

**City and County of Denver**  
**Graywater Treatment Works Design Criteria**

Table of Contents

1.0	Introduction
2.0	Flow Projections
3.0	Design Criteria Applicable to All Graywater Treatment Works
4.0	Design Criteria for Indoor Toilet and Urinal Flushing Graywater Treatment Works
5.0	Design Criteria for Subsurface Irrigation Systems
6.0	Requirements for Dispersed Subsurface Irrigation Systems
7.0	Requirements for Mulch Basin Irrigation Systems
8.0	Signage Requirements
9.0	Operations and Maintenance Manual
10.0	References
Appendix A	Glossary of Terms

List of Tables

1	Graywater Treatment Works Setback Requirements
2	Soil Type Description and Maximum Hydraulic Loading Rate
3	Soil Amendment Gradation Requirements

**Abbreviations and Acronyms**

ANSI	American National Standards Institute
BK	Blocky
C.R.S.	Colorado Revised Statutes
FEMA	Federal Emergency Management Agency
gpd	gallons per day
GR	Granular
mg/L	milligrams per Liter
MPI	Minutes Per Inch
NFIP	National Flood Insurance Program
NSF	NSF International, formally known as National Sanitation Foundation
OWTS	On-site Wastewater Treatment System(s)
PR	Prismatic
UIC	Underground Injection Control

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## 1.0 Introduction

This design criteria document contains the minimum requirements for all graywater treatment works installed in the City and County of Denver.

Materials incorporated by reference include only those versions that were in effect as of **January 1, 2016** and not later amendments to the incorporated material.

A glossary of terms is included in Appendix A.

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## 2.0 Flow Projections

All graywater treatment works must be sized using the following flow projection methods:

### 2.1 Flow Projections for Residential Uses

Flow to graywater treatment works must be based on the occupancy and the fixtures connected to the graywater treatment works. The calculated graywater flow is the number of occupants multiplied by the estimated graywater flow from each attached fixture.

- A. The occupancy must be calculated based on a minimum of two (2) occupants for the first bedroom and one (1) occupant for each additional bedroom.
- B. The estimated graywater flow from each fixture is based on the design flow of the fixture. If the fixture's design flow is unknown then the estimated graywater flow per occupant is:
  - 1. Traditional fixtures: 25 gpd/occupant for each shower, bathtub, and wash basin and 15 gpd/occupant for each clothes washer.
  - 2. Water saving fixtures: 20 gpd/occupant for each shower, bathtub, and wash basin and 8 gpd/occupant for each clothes washer.

### 2.2 Flow Projections for Non-Residential Uses

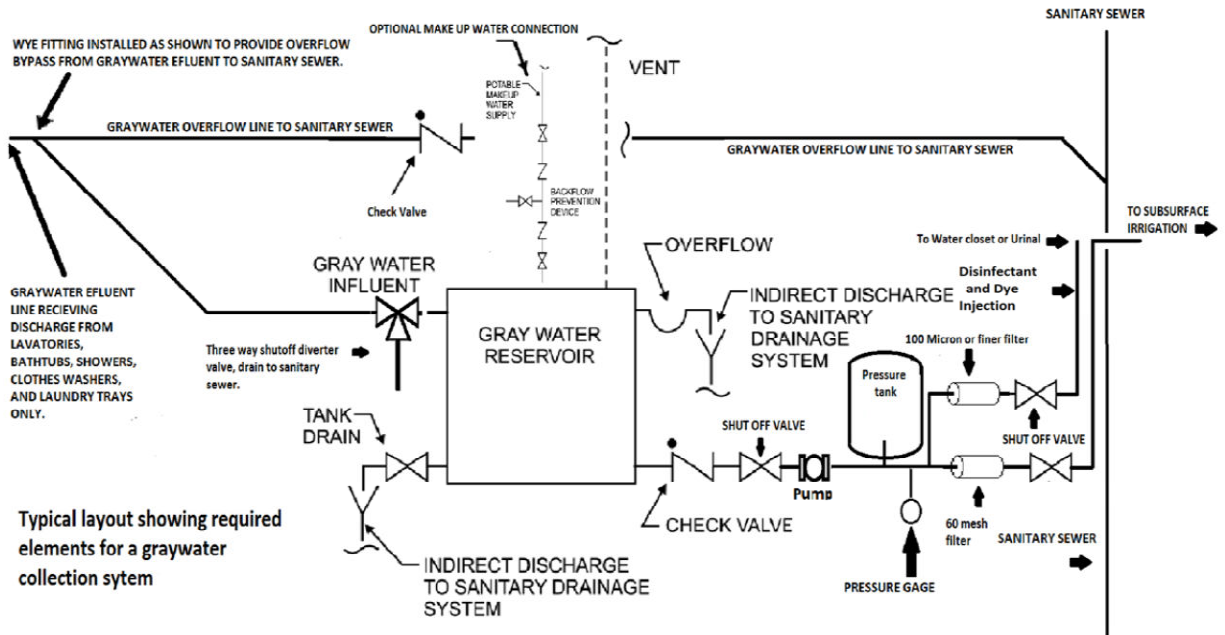
Graywater treatment works must be sized in accordance with fixture or water use records taking into account the number of fixtures attached to the graywater treatment works.

### 3.0 Design Criteria Applicable to All Graywater Treatment Works

The following minimum design criteria are required for all graywater treatment works:

- 3.1 All graywater treatment works must be designed to meet the design requirements of this Criteria Manual, the Denver and Colorado Plumbing Codes, the backflow prevention requirements of Section 5.05 of Denver Water's Engineering Standards, and the Colorado Water Quality Control Commission's Regulation 86, Graywater Control.
- 3.2 The design flow of each treatment component or combination of multiple components must be greater than the calculated peak graywater production if upstream of the storage tank or if no tank is present.
- 3.3 The graywater treatment works must have a diversion valve that directs graywater to either the graywater treatment works or a closed sewerage system. The diversion valve must be:
  - A. Easily operable;
  - B. Clearly labeled;
  - C. Constructed of material that is durable, corrosion resistant, watertight;
  - D. Designed to accommodate the inlet and outlet pipes in a secure and watertight manner, and;
  - E. Indirectly connect the bypass line to the closed sewerage system.
- 3.4 The graywater treatment works may not have any piping that allows the treatment process(es) or a storage tank to be bypassed prior to graywater use.
- 3.5 The graywater treatment works must include a tank to collect and store graywater except for subsurface irrigation systems that discharge to a mulch basin. The storage tank must:
  - A. Be constructed of durable, non-absorbent, water-tight, and corrosion resistant materials;
  - B. Be closed and have access openings for inspection and cleaning;
  - C. Be vented:
    1. for indoor tanks: the tanks must be vented to the atmosphere outside of the house;
    2. for outdoor tanks: the storage tank must have a downturned screened vent;
  - D. Have an overflow line:
    1. with the same or larger diameter line as the influent line;
    2. without a shut off valve;
    3. that is trapped to prevent the escape of gas vapors from the tank; and
    4. that is indirectly connected to the closed sewerage system;

- E. Have a valved drain line with the same or larger diameter line as the influent line that is indirectly connected to the closed sewerage system;
  - F. Be a minimum of 50 gallons;
  - G. Be placed on a stable foundation;
  - H. If located outdoors, not be exposed to direct sunlight, and;
  - I. Have a permanent label that states “CAUTION! NON-POTABLE WATER. DO NOT DRINK.”
- 3.6 Backup potable water requirements:
- A. Indoor toilet or urinal flushing graywater treatment works (Categories C and D) must have a backup potable water system connection.
  - B. Subsurface irrigation graywater treatment works (Categories A and B) may, but are not required to have a backup potable water system that provides potable irrigation water when graywater is not being produced or is produced in insufficient quantities.
  - C. Backup potable water system connections must be designed to prevent uncontrolled cross connections between the graywater treatment works and the potable water system. To meet this requirements, all connections to public or non-public water supply systems must be protected in accordance with Section 5.05 of Denver Water’s Engineering Standards (available at <http://www.denverwater.org/DoingBusinesswithUs/EngineeringOverview/>). Those standards require a reduced pressure principle backflow prevention assembly.
- 3.7 Graywater treatment works may not be used as a factor to reduce the design, capacity or soil treatment area requirements for OWTS or domestic wastewater treatment works.
- 3.8 Wastewater from graywater treatment works (e.g., filter backwash water) must be properly contained and disposed into a closed sewerage system or an approved Underground Injection Control (UIC) well.
- 3.9 All graywater piping shall be purple in color or the piping shall be installed with a purple identification tape or wrap the entire length of the piping and shall be embossed, or integrally stamped or marked, with the words: “CAUTION: NONPOTABLE WATER – DO NOT DRINK”..
- 3.10 Floodways / Floodplains
- A. Graywater treatment works and graywater use are prohibited in floodways.
  - B. Subsurface irrigation with graywater is prohibited in the 100-year floodplain.
  - C. Graywater treatment works located in a 100-year floodplain must meet or exceed the requirements of FEMA and the local emergency agency. The graywater system must be designed to minimize or eliminate infiltration of floodwaters into the system and prevent discharge from the system into the floodwaters.
- 3.11 Collection and distribution systems for all graywater treatment works must be located within the confines of the legal property boundary on which they are located and not within a City right of way, an easement, or an adjacent property.
- 3.12 The following figure is a schematic of a typical graywater system



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#### **4.0 Design Criteria for Indoor Toilet and Urinal Flushing Graywater Treatment Works**

##### **4.1 General Requirements**

- A. Criteria listed in Section 3.0 of this design criteria document apply to all subsurface irrigation graywater treatment works.
- B. A disinfection system is required for all graywater treatment works producing graywater to be used for indoor toilet and urinal flushing. The disinfection system must be capable of providing a free chlorine residual of 0.2 to 4.0 mg/L in the graywater throughout the indoor graywater plumbing system.
- C. All graywater treatment works producing water for indoor toilet and urinal flushing must include a dye injection system that is capable of providing a blue or green food grade vegetable dye at a concentration that is visibly distinct from potable water.

##### **4.2 Category C: Single Family**

The following minimum design criteria are required for Category C (single family, indoor toilet and urinal flushing) graywater treatment works:

- A. The graywater treatment works must be certified under “Class R” of NSF/ANSI 350 Onsite Residential and Commercial Water Reuse Treatment Systems.

##### **4.3 Category D: Non-Single Family**

The following minimum design criteria are required for Category D (non-single family, indoor toilet and urinal flushing) graywater treatment works for:

- A. The graywater treatment works must be certified under “Class R” or “Class C” of NSF/ANSI 350 Onsite Residential and Commercial Water Reuse Treatment Systems. Required classification shall be dictated by the size of the graywater treatment works and if the graywater sources are residential or commercial as defined by NSF/ANSI 350.
- B. For graywater treatment works that have a capacity to receive greater than 2,000 gallons per day, the design must be prepared under the supervision of and submitted with the seal and signature of a professional engineer licensed to practice engineering in the State of Colorado in accordance with the requirements of the Colorado Department of Regulatory Agencies (DORA) – Division of Registrations.

##### **4.4 Treatment Works Capable of Using Graywater for Toilet and Urinal Flushing and Subsurface Irrigation**

- A. Category C and D indoor toilet and urinal flushing graywater treatment works that are capable of using graywater for subsurface irrigation may be designed to allow graywater to be diverted to the subsurface irrigation system prior to the disinfection and dye process, however after the point of diversion the subsurface irrigation portion of the system must meet the requirements for subsurface irrigation systems described in Sections 5.0, 6.0, and 7.0.



## 5.0 Design Criteria for Subsurface Irrigation Systems

The following minimum design criteria are required for all graywater treatment works being used for subsurface irrigation.

### 5.1 General Requirements

- A. Criteria listed in Section 3.0 of this design criteria document apply to all Category A and B graywater treatment works.
- B. Subsurface irrigation components of the graywater irrigation system must be installed a minimum of four inches (4") and a maximum of twelve inches (12") below the finished grade.
- C. The irrigation field may only be located on slopes of less than thirty percent (30%) from horizontal.
- D. Controls must be present to ensure the distribution of graywater throughout the entire irrigation zone. Controls include valves, switches, timers, and other controllers, as appropriate.
- E. Emitters must be designed to resist root intrusion and be of a design recommended by the manufacturer for the intended graywater flow and use. Minimum spacing between emitters shall be sufficient to deliver graywater at an agronomic rate and to prevent surfacing or runoff.
- F. All irrigation supply lines shall be polyethylene tubing or PVC Class 200 pipe or better and Schedule 40 fittings. All joints shall be pressure tested at 40 psi (276 kPa), and shown to be drip tight for five minutes before burial. Drip feeder lines can be poly or flexible PVC tubing.
- G. All irrigation systems must meet the setback distances in Table 1.

**Table 1: Graywater Treatment Works Setback Requirements**

<b>Minimum Horizontal Distance Required from:</b>	<b>Graywater Storage Tank</b>	<b>Irrigation Field</b>
Buildings	5 feet	2 feet
Property line adjoining private property	10 feet	10 feet
Property line adjoining private property with supporting property line survey	1.5 feet	1.5 feet
Water supply wells	50 feet	100 feet
Streams and lakes	Outside of Floodway / 100 Yr. Floodplain	Outside of Floodway / 100 Yr. Floodplain
Seepage pits or cesspools	5 feet	5 feet
OWTS disposal field	5 feet	25 feet
OWTS tank	5 feet	10 feet
Domestic potable water service line	10 feet	10 feet
Public water main	10 feet	10 feet

## 5.2 Protocols for Determining the Size of the Subsurface Irrigation Area

- A. Irrigation Area Equation: The size of the irrigation area for single family (Category A and C), dispersed subsurface irrigation systems may be calculated using the following irrigation area equation. The equation cannot be used to size mulch basins.

$$LA = GW / (CF \times ET \times PF)$$

Where:

- LA = Landscaped area (square feet);
- GW = Estimated graywater flow (gallons per week);
- CF = Conversion factor, 0.62 (square foot x inch / gallon);
- ET = Evapotranspiration rate (inch / week), as determined by USDA Natural Resources Conservation Service CO652.0408 "Figure CO4- 1: Map of Colorado Climate Zones" dated April 1978, or weekly averages based on actual conditions;
- PF = Plant factor, 0.5.

- B. Site Evaluation: The size of the irrigation area for non-single family (Category B and D) dispersed subsurface irrigation must be determined by a site evaluation. Site evaluations may also be conducted to determine the size of single family Category A and C dispersed subsurface irrigation systems. The site evaluation must include:
1. A site map showing the location of proposed graywater irrigation components and the irrigation area in relation to physical features requiring setbacks in Table 1.
  2. A soil investigation to determine long-term acceptance rates of soils in a graywater irrigation area. The results of the soil investigation must be used as a basis for the design of the treatment works. The soil investigation must consist of either:
    - a. a visual and tactile evaluation of soil profile test pit, or
    - b. a percolation test.

## 5.3 Soil Requirements

- A. Table 2 describes soil types and maximum hydraulic loading rates for typical soils in the Denver area.
- B. Subsurface irrigation components of the graywater irrigation system must be installed in suitable soil, as defined in Table 2.
- C. A minimum of twenty-four inches (24") of suitable soil must be present between the subsurface irrigation components of the graywater irrigation system and any restrictive soil layer, bedrock, concrete, or the highest water table. Restrictive soil layers are soil types 4, 4A, and 5 in Table 2.
- D. Soil suitability:

1. Type 2, 2A, 3, or 3A undisturbed, native is suitable for subsurface graywater irrigation systems,
2. Type 0 or 1 soils must be amended as described in Section 5.3.D to improve drainage characteristics is suitable for subsurface irrigation systems,
3. Type 4, 4A, and 5 are not suitable for subsurface graywater irrigation and must be removed and replaced with soil with suitable drainage characteristics as described in Section 5.3.D.

**Table 2: Soil Type Description and Maximum Hydraulic Loading Rate**

<u>Soil Type</u>	<u>USDA Soil Texture</u>	<u>USDA Structure - Shape</u>	<u>USDA Soil Structure-Grade</u>	<u>Percolation Rate (MPI)</u>	<u>Loading Rate for Graywater (gal./sq. ft./day)</u>
0	Soil Type 1 with more than 35% Rock (>2mm); Soil Types 2-5 with more than 50% Rock (>2mm)	--	0 (Single Grain)	Less than 5	Not suitable without augmentation  1.0 with augmentation
1	Sand, Loamy Sand	--	0	5-15	Not suitable without augmentation  1.0 with augmentation
2	Sandy Loam, Loam, Silt Loam	PR BK GR	2 (Moderate) 3 (Strong)	16-25	0.8
2A	Sandy Loam, Loam, Silt Loam	PR, BK, GR 0 (none)	1 (Weak) Massive	26-40	0.6
3	Sandy Clay Loam, Clay Loam, Silty Clay Loam	PR, BK, GR	2, 3	41-60	0.4
3A	Sandy Clay Loam, Clay Loam, Silty Clay Loam	PR, BK, GR 0	1 Massive	61-75	0.2
4	Sandy Clay, Clay, Silty Clay	PR, BK, GR	2, 3	76-90	Not suitable
4A	Sandy Clay, Clay, Silty Clay	PR, BK, GR 0	1 Massive	91-120	Not suitable
5	Soil Types 2-4A	Platy	1, 2, 3	121+	Not suitable

E. Amended soils must meet the following criteria to ensure suitable drainage characteristics for surface graywater irrigation systems:

1. The amendment must have an organic content that is at least five percent (5%) and no greater than ten percent (10%);
2. The amendment must be a well blended mix of mineral aggregate (soil) and compost where the soil ratio depends on the requirements for the plant species; and

3. The mineral aggregate must meet the gradation requirements of Table 3.
4. Soil amendments must be tilled into the native soil a minimum of six inches (6") below irrigation application zone.
5. Soil types 0 and 1 must be amended before use. Soil type 4, 4A, and 5 are not suitable for subsurface irrigation and must be removed and replaced with soil with suitable drainage characteristics as described in Section 5.3.D.

**Table 3: Soil Amendment Gradation Requirements**

Sieve	Percent Passing
3/8	100
No. 4	95 - 100
No. 10	75 - 90
No. 40	25 - 40
No. 100	4 - 10
No. 200	2 - 5

- 5.4 Irrigation rates must not exceed maximum allowable soil loading rates in Table 2 based on the finest textured soil in the twenty-four inches (24") of suitable soil beneath the subsurface irrigation components

## 6.0 Requirements for Dispersed Subsurface Irrigation Systems

The following minimum design criteria are required for graywater treatment works using dispersed irrigation systems for subsurface irrigation:

- 6.1 Criteria listed in Sections 3.0 and 5.0 of this design criteria document apply to all graywater treatment works generating graywater for use in subsurface irrigation systems.
- 6.2 Dispersed irrigation systems must include a cartridge filter, which must meet the following requirements:
  - A. A minimum of 60 mesh;
  - B. Located between the storage tank and the irrigation system;
  - C. If a pump is being used to pressurize the graywater distribution system, the filter must be located after the pump.
  - D. Filters shall be accessible for inspection and maintenance.
  - E. Filters shall utilize a pressure gauge or other approved method to provide indication when a filter requires servicing or replacement.
  - F. Filters shall be installed with shutoff valves immediately upstream and downstream to allow for isolation during maintenance.

## 7.0 Requirements for Mulch Basin Irrigation Systems

The following minimum design criteria are required for graywater treatment works using mulch basin irrigation systems for subsurface irrigation:

- 7.1 Criteria listed in Section 3.0 of this design criteria document apply to all graywater treatment works generating graywater for use in subsurface irrigation systems.
- 7.2 Mulch basins must be sized using the Site Evaluation method described in Section 5.2.B. The soil requirements of Section 5.3 must be followed for siting and sizing of all mulch basins.
- 7.3 Mulch basins must meet the setback distances in Table 1.
- 7.4 The mulch basin must have a minimum depth of twelve inches (12") below grade and not more than twenty four (24") below grade.
- 7.5 Mulch Basin Supply Lines
  - A. All mulch basin supply lines shall be polyethylene tubing or PVC Class 200 pipe or better and Schedule 40 fittings. All joints shall be pressure tested at 40 psi (276 kPa), and shown to be drip tight for five minutes before burial.
  - B. Mulch basin supply lines must discharge a minimum of four inches (4") below grade into a container for dispersal of graywater into the mulch basin. The container must be designed to have four inches (4") of freefall between the invert of the discharge pipe and the mulch. The container must have an access lid for observation of flow and to check mulch levels.
- 7.6 Mulch shall be permeable enough to allow rapid infiltration of graywater.
- 7.7 Mulch Basin Minimum Void Space
  - A. If the graywater treatment works does not have a storage tank or if it has a tank that does not meet the requirements of Section 3.5, the minimum void space is three (3) times the anticipated average daily flow for graywater treatment works. This provides sufficient volume for graywater surges and should prevent surfacing or runoff.
  - B. If the graywater treatment works has a storage tank that meets the requirements of Section 3.5, the minimum void space is one and a half (1.5) times the anticipated average daily flow for graywater treatment works
- 7.8 Mulch basin irrigation systems do not require a filter.
- 7.9 Mulch basins may only be located on slopes of less than thirty percent (30%) from horizontal.

## 8.0 Signage Requirements

Words on signs shall be legibly and indelibly printed on a tag or sign constructed of corrosion-resistant waterproof material or shall be indelibly printed on the fixture. The letters of the words shall be not less than 0.5 inch (12.7 mm) in height and in colors in contrast to the background on which they are applied.

### 8.1 Single Family Graywater Treatment Works (Category A)

- A. There are no signage requirements for Category A Graywater Treatment Works.

### 8.2 Single Family Graywater Treatment Works (Category C)

- A. All single family graywater treatment works (Category C) must comply with the following signage requirements.
1. Plumbing fixtures flushed with nonpotable water shall be identified with permanent signage that reads as follows: "Nonpotable water is used to flush this fixture. CAUTION: NONPOTABLE WATER – DO NOT DRINK." In addition to the required wordage, the pictograph shown below shall appear on the required signage.



### 8.3 Non-Single Family Graywater Treatment Works (Categories B and D)

- A. All non-single family graywater treatment works (Categories B and D) must comply with the following signage requirements.
1. A permanent warning sign must be visible at all fixtures from which graywater is collected. The signs must state that, "WATER FROM THIS FIXTURE IS REUSED. CHEMICALS, EXCRETA, PETROLEUM OILS AND HAZARDOUS MATERIALS MUST NOT BE DISPOSED DOWN THE DRAIN";
  2. Each room that contains graywater treatment works components must have a sign that says "CAUTION GRAYWATER TREATMENT WORKS, DO NOT DRINK, DO NOT CONNECT TO THE POTABLE DRINKING WATER SYSTEM. NOTICE: CONTACT BUILDING MANAGEMENT BEFORE PERFORMING ANY WORK ON THIS WATER SYSTEM."

- B. Non-single family, subsurface irrigation graywater treatment works (Categories B and D, if applicable) must comply with the following signage requirement:
  - 1. Each irrigation area must have a sign that says “CAUTION GRAYWATER BEING USED FOR IRRIGATION. DO NOT DRINK, DO NOT CONNECT TO THE POTABLE DRINKING WATER SYSTEM.”
- C. Non-single family, indoor toilet and urinal flushing graywater treatment works (Category D) must comply with the following signage requirement:
  - 1. Plumbing fixtures flushed with nonpotable water must be identified as described in Section 8.2.A.

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**9.0 Operation and Maintenance Manual**

- 9.1 All graywater treatment works must have an Operations and Maintenance (O&M) manual. The O&M manual must include the following items:
- A. A graywater treatment works description including: equipment list, design basis data including but not limited to, design volumes, design flow rates of each component and service area, system as-built drawing, and process description.
  - B. Maintenance information for the graywater treatment works including but not limited to: component maintenance schedule, instructions for component repair, replacement, or cleaning, replacement component source list, testing and frequency for potable containment device, and instructions for periodic removal of residuals.
  - C. Operational ranges for parameters including but not limited to: disinfectant concentration levels, filter replacement parameters, pressure ranges, tank level, and valve status under normal operation.
  - D. Step-by-step instructions for starting and shutting down the graywater treatment works including but not limited to: valve operation, any electrical connections, cleaning procedures, visual inspection, and filter installation.
  - E. A guide for visually evaluating the graywater treatment works and narrowing any problem scope based on alarm activations, effluent characteristics, system operation, and history.
  - F. A list of graywater control measures in which the graywater treatment works must be operated.
- 9.2 The graywater treatment works must be operated and maintained in accordance with the O&M manual, including all manufacturer recommended maintenance activities.
- 9.3 The O&M manual must remain with the graywater treatment works throughout the system's life and be updated based on each time upgrades or modifications are made to the system.
- 9.4 The O&M manual must be transferred, upon change of ownership or occupancy, to the new owner or tenant.
- 9.5 Category D graywater treatment works with a capacity to receive greater than 2,000 gallons per day (gpd) must maintain operation and maintenance records for a minimum period of five (5) years.

## 10.0 References

City and County of Denver - Article II, Part 12 of the City and County of Denver Charter

Denver Revised Municipal Code - Chapter 24, Article XIII of the Denver Revised Municipal Code (DRMC)

The Colorado Water Quality Control Act (CWQCA) section 25-8-205(1)(g), C.R.S.

Colorado Water Quality Control Commission's (WQCC) Regulation 86, Graywater Control (5 CCR 1002-86).

Denver Graywater Rules and Regulations

Denver Water's Engineering Standards

USDA Natural Resources Conservation Service CO652.0408 "Figure CO4- 1: Map of Colorado Climate Zones" dated April 1978,

Denver Plumbing Code

Colorado Plumbing Code

NSF/ANSI 350

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**Appendix A Glossary of Terms**

“Agronomic rate” means the rate of application of nutrients to plants that is necessary to satisfy the nutritional requirements of the plants.

“Closed sewerage system” means either a permitted domestic wastewater treatment works, which includes a permitted and properly functioning OWTS with a design capacity more than 2,000 gpd, or a properly functioning and approved or permitted OWTS with a design capacity of 2,000 gpd or less.

“Component” means a subpart of a graywater treatment works which may include multiple devices.

“Cross-Connection” means any connection that could allow any water, fluid, or gas such that the water quality could present an unacceptable health and/or safety risk to the public, to flow from any pipe, plumbing fixture, or a customer’s water system into a public water system’s distribution system or any other part of the public water system through backflow.

“Design” means the process of selecting and documenting in writing the size, calculations, site specific data, location, equipment specification and configuration of treatment components that match site characteristics and facility use.

“Design flow” means the estimated volume of graywater per unit of time for which a component or graywater treatment works is designed.

“Dispersed subsurface irrigation” means a subsurface irrigation system including piping and emitters installed throughout an irrigation area.

“Emitter” means a device used in drip irrigation to control the flow of water into the soil.

“Facility” means any building, structure, or installation, or any combination thereof that uses graywater subject to a local graywater control program, is located on one or more contiguous or adjacent properties, and is owned or operated by the same person or legal entity. Facility is synonymous with the term operation.

“Floodplain (100-year)” means an area adjacent to a river or other watercourse which is subject to flooding as the result of the occurrence of a one hundred (100) year flood, and is so adverse to past, current or foreseeable construction or land use as to constitute a significant hazard to public or environmental health and safety or to property or is designated by the Federal Emergency Management Agency (FEMA) or National Flood Insurance Program (NFIP). In the absence of FEMA/NFIP maps, a professional engineer shall certify the floodplain elevations.

“Floodway” means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot or as designated by the Federal Emergency Management Agency or National Flood Insurance Program. In the absence of FEMA/NFIP maps, a professional engineer shall certify the floodway elevation and location.

“Graywater” means that portion of wastewater that, before being treated or combined with other wastewater, is collected from fixtures within residential, commercial, or industrial buildings or institutional facilities for the purpose of being put to beneficial uses. Sources of graywater are limited to discharges from bathroom and laundry room sinks, bathtubs, showers, and laundry machines. Graywater does not include the wastewater from toilets, urinals, kitchen sinks, dishwashers, or nonlaundry utility sinks.

“Graywater treatment works” means an arrangement of devices and structures used to: (a) collect graywater from within a building or a facility; and (b) treat, neutralize, or stabilize graywater within the same building or facility to the level necessary for its authorized uses.

“Mulch” means organic material including but not limited to leaves, prunings, straw, pulled weeds, and wood chips.

“Mulch basin” means a type of irrigation or treatment field filled with mulch or other approved permeable material of sufficient depth, length, and width to prevent ponding or runoff. A mulch basin may include a basin around a tree, a trough along a row of plants, or other shapes necessary for irrigation.

“Non-Single Family” means any structure that is not a single family structure.

“Potable water system” means a system for the provision of water to the public for human consumption through pipes or other constructed conveyances, where such system has less than fifteen service connections or regularly serves less than an average of at least 25 individuals daily at least 60 days per year.

“Professional engineer” means an engineer licensed in accordance with section 12-25-1, C.R.S.

“Public water system” means a system for the provision of water to the public for human consumption through pipes or other constructed conveyances, if such system has at least fifteen service connections or regularly serves an average of at least 25 individuals daily at least 60 days per year. A public water system is either a community water system or a non-community water system. Such term does not include any special irrigation district. Such term includes:

- (a) Any collection, treatment, storage, and distribution facilities under control of the supplier of such system and used primarily in connection with such system.
- (b) Any collection or pretreatment storage facilities not under such control, which are used primarily in connection with such system.

“Single family” means a detached or attached structure, arranged and designed as a single family residential unit intended to be occupied by not more than one family and that has separate water and sewer services connections from other dwelling units.

“Site evaluation” means a comprehensive analysis of soil and site conditions for a graywater irrigation area.

“Soil horizon” means layers in the soil column differentiated by changes in texture, color, redoximorphic features, bedrock, structure, consistence, and any other characteristic that affects water movement.

“Soil profile test pit” means a trench or other excavation used for access to evaluate the soil horizons for properties influencing effluent movement, bedrock, evidence of seasonal high ground water, and other information to be used in locating and designing a graywater irrigation area.

“Suitable soil” means unsaturated soil in which the movement of water, air, and growth of roots is sustained to support healthy plant life and conserve moisture. Soil criteria for graywater subsurface irrigation are further defined in the City and County of Denver’s Graywater Design Criteria Document.

“Subsurface irrigation” means a discharge of graywater into soil a minimum of four inches (4”) and no deeper than twelve inches (12”) below the finished grade.

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