**Chapter 14 Subsurface Graywater Soil Absorption Systems**

User note:

About this chapter: Chapter 14 provides regulations for disposing of nonpotable water to underground landscape irrigation piping. Testing procedures are provided to assess the capability of the soil to accept the volume of flow. This chapter covers the regulations, types and material standards for the piping of these systems.

Section 1401 General

1401.1 Scope

The provisions of this chapter shall govern the materials, design, construction and installation of subsurface graywater soil absorption systems connected to nonpotable water from on-site water reuse systems.

1401.2 Materials

Above-ground drain, waste and vent piping for subsurface graywater soil absorption systems shall conform to one of the standards listed in Table 702.1. Subsurface graywater soil absorption systems, underground building drainage and vent pipe shall conform to one of the standards listed in Table 702.2.

1401.3 Tests

Drain, waste and vent piping for subsurface graywater soil absorption systems shall be tested in accordance with Section 312.

1401.4 Inspections

Subsurface graywater soil absorption systems shall be inspected in accordance with Section 108.

1401.5 Disinfection

Disinfection shall not be required for on-site nonpotable water reuse for subsurface graywater soil absorption systems.

1401.6 Coloring

On-site nonpotable water reuse for subsurface graywater soil absorption systems shall not be required to be dyed.

Section 1402 System Design and Sizing

1402.1 Sizing

The system shall be sized in accordance with the sum of the output of all water sources connected to the subsurface graywater soil absorption system. Where graywater collection piping is connected to subsurface landscape irrigation systems, graywater output shall be calculated according to the gallons-per-day-per-occupant number based on the type of fixtures connected. The graywater discharge shall be calculated by the following equation:

(Equation 14-1)

where:

A = Number of occupants:

Residential—Number of occupants shall be determined by the actual number of occupants, but not less than two occupants for one bedroom and one occupant for each additional bedroom.

Commercial—Number of occupants shall be determined by the International Building Code.

B = Estimated flow demands for each occupant:

Residential—25 gallons per day (94.6 Lpd) per occupant for showers, bathtubs and lavatories and 15 gallons per day (56.7 Lpd) per occupant for clothes washers or laundry trays.

Commercial—Based on type of fixture or water use records minus the discharge of fixtures other than those discharging graywater.

C = Estimated graywater discharge based on the total number of occupants.

1402.2 Percolation Tests

The permeability of the soil in the proposed absorption system shall be determined by percolation tests or permeability evaluation.

1402.2.1 Percolation Tests and Procedures

Not fewer than three percolation tests in each system area shall be conducted. The holes shall be spaced uniformly in relation to the bottom depth of the proposed absorption system. More percolation tests shall be made where necessary, depending on system design.

1402.2.1.1 Percolation Test Hole

The test hole shall be dug or bored. The test hole shall have vertical sides and a horizontal dimension of 4 inches to 8 inches (102 mm to 203 mm). The bottom and sides of the hole shall be scratched with a sharp-pointed instrument to expose the natural soil. Loose material shall be removed from the hole and the bottom shall be covered with 2 inches (51 mm) of gravel or coarse sand.

1402.2.1.2 Test Procedure, Sandy Soils

The hole shall be filled with clear water to not less than 12 inches (305 mm) above the bottom of the hole for tests in sandy soils. The time for this amount of water to seep away shall be determined, and this procedure shall be repeated if the water from the second filling of the hole seeps away in 10 minutes or less. The test shall proceed as follows: Water shall be added to a point not more than 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, water levels shall be measured at 10-minute intervals for a period of 1 hour. Where 6 inches (152 mm) of water seeps away in less than 10 minutes, a shorter interval between measurements shall be used, but in no case shall the water depth exceed 6 inches (152 mm). Where 6 inches (152 mm) of water seeps away in less than 2 minutes, the test shall be stopped and a rate of less than 3 minutes per inch (7.2 s/mm) shall be reported. The final water level drop shall be used to calculate the percolation rate. Soils not meeting the requirements of this section shall be tested in accordance with Section 1402.2.1.3

1402.2.1.3 Test Procedure, Other Soils

The hole shall be filled with clear water, and a minimum water depth of 12 inches (305 mm) shall be maintained above the bottom of the hole for a 4-hour period by refilling whenever necessary or by use of an automatic siphon. Water remaining in the hole after 4 hours shall not be removed. Thereafter, the soil shall be allowed to swell not less than 16 hours or more than 30 hours. Immediately after the soil swelling period, the measurements for determining the percolation rate shall be made as follows: any soil sloughed into the hole shall be removed and the water level shall be adjusted to 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, the water level shall be measured at 30-minute intervals for a period of 4 hours, unless two successive water level drops do not vary by more than 1/16 inch (1.59 mm). Not fewer than three water level drops shall be observed and recorded. The hole shall be filled with clear water to a point not more than 6 inches (152 mm) above the gravel or coarse sand whenever it becomes nearly empty. Adjustments of the water level shall not be made during the three measurement periods except to the limits of the last measured water level drop. Where the first 6 inches (152 mm) of water seeps away in less than 30 minutes, the time interval between measurements shall be 10 minutes and the test run for 1 hour. The water depth shall not exceed 5 inches (127 mm) at any time during the measurement period. The drop that occurs during the final measurement period shall be used in calculating the percolation rate.

1402.2.1.4 Mechanical Test Equipment

Mechanical percolation test equipment shall be of an approved type.

1402.2.2 Permeability Evaluation

Soil shall be evaluated for estimated percolation based on structure and texture in accordance with accepted soil evaluation practices. Borings shall be made in accordance with Section 1402.2.1.1 for evaluating the soil.

1402.3 Subsurface Graywater Soil Absorption Site Location

The surface grade of all soil absorption systems shall be located at a point lower than the surface grade of any water well or reservoir on the same or adjoining lot. Where this is not possible, the site shall be located so surface water drainage from the site is not directed toward a well or reservoir. The soil absorption system shall be located with a minimum horizontal distance between various elements as indicated in Table 1402.3. Private sewage disposal systems in compacted areas, such as parking lots and driveways, are prohibited. Surface water shall be diverted away from any soil absorption site on the same or neighboring lots.

TABLE 1402.3

LOCATION OF SUBSURFACE GRAYWATER SOIL ABSORPTION SYSTEM

ELEMENT MINIMUM HORIZONTAL DISTANCE

Storage tank (feet) Absorption field (feet)

Buildings 5 2

Lot line adjoining private property 5 5

Public water main 10 10

Seepage pits 5 5

Septic tanks 0 5

Streams and lakes 50 50

Water service 5 5

Water wells 50 100

For SI: 1 foot = 304.8 mm.

Section 1403 Installation

1403.1 Installation

Absorption systems shall be installed in accordance with Sections 1403.1.1 through 1403.1.5.

1403.1.1 Absorption Area

The total absorption area required shall be computed from the estimated daily graywater discharge and the design-loading rate based on the percolation rate for the site. The required absorption area equals the estimated graywater discharge divided by the design-loading rate from Table 1403.1.1.

TABLE 1403.1.1

DESIGN LOADING RATE

PERCOLATION RATE (minutes per inch) DESIGN LOADING FACTOR (gallons per square foot per day)

0 to less than 10 1.2

10 to less than 30 0.8

30 to less than 45 0.72

45 to 60 0.4

For SI: 1 minute per inch = min/25.4 mm, 1 gallon per square foot = 40.7 L/m2.

1403.1.2 Seepage Trench Excavations

Seepage trench excavations shall be not less than 1 foot (305 mm) in width and not greater than 5 feet (1524 mm) in width. Trench excavations shall be spaced not less than 2 feet (610 mm) apart. The soil absorption area of a seepage trench shall be computed by using the bottom of the trench area (width) multiplied by the length of pipe. Individual seepage trenches shall be not greater than 100 feet (30 480 mm) in developed length.

1403.1.3 Seepage Bed Excavations

Seepage bed excavations shall be not less than 5 feet (1524 mm) in width and have more than one distribution pipe. The absorption area of a seepage bed shall be computed by using the bottom of the trench area. Distribution piping in a seepage bed shall be uniformly spaced not greater than 5 feet (1524 mm) and not less than 3 feet (914 mm) apart, and greater than 3 feet (914 mm) and not less than 1 foot (305 mm) from the sidewall or headwall.

1403.1.4 Excavation and Construction

The bottom of a trench or bed excavation shall be level. Seepage trenches or beds shall not be excavated where the soil is so wet that such material rolled between the hands forms a soil wire. Smeared or compacted soil surfaces in the sidewalls or bottom of seepage trench or bed excavations shall be scarified to the depth of smearing or compaction and the loose material removed. Where rain falls on an open excavation, the soil shall be left until sufficiently dry so a soil wire will not form when soil from the excavation bottom is rolled between the hands. The bottom area shall then be scarified and loose material removed.

1403.1.5 Aggregate and Backfill

Not less than 6 inches (152 mm) in depth of aggregate, ranging in size from 1/2 to 21/2 inches (12.7 mm to 64 mm), shall be laid into the trench below the distribution piping elevation. The aggregate shall be evenly distributed not less than 2 inches (51 mm) in depth over the top of the distribution pipe. The aggregate shall be covered with approved synthetic materials or 9 inches (229 mm) of uncompacted marsh hay or straw. Building paper shall not be used to cover the aggregate. Not less than 9 inches (229 mm) of soil backfill shall be provided above the covering.

1403.2 Distribution Piping

Distribution piping shall be not less than 3 inches (76 mm) in diameter. Materials shall comply with Table 1403.2. The top of the distribution pipe shall be not less than 8 inches (203 mm) below the original surface. The slope of the distribution pipes shall be not less than 2 inches (51 mm) and not greater than 4 inches (102 mm) per 100 feet (30 480 mm).

TABLE 1403.2

DISTRIBUTION PIPE

MATERIAL STANDARD

Polyethylene (PE) plastic pipe ASTM F405

Polyvinyl chloride (PVC) plastic pipe ASTM D2729

Polyvinyl chloride (PVC) plastic pipe with a 3.5-inch O.D. and solid cellular core or composite wall ASTM F1488

For SI: 1 inch=25.4 mm.

1403.2.1 Joints

Joints in distribution pipe shall be made in accordance with Section 705.