

2010

GREEN PLUMBING & MECHANICAL CODE SUPPLEMENT

FOR USE WITH ALL CODES

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CHAPTER 5

ALTERNATE WATER SOURCES FOR NON-POTABLE APPLICATIONS

501.0 General.

501.1 Scope. The provisions of this chapter shall apply to the construction, alteration, and repair of alternate water source systems for non-potable applications.

501.1.1 Allowable Use of Alternate Water. Where approved or required by the Authority Having Jurisdiction, alternate water sources (reclaimed (recycled) water, rainwater, gray water and onsite treated non-potable water) shall be permitted to be used in lieu of potable water for the applications identified in this chapter.

501.2 System Design. Alternate water source systems complying with this chapter shall be designed by a person registered or licensed to perform plumbing design work. Components, piping, and fittings used in any alternate water source system shall be listed.

Exceptions:

- (1) A person registered or licensed to perform plumbing design work is not required to design rainwater catchment systems used for irrigation with a maximum storage capacity of 360 gallons (1363 L).
- (2) A person registered or licensed to perform plumbing design work is not required to design rainwater catchment systems for single family dwellings where all outlets, piping, and system components are located on the exterior of the building.
- (3) A person registered or licensed to perform plumbing design work is not required to design gray water systems having a maximum discharge capacity of 250 gallons per day (gal/d) (15.77 L/s) for single family and multi-family dwellings.
- (4) A person registered or licensed to perform plumbing design work is not required to design an on-site treated non-potable water system for single family dwellings having a maximum discharge capacity of 250 gal/d (15.77 L/s).

501.3 Permit. It shall be unlawful for any person to construct, install, alter, or cause to be constructed, installed, or altered any alternate water source system in a building or on a premise without first obtaining a permit to do such work from the Authority Having Jurisdiction.

Exceptions:

- (1) A permit is not required for exterior rainwater catchment systems used for outdoor drip and subsurface irrigation with a maximum storage capacity of 360 gallons (1363 L).
- (2) A plumbing permit is not required for rainwater catchment systems for single family dwellings where all outlets, piping, and system components are located on the exterior of the building. This does not exempt the need for permits if required for electrical connections, tank supports, or enclosures.

501.4 Component Identification. System components shall be properly identified as to the manufacturer.

501.5 Maintenance and Inspection. Alternate water source systems and components shall be inspected and maintained in accordance with Section 501.5.1 through Section 501.5.3.

501.5.1 Frequency. Alternate water source systems and components shall be inspected and maintained in accordance with Table 501.5 unless more frequent inspection and maintenance is required by the manufacturer.

501.5.2 Maintenance Log. A maintenance log for gray water, rainwater, and on-site treated non-potable water systems is required to have a permit in accordance with Section 501.3 and shall be maintained by the property owner and be available for inspection. The property owner or designated appointee shall ensure that a record of testing, inspection and maintenance as required by Table 501.5 is maintained in the log. The log will indicate the frequency of inspection and maintenance for each system.

501.5.3 Maintenance Responsibility. The required maintenance and inspection of alternate water source systems shall be the responsibility of the property owner, unless otherwise required by the Authority Having Jurisdiction.

501.6 Operation and Maintenance Manual. An operation and maintenance manual for gray water, rainwater, and on-site treated water systems required to have a permit in accordance with Section 501.3 shall be supplied to the building owner by the system designer. The operating and maintenance manual shall include the following:

- (1) Detailed diagram of the entire system and the location of system components.
- (2) Instructions on operating and maintaining the system.
- (3) Details on maintaining the required water quality as determined by the Authority Having Jurisdiction.
- (4) Details on deactivating the system for maintenance, repair, or other purposes.
- (5) Applicable testing, inspection, and maintenance frequencies as required by Table 501.5.
- (6) A method of contacting the manufacturer(s).

501.7 Minimum Water Quality Requirements. The minimum water quality for alternate water source systems shall meet the applicable water quality requirements for the intended application as determined by the public health Authority Having Jurisdiction. In the absence of water quality requirements, the EPA/625/R-04/108 contains recommended water reuse guidelines to assist regulatory agencies develop, revise, or expand alternate water source water quality standards.

TABLE 501.5
MINIMUM ALTERNATE WATER SOURCE TESTING,
INSPECTION, AND MAINTENANCE FREQUENCY

DESCRIPTION	MINIMUM FREQUENCY
Inspect and clean filters and screens, and replace (if necessary)	Every 3 months
Inspect and verify that disinfection, filters and water quality treatment devices and systems are operational and maintaining minimum water quality requirements as determined by the Authority Having Jurisdiction	In accordance with manufacturer's instructions, and the Authority Having Jurisdiction
Inspect and clear debris from rainwater gutters, downspouts, and roof washers	Every 6 months
Inspect and clear debris from roof or other aboveground rainwater collection surfaces	Every 6 months
Remove tree branches and vegetation overhanging roof or other aboveground rainwater collection surfaces	As needed
Inspect pumps and verify operation	After initial installation and every 12 months thereafter
Inspect valves and verify operation	After initial installation and every 12 months thereafter
Inspect pressure tanks and verify operation	After initial installation and every 12 months thereafter
Clear debris from and inspect storage tanks, locking devices, and verify operation	After initial installation and every 12 months thereafter
Inspect caution labels and marking	After initial installation and every 12 months thereafter
Inspect and maintain mulch basins for gray water irrigation systems	As needed to maintain mulch depth and prevent ponding and runoff
Cross-connection inspection and test*	After initial installation and every 12 months thereafter

* The cross-connection test shall be performed in the presence of the Authority Having Jurisdiction in accordance with the requirements of this Chapter.

Exceptions:

- (1) Water treatment is not required for rainwater catchment systems used for aboveground irrigation with a maximum storage capacity of 360 gallons (1363 L).
- (2) Water treatment is not required for gray water used for subsurface irrigation.
- (3) Water treatment is not required for rainwater catchment systems used for subsurface or drip irrigation.

501.8 Material Compatibility. Alternate water source systems shall be constructed of materials that are compatible with the type of pipe and fitting materials, water treatment, and water conditions in the system.

501.9 System Controls. Controls for pumps, valves, and other devices that contain mercury that come in contact with alternate water source water supply shall not be permitted.

502.0 Gray Water Systems.

502.1 General. The provisions of this section shall apply to the construction, alteration, and repair of gray water systems.

502.2 Gray Water System.

502.2.1 Discharge. Gray water shall be permitted to be diverted away from a sewer or private sewage disposal system, and discharge to a subsurface irrigation or subsoil irrigation system. The gray water shall be permitted to discharge to a mulch basin for single family and multi-family dwellings. Gray water shall not be used to irrigate root crops or food crops intended for human consumption that come in contact with soil.

502.2.2 Surge Capacity. Gray water systems shall be designed to have the capacity to accommodate peak flow rates and distribute the total amount of estimated gray water on a daily basis to a subsurface irrigation field, subsoil irrigation field, or mulch basin without surfacing, ponding, or runoff. A surge tank is required for all systems that are unable to accommodate peak flow rates and distribute the total amount of gray water by gravity drainage. The water discharge for gray water systems shall be determined in accordance with Section 502.8.1 or Section 502.8.2.

502.2.3 Diversion. The point of diversion of gray water to the sanitary drainage system shall occur downstream of fixture traps and vent connections through an approved gray water diverter valve. The gray water diverter shall be installed in an accessible location and clearly indicate the direction of flow.

502.2.4 Backwater Valves. Gray water drains subject to backflow shall be provided with a backwater valve so located as to be accessible for inspection and maintenance.

502.3 Connections to Potable and Reclaimed (Recycled) Water Systems. Gray water systems shall have no direct connection to any potable water supply, on-site treated non-potable water supply, or reclaimed (recycled) water systems. Potable, on-site treated non-potable, or reclaimed (recycled) water is permitted to be used as makeup water for a non-pressurized storage tank provided the connection is protected by an airgap in accordance with the plumbing code.

502.4 Location. No gray water system or part thereof shall be located on any lot other than the lot that is the site of the building or structure that discharges the gray water, nor shall any gray water system or part thereof be located at any point having less than the minimum distances indicated in Table 502.4.

502.5 Plot Plan Submission. No permit for any gray water system shall be issued until a plot plan with appropriate data satisfactory to the Authority Having Jurisdiction has been submitted and approved.

TABLE 502.4
LOCATION OF GRAY WATER SYSTEM

MINIMUM HORIZONTAL DISTANCE IN CLEAR REQUIRED FROM:	SURGE TANK (feet)	SUBSURFACE AND SUBSOIL IRRIGATION FIELD AND MULCH BED (feet)
Building structures ¹	5 ^{2,9}	2 ^{3,8}
Property line adjoining private property	5	5 ⁸
Water supply wells ⁴	50	100
Streams and lakes ⁴	50	50 ⁵
Sewage pits or cesspools	5	5
Sewage disposal field	5	4 ⁶
Septic tank	0	5
On-site domestic water service line	5	5
Pressurized public water main	10	10

For SI units: 1 foot = 304.8 mm

Note: Where irrigation or disposal fields are installed in sloping ground, the minimum horizontal distance between any part of the distribution system and the ground surface shall be 15 feet (4572 mm).

- ¹ Including porches and steps, whether covered or uncovered, breezeways, roofed carports, roofed patios, carports, covered walks, covered driveways, and similar structures or appurtenances.
- ² The distance shall be permitted to be reduced to 0 feet for aboveground tanks when first approved by the Authority Having Jurisdiction.
- ³ Reference to a 45 degree (0.79 rad) angle from foundation.
- ⁴ Where special hazards are involved, the distance required shall be increased as directed by the Authority Having Jurisdiction.
- ⁵ These minimum clear horizontal distances shall also apply between the irrigation or disposal field and the ocean mean higher high tide line.
- ⁶ Add 2 feet (610 mm) for each additional foot of depth in excess of 1 foot (305 mm) below the bottom of the drain line.
- ⁷ For parallel construction or for crossings, approval by the Authority Having Jurisdiction shall be required.
- ⁸ The distance shall be permitted to be reduced to 1½ feet (457 mm) for drip and mulch basin irrigation systems.
- ⁹ The distance shall be permitted to be reduced to 0 feet for surge tanks of 75 gallons (284 L) or less.

502.6 Prohibited Location. Where there is insufficient lot area or inappropriate soil conditions for adequate absorption to prevent the ponding, surfacing or runoff of the gray water, as determined by the Authority Having Jurisdiction, no gray water system shall be permitted. A gray water system is not permitted on any property in a geologically sensitive area as determined by the Authority Having Jurisdiction.

502.7 Drawings and Specifications. The Authority Having Jurisdiction shall require any or all of the following information to be included with or in the plot plan before a permit is issued for a gray water system, or at any time during the construction thereof:

- (1) Plot plan drawn to scale and completely dimensioned, showing lot lines and structures, direction and approximate slope of surface, location of all present or proposed

retaining walls, drainage channels, water supply lines, wells, paved areas and structures on the plot, number of bedrooms and plumbing fixtures in each structure, location of private sewage disposal system and expansion area or building sewer connecting to the public sewer, and location of the proposed gray water system.

- (2) Details of construction necessary to ensure compliance with the requirements of this chapter, together with a full description of the complete installation, including installation methods, construction, and materials as required by the Authority Having Jurisdiction.
- (3) Details for all holding tanks shall include all dimensions, structural calculations, bracings, and such other pertinent data as required.
- (4) A log of soil formations and groundwater level as determined by test holes dug in proximity to any proposed irrigation area, together with a statement of water absorption characteristics of the soil at the proposed site as determined by approved percolation tests.
- (5) Distance between the plot and any surface waters such as lakes, ponds, rivers or streams, and the slope between the plot and the surface water, if in close proximity.

Exception: The Authority Having Jurisdiction shall permit the use of Table 502.4 in lieu of percolation tests.

502.8 Procedure for Estimating Gray Water Discharge. Gray water systems shall be designed to distribute the total amount of estimated gray water on a daily basis. The water discharge for gray water systems shall be determined in accordance with Section 502.8.1 or Section 502.8.2.

502.8.1 Single Family Dwellings and Multi-Family Dwellings. The gray water discharge for single family and multi-family dwellings shall be calculated by water use records, calculations of local daily per person interior water use, or the following procedure:

- (1) The number of occupants of each dwelling unit shall be calculated as follows:

First Bedroom	2 occupants
Each additional bedroom	1 occupant
- (2) The estimated gray water flows of each occupant shall be calculated as follows:

Showers, bathtubs	25 gallons per day/occupant and lavatories
Laundry	15 gallons per day/occupant

- (3) The total number of occupants shall be multiplied by the applicable estimated gray water discharge as provided above and the type of fixtures connected to the gray water system.

502.8.2 Commercial, Industrial, and Institutional Occupancies. The gray water discharge for commercial, industrial, and institutional occupancies shall be calculated by utilizing the procedure in Section 502.8.1, water use records, or other documentation to estimate gray water discharge.

502.9 Gray Water System Components. Gray water system components shall be in accordance with Section 502.9.1 through Section 502.9.5.

502.9.1 Surge Tanks. Where installed, surge tanks shall comply with the following:

- (1) Surge tanks shall be constructed of solid, durable materials not subject to excessive corrosion or decay and shall be watertight. Surge tanks constructed of steel shall be approved by the Authority Having Jurisdiction, provided such tanks comply with approved applicable standards.
- (2) Each surge tank shall be vented as required by the plumbing code. The vent size shall be determined based on the total gray water fixture units as outlined in the plumbing code.
- (3) Each surge tank shall have an access opening with lockable gasketed covers or approved equivalent to allow for inspection and cleaning.
- (4) Each surge tank shall have its rated capacity permanently marked on the unit. In addition, a sign stating GRAY WATER, DANGER — UNSAFE WATER shall be permanently marked on the holding tank.
- (5) Each surge tank shall have an overflow drain. The overflow drains shall have permanent connections to the building drain or building sewer, upstream of septic tanks, if any. The overflow drain shall not be equipped with a shutoff valve.
- (6) The overflow drainpipes shall not be less in size than the inlet pipe. Unions or equally effective fittings shall be provided for all piping connected to the surge tank.
- (7) Surge tank shall be structurally designed to withstand anticipated earth or other loads. Surge tank covers shall be capable of supporting an earth load of not less than 300 pounds per square foot (1b/ft²) (1465 kg/m²) when the tank is designed for underground installation.
- (8) If a surge tank is installed underground, the system shall be designed so that the tank overflow will gravity drain to the existing sewer line or septic tank. The tank shall be protected against sewer line backflow by a backwater valve installed in accordance with the plumbing code.
- (9) Surge tanks shall be installed on dry, level, well-compacted soil if underground or on a level 3 inch (76 mm) thick concrete slab if aboveground.
- (10) Surge tanks shall be anchored to prevent against overturning when installed aboveground. Underground tanks shall be ballasted, anchored, or otherwise secured, to prevent the tank from floating out of the ground when empty. The combined weight of the tank and hold down system shall meet or exceed the buoyancy forces of the tank.

502.9.2 Gray Water Pipe and Fitting Materials. Aboveground and underground building drainage and vent pipe and fittings for gray water systems shall comply with the requirements for aboveground and

underground sanitary building drainage and vent pipe and fittings in the plumbing code. These materials shall extend not less than 2 feet (610 mm) outside the building.

502.9.3 Subsoil Irrigation Field Materials. Subsoil irrigation field piping shall be constructed of perforated high-density polyethylene pipe, perforated ABS pipe, perforated PVC pipe, or other approved materials, provided that sufficient openings are available for distribution of the gray water into the trench area. Material, construction, and perforation of the pipe shall be in compliance with the appropriate absorption field drainage piping standards and shall be approved by the Authority Having Jurisdiction.

502.9.4 Subsurface Irrigation Field and Mulch Basin Supply Line Materials. Materials for gray water piping outside the building shall be polyethylene or PVC. Drip feeder lines shall be PVC or polyethylene tubing.

502.9.5 Valves. Valves shall be accessible.

502.9.6 Trap. Gray water piping discharging into the surge tank or having a direct connection to the sanitary drain or sewer piping shall be downstream of an approved water seal type trap(s). If no such trap(s) exists, an approved vented running trap shall be installed upstream of the connection to protect the building from any possible waste or sewer gases.

502.9.7 Backwater Valve. A backwater valve shall be installed on all gray water drain connections to the sanitary drain or sewer.

502.10 Subsurface Irrigation System Zones. Irrigation or disposal fields shall be permitted to have one or more valved zones. Each zone must be of adequate size to receive the gray water anticipated in that zone.

TABLE 502.10
DESIGN OF SIX TYPICAL SOILS

TYPE OF SOIL	MINIMUM SQUARE FEET OF IRRIGATION AREA PER 100 GALLONS OF ESTIMATED GRAY WATER DISCHARGE PER DAY	MAXIMUM ABSORPTION CAPACITY IN GALLONS PER SQUARE FOOT OF IRRIGATION/LEACHING AREA FOR A 24-HOUR PERIOD
Coarse sand or gravel	20	5.0
Fine sand	25	4.0
Sandy loam	40	2.5
Sandy clay	60	1.7
Clay with considerable sand or gravel	90	1.1
Clay with small amounts of sand or gravel	120	0.8

For SI units: 1 square foot = 0.0929 m², 1 gallon per day = 0.000043 L/s

502.10.1 Required Area of Subsurface Irrigation Fields, Subsoil Irrigation Fields and Mulch Basins. The minimum effective irrigation area of subsurface irrigation fields, subsoil irrigation fields, and mulch basins shall be determined by Table 502.10 for the

type of soil found in the excavation, based upon a calculation of estimated gray water discharge pursuant to Section 502.8. For a subsoil irrigation field, the area shall be equal to the aggregate length of the perforated pipe sections within the valved zone multiplied by the width of the proposed subsoil irrigation field.

502.10.2 Determination of Maximum Absorption Capacity. The irrigation field and mulch basin size shall be based on the maximum absorption capacity of the soil and determined using Table 502.10. For soils not listed in Table 502.10, the maximum absorption capacity for the proposed site shall be determined by percolation tests or other method acceptable to the Authority Having Jurisdiction. A gray water system shall not be permitted, where the percolation test shows the absorption capacity of the soil is unable to accommodate the maximum discharge of the proposed gray water irrigation system.

502.10.3 Groundwater Level. No excavation for an irrigation field, disposal field, or mulch basin shall extend within 3 feet (914 mm) vertical of the highest known seasonal groundwater level, nor to a depth where gray water contaminates the groundwater or surface water. The applicant shall supply evidence of groundwater depth to the satisfaction of the Authority Having Jurisdiction.

502.11 Subsurface and Subsoil Irrigation Field, and Mulch Basin Design and Construction. Subsurface and subsoil irrigation field, and mulch basin design and construction shall be in accordance with Section 502.11.1 through Section 502.11.3. Where a gray water irrigation system design is predicated on soil tests, the subsurface or subsoil irrigation field or mulch basin shall be installed at the same location and depth as the tested area.

502.11.1 Subsurface Irrigation Field. A subsurface irrigation field shall be in accordance with Section 502.11.1.1 through Section 502.11.1.6.

502.11.1.1 Minimum Depth. Supply piping, including drip feeders, shall be not less than 2 inches (51 mm) below finished grade and covered with mulch or soil.

TABLE 502.11.1
SUBSURFACE IRRIGATION DESIGN CRITERIA FOR SIX TYPICAL SOILS

TYPE OF SOIL	MAXIMUM EMITTER DISCHARGE	MINIMUM NUMBER OF EMITTERS PER GALLON OF ESTIMATED GRAY WATER DISCHARGE PER DAY*
	gallon/day	gallon/day
Sand	1.8	0.6
Sandy loam	1.4	0.7
Loam	1.2	0.9
Clay loam	0.9	1.1
Silty clay	0.6	1.6
Clay	0.5	2.0

For SI units: 1 gallon per day = 0.000043 L/s

* The estimated gray water discharge per day shall be determined in accordance with Section 503.9.

502.11.1.2 Filter. Not less than 140 mesh (115 micron) filter with a capacity of 25 gallons per minute (gpm) (1.58 L/s), or equivalent shall be installed. Where a filter backwash is installed, the backwash and flush discharge shall discharge into the building sewer or private sewage disposal system. Filter backwash and flush water shall not be used for any purpose.

502.11.1.3 Emitter Size. Emitters shall be installed in accordance with the manufacturer's installation instructions. Emitters shall have a flow path of not less than 1200 microns (μ) (1200 μm) and shall not have a coefficient of manufacturing variation (Cv) exceeding 7 percent. Irrigation system design shall be such that emitter flow variation shall not exceed 10 percent.

502.11.1.4 Number of Emitters. The minimum number of emitters and the maximum discharge of each emitter in an irrigation field shall be in accordance with Table 502.11.1.

502.11.1.5 Controls. The system design shall provide user controls, such as valves, switches, timers, and other controllers, to rotate the distribution of gray water between irrigation zones.

502.11.1.6 Maximum Pressure. Where pressure at the discharge side of the pump exceeds 20 pounds-force per square inch (psi) (138 kPa), a pressure-reducing valve able to maintain downstream pressure not exceeding 20 psi (138 kPa) shall be installed downstream from the pump and before any emission device.

502.11.2 Mulch Basin. A mulch basin shall be in accordance with Section 502.11.2.1 through Section 502.11.2.4.

502.11.2.1 Single Family and Multi-Family Dwellings. The gray water discharge to a mulch basin is limited to single family and multi-family dwellings.

502.11.2.2 Size. Mulch basins shall be of sufficient size to accommodate peak flow rates and distribute the total amount of estimated gray water on a daily basis without surfacing, ponding or runoff. Mulch basins shall have a depth of not less than 10 inches (254 mm) below finished grade. The mulch basin size shall be based on the maximum absorption capacity of the soil and determined using Table 502.10.

502.11.2.3 Minimum Depth. Gray water supply piping, including drip feeders, shall be a minimum 2 inches (51 mm) below finished grade and covered with mulch.

502.11.2.4 Maintenance. The mulch basin shall be maintained periodically to retain the required depth and area, and to replenish the required mulch cover.

502.11.3 Subsoil Irrigation Field. Subsoil irrigation fields shall be in accordance with Section 502.11.3.1 through Section 502.11.3.3.

502.11.3.1 Minimum Pipe Size. Subsoil irrigation field distribution piping shall be not less than 3 inches (80 mm) diameter.

502.11.3.2 Filter Material and Backfill. Filter material, clean stone, gravel, slag, or similar material acceptable to the Authority Having Jurisdiction, varying in size from 3/4 of an inch (19.1 mm) to 2 1/2 inches (64 mm) shall be placed in the trench to the depth and grade in accordance with Table 502.11.3. The perforated section of subsoil irrigation field distribution piping shall be laid on the filter material in an approved manner. The perforated section shall then be covered with filter material to the minimum depth in accordance with Table 502.11.3. The filter material shall then be covered with porous material to prevent closure of voids with earth backfill. No earth backfill shall be placed over the filter material cover until after inspection and acceptance.

502.11.3.3 Subsoil Irrigation Field Construction. Subsoil irrigation fields shall be constructed in accordance with Table 502.11.3. Where necessary on sloping ground to prevent excessive line slopes, irrigation lines shall be stepped. The lines between each horizontal leaching section shall be made with approved watertight joints and installed on natural or unfilled ground.

TABLE 502.11.3
SUBSOIL IRRIGATION FIELD CONSTRUCTION

DESCRIPTION	MINIMUM	MAXIMUM
Number of drain lines per valved zone	1	-
Length of each perforated line	-	100 feet
Bottom width of trench	12 inches	18 inches
Spacing of lines, center to center	4 feet	-
Depth of earth cover of lines	10 inches	-
Depth of filter material cover of lines	2 inches	-
Depth of filter material beneath lines	3 inches	-
Grade of perforated lines level	level	3 inches per 100 feet

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 inch per foot = 83.3 mm/m

502.12 Gray Water System Color and Marking Information. Pressurized gray water distribution systems shall be identified as containing non-potable water in accordance with the plumbing code.

502.13 Special Provisions.

502.13.1 Other Collection and Distribution Systems. Other collection and distribution systems shall be approved by the local Authority Having Jurisdiction, as allowed by Section 102.0 of this supplement and the plumbing code.

502.13.2 Higher Requirements. Nothing contained in this chapter shall be construed to prevent the Authority Having Jurisdiction from requiring compliance with higher requirements than those contained herein, where such higher requirements are essential to maintain a safe and sanitary condition.

502.14 Testing. Building drains and vents for gray water systems shall be tested in accordance with the plumbing code. Surge tanks shall be filled with water to the overflow line prior to and during inspection. Seams and joints shall be left exposed, and the tank shall remain watertight. A flow test shall be performed through the system to the point of gray water discharge. Lines and components shall be watertight up to the point of the irrigation perforated and drip lines.

502.15 Maintenance. Gray water systems and components shall be maintained in accordance with Table 501.5.

503.0 Reclaimed (Recycled) Water Systems.

503.1 General. The provisions of this section shall apply to the installation, construction, alteration, and repair of reclaimed (recycled) water systems intended to supply uses such as water closets, urinals, trap primers for floor drains and floor sinks, aboveground and subsurface irrigation, industrial or commercial cooling or air conditioning and other uses approved by the Authority Having Jurisdiction.

503.2 Permit. It shall be unlawful for any person to construct, install, alter, or cause to be constructed, installed, or altered any reclaimed (recycled) water system within a building or on a premises without first obtaining a permit to do such work from the Authority Having Jurisdiction.

503.2.1 Plumbing Plan Submission. No permit for any reclaimed (recycled) water system shall be issued until complete plumbing plans, with appropriate data satisfactory to the Authority Having Jurisdiction, have been submitted and approved.

503.3 System Changes. No changes or connections shall be made to either the reclaimed (recycled) water system or the potable water system within any site containing a reclaimed (recycled) water system without approval by the Authority Having Jurisdiction.

503.4 Connections to Potable or Reclaimed (Recycled) Water Systems. Reclaimed (recycled) water systems shall have no connection to any potable water supply or alternate water source system. Potable water is permitted to be used as makeup water for a reclaimed (recycled) water storage tank provided the water supply inlet is protected by an airgap or reduced-pressure principle backflow preventer complying with the plumbing code.

503.5 Initial Cross-Connection Test. A cross-connection test is required in accordance with Section 503.11.2. Before the building is occupied or the system is activated, the installer shall perform the initial cross-connection test in the presence of the Authority Having Jurisdiction and other authorities having jurisdiction. The test shall be ruled successful by the Authority Having Jurisdiction before final approval is granted.

503.6 Reclaimed (Recycled) Water System Materials. Reclaimed (recycled) water supply and distribution system materials shall comply with the requirements of the plumbing code for potable water supply and distribution systems, unless otherwise provided for in this section.

503.7 Reclaimed (Recycled) Water System Color and Marking Information. Reclaimed (recycled) water systems shall have a colored background in accordance with the plumbing code. Reclaimed (recycled) water systems shall be marked, in lettering in accordance with the plumbing code, with the words: "CAUTION: NON-POTABLE RECLAIMED (RECYCLED) WATER, DO NOT DRINK." Field marking of pipe meeting these requirements shall be permitted.

503.8 Valves. Valves, except fixture supply control valves, shall be equipped with a locking feature.

503.9 Installation.

503.9.1 Hose Bibbs. Hose bibbs shall not be allowed on reclaimed (recycled) water piping systems located in areas accessible to the public. Access to reclaimed (recycled) water at points in the system accessible to the public shall be through a quick-disconnect device that differs from those installed on the potable water system. Hose bibbs supplying reclaimed (recycled) water shall be marked with the words: "CAUTION: NON-POTABLE RECLAIMED WATER, DO NOT DRINK," and the symbol in Figure 503.9.

503.9.2 Required Appurtenances. The reclaimed (recycled) water system and the potable water system within the building shall be provided with the required appurtenances (valves, air/vacuum relief valves, etc.) to allow for deactivation or drainage as required for cross-connection test in Section 503.11.2.

503.9.3 Same Trench as Potable Water Pipes. Reclaimed (recycled) water pipes shall be permitted to be run or laid in the same trench as potable water pipes with a 12 inches (305 mm) minimum vertical and horizontal separation when both pipe materials are approved for use within a building. When piping materials do not meet this requirement the minimum horizontal separation shall be increased to 60 inches (1524 mm). The potable water piping shall be installed at an elevation above the reclaimed (recycled) water piping. Reclaimed

(recycled) water pipes laid in the same trench or crossing building sewer or drainage piping shall be installed in accordance with the plumbing code for potable water piping.

503.10 Signs. Rooms and water closet tanks in buildings using reclaimed (recycled) water shall be in accordance with Section 503.10.1 through Section 503.10.2.

503.10.1 Commercial, Industrial, and Institutional Restroom Signs. A sign shall be installed in restrooms in commercial, industrial, and institutional occupancies using reclaimed (recycled) water for water closets, urinals, or both. Each sign shall contain 1/2 of an inch (12.7 mm) letters of a highly visible color on a contrasting background. The location of the sign(s) shall be such that the sign(s) shall be visible to all users. The location of the sign(s) shall be approved by the Authority Having Jurisdiction and shall contain the following text:

TO CONSERVE WATER, THIS BUILDING USES RECLAIMED (RECYCLED) WATER TO FLUSH TOILETS AND URINALS.

503.10.2 Equipment Room Signs. Each room containing reclaimed (recycled) water equipment shall have a sign posted with the following wording in 1 inch (25.4 mm) letters:

CAUTION: NON-POTABLE RECLAIMED (RECYCLED) WATER, DO NOT DRINK. DO NOT CONNECT TO DRINKING WATER SYSTEM. NOTICE: CONTACT BUILDING MANAGEMENT BEFORE PERFORMING ANY WORK ON THIS WATER SYSTEM.

503.11 Inspection and Testing. Reclaimed (recycled) water systems shall be inspected and tested in accordance with Section 503.11.1 through Section 503.11.2.

503.11.1 Supply System Inspection and Test. Reclaimed (recycled) water systems shall be inspected and tested in accordance with the plumbing code for testing of potable water piping.

503.11.2 Annual Cross-Connection Inspection and Testing. An initial and subsequent annual inspection and test shall be performed on both the potable and reclaimed (recycled) water systems. The potable and reclaimed (recycled) water system shall be isolated from each other and independently inspected and tested to ensure there is no cross-connection in accordance with Section 503.11.2.1 through Section 503.11.2.4.

503.11.2.1 Visual System Inspection. Prior to commencing the cross-connection testing, a dual system inspection shall be conducted by the Authority Having Jurisdiction and other authorities having jurisdiction as follows:

- (1) Meter locations of the reclaimed (recycled) water and potable water lines shall be checked to verify that no modifications were made, and that no cross-connections are visible.
- (2) Pumps and equipment, equipment room signs, and exposed piping in equipment room shall be checked.



FIGURE 503.9

- (3) Valves shall be checked to ensure that valve lock seals are still in place and intact. Valve control door signs shall be checked to verify that no signs have been removed.

503.11.2.2 Cross-Connection Test. The procedure for determining cross-connection shall be followed by the applicant in the presence of the Authority Having Jurisdiction and other authorities having jurisdiction to determine whether a cross-connection has occurred as follows:

- (1) The potable water system shall be activated and pressurized. The reclaimed (recycled) water system shall be shut down, depressurized, and drained.
- (2) The potable water system shall remain pressurized for a minimum period of time specified by the Authority Having Jurisdiction while the reclaimed (recycled) water system is empty. The minimum period the reclaimed (recycled) water system is to remain depressurized shall be determined on a case-by-case basis, taking into account the size and complexity of the potable and reclaimed (recycled) water distribution systems, but in no case shall that period be less than 1 hour.
- (3) The drain on the reclaimed (recycled) water system shall be checked for flow during the test and all fixtures, potable and reclaimed (recycled), shall be tested and inspected for flow. Flow from any reclaimed (recycled) water system outlet indicates a cross-connection. No flow from a potable water outlet shall indicate that it is connected to the reclaimed (recycled) water system.
- (4) The potable water system shall then be depressurized and drained.
- (5) The reclaimed (recycled) water system shall then be activated and pressurized.
- (6) The reclaimed (recycled) water system shall remain pressurized for a minimum period of time specified by the Authority Having Jurisdiction while the potable water system is empty. The minimum period the potable water system is to remain depressurized shall be determined on a case-by-case basis, but in no case shall that period be less than 1 hour.
- (7) All fixtures, potable and reclaimed (recycled), shall be tested and inspected for flow. Flow from any potable water system outlet indicates a cross-connection. No flow from a reclaimed (recycled) water outlet will indicate that it is connected to the potable water system.
- (8) The drain on the potable water system shall be checked for flow during the test and at the end of the test.

- (9) If there is no flow detected in any of the fixtures which would indicate a cross-connection, the potable water system shall be repressurized.

503.11.2.3 Discovery of Cross-Connection. In the event that a cross-connection is discovered, the following procedure, in the presence of the Authority Having Jurisdiction, shall be activated immediately:

- (1) Reclaimed (recycled) water piping to the building shall be shut down at the meter, and the reclaimed (recycled) water riser shall be drained.
- (2) Potable water piping to the building shall be shut down at the meter.
- (3) The cross-connection shall be uncovered and disconnected.
- (4) The building shall be retested following procedures listed in Section 503.11.2.1 and Section 503.11.2.2.
- (5) The potable water system shall be chlorinated with 50 parts-per-million (ppm) chlorine for 24 hours.
- (6) The potable water system shall be flushed after 24 hours, and a standard bacteriological test shall be performed. If test results are acceptable, the potable water system shall be permitted to be recharged.

503.11.2.4 Annual Inspection. An annual inspection of the reclaimed (recycled) water system, following the procedures listed in Section 503.11.2.1 shall be required. Annual cross-connection testing, following the procedures listed in Section 503.11.2.2 shall be required by the Authority Having Jurisdiction, unless site conditions do not require it. In no event shall the test occur less than once in 4 years.

Alternate testing requirements shall be permitted by the Authority Having Jurisdiction.

503.12 Sizing. Reclaimed (recycled) water piping shall be sized in accordance with the plumbing code for sizing potable water piping.

504.0 On-Site Treated Non-Potable Water Systems.

504.1 General. The provisions of this section shall apply to the installation, construction, alteration, and repair of on-site treated non-potable water systems intended to supply uses such as water closets, urinals, trap primers for floor drains and floor sinks, above and below ground irrigation, and other uses approved by the Authority Having Jurisdiction.

504.2 Plumbing Plan Submission. No permit for any on-site treated non-potable water system shall be issued until complete plumbing plans, with appropriate data satisfactory to the Authority Having Jurisdiction, have been submitted and approved.

504.3 System Changes. No changes or connections shall be made to either the on-site treated non-potable water system or the potable water system within any site containing an on-site treated non-potable water system without approval by the Authority Having Jurisdiction.

504.4 Connections to Potable or Reclaimed (Recycled) Water Systems. On-site treated non-potable water systems shall have no connection to any potable water supply or reclaimed (recycled) water source system. Potable or reclaimed (recycled) water is permitted to be used as makeup water for a non-pressurized storage tank provided the makeup water supply is protected by an airgap in accordance with the plumbing code.

504.5 Initial Cross-Connection Test. A cross-connection test is required in accordance with Section 504.12.2. Before the building is occupied or the system is activated, the installer shall perform the initial cross-connection test in the presence of the Authority Having Jurisdiction and other authorities having jurisdiction. The test shall be ruled successful by the Authority Having Jurisdiction before final approval is granted.

504.6 On-Site Treated Non-Potable Water System Materials. On-site treated non-potable water supply and distribution system materials shall comply with the requirements of the plumbing code for potable water supply and distribution systems, unless otherwise provided for in this section.

504.7 On-Site Treated Non-Potable Water Devices and Systems. Devices or equipment used to treat on-site treated non-potable water in order to maintain the minimum water quality requirements determined by the Authority Having Jurisdiction shall be listed or labeled (third-party certified) by a listing agency (accredited conformity assessment body) and approved for the intended application.

504.8 On-Site Treated Non-Potable Water System Color and Marking Information. On-site treated water systems shall have a colored background in accordance with the plumbing code. On-site treated water systems shall be marked, in lettering in accordance with the plumbing code, with the words: "CAUTION: ON-SITE TREATED NON-POTABLE WATER, DO NOT DRINK." Field marking of pipe meeting these requirements shall be acceptable.

504.9 Valves. Valves, except fixture supply control valves, shall be equipped with a locking feature.

504.10 Design and Installation. The design and installation of on-site treated non-potable systems shall be in accordance with Section 504.10.1 through Section 504.10.5.

504.10.1 Listing Terms and Installation Instructions. On-site treated non-potable water systems shall be installed in accordance with the terms of its listing and the manufacturer's installation instructions.

504.10.2 Minimum Water Quality. On-site treated non-potable water supplied to toilets or urinals or for other uses in which it is sprayed or exposed shall be disinfected. Acceptable disinfection methods shall include chlorination, ultraviolet sterilization, ozone, or other methods as approved by the Authority Having Jurisdiction. The minimum water quality for on-site

treated non-potable water systems shall meet the applicable water quality requirements for the intended applications as determined by the public health Authority Having Jurisdiction.

504.10.3 Deactivation and Drainage. The on-site treated non-potable water system and the potable water system within the building shall be provided with the required appurtenances (valves, air/vacuum relief valves, etc.) to allow for deactivation or drainage as required for cross-connection test in accordance with Section 504.12.2.

504.10.4 Near Underground Potable Water Pipe. On-site treated non-potable water pipes shall be permitted to be run or laid in the same trench as potable water pipes with a 12 inch (305 mm) minimum vertical and horizontal separation when both pipe materials are approved for use within a building. Where piping materials do not meet this requirement the minimum separation shall be increased to 60 inches (1524 mm). The potable water piping shall be installed at an elevation above the on-site treated non-potable water piping.

504.10.5 Required Filters. A filter permitting the passage of particulates no larger than 100 microns (100 µm) shall be provided for on-site treated non-potable water supplied to water closets, urinals, trap primers, and drip irrigation system.

504.11 Signs. Signs in buildings using on-site treated non-potable water shall be in accordance with Section 504.11.1 and Section 504.11.2.

504.11.1 Commercial, Industrial, and Institutional Restroom Signs. A sign shall be installed in all restrooms in commercial, industrial, and institutional occupancies using on-site treated water for water closets, urinals or both. Each sign shall contain ½ of an inch (12.7 mm) letters of a highly visible color on a contrasting background. The location of the sign(s) shall be such that the sign(s) shall be visible to all users. The location of the sign(s) shall be approved by the Authority Having Jurisdiction and shall contain the following text:

TO CONSERVE WATER, THIS BUILDING USES ON-SITE TREATED NON-POTABLE WATER TO FLUSH TOILETS AND URINALS.

504.11.2 Equipment Room Signs. Each room containing on-site treated water equipment shall have a sign posted with the following wording in 1 inch (25.4 mm) letters:

CAUTION ON-SITE TREATED NON-POTABLE WATER, DO NOT DRINK. DO NOT CONNECT TO DRINKING WATER SYSTEM. NOTICE: CONTACT BUILDING MANAGEMENT BEFORE PERFORMING ANY WORK ON THIS WATER SYSTEM.

This sign shall be posted in a location that is visible to anyone working on or near on-site treated non-potable water equipment.

504.12 Inspection and Testing. On-site treated non-potable water systems shall be inspected and tested in accordance with 504.12.1 through Section 504.12.2.

504.12.1 Supply System Inspection and Test.

On-site treated non-potable water systems shall be inspected and tested in accordance with the plumbing code for testing of potable water piping.

504.12.2 Annual Cross-Connection Inspection and Testing.

An initial and subsequent annual inspection and test shall be performed on both the potable and on-site treated non-potable water systems. The potable and on-site treated non-potable water system shall be isolated from each other and independently inspected and tested to ensure there is no cross-connection in accordance with Section 504.12.2.1 through Section 504.12.2.4.

504.12.2.1 Visual System Inspection. Prior to commencing the cross-connection testing, a dual system inspection shall be conducted by the Authority Having Jurisdiction and other authorities having jurisdiction as follows:

- (1) Pumps and equipment, equipment room signs, and exposed piping in equipment room shall be checked.
- (2) Valves shall be checked to ensure that valve lock seals are still in place and intact. Valve control door signs shall be checked to verify that no signs have been removed.

504.12.2.2 Cross-Connection Test. The procedure for determining cross-connection shall be followed by the applicant in the presence of the Authority Having Jurisdiction and other authorities having jurisdiction to determine whether a cross-connection has occurred as follows:

- (1) The potable water system shall be activated and pressurized. The on-site treated non-potable water system shall be shut down and completely drained.
- (2) The potable water system shall remain pressurized for a minimum period of time specified by the Authority Having Jurisdiction while the on-site treated non-potable water system is empty. The minimum period the on-site treated non-potable water system is to remain depressurized shall be determined on a case-by-case basis, taking into account the size and complexity of the potable and on-site treated water distribution systems, but in no case shall that period be less than 1 hour.
- (3) Fixtures, potable and on-site treated, shall be tested and inspected for flow. Flow from any on-site treated water system outlet indicates a cross-connection. No flow from a potable water outlet shall indicate that it is connected to the on-site treated water system.
- (4) The drain on the on-site treated non-potable water system shall be checked for flow during the test and at the end of the test.

- (5) The potable water system shall then be completely drained.
- (6) The on-site treated non-potable water system shall then be activated and pressurized.
- (7) The on-site treated non-potable water system shall remain pressurized for a minimum period of time specified by the Authority Having Jurisdiction while the potable water system is empty. The minimum period the potable water system is to remain depressurized shall be determined on a case-by-case basis, but in no case shall that period be less than 1 hour.
- (8) Fixtures, potable and on-site treated non-potable, shall be tested and inspected for flow. Flow from any potable water system outlet indicates a cross-connection. No flow from an on-site treated water outlet will indicate that it is connected to the potable water system.
- (9) The drain on the potable water system shall be checked for flow during the test and at the end of the test.
- (10) If there is no flow detected in any of the fixtures which would indicate a cross-connection, the potable water system shall be repressurized.

504.12.2.3 Discovery of Cross-Connection.

In the event that a cross-connection is discovered, the following procedure, in the presence of the Authority Having Jurisdiction, shall be activated immediately:

- (1) On-site treated non-potable water piping to the building shall be shut down at the meter and the on-site treated water riser shall be drained.
- (2) Potable water piping to the building shall be shut down at the meter.
- (3) The cross-connection shall be uncovered and disconnected.
- (4) The building shall be retested in accordance with procedures listed in Section 504.12.2.1 and Section 504.12.2.2.
- (5) The potable water system shall be chlorinated with 50 ppm chlorine for 24 hours.
- (6) The potable water system shall be flushed after 24 hours, and a standard bacteriological test shall be performed. If test results are acceptable, the potable water system shall be permitted to be recharged.

504.12.2.4 Annual Inspection. An annual inspection of the on-site treated non-potable water system shall be required in accordance with Section 504.12.2.1. Annual cross-connection testing in accordance with Section 504.12.2.2 shall be required by the Authority Having Jurisdiction, unless site conditions do not require it. The test shall occur no less than once every 4 years.

Alternate testing requirements shall be permitted by the Authority Having Jurisdiction.

504.13 Sizing. Unless otherwise provided for in this supplement, on-site treated non-potable water piping shall be sized in accordance with the plumbing code for sizing potable water piping.

505.0 Non-Potable Rainwater Catchment Systems.

505.1 General. The provisions of this section shall apply to the installation, construction, alteration, and repair of rainwater catchment systems intended to supply uses such as water closets, urinals, trap primers for floor drains and floor sinks, irrigation, industrial processes, water features, cooling tower makeup and other uses approved by the Authority Having Jurisdiction. Additional design criteria can be found in the ARCSA/ASPE Rainwater Catchment Design and Installation Standard.

505.2 Plumbing Plan Submission. No permit for any rainwater catchment system requiring a permit shall be issued until complete plumbing plans, with appropriate data satisfactory to the Authority Having Jurisdiction, have been submitted and approved. No changes or connections shall be made to either the rainwater catchment or the potable water system within any site containing a rainwater catchment water system without approval by the Authority Having Jurisdiction.

505.3 System Changes. No changes or connections shall be made to either the rainwater catchment system or the potable water system within any site containing a rainwater catchment system requiring a permit without approval by the Authority Having Jurisdiction.

505.4 Connections to Potable or Reclaimed (Recycled) Water Systems. Rainwater catchment systems shall have no direct connection to any potable water supply or alternate water source system. Potable or reclaimed (recycled) water is permitted to be used as makeup water for a rainwater catchment system provided the potable or reclaimed (recycled) water supply connection is protected by an airgap or reduced-pressure principle backflow preventer in accordance with the plumbing code.

505.5 Initial Cross-Connection Test. Where any portion of a rainwater catchment system is installed within a building, a cross-connection test is required in accordance with 505.11.2. Before the building is occupied or the system is activated, the installer shall perform the initial cross-connection test in the presence of the Authority Having Jurisdiction and other authorities having jurisdiction. The test shall be ruled successful by the Authority Having Jurisdiction before final approval is granted.

505.6 Sizing. Rainwater catchment system distribution piping for indoor applications shall be sized as outlined in this supplement for sizing potable water piping. The design and size of rainwater drains, gutters, conductors, and leaders shall be in accordance with the plumbing code.

505.7 Rainwater Catchment System Materials. Rainwater catchment system materials shall be in accordance with Section 505.7.1 through Section 505.7.4.

505.7.1 Water Supply and Distribution Materials. Rainwater catchment water supply and distribution mate-

rials shall comply with the requirements of the plumbing code for potable water supply and distribution systems, unless otherwise provided for in this section.

505.7.2 Rainwater Catchment System Drainage Materials. Materials used in rainwater catchment drainage systems, including gutters, downspouts, conductors, and leaders shall comply with the requirements of the plumbing code for storm drainage.

505.7.3 Storage Tanks. Rainwater storage tanks shall be in accordance with Section 505.9.5.

505.7.4 Collections Surfaces. The collection surface shall be constructed of a hard, impervious material.

505.8 Rainwater Catchment Water System Color and Marking Information. Rainwater catchment systems shall have a colored background in accordance with the plumbing code. Rainwater catchment systems shall be marked, in lettering in accordance with the plumbing code, with the words: "CAUTION: NON-POTABLE RAINWATER WATER, DO NOT DRINK."

505.9 Design and Installation.

505.9.1 Outside Hose Bibbs. Outside hose bibbs shall be allowed on rainwater piping systems. Hose bibbs supplying rainwater shall be marked with the words: "CAUTION: NON-POTABLE WATER, DO NOT DRINK" and the symbol in Figure 503.9.

505.9.2 Deactivation and Drainage for Cross-connection Test. The rainwater catchment system and the potable water system within the building shall be provided with the required appurtenances (e.g., valves, air or vacuum relief valves, etc.) to allow for deactivation or drainage as required for cross-connection test in Section 505.11.2.

505.9.3 Collection Surfaces. Rainwater shall be collected from roof surfaces. Rainwater catchment system shall not collect rainwater from:

- (1) Vehicular parking surfaces.
- (2) Surface water runoff.
- (3) Bodies of standing water.

505.9.3.1 Prohibited Discharges. Overflows and bleed-off pipes from roof-mounted equipment and appliances shall not discharge onto roof surfaces that are intended to collect rainwater.

505.9.4 Minimum Water Quality. The minimum water quality for harvested rainwater shall meet the applicable water quality requirements for the intended applications as determined by the public health Authority Having Jurisdiction. No treatment is required for rainwater used for subsurface or non-sprinkled surface irrigation where the maximum storage volume is less than 360 gallons (1363 L).

505.9.5 Rainwater Storage Tanks. Rainwater storage tanks shall be constructed and installed in accordance with Section 505.9.5.1 through Section 505.9.5.7.

505.9.5.1 Construction. Rainwater storage shall be constructed of solid, durable materials not subject

to excessive corrosion or decay and shall be water-tight. Storage tanks shall be approved by the Authority Having Jurisdiction, provided such tanks comply with approved applicable standards.

505.9.5.2 Location. Rainwater storage tanks shall be permitted to be installed above or below grade.

505.9.5.3 Above Grade. Above grade storage tanks shall be of an opaque material, approved for aboveground use in direct sunlight or shall be shielded from direct sunlight. Tanks shall be installed in an accessible location to allow for inspection and cleaning. The tank shall be installed on a foundation or platform that is constructed to accommodate all loads in accordance with the building code.

505.9.5.4 Below Grade. Rainwater storage tanks installed below grade shall be structurally designed to withstand all anticipated earth or other loads. Holding tank covers shall be capable of supporting an earth load of not less than 300 pounds per square foot (lb/ft²) (1465 kg/m²) when the tank is designed for underground installation. Below grade rainwater tanks installed underground shall be provided with manholes. The manhole opening shall be located a minimum of 4 inches (102 mm) above the surrounding grade. The surrounding grade shall be sloped away from the manhole. Underground tanks shall be ballasted, anchored, or otherwise secured, to prevent the tank from floating out of the ground when empty. The combined weight of the tank and hold down system should meet or exceed the buoyancy force of the tank.

505.9.5.5 Drainage and Overflow. Rainwater storage tanks shall be provided with a means of draining and cleaning. The overflow drain shall not be equipped with a shutoff valve. The overflow outlet shall discharge as required by the plumbing code for storm drainage systems. Where discharging to the storm drainage system, the overflow drain shall be protected from backflow of the storm drainage system by a backwater valve or other approved method.

505.9.5.5.1 Overflow Outlet Size. The overflow outlet shall be sized to accommodate the flow of the rainwater entering the tank and not less than the aggregate cross-sectional area of all inflow pipes.

505.9.5.6 Opening and Access Protection.

505.9.5.6.1 Animals and Insects. Rainwater tank openings shall be protected to prevent the entrance of insects, birds, or rodents into the tank.

505.9.5.6.2 Human Access. Rainwater tank access openings exceeding 12 inches (305 mm) in diameter shall be secured to prevent tampering and unintended entry by either a lockable device or other approved method.

505.9.5.7 Marking. Rainwater tanks shall be permanently marked with the capacity and the language: "NON-POTABLE RAINWATER." Where openings are provided to allow a person to enter the tank, the opening shall be marked with the following language: "DANGER-CONFINED SPACE."

505.9.6 Pumps. Pumps serving rainwater catchment systems shall be listed. Pumps supplying water to water closets, urinals, and trap primers shall be capable of delivering not less than 15 psi (103 kPa) residual pressure at the highest and most remote outlet served. Where the water pressure in the rainwater supply system within the building exceeds 80 psi (552 kPa), a pressure reducing valve reducing the pressure to 80 psi (552 kPa) or less to all water outlets in the building shall be installed in accordance with the plumbing code.

505.9.7 Roof Drains. Primary and secondary roof drains, conductors, leaders, and gutters shall be designed and installed in accordance with the plumbing code.

505.9.8 Water Quality Devices and Equipment. Devices and equipment used to treat rainwater to maintain the minimum water quality requirements determined by the Authority Having Jurisdiction shall be listed or labeled (third-party certified) by a listing agency (accredited conformity assessment body) and approved for the intended application.

505.9.9 Freeze Protection. Tanks and piping installed in locations subject to freezing shall be provided with an adequate means of freeze protection.

505.9.10 Debris Removal. The rainwater catchment conveyance system shall be equipped with a debris excluder or other approved means to prevent the accumulation of leaves, needles, other debris and sediment from entering the storage tank. Devices or methods used to remove debris or sediment shall be accessible and sized and installed in accordance with manufacturer's installation instructions.

505.9.11 Required Filters. A filter permitting the passage of particulates no larger than 100 microns (100 μm) shall be provided for rainwater supplied to water closets, urinals, trap primers, and drip irrigation system.

505.9.12 Roof Gutters. Gutters shall maintain a minimum slope and be sized in accordance with the plumbing code.

505.10 Signs. Signs in buildings using rainwater water shall be in accordance with Section 505.10.1 and Section 505.10.2.

505.10.1 Commercial, Industrial, and Institutional Restroom Signs. A sign shall be installed in all restrooms in commercial, industrial, and institutional occupancies using non-potable rainwater for water closets, urinals or both. Each sign shall contain ½ of an inch (12.7 mm) letters of a highly visible color on a contrasting background. The location of the sign(s) shall be such that the sign(s) shall be visible to all users. The number and location of the signs shall be approved by the Authority Having Jurisdiction and shall contain the following text:

TO CONSERVE WATER, THIS BUILDING USES RAINWATER TO FLUSH TOILETS AND URINALS.

505.10.2 Equipment Room Signs. Each equipment room containing non-potable rainwater equipment shall have a sign posted with the following wording in 1 inch (25.4 mm) letters:

CAUTION NON-POTABLE RAINWATER, DO NOT DRINK. DO NOT CONNECT TO DRINKING WATER SYSTEM. NOTICE: CONTACT BUILDING MANAGEMENT BEFORE PERFORMING ANY WORK ON THIS WATER SYSTEM.

This sign shall be posted in a location that is visible to anyone working on or near rainwater water equipment.

505.11 Inspection and Testing. Rainwater catchment systems shall be inspected and tested in accordance with Section 505.11.1 through Section 505.11.2.

505.11.1 Supply System Inspection and Test. Rainwater catchment systems shall be inspected and tested in accordance with the applicable provisions of the plumbing code for testing of potable water and storm drainage systems.

505.11.2 Annual Cross-Connection Inspection and Testing. An initial and subsequent annual inspection and test required by Section 505.5 shall be performed on both the potable and rainwater catchment water systems. The potable and rainwater catchment water system shall be isolated from each other and independently inspected and tested to ensure there is no cross-connection in accordance with Section 505.11.2.1 through Section 505.11.2.4.

505.11.2.1 Visual System Inspection. Prior to commencing the cross-connection testing, a dual system inspection shall be conducted by the Authority Having Jurisdiction and other authorities having jurisdiction as follows:

- (1) Pumps, equipment, equipment room signs, and exposed piping in equipment room shall be checked.

505.11.2.2 Cross-Connection Test. The procedure for determining cross-connection shall be followed by the applicant in the presence of the Authority Having Jurisdiction and other authorities having jurisdiction to determine whether a cross-connection has occurred as follows:

- (1) The potable water system shall be activated and pressurized. The rainwater catchment water system shall be shut down and completely drained.
- (2) The potable water system shall remain pressurized for a minimum period of time specified by the Authority Having Jurisdiction while the rainwater catchment water system is empty. The minimum period the rainwater catchment water system is to remain depressurized shall be determined on a case-by-case basis, taking into

account the size and complexity of the potable and rainwater catchment water distribution systems, but in no case shall that period be less than 1 hour.

- (3) Fixtures, potable and rainwater shall be tested and inspected for flow. Flow from any rainwater catchment water system outlet shall not indicate a cross-connection. No flow from a potable water outlet shall indicate that it is connected to the rainwater water system.
- (4) The drain on the rainwater catchment water system shall be checked for flow during the test and at the end of the period.
- (5) The potable water system shall then be completely drained.
- (6) The rainwater catchment water system shall then be activated and pressurized.
- (7) The rainwater catchment water system shall remain pressurized for a minimum period of time specified by the Authority Having Jurisdiction while the potable water system is empty. The minimum period the potable water system is to remain depressurized shall be determined on a case-by-case basis, but in no case shall that period be less than 1 hour.
- (8) Fixtures, potable and rainwater catchment, shall be tested and inspected for flow. Flow from any potable water system outlet shall not indicate a cross-connection. No flow from a rainwater catchment water outlet shall indicate that it is connected to the potable water system.
- (9) The drain on the potable water system shall be checked for flow during the test and at the end of the period.
- (10) If there is no flow detected in any of the fixtures which would indicate a cross-connection, the potable water system shall be repressurized.

505.11.2.3 Discovery of Cross-Connection. In the event that a cross-connection is discovered, the following procedure, in the presence of the Authority Having Jurisdiction, shall be activated immediately:

- (1) Rainwater catchment water piping to the building shall be shut down at the meter, and the rainwater water riser shall be drained.
- (2) Potable water piping to the building shall be shut down at the meter.
- (3) The cross-connection shall be uncovered and disconnected.
- (4) The building shall be retested following procedures listed in Section 505.11.2.1 and Section 505.11.2.2.
- (5) The potable water system shall be chlorinated with 50 ppm chlorine for 24 hours.

- (6) The potable water system shall be flushed after 24 hours, and a standard bacteriological test shall be performed. If test results are acceptable, the potable water system shall be permitted to be recharged.

505.11.2.4 Annual Inspection. An annual inspection of the rainwater catchment water system, following the procedures listed in Section 505.11.2.1 shall be required. Annual cross-connection testing, following the procedures listed in Section 505.11.2.2 shall be required by the Authority Having Jurisdiction, unless site conditions do not require it. In no event shall the test occur less than once in 4 years.

Alternate testing requirements shall be permitted by the Authority Having Jurisdiction.

CHAPTER 6

WATER HEATING DESIGN, EQUIPMENT AND INSTALLATION

601.0 General.

601.1 Scope. The provisions of this chapter shall establish the means of conserving potable and non-potable water and energy associated with the generation and use of hot water in a building. This includes provisions for the hot water distribution system, which is the portion of the potable water distribution system between a water heating device and the plumbing fixtures, including all dedicated return piping and appurtenances to the water heating device in a recirculation system.

602.0 Service Hot Water – Low-Rise Residential Buildings.

602.1 General. The service water heating system for single-family houses, multi-family structures of three stories or fewer above grade, and modular houses shall be in accordance with Section 602.2 through Section 602.5. The service water heating system of all other buildings shall be in accordance with Section 604.0.

602.2 Water Heaters and Storage Tanks. Residential-type water heaters, pool heaters, and unfired water heater storage tanks shall meet the minimum performance requirements specified by federal law.

Unfired storage water heating equipment shall have a heat loss through the tank surface area of less than 6.5 British thermal units per hour per square foot ($\text{Btu}/\text{h}\cdot\text{ft}^2$) ($20.5 \text{ W}/\text{m}^2$). [ASHRAE 90.2:7.1]

602.3 Recirculation Systems.

602.3.1 Pump Operation. Circulating hot water systems shall be arranged so that the circulating pump(s) can be turned off (automatically or manually) when the hot water system is not in operation. [ASHRAE 90.2:7.2]

602.3.2 Demand Controlled. The circulation pump shall not operate continuously, be controlled by a timer or have the pump operation initiated by water temperature. The circulation pump shall only operate when a signal is received shortly before hot water is desired at the fixture.

602.3.3 System Balancing. Systems with multiple recirculation zones shall be balanced to uniformly distribute hot water, or they shall be operated with a pump for each zone.

602.3.4 Flow Balancing Valves. Flow balancing valves shall be a factory preset automatic flow control valve, a flow regulating valve, or a balancing valve with memory stop.

602.3.5 Air Elimination. Provision shall be made for the elimination of air from the return system.

602.3.6 Gravity or Thermosiphon Systems. Gravity or thermosiphon systems are prohibited.

602.4 Central Water Heating Equipment. Service water heating equipment (central systems) that does not fall under

the requirements for residential-type service water heating equipment addressed in Section 602.0 shall meet the applicable requirements for service water-heating equipment found in Section 603.0. [ASHRAE 90.2:7.3]

602.5 Insulation. Hot water supply and return piping shall be thermally insulated. The wall thickness of the insulation shall be equal to the nominal diameter of the pipe up to 2 inches (50 mm). The wall thickness shall be not less than 2 inches (51 mm) for nominal pipe diameters exceeding 2 inches (50 mm). The conductivity of the insulation [k -factor ($\text{Btu}\cdot\text{in}/(\text{h}\cdot\text{ft}^2\cdot^\circ\text{F})$)], measured radially, shall be less than or equal to 0.28 [$\text{Btu}\cdot\text{in}/(\text{h}\cdot\text{ft}^2\cdot^\circ\text{F})$] [$0.04 \text{ W}/(\text{m}\cdot\text{k})$]. Hot water piping to be insulated shall be installed such that insulation is continuous. Pipe insulation shall be installed to within $\frac{1}{4}$ of an inch (6.4 mm) of all appliances, appurtenances, fixtures, structural members, or a wall where the pipe passes through to connect to a fixture within 24 inches (610 mm). Building cavities shall be large enough to accommodate the combined diameter of the pipe plus the insulation, plus any other objects in the cavity that the piping must cross. Pipe supports shall be installed on the outside of the pipe insulation.

Exceptions:

- (1) Where the hot water pipe is installed in a wall that is not of sufficient width to accommodate the pipe and insulation, the insulation thickness shall be permitted to have the maximum thickness that the wall can accommodate and not less than $\frac{1}{2}$ of an inch (12.7 mm) thick.
- (2) Hot water supply piping exposed under sinks, lavatories, and similar fixtures.
- (3) Where hot water distribution piping is installed within attic, crawlspace, or wall insulation.
 - (a) In attics and crawlspaces the insulation shall cover the pipe not less than $5\frac{1}{2}$ inches (140 mm) further away from the conditioned space.
 - (b) In walls, the insulation must completely surround the pipe with not less than 1 inch (25.4 mm) of insulation.
 - (c) If burial within the insulation will not completely or continuously surround the pipe, then these exceptions do not apply.

602.6 Hard Water. Where water has hardness equal to or exceeding 9 grains per gallon (gr/gal) (154 mg/L) measured as total calcium carbonate equivalents, the water supply line to water heating equipment in new one- and two family dwellings shall be roughed-in to allow for the installation of water treatment equipment.

602.7 Maximum Volume of Hot Water. The maximum volume of water contained in hot water distribution lines between the water heater and the fixture stop or connection to showers, kitchen faucets, and lavatories shall be determined in accordance with Sections 602.7.1, 602.7.2, or 602.7.3. The water volume shall be calculated using Table 602.7.