

## Collecting and Using Rainwater at Home

Rainwater harvesting—collecting and storing rain for later use—is an ancient practice. It is still used in many rural places throughout the world, and today it is making a comeback in urban centres as an additional source of water.

At its simplest, rainwater harvesting consists of a rain barrel placed under the downspout of your home to collect rainwater for garden irrigation.

Larger, more sophisticated, systems can be incorporated into your home's plumbing system to provide water for a variety of household needs, from toilet flushing to laundry, and even drinking water (in these instances the rainwater will be treated prior to use).

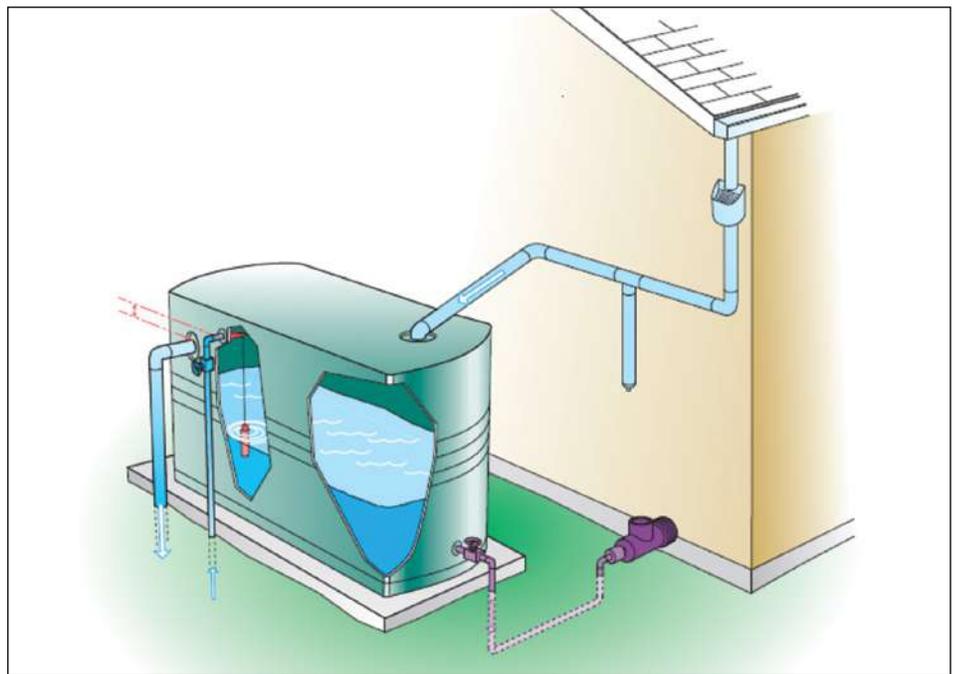
All rainwater harvesting systems, simple or complex, have the same basic components:

- A *catchment area* to capture the rainfall—this is typically the roof of the house.
- A *conveyance system* to move the water from the roof to a storage area—eavestroughs and downspouts, and maybe piping.

- A *storage system* to hold the rainwater for future use—a barrel, a cistern or a tank.
- A *distribution system* to get the water from storage to where it is being used—this can range from a watering can to full integration with the existing plumbing system in the house.

Rainwater harvesting is advantageous for a number of reasons:

- It can offset the amount of municipally treated water you use in your home - helping to reduce your water bill
- Larger cisterns can help divert and retain runoff from your property – reducing the impact on local stormwater infrastructure and combined sewer systems



**Figure 1** A rainwater harvesting system with top-up supply and an overflow pipe that discharges surplus rainwater to an appropriate location

- Stored rainwater can be used for landscape irrigation even during watering bans and helps to replenish groundwater supplies with water that would normally flow to stormwater systems
- For those on well water, rainwater harvesting offers a way to reduce well pump energy consumption and reduce the amount of water the well has to deliver – an important consideration if your well is affected by dry spells or water table fluctuations.

## GETTING STARTED

When thinking about harvesting rainwater for your home, there are a number of questions to consider.

### 1) What would you like to use rainwater for?

Are you simply looking to harvest rainwater for outdoor watering purpose, or are you interested in a system that provides water for indoor uses as well (e.g., toilets, laundry)? Or are you wondering about using rainwater on a seasonal basis for a variety of purposes at the cottage? Each scenario involves different set-up, equipment, maintenance and costs.

### 2) Which rainwater uses are approved in your area?

The use of rainwater and other non-potable water supplies is regulated differently in each province and territory. The *2010 National*

*Plumbing Code of Canada* permits the use of non-potable water (including rainwater) for toilet and urinal flushing as well as outdoor irrigation. However, provincial, territorial and local jurisdictions may have different positions and requirements so it is prudent to check with local building authorities to see what's allowed in your specific area and what's not - before constructing your system.

### 3) How much rainwater do you need?

Depending on what you wish to use your rainwater for, the amount you need will vary depending on:

- Household water consumption habits—e.g., how often do you water outdoors and how much water is used, how many toilet flushes are there in a given period, how many loads of laundry?
- The number of people in your household.
- The age and efficiency of your plumbing fixtures (e.g., toilets/washing machines). If they are not water efficient, you may wish to replace them with some that are to make the most of both the rainwater you harvest and the municipal water you purchase.

CMHC's *Collecting and Using Rainwater At Home, A Guide for Homeowners* includes a worksheet on residential water consumption per household activity based on

average consumption rates. This will help you calculate how much rainwater is needed to meet various requirements in your household on a daily, weekly, monthly and yearly basis – depending on what is allowed by the building authority in your area.

### 4) How much rainwater can you collect?

The amount of rain you can harvest is calculated based on the square footage of your catchment area and the climatic rainfall conditions in your area. The general rule of thumb is that about 80% of the annual rain that falls on a catchment area can be collected; the rest is lost due to overflows, leaks, absorption by the roofing materials, and so on. Refer to the guide (see above) on how to determine how much rainwater you may be able to collect over the course of the year.

### 5) How much rainwater can you store?

Rainwater storage tanks are available in many sizes, from less than one hundred litres suitable for supplementary outdoor plant watering to thousands of litres for larger residential systems.

The *Rainwater Guide* offers help with determining optimal tank size for a specific volume of water needed based on your roof area and local climatic conditions.

## DESIGNING YOUR SYSTEM

This section provides an overview of the key components and features of a rainwater harvesting system.

### Roof Catchment Area

Certain roofing materials can impact rainwater quantity and quality. For instance, porous materials such as asbestos shingles, clay or concrete tiles, or wood shingles will soak up some of the rainwater, which reduces the amount harvested during a rainfall. Other non-absorptive roofing materials, such as steel, shed water readily for collection. Certain roofing materials may contain potential contaminants (heavy metals, and pesticides) that can be

absorbed by the rainwater as it flows over the roof surface, making it unsuitable as drinking water, or for use on edible plants.

### Eavestroughs and downspouts

To get the full benefit of the catchment area, your home needs to be equipped with properly sized and sloped eavestroughs (gutters) and an adequate number of downspouts. Otherwise water may overflow during heavy rainstorms and get absorbed in the ground or run off into the storm sewers. It may be necessary to have an in-ground collection system that gathers all the water drained by downspouts located at different positions around the house to take full advantage of the rainwater that falls on the roof.

### Rainwater conveyance network piping

The conveyance network includes the plumbing used to take the rainwater to the storage tank and to distribute it from the tank to the various end-use points. Pipe materials, sizes and slopes are regulated by local and provincial codes. Above-ground piping should be UV-resistant and structurally strong enough to keep it from deteriorating or being damaged.

### Rainwater storage tanks

Tanks can be located above or below ground (see figure 3), outside or inside the home, garage or shed, and are available in many different sizes and materials.



**Figure 2** Roofing material, such as wood shingles, can impact the quantity and quality of rainwater you can collect



Photo by: Bob Burgess ([www.rainwaterconnection.com](http://www.rainwaterconnection.com))

**Figure 3** Concrete underground rainwater tank (10,600 L) being lowered into place



**Figure 4** Rainwater harvesting at its simplest: a rain barrel placed below a downspout

Polyethylene or polypropylene tanks are the most common. They are durable, lightweight and available in a range of sizes, shapes and colours, and typically suitable for both above- and below-ground installation (see figure 4). Concrete tanks are generally only used in below-ground systems. They can be cast in place as part of a building's foundation or installed separately elsewhere on your property.

Other types of materials include fiberglass (above or below ground), galvanized steel (low cost, above ground only), stainless steel (more costly, above ground only), and wood (aesthetically pleasing, above ground only).

### Protective measures

A well-designed system includes an *overflow pipe* to protect against damage caused by the tank overflowing during periods of heavy rains or low usage. All overflow water should be discharged away from foundations and other structures.

Tanks, conveyance networks and distribution systems must be *protected against freezing*. All below-ground components should be installed below the frost line. Seasonal systems should be completely drained at the end of the season.

In plumbing systems where there is a possibility that the rainwater conveyance piping could become interconnected with the household potable water piping, the use of *backflow prevention devices* ensures that non-potable water cannot flow backwards into the potable water system and contaminate it—this is required by the *2010 National Plumbing Code of Canada*.

### Rainwater treatment and filtration components

Rainwater can become contaminated from leaf litter and debris on your roof as well as from dust and local air pollution. Care should be taken to remove contaminants before they collect in your storage tank. *Pre-filtration devices* can be incorporated in the conveyance system to remove contaminants that may collect on the roof, before the water reaches

the storage tank. Options include gutter guards, downspout filters and “first-flush” devices to divert the first several litres of rainwater from the roof away from the conveyance system at the start of each rainfall.

### Post-storage treatment

Depending on the intended use of your rainwater, you may wish to consider some form of filtration and/or disinfection of the water that comes from the storage tank to reduce potential health risks, particularly if you wish to use the harvester rainwater for drinking. Check with your local health and building departments.

## PREPARING FOR INSTALLATION

Proper installation of a rainwater harvesting system is essential. While a simple rain barrel can be placed almost anywhere with very few restrictions (apart from ensuring it does not spill water against the wall or foundation of the house), a large system must be installed safely, in accordance with local and provincial codes and standards. Whether you choose an above-ground, indoor or underground tank, there are a number of issues to consider.

### Site selection

Proper site selection will help prevent the rainwater system from causing damage to, being damaged by, or interfering with existing property features. Factors include

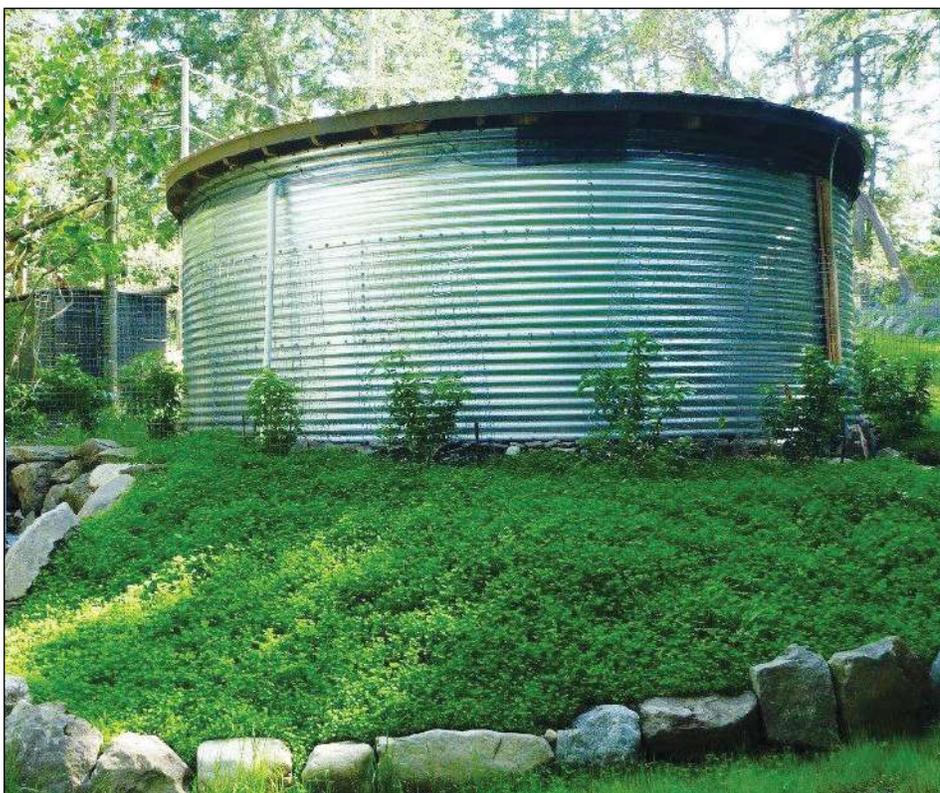


Photo by: Bob Burgess ([www.rainwaterconnection.com](http://www.rainwaterconnection.com))

**Figure 5** A 45,500-L steel cistern

location of utility services, wells and septic tanks; topography, depth to bedrock and soil classification; property easements and rights-of-ways, and visibility and aesthetics for you and your neighbours.

### Tank placement

Water is heavy—1,000 litres (enough to fill a 1 metre by 1 metre by 1 metre cube) weighs 1,000 kg—so the tank will need adequate structural support. Depending on local regulations, above-ground tanks may be placed on a flat, level concrete or compacted earthen or gravel base. In some municipalities, the base must be designed by a structural engineer. Whether

indoors or outdoors, the tank also needs to be secured to prevent it from falling over. Anchoring devices or ballasts are required for below-ground tanks to ensure that buoyancy doesn't push them to the surface.

### Health and safety

The health and safety implications of your rainwater harvesting system need to be addressed. All plumbing and electrical work must be undertaken by certified plumbers and electricians, in accordance with local codes and regulations.

Further, the 2010 National Plumbing Code of Canada requires that plumbing that provides non-

potable water within a residence must be labeled accordingly. This will prevent plumbers or Do-It-Yourselfers from accidentally connecting non-potable supplies to the potable supply and thereby possibly contaminating the drinking water and placing the household at risk. Check your local regulations for precautions that must be taken in your area.

### MAINTENANCE

A rainwater harvesting system needs ongoing monitoring and regular maintenance to protect against blockage, contamination and unwanted leaks, and to ensure optimal performance and water quality.

Most of the maintenance routines are quick and easy to perform, and require mainly a visual inspection



Photo by: [www.masternylist.com/gutters/](http://www.masternylist.com/gutters/)

**Figure 6** Failure to maintain eavestroughs and downspouts can lead to problems: this downspout is completely clogged by accumulated debris and had to be replaced

of the system components every 3, 6 and 12 months, with replacements and repairs as needed. Some municipalities may require an annual mandatory inspection by a licensed plumber. It is also recommended that the storage tank be drained every 3 to 5 years to check for deterioration and clean out accumulated debris. CMHC's *Collecting and Using Rainwater At Home, A Guide for Homeowners*, contains a detailed inspection and maintenance schedule as well as troubleshooting guidance.

## COSTING YOUR SYSTEM

Because each system is unique, its cost is unique as well. A rainwater harvesting system can cost anywhere from a few hundred to thousands of dollars, depending on its size and level of sophistication. Costs may also vary by region and by availability of trades and rainwater harvesting experts.

## Get estimates

Talk with several suppliers and/or rainwater harvesting experts and get quotes, so you can compare and can choose based on the best value for your investment. Use the costing worksheet in CMHC's *Collecting and Using Rainwater At Home, A Guide for Homeowners* to make sure you are including everything needed for your system and to keep track of quotes.

## TOOLS AND ADDITIONAL RESOURCES

*Collecting and Using Rainwater at Home, A Guide for Homeowners* (the source document for this AYH fact sheet). Includes worksheets, planning and costing checklists, and more.

*Landscape Guide for Canadian Homes*

*Rain Gardens: Improve Stormwater Management in Your Yard*

*Household Guide to Water Efficiency*



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