

Rainwater Harvesting

You can capture and use rainwater, just as people have been doing for thousands of years! Using rainwater in your yard (and possibly inside your home) for non-drinking purposes keeps rainfall from turning into runoff, and also means you don't end up paying to treat water for uses that don't need it.



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When it rains, it pours! Your roof is likely the largest contributor of runoff on your property. Say you have a 10-metre by 12-metre roof surface. During a single 2.5-centimetre rain event, 3000 litres of rainwater can run off your roof. Multiply that over the course of the year, and that's a lot of water just washing away.

Rainwater harvesting captures that water and puts it to use. Rainwater can be used for non-potable (non-drinkable) purposes such as watering lawns, gardens, and planters. With a proper cistern and plumbing system installed, rainwater can even be used inside your house to flush toilets.

When it rains, all those hundreds of litres of water pour into your eavestroughs and are funneled through your downspouts. Directing this water away from building foundations is critical for keeping them dry. But this creates points of heavy, focused water release, and turf-based landscapes are often incapable of absorbing these concentrated flows, resulting in stormwater runoff flowing off your site. Even worse, downspouts are often put onto driveways without any chance to soak in, flowing directly to streets and ditches, burdening the conveyance system.



Benefits of Rainwater Harvesting

A free source of water!

Conserves our drinking water supply. Why spend the money to treat water up to a drinking-water (potable) standard when you aren't going to drink it? Whether you are responsible for your own water treatment from a well, or if a municipality does it for you — either way — you are paying for the treatment.

Plants prefer rainwater. Unfortunately, the same chemicals used to make drinking water safe also kill beneficial organisms in the soil, reducing nutrient uptake by plants. Rainwater is also warmer than tap water, so plants grow faster.

An extra water source. In times of restriction or emergency, rainwater can provide a backup.

Rainwater Harvesting is Best...

When you have plants that need a lot of water. Usually this includes planters and containers (which should likely be watered every day) and vegetable gardens that need an even supply for the tastiest results. These types of gardens and a supply of rainwater go hand-in-hand.

When you need to retain stormwater on your property. If you live in an area that restricts the amount of runoff you can discharge, rainwater harvesting can help.

When you don't have room for a rain garden or a green thumb. Not every property has room for a rain garden. Tanks can be tucked away, whereas rain gardens (the greener option) take up space that you might otherwise want to have as turf for active use, especially when kids are young.



Outdoor Irrigation: Rain Barrels

Rain barrels are the easiest way to get started with harvesting rainwater. They provide a ready supply of water on dry days, ideal for watering your lawn, garden, and potted plants. They come in a variety of sizes and colours and can be easily incorporated into your existing landscape.

Components

Collection and Conveyance. Connects the water supply (rainwater flowing from the roof) to the rain barrel. Includes filtration such as leaf/debris screens covering the eavestroughs and a “first-flush” system that diverts a small initial volume of each rainfall (which tends to carry the most dirt and debris).

Storage. Rain barrels are commonly available in plastic, fibreglass, and galvanized steel. Steel tanks are often lined with plastic to prevent leaks and ensure water quality. Translucent or transparent barrels will grow algae in the presence of sunlight, but can be quickly and easily transformed with a coat of spray paint for plastic. Fibreglass tanks are less common now, as

they become brittle in the presence of sunlight and are more costly to manufacture than plastic. Rotational moulded polyethylene tanks do not have seams and are therefore the least prone to leak. Check that plastic tanks are BPA free.

Base Support. A solid, level, raised base under the barrel. This could be cinder blocks, bricks, or a wooden platform. Remember, water is heavy! One litre weighs a kilogram, so a good support base for your cistern is vital.

Distribution system. A ladle, bucket, solar-powered pump and hose, or electric submersible pump and hose are all options to get water to your plants.



Check out a quick
intro to setting up
your rain barrel
[bit.ly/
RainBarrelSetup](https://bit.ly/RainBarrelSetup)

Things to Consider

Placement. Where do you want to put your rain barrel? If it's located right next to your garden, you can connect a soaker hose to the spigot for slow-drip irrigation. Placing it next to your patio or deck makes watering hanging baskets and planters convenient.



Make sure the barrel is placed in an area where the grade slopes away from the foundation of the house.

Avoid placing rain barrels on your driveway, porch, pathway, or other hard surfaces.

These surfaces don't usually allow for proper direction of overflow. A more permeable surrounding surface is better (such as garden areas).

Overflow. Rain barrels come with an overflow system, such as a pipe or hose,

Maintenance

A bit of regular maintenance will extend the life of your rain barrel and keep the water it collects clean.

Inspection. Inspect your rain barrel regularly, especially after a big rainfall. Check for tears in the bug screen and cracks or leaks in the spigot, hose, valves or body of the barrel itself. Clear leaf and twig debris away from the top of the barrel to prevent clogging, and check pipes and hoses for obstructions.

Cleaning. Clean your rain barrel once before use and then once a year after that. Use vinegar or another non-toxic cleanser on the inside of the barrel and the spigot. Use a non-abrasive brush. Rinse the barrel thoroughly after cleaning.

Winterizing. Drain your rain barrel onto an absorbent surface before the cold sets in to prevent ice damage. Leaving the drain valve open during the colder months (October to April) will also help prevent ice damage.

designed to divert water beyond the barrel's capacity to a suitable location away from the home. Be sure to direct your overflow pipe towards an absorbent, landscaped area, swale or soakaway; or ideally a rain garden.

Consider the slope of your yard when placing your rain barrel to ensure that overflow has somewhere safe to run, not towards your house or onto a neighbour's property.

If your rain barrel frequently overflows, consider hooking up a second rain barrel. You can direct the overflow pipe from the first right into the second's intake. Place the first on a higher base to let gravity assist, too.

Safety. A full rain barrel can weigh upwards of 250 kilograms. Make sure your barrel is sturdy and stable on a level surface. You can strap the barrel to a nearby wall or fence-post to prevent tipping.

ABOVE: Drip irrigation uses emitters. This is a surface installation but the lines can also be buried.

What About Mosquitoes?



Mosquitoes require calm water for about 7 days to successfully breed. Keep them out with a lid or screen, or stir the water regularly. Alternatively, add a tablespoon of dish soap or a half-cup of bleach to the barrel water (these minute amounts will not harm your plants). Better yet, don't leave the water sitting there — put it to use in your yard!

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Cisterns and Larger Harvesting Systems

Rain barrels provide a great starting point for your rainwater harvesting efforts. They're inexpensive and easy to set up and maintain. But remember how 3000 litres of water can run off your roof during a single 25-mm rainfall? A 250-litre barrel is going to fill up pretty fast!

The next level of rainwater harvesting will appeal to the passionate gardener. It involves using collected water for outdoor subsurface irrigation. Since about half of annual water usage in Alberta is for outdoor irrigation, collecting and using rainfall at a bigger scale for this purpose will make a significant difference to the demand on potable water.

Components

Although not as intensive a project as the year-round indoor-use system described in the next section, professional consultation and installation is recommended to ensure a properly functioning system.

Storage. May be located above or buried below ground. The size of the cistern will be determined by the desired area of irrigation and the area of the roof surface being directed into the cistern. The size and placement of your cistern will also largely depend on your site conditions, available space, accessibility, buried service lines and utilities, etc. A "water tote" is shown to the right.

Collection and Conveyance. Connects the water supply (rainwater flowing from the roof) to the cistern. Includes filtration such as leaf/debris screens covering the eaves troughs and a "first-flush" system that diverts a small initial volume of each rainfall (which tends to carry the most dirt and debris).

Distribution System. A pump is installed to move the water from the cistern to the irrigation system. Solar-powered models are available and eliminate the need for attachment to an outlet. The irrigation components typically consist of standard equipment used with conventional potable water, including zone valves, sprays, and drip systems.

Overflow Management. Observe similar considerations for overflow as for a small rain barrel, but keep in mind the potential to have to manage a higher volume of overflow. Directing overflow to a rain garden is a good solution.



Things to Consider

Programs and Requirements. Check with your local jurisdiction to find out if there are any restrictions, (e.g., on tank placement), or if any permits are required. Also check-in with your insurer. Municipalities and eco-groups may offer rebates, incentives or subsidies.



Source water for food crops. Concerns include pathogens from critters, roofing and tank materials, what blows onto the roof as dust, and toxins from some kinds of algae. Roofing materials may *leach* (give off) substances you don't want your plants taking in, especially root (e.g., potato, carrot) or shoot (e.g., asparagus, lettuce) crops. Metal and asphalt roofs are better, while cedar or treated shakes should not be collected from. Galvanized roofs, solders, adhesives and flashings may all leach, but not necessarily much. To mitigate risk: Water the soil rather than the plant and wash plants before eating them. Don't water the day of harvest. Get your rainwater tested to ensure it is safe. If it's a new roof, consider waiting three years for adhesives and the like to cure and test again. Make sure you have a first flush diverter. Consider adding a finer filter. Use an opaque tank to prevent algae growth.

Floating. Some types of tanks such as fibreglass can float when they are low or empty and require hold-down straps or similar, especially where groundwater may be high.

Maintenance

On a bigger scale but similar to a rain barrel, the system will need to be drained and decommissioned before freezing weather to prevent ice damage. Added filtration and electrical components will require a bit of extra attention.

Roof Surface. Inspect at the beginning of every spring for build-up of leaves and debris. Cut back overhanging vegetation.

Eavestroughs and Downspouts. Inspect at the beginning of every spring, clearing debris and making sure conveyance pipe connections are secure.

Filtration. Inspect every few rainfall events or according to manufacturer's guidelines, cleaning off mesh filters and clearing debris. Decommission before freeze-up.

Conveyance Pipe. Inspect regularly during rainfall events. If there is pooled water or the ground is saturated at the downspout/

conveyance connection, the pipe could be clogged.

Cistern. Have a qualified person inspect the tank annually.

Distribution System. Inspect the pump regularly to ensure it's functioning properly.

Overflow Pipe. Inspect monthly during the rainy season. Install a splash pad (rocks, gravel, or concrete pad) at the discharge point to prevent erosion. Make sure the cover is locked and that there are no holes in the screen, and remove debris to prevent clogging.



Are There Any Other Uses for Rainwater in My Home?

In Alberta, toilet flushing is currently the only approved indoor use for rainwater, but this may change in the future. In other parts of the world, harvested rainwater is commonly used for laundry. If you are building new, you might want to consider including purple pipe to a cold-only laundry connection in order to ready your home for when this use is approved.

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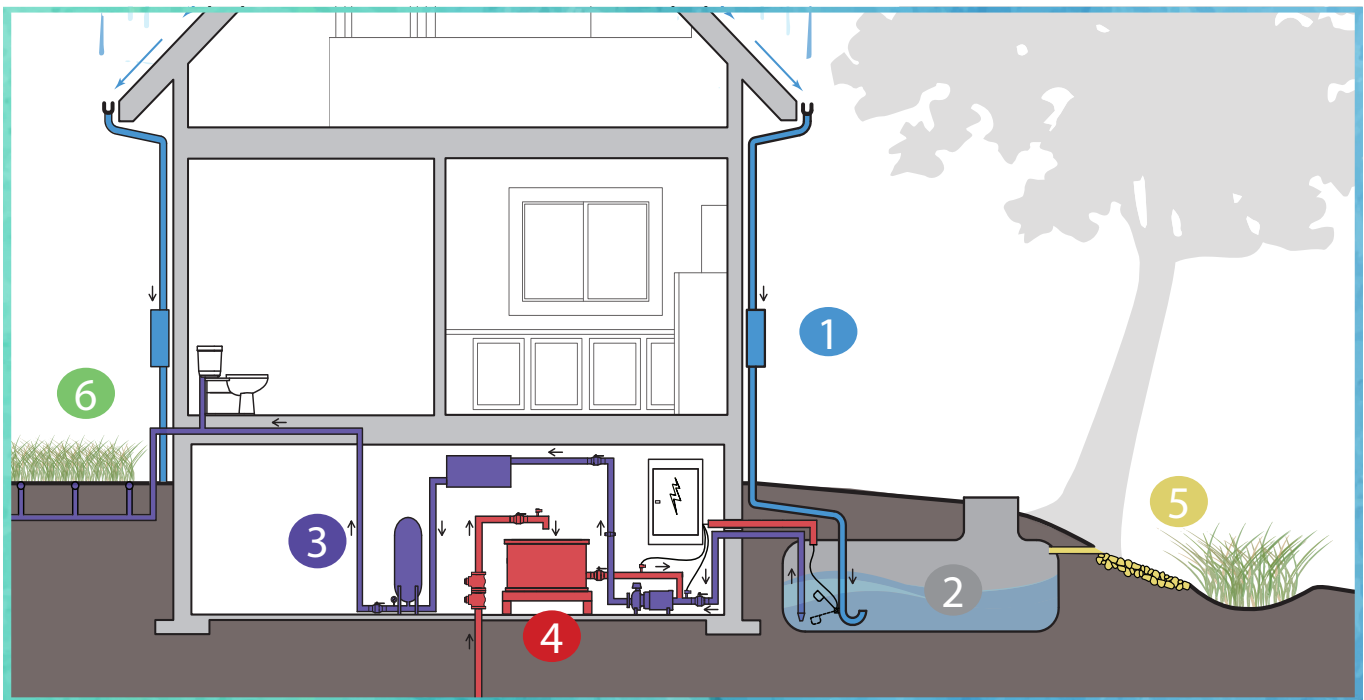
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Indoor Non-Potable Use

This section describes rainwater harvesting systems used for indoor, non-potable purposes, i.e., toilet flushing. This is a much more ambitious project than just catching rainwater in a barrel. But it adds value to a property by making use of a free resource, reducing consumption of clean drinking water for non-drinking purposes, and contributing to “greener” infrastructure. Professional consultation and installation is required.



Components

- 1 Collection and Conveyance:** Connects the water supply (rainwater flowing from the roof) to a storage tank. Incorporates pre-storage filtration.
- 2 Storage Tank:** Available in a variety of sizes and materials, including plastic, fiberglass, concrete, metal, crate and bag, and bladder style. Material and placement (above ground, below ground, or indoors) will depend on site conditions and preferences.
- 3 Distribution System:** Consists of pumps, pressure tanks, pressure-rated purple piping, valves, and filtration/disinfection components.
- 4 Top-Up and Backflow Prevention Systems:** During low rainfall and winter, a top-up system can supply municipal or well water. An air gap is required so there is no connection between potable and non-potable plumbing lines. A backflow prevention device also prevents non-potable water from coming in contact with potable water lines.
- 5 Overflow Management:** During heavy rain, the storage tank may reach capacity. Excess water should be directed to a rain garden or other landscaped area.
- 6 Subsurface Irrigation:** For outdoor watering.

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TOP LEFT: Modular cisterns are available for different surface-weight loadings. To be used as a cistern, they are wrapped in a waterproof membrane, using the same technology and installers as are used for basement radon-proofing. **TOP RIGHT:** Cartridge filter canisters below (blue) and UV disinfection above. **BOTTOM:** Purple-pipe distribution manifold in a home with rainwater used for toilet flushing.



Things to Consider

Permits and Incentives. As with the outdoor irrigation cistern system described previously, check with your local jurisdiction to find out about any placement restrictions, required permits, or available rebates or incentives. Also check in with your insurer.

Site Conditions. The design, layout, and installation of a rainwater system will be determined by conditions on your property, including:

- Buried service lines and utilities.
- Site accessibility (for excavation and/or installation).
- Topography.
- Available space for storage tank.

Cold Weather. Storage tanks and conveyance pipes will have to be buried below the frost line, or have insulation or a heating system installed, or be located indoors.

Unless specifically designed to withstand winter temperatures, the system (especially above-ground filtration components) will need to be drained and decommissioned before the cold sets in.

Maintenance

This more complex rainwater harvesting system will require regular maintenance, including some inspection by qualified personnel.

Roof Surface. Inspect every 6 months for build-up of leaves and debris. Cut back overhanging vegetation.

Eavestroughs and Downspouts. Inspect every spring and fall, clearing debris and making sure conveyance pipe connections are secure.

Pre-Storage Filtration. Inspect frequently, after multiple rainfall events or according to the manufacturer's guidelines, cleaning off mesh filters and clearing accumulated debris. Decommission before winter freeze.

Conveyance Pipe. Inspect regularly during rainfall events. If there is pooled water or the ground is saturated at the downspout/conveyance connection, the pipe could be clogged.

Storage Tank. The inside of the storage tank should be inspected annually by qualified personnel. Leaks should be repaired according to manufacturer's specifications.

Distribution System. Inspect annually. If the pump turns on when there is no non-potable water being used, there could be a leak somewhere in the distribution plumbing lines (such as a leaky toilet that slowly draws down water).

Post-Storage Filtration/Disinfection. Inspect every 3 months or as required by product guidelines, cleaning or replacing filters and components as necessary.

Top-Up System. Inspect every 6 months or more frequently if top-up is an ongoing issue.

Backflow Prevention Devices. Require annual inspection by qualified personnel.

Overflow Pipe. Inspect monthly during the rainy season. Install a splash pad (rocks, gravel, or concrete pad) at the discharge point to prevent erosion. Make sure the cover is locked and that there are no holes in the screen, and remove debris to prevent clogging.

A Drop in the Bucket?



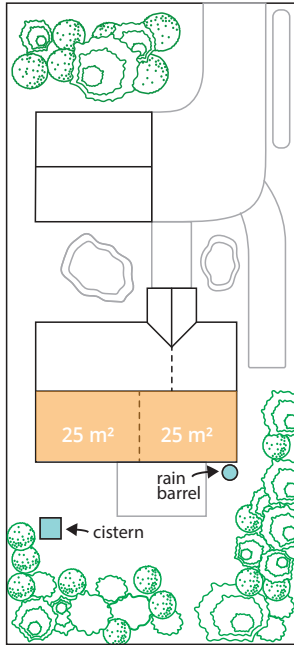
Will all this rainwater harvesting have an impact on your water utility bill? If you have a large landscape that you previously used potable water to irrigate, you will see a difference over the summer. Systems for toilet flushing will notice a difference year-round. It should be noted, though, that the initial price of a larger-scale rainwater harvesting system is significant, and municipal water is currently relatively inexpensive. However, resource prices fluctuate and may well rise in the face of fresh-water shortages.

That said, with such a long timeframe for the investment to “pay for itself,” the primary reasons to install this scale of system are water conservation, water security, and stormwater management.

If your primary water source is well water, rainwater harvesting reduces the stress on groundwater supplies and preserves domestic treatment equipment and their cost for only cleaning water that needs to be potable.

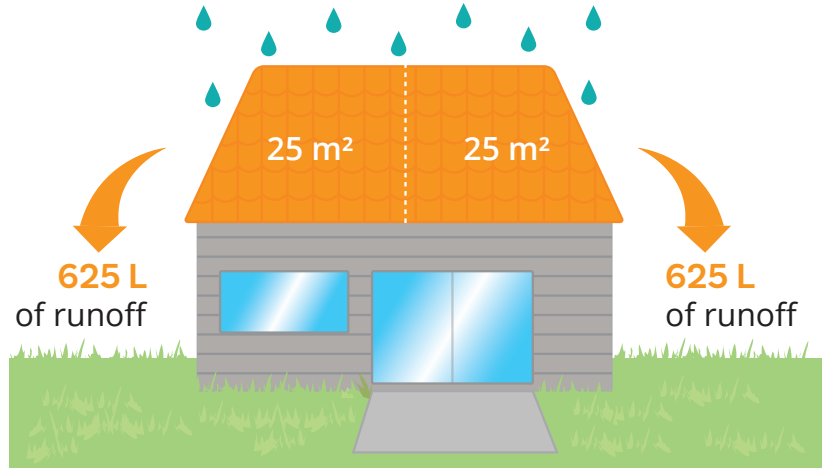
CONSIDER THIS EXAMPLE

EXAMPLE PLAN



HOW MUCH RUNOFF?

On one side of the house's roof, a 2.5-cm rain event generates...



IDEAS

You could reduce runoff with a **rain barrel** next to the patio, to water potted plants. Three rain barrels would capture the flows from a 2.5 cm rain event. You could add a **cistern** that collects rainwater from half of the roof for thirsty veggies or as part of a **toilet flushing system**. If you had a cistern you would probably set it up to collect from more of the roof's area.

210 L

Rain Barrel



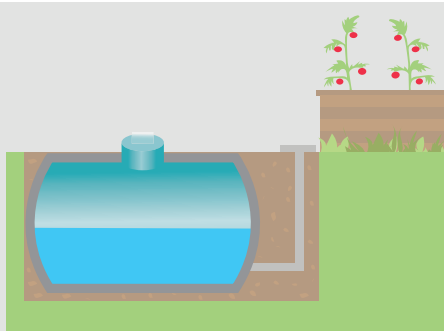
Weekend Warrior

(difficulty: easy)

\$

2,000 L

Cistern



Phone a Very Good Friend

(difficulty: intermediate)

\$\$\$

6,000 L

Toilet Flushing System



Call the Pros

(difficulty: advanced)

\$\$\$\$\$



Have you evaluated your site yet? Our **Evaluate Your Site** section walks through the steps of identifying source flows, calculating runoff volumes, identifying opportunities to reduce runoff, and sizing your solutions.

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Put a fine point on it

Your turn to do the math. Here are some simple ways to figure out how much to store for different needs. Ideally you want to retain the 2.5 cm rain event, because that is the amount that will capture most storms, which is what does the bulk of the work to protect our water bodies. Capturing more than that is generally infeasible because the amounts increase dramatically. The flip side is how much you want to have on hand for irrigation.

How many rain barrels will hold the runoff from a 2.5 cm Rain Event?

Contributing Roof Area	200 L Rain barrel	1000 L Water Tote
up to 8 m ²	1	1
up to 16 m ²	2	1
up to 32 m ²	4	1
up to 56 m ²	7	2
up to 64 m ²	8	2

As shown in the table to the left, runoff from even small roof areas can far outstrip the capacity of the average rain barrel, which is about 200 litres. On the other hand, a typical water tote holds 1000 litres, which is equal to one cubic metre. These plastic totes are supported by a reinforcing metal cage and are about half the price per litre compared to rain barrels.

A 2.5 cm rain event generates 25L of runoff per square metre of roof area. If you multiply your roof area by 25 and divide by the capacity of your storage container, that is how many containers you need to fully hold back the 2.5 cm rain event for stormwater management purposes. But remember, you need your container to have that capacity when that rain event happens, so oversizing is best, because most people don't want to have an empty rain barrel just waiting for a storm to happen. Think about how low you're willing to go between rain events.

Sizing a Cistern for Irrigation

Garden Size	Volume Required for Summer (assumes 3.5 cm per week for 8 weeks)	Optimal Cistern Size (1/3 less than total)	Minimum Contributing Roof Area Needed
25 m ²	7000 L	5250 L	50 m ²
50 m ²	14 000 L	10 500 L	75 m ²
100 m ²	28 000 L	21 000 L	150 m ²
150 m ²	42 000 L	31 500 L	200 m ²
200 m ²	56 000 L	42 000 L	275 m ²

So you want to go bigger. It's beyond the scope of this guide to go deeply into the subject, but to the left is a rough guide on how to size a cistern for irrigating a thirsty veggie garden or other water-loving landscape.

In this case you want to think about how much water you will need for the entire season, and then factor down a certain amount on the premise that you will use some water, then it will rain, then you will use some water and so on. The roof sizes needed are based on average Alberta conditions.

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Products and Suppliers

There are several suppliers of rainwater harvesting equipment across Western Canada. Basic rain barrels can often be found at hardware or big-box stores. Water totes, also known as *Intermediate Bulk Containers*, are often available second hand (look for food grade, pressure-tested, cleaned units). For more options of styles and materials, and for larger-scale systems, browse these suppliers:

Regency Irrigation
regencyirrigation.com

FRP Manufacturing
water-tanks.ca/products/balltanks.php

Barr Plastics
barrplastics.com/rainwater-harvesting-stormwater-management.html

Blaze Plastics
blazeplastics.ca

Polywest
<https://www.polywest.ca/polyethylene-tanks/>

More Information

Resilient Landscaping Canada (prairie-focused, a resource of the ALIDP)
resilientlandscaping.ca

Pigeon Lake Watershed Association
plwa.ca

Connect the Drops: Resources include an Excel-based design and costing tool.
connectthedrops.ca

City of Calgary Rainwater Harvesting Guidelines includes a handy Homeowner Checklist and Maintenance Log.
<https://www.alidp.org/assets/pdfs/rainwater-harvesting-guide-2013-0260.pdf>

Collecting and Using Rainwater at Home: A Guide for Homeowners: A thorough yet approachable Q&A-style guide from the Federal Government.
https://publications.gc.ca/collections/collection_2014/schl-cmhc/NH15-474-2013-eng.pdf

Alberta Municipal Affairs detailed guidance documents.
<https://www.alberta.ca/reclaimed-water.aspx>



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Environment
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