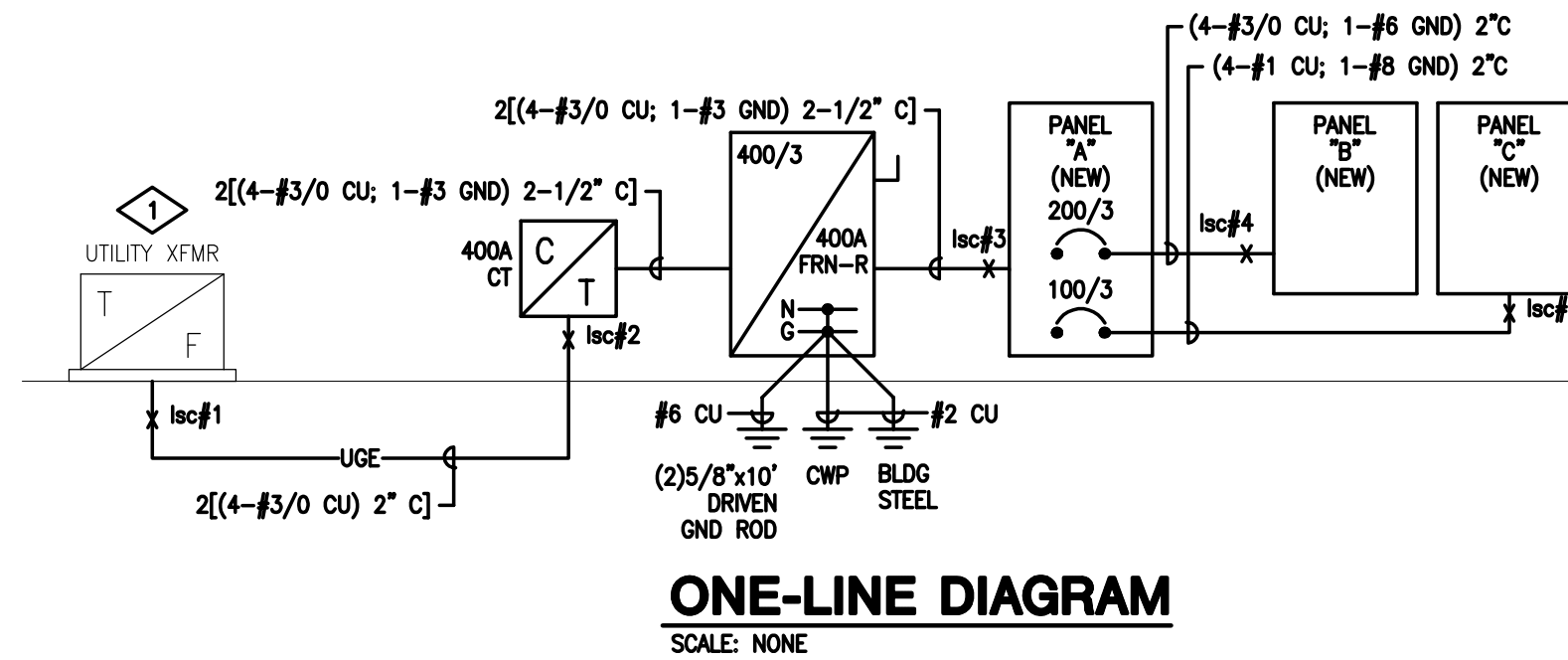
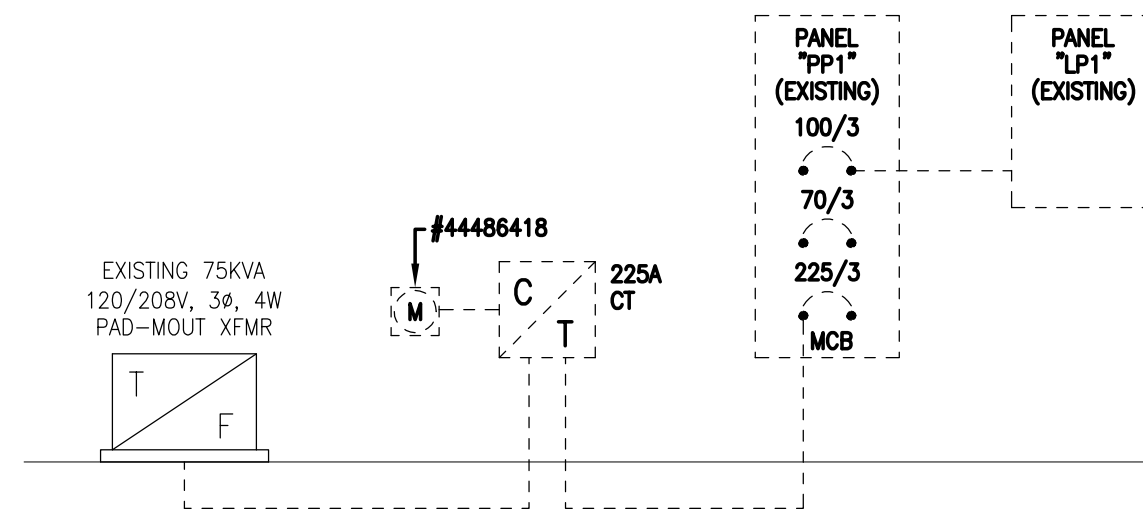
- PRIOR TO SUBMITTING BIDS THE ELECTRICAL CONTRACTOR SHALL VISIT THE SITE TO VERIFY EXISTING ELECTRICAL EQUIPMENT CONDITIONS AND DIFFICULTIES THAT WILL AFFECT EXECUTION OF THE WORK. FIELD VERIFY QUANTITIES OF EXISTING LIGHT FIXTURES, ELECTRICAL DEVICES, COMMUNICATION DEVICES, FIRE ALARM DEVICES, AND ELECTRICAL EQUIPMENT. NOTIFY THE ARCHITECT AND ENGINEER OF ANY EXISTING CONDITIONS WHICH MODIFY THE SCOPE OF WORK AS SHOWN ON THE CONSTRUCTION DOCUMENTS. SUBMISSION OF A BID PROPOSAL WILL BE CONSIDERED AS EVIDENCE THAT SUCH AN EXAMINATION HAS BEEN MADE AND LATER CLAIMS FOR MOBILIZATION, LABOR, EQUIPMENT, AND/OR MATERIALS REQUIRED BECAUSE OF DIFFICULTIES ENCOUNTERED WILL NOT BE RECOGNIZED.
- REFER TO THE SPECIFICATION BOOK FOR ADDITIONAL REQUIREMENTS. IN THE CASE OF ANY CONFLICTS BETWEEN THE SPECIFICATION BOOKS, AND THESE AND ANY OTHER PLAN NOTES, THE MORE STRINGENT REQUIREMENT SHALL GOVERN.
- ELECTRICAL CONTRACTOR SHALL FULLY COORDINATE WITH OWNER REPRESENTATIVES. ALL ELECTRICAL WORK PERFORMED UNDER THIS CONTRACT SHALL CONFORM WITH LATEST EDITIONS OF THE NATIONAL ELECTRICAL CODE, INTERNATIONAL BUILDING CODE, LOCAL BUILDING AND FIRE DEPARTMENT REQUIREMENTS. PERFORM WORK IN ACCORDANCE WITH REQUIREMENTS OF OWNER REPRESENTATIVE.
- ELECTRICAL CONTRACTOR SHALL MAINTAIN ON THE JOB AN UP TO DATE SET OF WORKING DRAWINGS, MARKED UP TO SHOW ELECTRICAL SYSTEMS AS INSTALLED. PROVIDE TENANT REPRESENTATIVE WITH ONE SET OF REPRODUCIBLES WITH "AS BUILT" PROJECT RECORD INFORMATION CLEARLY INDICATED. ELECTRICAL CONTRACTOR SHALL OBTAIN AND PAY FOR ALL LOCAL FEES, PERMITS, AND SERVICES OF INSPECTION AUTHORITIES REQUIRED BY ELECTRICAL WORK FOR THIS ELECTRICAL CONSTRUCTION.
- REFER TO ARCHITECTURAL AND MECHANICAL EQUIPMENT DRAWINGS FOR EXACT LOCATIONS OF ELECTRICAL DEVICES AND LIGHT FIXTURES. DO NOT SCALE FROM THE ELECTRICAL PLANS. ADDITIONAL ELECTRICAL REQUIREMENTS ON ARCHITECTURAL PLANS, KITCHEN EQUIPMENT PLANS, AND MECHANICAL PLANS SHALL BE INCLUDED IN THE ELECTRICAL CONTRACTOR'S BID.
- THE ELECTRICAL DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL ARRANGEMENT OF ELECTRICAL WORK. LOCATIONS ARE APPROXIMATE AND SHALL BE SUBJECT TO MINOR MODIFICATIONS AS DIRECTED BY THE GENERAL CONTRACTOR AND OWNER REPRESENTATIVES. ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE EXACT FITTING OF ALL MATERIALS, EQUIPMENT, ETC., IN THE BUILDING AND TENANT SPACE. ALL DIMENSIONS SHALL BE VERIFIED ON THE JOB. ELECTRICAL CONTRACTOR SHALL CUT, CHANNEL, CHASE, AND/OR DRILL FLOORS, WALLS, ANCHORAGE, ETC., OR WORK. PROVIDE X-RAY OF FLOOR PRIOR TO CORE DRILLS. ELECTRICAL CONTRACTOR SHALL PROVIDE PRODUCT LITERATURE INFORMATION ON SITE FOR FIELD INSPECTOR REGARDING FIRE RATING OF FLOOR BOXES AND POKE THRU DEVICES.
- ELECTRICAL CONTRACTOR SHALL NOTIFY THE ARCHITECT AND ENGINEER OF ANY CHANGES REQUIRED BY THE BUILDING MANAGEMENT AND OWNER'S REPRESENTATIVES.
- PROVIDE COMPLETE AND ACCURATE TYPED PANEL BOARD CIRCUIT DIRECTORIES AT THE COMPLETION OF WORK PER NEC 408.4. CLEAN EXPOSED PANEL BOARD SURFACES AND CHECK TIGHTNESS OF ELECTRICAL CONNECTIONS. REPLACE DAMAGED CIRCUIT BREAKERS AS REQUIRED AND PROVIDE CLOSURE PLATES FOR VACANT SPACES. ALL NEW PANELS SHALL BE DOOR-IN-DOOR CONSTRUCTION TYPE. ALL PANEL SCHEDULES SHALL INDICATE THE NAME OF THE UPSTREAM PANEL OR SWITCHBOARD PROVIDING POWER.
- ALL WALL MOUNTED OUTLETS SHALL BE OFFSET SO THEY ARE NOT BACK TO BACK, FOR SOUND TRANSMISSION PURPOSES. A HORIZONTAL DISTANCE OF AT LEAST 6 INCHES SHALL SEPARATE

- OUTLET BOXES ON OPPOSITE SIDES OF WALLS AND PARTITIONS. MOUNT ELECTRICAL AND COMMUNICATIONS OUTLETS ON WALLS AS CLOSE TOGETHER AS POSSIBLE.
- FIRE RESISTIVE WALLS AND PARTITIONS MAY HAVE OPENINGS FOR STEEL ELECTRICAL OUTLET BOXES NOT EXCEEDING 16 SQUARE INCHES IN AREA. PROVIDE THE AGGREGATE AREA OF SUCH OPENINGS IS NOT MORE THAN 100 SQUARE INCHES FOR ANY 100 SQUARE FEET OF WALL. A HORIZONTAL DISTANCE OF AT LEAST 24 INCHES SHALL SEPARATE OUTLET BOXES ON OPPOSITE SIDES OF FIRE RESISTIVE WALLS AND PARTITIONS.
- ALL WIRING SHALL BE RUN CONCEALED. ALL HOMERUNS SHALL BE EMT. REFER TO DIV. 26 SPECIFICATIONS FOR MORE INFORMATION.
- VOLTAGE DROP: THE ELECTRICAL CONTRACTOR SHALL ENSURE THAT VOLTAGE DROP FOR FEEDERS TO DISTRIBUTION EQUIPMENT DOES NOT EXCEED 2% AND VOLTAGE DROP IN BRANCH CIRCUITING DOES NOT EXCEED 3% FOR OVERALL VOLTAGE DROP OF 5% (MAXIMUM). FEEDERS LISTED ON SCHEDULES AND THE ELECTRICAL ONE-LINE DIAGRAM ARE A BASE FEEDER/BRANCH CIRCUIT SIZE AND SHALL BE ADJUSTED AS NEEDED BASED ON ACTUAL LENGTHS OF CONDUCTORS.
- ALL JUNCTION BOX COVERS SHALL BE INDELEBLY LABELED WITH PANEL DESIGNATION AND BRANCH CIRCUIT NUMBER OF EACH WIRE WITHIN THE JUNCTION BOX.
- NEUTRALS, RACEWAYS, AND NON-CURRENT CARRYING PARTS OF ELECTRICAL EQUIPMENT AND ASSOCIATED ENCLOSURES SHALL BE GROUNDED IN FULL ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. PROVIDE HARD WIRE GROUND CONNECTIONS TO ALL DEVICES AND SEPARATE INSULATED GROUND WIRE CONTINUOUS IN EACH CIRCUIT (#12 CU MINIMUM "GREEN" TRACER GROUND).
- RECEPTACLES FOR COMPUTERS, COPIERS, AND PRINTERS, WHICH ARE SEMI-DEDICATED, DEDICATED, OR ISOLATED, SHALL HAVE A SEPARATE NEUTRAL AND DEDICATED GROUND CONDUCTOR RUN FROM THE BRANCH CIRCUIT PANEL BOARD.
- ALL LIGHT FIXTURES SHALL BE SUPPORTED INDEPENDENTLY FROM STRUCTURE. REFER TO ARCHITECTURAL PLANS FOR EXACT LOCATIONS OF LIGHT FIXTURES AND ELECTRICAL DEVICES.
- ELECTRICAL CONTRACTOR SHALL COORDINATE EXACT LOCATIONS OF LIGHTING FIXTURES IN MECHANICAL ROOMS/SPACES WITH MECHANICAL DUCT WORK INSTALLER PRIOR TO ROUGH IN. LOCATE BELOW DUCT WORK (8"-0" A.F.F. MIN.) CENTERED IN ROOM AS MUCH AS POSSIBLE. ELECTRICAL CONTRACTOR SHALL FIELD VERIFY ALL MECHANICAL EQUIPMENT LOCATIONS AND REQUIREMENTS WITH MECHANICAL PLANS, MECHANICAL CONTRACTOR, AND ACTUAL MECHANICAL EQUIPMENT SUPPLIED. INCLUDE ALL REQUIRED OUTLETS; HEAVY DUTY DISCONNECT SWITCHES, FUSES, CONTROLS, CONTROL WIRING, AND ALL CONNECTIONS IN THE ELECTRICAL BID.
- VERIFY ALL SPECIFIC KITCHEN AND BREAK ROOM EQUIPMENT REQUIREMENTS WITH EQUIPMENT SUPPLIER PRIOR TO ROUGH IN. COORDINATION SHALL INCLUDE MOUNTING HEIGHTS, CONNECTION TYPE AND POWER REQUIREMENTS. ALL CONNECTIONS FOR KITCHEN EQUIPMENT SHALL BE IN ACCORDANCE WITH EQUIPMENT MANUFACTURER'S AND SUPPLIER'S RECOMMENDATIONS. PROVIDE CORD AND PLUG FOR DISHWASHERS AND GARBAGE DISPOSER PER NEC 422.16(B)(1) AND (2).
- VERIFY ALL SPECIFIC COMPUTER AND COMMUNICATIONS EQUIPMENT REQUIREMENTS WITH EQUIPMENT SUPPLIER PRIOR TO ROUGH IN. COORDINATION SHALL INCLUDE MOUNTING HEIGHTS, CONNECTION TYPE AND POWER REQUIREMENTS. ALL CONNECTIONS FOR COMPUTER AND COMMUNICATIONS EQUIPMENT SHALL BE IN ACCORDANCE WITH EQUIPMENT MANUFACTURER'S AND SUPPLIER'S RECOMMENDATIONS

- ALL NEW MULTI-WIRE BRANCH CIRCUITS SHALL INCLUDE SEPARATE NEUTRAL CONDUCTORS OR THE BREAKERS AS REQUIRED BY 2011 NEC SECTION 210.4 (B).
- ALL NEW SWITCHES, POWER OUTLETS, TELEPHONE OUTLETS, FIRE ALARM DEVICES, AND COMMUNICATIONS OUTLETS SHALL MEET THE REQUIREMENTS FOR AMERICANS WITH DISABILITIES (A.D.A.) MOUNTING HEIGHTS AND ORIENTATIONS, TYPICAL UNLESS OTHERWISE NOTED. RECEPTACLES SHALL BE A MINIMUM OF 15" A.F.F. AND SWITCHES A MAXIMUM OF 48" A.F.F. TO CENTERLINE, TYPICAL UNLESS OTHERWISE NOTED.
- COORDINATE MOUNTING HEIGHTS AND LOCATIONS OF ALL ELECTRICAL DEVICES LOCATED WITHIN, ABOVE, OR NEAR MILLWORK WITH ARCHITECTURAL DRAWINGS, APPROVED "SHOP DRAWINGS", AND MILLWORK CONTRACTOR. MAINTAIN CONSISTENT MOUNTING PRACTICES FOR A UNIFORM APPEARANCE. VERIFY ALL OUTLET REQUIREMENTS PRIOR TO ROUGH IN.
- PROVIDE 4" SQUARE (DOUBLE GANG) JUNCTION BOX WITH SINGLE GANG PLASTER RING FOR ALL NEW COMBINATION TELEPHONE/DATA OUTLETS. STUB 3/4" EMPTY CONDUIT UP TO 6" ABOVE ACCESSIBLE CEILING WITH PULL WIRE IN CONDUIT AND PLASTIC BUSHINGS ON CONDUIT ENDS. TENANT COMMUNICATIONS SYSTEM VENDOR UNDER SEPARATE CONTRACT SHALL PROVIDE ALL COMMUNICATION DEVICES AND WIRING. COORDINATE EXACT REQUIREMENTS AND OUTLET LOCATIONS WITH ARCHITECTURAL PLANS PRIOR TO ROUGH IN.
- ELECTRICAL CONTRACTOR SHALL FULLY FIELD COORDINATE COMMUNICATIONS SYSTEM INSTALLATION (DEVICES AND CABLES) WITH TENANT REPRESENTATIVE PRIOR TO ROUGH IN AND PURCHASING OF MATERIALS.
- FIRE ALARM SYSTEM AND DEVICES INDICATED ON PLANS ARE APPROXIMATE AND SHOWN AS A PERFORMANCE SPECIFICATION ONLY. THE ELECTRICAL CONTRACTOR SHALL PROVIDE COMPLETE OPERATIONAL FIRE ALARM SYSTEM ON A DESIGN-BUILD BASIS. ALL FIRE ALARM WORK TO BE PERFORMED BY OWNER APPROVED FIRE ALARM CONTRACTOR. CONNECT DEVICES TO FIRE ALARM ZONES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. PROVIDE FIRE ALARM BOOSTER PANELS IF REQUIRED. REFER TO DIVISION 26 SPECIFICATIONS FOR ADDITIONAL INFORMATION.
- THE ELECTRICAL CONTRACTOR SHALL PROVIDE FULLY ENGINEERED FIRE ALARM SHOP DRAWINGS FOR REVIEW BY THE LOCAL BUILDING AND FIRE DEPARTMENT. THE FIRE ALARM SHOP DRAWINGS SHALL BE SIGNED AND SEALED BY A PROFESSIONAL ENGINEER LICENSED BY THE STATE IN WHICH THE PROJECT IS LOCATED.
- ALL FLOOR AND WALL PENETRATIONS WHERE ELECTRICAL DEVICES AND RACEWAY HAVE BEEN REMOVED MUST BE REPAIRED AND SEALED TO MAINTAIN THE REQUIRED FIRE RATING. ALL LUMINAIRES PENETRATING A ONE HOUR FIRE RESISTIVE ENCLOSURE SHALL BE PROPERLY TENTED TO MAINTAIN FIRE RATING OF THE ENCLOSURE. ALL CONDUITS PENETRATING A ONE HOUR FIRE RATED WALL OR CEILING SHALL BE FIRE STOPPED WITH A U.L. LISTED FIRE STOPPING COMPOUND SEALANT.
- MINIMUM WORKING CLEARANCES PER THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE SHALL BE PROVIDED AROUND AND IN FRONT OF ALL ELECTRICAL EQUIPMENT.
- ALL CIRCUIT BREAKER LUGS SHALL BE RATED FOR A MINIMUM OF 75 DEGREES CELSIUS.

3Ø FAULT CALCULATION

<p>POINT #1, AT THE UTILITY TRANSFORMER; (BASED ON 150KVA)</p> <p>$I_{sc} = 26,000 \text{ A}$</p>
<p>POINT #2, AT THE MAIN DISCONNECT;</p> <p>$f = 1.73 \times \frac{\text{Length}}{12} \times \frac{I_{sc}(\text{source})}{26000 \text{ A}} \times \frac{L-L \text{ Volts}}{208} \times \text{Wire Factor}$ $f = 1.73 \times \frac{12}{12} \times \frac{26000 \text{ A}}{26000 \text{ A}} \times \frac{208}{208} \times 27846$ $f = 0.09$</p> <p>$M = 1 / 1 + f = 1 / 1 + 0.09 = 0.91$</p> <p>$I_{sc} = M \times I_{sc}(\text{source}) = 0.91 \times 26000 \text{ A} = 23,784 \text{ A}$</p>
<p>POINT #3, AT PANEL "A";</p> <p>$f = 1.73 \times \frac{\text{Length}}{20} \times \frac{I_{sc}(\text{source})}{23784 \text{ A}} \times \frac{L-L \text{ Volts}}{208} \times \text{Wire Factor}$ $f = 1.73 \times \frac{20}{20} \times \frac{23784 \text{ A}}{23784 \text{ A}} \times \frac{208}{208} \times 25686$ $f = 0.15$</p> <p>$M = 1 / 1 + f = 1 / 1 + 0.15 = 0.87$</p> <p>$I_{sc} = M \times I_{sc}(\text{source}) = 0.87 \times 23784 \text{ A} = 20,609 \text{ A}$</p>
<p>POINT #4, AT PANEL "B";</p> <p>$f = 1.73 \times \frac{\text{Length}}{4} \times \frac{I_{sc}(\text{source})}{20609 \text{ A}} \times \frac{L-L \text{ Volts}}{208} \times \text{Wire Factor}$ $f = 1.73 \times \frac{4}{4} \times \frac{20609 \text{ A}}{20609 \text{ A}} \times \frac{208}{208} \times 7292$ $f = 0.09$</p> <p>$M = 1 / 1 + f = 1 / 1 + 0.09 = 0.91$</p> <p>$I_{sc} = M \times I_{sc}(\text{source}) = 0.91 \times 20609 \text{ A} = 18,838 \text{ A}$</p>
<p>POINT #5, AT PANEL "C";</p> <p>$f = 1.73 \times \frac{\text{Length}}{100} \times \frac{I_{sc}(\text{source})}{20609 \text{ A}} \times \frac{L-L \text{ Volts}}{208} \times \text{Wire Factor}$ $f = 1.73 \times \frac{100}{100} \times \frac{20609 \text{ A}}{20609 \text{ A}} \times \frac{208}{208} \times 7292$ $f = 2.35$</p> <p>$M = 1 / 1 + f = 1 / 1 + 2.35 = 0.30$</p> <p>$I_{sc} = M \times I_{sc}(\text{source}) = 0.30 \times 20609 \text{ A} = 6,151 \text{ A}$</p>



DETAIL NOTES

- EXISTING 75KVA UTILITY TRANSFORMER. MAY BE REPLACED WITH 150KVA TRANSFORMER. COORDINATE WITH ICE. FAULT CURRENT CALCULATIONS AND EQUIPMENT SPECIFICATIONS BASED ON WORST-CASE ASSUMPTION OF 150KVA UTILITY TRANSFORMER.

ELECTRICAL SYMBOLS LEGEND

POWER SYMBOLS	LIGHTING SYMBOLS
<ul style="list-style-type: none"> JUNCTION BOX; CEILING MOUNTED JUNCTION BOX; WALL MOUNTED JUNCTION BOX; WITH COVER PLATE PULLBOX SIMPLEX RECEPTACLE DUPLEX RECEPTACLE DOUBLE DUPLEX RECEPTACLE DUPLEX RECEPTACLE ON DEDICATED CIRCUIT SPECIAL RECEPTACLE - AS NOTED ON PLANS COMBINATION POWER/COMMUNICATIONS FLOOR BOX PLUGMOLD DUPLEX FLOOR RECEPTACLE COMBINATION DATA/TELEPHONE FLOOR OUTLET TELEPHONE FLOOR OUTLET CRT OR DATA FLOOR OUTLET PANELBOARD SWITCHBOARD DISCONNECT SWITCH, NON-FUSED DISCONNECT SWITCH, FUSED TRANSFORMER MOTOR TIME CLOCK METER WATER HEATER THERMAL OVERLOAD SWITCH 	<ul style="list-style-type: none"> RECESSED FLUORESCENT FIXTURE SURFACE FLUORESCENT FIXTURE PENDANT FLUORESCENT FIXTURE FLUORESCENT STRIP FIXTURE FLUORESCENT WALL BRACKET UNDER CABINET FLUORESCENT FIXTURE FLUORESCENT ON EMERGENCY CIRCUIT DOWNLIGHT FIXTURE PENDANT FIXTURE WALL MOUNTED FIXTURE WALLWASH FIXTURE EMERGENCY FIXTURE TRACK LIGHTING EXIT SIGNS; WALL, CEILING MOUNTED. EMERGENCY BATTERY PACK FIXTURE POLE MOUNTED OUTDOOR FIXTURE SWITCH, SINGLE POLE SW2 TWO POLE SWITCH SW3 THREE WAY SWITCH SW4 FOUR WAY SWITCH SM MOTION SENSOR SWITCH SK KEYED SWITCH SD DIMMER SWITCH ST TIMER SWITCH SP SWITCH WITH PILOT LIGHT OC OCCUPANCY SENSOR
TELECOMMUNICATION SYMBOLS	FIRE ALARM and MISCELLANEOUS SYMBOLS
<ul style="list-style-type: none"> TELEPHONE OUTLET, SINGLE GANG BOX, 3/4" CONDUIT STUB TO ACCESSIBLE CEILING. DATA OUTLET, SINGLE GANG BOX, 3/4" CONDUIT STUB TO ACCESSIBLE CEILING. DATA/TELEPHONE OUTLET, DOUBLE GANG BOX, 3/4" CONDUIT STUB TO ACCESSIBLE CEILING. TELEVISION CABLE OUTLET 	<ul style="list-style-type: none"> FIRE HORN WITH STROBE LIGHT MANUAL PULL STATION SMOKE DETECTOR HEAT DETECTOR CEILING MOUNTED FIRE ALARM SPEAKER CEILING MOUNTED FIRE ALARM SPEAKER/STROBE CEILING MOUNTED FIRE ALARM STROBE REMOTE LAMP FIRE ALARM STROBE LIGHT DUCT DETECTOR MOTION SENSOR FIRE/SMOKE DAMPER THERMOSTAT PAGER OR MUSIC SPEAKER PHOTOCELL WAP
NOTATION SYMBOLS and TEXT	
<ul style="list-style-type: none"> AFF ABOVE FINISHED FLOOR AC ABOVE COUNTER GFI GROUND FAULT CIRCUIT INTERRUPTER GND GROUND IG ISOLATED GROUND NL NIGHT LIGHT RL RELOCATED DEVICE OR EQUIPMENT WP WEATHER PROOF 	
CIRCUITING SYMBOLS	
<ul style="list-style-type: none"> HOMERUN, SOLID 120/208 V, OPEN 277/480 V CIRCUIT; RUN CONCEALED IN WALL OR CEILING CIRCUIT; RUN CONCEALED IN FLOOR OR GRADE CONDUIT RISER; TURNED UP, TURNED DOWN 	
ONE LINE DIAGRAM SYMBOLS	
<ul style="list-style-type: none"> PANEL BOARD CURRENT TRANSFORMER PULL BOX FUSED DISCONNECT SWITCH NON-FUSED DISCONNECT SWITCH MOTOR 	<ul style="list-style-type: none"> INTERIOR TRANSFORMER EXTERIOR PAD MOUNTED TRANSFORMER TRANSFER SWITCH OVERHEAD POLE MOUNTED TRANSFORMER WEATHER HEAD CURRENT TRANSFORMER GENERATOR METER FUSED DISCONNECT WITHIN SWITCHBOARD SPARE SPARE SWITCH WITHIN SWITCHBOARD SPACE WITHIN SWITCHBOARD CIRCUIT BREAKER WEATHER HEAD GROUNDING CONNECTION



CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

GENERAL NOTES, LEGEND, ONE-LINE
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

REVISIONS

1. 11/11/13 ISSUE FOR BIDDING AND CONSTRUCTION

DRAWN BY: JTG
REVIEWED BY: SLS
Date:

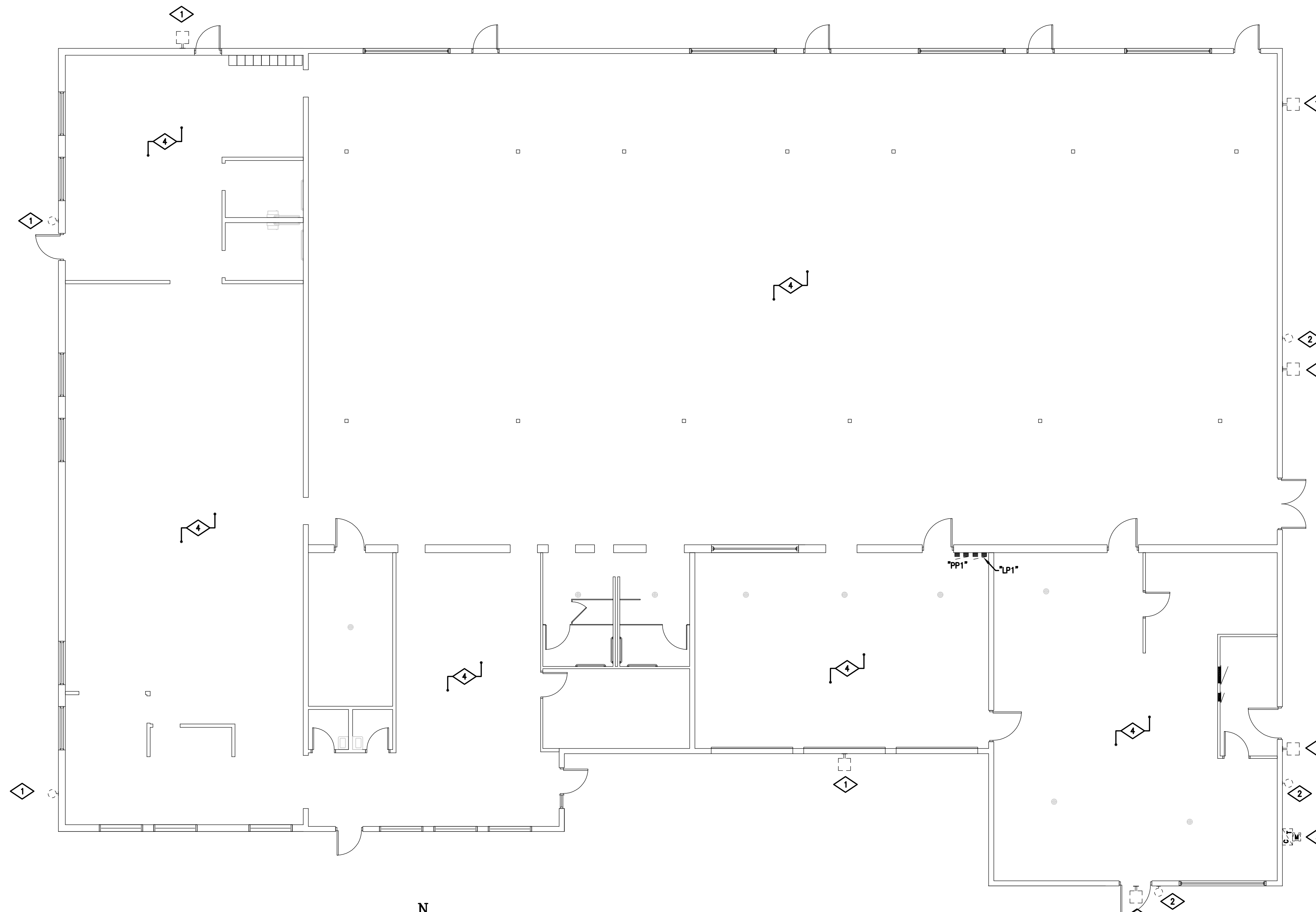
SHEET 1 OF 9 E-001

CAD FILE NO.



7822 S. Wheeling Ct, Suite B, Englewood, CO 80112 | P: (303) 696-1571 | projects@coreyeng.com

JOB# 11298



FIRST FLOOR ELECTRICAL DEMOLITION PLAN

SCALE: 1/8"=1'-0"

GENERAL NOTES:
 A. NEW AND RELOCATED ITEMS SHOWN AS BOLD
 EXISTING ITEMS SHOWN AS LIGHT

DETAIL NOTES

1. EXISTING WALLPACK JUNCTION BOX/CONDUIT STUB TO BE RE-USED FOR NEW FIXTURE. REMOVE FIXTURE AND LEAVE JUNCTION BOX AND CONDUIT IN PLACE FOR RE-USE.
2. EXISTING FIXTURE TO BE REMOVED. REMOVE FIXTURE, MOUNTING HARDWARE, JUNCTION BOX AND CONDUIT STUB. PATCH EXTERIOR WALL TO MAINTAIN WEATHERPROOFING AND PROVIDE A CLEAN APPEARANCE.
3. EXISTING 225A CT AND METER TO BE REMOVED. REMOVE SERVICE CONDUCTORS AND CAP OR REMOVE ABANDONED UNDERGROUND CONDUITS.
4. REMOVE CONSTRUCTION LIGHTING (REMAINING FROM DEMOLITION PHASE) FROM ALL AREAS.



SLATERPAULL
 ARCHITECTS
 1331 Nineteenth Street
 Denver, CO 80202 | P 303.697.0977
 www.slaterpaul.com

CITY AND COUNTY OF DENVER
 DEPARTMENT OF
 PARKS & RECREATION
 201 West Colfax Avenue, Dept. 613
 Denver, Colorado 80202

FIRST FLOOR ELECTRICAL DEMOLITION PLAN
 S. JASON STREET
 MAINTENANCE FACILITY
 678 S. Jason Street
 Denver, Colorado 80223

REVISIONS

1	11/11/13 ISSUE FOR BIDDING AND CONSTRUCTION

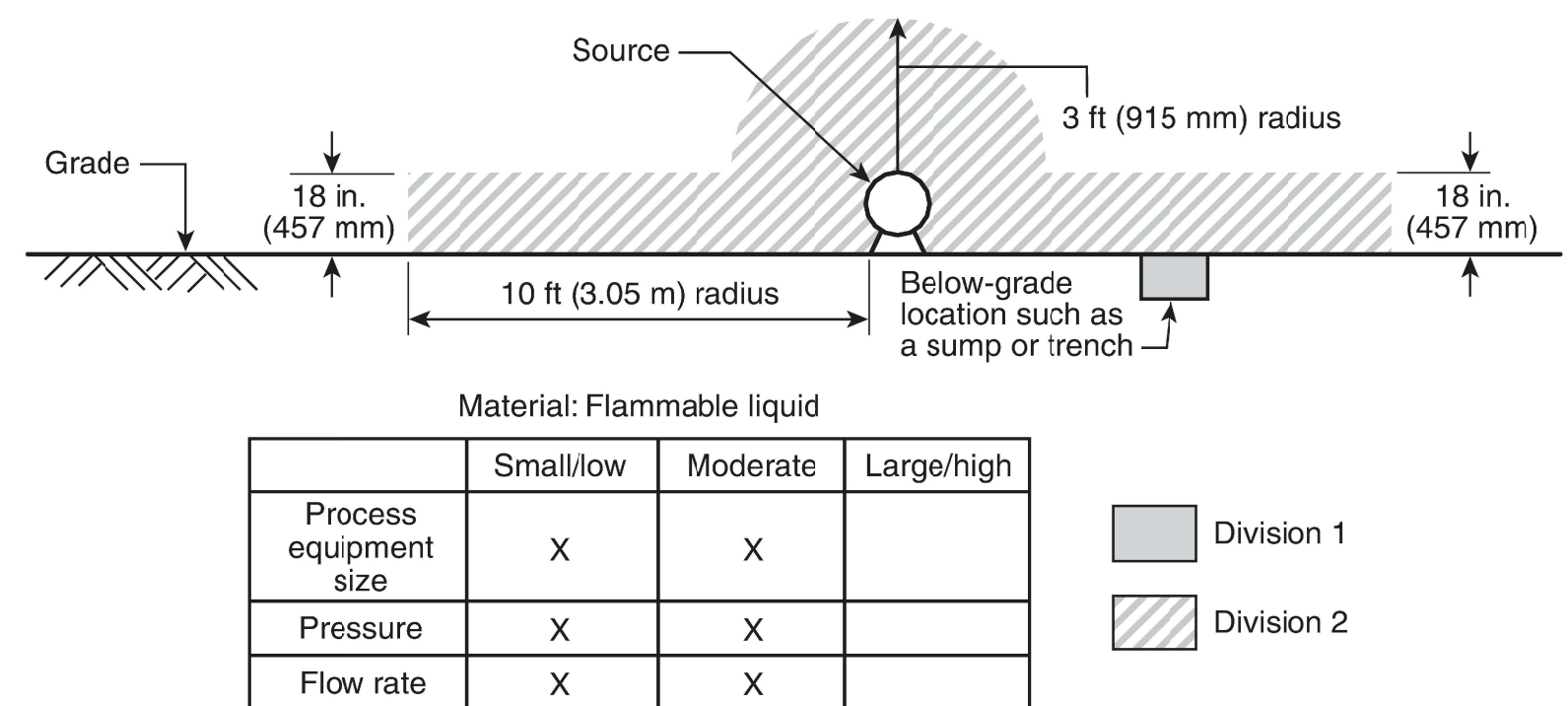
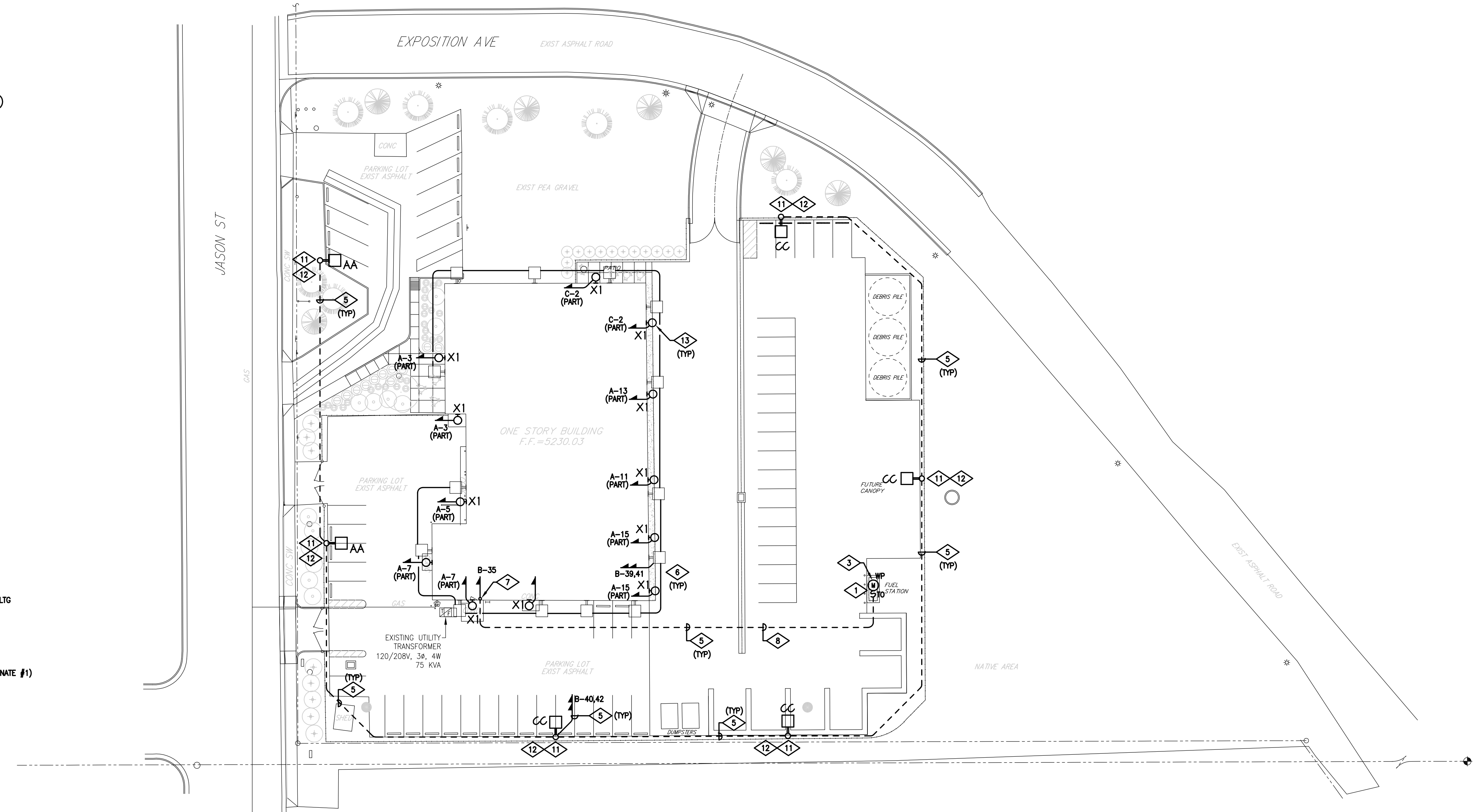
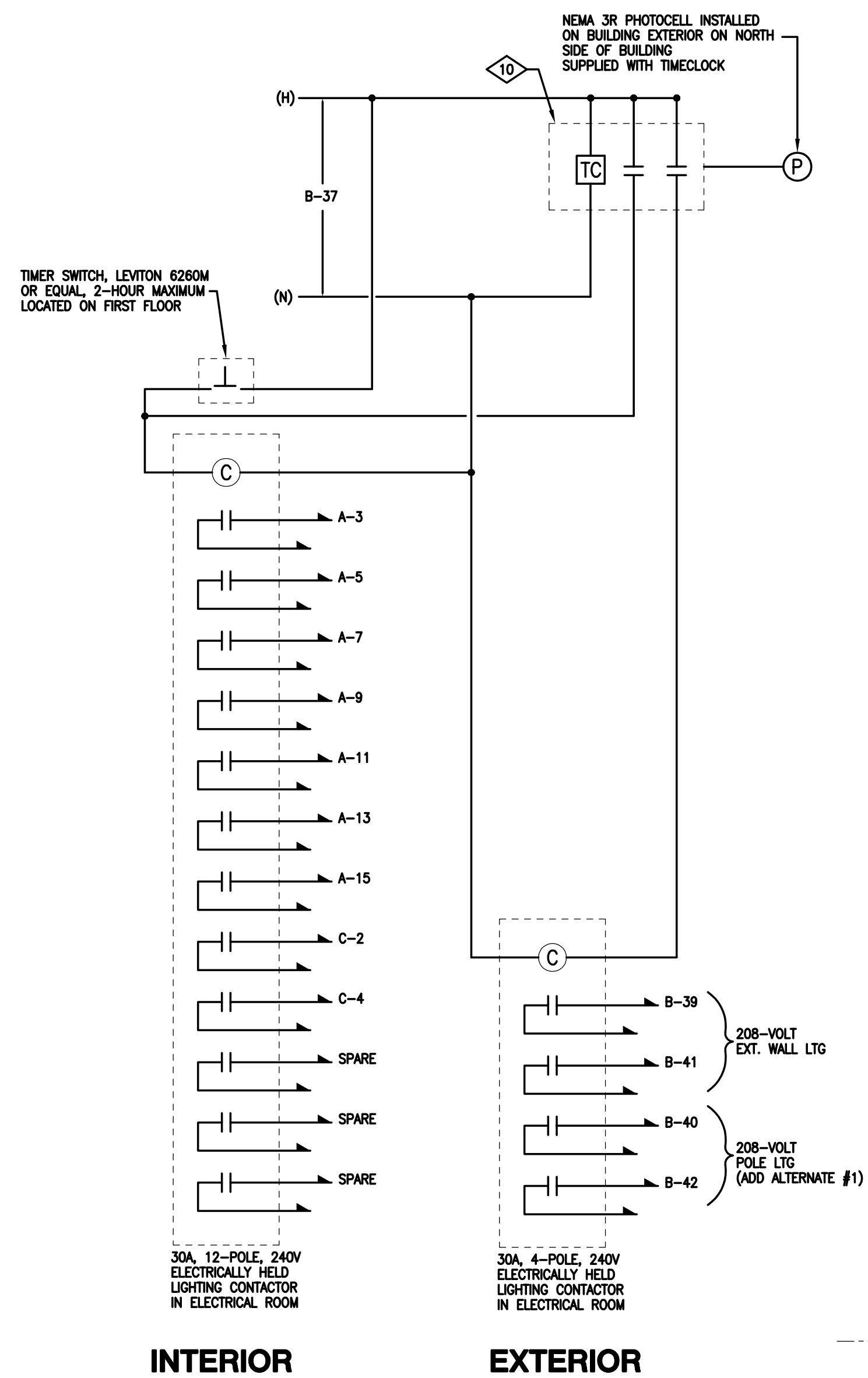
DRAWN BY: JTG
 REVIEWED BY: SLS
 Date:

SHEET
 2 OF 9 ED-110

CAD FILE NO.



JOB# 11298



DETAIL NOTES

- PROVIDE POWER FOR 120V, 1 ϕ FUEL PUMP AT ABOVE-GROUND FUEL DISPENSING FACILITY. ALL CIRCUITING AND RACEWAY SHALL MEET THE REQUIREMENTS OF NEC 501 AND 514. REFER TO THE FLAMMABLE SOURCE AREA CLASSIFICATION DETAIL, THIS SHEET, FOR ADDITIONAL DETAILS AND REQUIREMENTS FOR INSTALLATIONS IN THE VICINITY OF THIS EQUIPMENT.
- NOT USED.
- PROVIDE BRAIDED COPPER GROUNDING STRAP AND (2) 5/8" X 10'-0" COPPER OR COPPER-CLAD DRIVEN GROUND RODS INSTALLED WITHIN 12'-0" OF THE FUEL DISPENSING FACILITY FOR SUPPLEMENTAL GROUNDING PROTECTION. BOND THE GROUNDING STRAP TO ALL METAL PARTS OF THE FUEL STORAGE SYSTEM. DO NOT BOND EQUIPMENT GROUND TO THE SUPPLEMENTAL GROUNDING SYSTEM.
- NOT USED.
- REFER TO DIVISION 26 AND 31 SPECIFICATIONS FOR TRENCHING AND IDENTIFICATION REQUIREMENTS. INCLUDE EXACT ELECTRICAL TRENCH ROUTING LOCATIONS ON AS-BUILT MARKUPS FOR INCLUSION IN RECORD DOCUMENTS.
- CONNECT EXISTING FIXTURES INSTALLED UNDER SEPARATE PROJECT TO THE NEW CIRCUITRY SHOWN. AUTOMATIC CONTROL SHALL BE BY TIMECLOCK/PHOTOCELL CONTROL AS SPECIFIED IN THE LIGHTING CONTROL DIAGRAM, THIS SHEET.
- PROVIDE CONDUIT SEAL-OFFS AT STUB-IN TO BUILDING PER THE REQUIREMENTS OF NEC 501 AND 514.
- PROVIDE AN ADDITIONAL (1) 1" EMPTY CONDUIT RUN ALONGSIDE POWER CONDUITS TO FUEL DISPENSING FACILITY WITH PULL STRINGS AND PLASTIC BUSHINGS ON CONDUIT ENDS FOR COMMUNICATIONS CABLING. PROVIDE CONDUIT SEAL-OFFS AT STUB-IN TO BUILDING PER THE REQUIREMENTS OF NEC 501 AND 514.
- NOT USED.
- PROVIDE DIGITAL ASTRONOMIC TIME CLOCK WITH PHOTOCELL INPUT AND DUAL SEPARATELY PROGRAMMABLE OUTPUTS. FIRST OUTPUT TO BE CONNECTED TO 12-POLE CONTACTOR TO CONTROL INTERIOR LIGHTING, AS REQUIRED PER IECC 2009, VIA 2-HOUR PUSHBUTTON TIMER SWITCH. SECOND OUTPUT TO BE CONNECTED TO 4-POLE CONTACTOR TO CONTROL EXTERIOR LIGHTING WITH PHOTOCELL-ON, TIMECLOCK OFF OPERATION WITH HOURS OF OPERATION OF EXTERIOR LIGHTS TO BE DETERMINED BY OWNER. FOR INITIAL SETUP, PROGRAM EXTERIOR LIGHTING TO TURN ON AT DUSK AND OFF AT DAWN. PROGRAM INTERIOR LIGHTING TO TURN ON AT 4:00AM AND OFF AT 12:00AM. EXACT SET POINTS TO BE DETERMINED BY OWNER.
- REFER TO POLE BASE DETAIL, SHEET E101, FOR POLE BASE SPECIFICATIONS. COORDINATE INSTALLATION WITH SITE WORK CONTRACTOR TO AVOID INTERFERENCE WITH NEW PAVING WORK. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL POLE FOUNDATIONS AND RELATED EXCAVATION AND BACKFILL.
- ALL SITE LIGHTING POLES AND CIRCUITING SHALL BE PRICED SEPARATELY AS ADD ALTERNATE #1.
- INSTALL EMERGENCY FIXTURES ADJACENT TO EACH EXTERIOR DOOR. COORDINATE MOUNTING HEIGHT IN FIELD.



SLATERPAULL
ARCHITECTS
1331 Nineteenth Street
Denver, CO 80202
P 303.637.0977
www.slaterpaul.com

CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

ELECTRICAL SITE PLAN AND DETAILS
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

REVISIONS

NO.	DATE	DESCRIPTION
1	11/11/13	ISSUE FOR BIDDING AND CONSTRUCTION

DRAWN BY: JTG
REVIEWED BY: SLS
Date:

SHEET
3 OF 9
E-100

CAD FILE NO.



JOB# 11298



SLATERPAULL
ARCHITECTS
1331 Nineteenth Street
Denver, CO 80202 | www.slaterpaull.com
P: 303.637.0977

CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

PHOTOMETRIC PLAN AND DETAILS
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

REVISIONS
1. 11/11/13 ISSUE FOR BIDDING AND CONSTRUCTION

DRAWN BY: JTG
REVIEWED BY: SLS
Date:

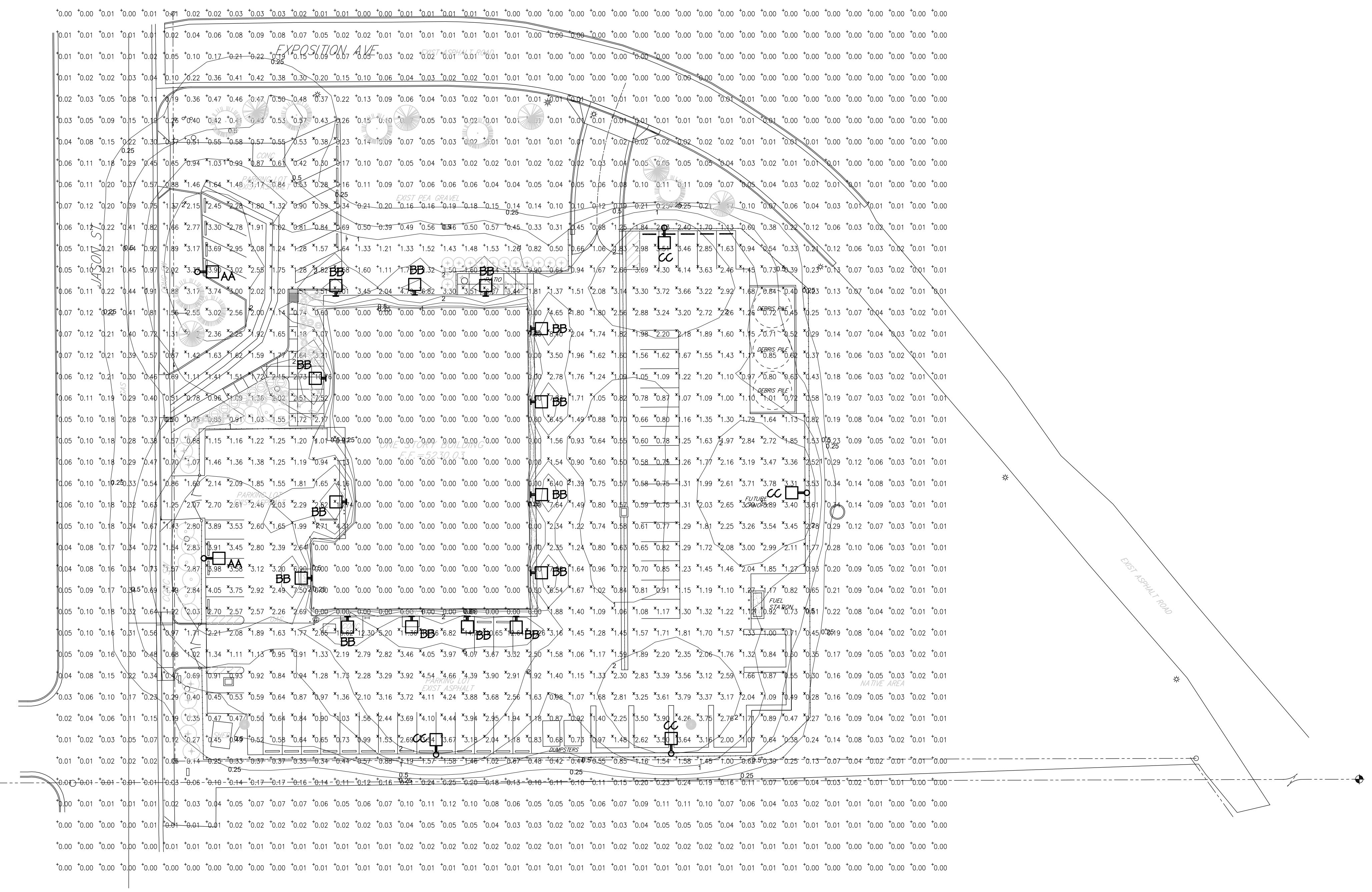
SHEET
4 OF 9
E-101

CAD FILE NO.



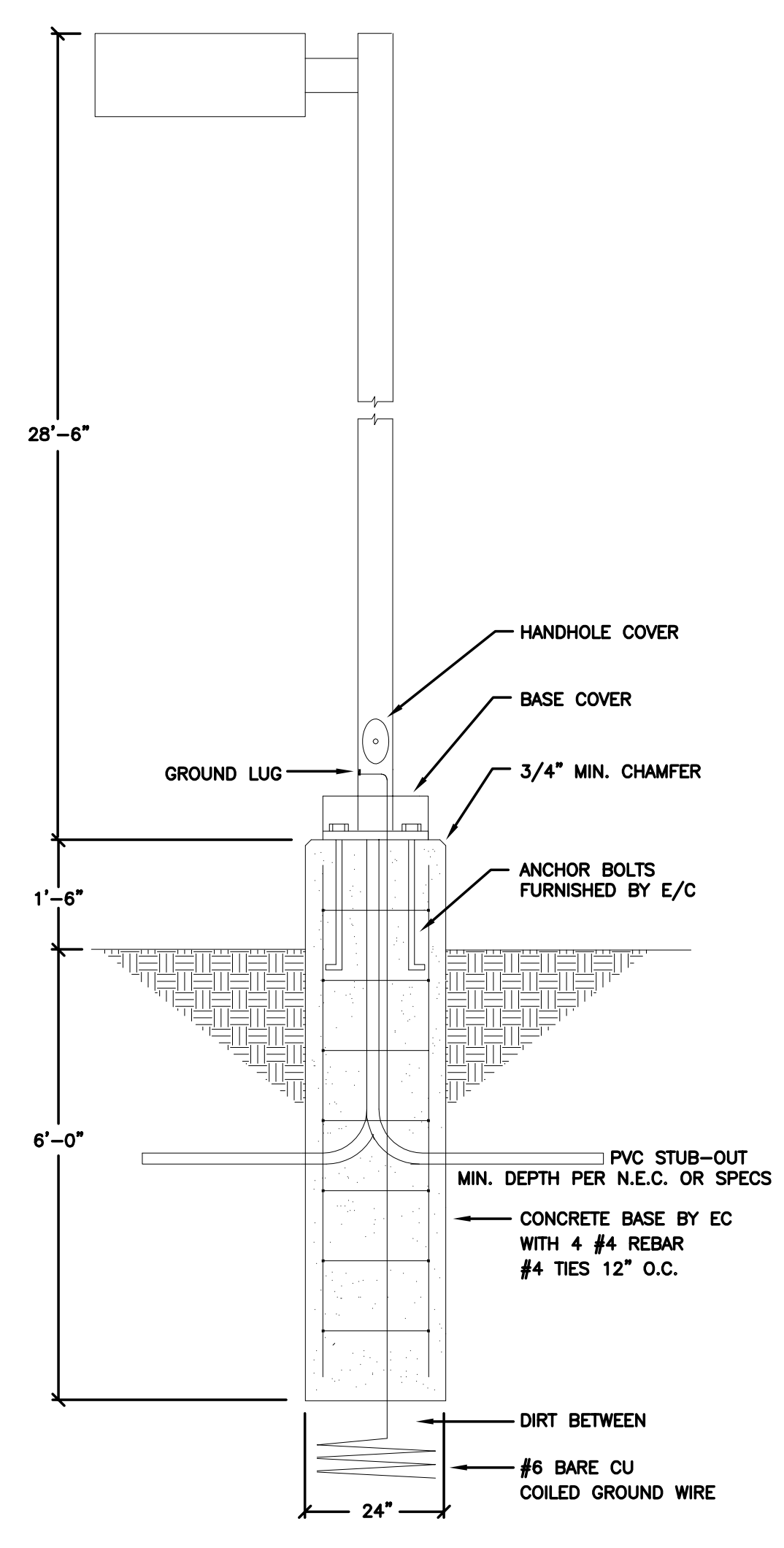
7822 S. Wheeling Ct. Suite B, Englewood, CO 80112 | P: (303) 696-1571 | projects@coreyeng.com

JOB# 11298



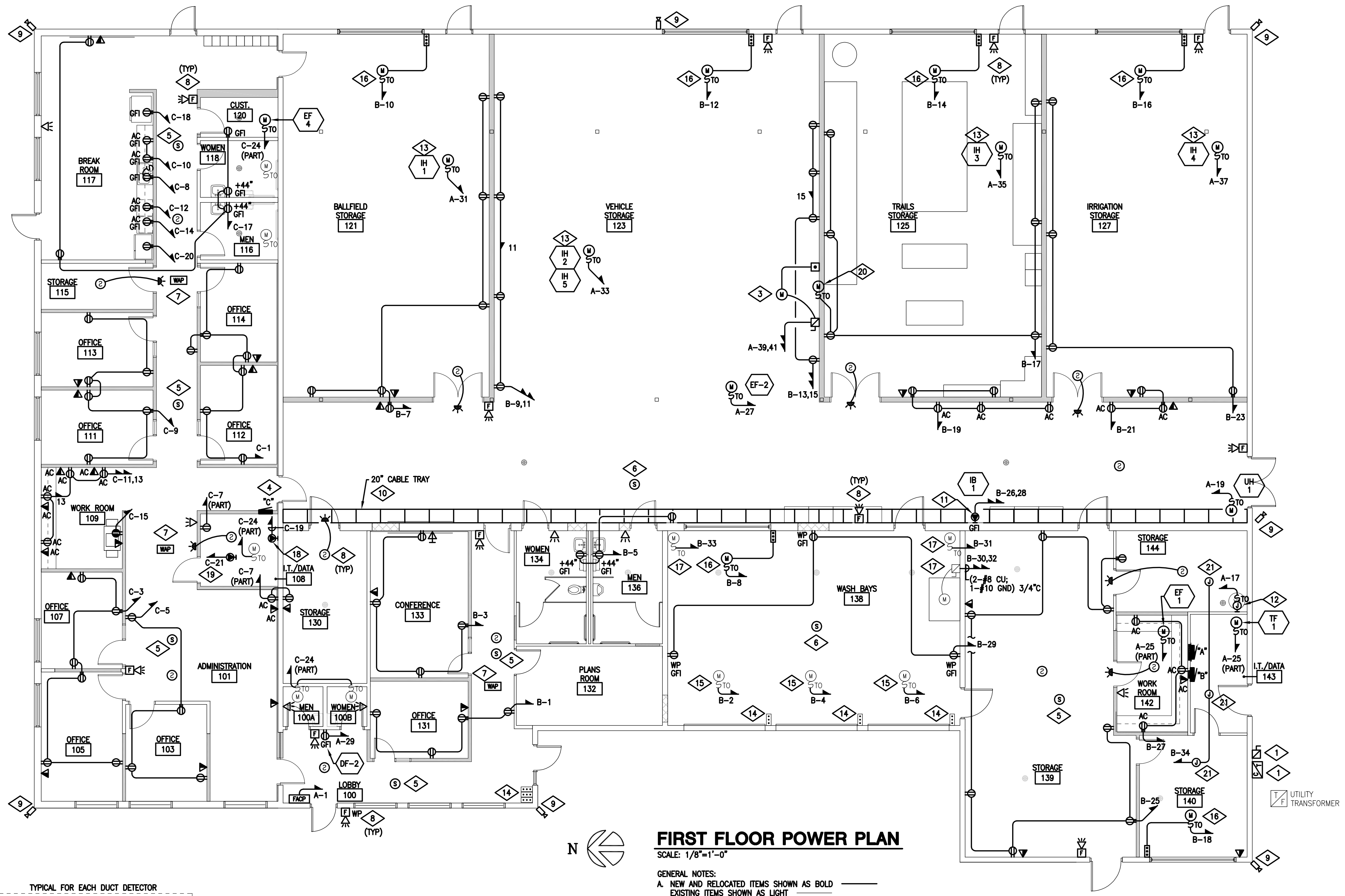
PHOTOMETRICS PLAN
SCALE: 1"=30'-0"

GENERAL NOTES:
A. NEW AND RELOCATED ITEMS SHOWN AS BOLD
EXISTING ITEMS SHOWN AS LIGHT



POLE BASE DETAIL
NOT TO SCALE

F:\DATA\ACAD\11200 - 11299\11298 S. Jason Street Maintenance Building\11298 E101.dwg, 2/6/2014 12:37:38 PM

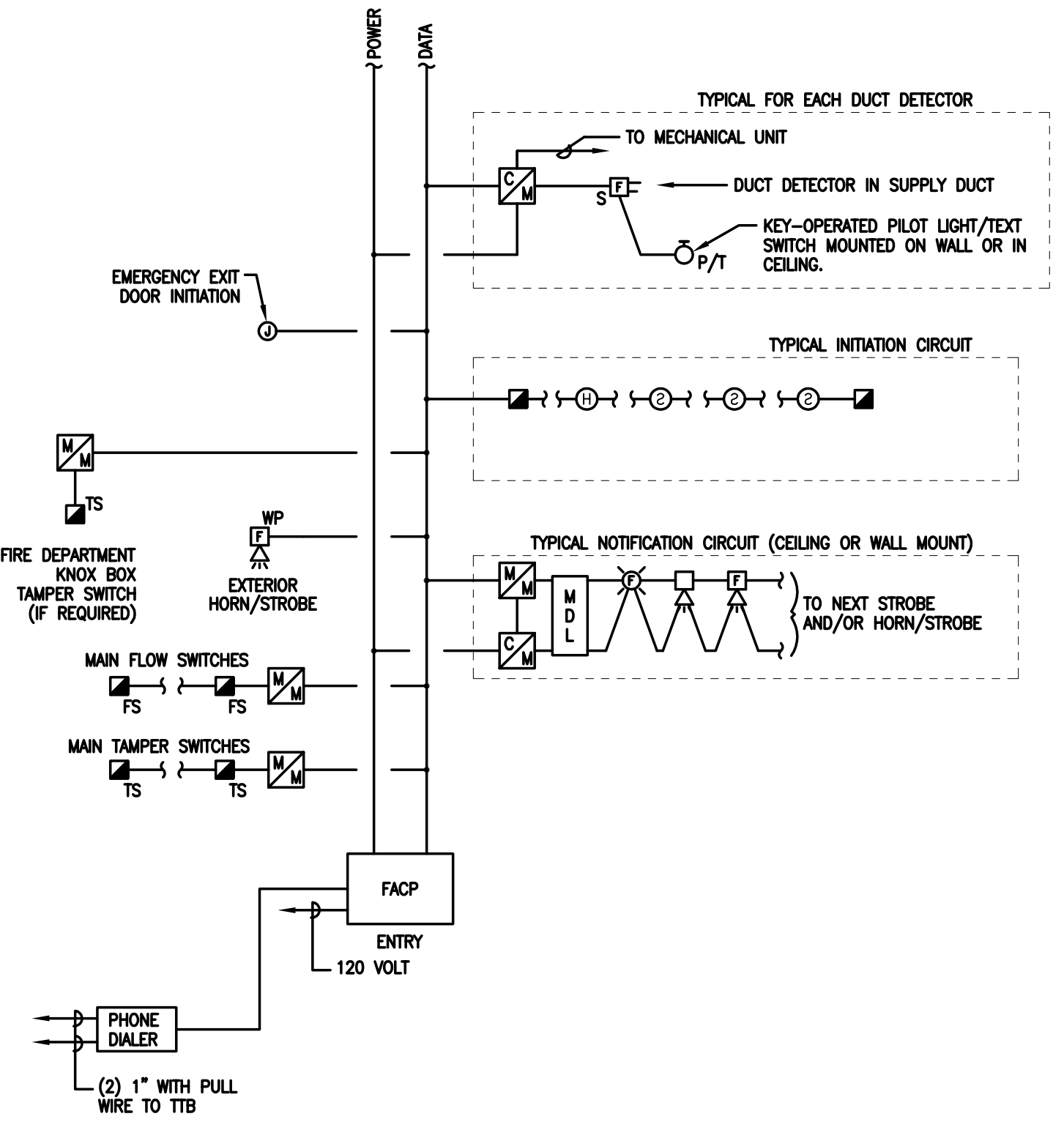


FIRST FLOOR POWER PLAN
SCALE: 1/8"=1'-0"

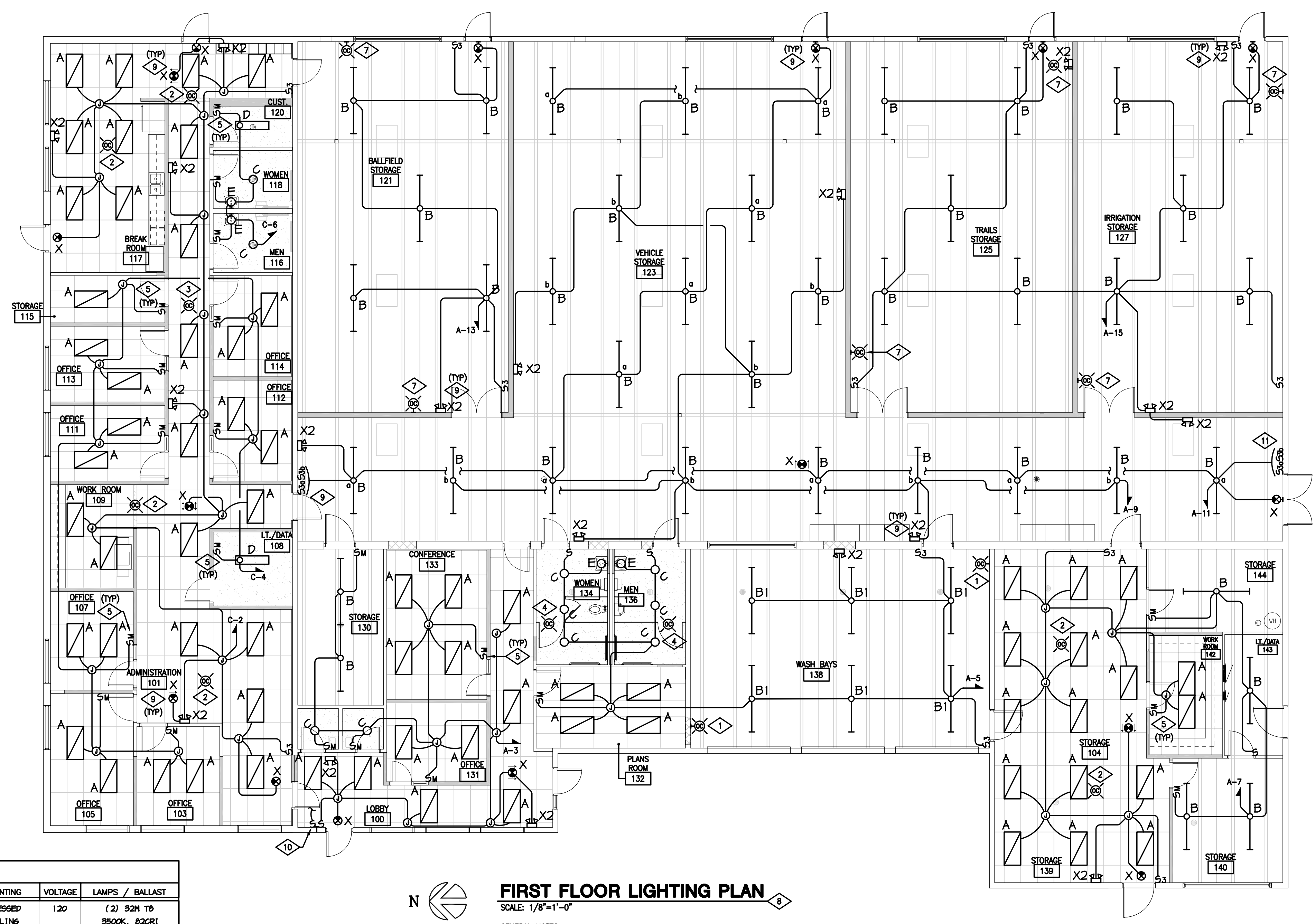
GENERAL NOTES:
A. NEW AND RELOCATED ITEMS SHOWN AS BOLD
EXISTING ITEMS SHOWN AS LIGHT

DETAIL NOTES

1. PROVIDE NEW 400A NEMA 3R CT CABINET, XCEL METER AND 400A3P SERVICE DISCONNECT. REFER TO THE ONE-LINE DIAGRAM FOR MORE INFORMATION.
2. NOT USED.
3. PROVIDE CONNECTION FOR VEHICLE LIFT. LOCATION TO BE COORDINATED IN FIELD. FOR PRICING ASSUME 2HP, 208V, 1Φ.
4. PANEL TO BE FULLY RECESSED IN WALL. PAINT TO MATCH WALL COLOR. PROVIDE EMBOSSED LABEL INDICATING VOLTAGE, PHASE, AMPS, AND PANEL NAME.
5. PROVISION FOR CEILING INTERCOM SPEAKER, VALCOM V9022. PROVIDE ABOVE CEILING JUNCTION BOX AND 3/4" CONDUIT STUBBED 6" INTO ACCESSIBLE CEILING WITH PULL STRINGS AND BUSHINGS FOR INTERCOM CABLE. SPEAKER TO BE FLUSH-MOUNTED IN CEILING TILE. COORDINATE WITH OWNER'S INTERCOM INSTALLER FOR EXACT REQUIREMENTS.
6. PROVISION FOR CEILING-MOUNTED INTERCOM SPEAKER, VALCOM BI-HORN V1030C. PROVIDE SURFACE-MOUNTED JUNCTION BOX ON CEILING AND 3/4" CONDUIT ROUTED TO NEARBY CABLE TRAY WITH PULL STRINGS AND BUSHINGS FOR INTERCOM CABLE. COORDINATE WITH OWNER'S INTERCOM INSTALLER FOR EXACT REQUIREMENTS.
7. CEILING-MOUNTED WIRELESS ACCESS POINT, POWERED OVER ETHERNET. CONTRACTOR TO PROVIDE ABOVE-CEILING JUNCTION BOX WITH 3/4" CONDUIT STUBBED 6" INTO ACCESSIBLE CEILING SPACE WITH PULL STRINGS AND BUSHINGS. COORDINATE EXACT REQUIREMENTS WITH OWNER'S NETWORKING REPRESENTATIVE PRIOR TO ROUGH-IN.
8. FIRE ALARM SYSTEM AND DEVICES SHOWN AS A PERFORMANCE SPECIFICATION ONLY. REFER TO GENERAL NOTES AND DIVISION 28 SPECIFICATIONS FOR ADDITIONAL INFORMATION AND REQUIREMENTS. NOTE: OWNER REQUIRES 2 SETS OF MARKED-UP AS BUILT DRAWINGS SHOWING CONDUIT ROUTING FOR FIRE ALARM CABLE.
9. PROVIDE ROUGH-IN FOR SECURITY CAMERA. PROVIDE FLUSH-MOUNTED 4" SQUARE JUNCTION BOX AND 3/4" CONDUIT STUBBED INSIDE BUILDING ENVELOPE WITH PLASTIC BUSHINGS AND PULL STRING FOR A/V CABLE. COORDINATE EXACT HEIGHT, AND ANY ADDITIONAL REQUIREMENTS WITH OWNER'S SECURITY VENDOR PRIOR TO ROUGH-IN.
10. PROVIDE 20" WIDE, 6" DEEP ALUMINUM OR STEEL CABLE TRAY ALONG ENTIRE LENGTH OF WALL FOR SECURITY, DATA AND OTHER LOW-VOLTAGE CABLING. MOUNT FLUSH TO WALL ABOVE OTHER SYSTEMS. COORDINATE EXACT HEIGHT IN FIELD. SECURE TO STRUCTURE USING THREADED ROD. PROVIDE SUPPORTS EVERY 8'-0" ON CENTER AT A MINIMUM.
11. POWER FOR ICE MACHINE. PROVIDE NEMA 6-20 STRAIGHT-BLADE RECEPTACLE AND CORD AND PLUG FOR EQUIPMENT. COORDINATE EXACT MOUNTING HEIGHT AND RECEPTACLE TYPE WITH ACTUAL EQUIPMENT SUPPLIED PRIOR TO ROUGH-IN. PROVIDE (2-#12 GND) 1/2" HOMERUN.
12. PROVIDE CONNECTION TO GAS-FIRED WATER HEATER IGNITION CIRCUIT, AND RECIRC PUMP.
13. PROVIDE POWER FOR PUMP SERVING INFRARED HEAT IN VICINITY. COORDINATE EXACT ELECTRICAL REQUIREMENTS FOR HEATERS WITH HVAC INSTALLER.
14. MAINTAIN EXISTING CONNECTION OF REMOTE CONTROLS FOR EXISTING OVERHEAD DOOR OPERATORS.
15. RE-CONNECT EXISTING OVERHEAD DOOR OPERATORS TO NEW CIRCUITS INDICATED. PROVIDE (2-#12CU; 1-#12 GND) 1/2" HOMERUNS.
16. NEW DOOR OPERATOR. BASIS OF DESIGN IS 120V, 1/2 HP, WITH 24-VOLT CONTROLS. ELECTRICAL CONTRACTOR TO PROVIDE ALL LINE-VOLTAGE WIRING AND RACEWAY/BOXES AS REQUIRED FOR 24-VOLT 3-BUTTON CONTROL STATION INSTALLATION. COORDINATE EXACT REQUIREMENTS WITH ACTUAL EQUIPMENT PROVIDED. UPSIZE CIRCUIT AND OVERCURRENT PROTECTION AS REQUIRED IF HIGHER-HORSEPOWER OPERATOR IS PROVIDED.
17. PROVIDE NEW HOMERUN TO EXISTING EQUIPMENT AS INDICATED.
18. PROVIDE NEMA L5-30R RECESSED IN WALL WITH (2-#10 CU; 1-#10 GND) 3/4" HOME RUN TO CIRCUIT INDICATED.
19. PROVIDE NEMA L5-30R SURFACE MOUNTED ON OWNER'S LADDER RACK WITH (2-#10 CU; 1-#10 GND) 3/4" HOME RUN TO CIRCUIT INDICATED.
20. PROVIDE THERMAL OVERLOAD SWITCH AND 120V CONNECTION TO METHANE EXHAUST FAN.
21. PROVIDE CONNECTION TO HEAT PAPE. COORDINATE EXACT LOCATION IN FIELD.



FIRE ALARM SYSTEM DIAGRAM
SCALE: NONE



LIGHTING FIXTURE SCHEDULE						
TYPE	MANUFACTURER	CATALOG NUMBER	DESCRIPTION	MOUNTING	VOLTAGE	LAMPS / BALLAST
A	METALUX COLUMBIA LITHONIA	26C8-232-A-UNV-ER01	RECESSED 2' X 4' LENSED TROFFER	RECESSED CEILING	120	(2) 32W T8 3500K, 02CRI PROGRAM ST
B	METALUX COLUMBIA LITHONIA	0T-SNF-232-UNV-ER01-H6	0' TANDEM STRIPLIGHT WITH WIRE GUARD	SUSPENDED CEILING	120	(4) 32W T8 3500K, 02CRI PROGRAM ST
B1	METALUX COLUMBIA LITHONIA	0T-VT2-232-DR-UNV-ER01	0' VAPOR TIGHT SURFACE MOUNTED LIGHT WITH LENS	SUSPENDED CEILING	120	(4) 32W T8 3500K, 02CRI
C	HALO PRESCOLITE 60THH	H2721CAT-470H	COMPACT FLUORESCENT DOWNLIGHT	RECESSED CEILING	120	26W CFL 3500K, 02CRI ELECTRONIC
D	METALUX COLUMBIA LITHONIA	ME-232-A-UNV-ER01	ACRYLIC WRAP	SURFACE CEILING	120	(2) 32W T8 3500K, 02CRI PROGRAM ST
E	METALUX COLUMBIA LITHONIA	BAU-217-UNV-ER01	2' HALL MOUNT VANITY LIGHT	HALL HEIGHT TBD	120	(2) 17W T8 3500K, 02CRI PROGRAM ST
X	SURELITES DUAL LITE LITHONIA	LPX1-6	WHITE POLYCARBONATE EXIT SIGN WITH GREEN LED LETTERS AND 90 MINUTE BATTERY	UNIVERSAL	120	INCLUDED
X1	SURELITES DUAL LITE LITHONIA	AEL2-31-BZ	BRONZE ARCHITECTURAL EXTERIOR EMERGENCY LIGHT, LED LIGHT SOURCE	HALL HEIGHT TBD	120	INCLUDED
X2	SURELITES DUAL LITE LITHONIA	CG2 EZZ ELM2	HALL MOUNTED PRO6 EYE EMERGENCY LIGHT	HALL HEIGHT TBD	120	INCLUDED
AA	LUMARK	HPTR-35-250H-200V-LL-BK 5656A28.55FH1	FULL CUTOFF POLE LIGHT, BLACK SQUARE STRAIGHT STEEL POLE, 20'-6" HEIGHT TYPE III SEGMENTED OPTICS	POLE 20'-6" POLE, 18" BASE	200	250W HPS
BB	LUMARK	HPVP-FC-HP100-200V-LL-BK	FULL CUTOFF WALLPACK WITH HPS LAMPS	HALL HEIGHT TBD	200	100W HPS
CC	LUMARK	HPTR-SL-250H-200V-LL-BK 5656A28.55FH1	FULL CUTOFF POLE LIGHT, BLACK SQUARE STRAIGHT STEEL POLE, 20'-6" HEIGHT TYPE SL SPILL LIGHT ELIMINATOR OPTICS	POLE 20'-6" POLE, 18" BASE	200	250W HPS

FIRST FLOOR LIGHTING PLAN
SCALE: 1/8"=1'-0"
GENERAL NOTES:
A. NEW AND RELOCATED ITEMS SHOWN AS BOLD
EXISTING ITEMS SHOWN AS LIGHT

- DETAIL NOTES**
- PROVIDE WATTSTOPPER CB-100 WET LOCATION OCCUPANCY SENSOR, OR EQUAL. PROVIDE POWER PACKS AS NECESSARY. INSTALL PER MANUFACTURER'S INSTRUCTIONS. SWITCHING SHALL BE DOWNSTREAM OF POWER PACKS.
 - PROVIDE WATTSTOPPER DT-305 CEILING MOUNTED DUAL TECHNOLOGY OCCUPANCY SENSOR, OR EQUAL. PROVIDE POWER PACKS AS NECESSARY. INSTALL PER MANUFACTURER'S INSTRUCTIONS. SWITCHING SHALL BE DOWNSTREAM OF POWER PACKS.
 - PROVIDE WATTSTOPPER WT-2255 CEILING MOUNTED ULTRASONIC (CORRIDOR PATTERN) OCCUPANCY SENSOR, OR EQUAL. PROVIDE POWER PACKS AS NECESSARY. INSTALL PER MANUFACTURER'S INSTRUCTIONS. SWITCHING SHALL BE DOWNSTREAM OF POWER PACKS.
 - PROVIDE WATTSTOPPER DT-355 LINE VOLTAGE CEILING MOUNTED DUAL TECHNOLOGY OCCUPANCY SENSOR, OR EQUAL. INSTALL PER MANUFACTURER'S INSTRUCTIONS. SWITCHING SHALL BE DOWNSTREAM OF SENSOR.
 - PROVIDE WATTSTOPPER DW-100 DUAL TECHNOLOGY WALL MOUNTED OCCUPANCY SENSOR, OR EQUAL. CONFIGURE AS VACANCY SENSOR. INSTALL PER MANUFACTURER'S INSTRUCTIONS. NOTE: NEUTRAL CONDUCTOR IS REQUIRED AT THE SWITCH.
 - NOT USED.
 - PROVIDE LOW-VOLTAGE, WALL-MOUNTED PASSIVE INFRARED OCCUPANCY SENSOR, WATTSTOPPER CX-100 OR EQUAL. PROVIDE POWER PACKS AS NECESSARY. INSTALL PER MANUFACTURER'S INSTRUCTIONS. SWITCHING SHALL BE DOWNSTREAM OF POWER PACKS.
 - EXTERIOR NON-EMERGENCY WALL LIGHTS ARE SHOWN ON THE SITE PLAN, SHEET E-100.
 - CONNECT EXIT SIGNS AND EMERGENCY LIGHTING TO THE UNSWITCHED LEG OF THE LOCAL LIGHTING CIRCUIT.
 - PROVIDE TIMER OVERRIDE SWITCH WITH 2-HOUR MAXIMUM OVERRIDE INTERVAL, LEVITON #6260M OR EQUAL, CONNECTED TO THE LIGHTING CONTACTOR AS SHOWN IN THE LIGHTING CONTROL DIAGRAM, E-100. PROVIDE PRINTED TYPE-WRITTEN LABEL INDICATING "AFTER-HOURS LIGHTING OVERRIDE".
 - DUAL-LEVEL SWITCHING THIS AREA SHALL BE CONFIGURED AS INDICATED BY LOWERCASE LETTERING, IN AN "EVERY OTHER" CONFIGURATION.



CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

ROOF ELECTRICAL PLAN
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

REVISIONS

1. 11/11/13 ISSUE FOR BIDDING AND CONSTRUCTION

DRAWN BY: JTG

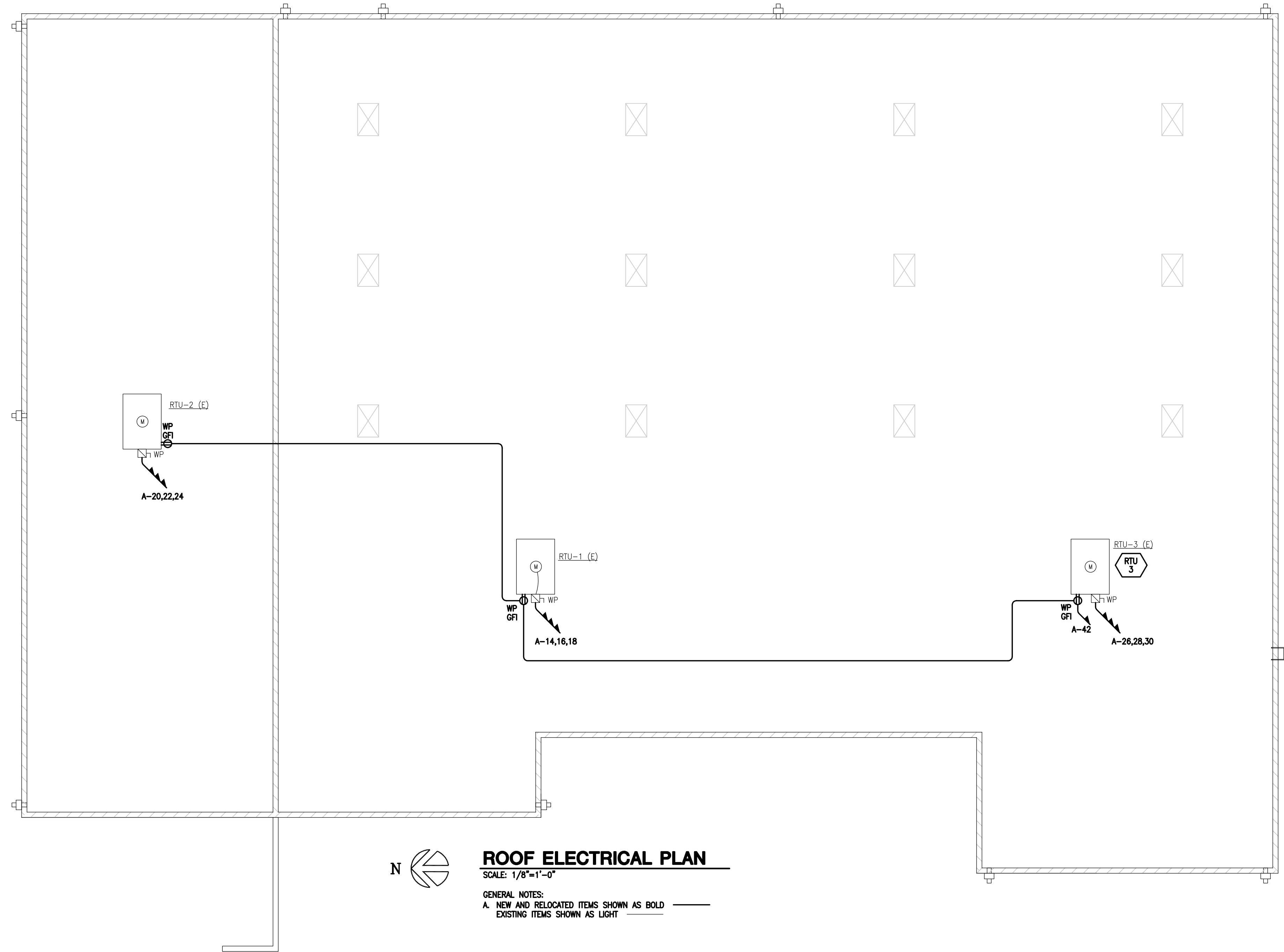
REVIEWED BY: SLS

Date:

SHEET 7 OF 9

E-130

CAD FILE NO.



ROOF ELECTRICAL PLAN

SCALE: 1/8"=1'-0"

GENERAL NOTES:
A. NEW AND RELOCATED ITEMS SHOWN AS BOLD
EXISTING ITEMS SHOWN AS LIGHT



JOB# 11298

PANEL "C" (NEW)														
FLUSH		MAIN		VOLTAGE 120 / 208 V		3 #		4 W						
SURFACE		BUS 100A		FEED THRU		A.I.C. 10,000A								
TYPE	DESCRIPTION	BKR	CIR	LOAD (VOLT AMPS) / PHASE			CIR	BKR	DESCRIPTION	TYPE				
				A	B	C								
R	OFFICE RECP	20	1	1280	1000		2	20	LIGHTING	L				
R	OFFICE RECP	20	3		1080	1000	4	20	LIGHTING	L				
R	OFFICE RECP	20	5			720	1000	6	20	LIGHTING	L			
R	OFFICE RECP	20	7	540	1176			8	20	DISPOSER	K			
R	OFFICE RECP	20	9		1080	1000		10	20	BREAK COUNTER	K			
R	WORK CTR RECP	20	11		360	500		12	20	BREAK COUNTER	K			
R	WORK CTR RECP	20	13	360	500			14	20	BREAK COUNTER	K			
R	COPIER	20	15		1000	0		16	20	SPARE				
R	RESTROOM REC	20	17			720	1800	18	20	VENDING	K			
G	DED SERVER REC	30	19	2000	750			20	20	REFNG	K			
G	DED SERVER REC	30	21		2000	0		22	20	SPARE				
	SPARE	20	23			0	650	24	20	FANS	M			
	SPARE	20	25	0	0			26	20	SPARE				
	SPARE	20	27		0	0		28	20	SPARE				
	SPARE	20	29			0	0	30	20	SPARE				
	SPARE	20	31	0	0			32	20	SPARE				
	SPARE	20	33		0	0		34	20	SPARE				
	SPARE	20	35			0	0	36	20	SPARE				
	SPACE	37	0	0				38		SPACE				
	SPACE	39		0	0			40		SPACE				
	SPACE	41			0	0		42		SPACE				
				7568	7160	5750								
LOAD TYPE														
		CONNECTED KVA			TOTAL			FACTOR			DEMAND KVA			
		A	B	C	ALL PHASES			A	B	C	ALL PHASES			
LIGHTING		1.0	1.0	1.0	3.0	125%	1.3	1.3	1.3	3.8				
RECEPTACLE (10KVA OR LESS)		2.2	3.2	1.8	7.1	100%	2.2	3.2	1.8	7.1				
RECEPTACLE (OVER 10KVA)		0.0	0.0	0.0	0.0	50%	0.0	0.0	0.0	0.0				
HVAC/MOTOR		0.0	0.0	0.0	0.0	100%	0.0	0.0	0.0	0.0				
MOTOR(LARGEST)		0.0	0.0	0.7	0.7	125%	0.0	0.0	0.8	0.8				
KITCHEN EQUIPMENT		2.4	1.0	2.3	5.7	65%	1.6	0.7	1.5	3.7				
MISCELLANEOUS		2.0	2.0	0.0	4.0	100%	2.0	2.0	0.0	4.0				
TOTAL KVA		7.6	7.2	5.8	20.5		TOTAL KVA	7.0	7.1	5.4	19.4			
WITH GROUND BUS								TOTAL AMPS	58.2	58.8	44.6			
LEGEND		L = LIGHTING	R = RECEPTACLE	M = HVAC / MOTOR	K = KITCHEN	G = MISCELLANEOUS								

PANEL "X" (NEW)														
FLUSH		MAIN		VOLTAGE 120 / 208 V		3 #		4 W						
SURFACE		BUS 400A		FEED THRU		A.I.C. 22,000A								
TYPE	DESCRIPTION	BKR	CIR	LOAD (VOLT AMPS) / PHASE			CIR	BKR	DESCRIPTION	TYPE				
				A	B	C								
G	FIRE ALARM	20	1	500	12968		2	200	SUBFEED "B"	RMG				
L	LIGHTING	20	3		1500	10773		4		LRMG				
L	LIGHTING	20	5			1500	12201	6		LRMG				
L	LIGHTING	20	7	1500	7586			8	100	SUBFEED "C"	LRMG			
L	LIGHTING	20	9		1500	7160		10		LRMG				
L	LIGHTING	20	11			1500	5750	12		LRMG				
L	LIGHTING	20	13	1500	4200			14	50	RTU-1	M			
L	LIGHTING	20	15		1500	4200		16			M			
G	WTR HEATER IGH	20	17			200	4200	18			M			
M	UH-1	20	19		1176	3300		20	30	RTU-2	M			
M	UH-2	20	21			1176	3300	22			M			
M	UH-3	20	23			1176	3300	24			M			
M	TF-1, EF-1	20	25	500	3300			26	30	RTU-3	M			
M	EF-2	20	27		300	3300		28			M			
M	WATER COOLER	20	29			400	3300	30			M			
M	IR HEATER	20	31	1176	560			32	30	EF-3	M			
M	IR HEATER	20	33		1176	560		34			M			
M	IR HEATER	20	35			1176	560	36			M			
M	IR HEATER	20	37	1176	1500			38	20	EH-1	M			
M	VEHICLE LIFT	30	39		2000	1500		40	2		M			
M		2	41			2000	540	42	20	ROOF GFI	R			
				40960	39945	37803								
LOAD TYPE														
		CONNECTED KVA			TOTAL			FACTOR			DEMAND KVA			
		A	B	C	ALL PHASES			A	B	C	ALL PHASES			
LIGHTING		4.0	7.3	5.8	17.1	125%	5.0	9.1	7.2	21.3				
RECEPTACLE (10KVA OR LESS)		3.3	3.3	3.3	10.0	100%	3.3	3.3	3.3	10.0				
RECEPTACLE (OVER 10KVA)		3.3	2.4	2.3	7.9	50%	1.7	1.2	1.1	4.0				
HVAC/MOTOR		21.1	18.9	19.7	59.8	100%	21.1	18.9	19.7	59.8				
MOTOR(LARGEST)		4.2	4.2	4.2	12.6	125%	5.3	5.3	5.3	15.8				
KITCHEN EQUIPMENT		2.4	1.0	2.3	5.7	100%	2.4	1.0	2.3	5.7				
MISCELLANEOUS		2.6	2.9	0.2	5.6	100%	2.6	2.9	0.2	5.6				
TOTAL KVA		41.0	39.9	37.8	118.7		TOTAL KVA	41.3	41.6	39.2	122.2			
WITH GROUND BUS								TOTAL AMPS	344.5	347.0	326.4			
LEGEND		L = LIGHTING	R = RECEPTACLE	M = HVAC / MOTOR	K = KITCHEN	G = MISCELLANEOUS								

* PROVIDE UL-LISTED LOCK-ON DEVICE

MECHANICAL EQUIPMENT SCHEDULE											
DESIGNATION	DESCRIPTION	VOLT	PH	HP	KVA	CONDUCTORS	CONDUIT	SW	CB	FUSE SIZE/TYPE	REMARKS
DF-2	ELEC WATER COOLER	120	1	4	0.37	2-#12 CU; 1-#12 GND	1/2"		20/1		E, G
EF-1	EXHAUST FAN	120	1		0.08	2-#12 CU; 1-#12 GND	1/2"	STO	20/1		E
EF-2	EXHAUST FAN	120	1		0.22	2-#12 CU; 1-#12 GND	1/2"	STO	20/1		E
EF-4	EXHAUST FAN	120	1		0.02	2-#12 CU; 1-#12 GND	1/2"	STO	20/1		E
EP-100 (H-1 THRU 5)	IR HEAT PUMP	120	1		1/2	2-#12 CU; 1-#12 GND	1/2"	STO	20/1		A
IB-1	ICE MAKER	208	1	12.5		2-#12 CU; 1-#12 GND	1/2"		20/2		E, F
RTU-1	EXISTING ROOFTOP UNIT	208	3	15.3		3-#8 CU; 1-#10 GND	1"	30/3	30/3	20A FRN-R	C, D
RTU-2	EXISTING ROOFTOP UNIT	208	3	27		3-#8 CU; 1-#10 GND	1"	30/3	30/3	30A FRN-R	C, D
RTU-3	EXISTING ROOFTOP UNIT	208	3	18.2		3-#8 CU; 1-#10 GND	1"	30/3	30/3	25A FRN-R	C, D
TF-1	TRANSFER FAN	120	1		4/25	2-#12 CU; 1-#12 GND	1/2"	STO	20/1		E
UH-1	UNIT HEATER	120	1		1/50	2-#12 CU; 1-#12 GND	1/2"	STO	20/1		E

- NOTES
- A. PROVIDE CONNECTION TO PUMPS SHOWN ON PLANS AND ANY ADDITIONAL ELECTRICAL REQUIRED AT IR HEAT ELEMENTS.
 - B. NOT USED.
 - C. PROVIDE NEW CONNECTION TO EXISTING ROOFTOP UNITS. EXISTING ROOFTOP DISCONNECTS MAY BE REUSED IF THEY ARE UNDAMAGED AND MEET THE SPECIFICATIONS INDICATED.
 - D. AMPERAGES OF EXISTING ROOFTOP UNITS ARE MCA (MINIMUM CIRCUIT AMPACITY) AS FULL-LOAD AMP RATINGS WERE NOT AVAILABLE.
 - E. REFER TO MECHANICAL AND PLUMBING PLANS FOR CONTROLS. CONTROL DEVICES TO BE FURNISHED BY MECHANICAL ELECTRICAL CONTRACTOR SHALL INSTALL AND WIRE LINE-VOLTAGE CONTROLS.
 - F. PROVIDE RECEPTACLE. COORDINATE EXACT RECEPTACLE TYPE WITH ACTUAL EQUIPMENT SUPPLIED. FOR PRICING, PROVIDE NEMA 6-20R.
 - G. PROVIDE NEMA 5-20R GFCI RECEPTACLE.

PANEL "B" (NEW)															
FLUSH		MAIN		VOLTAGE 120 / 208 V		3 #		4 W							
SURFACE		BUS 200A		FEED THRU		A.I.C. 22,000A									
TYPE	DESCRIPTION	BKR	CIR	LOAD (VOLT AMPS) / PHASE			CIR	BKR	DESCRIPTION	TYPE					
				A	B	C									
R	OFFICE REC	20	1	720	800		2	20	EXISTING OH DOOR	M					
R	CONF RM REC	20	3		720	800		4	20	EXISTING OH DOOR	M				
R	RESTROOM REC	20	5		540	800		6	20	EXISTING OH DOOR	M				
R	BALLFIELD STO REC	20	7	1080	1176			8	20	OVERHEAD DOOR	M				
R	VEHICLE STO REC	20	9		360	1176		10	20	OVERHEAD DOOR	M				
R	VEHICLE STO REC	20	11			360	1176	12	20	OVERHEAD DOOR	M				
R	VEHICLE STO REC	20	13	360	1176			14	20	OVERHEAD DOOR	M				
R	VEHICLE STO REC	20	15			360	1176	16	20	OVERHEAD DOOR	M				
RM	TRAILS STO REC/FAN	20	17			1130	1176	18	20	OVERHEAD DOOR	M				
R	TRAILS STO REC	20	19	900	0			20	20	SPARE					
R	IRRIGATION STO REC	20	21		540	0		22	20	SPARE					
R	IRRIGATION STO REC	20	23			720	0	24	20	SPARE					
R	STORAGE REC	20	25	1440	1300			26	20	ICE MAKER	M				
R	WORK ROOM REC	20	27		540	1300		28	2		M				
R	WASH REC	20	29		540	2808		30	40	WASH MACHINE	M				
M	UNIT HEATER	20	31	1176	2808			32	2		M				
M	UNIT HEATER	20	33		1176	850		34	20	HEAT TAPE	G				
M	FUEL PUMP	20	35			1176	0	36		SPACE					
G	TIMELOCK	20	37	50	0			38		SPACE					
L	EXTERIOR LTD	20	39		975	800		40	20	EXTERIOR POLES	L				
L		2	41			975	800	42	2		L				
				12968	10773	12201									
LOAD TYPE															
		CONNECTED KVA			TOTAL			FACTOR			DEMAND KVA				
		A	B	C	ALL PHASES			A	B	C	ALL PHASES				
LIGHTING		0.0	1.8	1.8	3.6	125%	0.0	2.2	2.2	4.4					
RECEPTACLE (10KVA OR LESS)		3.3	2.5	3.2	10.0	100%	3.3	2.5	3.2	9.1					
RECEPTACLE (OVER 10KVA)		1.2	0.0	0.0	0.3	50%	0.6	0.0	0.0	0.6					
HVAC/MOTOR		5.6	4.3	4.4	14.4	100%	5.6	4.3	4.4	14.4					
MOTOR(LARGEST)		2.8	1.3	2.8	6.9	125%	3.5	1.6	3.5	8.6					
KITCHEN EQUIPMENT		0.0	0.0	0.0	0.0	100%	0.0	0.0	0.0	0.0					
MISCELLANEOUS		0.1	0.9	0.0	0.9	100%	0.1	0.9	0.0	0.9					
TOTAL KVA		13.0	10.8	12.2	36.0		TOTAL KVA	13.1	11.5	13.3	38.0				
WITH GROUND BUS								TOTAL AMPS	109.2	96.2	111.2	105.4			
LEGEND		L = LIGHTING	R = RECEPTACLE	M = HVAC / MOTOR	K = KITCHEN	G = MISCELLANEOUS									

G PROVIDE GFI CIRCUIT BREAKER IN THIS POSITION.



CITY AND COUNTY OF DENVER
 DEPARTMENT OF
 PARKS & RECREATION
 201 West Colfax Avenue, Dept. 613
 Denver, Colorado 80202

ELECTRICAL SCHEDULES
 S. JASON STREET
 MAINTENANCE FACILITY
 678 S. Jason Street
 Denver, Colorado 80223

REVISIONS

1	11/11/13	ISSUE FOR BIDDING AND CONSTRUCTION

DRAWN BY: JTG

REVIEWED BY: SLS

Date:

SHEET 8 OF 9 E-601



7822 S. Wheeling Ct, Suite B, Englewood, CO 80112 | P (303) 696-1571 | projects@coreyeng.com

JOE# 11298

CAD FILE NO.



COMcheck Software Version 3.9.1
Exterior Lighting Compliance
Certificate

2009 IECC

Section 1: Project Information

Project Type: **Alteration**
Project Title: S Jason Street Maintenance Building
Exterior Lighting Zone: **4 (High activity metropolitan commercial district)**

Construction Site: 678 S. Jason St, Denver, CO 80223
Owner/Agent:
Designer/Contractor: James Glavin, Corey Electrical Engineering, Inc., 7822 S. Wheeling Ct, Suite B, Englewood, CO 80112, 303-696-1257

Section 2: Exterior Lighting Area/Surface Power Calculation

A Exterior Area/Surface	B Quantity	C Allowed Watts /Unit	D Tradable Wattage	E Allowed Watts (B x C)	F Proposed Watts
Main door (Main entry)	3 ft of door width	20	Yes	60	2900
Other ma doors (Other door (not main entry))	30 ft of door width	20	Yes	600	0
Rear walkway (Walkway < 10 feet wide)	150 ft of walkway length	1	Yes	150	0
Front south parking (Parking area)	14667 ft2	0.13	Yes	1907	0
Front North parking (Driveway)	6073 ft2	0.13	Yes	789	0
Front walk (Walkway >= 10 feet wide)	27 ft2	0.2	Yes	5	0
				Total Tradable Watts* =	2900
				Total Allowed Watts =	3542
				** A supplemental allowance equal to 1300 watts may be applied toward compliance of both non-tradable and tradable areas/surfaces.	1300

* Wattage tradeoffs are only allowed between tradable areas/surfaces.
** A supplemental allowance equal to 1300 watts may be applied toward compliance of both non-tradable and tradable areas/surfaces.

Section 3: Exterior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Watt. (C X D)	E Watt.	
Main door (Main entry 3 ft of door width): Tradable Wattage					
HID 1: BB: Walpacks / High-Pressure Sodium 100W / Standard	1	14	100	1400	
HID 2: AA/CC: Poles / High-Pressure Sodium 250W / Standard	1	6	250	1500	
Other ma doors (Other door (not main entry) 30 ft of door width): Tradable Wattage					
Rear walkway (Walkway < 10 feet wide 150 ft of walkway length): Tradable Wattage					
Front south parking (Parking area 14667 ft2): Tradable Wattage					
Front North parking (Driveway 6073 ft2): Tradable Wattage					
Front walk (Walkway >= 10 feet wide 27 ft2): Tradable Wattage					
				Total Tradable Proposed Watts =	2900

Section 4: Requirements Checklist

- Lighting Wattage:**
1. Within each non-tradable area/surface, total proposed watts must be less than or equal to total allowed watts. Across all tradable areas/surfaces, total proposed watts must be less than or equal to total allowed watts.

Project Title: S Jason Street Maintenance Building
Data filename: F:\DATA\ACAD\11 Archives\11200 - 11299\11298 S Jason Street Maintenance Building\Design\IECC-Comcheck\11298.cck
Report date: 07/26/12
Page 1 of 2

Compliance: Passes.

Controls, Switching, and Wiring:

2. All exemption claims are associated with fixtures that have a control device independent of the control of the nonexempt lighting.
3. Lighting not designated for dusk-to-dawn operation is controlled by either a photosensor (with time switch), or an astronomical time switch.
4. Lighting designated for dusk-to-dawn operation is controlled by an astronomical time switch or photosensor.
5. All time switches are capable of retaining programming and the time setting during loss of power for a period of at least 10 hours.

Exterior Lighting Efficacy:

6. All exterior building grounds luminaires that operate at greater than 100W have minimum efficacy of 60 lumens/watt.

Exceptions:

- Lighting that has been claimed as exempt and is identified as such in Section 3 table above.
- Lighting that is specifically designated as required by a health or life safety statute, ordinance, or regulation.
- Emergency lighting that is automatically off during normal building operation.
- Lighting that is controlled by motion sensor.

Section 5: Compliance Statement

Compliance Statement: The proposed exterior lighting design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed lighting system has been designed to meet the 2009 IECC requirements in COMcheck Version 3.9.1 and to comply with the mandatory requirements in the Requirements Checklist.

James Glavin - Engineer
Name - Title Signature Date 2012-11-27

Project Title: S Jason Street Maintenance Building
Data filename: F:\DATA\ACAD\11 Archives\11200 - 11299\11298 S Jason Street Maintenance Building\Design\IECC-Comcheck\11298.cck
Report date: 07/26/12
Page 2 of 2



COMcheck Software Version 3.8.1
Interior Lighting Compliance
Certificate

2009 IECC

Section 1: Project Information

Project Type: **Alteration**
Project Title: S Jason Street Maintenance Building

Construction Site: 678 S. Jason St, Denver, CO 80223
Owner/Agent:
Designer/Contractor: James Glavin, Corey Electrical Engineering, Inc., 7822 S. Wheeling Ct, Suite B, Englewood, CO 80112, 303-696-1257

Section 2: Interior Lighting and Power Calculation

A Area Category	B Floor Area (ft2)	C Allowed Watts / ft2	D Allowed Watts (B x C)	
Office	14196	1.0	14196	
			Total Allowed Watts =	14196

Area Category Exemption Qualifications

Activity Area	Total Wattage Pre-Alt.	Total Wattage Post-Alt.	Total Pre-Alt. Fixtures	# Fixtures Repl./Added

Section 3: Interior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Watt. (C X D)	E Watt.	
Office (14196 sq.ft.)					
Linear Fluorescent 1: A: 2x4 / 48" T8 32W / Electronic	2	67	64	4288	
Linear Fluorescent 2: B: Striplight / 48" T8 32W / Electronic	4	46	128	5888	
Compact Fluorescent 1: C: Downlight / Triple 4-pin 26W / Electronic	1	10	26	260	
Linear Fluorescent 3: D: Wrap / 48" T8 32W / Electronic	2	2	64	128	
Linear Fluorescent 4: E: Wall Bracket / 24" T8 17W / Electronic	2	4	31	136	
				Total Proposed Watts =	10700

Section 4: Requirements Checklist

Lighting Wattage:

1. Total proposed watts must be less than or equal to total allowed watts.

Allowed Watts	Proposed Watts	Complies
14196	10700	Passes

Controls, Switching, and Wiring:

2. Daylight zones under skylights more than 15 feet from the perimeter have lighting controls separate from daylight zones adjacent to vertical fenestration.
3. Daylight zones have individual lighting controls independent from that of the general area lighting.

Project Title: S Jason Street Maintenance Building
Data filename: F:\DATA\ACAD\11 Archives\11200 - 11299\11298 S Jason Street Maintenance Building\Design\IECC-Comcheck\11298.cck
Report date: 07/26/12
Page 1 of 4

Exceptions:

- Contiguous daylight zones spanning no more than two orientations are allowed to be controlled by a single controlling device.
- Daylight spaces enclosed by walls or ceiling height partitions and containing two or fewer light fixtures are not required to have a separate switch for general area lighting.
- Independent controls for each space (switch/occupancy sensor).

Exceptions:

- Areas designated as security or emergency areas that must be continuously illuminated.
- Lighting in stairways or corridors that are elements of the means of egress.
- Master switch at entry to hotel/motel guest room.
- Individual dwelling units separately metered.
- Medical task lighting or art/history display lighting claimed to be exempt from compliance has a control device independent of the control of the nonexempt lighting.
- Each space required to have a manual control also allows for reducing the connected lighting load by at least 50 percent by either controlling all luminaires, dual switching of alternate rows of luminaires, alternate luminaires, or alternate lamps, switching the riddle lamp luminaires independently of other lamps, or switching each luminaire or each lamp.

Exceptions:

- Only one luminaire in space.
- An occupant-sensing device controls the area.
- The area is a corridor, storeroom, restroom, public lobby or sleeping unit.
- Areas that use less than 0.6 Watts/sq.ft.
- Automatic lighting shutoff control in buildings larger than 5,000 sq. ft.

Exceptions:

- Sleeping units, patient care areas, and spaces where automatic shutoff would endanger safety or security.
- Photoelectric/astromnical time switch on exterior lights.

Exceptions:

- Lighting intended for 24 hour use.
- Tandem wired one-lamp and three-lamp ballasted luminaires (No single-lamp ballasts).

Exceptions:

- Electronic high-frequency ballasts; Luminaires on emergency circuits or with no available pair.

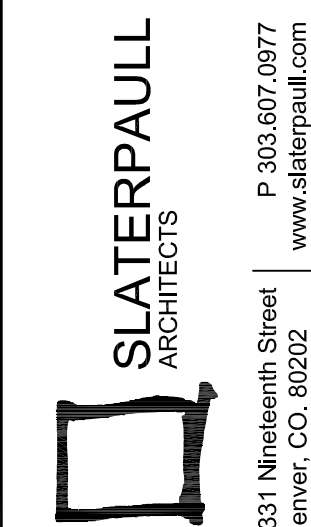
Interior Lighting PASSES

Section 5: Compliance Statement

Compliance Statement: The proposed lighting alteration project represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed lighting alteration project has been designed to meet the 2009 IECC, Chapter 8, requirements in COMcheck Version 3.8.1 and to comply with the mandatory requirements in the Requirements Checklist.

James Glavin - Engineer
Name - Title Signature Date 2012-07-26

Project Title: S Jason Street Maintenance Building
Data filename: F:\DATA\ACAD\11 Archives\11200 - 11299\11298 S Jason Street Maintenance Building\Design\IECC-Comcheck\11298.cck
Report date: 07/26/12
Page 2 of 4



CITY AND COUNTY OF DENVER
DEPARTMENT OF
PARKS & RECREATION
201 West Colfax Avenue, Dept. 613
Denver, Colorado 80202

ELECTRICAL SCHEDULES
S. JASON STREET
MAINTENANCE FACILITY
678 S. Jason Street
Denver, Colorado 80223

REVISIONS

1. 11/11/13 ISSUE FOR BIDDING AND CONSTRUCTION

DRAWN BY: JTG

REVIEWED BY: SLS

Date:

SHEET 9 OF 9 E-602

CAD FILE NO.



7822 S. Wheeling Ct, Suite B, Englewood, CO 80112 | P (303) 696-1257 | projects@coreyeng.com

JOE# 11298