

4.13 Gray Water System

Revision: November 3, 2016

Installer registration permit: Property owner or standard and basic (complex if pressurized)

Licensed professional engineer required: No (yes if pressurized)

4.13.1 Description

A gray water system is used to distribute gray water in the root zone of landscaping. Gray water is domestic wastewater that consists of used water from bathtubs, showers, and sinks used only for hand washing. Other acceptable gray water sources may be determined on a case-by-case basis as long as the source does not come into contact with blackwaste or food products (e.g., drinking fountain or ice machine). Gray water does not include wastewater from toilets, kitchen sinks, water softeners, dishwashers, or clothes washing machines, or nondomestic wastewater sources. A gray water system consists of a separate plumbing system for the approved gray water sources from the nonapproved wastewater sources, a dosing chamber or tank with surge capacity to temporarily hold large drain flows, a filter to remove particles that could clog the irrigation system, a pump to move the gray water from the surge tank to the dosing chamber to the drip irrigation field (if necessary), and a drip irrigation system or mini-leachfield to distribute the gray water.

4.13.2 Approval Conditions

1. Gray water treatment system components must meet all the effective soil depths and separation distance criteria required by IDAPA 58.01.03 for standard systems.
2. Minimum irrigation area shall be based on the landscape area calculated in Equation 4-11 and/or Equation 4-12.
3. Separate plumbing designs for the gray water and other wastewater sources will need to be approved by the Idaho Division of Building Safety, Plumbing Program.
4. Gray water tanks for gravity flow systems must be watertight, noncorrosive, and included on the approved product lists in sections 5.2 and 5.3.
5. Dosing chambers shall meet the requirements of section 4.19.3.4 and should account for surge flows and storage to meet the irrigation needs of the system:
 - a. Must have an overflow to the subsurface sewage disposal system with an invert elevation lower than the inlet or pressure pipe outlet of the chamber.
 - b. High level audio and visual alarms are not required.
6. The system must be designed by a PE licensed in Idaho if using drip or pressure distribution.
7. The design engineer shall provide an O&M manual for the system to the health district before permit issuance.
8. The drip distribution (irrigation) system shall meet the requirements of section 4.5 for pretreated effluent drip distribution systems except that a pretreatment system is not required.
9. Mini-leachfields shall meet the design requirements for drainfields outlined in IDAPA 58.01.03.008, except for those deviations allowed in Table 4-10, and shall use geotextile fabric for the drainrock-soil barrier.

- 10 Gray water may not be used to irrigate vegetable gardens.
11. Gray water shall not be applied on the land surface or be allowed to reach the land surface.
12. All wastewater generated that is not approved to be discharged to the gray water system shall either discharge to a full-sized subsurface sewage disposal system or collection system for a private or public municipal wastewater treatment plant.

Table 4-10. Gray water gravity flow mini-leachfield design criteria.

Mini-leachfield Design Criteria	Minimum	Maximum
Number of drain lines per irrigation zone	1	—
Length of each perforated line	—	100 feet
Distribution area square footage	—	1,500
Bottom width of trench	6 inches	18 inches
Total depth of trench	12 inches	18 inches
Spacing of line, center-to-center	3 feet	4 feet
Depth of earth cover over lines	6 inches	12 inches
Depth of aggregate over pipe	2 inches	—
Depth of aggregate beneath pipe	2 inches	—
Grade on perforated pipe	Level	1 inch/100 feet

4.13.3 Design Requirements

1. Gray water flows are determined by calculating the maximum number of occupants or visitors in the wastewater-generating structure. Residences shall be based on the first bedroom with two occupants and each bedroom thereafter with one occupant unless higher usage is proposed by the applicant.
2. Estimated daily gray water flows for each occupant are shown in Table 4-11:

Table 4-11. Gray water flow by fixture type connected to system in gallons per person per day.

Fixture	Gallons/Person/Day
Shower/bath	18
Hand sinks (faucets)	12
Other	Case-by-case determination

Multiply the number of occupants and visitors by the estimated gray water flow for the fixtures proposed to be connected to the gray water system.

For example: A three-bedroom house is designed for four people. The house has showers and hand sinks, thus each occupant is assumed to produce 430 GPD of gray water, resulting in a total of 120 GPD.

2. The formula shown in Equation 4-11 is used to estimate the square footage of landscape to be irrigated:

$$LA = \frac{GW}{ET \times PF \times 0.62}$$

Equation 4-11. Landscaped area needed for gray water produced.

where:

- GW = estimated gray water produced (gallons per week)
- LA = landscaped area (square feet)
- ET = evapotranspiration (inches per week)
- PF = plant factor, based on climate and type of plants either 0.3, 0.5, or 0.8
- 0.62 = conversion factor (from inches of ET to gallons per week)

For example: If ET = 2 inches per week, and lawn grasses are grown with a PF of 0.8 (high water using) then the landscaped area is equal to:

$$LA = (120 \text{ GPD} \times 7 \text{ days}) / (2 \times 0.8 \times 0.62) = 847 \text{ ft}^2 \text{ of lawn.}$$

3. An alternative to using gray water for lawns is to irrigate landscape plants. A plant factor depends on the type of plants watered, an ET rate, and plant canopy. Table 4-12 is used to calculate square footage of landscape plants that can be irrigated with gray water.

Table 4-12. Gray water application rates for landscape plants.

Evapotranspiration (inches per week)	Relative Water Need of Plant (plant factor)	Gallons per Week		
		200 ft ² Canopy	100 ft ² Canopy	50 ft ² Canopy
1	Low water using 0.3	38	19	10
	Medium water using 0.5	62	31	16
	High water using 0.8	100	50	25
2	Low water using 0.3	76	38	19
	Medium water using 0.5	124	62	31
	High water using 0.8	200	100	50
3	Low water using 0.3	114	57	28
	Medium water using 0.5	186	93	47
	High water using 0.8	300	150	75

Note: square feet (ft²)

Gallons per week (GPW) calculation for this chart was determined with Equation 4-12:

$$Gray \text{ water flow (GPW)} = ET \times \text{plant factor} \times \text{area} \times 0.62 \text{ (conversion factor)}$$

Equation 4-12. Gallons per week needed for irrigated plants.

This formula does not account for irrigation efficiency. If the irrigation system does not distribute water evenly, extra water will need to be applied.

For example: A three-bedroom home will produce 840 GPW (7 days x 120 GPD). If ET = 2 inches per week, then with the 840 gallons of gray water a homeowner could irrigate the following :

- a. Four small fruit trees: $4 \times 50 = 200$ gallons (high water using, 50-foot canopy)
- b. Six medium shade trees: $6 \times 62 = 372$ gallons (medium water using, 100-foot canopy)
- c. Eight large shrubs: $8 \times 31 = 248$ gallons (medium water using, 50-foot canopy)
- d. Total water use per week: 820 GPW

4.13.4 Other Requirements

1. The Uniform Plumbing Code (UPC) Gray Water Standards require that all gray water piping be marked *Danger—Unsafe Water*.
2. Valves in the plumbing system must be readily accessible, and backwater valves must be installed on dosing chamber drain connections to sanitary drains or sewer piping. Ball valves are recommended to be used in the system. Finally all piping must be downstream of water-seal type trap(s). If no such trap exists, an approved vented running trap shall be installed upstream of the connection to protect the building from possible waste or sewer gasses.
3. Dosing chamber or tank must be vented, and the tank drain and overflow gravity drain must be permanently connected to the structure’s septic tank or sewer line. The drain and overflow drain shall not be smaller in diameter than the inlet pipe.
4. Filters with a minimum flow capacity of 25 GPM are required.

Notes:

1. The plants listed in Table 4-13 are tolerant of sodium and chloride ions or have been reported to do well under gray water irrigation.
2. Different types of media can be used in gray water filtration. These include nylon or cloth filters, sand filters, and rack or grate filters.

Table 4-13. Sodium and chloride tolerant plants.

Agapanthus	Cottonwood	Honeysuckle	Olive	Rosemary
Arizona cypress	Crape myrtle	Italian stone pine	Pfitzer bush	Strawberry clover
Bermuda grass	Deodar cedar	Juniper	Purple hopseed bush	Star jasmine
Bougainvillea	Evergreen shrubs	Oaks	Redwoods	Sweet clover
Carpet grass	Holly	Oleander	Rose	

Figure 4-18 shows a single-tank gravity gray water system, and Figure 4-19 shows a single-tank pumped gray water system.

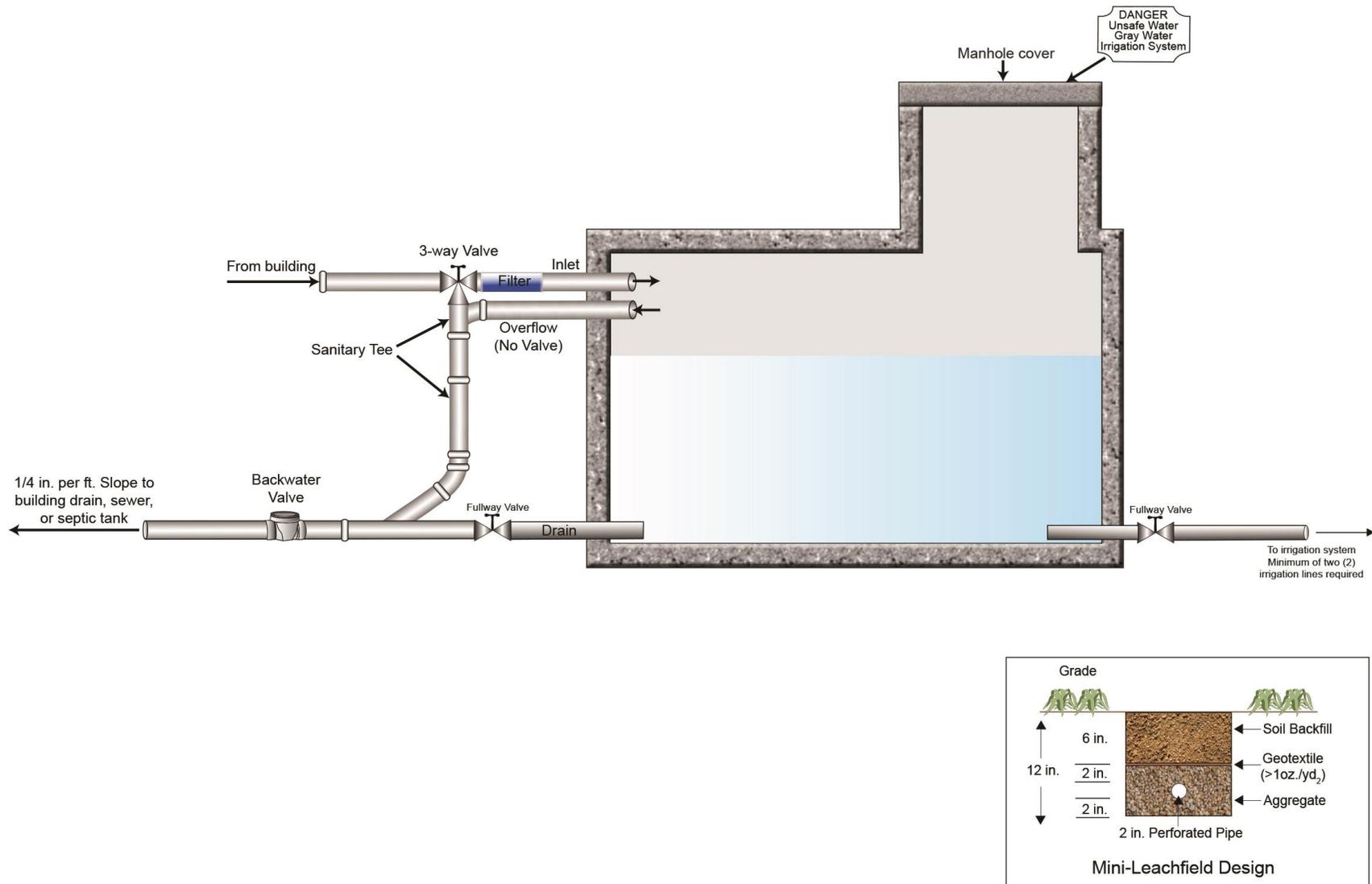


Figure 4-18. Gray water system (single-tank gravity).

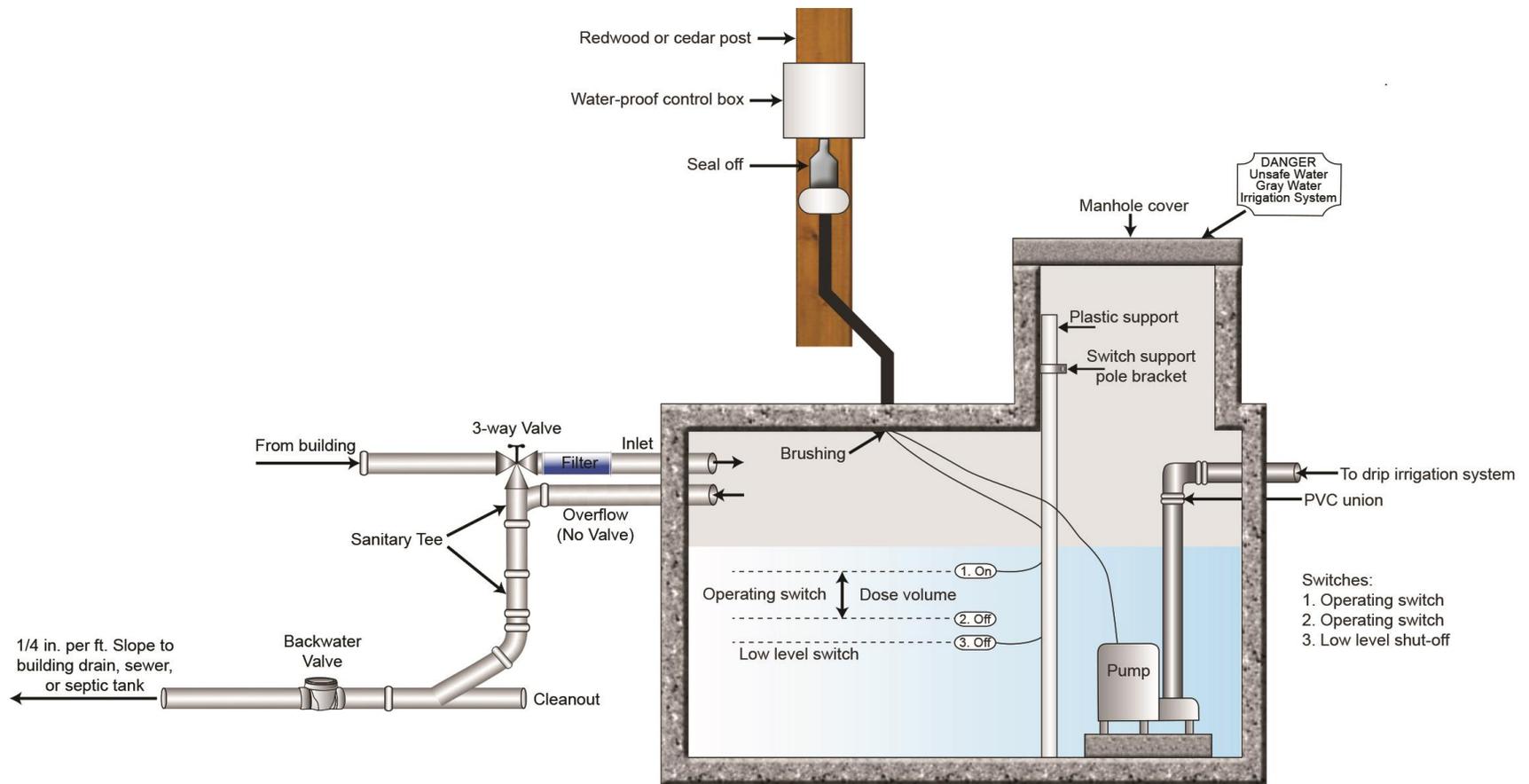


Figure 4-19. Gray water system (single-tank pumped).