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Cisterns

What is a cistern?

A cistern is a sealed tank used to collect rainwater that flows from your rooftop and store it for non-potable, exterior uses, such as landscape irrigation and car washing. Generally larger than rain barrels, cisterns have capacities ranging from 100 gallons to several thousand gallons and can collect water from several downspouts from one building's roof or from multiple roofs.

A cistern should be watertight with smooth interior surfaces, a watertight lid, and downspouts to which it is connected. Cisterns can be constructed from a variety of non-reactive materials, such as reinforced concrete, galvanized steel, or plastic. Concrete blocks and wood are sometimes used, but these ground, partially buried, or below ground.

Water collected in or draining from a cistern is non-potable (not suitable for drinking) because it may contain roof debris with high levels of bacteria or other pollutants. Though cisterns can be designed to provide potable water, we will only issue a rebate for non-potable exterior water use. You may use collected rainwater to water vegetable gardens, but be sure to wash fruits and vegetables with tap water before eating or cooking with them.



What are the benefits to property owners and communities?

Using a cistern can provide a supplemental (non-potable) water source, reducing your use of (potable) drinking water for exterior uses. In this way, on-site stormwater storage can contribute to water conservation and may reduce water utility costs. You can use the collected water any time, even during a drought or during other periods of city- or county-imposed water restrictions.

Rainwater from downspouts often drains onto driveways, sidewalks, or other paved (impervious) surfaces and is not able to soak into the ground. Water rushing over these hard surfaces (runoff) picks up pollutants along the way. Eventually, the runoff flows into storm drains, which in turn empty directly into local streams. A surge of polluted water entering streams can cause flash flooding and erosion, reduced water quality, and degraded fish habitat.

By installing a cistern, you can reduce the amount of stormwater runoff from your property, allowing more of the water to soak into the ground. When you and your neighbors install cisterns, you can help replenish groundwater, minimize flash flooding, reduce water pollution and stream erosion, and improve fish habitat.

How can your cistern qualify for a rebate?

To qualify for a rebate through the Rain Check Rebate Program, your cistern must capture at least 250 gallons of rainwater during a storm. This criterion is applicable to residential properties, commercial properties, homeowner associations, condominium associations, civic associations, multi-family dwellings, and projects conducted by nonprofit and not-for-profit organizations. To alleviate costs, the Rain Check Rebate Program provides a rebate of \$2 per gallon stored up to \$4,000 for residential properties, and up to \$20,000 for commercial properties, homeowner associations,



condominium associations, civic associations, multi-family dwellings, and projects conducted by nonprofit and not-for-profit organizations.

How can you determine if your property is suitable for a cistern?

A cistern is a good option for homes and buildings with

- relatively large rooftops and the capability to divert multiple downspouts into one cistern;
- downspouts that discharge onto driveways, other paved surfaces, or steep slopes; and
- gardens or other landscape features that require frequent watering.

Assessing your property while it's raining will allow you to see how and where your downspouts discharge water. To catch rainwater from a single downspout draining a relatively small rooftop, rain barrels may be a more appropriate option.

A cistern should be located as close as possible to the rainwater harvesting source (the downspouts) and to the gardens or other areas where you will use the water. Install your cistern

- where the area surrounding the cistern drains (or will be graded to drain) surface water away from the cistern and from building foundations;
- upslope from any sewage disposal facilities;
- at least 10 feet away from watertight sewer lines and drains; and
- at least 50 feet away from non-watertight sewer lines and drains, septic tanks, and sewage absorption fields.

Other constraints to consider include proximity to trees and, for above ground systems, finding and/or creating level ground. Depending on the cistern's size and type (above ground or below ground), you may need to excavate and/or grade an appropriate area for cistern placement. In some cases, you may want to install a concrete pad. Excessive disturbance to tree roots – either by cutting/damaging roots during excavation for an underground tank or by compacting soils in the root zone during grading or placement of tanks or concrete – can lead to tree death. Placing cisterns at least 10 feet from existing tree trunks is recommended.

What size cistern will you need?

The size of the cistern you will need to maximize capture of roof runoff depends on the area (square footage) of the portion of the roof draining into the downspout(s) and predicted annual precipitation. Roof area can be calculated by measuring the length and width of the flat area covered by the roof. Note: The slope of the roof does not affect the calculation of roof area draining into the downspout(s). Ideally, cistern size should also match your anticipated annual need for exterior water (for example, for seasonal landscape watering).

Cistern volume can be determined, for any given rainfall, using the following general equation: cistern volume (in gallons) = roof surface area (in square feet) x rainfall amount (in feet) x 0.90 x 7.5 gallons/ cubic foot. For example: one 250-gallon cistern would provide runoff storage from a rooftop area of approximately 880 square feet for 0.5 inches (0.042 feet) of rainfall: 250 gallons = 880 square feet x 0.042 foot x 0.90 x 7.5 gallons/cubic foot. Rain collection calculators are available online, one example can be found at www.csgnetwork.com/rwcollectioncalc.html.

How can you provide for overflow during large storms?

To provide adequate storage, cisterns should be drained between rainstorms. You may need additional storage if you do not use all stored water between storms. When a cistern fills to capacity, it discharges through an overflow outlet, which should be directed to a safe location away from the cistern and from nearby building foundations. Ideally, overflow should be directed into a dry well, rain garden, or other runoff collection and treatment feature. Cisterns can be designed to provide continuous, slow discharge to allow for adequate capacity during consecutive storms.

Which other techniques work well with cisterns?

Cisterns work well with most other stormwater reduction techniques, such as rain gardens, green roofs, and urban tree canopies. But remember that placing a cistern at a downspout that empties into a rain garden may reduce the amount of water that is available to maintain the rain garden plant community.

What are the costs?

Cistern costs range from several hundred dollars to several thousand dollars, depending on the size, type (above ground or below ground), design, and amount of construction required for installation. A typical 300–350 gallon cistern, which is a typical size for a single family residence, will cost between \$300 and \$660 depending on material. Larger cisterns that hold 10,000 or more gallons and are typically used on commercial properties or apartment buildings, can cost anywhere from \$3,000 and up. You can expect to pay between \$1,500 and several thousand dollars for installation, depending upon the size of the system. While these costs may seem high, they are offset by the reduction or elimination in the cost of tap water use for landscaping and other non-potable water needs. Approval of your cistern project through the Rain Check Rebates Program can help reduce costs.

Can you do this project yourself?

A small cistern may be suitable as a do-it-yourself project, but larger or more complex cisterns, including those that require electricity (for pumping), grading, excavation, or other construction efforts, may require installation by a professional with experience in this type of work.

How can you design and build a cistern?

Your preferences and lot constraints will, to some extent, dictate the type (above ground or below ground) and material (stone, wood, or synthetic) you choose for your cistern. Resources to assist you can be found at the end of this document.

Where can you buy a pre-assembled cistern?

Depending on the type of cistern you choose for your property, you can find some pre-assembled tanks and components at home improvement stores or online.

How do you install a cistern?

Do-it-yourself websites describe how to install certain types of cisterns; however, large and complex cisterns will probably require installation by an experienced professional. Refer to the resources found at the end of this document.

Identify and avoid utilities

If you will be installing an underground cistern, prior to starting your cistern installation project, find existing underground utilities, such as water mains, telecommunication lines, and gas lines, so you can avoid them. Call Miss Utility at 811 or 1-800-257-7777, or visit their website at www.missutility.net/maryland/ for assistance.

How should you choose a contractor?

If you decide to have a contractor design and install your cistern, choose carefully. Ask potential contractors how much experience they have installing cisterns. An experienced contractor should be able to supply references from past clients. Find out if they are insured or bonded, if they are certified or accredited by the American Rainwater Catchment Systems Association (www.arcsa.org/), if they are a LEED (Leadership in Energy and Environmental Design) professional, and if they are experienced in low impact development design work. Ask potential contractors to explain what is included in their services, how long it should take to complete the project, whether they will work with other subcontractors (such as electricians) if needed, and whether their work would be guaranteed. Ask potential contractors what type of system they would recommend for your property and request a written estimate that includes parts and labor.

Is a permit required?

A permit is not required for most cisterns. However, if installing your cistern (on its own or in combination with a concurrent project on your property) results in more than 5,000 square feet and/or 100 cubic yards of earth-moving disturbance (such as grading, cutting, and filling), a change in grade of +/- 12", or if the cistern requires electrical operations a permit is required. Contact the County's Department of Permitting, Inspections and Enforcement for more information: (301) 636-2000 or www.princegeorgescountymd.gov/1024/Permitting-Inspections-and-Enforcement.

What maintenance will be required?

Cisterns require periodic maintenance. All cisterns should be designed with multiple access points to support pump maintenance, inspection, repair, and cleaning. Inspect your cistern and its associated components twice per year to ensure that

- downspouts are properly positioned, intact, and free of debris;
- filters and screens are intact and free of debris and sediment;
- tanks and covers are intact and not leaking;
- pumps are working properly;
- overflow outlets are clear and are directed away from building foundations; and
- spigots and hoses are functioning properly.

To maintain adequate storage, cisterns should be drained between significant rainstorms. Clean out the cistern and its inflow and outflow components as part of routine maintenance during dry parts of the year. Unless designed for placement below ground or for freezing temperatures, the cistern should be disconnected and drained in the fall or winter, before the first frost, to avoid damage.

| MAINTENANCE SCHEDULE FOR CISTERNS | | | | | | | | | | | | |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|--|--------|--|--|
| | Spring | | | Summer | | | Fall | | | Winter | | |
| Drain after significant rainfalls | Required as Necessary | Required as Necessary | Required as Necessary | Required as Necessary | Required as Necessary | Required as Necessary | Required as Necessary | Required as Necessary | | | | |
| Clean cistern and inflow/outflow components | Required | | | | | | | | | | | |
| Inspect and conduct required maintenance | Required | | | | | | Required | | | | | |



For more information

While Prince George's County does not endorse any one method of building or installing a cistern or any particular cistern vendor, the following information is supplied for your consideration.

Building, Installing, and Maintaining a Cistern

Construction of Rain Barrels and Cisterns, Low Impact Development Center

http://www.lid-stormwater.net/raincist_home.htm

Specifications of Rain Barrels and Cisterns, Low Impact Development Center

http://www.lid-stormwater.net/raincist_specs.htm

HarvestH2O, Rainwater Harvesting: Comparing Rainwater Storage Options

<http://www.harvesth2o.com/rainwaterstorage.shtml>

Maryland Stormwater Design Manual (Chapter 5.0)

[https://mde.maryland.gov/programs/Water/StormwaterManagementProgram/Documents/
www.mde.state.md.us/assets/document/Design%20Manual%20Chapter%205%2003%2024%202009.pdf](https://mde.maryland.gov/programs/Water/StormwaterManagementProgram/Documents/www.mde.state.md.us/assets/document/Design%20Manual%20Chapter%205%2003%2024%202009.pdf)

American Rainwater Catchment Systems Association, Public Domain RWH Manuals

<https://www.arcsa.org/page/101>

US Environmental Protection Agency, Water: Green Infrastructure, Design and Implementation Resources

<https://www.epa.gov/green-infrastructure>

Penn State Extension, Rainwater Cisterns: Design, Construction, and Treatment

<https://extension.psu.edu/rainwater-cisterns-design-construction-and-treatment>

Contech Engineered Solutions, Cistern Design Considerations for Large Rainwater Harvesting Systems

<https://www.conteches.com/knowledge-center/pdh-article-series/cistern-design-considerations-for-large-rainwater-harvesting-systems>

American Rainwater Catchment Systems Association Resource Guide

<http://www.arcsaresource.com/>

Vendors

Rain Harvest Systems

www.rainharvest.com/water-tanks-plastic/in-ground-cisterns.asp

Rainwater Harvesting, Water Tanks/Cisterns

www.harvestingrainwater.com/rainwater-harvesting-inforesources/suppliers/water-tankscisterns/

Cistern Costs

http://www.lid-stormwater.net/raincist_cost.htm

<http://home.costhelper.com/cistern.html>

For more information, call 410-974-2941 or contact cbtrust.org.