Potable Water Systems and Coconino County

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Presented to: Citizen Advisory Committee

Willow Bend Environmental Education Center

Flagstaff, Arizona

Why harvest rainwater?

- Sustainable, local source of fresh water
- Prevents stormwater runoff and contamination of clean water
- Can help prevent erosion of land and localized flooding
- Promotes water conscious practices in the home and community
- Water efficiency and rainwater harvest systems can earn significant points toward sustainable building credentials, such as LEED designation and the CCSBP Project Certification.

Potable vs. Non-Potable Water

- The International Code Council defines potable water as: Water free from impurities present in amounts sufficient to cause disease or harmful physiological effects and conforming in bacteriological and chemical quality to the requirements of the public health authority having jurisdiction. (International Code Council, 2017).

- The water is **safe for human consumption** through activities like cooking, drinking, bathing, and food preparation. Water that has not been properly filtered, treated, and stored should never be used for potable applications because it can carry bacteria, viruses, or other disease that can make a person ill.

- Water for food crop irrigation can leech chemicals into the crop if not properly treated. Untreated, non-potable water should be used for landscaping and non-edible plant irrigation only.

Potable vs. Non-Potable Water

- All components of a potable system must be constructed of materials that are compatible with the collection surface and the rainwater quality for the desired end use.
- Potable systems require more components that a non-potable rainwater harvest system.
- Potable rainwater systems require regular maintenance, testing, and other associated costs (such as filter replacements)

Special Considerations for a Domestic Potable System

- How much water can be harvested? Is a backup system needed?
- Roof type: different roofing materials leech different chemicals
- Roof Washers/ Debris Excluders
- System must be protected from pests and vermin
- Freeze Protection
- Choosing the right filtration system
- Shutoff valves to isolate all components
- System must be approved and water quality must be tested

Collection Surface

P2914.2 Collection surface.

- Rainwater shall be collected only from **above-ground impervious roofing surfaces constructed from *approved* materials.**

- Collection of water from vehicular parking or pedestrian walkway surfaces shall be prohibited except where the water is used exclusively for landscape irrigation.

- Overflow and bleed-off pipes from roof-mounted *appliances* including, but not limited to, evaporative coolers, water heaters and solar water heaters shall not discharge onto rainwater collection surfaces.

Roofing Material and Water Quality

Your roofing material will determine if your water quality must be tested for the system to be approved; it can also influence how much to filter or treat the water before use.

- Asphalt Shingle and Wood Shingle
- Clay or Cement Tile
- Slate
- Metal roofs are recommended
- Green or Living Roofs

Roofing Material and Water Quality

- **P2914.14.8 Water quality test.**

The quality of the water for the intended application shall be **verified at the point of use** in accordance with the requirements of the *jurisdiction*.

If testing is required, the water shall be tested for potability by a laboratory licensed by the Arizona Department of Health Services.

Approved roofing material such as tile, metal, slate, concrete, fiberglass, or other approved material **shall not** be subject to testing.

Water shall be tested if collected off asphalt shingles or galvanized metal roofing.

- **P2914.2 Collection surface.**

Where asphalt shingles are used as part of the collection surface, the water shall be tested for potability by a laboratory licensed by the Arizona Department of Health Services. Laboratory results shall be provided to the Coconino County Building Division **before** the water can be used for potable purposes.

Roof Washers

Debris, animal waste, dust, pollen, and other materials must be filtered out of the water to prevent contamination and potential illness.

Roof washers are a system of components that help to clean the water coming off the roof before it is filtered and stored.

Some codes require more components to wash a roof than others. Coconino County's proposed code will require a debris excluder and first-flush diverter

Debris Excluders and Leaf Screens

- Filters out any large debris, such as leaves, sticks, pine cones, insects, and other waste.
- Prevents clogging of the system and contamination of the water.
- Can be a screen secured on top of the gutter or an excluder that prevents debris from entering the tank itself.

Box Roof Washers

- Filters the water in a way similar to a debris excluder or leaf screen.
- Can clog easily.
- Requires all water to pass through any captured debris.
- Not required in Coconino County.

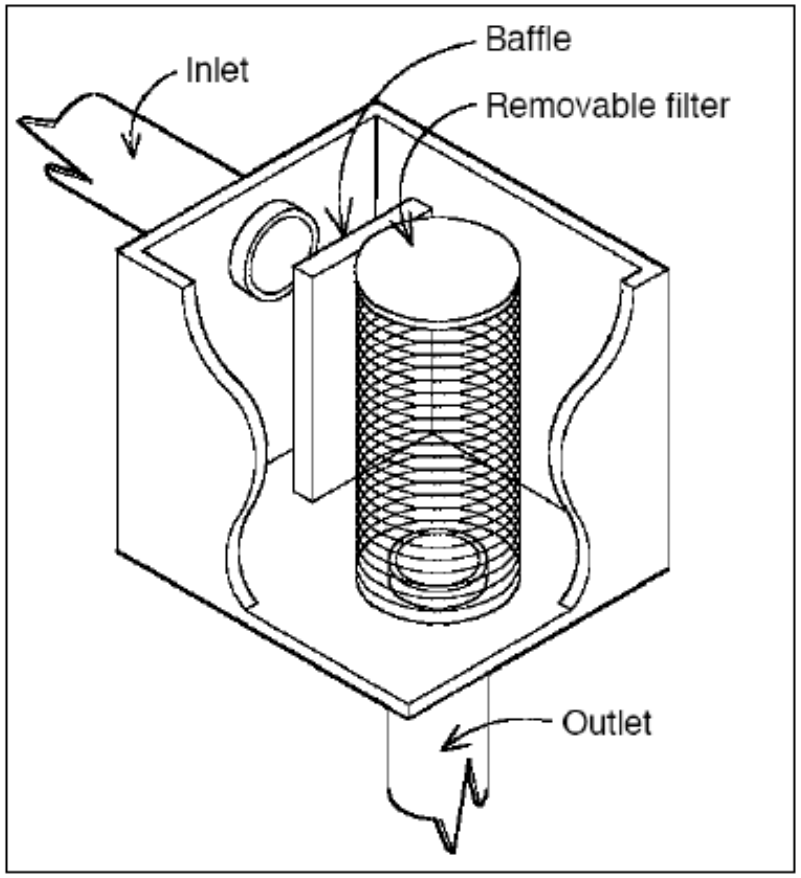
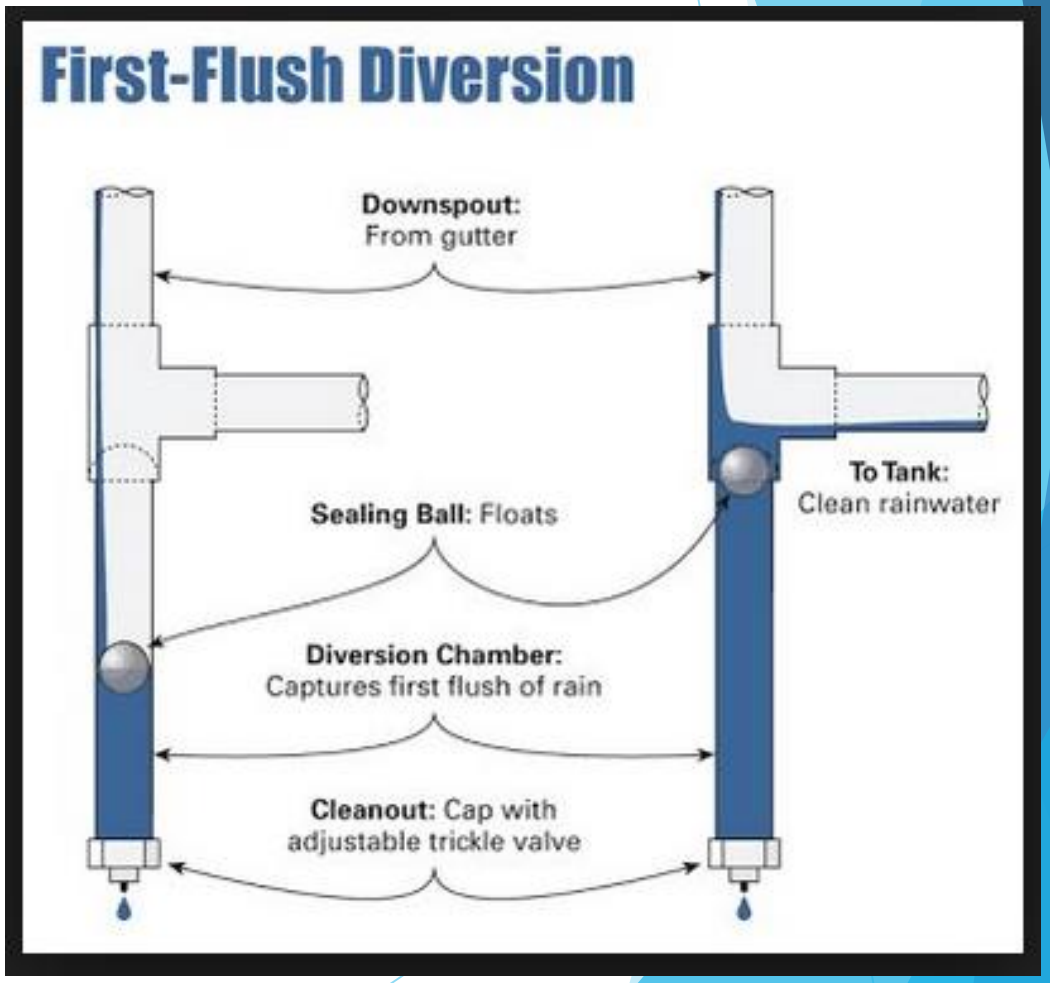


Figure 2-4. Box roof washer
(TWDB, 2005)

First Flush Diverters

- Diverts the initial runoff away from the rainwater system, allowing the roof to be well-rinsed before any runoff enters the water storage system.
- Should be sized to divert a minimum of 10 gallons for every 1,000 square feet of collection surface.
- Places with extended dry periods may require a larger diverter.



DIY First-Flush Diverters

First-Flush Diverters

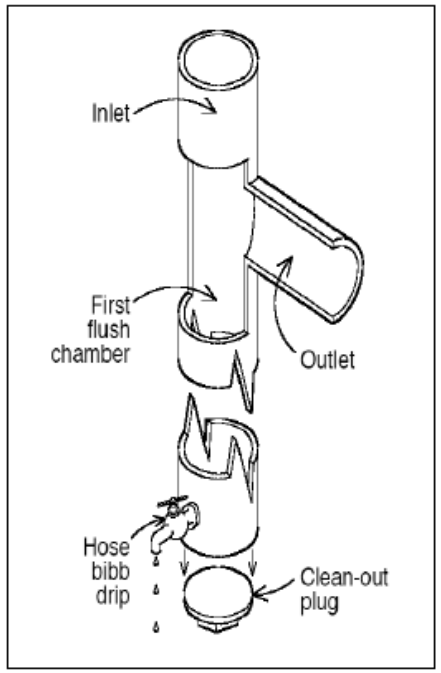


Figure 2-2. Standpipe first-flush diverter

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.

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.

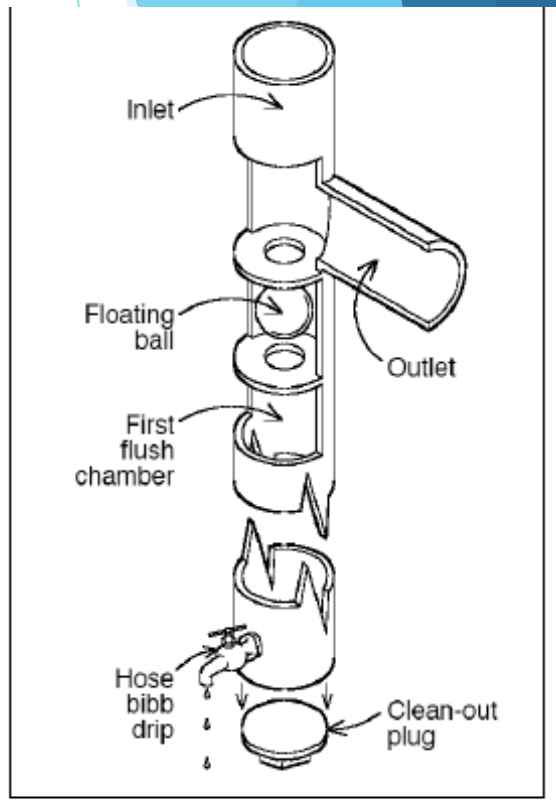


Figure 2-3. Standpipe with ball valve

Diameter (in)	Length (inches) per Gallon of Storage
3	33
4	18
6	8
8	5

Table 14.1. Length of Piping Per Gallon of Storage (TWDB, 2005)

Filtration and Disinfection Options

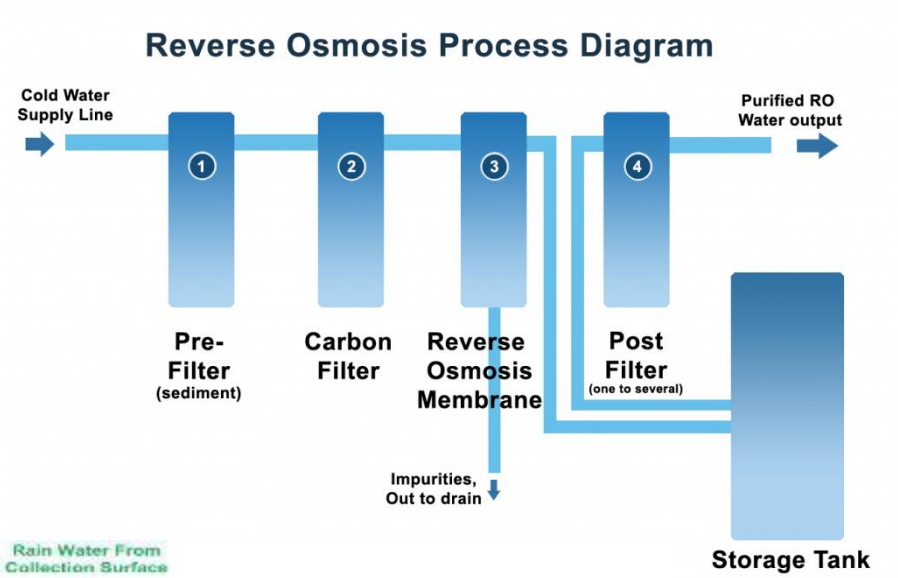
- **P2914.7 Filtration.**

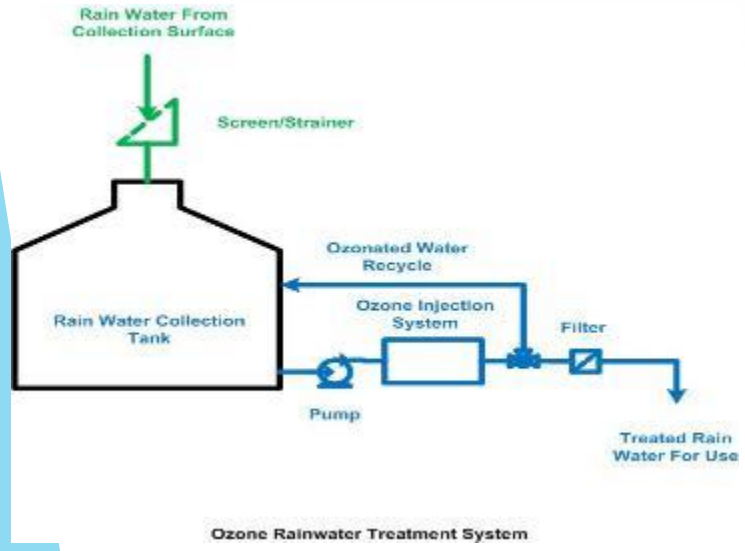
Collected rainwater shall be filtered as required for the intended end use. Filters shall be accessible for inspection and maintenance. Filters shall utilize a pressure gauge or other *approved* method to provide indication when a filter requires servicing or replacement. Filters shall be installed with shutoff valves installed immediately upstream and downstream to allow for isolation during maintenance.

- **P2914.8 Disinfection.**

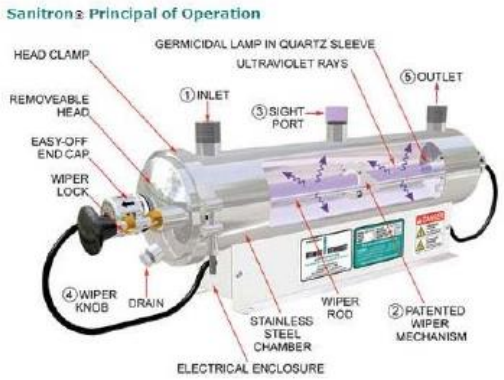
Where the intended application for rainwater requires disinfection or other treatment or both, it shall be disinfected as needed to ensure that the required water quality is delivered at the point of use.

Extra Filtration and Disinfection

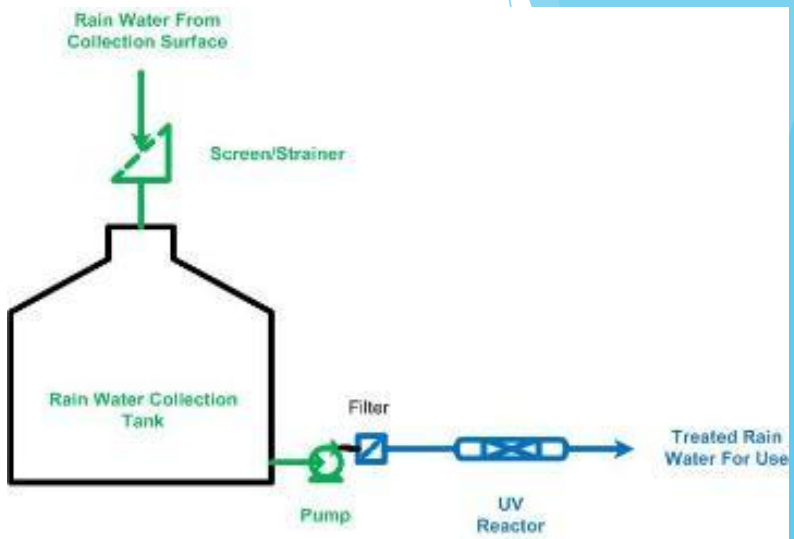


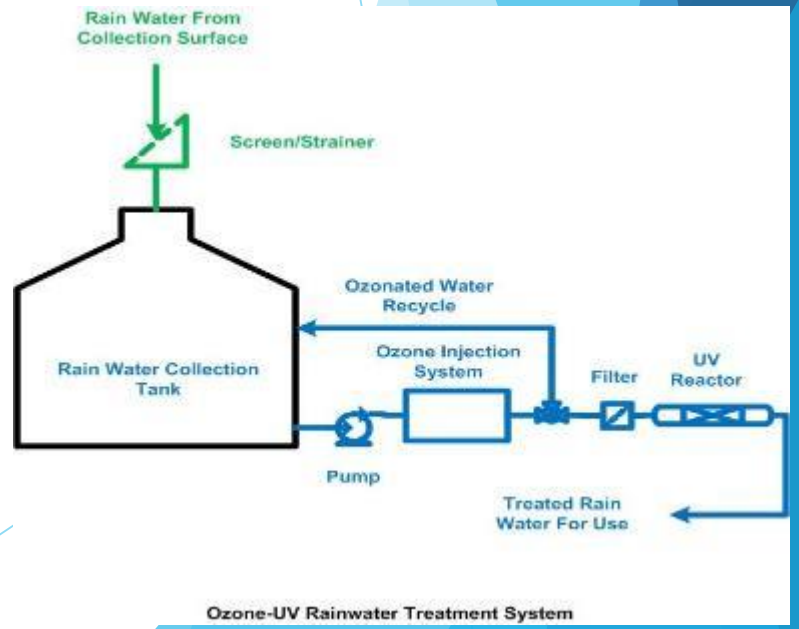


UV Sterilizers



www.cleanwaterstore.com/ultraviolet-sterilizers





Diagrams from: https://www.spartanwatertreatment.com/rainwater-harvesting-water-treatment.html

Shutoff Valves and Accessibility

- All components for the system must have appropriately placed shutoff valves to allow sections of the system to be isolated for maintenance, testing, or repair.

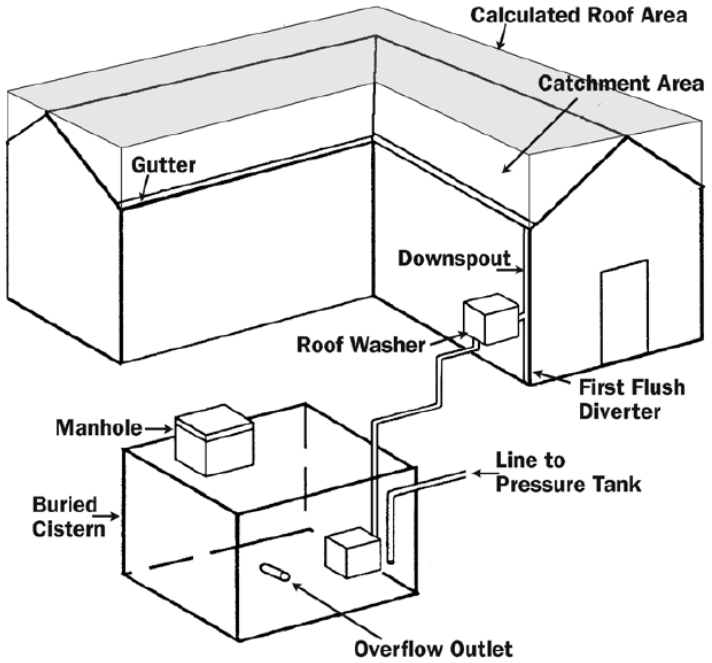


Figure 1. Basic rainwater harvesting system

MT State/ MSU Water Guide 2006

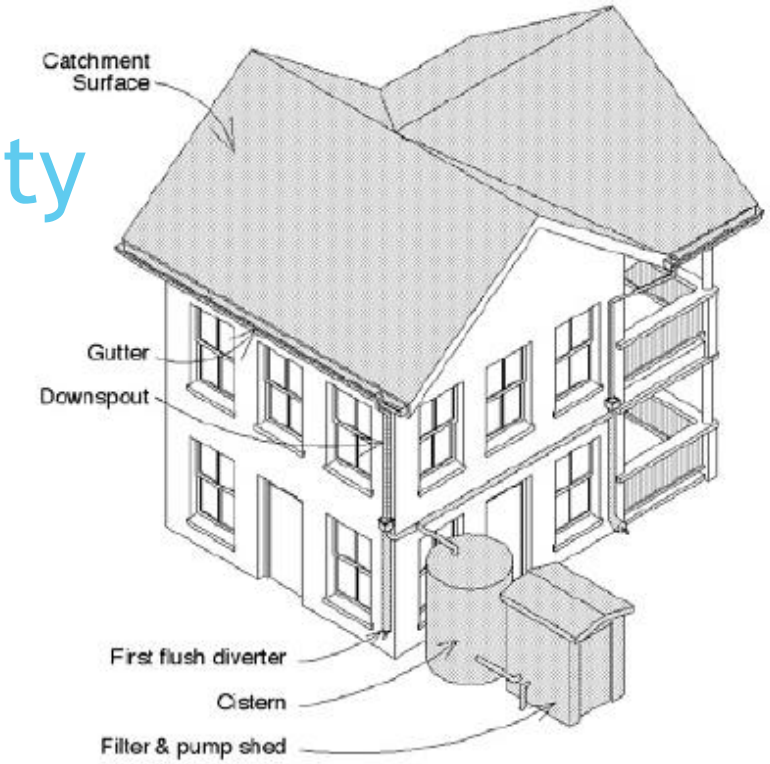


Figure 2-1. Typical rainwater harvesting installation (TWDB, 2005)

P2914.11 Pumping and control system.

Mechanical equipment including pumps, valves and filters shall be easily accessible and removable in order to perform repair, maintenance and cleaning. The minimum flow rate and flow pressure delivered by the pumping system shall be appropriate for the application and in accordance with Section P2903.

Freeze Protection

P2915.3 Freeze protection.

Where sustained freezing temperatures occur during operations, provisions shall be made to keep storage tanks and the related piping from freezing.

- Bury, insulate, or protect cisterns from prolonged freezing temperatures.
- All pipes, valves, and outlets should be protected from freezing via shutoff valves, insulation, or other protective measures.
- Larger tanks are more resistant to freezing due to the thermal mass of the stored water.

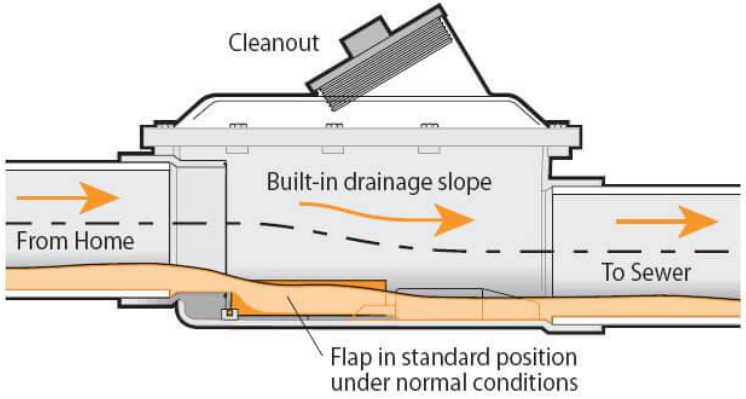
Backwater and Pressure Valves

- **P2914.10.1 Backwater valve.**

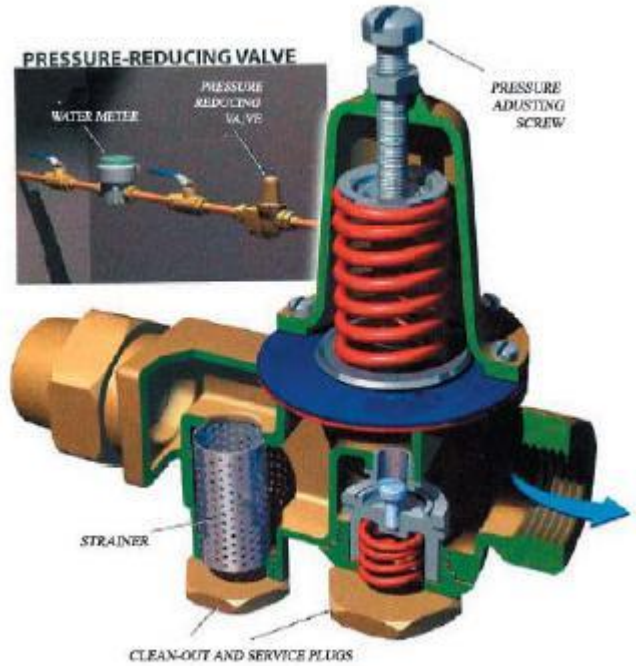
Backwater valves shall be installed on each overflow and tank drain pipe. Backwater valves shall be in accordance with Section P3008.

- **P2914.12 Water pressure-reducing valve or regulator.**

Where the water pressure supplied by the pumping system exceeds 80 psi (552 kPa) static, a pressure-reducing valve shall be installed to reduce the pressure in the rainwater distribution system piping to 80 psi (552 kPa) static or less. Pressure-reducing valves shall be specified and installed in accordance with Section P2903.3.1.



https://www.squareoneinsurance.com/backwater-valve



http://www.vwd.org/departments/customer-service/pressure-regulator-information

Design Considerations

- Minimize distances between where water is collected, stored, and used.
- Proximity to your home's foundation and other buildings
- Issues with water weight compacting the soil beneath your storage tank
- Slope of the land and natural drainage
- Maintenance Access
- Aesthetics-Above ground or buried?
- Different materials for storage tanks, gutters, etc.

https://stormwater.pca.state.mn.us/index.php?title=Comparison_of_properties_of_different_types_of_storage_tanks

- Filter size and disinfection options
- Roofing material and how often to test your water's quality
- What to test your water for?
- Feasibility of installing and using a system, including site, cost, and climate

The User Guide for Domestic Potable Rainwater Use in Coconino County

What is the guide for?

- The guide will help users understand the code and the components of designing and installing a rainwater harvest system for potable domestic uses, such as drinking, bathing, and cooking.

How is the guide organized?

- Part 1 explains the basics of what is required for a potable water harvesting system in Coconino County.
- Part 2 discusses how to design a rainwater harvest system for potable use. This includes information about how to properly size a system to meet your needs, where to locate a system, estimating the expected yield in harvested rainwater, and the costs of a typical system.
- Part 3 outlines guidelines for testing your rainwater system and the quality of your harvested water.
- Part 4 includes appendices, such as a full copy of the approved code for Potable Rainwater Distribution Systems [P2914] and Potable Water Storage Tanks [P2915], estimation worksheets, and recommended resources.
- Throughout the guide, there are links that will connect the user to the relevant section of the code or guide that is being referenced. Where appropriate, the code is also cited directly to assist anyone using a print version of the guide.

Thank You!

Questions?

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