



## Rainwater & Gray Water Policy

### APPENDIX H

### WATER RECOVERY

#### Division I – All

**H101 General.** This appendix is designed to provide safe usage of water that is acquired through a Re-use source and/or through Rainwater Harvesting methods. For the purpose of this appendix, Water Recovery shall mean water that is acquired through a source other than the local municipal water supply, is saved from loss and made available for use.

Since water acquired from sources other than a municipal water supply has inherent limitations of quality and usability, installation requirements are necessary to protect the end user and prevent the possible contamination of potable water sources that are also present on the property. As such, the requirements as specified in this appendix shall be applicable as follows:

- a. Rainwater Harvesting Systems, Division II;
- b. Reclaimed Water Systems, Division III;
- c. Gray Water Systems, Division IV.

There may be other methods of water recovery, or water sources available or newly created, that are not specifically addressed in this appendix. Any system not specifically covered in this appendix shall be subject to approval of the Building Official, under the authority granted by this code as follows:

- a. Section 104.1 “The building official shall have the authority to render interpretations of this code and to adopt and enforce rules and supplemental regulations to clarify the application of its provisions.”
- b. Section 104.11 “The building official may approve any such alternate (*design or method of construction*), provided the building official finds that the proposed design is satisfactory and complies with the provisions of this code and that the material, method or work offered is, for the purpose intended, at least the

equivalent of that prescribed in this code in suitability, strength, effectiveness, fire resistance, durability, safety and sanitation.”

**H102 Scope.** This appendix shall apply to the installation, construction, alteration, repair and maintenance of any Water Recovery System. The provisions listed in this appendix are only authorized for the use of non-potable water. However, all systems shall comply with the same plumbing requirements as a potable water system.

The provisions of this code for “Plumbing” and “Plumbing Systems” shall be applicable to those systems described in this appendix, except as amended by this appendix. Although some provisions of this appendix are applicable to potable systems, when any use is intended to be for potable water, the design and purification system must be separately approved by the Building Official.

**Exception:** This appendix shall not apply to water whose source is from a well. The other plumbing provisions of this code will still apply to a well system. If such well water is combined with a Water Recovery System, then the system after the combination shall comply with this appendix.

**H103 Authority having Jurisdiction.** The provisions of this appendix shall be under the authority of the Building Official except where the Director of the Water Department is specifically listed as the authority or as shared authority.

**H104 State Law.** Various provisions of this appendix are also referenced under State Law along with other sources of recommended installation methods. Compliance with State Law is the responsibility of the producer, provider and user of such installations. It is recommended that the following reference material be reviewed for guidance:

Harvesting, Storing, and Treating Rainwater for Domestic Indoor Use  
[http://www.tceq.state.tx.us/files/gi-366.pdf\\_4231966.pdf](http://www.tceq.state.tx.us/files/gi-366.pdf_4231966.pdf)

The Texas Manual on Rainwater Harvesting  
[http://www.twdb.state.tx.us/publications/reports/RainwaterHarvestingManual\\_3rdedition.pdf](http://www.twdb.state.tx.us/publications/reports/RainwaterHarvestingManual_3rdedition.pdf)

Texas Rainwater Harvesting Evaluation Committee Final Report  
<http://www.twdb.state.tx.us/iwt/rainwater/docs/RainwaterCommitteeFinalReport.pdf>

Rainwater Harvesting – Frequently Asked Questions  
<http://www.twdb.state.tx.us/iwt/rainwater/faq.html>

Water Reuse – Frequently Asked Questions  
<http://www.twdb.state.tx.us/iwt/reuse/faq.html>

State of Texas Administrative Code – Title 30, Environmental Quality  
Chapter 210 – Use of Reclaimed Water  
[http://info.sos.state.tx.us/pls/pub/readtac\\$ext.ViewTAC?tac\\_view=4&ti=30&pt=1&ch=210](http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=4&ti=30&pt=1&ch=210)

State of Texas Administrative Code – Title 30, Environmental Quality  
Chapter 210 – Use of Graywater Systems  
[http://info.sos.state.tx.us/pls/pub/readtac\\$ext.ViewTAC?tac\\_view=5&ti=30&pt=1&ch=210&sch=F&rl=Y](http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=5&ti=30&pt=1&ch=210&sch=F&rl=Y)

State of Texas Administrative Code – Title 30, Environmental Quality  
Chapter 210 – Rules and Regulations for Public Water Systems  
[http://info.sos.state.tx.us/pls/pub/readtac\\$ext.ViewTAC?tac\\_view=4&ti=30&pt=1&ch=290](http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=4&ti=30&pt=1&ch=290)

No provision of this appendix shall be construed as granting authority to violate nor assuring compliance with State Law. The provisions of this appendix and this code may be more stringent than those covered under state law.

**H105 Color Coding.** Color coding requirements are specified in various sections of this appendix to identify piping used for water recovery systems when entering a building. Such color coding is prohibited from use on any other plumbing system.

**Exception:** When required by the Water Department, such color coding may also be required for exterior piping, such as irrigation systems that use water from systems covered in this appendix.

## Division II – Rainwater Harvesting

**H201 Scope.** The provisions of this Division shall apply to the installation, construction, alteration, repair and maintenance of Rainwater Harvesting Systems. Provisions listed herein that are identified as “Recommended Practice” or “Informational” in italic text shall not be mandatory. If collected rain water is combined with another water recovery source or domestic water, the most restrictive provisions shall apply.

**Exception:** Any piping, joints and equipment used for irrigation systems that occur after the pump shall be subject to any applicable provisions in the Water Department Irrigation regulations. An irrigation and/or backflow permit may be required by the Water Department.

**H202 Definitions.** All definitions listed in this section are intended to be in agreement with the State of Texas laws. Any definition not listed shall be as defined in this code, other city codes or State Law.

**CATCHMENT SURFACE** is the collection surface from which rainfall runs off.; e.g. roof top, wall, surface paving, etc.

**DEBRIS** is used to describe any visible contaminant including leaves and twigs, dust and dirt, bird and animal droppings, insects, and other visible material.

*Informational: Although debris obviously reduces the aesthetic quality of the water, it can also pose unseen chemical and biological health threats. For example, leaves and dust can contain unseen chemical contaminants such as herbicides and pesticides. Similarly, bird and animal dropping can contain microscopic parasites, bacteria, and viruses.*

*Other contaminants can include:*

*Volatile Organic Chemicals (VOC) can be introduced when rainwater comes into contact with materials containing refined organic products including plastics, glues, and solvents, as well as gasoline, greases, and oils.*

*Synthetic Organic Chemicals (SOCs) are chemicals that are typically found in pesticides, herbicides, and similar man-made products.*

*Minerals are inorganic materials found naturally in the environment including inorganic salts (such as calcium carbonate, sodium bicarbonate, magnesium sulfate, and sodium chloride).*

*Metals include lead, arsenic, copper, iron, and manganese.*

**NONPOTABLE WATER** is water that may have received some treatment but not enough to make it safe for potable use. Nonpotable water can be used for watering lawns

and gardens, washing clothes, or flushing toilets, but should not be used for any purpose that might result in the ingestion of the water or its contact with the skin.

**POTABLE WATER** is water that is used for preparing food or beverages for human consumption, for washing dishes and utensils that are used to prepare or consume food or beverages, for bathing, or for any other purpose that might result in the ingestion of water or its contact with the skin.

**RAINWATER HARVESTING** is the capture and storage of rainwater for purposes such as landscape irrigation, potable and non-potable indoor uses, and storm water abatement.

*Informational: Rainwater harvesting can be classified into two broad categories: land-based and roof-based. Land-based rainwater harvesting occurs when rainwater runoff from the land is collected in ponds and small impoundments before it reaches a river or stream. Roof-based harvesting involves collecting the rainwater that falls on a roof before the water reaches the ground. Both systems are subject to contamination and must be properly treated before it can be used.*

**H203 Permits required.** No special permit(s) is required by this department for a rainwater system beyond the permits already required by this code and other city codes. Examples, but not an all inclusive list, of possible permits are as follows:

- a. Rainwater collection system that conveys water to an above ground tank, such as a rain barrel, for gravity flow (hose flow) irrigation distribution:
  1. no permits are required. However, the following provisions are mandatory:
    - i. mosquito protection
    - ii. the tank (the barrel) must be in compliance with the tank provisions listed herein to prevent algae growth, provide overflow protection, etc.
- b. Rainwater collection system that conveys water to an above or below ground tank for pressurized distribution, such as through a pump:

Permits are required for:

1. the pump and its electrical service;
2. all piping, joints and equipment after the pump when the system enters a building or structure. The entire system starting from the catchment surface is subject to compliance and inspection;
3. other than the pump, as listed above, no permits are required by this department when the system is for irrigation only and does not enter a building or structure. However, an irrigation and/or backflow permit may be required by the Water Department. The following provisions are mandatory:
  - i. mosquito protection

- ii. the tank must be in compliance with the tank provisions listed herein to prevent algae growth, provide overflow protection, etc.
- c. Rainwater collection system in which the rainwater is combined with another water recovery source or domestic water:
  - 1. the most restrictive permit requirements shall be applicable, and the entire system starting from the catchment surface is subject to compliance and inspection.
- d. Any piping, joints and equipment used for irrigation systems that occur after the pump shall be subject to any applicable provisions in the Water Department Irrigation regulations.

When a permit is required through this department, even if just for the pump, plans and diagrams must be submitted showing compliance with the provisions of this appendix.

**Exception:** Plans need not be provided to this department for any portion of the irrigation piping that occurs after the pump.

#### **H204 System Limitations/Restrictions.**

**H204.1 Allowable Uses.** The provisions of this division are designed only for the non-potable use of rain water. Although some provisions listed herein are applicable to potable systems, when any use is intended to be for potable water, the design and purification system must be separately approved by the Building Official.

Non-potable uses include irrigation, water closets (toilets), urinals, washing clothes, and industrial uses.

*Informational: In planning a rainwater collection and storage system:*

- a. *The catchment and storage facilities must be designed so that they reduce potential sources of contamination.*
- b. *The catchment surface and storage tanks should be large enough to capture and store enough rainwater to last until the next time it rains. Otherwise, you will need to identify a supplemental source of water.*

*Fort Worth, Texas has an average of 35 inches of rainfall per year. A 2,000 sq.ft. roof can provide about 35,000 gallons of water annually. There is an average of 55 days between rainfall periods. If storage capacity is not large enough to capture the maximum water at each rainfall event, the overflow will be lost and realization of the full 35,000 gallon potential will not be achieved.*

**H204.2 Connection to Potable Water Systems.** The rainwater system shall have no connection to any potable water system, except as approved by the Water Department. When the rainwater system tank is supplemented with a potable water

source, such connection shall be made with an air gap. Exposed piping shall be resistant to damage from UV rays and must have adequate freeze protection.

Public water system customers that also have rainwater harvesting systems must install a reduced pressure zone (RPZ) backflow preventer at the service meter.

**Exception:** A reduced pressure zone backflow preventer is not required for the gravity fed (rain barrel) irrigation system where no cross-connection to the potable supply exists.

**H204.3 Components.** Regardless of the complexity of the system, the rainwater harvesting system comprises six basic components:

- a. Catchment surface: the collection surface from which rainfall runs off.
- b. Gutters and downspouts: channel water from the roof to the tank.
- c. Leaf screens, first-flush diverters, and roof washers: components which remove debris and dust from the captured rainwater before it goes to the tank.
- d. One or more storage tanks, also called cisterns.
- e. Delivery system: gravity-fed or pumped to the end use.
- f. Treatment/purification: filters and other methods to prevent particles from clogging, contaminating or damaging equipment.

**H204.3.1 Catchment surface.** *(This subsection is Informational only)*

- a. *Roofs with copper flashings can cause discoloration of porcelain fixtures.*
- b. *Clay and concrete tiles may contribute to as much as a 10% loss of water due to texture, inefficient flow, or evaporation.*
- c. *Due to leaching of toxins, composite shingles are not appropriate for potable systems, but can be used to collect water for irrigation. Composite roofs have an approximated 10% loss due to inefficient flow or evaporation.*
- d. *Water harvested using wood shingle, tar, and gravel roofing materials is suitable only for irrigation due to leaching of compounds.*
- e. *Slate's smoothness makes it ideal for a catchment surface for portable use, assuming no toxic sealant is used.*

**H204.3.2 Gutters and downspouts.** *(This subsection is Informational only)*

- a. *For potable water systems, lead cannot be used as gutter solder.*
- b. *Copper can cause discoloration of porcelain fixtures.*

**H204.3.3 Leaf Screens.** Leaf screens are required to prevent larger debris from entering the system. Debris can fill holding tanks, block piping and clog or damage pumps, irrigation emitters and plumbing equipment. Leaf screens come in many forms including:

- a. Leaf guards, usually ¼" mesh screens in wire frames that fit along the length of the gutter.

- b. Funnel-type downspout filter, made of PVC or galvanized steel fitted with a stainless steel or brass screen.
- c. Strainer baskets, spherical cage-like strainers that slip into the drop outlet of the downspout.
- d. A cylinder of rolled screen inserted into the drop outlet.
- e. Filter sock of nylon mesh can be installed on the PVC pipe at the tank inflow.

**H204.3.4 First-Flush Diverters.** First-flush diverters are required. A roof can be a natural collection surface for dust, leaves, blooms, twigs, insect bodies, animal feces, pesticides, and other airborne residues. The first-flush diverter routes the first flow of water from the catchment surface away from the storage tank. The first-flush diverter gives the system a chance to rid itself of the smaller contaminants that are not stopped by the leaf screens, such as dust, pollen, and bird and rodent feces.

*Informational: The first-flush diverters should be capable of diverting at least 10 gallons per 1,000 square feet of collection (roof) area. Diverters need to be emptied after each rain event.*

**H204.3.5 Roof Washers.** The roof washer is required for systems to be used as potable water. For irrigation systems using drip irrigation, installation is recommended to prevent clogging of the emitters.

**H204.3.6 Storage Tanks.** A gallon of water weighs 8.34 pounds. (50 gallons weighs 417 pounds) Storage tanks, their foundation and their installation method must be capable of holding the imposed weight. Also, the water and its clarity may be affected by exposure to sunlight and the tank material, lining, or any paint that might be used.

Tank water is subject to algae growth and mosquito breeding. Algae can affect the clarity and odor of the water. Mosquito breeding is a health hazard.

The following provisions are required.

- a. Storage tanks must be opaque, either upon purchase or painted later, to inhibit algae growth.
- b. For potable systems, storage tanks must never have been used to store toxic materials.
- c. Tanks must be covered and vents screened to discourage mosquito breeding.
- d. Tanks used for potable systems must be accessible for cleaning.
- e. Tanks should be protected for direct sunlight if possible.
- f. Tanks are required to have an overflow design, and the overflow discharge should not enter septic system drain fields and should be routed so that it does not affect the foundation of the tanks or any other structures.

- g. Tanks should be placed on a stable, level pad.
- h. Wood tanks for potable water use must be lined with a food-grade liner.
- i. Under ground tanks within 5' of the foundation of a building or structure require an engineered design to insure the stability of that building or structure.
- j. If supplied with supplemental water from a potable water source, the connection must be made through an air gap and must be inspected as part of the permit for the extension of the potable water line.

**H204.3.6.1 Tank size.** When used to supply plumbing fixtures, the tank shall be a minimum of twice the volume of water required to meet the daily requirements of the fixtures supplied, but not less than 50 gallons (189 L).

*Informational: When a plumbing fixture is operated, such as flushing a water closet or operating a washing machine, it is important to have the necessary quantity of water in the tank to meet the demand. Otherwise, the tank may empty faster than the supplemental line can refill.*

**H204.3.6.2 Makeup water.** When rainwater is used to supply plumbing fixtures, potable water or approved well water from a dependable supply, shall be provided as a source of makeup water to the tank. Such connection to the tank shall be made with an air gap. Further, an adequate internal cross-connection control program is required to be demonstrated to the Water Department.

**H204.3.7 Treatment.** Filter systems installed after the pump may be necessary to reduce the number and size of particles that are distributed in the system.

*Recommended Practice:*

*For non-potable systems used for hose irrigation, leaf screens on gutters and a roof washer is usually sufficient. If drip irrigation is planned, extra sediment filtration beyond the leaf screens, first-flush diverter and roof washer may be necessary to prevent clogging of emitters.*

*Disinfecting non-potable rainwater for indoor use is desirable to control microbial growth which could cause fouling and affect the operation of plumbing fixtures. A 5 micron filter may be sufficient. Disinfection can be accomplished by passing the water through ultraviolet light or by treating it with chlorine.*

*Informational: For non-potable rainwater for indoor use, household bleach (6% sodium hypochlorite) may be applied to the cistern at the rate of 2 fluid ounces per 1,000 gallons of water to achieve disinfection.*

For potable water systems, treatment beyond the leaf screen, first-flush diverter and roof washer is necessary to remove sediment and disease-causing pathogens.

*Recommended Practice: If using non-potable water inside a building, e.g. toilets, urinals, clothes washing, filtering to remove small particles that might clog valves and equipment should be considered.*

Treatment generally consists of filtration and disinfection processes in series before distribution.

Treatment options include:

- a. Cartridge Filters and Ultraviolet (UV) Light  
Two in-line sediment filters – the 5 micron fiber cartridge filter followed by the 3-micron activated charcoal cartridge filter – followed by ultraviolet light.
- b. Ozone  
Chemically, ozone is O<sub>3</sub>; essentially a more reactive form of molecular oxygen made up of three atoms of oxygen. An ozone generator forces ozone into storage tanks through rings or a diffuser stone. Ozone is unstable and reacts quickly to revert to O<sub>2</sub> and dissipates through the atmosphere.
- c. Membrane Filtration (Reverse Osmosis and Nanofiltration)  
Membrane filtration, such as reverse osmosis and nanofiltration work by forcing water under high pressure through a semipermeable membrane to filter dissolved solids and salts, both of which are in very low concentrations in rainwater.
- d. Chlorination  
A chlorine pump injects chlorine in to the water as it enters the building. A practical chlorine contact time, which is critical to kill bacteria, is usually from 2 minutes to 5 minutes with a free chlorine residual of 2 parts per million (ppm).

## **H205 Special Design Criteria**

**H205.1 Material.** Unless it can be shown by the designer that the acidic property of rainwater is to be reduced, the use of copper pipe or tubing shall be limited as follows:

- a. No prohibitions apply for a gravity flow (rain barrel) irrigation system.
- b. No prohibitions apply to the irrigation system after the pump. Copper shall not be used from the tank to the pump.
- c. When any part of the system enters a building or structure, copper shall not be used from the tank to any discharge point, except that those lines dedicated for irrigation only may use copper.

*Informational: Rainwater is very soft and somewhat acidic, so it tends to be more corrosive than most other sources of drinking water. Due to the corrosive tendencies of rainwater, you should NOT use copper pipe or tubing, even if it is ANSI/NSF certified, because of its potential to develop pinhole leaks.*

**H205.2 Material Identification.** If rainwater is used in a building or structure, the pipe from the tank to the discharge point shall be labeled for non-potable uses. The pipe should be labeled in black lettering “RAINWATER – DO NOT DRINK” on a bright orange background. The label should be marked at two-foot intervals throughout the length of the pipe. Every toilet, urinal, hose bib, or other fixture that uses rainwater should be permanently identified at the point of connection as non-potable rainwater by the above labeling.

Identification may be by any method noted in Division III of this appendix. For private residences, identification of fixtures may be accomplished with the installation of a permanent tag attached to the fixture cut-off valve.

If collected rain water is combined with another source of recovered water, the most restrictive provisions for use and identification shall apply.

**H206 Protection of the Roof.** In order to prevent water back up and accumulation on the roof, no screen, diverter, washer, filter or any other method subject to blockage shall be installed as listed below:

- a. No system shall block a roof scupper.
- b. No item shall be installed in the system that could back up water to the roof unless some form of overflow relief is installed such that the water is discharged before accumulation on the roof.

*Informational: Roof drainage must occur. Any system that prevents the water from leaving the roof can create maintenance issues, such as leakage, or can overload the roof leading to collapse.*

**H207 Inspection and Testing.** Rainwater water piping shall be tested as outlined in this code for testing of potable water piping. Associated back-flow devices, as required by this code and the Water Department, shall be tested as required for potable water systems.

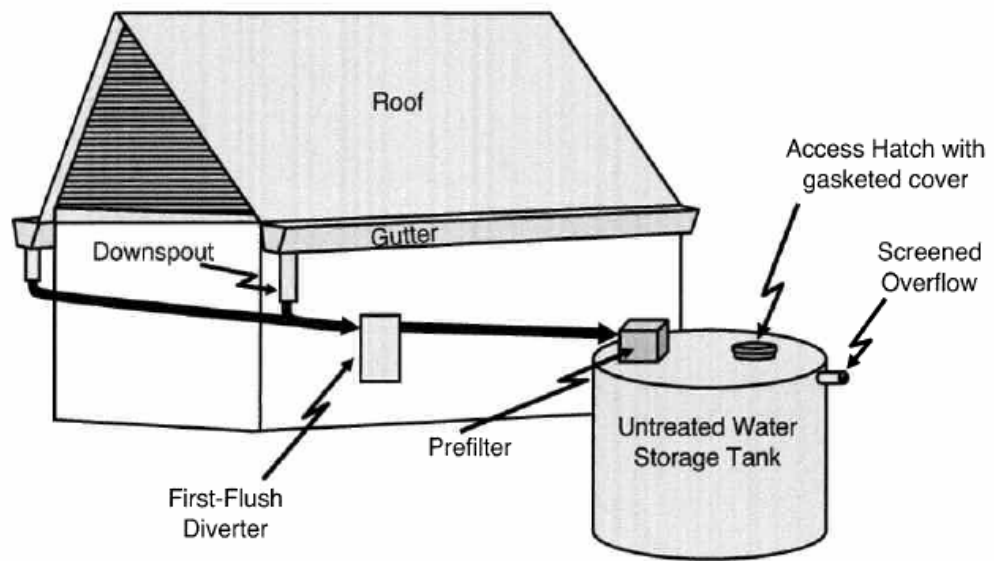
**H208 Maintenance.** The system must be maintained or appropriately abandoned in an approved manner as provided for in Section H209.

*Informational: The system owner should take into consideration the maintenance required to keep the system functioning as designed. Any failure to maintain the system can lead to damage to the tank, pump, piping, irrigation and plumbing equipment. Such damage should be expected to generate associated costs of repair.*

**H209 Abandonment.** When a rainwater system is to be abandoned, all re-piping necessary to supply the irrigation and/or plumbing system with another water source will require applicable permits along with a set of plans to be approved by the Building Official.

## Supplemental Information

### Rainwater Collection and Untreated Water Storage



## First-Flush Diverters

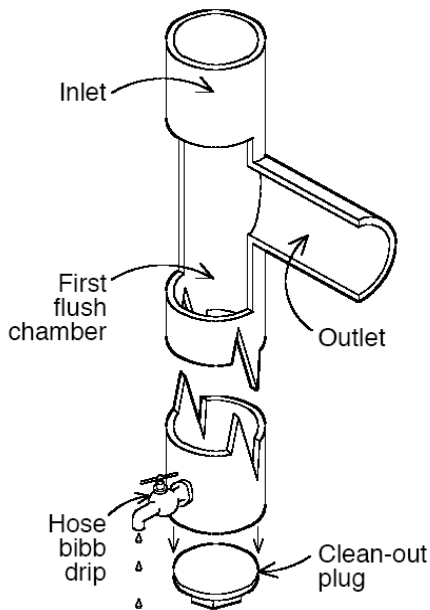


Figure 2-2. Standpipe first-flush diverter

### Standpipe with ball valve

The standpipe with ball valve is a variation of the standpipe filter. The cutaway drawing (Figure 2-3) shows the ball valve. As the chamber fills, the ball floats up and seals on the seat, trapping first-flush water and routing the balance of the water to the tank.

### Standpipe

The simplest first-flush diverter is a 6- or 8-inch PVC standpipe (Figure 2-2). The diverter fills with water first, backs up, and then allows water to flow into the main collection piping. These standpipes usually have a cleanout fitting at the bottom, and must be emptied and cleaned out after each rainfall event. The water from the standpipe may be routed to a planted area. A pinhole drilled at the bottom of the pipe or a hose bibb fixture left slightly open (shown) allows water to gradually leak out.

If you are using 3" diameter PVC or similar pipe, allow 33" length of pipe per gallon; 4" diameter pipe needs only 18" of length per gallon; and a little over 8" of 6" diameter pipe is needed to catch a gallon of water.

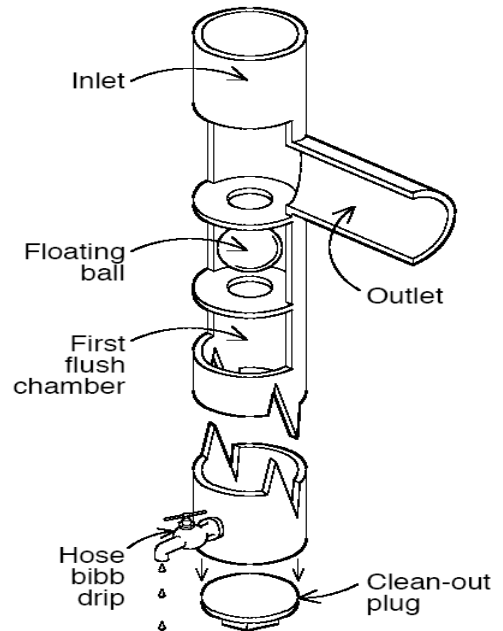


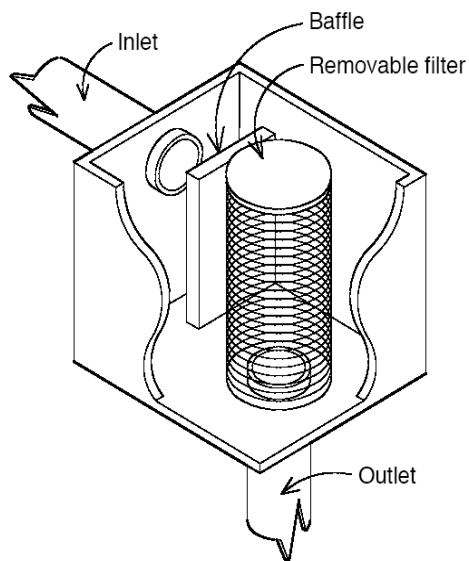
Figure 2-3. Standpipe with ball valve

## Roof Washers

The roof washer, placed just ahead of the storage tank, filters small debris for potable systems and also for systems using drip irrigation. Roof washers consist of a tank, usually between 30- and 50-gallon capacity, with leaf strainers and a filter (Figure 2-4). One commercially available roof washer has a 30-micron filter. (A micron, also called a micrometer, is one-millionth of a meter. A 30-micron filter has pores about one-third the diameter of a human hair.)

All roof washers must be cleaned. Without proper maintenance they not only become clogged and restrict the flow of rainwater, but may themselves become breeding grounds for pathogens.

The box roof washer (Figure 2-4) is a commercially available component consisting of a fiberglass box with one or two 30-micron canister filters (handling rainwater from 1,500- and 3,500-square-foot catchments, respectively). The box is placed atop a ladder-like stand beside the tank, from which the system owner accesses the box for cleaning via the ladder. In locations with limited drop, a filter with the canisters oriented horizontally is indicated, with the inlet and outlet of the filter being nearly parallel.



### Cistern Types

MATERIAL	FEATURES	CAUTION
<b>Plastics</b>		
Trash cans (20-50 gallon)	commercially available; inexpensive	use only new cans
Fiberglass	commercially available; alterable and moveable	must be sited on smooth, solid, level footing
Polyethylene/polypropylene	commercially available; alterable and moveable	UV-degradable, must be painted or tinted
<b>Metals</b>		
Steel drums (55-gallon)	commercially available; alterable and moveable	verify prior to use for toxics; prone to corrosion an rust;
Galvanized steel tanks	commercially available; alterable and moveable	possibly corrosion and rust; must be lined for potable use
<b>Concrete and Masonry</b>		
Ferrocement	durable and immoveable	potential to crack and fail
Stone, concrete block	durable and immoveable	difficult to maintain
Monolithic/Poured-in-place	durable and immoveable	potential to crack
<b>Wood</b>		
Redwood, fir, cypress	attractive, durable, can be disassembled and moved	expensive

Adapted from *Texas Guide to Rainwater Harvesting, Second Edition*, Texas Water Development Board, 1997.

## Average Annual Rainfall in the State of Texas For the Climatological Period 1971 - 2000.

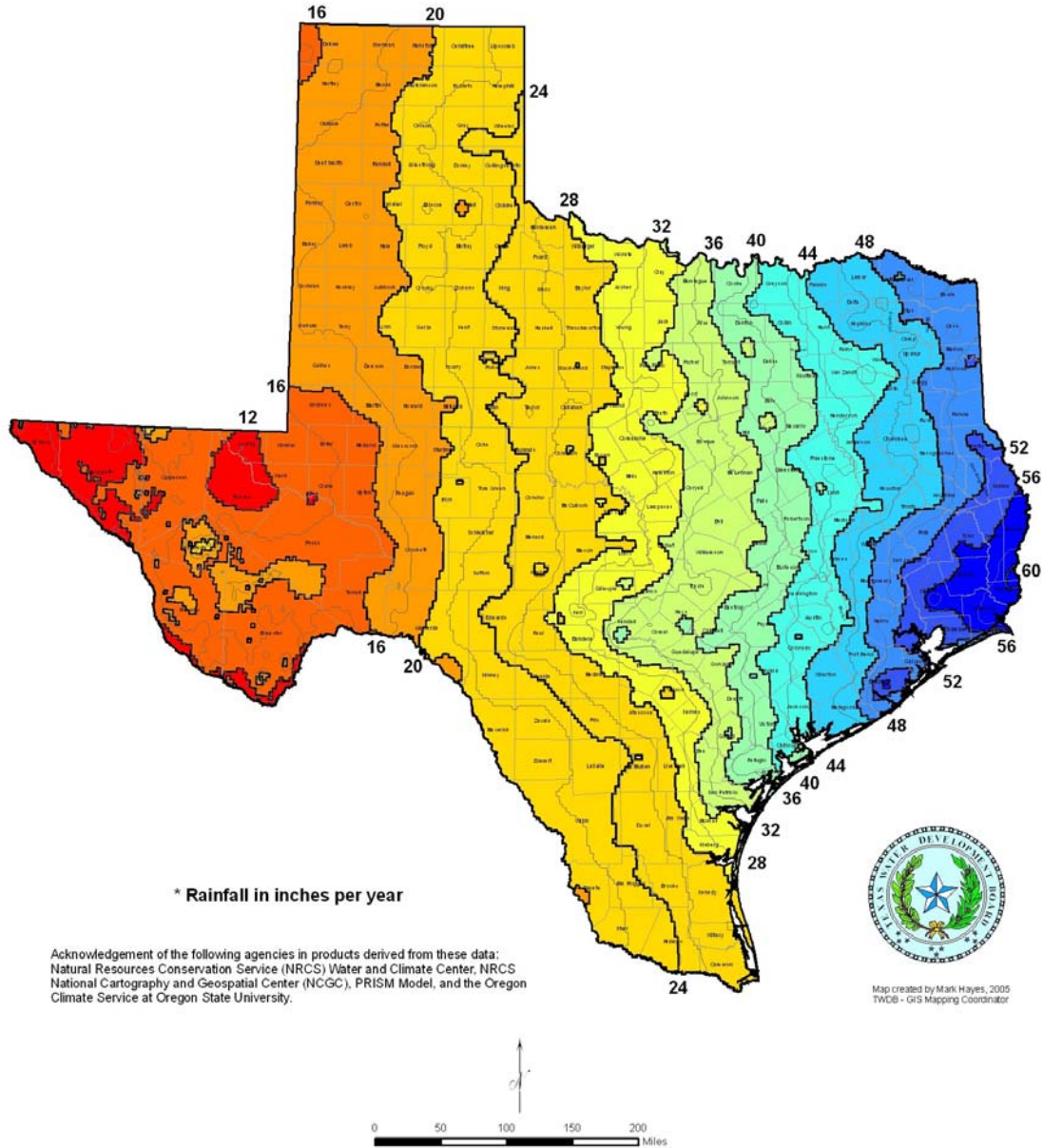


Figure 1. Average annual rainfall in Texas (in inches).

## Maximum Number of Consecutive Days Without Rainfall in Texas

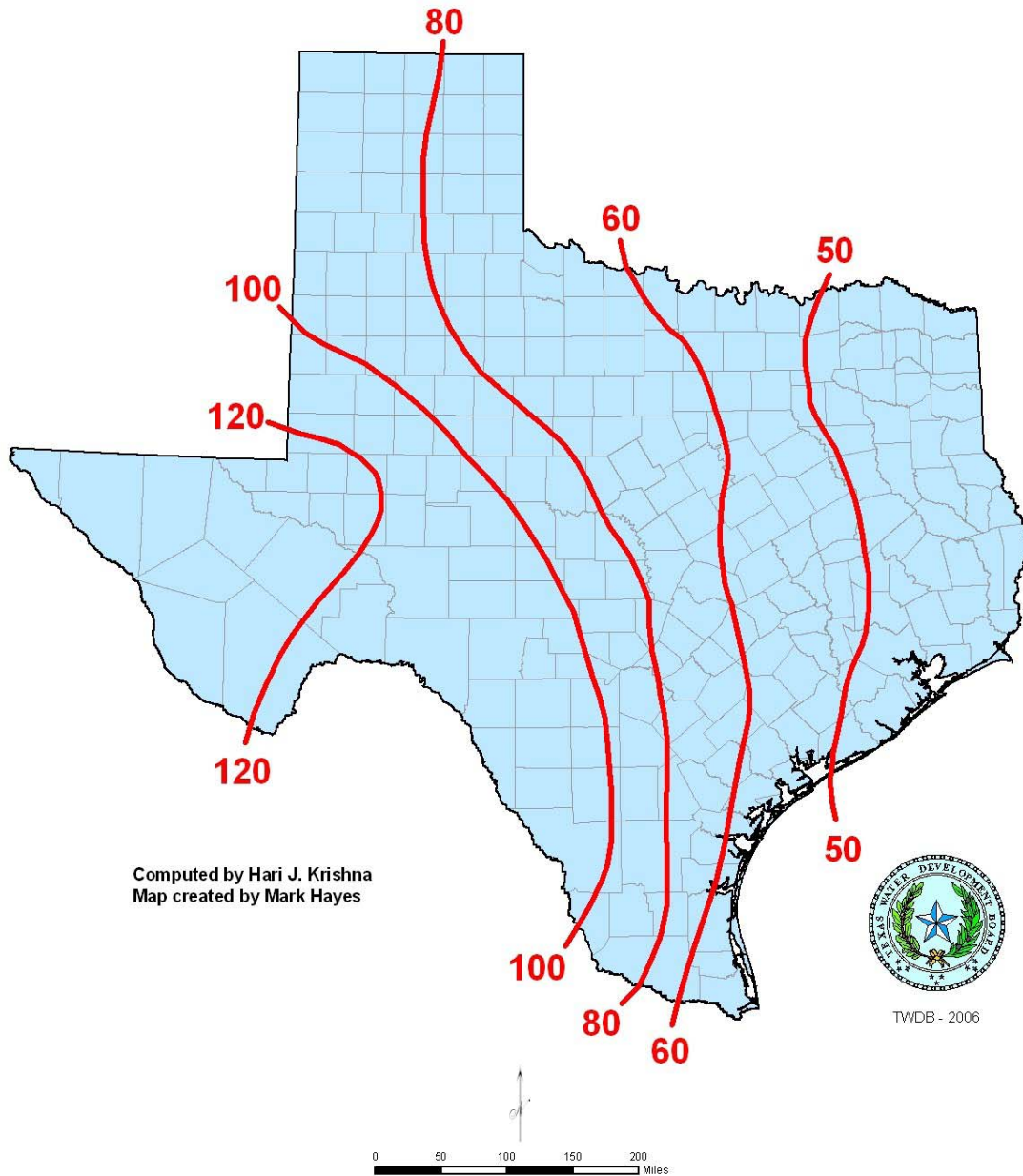


Figure 2. A map of Texas with isolines showing the maximum number of consecutive days without rainfall (Krishna, 2003; TWDB, 2005).

### Average Annual Runoff from 2,000 square feet of Roof Area

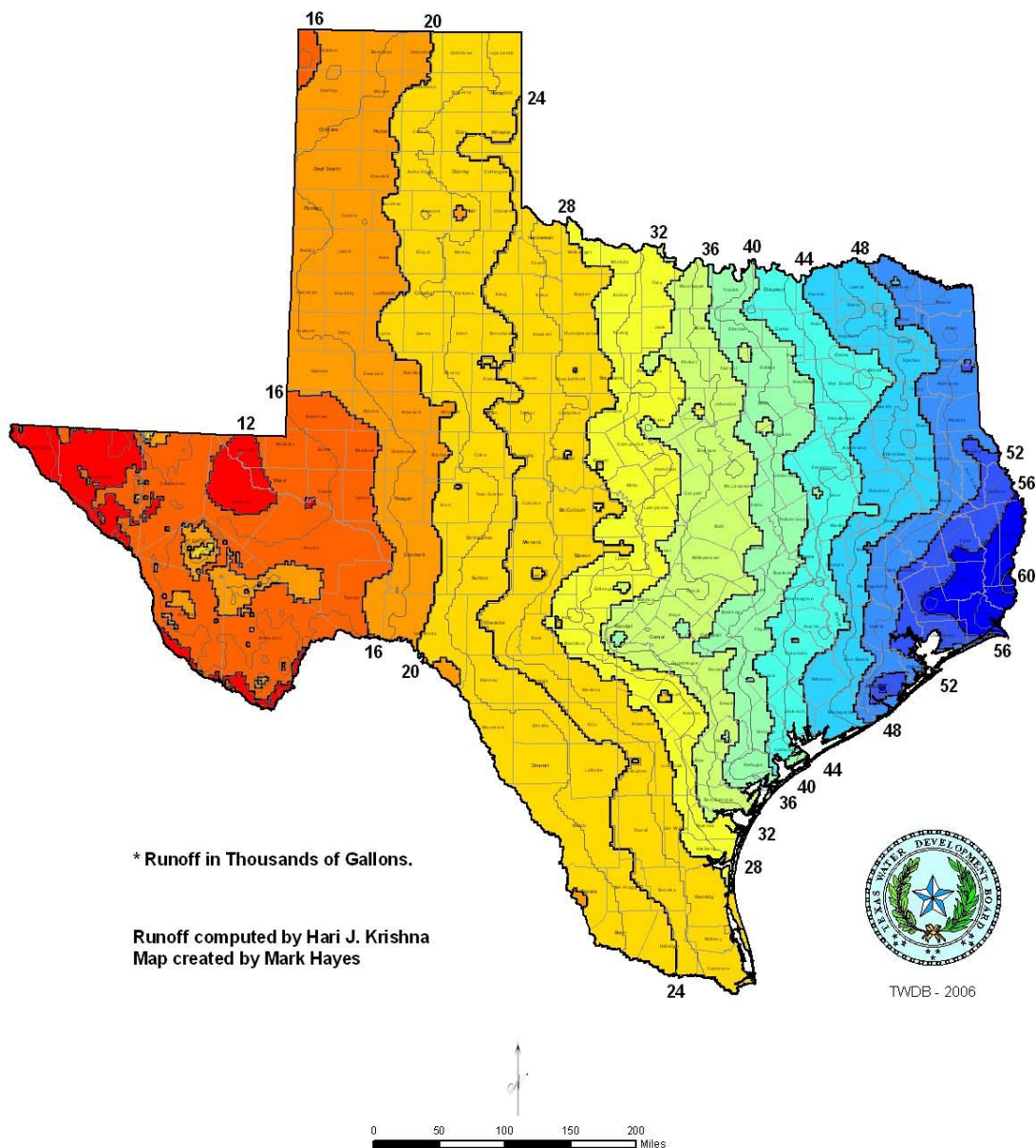


Figure 3. Map of Texas showing isolines of average annual runoff (in thousands of gallons) that can be expected from 2,000 square feet of roof area.

## **Division III – Reclaimed Water Systems**

**This Division is not in use at this time.**

## **Division IV – Gray Water**

**H401 Scope.** The provisions of this Division shall apply to the installation, construction, alteration, repair and maintenance of Gray Water Systems. Provisions listed herein that are identified as “Recommended Practice” or “Informational” in italic text shall not be mandatory. If Gray Water is combined with another water recovery source or domestic water, the most restrictive provisions shall apply.

This division shall apply to the entire Gray Water system.

**Exception:** Any piping, joints and equipment used for irrigation systems that occur after the pump shall be subject to any applicable provisions in the Water Department Irrigation regulations. An irrigation and/or backflow permit may be required by the Water Department.

**H402 Definitions.** All definitions listed in this section are intended to be in agreement with the State of Texas laws. Any definition not listed shall be as defined in this code, other city codes or State Law.

**GRAY WATER** – Wastewater from:

- a. showers;
- b. bathtubs;
- c. hand washing lavatories;
- d. sinks that are not used for disposal of hazardous or toxic ingredients;
- e. sinks not used for food preparation or disposal; and,
- f. clothes-washing machines.

Gray water does not include wastewater from the washing of material, including diapers, soiled with human excreta or wastewater that has come into contact with toilet waste.

**NUISANCE** – Any distribution, storage, or use of gray water, in such concentration and of such duration that is or may tend to be injurious to or which adversely affects human health or welfare, animal life, vegetation, or property, or which interferes with the normal use and enjoyment of animal life, vegetation, or property.

**H403 Permits required.** No special permit(s) is required by this department for a gray water system beyond the permits already required by this code and other city codes.

Any piping, joints and equipment used for irrigation systems that occur after the pump shall be subject to any applicable provisions in the Water Department Irrigation regulations. An irrigation and/or backflow permit may be required by the Water Department.

When a permit is required through this department, even if just for the pump, plans and diagrams must be submitted showing compliance with the provisions of this appendix.

**Exception:** Plans need not be provided to this department for any portion of the irrigation piping that occurs after the pump.

#### **H404 System Limitations/Restrictions.**

**H404.1 Connection to Potable Water Systems.** The gray water system shall have no connection to any potable water system, with or without mechanical backflow prevention devices. When the gray water system tank is supplemented with a potable water source, such connection shall be made with an air gap. Exposed piping shall be resistant to damage from UV rays and must have adequate freeze protection.

Where possible, the intake pipe shall extend into the tank to avoid venting through the intake pipe. The internal termination point of this intake pipe shall be higher than the overflow drain.

Public water system customers that also have a gray water system must install a reduced pressure zone (RPZ) backflow preventer at the service meter.

**H404.2 Permitted Fixtures.** Gray Water Systems may only be used as supply water to fixtures and/or appliances in which humans do not drink, consume, bath, wash food, dishes or wash their hands. Such allowable items include any of the following:

- a. toilet and urinal flushing;
- b. turf and general landscape irrigation.

Gray water may not be used to fill swimming pools, hot tubs, wading pools, or other structures designed for contact recreation. Gray water shall not be used for hose bibs and faucets.

*Informational: While irrigation systems are not covered by this division, the operator should be aware of the requirements under State Law listed in Texas Administrative Code (TAC), Title 30, Part 1, Chapter 210, Rule 210.83, 210.84 and 210.85 and the following recommended practices.*

*Recommended Practice:*

- a. *The irrigation application rates and application times shall be developed so as to minimize “wet grass” conditions in unrestricted landscaped areas during the periods the area could be in use.*
- b. *Irrigation systems shall be designed so that the irrigation spray does not reach any privately-owned premises outside the designated irrigation area or reach public drinking fountains.*

- c. *There shall be no application of effluent when the ground is water saturated or frozen.*
- d. *Irrigation operations shall be managed in a manner to minimize the inadvertent contact of gray water with humans.*
- e. *Operations or tailwater controls shall be provided to preclude discharge of gray water from irrigation sites.*
- f. *When using gray water, the system shall be designed and managed to prevent contamination of groundwater or surface water and to prevent the occurrence of nuisance conditions. Tail water control facilities shall be provided, where necessary, to prevent the discharge of any gray water from irrigated lands into or adjacent to water in the state.*
- g. *Gray water systems should maintain the following separations:*

<i>Element</i>	<i>Minimum Horizontal Distance</i>	
	<i>Holding Tank (feet)</i>	<i>Irrigation Disposal Field (feet)</i>
<i>Buildings</i>	<i>5</i>	<i>2</i>
<i>Property line adjoining private property</i>	<i>5</i>	<i>5</i>
<i>Public water main</i>	<i>10</i>	<i>10</i>
<i>Seepage pits</i>	<i>5</i>	<i>5</i>
<i>Septic tanks</i>	<i>0</i>	<i>5</i>
<i>Streams and lakes</i>	<i>50</i>	<i>50</i>
<i>Water service</i>	<i>5</i>	<i>5</i>
<i>Water wells</i>	<i>50</i>	<i>100</i>

**H404.3 Storage Tanks.** Storage tanks, their foundation and their installation method must be capable of holding the imposed weight. Also, the water and its clarity may be affected by exposure to sunlight and the tank material, lining, or any paint that might be used.

Tank water is subject to algae growth and mosquito breeding. Algae can affect the clarity and odor of the water. Mosquito breeding is a health hazard.

Therefore, the following provisions are required.

- a. Storage tanks must be opaque, either upon purchase or painted later, to inhibit algae growth.
- b. Tanks must be covered and vents screened to discourage mosquito breeding.
- c. Tanks should be protected for direct sunlight if possible.
- d. Tanks are required to have an overflow design, and the overflow discharge shall be to an approved disposal method.
- e. Tanks should be placed on a stable, level pad.

- f. Under ground tanks within 5' of the foundation of a building or structure require an engineered design to insure the stability of that building or structure.
- g. If supplied with supplemental water from a potable water source, the connection must be made through an air gap and must be inspected as part of the permit for the extension of the potable water line.

Where possible, the intake pipe shall extend into the tank to avoid venting through the intake pipe. The internal termination point of this intake pipe shall be higher than the overflow drain.

**H404.3.1 Tank size.** When used to supply plumbing fixtures, the tank shall be a minimum of twice the volume of water required to meet the daily requirements of the fixtures supplied, but not less than 50 gallons (189 L).

*Informational: When a plumbing fixture is operated, such as flushing a water closet, it is important to have the necessary quantity of water in the tank to meet the demand. Otherwise, the tank may empty faster than the supplemental line can refill.*

*The tank should be sized to limit the retention time of gray water to a maximum of 72 hours. Longer storage time increases the potential of microbial growth and odors.*

**H404.3.2 Makeup water.** When gray water is used to supply plumbing fixtures, potable water or approved well water from a dependable supply, shall be provided as a source of makeup water to the tank. Such connection to the tank shall be made with an air gap. Further, an adequate internal cross-connection control program is required to be demonstrated to the Water Department. .

**H404.3.3 Overflow.** When the supply of gray water has the potential of exceeding the storage capacity in an uncontrolled delivery system, an approved alternate means of disposal shall be provided. For a system that receives gray water only, the tank shall be equipped with an overflow pipe having the same or larger diameter as the influent pipe for the gray water. The overflow pipe shall be indirectly connected to the sanitary drainage system. If the tank is supplied with water recovered from another source, the most restrictive overflow provision shall apply.

*Informational: An approved means of disposal may mean into the municipal wastewater system, if such disposal would have been allowed before the installation of a gray water system.*

**H404.3.4 Drain.** For a system that receives gray water only, a drain shall be located at the lowest point of the tank and shall be indirectly connected to the sanitary drainage system. The drain shall be the same diameter as the overflow pipe required in Section H404.3.3. If the tank is supplied with water recovered from another source, the most restrictive drain provision shall apply.

**H404.3.5 Vent required.** The reservoir shall be provided with a vent sized in accordance with the vent provisions of this code based on the diameter of the reservoir influent pipe.

#### **H404.4 Treatment.**

**H404.4.1 Filtration entering the tank.** Gray water entering the tank shall pass through an approved filter such as a media, sand or diatomaceous earth filter.

A full-open valve shall be installed downstream of the last fixture connection to the gray water discharge pipe before entering the required filter.

**H404.4.2 Disinfection.** Gray water used for flushing water closets and urinals shall be disinfected by an approved method that employs one or more disinfectants such as chlorine, iodine or ozone as listed in Section H404.4.3.

**H404.4.3** Filter systems installed after the pump may be necessary to remove sediment and disease-causing pathogens and to reduce the number and size of particles that are distributed in the system.

*Recommended Practice:*

*Disinfecting gray water for indoor use is required to control microbial growth which could cause fouling and affect the operation of plumbing fixtures. A 5 micron filter may be sufficient. Disinfection can be accomplished by passing the water through ultraviolet light or by treating it with chlorine.*

*If using gray water for irrigation, filtering to remove small particles that might clog valves and equipment should be considered.*

Treatment generally consists of filtration and disinfection processes in series before distribution.

Treatment options include:

- a. Cartridge Filters and Ultraviolet (UV) Light  
Two in-line sediment filters – the 5 micron fiber cartridge filter followed by the 3-micron activated charcoal cartridge filter – followed by ultraviolet light.
- b. Ozone  
Chemically, ozone is O<sub>3</sub>: essentially a more reactive form of molecular oxygen made up of three atoms of oxygen. An ozone generator forces ozone into storage tanks through rings or a diffuser stone. Ozone is unstable and reacts quickly to revert to O<sub>2</sub> and dissipates through the atmosphere.

- c. **Membrane Filtration (Reverse Osmosis and Nanofiltration)**  
Membrane filtration, such as reverse osmosis and nanofiltration work by forcing water under high pressure through a semipermeable membrane to filter dissolved solids and salts.
- d. **Chlorination**  
A chlorine pump injects chlorine in to the water as it enters the building. A practical chlorine contact time, which is critical to kill bacteria, is usually from 2 minutes to 5 minutes with a free chlorine residual of 2 parts per million (ppm).

**H404.4.4 Coloring.** When used for flushing water closets and urinals, the gray water shall be dyed blue or green with a food grade vegetable dye before such water is supplied to the fixtures.

## **H405 Special Design Criteria**

**H405.1 Material Identification.** Gray water piping and fittings shall be as required in this code for potable water piping and fittings. All gray water pipe and fittings shall be purple in color as follows:

- a. **Piping and fittings** shall be manufactured with purple color integral to the plastic, painted purple or wrapped with purple tape. Piping shall be marked on opposite sides to read “CAUTION: GRAY WATER, DO NOT DRINK” in intervals not to exceed three (3) feet (914 mm), or

may be continuously wrapped with purple-colored Mylar tape. The wrapping tape shall have a minimum nominal thickness of five ten-thousandths (0.0005) inch (0.127 mm) and a minimum width of two (2) inches (51 mm). Tape shall be fabricated of poly(vinyl chloride) with synthetic rubber adhesive and a clear polypropylene protective coating or approved equal.

The tape shall be purple (Pantone color #512) and shall be imprinted in nominal one-half ( ½ ) inch (12.7 mm) high, black uppercase letters, with the words “CAUTION: GRAY WATER, DO NOT DRINK.” The lettering shall be imprinted in two (2) parallel lines, such that after wrapping the pipe with a one-half ( ½ ) width overlap, one (1) full line of text shall be visible.

- b. All **valves** except fixture supply control valves shall be painted purple and be equipped with a locking feature.
- c. All **mechanical equipment** which is appurtenant to the gray water system shall be painted purple to match the Mylar wrapping tape.
- d. All purple paint shall be of an approved type designated for this type of use and installed in accordance with the manufacturer’s installation instructions.

#### H405.2 Installation.

- a. Gray water pipes shall not be run or laid in the same trench as potable water pipes. A ten (10) foot (3048 mm) horizontal separation shall be maintained between pressurized, buried reclaimed and potable water piping. Buried potable water pipes crossing pressurized reclaimed water pipes shall be laid a minimum of twelve (12) inches (305 mm) above the reclaimed water pipes.
- b. Gray water pipes laid in the same trench or crossing building sewer or drainage piping shall be installed in compliance with Sections 603.2 of this code. Gray water pipes shall be protected similar to potable water pipes.

#### H405.3 Signs.

1. **Restroom Entrance Signs.** All installations using gray water for water closets and/or urinals shall be identified with signs. Each sign shall contain one-half (½) 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 entering the restroom. 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  
GRAY  
WATER TO FLUSH TOILETS AND URINALS.

**Exception:** For private residences, identification of fixtures may be accomplished with the installation of a permanent tag attached to the fixture cut-off valve.

2. **Valve Seals.** Each valve or appurtenance shall be sealed in a manner approved by the Authority Having Jurisdiction after the gray system has been approved and placed into operation. These seals shall either be a crimped lead wire seal or a plastic breakaway seal which, if broken after system approval, shall be deemed conclusive evidence that the reclaimed water system has been accessed. The seals shall be purple with the words “GRAY WATER” and shall be supplied by installer or by other arrangements acceptable to the Building Official.

FIGURE 1: 30 TAC §210.25(b) (1)



**DO NOT DRINK THE WATER**  
**NO TOMAR EL AGUA**

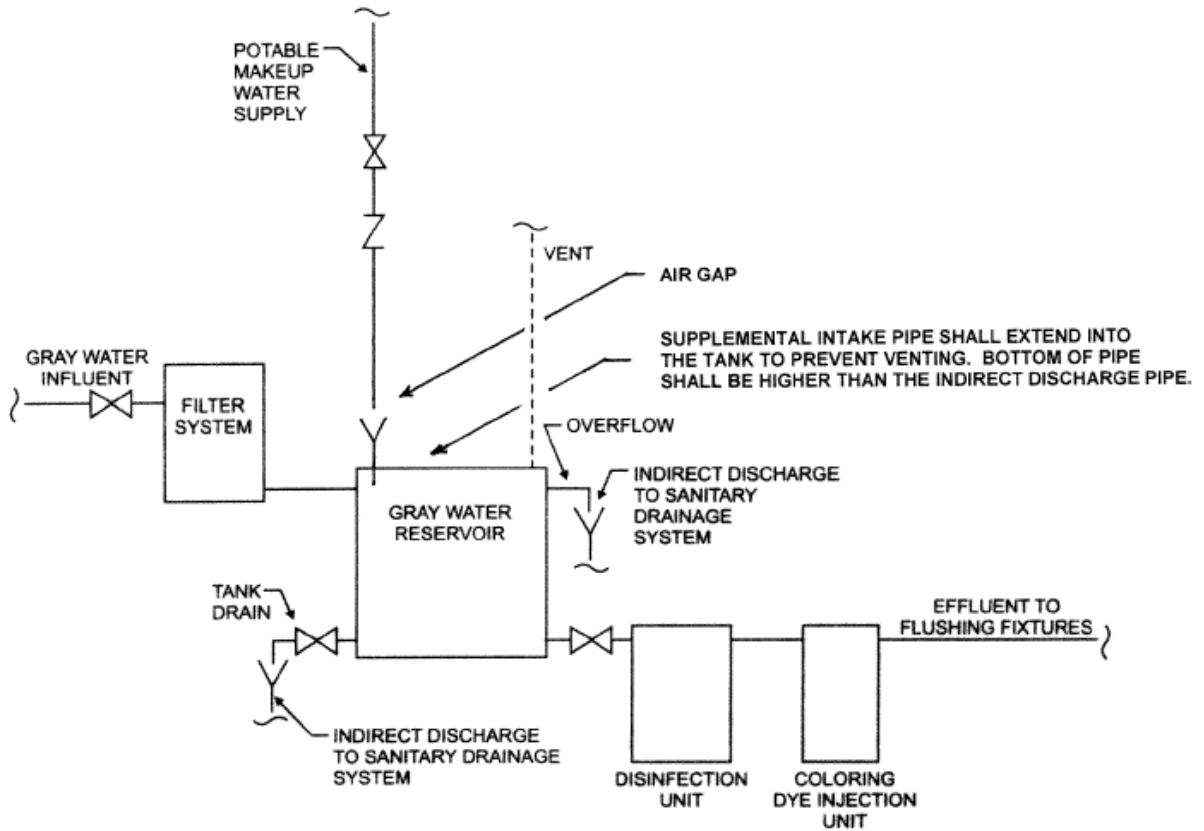
**H406 Inspection and Testing.** Gray water piping shall be tested as outlined in this code for testing of potable water piping. Associated back-flow devices, as required by this code and the Water Department, shall be tested as required for potable water systems.

**H407 Maintenance.** The system must be maintained or appropriately abandoned in an approved manner as provided for in Section H408.

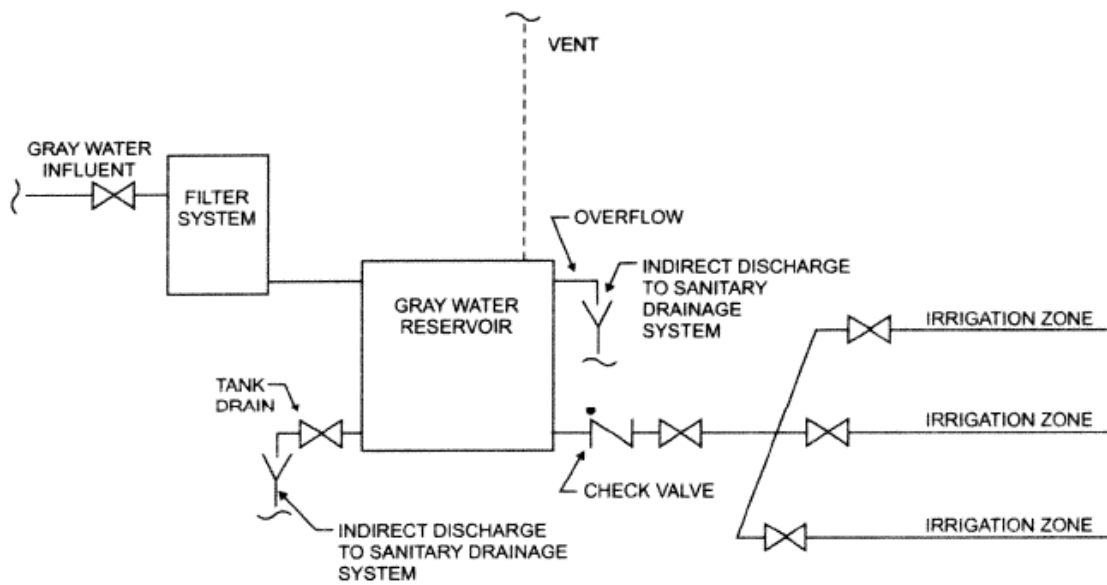
*Informational: The system owner should take into consideration the maintenance required to keep the system functioning as designed. Any failure to maintain the system can lead to damage to the tank, pump, piping, irrigation and plumbing equipment. Such damage should be expected to generate associated costs of repair.*

**H408 Abandonment.** When a gray water system is to be abandoned, all re-piping necessary to supply the irrigation and/or plumbing system with another water source will require applicable permits along with a set of plans to be approved by the Building Official.

**Supplemental Information**



**FIGURE AO101.1(1)  
GRAY WATER RECYCLING SYSTEM FOR FLUSHING WATER CLOSETS AND URINALS**



**FIGURE AO101.1(2)  
GRAY WATER RECYCLING SYSTEM FOR SUBSURFACE LANDSCAPE IRRIGATION**