SALT SPRING ISLAND

Non-Potable Rainwater Harvesting

Best Practices Guide

developed by

Salt Spring Island Watershed Protection Alliance

This guide is brought to you through the efforts of the Salt Spring Island Watershed Protection Alliance (SSIWPA): a collaborative process committed to bringing together the people, information and processes required to protect the health of Salt Spring Island watersheds and freshwater supplies.

Salt Spring Island,
British Columbia, Canada

Rainwater Harvesting: A Salt Spring Solution

Water conservation through rainwater harvesting to address the climate reality is an idea whose time has come. Safe and effective collection, storage and use of harvested rainwater for non-potable purposes by residents and visitors to Salt Spring Island can connect people with their water usage and improve conservation.

Rainwater harvesting (RWH) is the collection and storage of rainwater for potable and non-potable uses.

This guide is a best practices resource for those interested in building, customizing or expanding a RWH system. Information herein is accessible to residents with many different living and business conditions, building and property features. It demonstrates best practices for design, installation and maintenance of residential non-potable rainwater harvesting (RWH) systems and uses.

As one of the most desirable areas to live in Canada, Salt Spring Island is a coastal island in the Salish Sea that is nestled up to the eastern edge of Vancouver Island. Climate changes over the past decade have resulted in warmer, wetter winters and hotter, drier summers. Average total annual rainfall remains approximately 900 mm per year. Changes to rainfall pattern (more intense, less frequent) impacts groundwater recharge, lake recharge, stream flow, vegetation, fish and animal population health, as well as physical sustainability features like slope stability, and erosion of topsoil. Salt Spring residents and visitors currently rely on four relatively shallow lakes and groundwater reserves in fractured bedrock systems as drinking water sources.

At a population of 10,557 (2017) bouncing to 20,000+ in the busy tourist season, Salt Spring needs water conservation solutions to address the changing climate, protect critical streamflow as well as fish and aquatic health, and to offset the use of treated lakewater and groundwater for non-potable uses.

- Salt Spring Island Watershed Protection Alliance Steering Committee

This Salt Spring Island Non-Potable Rainwater Harvesting Best Practices Guide presents up to date information about the benefits and opportunities of rainwater harvesting for non-potable purposes. Each resident and visitor to Salt Spring Island bears a responsibility to learn and to practice sustainable approaches to the management of water — one of our most precious natural resources.

Increasing RWH systems on Salt Spring can:

- Reduce peak summer demand on water systems during seasonal drought
- Conserve groundwater supplies and prepare for emergency needs
- Prevent saltwater intrusion in wells located in coastal areas
- Slow down and even eliminate stormwater runoff
- Reduce the probability of harmful algal blooms

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Acknowledgements:

Some content of this Guide was adapted with permission from original text and technical illustrations published in the Regional District of Nanaimo Rainwater Harvesting Best Practices Guidebook (2012).

The authors acknowledge Bob Burgess for extensive contributions to the Regional District of Nanaimo's Rainwater Harvesting Best Practices Guide (RDN, 2012). SSIWPA is indebted to Bob Burgess for this foundation of coastal rainwater harvesting design and installation information, and the RDN's proven track record of achieving goals for water conservation continues to inspire the work of SSIWPA.

Some studies suggest that when people become involved with their own water supply through harvesting rainwater, they consciously reduce their overall water consumption by 20 to 60 per cent.
~ Australian Rainwater Industry Development Group 2008 Consumer Guide

Thank you:

The Regional District of Nanaimo Drinking Water
and Watershed Protection Program - Julie Pisani, Coordinator

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Salt Spring Island Local Trust Committee

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Andrea Palframan, Graphic Design

Resources:

SSI Rebates and Incentives
Rebate Application

www.ssiwpa.org

The SSIWPA website Rainwater Resources section lists websites and information about rainwater harvesting, storage and use. It is organized by category and very accessible.

Examples of SSIWPA Rainwater online resources:
Calculations and Conversions
Irrigation Water Demand Calculator
Roof Types and Their Characteristics
Water Use Comparison by Source Type

Selected Resources:

ARCSA Rainwater Catchment Design and Installation Manuals

Alberta Guidelines for Residential Rainwater Harvesting Systems

City of Calgary Rainwater Harvesting Guidelines

The Texas Manual on Rainwater Harvesting (Texas Water Development Board, 2005)

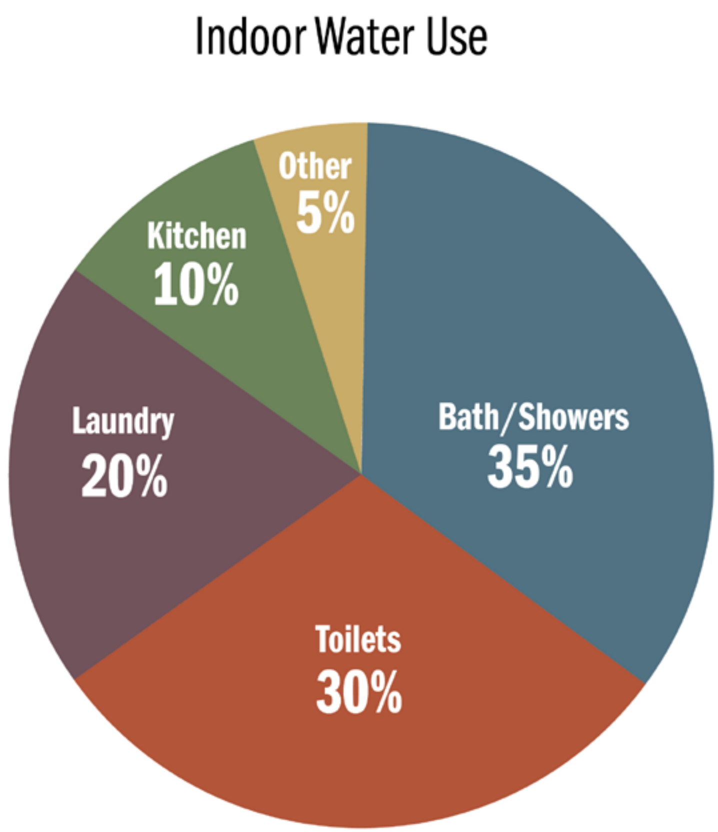
Plumbing Code

Contents:

1. Quick Self-Assessment: Is Rainwater Harvesting Right for You?

For the purposes of this Guide, rainwater is defined as rain that falls on, and is collected from, the roof(s) of a house and/or ancillary building such as a garage or shop.

Rainwater harvesting at any scale can have a positive impact on overall water conservation. Typical systems large enough to serve the needs for a small garden plot (9 square meters/100 square feet) for the dry season range in price from $1,800 - $2,200*. The more low tech solutions which require more human activity cost less, depending on the volume required over the dry season. Unlike other parts of the world, islanders in the Salish Sea must rely on storage or alternative sources to rainwater during annual droughts June through October.



SOURCE: RAINWATER HARVESTING BEST PRACTICES, REGIONAL DISTRICT OF NANAIMO

Average Residential Water Use Per Capita

320 L/day (BC Municipal Water Survey, 2016)

291 L/day (Stats Canada, 2019)

159 L/day (Self-reported, Rainwater Users in Gulf Islands BC, 2005)

Metering has been shown to increase water conservation in municipal systems

* simple conveyance piping ($200),
low end debris filter ($70),
1430 USG storage($1300),
simple pump ($200),
fittings ($100)

1. Quick Self-Assessment: Is Rainwater Harvesting Right for You?

Contribute to Water Conservation Solutions on Salt Spring Island! Non-potable RWH systems can be relatively simple to install and maintain. Before committing to the design and installation of a RWH system for your home, take the time to work through this quick Self-Assessment, to ensure there are no significant barriers to the proper installation and maintenance of the system you choose.

"Rainwater harvesting does not remove water available to local environments, it simply is gathered from a different part of the water cycle."

(Rainwater Harvesting on the Gulf Islands, Islands Trust Fund, 2006).

To find answers to the questions in the self-assessment, you may find it helpful to review:

- **Section 2.4: Planning & Professionals**
- **Section 3: Calculating Rainwater Supply, Demand and Storage Requirements**
- **Section 5: Operation and Maintenance of a Non-Potable RWH System**

THE IMPACT OF RAINWATER HARVESTING ON ENVIRONMENTAL SUSTAINABILITY AND WATER CONSERVATION IS PARTICULARLY GREAT IF:

- [ ] You live in a water district with dry season restrictions for outdoor watering, or
- [ ] Your water source is a groundwater well with limited capacity, and/or serving several residences or
- [ ] Your private well water quality changes from extended high withdrawals in the dry season, or
- [ ] You live in a neighbourhood with a high concentration of actively pumping groundwater wells

PARTICULARLY FOR POTABLE RWH SYSTEMS, IT'S ALSO IMPORTANT TO CONSIDER THE FOLLOWING:

- [ ] Do you have sufficient space for surface or subsurface tank installation (think creatively if necessary)?
- [ ] Am I interested in, and physically capable of, cleaning and maintaining my RWH system?
- [ ] IF NOT: am I able to cover the cost of hiring a professional to conduct regular and seasonal maintenance tasks?
- [ ] Am I at home often enough (particularly during the winter) to protect my system from freezing?
- [ ] Can I meet all associated bylaws and regulations?
- [ ] Are my existing rooftop(s) and gutters made of materials that will not contaminate the rainwater?

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2. Stored Rainwater Use Types and System Categories

This section contains a brief description of all RWH system types. With the correct design, construction and maintenance, RWH systems can be safe, suitable alternatives to treated water supplies for both outdoor and some non-potable indoor uses. Learning the basic differences between RWH system types will help you to follow Best Practices to prevent contamination, leakage and system failure, and in non-potable (indoor use) systems, to prevent cross connections between the harvested rainwater and the water in any drinking water system.

2.1 OUTDOOR USE NON-POTABLE RWH SYSTEMS

Non-Potable water for outdoor use is non-drinking water that is suitable for these outdoor uses:

- garden watering and irrigation systems
- pond filling
- animals
- outdoor cleaning/power washing
- vehicle washing
- fire protection or emergency water

Non-Potable (Outdoor Use) RWH systems may:

- have a range of storage tank sizes: from a rain barrel 200-1,000L (55-264 USG), to one or more large tanks - up to 19,000 L (5,000 USG)
- operate seasonally or year-round with breaks for cleaning and maintenance
- operate in an overflow design for year-round use
- require little debris removal or cleaning enroute to storage tanks
- include some post-storage treatment such as particle filtration to remove sediment or water disinfection to remove bacteria (but there is much less requirement to do so with the outdoor non-potable use category)
- be easier and less expensive to build and maintain than systems for indoor use

Some Rain Facts:

It is virtually mineral-free

It is the perfect temperature for plants when stored in a tank

It is naturally soft

Preferable for watering plants due to lower chlorine & heavy metals

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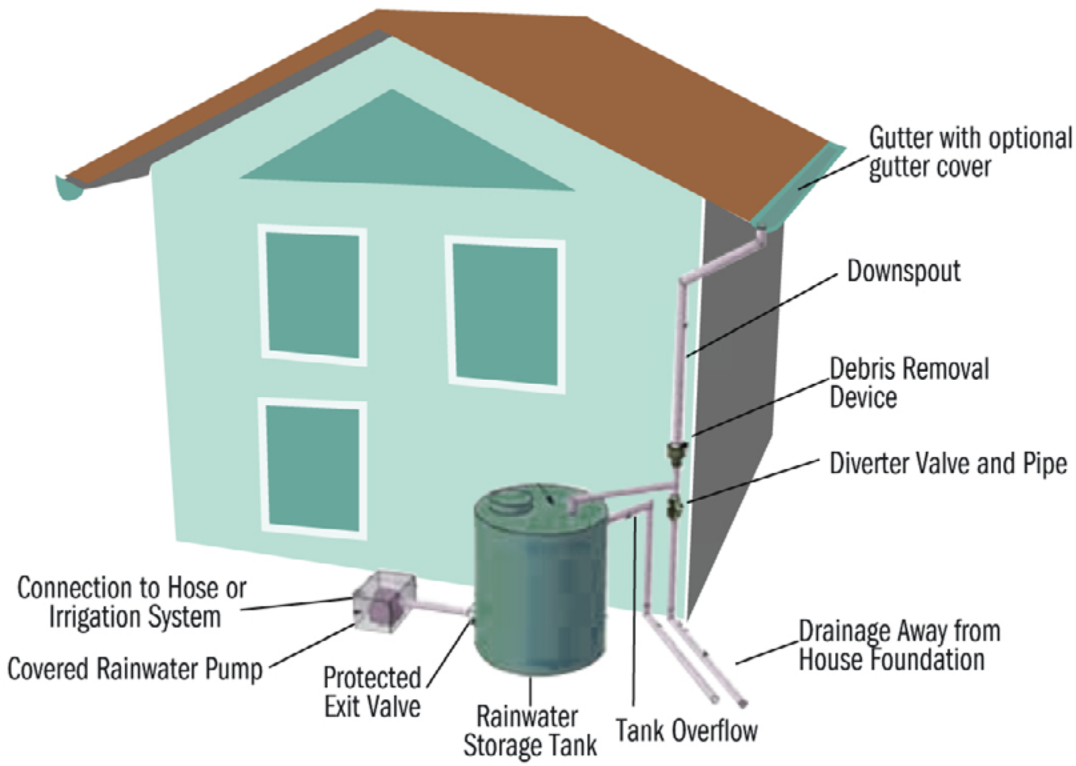
2. Stored Rainwater Use Types and System Categories



Pollen is very rich in nutrients and if it is not filtered out of the rain headed to your storage tank, it will cause algal blooms/bacterial growth problems. Most pollen ranges between 40 microns and 500 microns. This means the best prevention is to divert the rain during pollen season and avoid collecting any with pollen in it. Typical pre-tank filtration will not catch the smaller pollen particles. May have smaller settling tank before larger storage tank (clean often).

FIGURE 2.1.1 SIMPLIFIED DEPICTION OF A NON-POTABLE (OUTDOOR USE) RWH SYSTEM

2. Stored Rainwater Use Types and System Categories

2.1 OUTDOOR USE NON-POTABLE RWH SYSTEMS

Roof, Gutters and Downspouts: Most standard roofing types, gutters and downspouts can be used. Avoid materials containing lead or other contaminants that are toxic in irrigation water. Gutter covers are optional. If your storage tank location is suitable near your home, it is often sufficient in this climate to collect from your home's total roof area. Where transport from storage tank to use area is too distant for topographical or cost constraints; then collection from properly-roofed outbuildings is recommended.

Collection System: Once collected from gutters and downspouts, rainwater should proceed through a debris filtration step during transport to the tank(s). This filtration or pre-cleaning reduces the frequency of tank cleaning.

See Section 4: The Components of a RWH System

Water Storage Tank: The water storage tank may be installed above or below ground. In either case, an overflow is required and the end of the overflow pipe must drain the excess water away from the house. Algae blooms can occur in lighter coloured tanks exposed to sunlight. To prevent this choose a black tank and/or plan for a shady location where possible. Storage tank images for Salt Spring Island examples can be found at http://ssiwpa.org/rainwater-resources. A screen or other method to block overflow pipe access to wildlife (frogs) is required.

Water Distribution System: The distribution component of a Non-Potable (Outdoor Use) RWH system delivers the water to its final destination for use. An efficient water delivery system usually requires a pump for pressurization, except where low pressure gravity delivery to point of use may be sufficient (and will keep costs down). Distribution piping may run directly to an irrigation system, or may supply hose bibs on the house or throughout the property.

Any hose bib from a Non-Potable (Outdoor Use) RWH system should be clearly marked:

'NOT A SOURCE OF POTABLE WATER — DO NOT DRINK'.

Any non-potable stored rainwater for irrigation or non-potable use may never be connected to a drinking water system as a backup or supplementary source. (B.C. Plumbing Code A-1.4.1.2(1) and 2.7.1.1)

Guidance from an irrigation contractor, pump installer or trained plumber will help to ensure installation of an efficient, trouble-free distribution system as part of your RWH system.

See Section 2.4: Planning & Professionals for information on required/ recommended professionals who can guide RWH system installation to ensure safety, efficiency, and compliance with local regulatory requirements.

See Section 4: The Components of a RWH System, where detailed information for the two non-potable use system categories is provided. It is essential that systems be designed for their use.

2. Stored Rainwater Use Types and System Categories

2.2 INDOOR USE NON-POTABLE RWH SYSTEMS

Non-Potable water for indoor use is non-drinking water that is suitable for use inside the house for toilets, urinals and clothes washing. (CSA B805-18 table 5.1)

Non-Potable (Indoor Use) RWH systems generally require:

- Debris removal from gutters and en route to tank (reduces discolouration)
- A minimum requirement of 5 micron filtration post-storage, with 16 mJ/cm^2 UV or 0.5 micron microfiltration (CSA B805-18 Table 8.1 page 46)
- Supplemental water supply to the tank with an air-gap backflow prevention device
- Non-Potable water piping inside the house that is coloured and which must be installed by a registered plumber. This reduces cross-connection with the potable water supply.

These systems may:

- Include disinfection systems to remove bacteria
- Have smaller storage tanks than potable RWH systems
- Operate year-round.

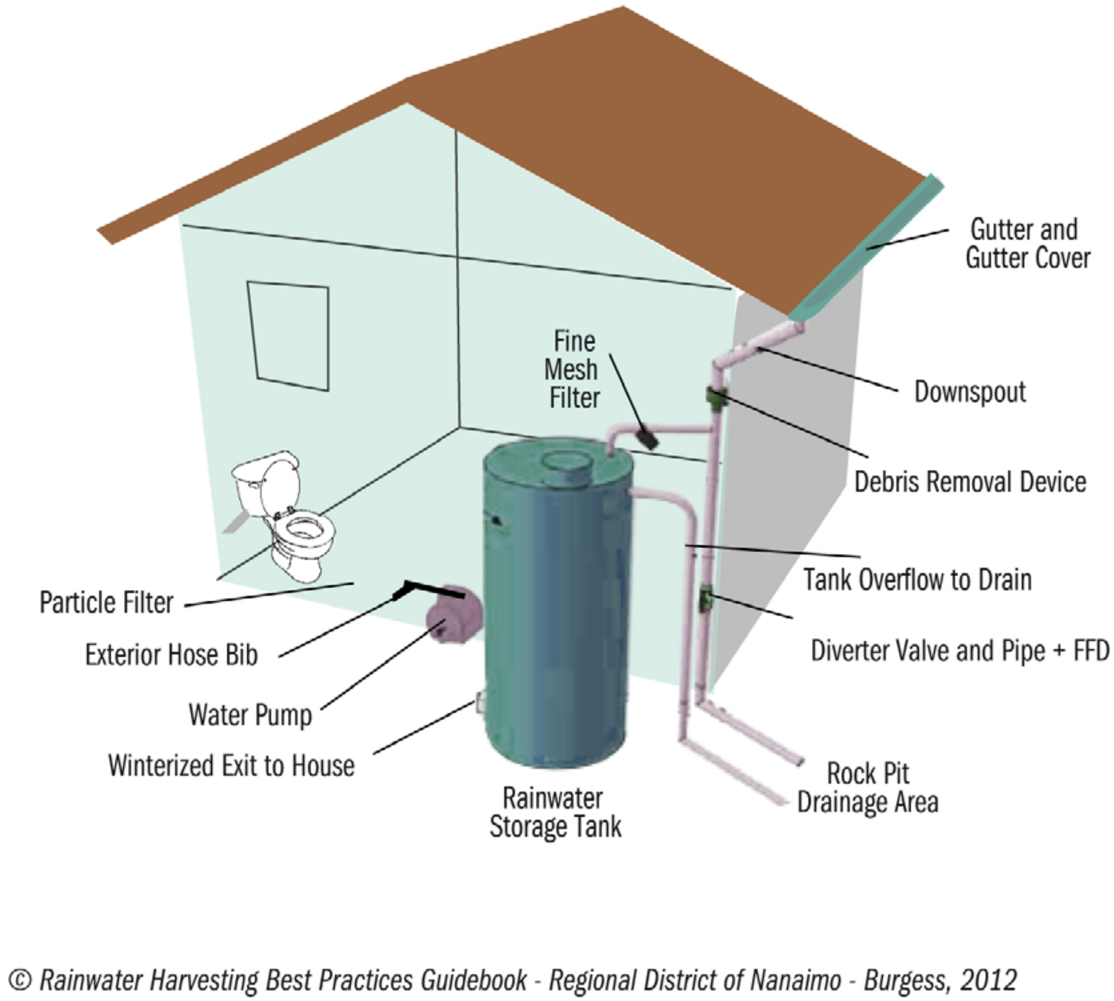


FIGURE 2.2.1 NON-POTABLE (INDOOR USE) RWH SYSTEM

2. Stored Rainwater Use Types and System Categories

2.2 INDOOR USE NON-POTABLE RWH SYSTEMS

Roof, Gutters, and Downspouts: Most roofing types can be used for collection of water for indoor non-potable purposes; however, cedar shingles or shakes should be avoided due to toxicity and to prevent water discolouration. Standard gutters and downspouts are appropriate. Gutter covers are often used to reduce debris build-up in the gutters that can discolour the water. It is often unnecessary to collect from all available rooftops and downspouts.

Collection System: Extra attention should be paid to cleaning the water before it reaches the tank. Using debris traps and gravity filters to remove debris and organic material suspended in the water will reduce maintenance, and may lengthen the life of the pump and filtration system for non-potable indoor use.

Water Diverter: A water diverter valve (FFD) prevents water from entering the tank at times when it would be inconvenient, **and is often, but not always, part of a First Flush Diverter (FFD),** such as when the water is of poor quality during pollen season, when the roof is being cleaned, or when the tank is already full. The diverter pipe must drain the water away from the home's foundation. It is useful to improve the colour and quality of the water used for toilet flushing as well as to reduce bacteria entering the storage tank. The simplest form of diverter is a single valve located so that water flows into a diverter pipe when the valve is opened. Refer to the SSIWPA website **rainwater resources page** for examples.

Water Storage Tank: For indoor non-potable use, the water storage tank(s) may be installed above or below ground. In either case, an overflow is required and the end of the overflow pipe must drain the excess water away from the house.

Water Distribution System: The water distribution component of a Non-Potable (Indoor Use) RWH system requires the services of a qualified plumber. The minimum filtration requirement for all non-potable water entering a house must be either 5 micron filter with >16 mJ/cm2 UV or 0.5 micron microfiltration. It must be pressurized (pumped) and be distributed via Non-Potable Water Piping (also called Greywater Plumbing or Purple Piping). Non-potable water must never be tied into an existing potable water system.

A particle filter is often added after the pump to reduce the size of water-borne particles that could interfere with flush mechanisms within the toilet.

See also 4.4 First Flush Diverter (FFD) to learn about diverting the first part of a rain event.

Reclaimed Water Piping:

- Is available in ½", ¾" & 1" diameters of half-inch, ¾ inch and one inch
- Degrades in UV light, so is suitable either buried or indoors
- To be called "Purple Pipe" it is required under CSA Standard to be SDR9 which is a type that is not readily available in the Gulf Islands

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2. Stored Rainwater Use Types and System Categories

2.3 POTABLE RWH SYSTEMS

This Guide will not provide detailed information about potable systems. Potable water is water that is safe to drink and meets Health Canada's Guidelines for Canadian Drinking Water Quality. Released in 2018, [Rainwater Harvesting Systems CSA B805-18] regulates collection, storage, purification and disinfection of rainwater.

Potable water uses include:

- drinking water
- household laundry
- bathing and showering
- cooking and food preparation
- dishwashing
- pools and hot tubs

Water colour, acidity, and freedom from pathogens must be addressed in Potable RWH systems.

Rainwater for potable use must undergo a more thorough disinfection process than indoor non-potable water.

[Click for a full list of common conversions and units used in measurements for RWH design.]

In comparison to their Non-Potable RWH counterparts, Potable RWH systems:

- must include post-storage water disinfection following regulations and standards (pathogen-free)
- operate year-round and are more complex and costly to build
- collect from most or all of available rooftops
- incorporate a higher degree of pre-cleaning before water enters the storage tank
- provide more storage capability, typically ranging in size from 34–75+ m^3 (9,000– 20,000+ USG)
- must have maintenance schedule, construction detail, operating procedure and safety plan
- all conveyance piping must follow Schedule 40
- potable system design should include advice of ASSE Accredited Rainwater Catchment System Professional Designers, Inspectors & Installers
- may include post disinfection tank to increase tap pressure and response volume
- design on advice of ASSE Accredited Rainwater Catchment System Professional Designers, Inspectors & Installers

Typically, homeowners would consider Potable RWH systems if:

- they reside in an area not serviced by a water supply
- well water quality is too poor for consumption
- the quantity of well water is insufficient to support household use
- there is no suitable groundwater well and well-drilling would be prohibitively expensive
- the homeowner is committed to taking complete responsibility for water self-sufficiency with minimal environmental impact

If Potable RWH is for you please consult a RWH or water purification and disinfection professional to ensure that you design a system that will be safe, reliable and suitable to your maintenance capacity.

2. Stored Rainwater Use Types and System Categories

2.4 PLANNING & PROFESSIONALS

Advances in rainwater collection techniques and technology can make your non-potable RWH system safer, more dependable, and easier to maintain.

Planning for a Non-Potable RWH System

Design: Careful design and making a plan helps to ensure safety and efficiency and realistic budget projections. Planning with the help of this Guide, and professional assistance where needed, will go a long way towards success and longevity of your non-potable RWH investment.

RWH for non-potable uses may be expanded in stages, but an endpoint concept from the start of planning will yield greater success and efficiency along the way.

Maintenance: The choice to collect and use rainwater brings with it the responsibility to maintain your RWH system.

- Factor in the frequency and cost of parts replacement
- Ensure that each piece of equipment in your system comes with the appropriate operation and maintenance manuals
- Use the Maintenance section of this Guide
- Place reminders in your calendar

The Need for Professionals: The installation of an outdoor-use, non-potable RWH often does not require expertise from registered plumbers or water treatment specialists. However, depending on the size of planned RWH tank(s), an Engineer and/or Geoscientist may be required.

As a general rule of thumb: As you encounter questions in the use of this Guide, you are encouraged to reach out to professionals in the community to get your questions answered. Even if regulation does not require it, hiring a professional or two in the design, installation and maintenance of your Non-Potable RWH system may be optimal in your situation.

Outdoor Use RWH system design may benefit from, but may not require, assistance of:

- Rainwater harvesting specialist
- Storage tank supplier
- Excavation, drainage, construction specialist
- Engineer/Geoscientist for any single cistern with volume above 3,000 USG, or for concrete cisterns; for assessing the correct size of drainage pipes, or determining the structural integrity of tank pads or underground cisterns
- Registered Plumbing specialist
- Water Quality/Treatment specialists (purification, disinfection, filtering, maintenance and testing requirements)
- Landscape designer (for irrigation system design)
- Architects (if the non-potable system is integrated with building design)

Indoor Use Non-Potable RWH and Potable RWH design requires expertise, as follows:

- Water Quality/Treatment specialist (purification, disinfection, filtering, maintenance and testing requirements)
- Registered Plumbing specialist
- Electrician
- Engineer/Geoscientist

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2. Stored Rainwater Use Types and System Categories: Planning & Professionals

Installation: Please check with the Capital Regional District Building Department whether your design requires a building permit or professionally-engineered installation. In general, tanks up to 3,000 USG that have specific siting requirements do not require a Building Permit. Manufacturer variability and other variability suggests that it is always better to check with the Building Office in the design stage.

Some aspects of RWH systems are regulated by local government regulations and bylaws, and may have components that must be installed by accredited tradespeople. Planning for successful maintenance in Non-Potable (Outdoor Use) RWH systems often means an ongoing relationship with one or more of these professionals: home designers, builders, product suppliers, plumbers, irrigation designers and other related contractors.

Tips:

- If your system is plumbed to a spigott that may be confused with potable water it must be marked NON POTABLE.
- Debris elimination and storage temperatures are key considerations.
- Gravity fed systems are problematic when longer pipe runs are used.
- Be aware of groundwater table height during winter if you plan on putting in an underground tank - ensure it doesn't rise to height of the tank.

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2. Stored Rainwater Use Types and System Categories

2.5 RWH SYSTEM COMPLIANCE WITH STANDARDS, BUILDING CODES, LOCAL REGULATIONS AND BYLAWS

Non-potable RWH systems require less compliance than potable RWH systems. Certain non-potable system components must be installed in accordance with applicable codes, regulations and bylaws within various levels of government, as follows:

Provincial:

- Hydraulic loads, peak storm event preparedness - B.C. Plumbing Code
- Piping under driveways - B.C. Plumbing Code
- Roof structures and building requirements - B.C. Building Code
- Drainpipe flow loads, drainage away from structures - B.C. Building Code
- Pumps, wiring – CSA C22.3 Electrical, and Electrical Safety Regulation
- Non-potable stored water quality - Health Canada's Guidelines for Canadian Drinking Water Quality

Do I need to apply for a permit from the Islands Trust?

Salt Spring Island bylaws generally consider water tanks/cisterns to be structures that must adhere to setbacks from lot lines and height limits. Variance permits may be required to locate tanks within setbacks or exceed the height limit.

Water tanks or cisterns may also contribute to a lot's total lot coverage limit.

Development permits may be required for water tanks installed in development permit areas.

Installers should check with the local Islands Trust office before installation.

Not on Salt Spring? Consult your local bylaws.

2. Stored Rainwater Use Types and System Categories

2.5 RWH SYSTEM COMPLIANCE WITH STANDARDS, BUILDING CODES, LOCAL REGULATIONS AND BYLAWS

Local Government:

Before you finalize your Non-Potable (Indoor Use) RWH system plans:

- Inform your local building inspection office (Capital Regional District) of your RWH design to determine whether you require a permit.
- Inform your local Islands Trust office of your RWH design to determine whether your design adheres to setback restrictions from lot lines and whether you need to apply for: a development permit, or a variance permit
- Obtain a building permit if required.
- If you require a building permit, it will need to be approved by Islands Trust for zoning.
- Obtain any plumbing permits that may be required.
- Plan to have the water in your Non-Potable (Indoor Use) RWH system tested for bacteriological and heavy metal contaminants at a certified regional water and environmental testing lab.

Professionals can help you to predict the quality of piping, tank fittings, and water purification and disinfection equipment. Vermin and insect protection is required under CSA B805-18/ICC 805-2018.

Even where no potable rainwater system is intended, it is wise to install a backflow prevention device to protect against any future cross connection issue.

Call Before You Dig! 1-800-474-6886

The installation of a RWH system should be treated like any other upgrade or new construction on your property. If you are digging trenches for piping, or excavating holes for tanks, it is advised that you "Call before you dig" to ensure safe practices pertaining to hydro and gas line locations.

Even where special regulations do not exist, or where building or plumbing permits are not required, you will lengthen the lifespan and value of your system by building it well from the start.

2. Stored Rainwater Use Types and System Categories

Potable RWH Compliance: Professionals are here to help and essential for compliance with regulations for potable RWH! Please refer to [the federal regulation standards guidance document for Potable Rainwater Harvesting Systems.]

The purpose of this Guide is to assist residents with understanding and developing non-potable RWH systems for personal, private residential use, rather than for public use.

The following is out of scope for this Guide:

- Guidance for Potable RWH systems for a single dwelling
- Guidance for Potable RWH systems for multiple dwellings, or for RWH for public or commercial potable use (i.e. workplace, store, and business)

"Less than three per cent of municipally-treated water is actually used for drinking.

The rest goes down the drain, down the toilet, or on our gardens."

(Environment Canada)

3. Calculating Rainwater Supply, Demand and Storage Requirements

3.1 SUPPLY: CALCULATIONS AND NOTES ON UNITS

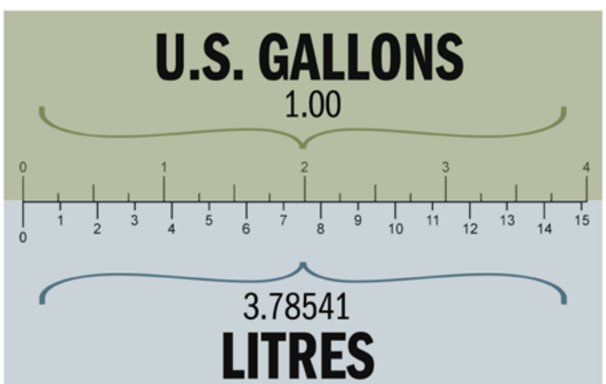
To do the calculation, you will need to know:

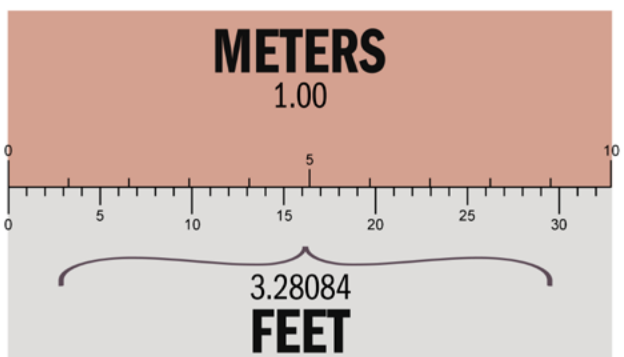
1. The amount of precipitation in your area
2. The size or catchment area of your roof
3. The proportion of total rainfall landing on the roof surface you can collect

Precipitation In Your Neighbourhood: Environment Canada's National Climate Data system lists precipitation data from Saanichton BC, or Shawnigan Lake, BC as the closest stations to Salt Spring Island. You may wish to use average monthly precipitation numbers from Environment Canada, even if their closest stations are not on Salt Spring Island. However, your calculations may be most accurate if you use precipitation data collected by the University of Victoria Schools Regional Weather Network for Saltspring Elementary and Middle Schools, Fernwood Elementary School, or Fulford Elementary School.

The tables at SSIWPA.org and in this Guide refer to Salt Spring Island weather station data.

Click here for Units and Conversions for Rainwater Collection





A Note on Units:

While metric is the primary system of measure throughout this Guide, imperial units are included in brackets to reach a wider audience, and because the imperial system remains an industry standard in North America.

Manuals, tanks and pumps could be referencing US gallons or Imperial gallons, and these are not the same. Be careful to know and convert to the same units.

3. Calculating Rainwater Supply, Demand and Storage Requirements

3.2 SUPPLY: HOW MUCH RAINWATER CAN I COLLECT PER 100 M^2?

Time of Year	Typical Average Rainfall (mm)	Collection Efficiency	Min. Rainfall Collected L (USG)	Max. Rainfall Collected L (USG)
Jan 1- Mar 31	124 - 592	85%	10,540 (3276)	59,200 (15639)
Apr 1 - Jun 30	44 -209	75%	3300 (1162)	20,900 (5521)
Jul 1 - Sep 30	4 - 124	65%	260 (106)	12,400 (3276)
Oct 1 - Dec 31	52 - 561	75%	3900 (773)	56,100 (11115)

FIGURE 3.2.1SEASONAL RAINWATER SUPPLY - GANGES WEATHER STATION

Assumptions:

Does not account for losses to leaks and evaporation during storage.
Based on 10th (min_ and 90th (max) percentiles fo rhte monthly rainfall averages at Ganges Weather Station (2008-2019).
Assumes: 100 m^2 (1,076 ft^2) steel roof on Ganges house; clear., level.
Outdoor average usage basedon Burgess, 2012 (no alternate supplies).

Size or Footprint of Your Roof (Roof Rain Harvesting Area):

The roof rain harvesting area (sometimes called catchment) refers to the footprint or horizontal plane under the eaves, rather than the actual surface area of the roof. Harvesting area is not affected by roof slope. Determining the roof harvesting area will allow you to calculate the total amount of water you can collect for a given rainfall event.

Calculating Roof Harvesting Area:

Width (from gutter to gutter) multiplied by Length (length of gutter) equals Harvesting Area: 9 m (29.5 ft) x 11.1m (36.5 ft) = 100m^2 (1,076 sq.ft). Therefore, if the roof footprint is 9 m wide by 11.1m long, the harvesting area equals 100 m^2 (1,076 sq.ft).

Proportion of Total Rainfall You Can Collect (Collection Efficiency):

The percentage of rainfall landing on the roof that will actually remain in storage; it depends on several site-specific and seasonal factors.
As a general rule of thumb, you can expect to collect an average of 75–80 per cent of the actual precipitation.

Common reasons for water loss include:

- Roof material type, overhanging branches, and prevailing winds
- Overflow and spillage from undersized piping and inefficient filtering
- Seasonal factors e.g. snowfall that does not melt but evaporates, light shower rainfalls in the summer, the need to divert water during spring pollen season, and the need to shut down and clean the system after pollen season

3. Calculating Rainwater Supply, Demand and Storage Requirements

Calculating Actual Annual Rainwater Collection Potential

A. Harvesting Area (in m^2)
B. Annual Precipitation (in mm)

My Collection Potential Is:
AxB = potential water collection (in litres) x 75%

According to the Canadian Weather Atlas, an average annual precipitation at the Ganges, Salt Spring Island weather station is 1028 mm (40.5 inches).

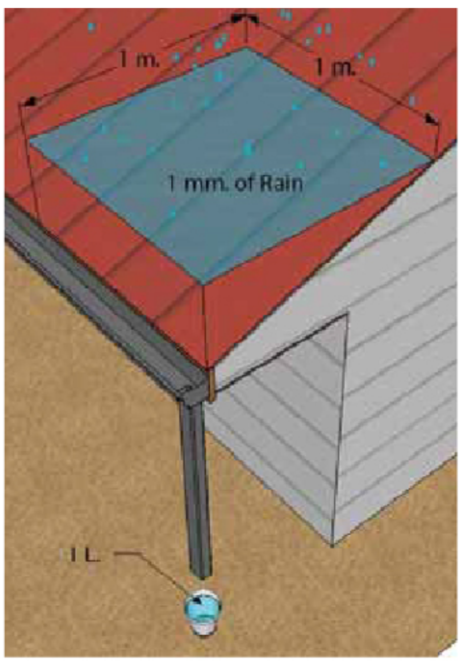


FIGURE 3.2.2 MEASURING HARVESTING AREA

Accordingly, a house near the Ganges weather station with a catchment area of 100 m^2 would capture 100 m2 X 1,028mm = 102,800 litres (102.8 m^3) of water each year, if 100 per cent collection efficiency were possible.

At 75% efficiency and assuming that annual precipitation is distributed evenly over 12 months, the potential collection of that same house would be 77,100 litres (77.1 m^3).

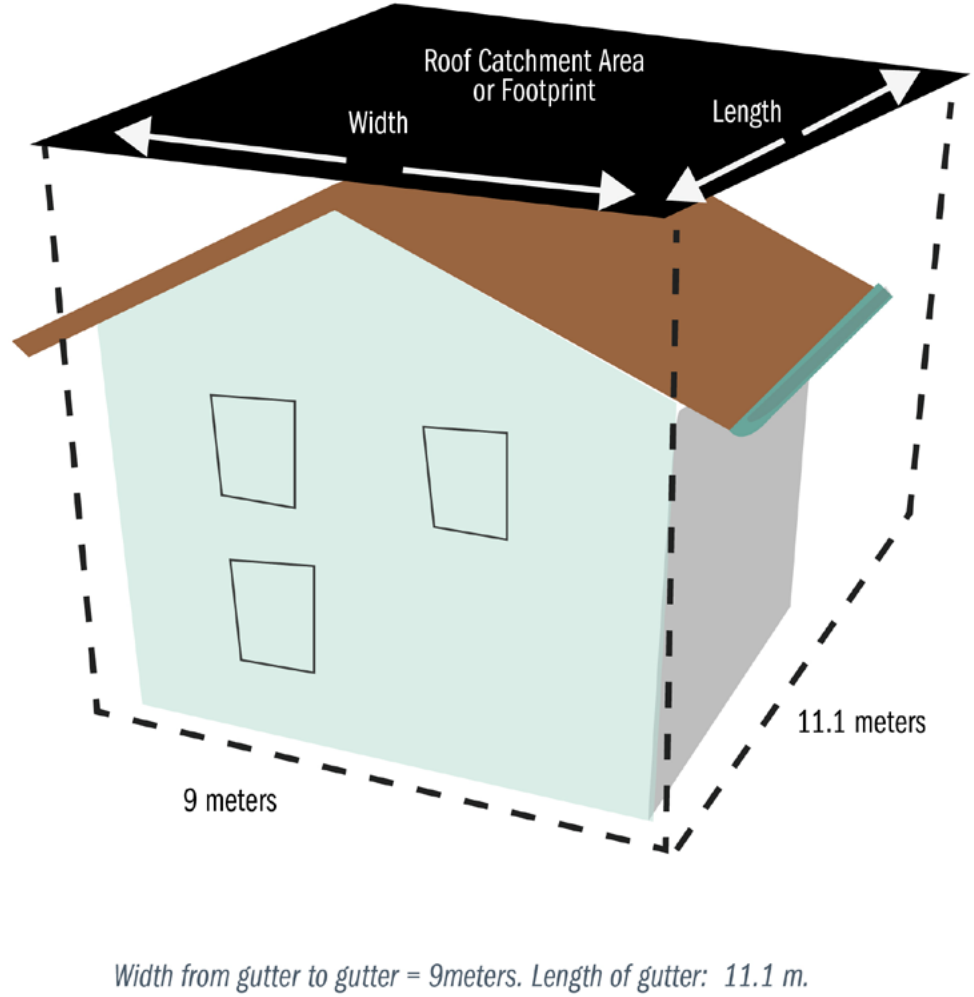


FIGURE 3.2.3 MEASURING HARVESTING AREA - ENTIRE ROOF

For a more refined calculation and monthly collection planning - see the next section!

3. Calculating Rainwater Supply, Demand and Storage Requirements

Time of Year	Typical Average Rainfall (mm)	Collection Efficiency	Min. Rainfall Collected L (USG)	Max. Rainfall Collected L (USG)	Outdoor Usage L (USG)	Minimum Stored at end of season L (USG)	Maximum Stored at end of season L (USG)
Jan 1- Mar 31	124 - 592	85%	10,540 (3276)	59,200 (15639)	0	10,540 (3,276)	59,200 (15,639)
Apr 1 - Jun 30	44 -209	75%	3300 (1162)	20,900 (5521)	10,000 (2,641)	3,840 (1,104)	70,100 (18,519)
Jul 1 - Sep 30	4 - 124	65%	260 (106)	12,400 (3276)	25,000 (6,604)	0 (0)	57,500 (15,191)
Oct 1 - Dec 31	52 - 561	75%	3900 (773)	56,100 (11115)	5,000 (1,321)	0 (0)	108,600 (24,985)

FIGURE 3.2.4: OUTDOOR USE SEASONAL SUPPLY - DEMAND PER 100 M^2 ROOF AREA

This table is an example indicating storage volumes remaining at the end of a season of water use. In this scenario the roof catchment area is 100 m^2 (1,076 sq.ft.) on a house located close to the Ganges, Salt Spring Island, BC school weather station. Collection efficiency figures assume that the house has a metal roof and no trees nearby. The table shows that installation of a cistern with an operating capacity of 25,000 L (5,500USG) would provide for all of the water demand (40 m^3 or 8,800 USG) in a year with average rainfall if the demand were parsed out according to the seasons, as shown. The table also shows that the tank would overflow during much of the winter. Or, in this scenario the operator might divert rainwater collection from early winter until February or March. To protect against the possibility of a spring drought, the owner might do well to collect a full tank before the pollen shutdown at the end of March, as security. This scenario does not integrate any supplemental water supply during the summer when rainwater replenishment is low. Water from a supplemental source (a well, piped-water or water truck) during the summer would reduce the required storage amount

Monthly data can help to estimate the proportion of total water demand that can be supplied by rainwater.

Design of your Non-Potable RWH may include sufficient potential for collection from 1-2 months in late winter or spring, but it is wise to add a buffer time around your collection period and to install for potential overflow, rather than failing to catch enough water.

Assumptions:

- No alternate supplies
- Outdoor average usage based on Burgess, 2012
- Minimum* 10th percentile rainfall volumes calculated based on averages of actual monthly rainfall 2008-2019

3. Calculating Rainwater Supply, Demand and Storage Requirements

3.3 DEMAND AND CONSERVATION

The average Canadian uses 204 litres of water per day (2013 numbers) when the usage is averaged over all seasons. However, daily usage per individual on a summer day is typically much higher per capita, due to irrigation demand. Committing to practices that will lower your water demand will help to reduce the amount of rainwater storage you need to provide, preserve local groundwater levels and reduce demand on surface potable water sources, leaving more for the environment other critical potable community needs.

As you calculate the amount of rainwater you will need to store, it's a good time to look at total household water usage and consider how you might conserve.

Gardens: Based on the nursery standard of 25 mm (1 inch) of water over the soil area of the garden bed per week: An annual garden of 12 beds, 30 m^2 (10 ft x 3 ft) with an efficient drip irrigation system requires 3,200 L (845 USG) of water per month in each of the driest months, July and August.

Outdoor Cleaning and Hot Tubs: Diverting non-potable water for outdoor cleaning and filling the hot tub has a year-round impact. These uses combined can amount to as much as 4.5 m^3 (1,189 USG) per season. Assuming 4 re-fills per year, using non-potable water instead could save 18 m^3 (4755 USG) of water per year.

Toilet Flushing with Non-Potable Rainwater: Using rainwater to flush all the toilets in a home can save 10 to 20 per cent of annual water consumption. A three-person household that uses rainwater for toilet flushing is estimated to save as much as 2,200 L (581USG) per month for a three-person household, or 26,200 L (6,921USG) per year.

Water conservation and Agriculture: Saanich Peninsula farmers surveyed in 2004 reported 92% of all potable water used was for irrigation!

Visit our website for IRRIGATION CALCULATOR

Water Conservation Tips:

- Replant with drought-tolerant varieties
- Reduce usage of potable, treated water for non-potable uses
- Replace fixtures with water-efficient versions, especially toilets
- Repair leaks – you could save 10,000 L per year!
- Install an efficient (low volume) irrigation system
- Reuse greywater!

Salt Spring Island Watershed Protection Alliance

3. Calculating Rainwater Supply, Demand and Storage Requirements

3.4 STORAGE: HOW MUCH DO I NEED?

Calculate your outdoor water use: Determining outdoor rainwater demand or "planned usage" is a bit complicated.
The very best method is to begin with irrigation and planting design concurrently with the rainwater system design.

Check our website for irrigation calculator. You may also check https://land-calc.irrigationbc.com/ to calculate your landscape irrigation needs if they are a bit more complex than one garden area.

The next best method is to use a flow meter ($20 at your local hardware store in the garden section or available online) to measure your water use for each irrigation area for a week in the driest part of the growing season to estimate your "peak flow" daily needs.

Determining Tank Size Using Water Balance Tables: To help determine optimal tank size, many people consult a water balance table. A water balance table compares rainwater supply against total water demand to determine the volume of water that would be left in the storage tank at the end of each month. This calculation helps to estimate what size of tank would provide for projected demands without running dry during the summer.

See next page: Figure 3.4.2 for an example of a seasonal rainwater supply water balance table.

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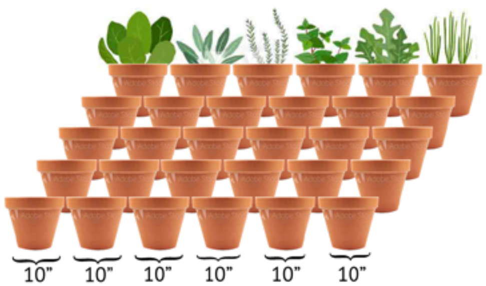
Summer Irrigation Water Use Scenarios

Data Adapted from Burgess 2012

SCENARIO A
Container Garden

Hand- or drip-watered
Weekly demand, peak, all 30 pots: 15.24 L (4 USG)
Weekly demand, shoulder: 7.62 L (2 USG)

Total water required: 214 L (57 USG)*



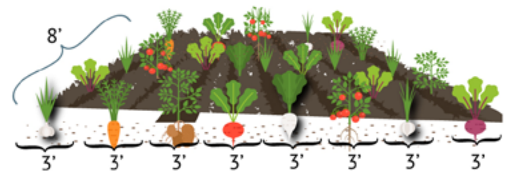
30 deck pots (glazed, 10 inch diam.): Equivalent soil area 0.60m^2 or 6.5ft^2

SCENARIO B
Vegetable Garden

Both types have total soil area = 14m^2 (150 ft^2)
Weekly demand, peak: 356 L (94 USG)
Weekly demand, shoulder: 178 L (47 USG)

Total water required: 4,978 L (1,315 USG)*

Type B1: Featuring loamy soil with flowering annuals or vegetables. One bed or area measuring approx. 7.6m x 1m wide (25ft X 3ft)



Type B2: Eight raised beds or garden plots, each measuring approx. 2.5m x 1m wide (3ft x 8ft x 3ft)

SCENARIO C
Small Orchard

Assumes watering area 9.15m x 9.15m (30 ft x 30 ft)
4 standard trees = 83.6 m^2
Weekly demand, peak: 2,123 L (560 USG)
Weekly demand, shoulder: 1,062 L (281 USG)

Total water required: 29,728 L (7,853 USG)*

Watering Area 30' x 30' / 4 standard trees

*Based on rotor spray irrigation style. Total could be reduced significantly by use of drip ring irrigation.

Notes:

Select the next tank size up from your estimated demand.
Peak Demand : July and August.
Shoulder Seasons: May, June and September.

These are approximate 'rules of thumb' based on 25 mm of rain per week at peak season. You will need to adjust for your variability in soil type, plant type, sun and wind, slope, type of watering system, timing of application.

See page 21: Figure 3.4.2 for an example of a seasonal rainwater supply water balance table.

Salt Spring Island Watershed Protection Alliance

3. Calculating Rainwater Supply, Demand and Storage Requirements

TWO 7,550L (2,000 USG) POLYETHYLENE TANKS WITH INTERCONNECTING PIPING AND PROTECTIVE VALVE BOXES (BEFORE FINAL BACKFILL). COLLECTION FROM PUMPHOUSE ROOF.

PUMP TANK NEXT TO HOUSE PUMPS RAIN TO STORAGE TANKS A FURTHER DISTANCE AWAY.

3. Calculating Rainwater Supply, Demand and Storage Requirements

3.5 FIRE AND EMERGENCY STORAGE TANKS

Additional water storage capacity can be added to the rainwater storage tank to provide a reserve source for fire and emergency uses. This emergency water can be accessed from the tank in case of a fire, prolonged power outage or earthquake.

Determining Your Emergency Water Storage Requirement for Fire Suppression

The output of a high capacity gasoline fire pump is 205 L/min (55 USG/min). That flow rate can be multiplied by the number of minutes until the Fire Dept. can be expected to arrive.

For example: 205 L/minute x 30 min = 6.2m^3 (1640 USG) of water reserved for fire suppression.

Note: Fire Underwriters suggest a flow of no less than 4,000 L/min for a wood frame house with wood shingles or shakes. A typical house fire on Salt Spring Island requires a minimum of 45,460 L to suppress.

This formula is just one simple way to calculate reservoir size.

You may also have a fire sprinkler system that determines your required water storage.

Salt Spring Island Watershed Protection Alliance

4. The Components of a RWH System

4.1 THE PATH OF THE RAINDROP: ROOF TO TAP

Every RWH system will include features to suit the water requirements and the individual site. This Guide does not attempt to cover all possible approaches or component details. This chapter is organized to follow the path that a raindrop takes as it lands and travels through a typical non-potable rainwater harvesting system to its final destination.

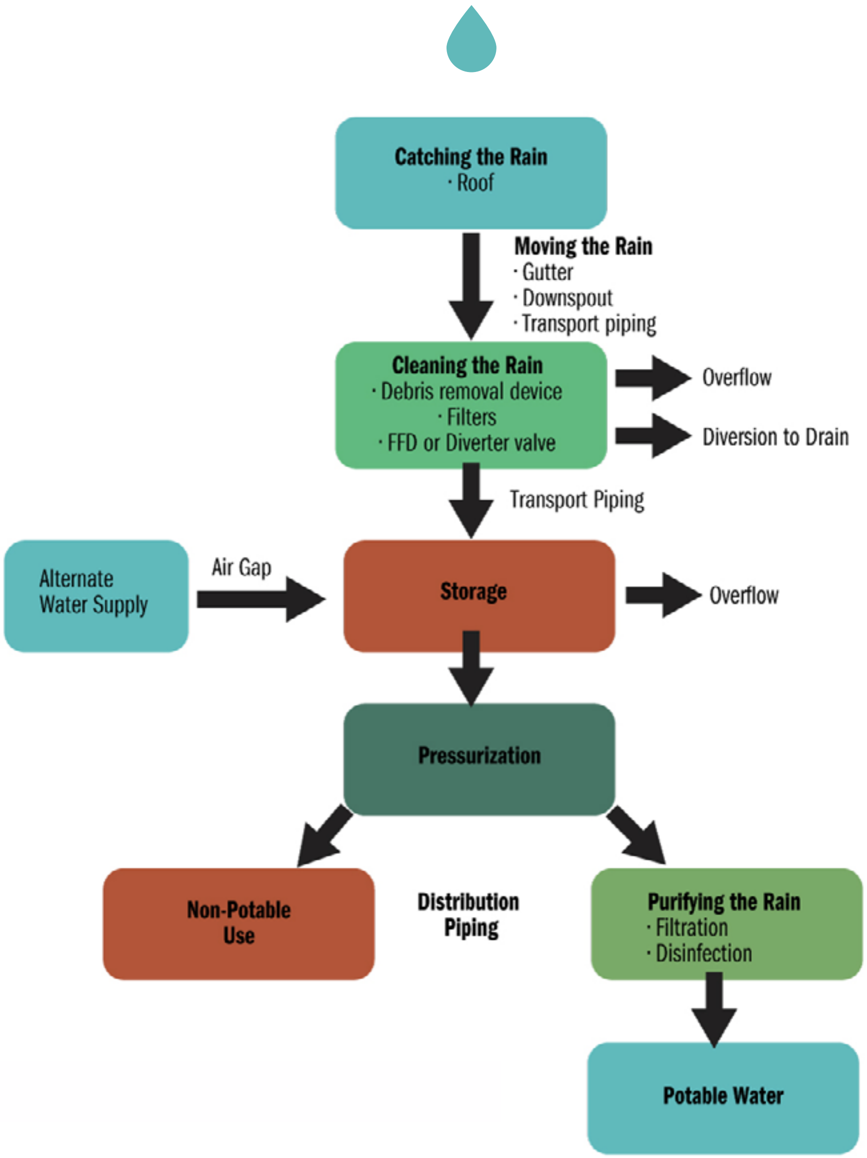


FIGURE 4.1.1 RAINWATER HARVESTING FLOW SCHEMATIC DIAGRAM

Salt Spring Island Watershed Protection Alliance

4. The Components of a RWH System

4.2 CATCHING THE RAIN: ROOF AND GUTTERS

If creating or renovating the roof, select materials that are non-toxic, easy to keep clean and efficient for collection. Individual roof products vary; it is important to check if toxins may leach from any particular roof product.

Safest:

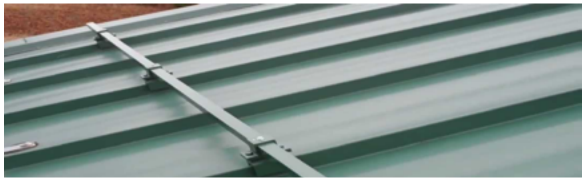
- Enamelled steel, factory-coated
- Galvanized metal, zinc- coated
- Terracotta
- Concrete tile
- Slate, glazed
- Fibreglass shingles

Avoid:

- Asphalt shingles
- Cedar shakes, or shingles
- Bitumen, or composition roofing
- Copper or lead flashing materials

Snow Rails:

- Prevent gutter damage
- Protect entryways and planting beds located under eaves



Gutters:

- Select size to handle peak water flows - a 12.5 cm (5”) wide gutter will often suffice.
- The minimum required slope of 1:200 (1/16” per linear foot) should be increased where possible to assist debris to flow out of the gutter.
- Where aesthetics are not a concern, some rainwater harvesters use slopes of 1:100 or 1:50 (1/8-inch or ¼-inch per linear foot).
- The best gutter shape is continuous, seamless aluminum without ridges or joins.
- Half-round gutters are ideal, but fascia gutters with smaller bottoms than tops are also effective.
- Maintain an unobstructed gutter opening to the downspout that prevents buildup of debris at its edge – this may require hand cleaning and/or flushing during the collection season. Avoid a plastic lip that will contribute to debris and water buildup.
- Splash guards are added to the outside edge of a gutter to prevent fast flowing rooftop water from overshooting the gutter. They are typically placed where a roof valley joins the inside corner of a gutter, and where a gutter cover is being used. A variety of splashguard options are available.

Gutters affect the amount and quality of collected rainwater, as well as the maintenance required. Clean and properly constructed gutters are essential for good quality water, and also reduce fire risk and mosquito breeding in summer.

Whether your gutter covers are made of a fine mesh or holes in a plastic or aluminum cover, ***the type of gutter cover you select will impact the amount of debris that collects in the gutter and therefore the time spent on gutter cleaning.***

Part 7 of the [B.C. Plumbing Code] addresses hydraulic loads used to size gutters, rainwater leaders, building drains and sewers.

See Section 5: Maintenance, for gutter and downspout details.

[Click for information on pipe materials.]

4. The Components of a RWH System

4.3 MOVING THE RAIN: ROOF TO TANK

Transport Piping Systems move collected rainwater from gutters to storage tank(s). When water is collected from downspouts on two or more sides of a house, transport piping must be installed around the house perimeter. There are three types of rainwater transport or conveyance systems: **dry**, **surge/ pump tank**, and **wet**.

DESIGN TIP: Save money on transport piping by deciding how much water you need, and selecting the easiest roofs on your property from which to collect.

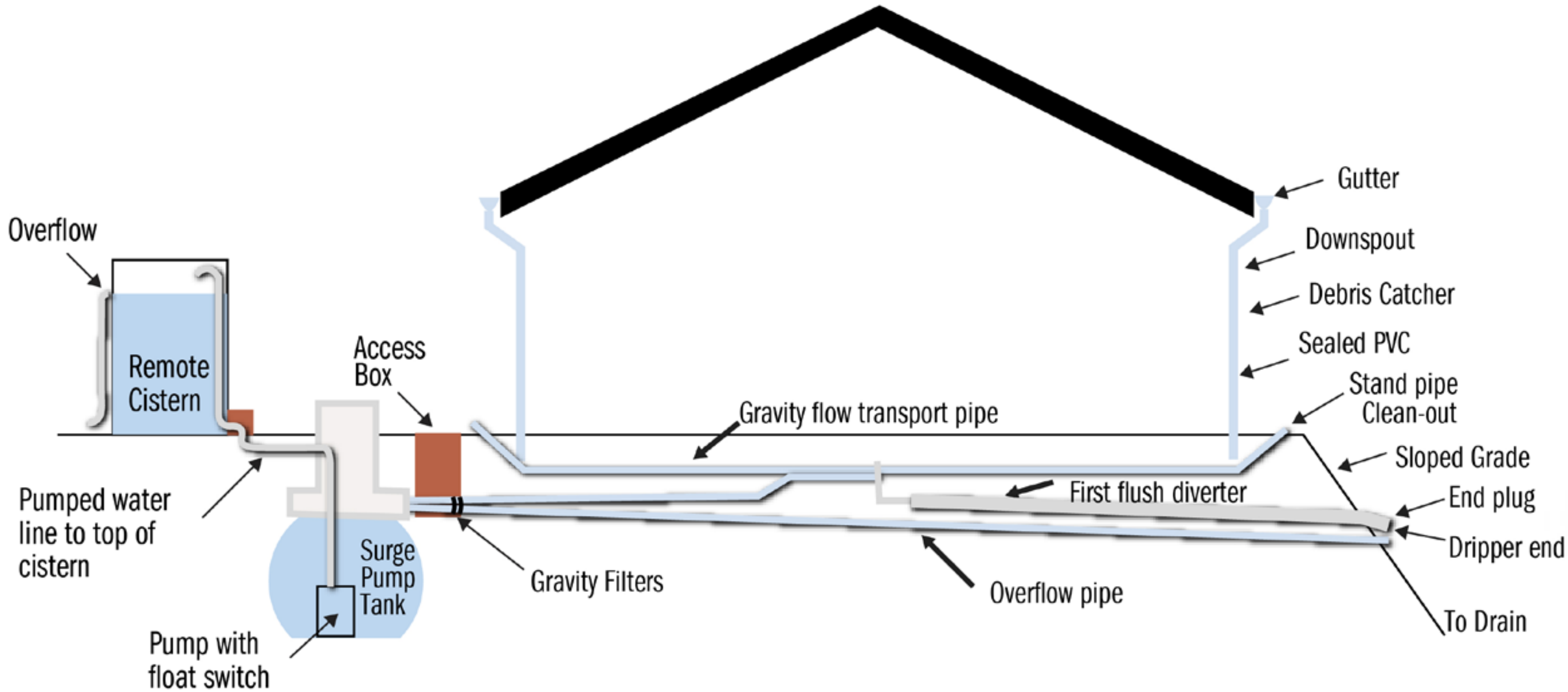
Surge/Pump Tank Rainwater Transport System: A pipe system with direct gravity flow to a surge/pump tank; from there, water is pumped to the cistern. These systems are commonly used when the storage tank is uphill and some distance away from the building, or when the owner wants to hide all collection pipes below grade.

Piping is similar to a dry system. Typically, the surge/pump tank is relatively small: 180 to 400 litres (47 to 105 USG), but is large enough for the pump to manage peak rainwater flows. This tank must be equipped with an overflow. It is important that the transfer pump is equipped with a float switch to turn the pump on and off automatically.

While a surge/pump tank may be preferable for logistic or aesthetic reasons, the extra capital cost could be as much as $2000 and there are additional maintenance requirements such as periodic tank cleaning and pump and float switch servicing. Note that ***these systems do not work during power outages.***

Wet systems: These are not recommended. The water is contained in sealed pipes that typically form a U shape: water travels down, across, and back up into the cistern. A section of sealed pipe is installed above the top of the tank to create a head of water that pushes water across and back up into the tank. CONS: Large amounts of water can potentially become trapped in the pipes between rain events. Unless frequently flushed or emptied with a First Flush Diverter (FFD), this water can freeze in winter or become stagnant in summer.

Warning: These wet systems are the most difficult to maintain and have the lowest rates of collection efficiency. They are useful where there is no power supply, or for a homeowner who is interested in accepting responsibility for more maintenance in exchange for lower capital and operating costs.



NOTE: Underground First Flush Diverters require high maintenance to operate correctly. They must be designed for appropriate flow rates.

FIGURE 4.3.1. A SURGE/PUMP TANK SYSTEM

4. The Components of a RWH System

4.3 MOVING THE RAIN: ROOF TO TANK

Dry Rainwater Transport System: A pipe system where the water runs downhill by gravity to the top of the cistern. This is the simplest of transport. No pockets of water can collect to grow bacteria or freeze. ***No power, and very little maintenance,*** beyond occasional brushing and flushing, is required.

Gravity Transport With Head of Water: The weight of a vertical column of water can pressurize a hose and serve to transport water easily to a tank that is further away from a building without the use of a pump.

GRAVITY-FED DRY TRANSPORT SYSTEM TO 1,000 USG TANK.

Salt Spring Island Watershed Protection Alliance

4. The Components of a RWH System

4.3 MOVING THE RAIN: ROOF TO TANK

Pipe Size and Slope: The required size and slope of the transport pipe (considered a drain) is stipulated in the B.C. Building and Plumbing Codes. Sizes are intended to ensure that debris is carried away to avoid water backups.

Minimum pipe diameter depends on pipe slope and on the size of the water catchment surface. The larger the water catchment surface, the larger the pipe must be to transport the water.

As a general rule, for a roof catchment area of 200 m^2 (2,150 sq. ft.) the following pipe size and slope would be adequate:

- 75mm (3-inch) pipe at a slope of 1:50 (2%), or
- 100mm (4-inch) pipe at a slope of 1:100 (1%)

A 1:100 slope means a 1 cm fall for every 1m of length, which is referred to as a one per cent slope.

In imperial units, a one per cent slope is a 1 ft (12-inch) fall for 100 ft, or approximately 1/8th–inch per foot.

If in doubt, consult your contractor or local building inspector to select the appropriate pipe diameter for your particular RWH system.

Non-Potable RWH Transport Pipe Types: The type of pipe selected depends on where it is located, and whether it is being used to transport potable water. Three types of piping are most commonly used:

- For below-grade piping, a PVC sewer-grade pipe that is stamped as CSA B182.1 320 kPa is common. ABS sewer pipe can also be used if care is taken that the joints are carefully cemented to avoid groundwater infiltration. These types of pipes can also be used above grade, but they should be painted to reduce deterioration in sunlight.

- When installing piping under areas that are subject to vehicle loading such as driveways which have less than a 600 mm (2 ft) cover of well-compacted soil, SDR or or solid core ABS should be used (Schedule 40 BC Plumbing Code)

- For above-grade installations where the pipe is exposed to sunlight, it is recommended to use the thicker-walled PVC DWV pipe only if coated.

4. The Components of a RWH System

4.4 CLEANING THE RAIN

Using debris traps and gravity filters reduces contaminant loading on the storage tank, and unwanted insect or critters. These can include coarse debris filters like leaf traps, and fine debris like first flush diverters. Some pre-filters combine these two functions into one unit.

Additionally having a way to divert rain water from the tank allows for diverting water when cleaning gutters, diverting water during heavy pollen, or allowing for tank maintenance.

Every rainwater collection system (even those designed for non-potable, outdoor use) should include a means to divert water from the tank. Diversion is required, for example, when the roof or gutters are being cleaned, when rainwater is contaminated with pollen, or when the tank is full. The simplest form of diverter is a single valve located so that water flows into a diverter pipe when the valve is opened. Other forms of diverters are the same premise, but might have multiple diversion chambers. The diverter pipe must drain the diverted water away from any building foundation.

BANJO GRAVITY STRAINER WITH 180 MICRON SCREEN

Gutter Guards are Useful

Micromesh gutter guards with fine holes reduce mold and provide effective debris screening.

Why Pre-Filter?

- Improve the quality and freshness of the water.
- Eliminate many water-borne particles that carry bacteria and consume oxygen from the water as they decompose.
- Reduce the nutrients in the water that foster mosquito growth and algae blooms when subjected to sunshine.
- Decrease the frequency of tank cleaning from annually to as rarely as every 15 years

Always store your rainwater in cisterns out of direct sunlight, when possible. Stored rainwater is impacted by airborne pollutants such as smoke, heavy metals, contaminants on the roof such as bird droppings and pollen, and toxins leaching from the roofing material. It is also susceptible to algal growth which is instigated by sunlight.

To improve the quality and safety of stored rainwater, employ debris-removal devices and First Flush Diverters as pre-cleaning tools. Pre-storage purification reduces contaminant buildup, bacterial growth in the tank, and frequency of tank cleaning.

Debris Removal Devices: remove both organic and inorganic particles suspended in the water, as opposed to substances or pathogens that are dissolved in the water. Debris removal devices include very fine gutter covers, debris traps, rain screens, roof washers and super filters, which clean rainwater from the entire roof at one point.

PHOTO OF FILTER BASKET

More examples here: https://premierplastics.com/products/water-tank-accessories/filters-screens/

Salt Spring Island Watershed Protection Alliance

4. The Components of a RWH System

4.4 CLEANING THE RAIN

Select a debris removal device that:

- is sized to handle peak water flow from your roof. Oversized devices require less frequent cleaning;
- is fine enough to meet your needs. Some rainwater harvesters install two consecutive filters with decreasing mesh sizes to prevent the filters from becoming clogged;
- is constructed of durable materials to withstand sun and freezing temperatures;
- is designed with sufficient height between the water entry and exit points to operate effectively; and,
- matches your maintenance expectations. Some devices are virtually self cleaning.

First Flush Diverter (FFD): A pipe or other device that rejects the first water collected from the roof at the beginning of any rain event. Its primary function is to prevent soluble pollutants or very fine suspended solids (e.g. pollen) from entering the water storage tank. Materials eliminated can include dissolved bacteria or cysts, heavy metals and other toxins from the roof, and acidic tannins or polluted water from ponds of debris in the gutters.

The first rain arriving on the roof contains the highest concentrations of these soluble pollutants. Research suggests that up to 80 per cent of pollutants are found in the first 0.5 to 0.75 mm (0.02 to 0.03 inch) of a rain event. Depending on its location in the transport piping system, a FFD can also capture larger, heavier suspended debris particles.

FIGURE 4.4.1: DEBRIS PAIL AND DEBRIS TRAPS

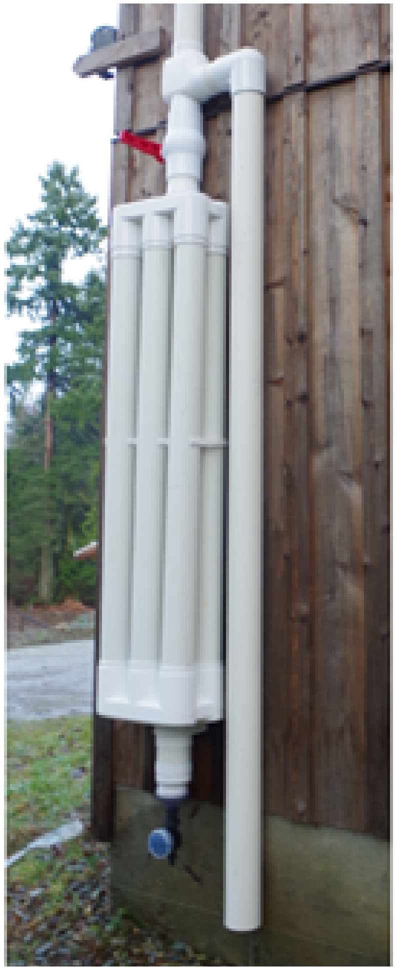


FIGURE 4.4.2: MULTICHAMBER DIVERTER
PHOTO CREDIT SANDRA UNGERSON

4. The Components of a RWH System

4.4 CLEANING THE RAIN

How Does a FFD Work? The simplest FFD is a pipe that exits from the bottom of a horizontal section of transport piping. The first water from the roof enters and fills this diverter pipe. This pipe backs up when filled completely, allowing the remaining rainwater to flow over it and continue to the tank. A dripper valve allows the trapped water to drain slowly from the diverter pipe. Within one or two days the diverter pipe is empty, and is prepared to reject the first portion of the next rain event.

When to Use a FFD: While FFDs are less critical for Non-Potable RWH systems, they are popular among gardeners to reduce water acidity and the leaching of fungicides that are often added to modern fibreglass or asphalt shingles. FFDs should be included in any Potable RWH system. They reduce fine sediment and concentrations of bacteria in stored water, and therefore minimize demand on post-storage disinfection equipment.
The amount of water rejected in the FFD varies according to the roof and site conditions.

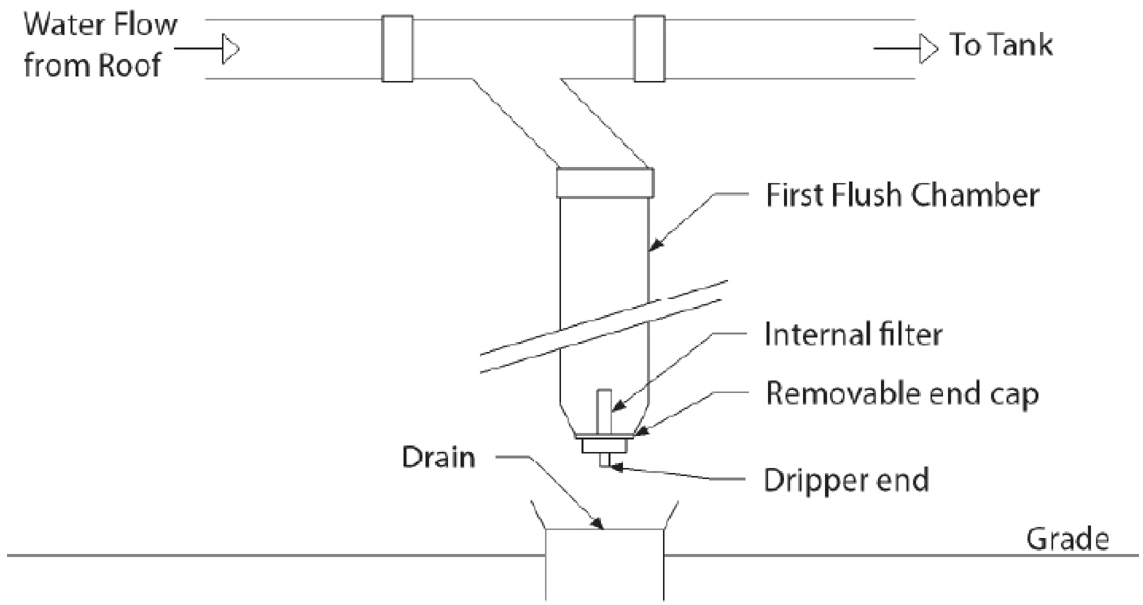


FIGURE 4.4.1 WATER THROUGH FIRST FLUSH CHAMBER

Click for a list of types of FFDs

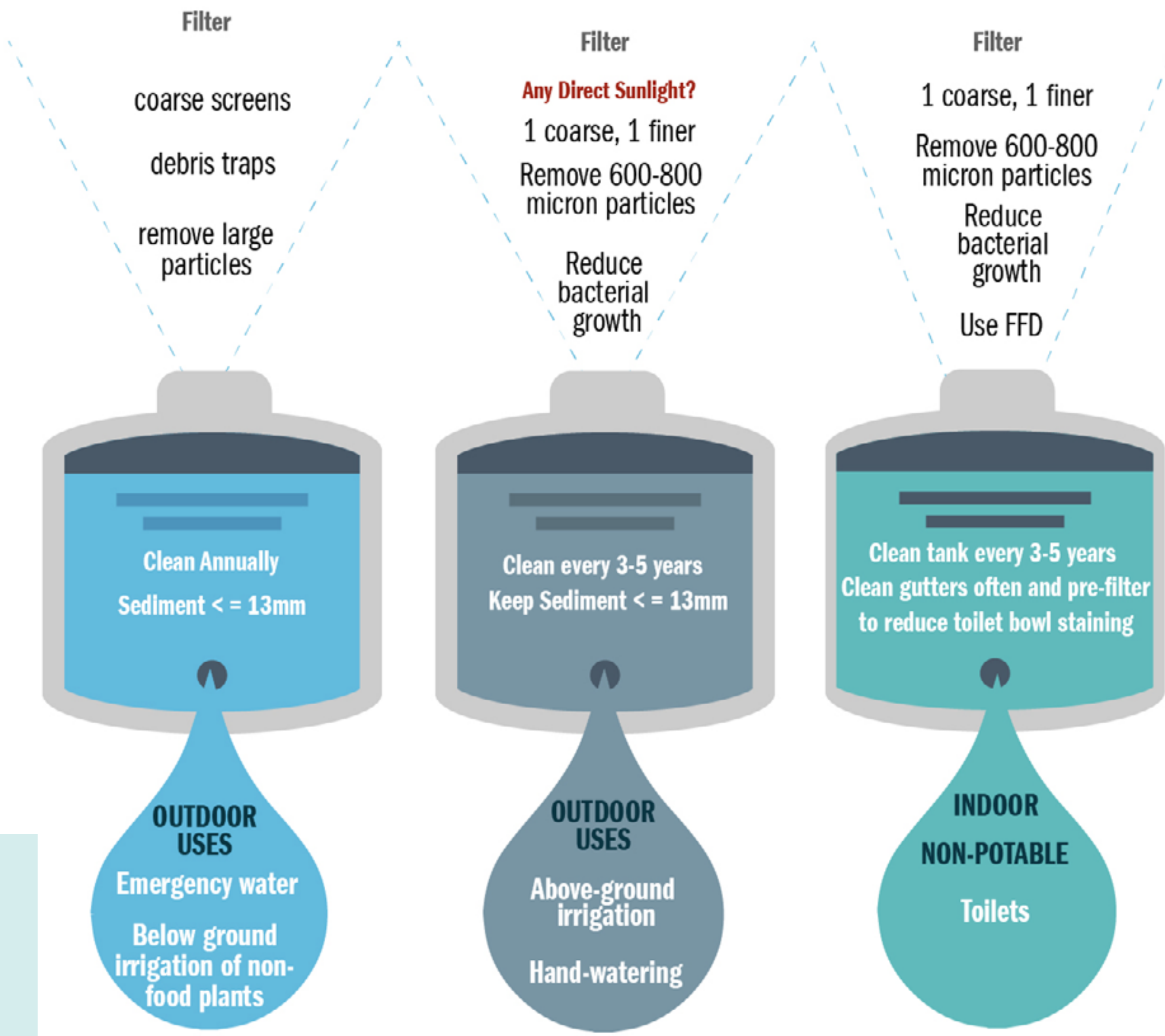
4. The Components of a RWH System

4.5 STORING THE RAIN

Storage is at the heart of every RWH system in coastal B.C., where the majority of annual rainfall arrives in winter and summers are dry. It is also the most expensive component in the system. Your own preferences, water requirements, location, and budget will influence your choice of tank. See figure adjacentfor examples.

Prior to investment, consider: the tank's durability (including warranty and potential lifespan); protection from sunlight penetration; retail cost, transportation, and site preparation costs. Also, be sure to note whether the tank size is being quoted in US or Imperial gallons or cubic metres.

When selecting, installing, and maintaining a rainwater storage tank, carefully consider the type of cistern, cistern size, cistern site placement, neighbourliness, and future expansion.



DID YOU KNOW? Bigger bang for your buck: bigger tanks cost less per volume of water stored.

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FIGURE 4.54: COMMON ABOVE GROUND STORAGE TANKS

[Visit our website for current costs]

FIGURE 4.54: COMMON BELOW GROUND STORAGE TANKS

[Visit our website for current costs]

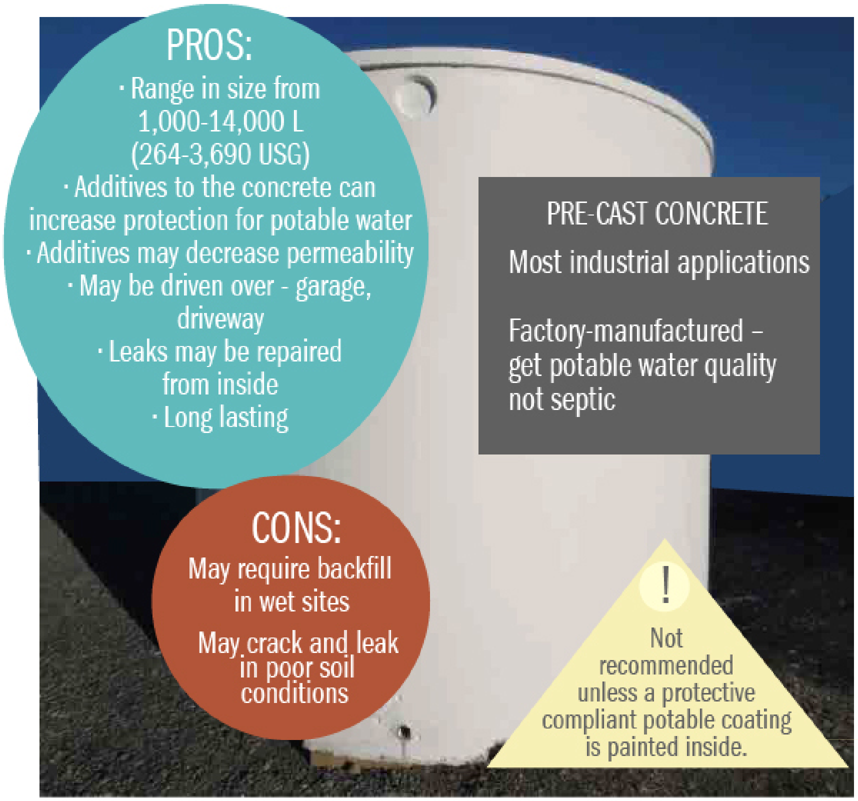


FIGURE 4.5.2: PRE-CAST CONCRETE WATER STORAGE TANK

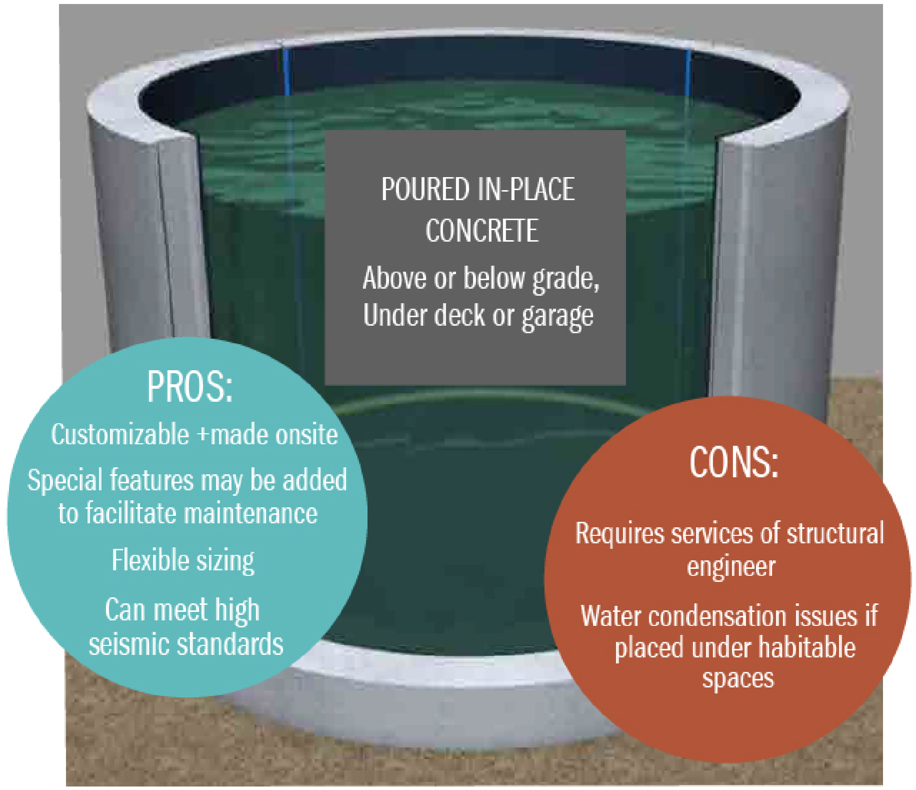


FIGURE 4.53: POURED IN PLACE WATER STORAGE TANK

Visit our website for current costs and information about tank requirements.

4. The Components of a RWH System

4.6 TANK INSTALLATION

Tank Tips:

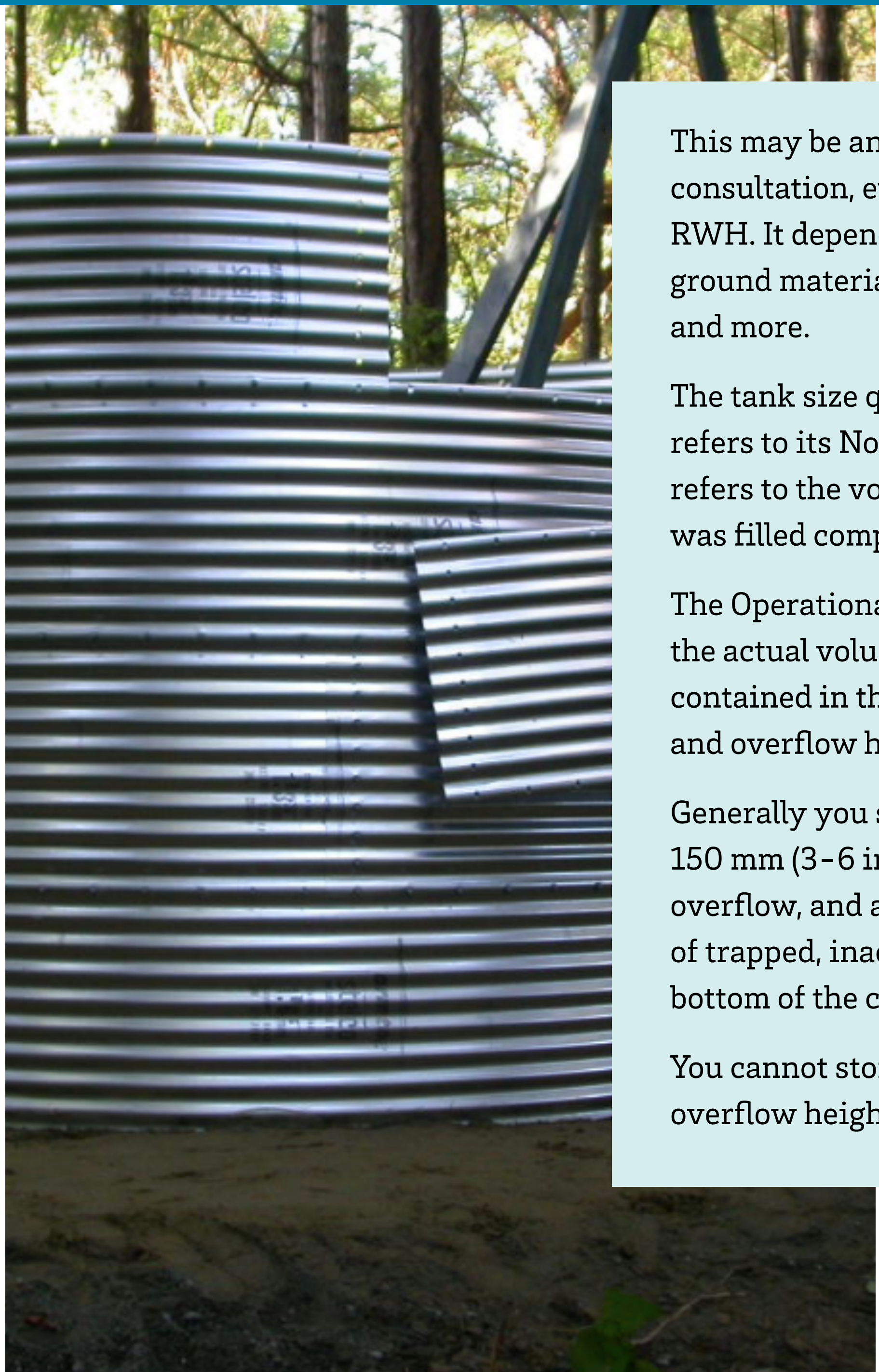
- Take advantage of gravity flow: locate the tank near a downspout, or downhill from the house where multiple downspouts can feed by gravity. Gravity-filled systems are the least expensive, are easiest to maintain, and still collect water during power outages.

- Paint the tank to match adjacent buildings, tucked under a deck, fenced with wood, encircled with lattice work on which plants can climb, or installed discreetly behind a larger structure.

- Conform to local regulations regarding height restrictions and setbacks from property lines (there are no property setback restrictions on Salt Spring Island).

- Plan ahead for tanks you may wish to add in future:
  - Set aside adequate space, and ensure the tops of all tanks will be at the same elevation.
  - Install a valved pipe-end that will connect to the next tank

Click here for Tank Installation Checklist and Tank Safety Checklist



This may be an area for professional consultation, even for a non-potable RWH. It depends on site slope and ground materials, seismic constraints and more.

The tank size quoted by tank suppliers refers to its Nominal Capacity, which refers to the volume of water if the tank was filled completely to the top.

The Operational Capacity refers to the actual volume of water that can be contained in the tank after the fittings and overflow have been added.

Generally you should not count the 75-150 mm (3-6 inches) of space above the overflow, and at least 75 mm (3 inches) of trapped, inaccessible water at the bottom of the cistern.

You cannot store water above the overflow height.

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4. The Components of a RWH System

4.6 TANK INSTALLATION

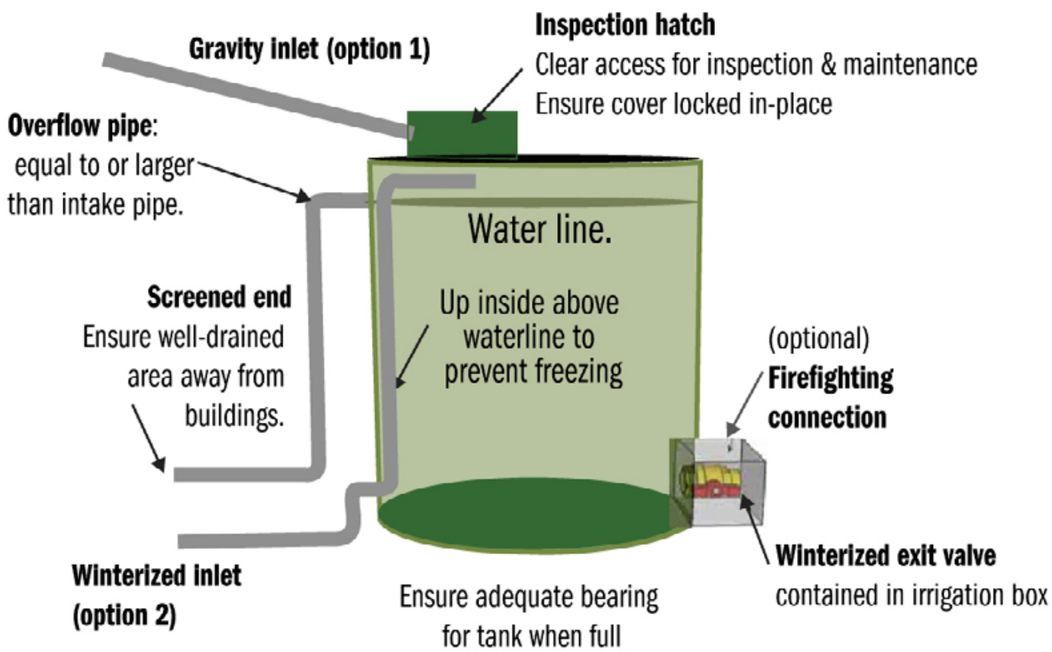

FIGURE 4.6.1: KEY FEATURES OF A WATER STORAGE TANK.

4. The Components of a RWH System

4.7 PRESSURIZING THE RAIN: PUMP TYPES AND PUMP SAFETY CHECKLIST

There are constant speed pumps and variable speed pumps. Both these can be supplied as external or submersible models. Constant Speed pumps can be controlled by a pressure tank and pressure switch, or through internal computer. Variable speed will speed up or down to meet your desired flow/pressure needs.

Click for more information about pump types

Selecting your Pump:

- How often the pump will be used?
- How often will you need to turn the pump on and off?
- Will the pump be required to run for long periods (for example, to accommodate some irrigation systems)?
- How important is pump reliability? What are the repercussions if the pump fails while you are away?
- Is pump noise a concern for you or for your neighbours?
- Is the pump for a potable water system? All potable water systems must be NSF 61 certified (potable water safe -i.e no mercury, oils, etc.).

Because gravity pressure is often insufficient, most RWH systems rely on some form of mechanical pump to deliver stored water to its end use. For example, water must be stored almost 11m (35 ft) above a garden to provide a gravity head pressure of 15psi (pounds per square inch), which is the minimum requirement for an efficient drip irrigation system.

Pump Pressure or Head: Water pressure is usually measured in pounds per square inch (psi), but pump size is often measured in feet of head or Head Pressure (HD, which stands for Head).

The term feet of head originated because a column of water 2.31ft. (0.7 m) high will exert a pressure of 1 psi, or 1 vertical foot will exert a pressure of 0.43psi. For example, a 10 ft (3.05 m) high column of water exerts 10 X 0.43 = 4.3 psi of head pressure.

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4. The Components of a RWH System

4.8 PURIFYING THE RAIN

Generally, Non-Potable RWH systems (Outdoor or Indoor Use) do not require post-storage water disinfection or sanitation when the water comes out of the tank.

However, post-storage water filtration and/or disinfection is a very important step for these reasons:

- CSA standard requires spray-irrigated rainwater to be filtered to 5 microns with a low dose of UV to reduce pathogens in sprays.
- Algal blooms in sun-exposed tanks may be toxic to plants, humans, and animals
- Sediment in your tank may trigger a rotting or septic smell that indicates anaerobic bacteria growth
- Cloudy water with suspended particles may clog pumps or drip water emitters

Refer back to p.36, Figure 4.5.1: How to Filter & When to Clean your Tank

Drip systems are more efficient, better for plant health and there are no issues with pathogenic microbes given that the water is dispersed at the surface or sub-surface.

Do:

- Use gutter covers to minimize fir needles, leaves and contact with debris that contains tannins and other chemicals
- Install debris removal devices in collection system to remove all suspended particles larger than 500 microns
- Use a First Flush Diverter (it is not required for Non-Potable Rainwater Collection, but recommended)
- Consider aerating stored rainwater with a small pond air pump to help clarify impurities.

If a separate Non-Potable, Indoor Use rainwater line were installed for toilet flushing, the rainwater pipes would have to be coloured or clearly labelled to prevent possible cross-connection between these pipes and publicly-supplied potable water.

On Salt Spring Island, a cross-connection control valve would need to be installed, inspected independently by the CRD Building Department and serviced annually.

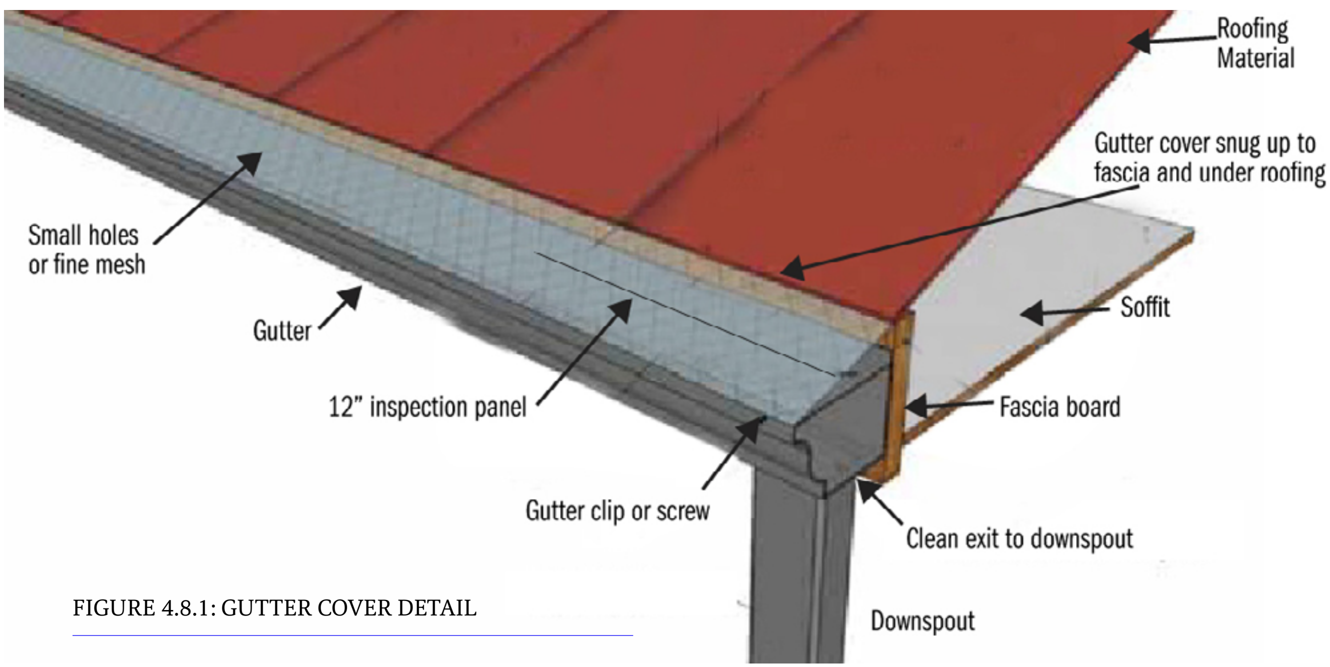

FIGURE 4.8.1: GUTTER COVER DETAIL

5. Operation and Maintenance of a Non-Potable RWH System

5.1 MAINTENANCE TASKS

All rainwater harvesting systems require some maintenance. Non-potable RWH are generally LOW maintenance. A few simple steps regularly taken will protect your investment. The following section summarizes key maintenance tasks for Non-Potable RWH systems.

Maintenance Tasks - Non-Potable Outdoor Use

Even if the water is used outdoors, it still comes into human contact with tasks like washing the dog or hand-watering the garden. Maintenance tasks and proper design will help to ensure that this water is kept relatively toxin-free, contaminant-free, and odour-free.

Maintenance Tasks - Non-Potable Indoor Use

For Non-Potable (Indoor Use) RWH systems, include all tasks in the Non-Potable (Outdoor Use) system maintenance regime. In addition, gutters should be cleaned more often to prevent debris buildup that could discolour the water. Winterizing tasks will be more important, as these systems typically run year-round. If a filter is installed after the pump, consult with a professional about regular servicing requirements.

Maintenance Checklist

ANNUAL MAINTENANCE CHECKLIST ACTIONS	FEB/MAR	AFTER POLLEN SEASON LATE APRIL - MAY	SEPT-OCT CLEANUP
Inspect roof, prune hanging branches	■	■	■
Open diverter for maintenance period	■	■	■
While diverting: Check and clean gutters, gutter guards	■	■	■
Check screen end on overflow pipe; Clean debris	■		
Reconnect pump, cover	■		
Replace post-pump filters, if any	■		
While diverting: Clean debris removal device(s)	■	■	■
During pollen season: Keep diverter open		■	
Check piping horizontal sections; If pollen collected, flush		■	
While Diverting: Clean and inspect roof		■	
Inspect tank valves, labels, locking system			■
Check stored water quality; Add bleach if necessary		■	
After cleaing of pollen diversion: Close diverter valve		■	
To perform winter shutdown: Open tank exit valve; Rinse & drain tank			■
Check sediment depth in tank; If >13mm, clean tank			■
Disconnect pump, store indoors			■
Inspect any cross-connection control valves			■

FIGURE 5.1.1 MAINTENANCE TASK DIAGRAM

ssiwpa.org/rainwater-resources
Also see page 45 for maintenance information.

5. Operation and Maintenance of a Non-Potable RWH System

5.2 ESTABLISHING YOUR MAINTENANCE SCHEDULE & CHECKLIST

Establishing your Maintenance Schedule & Checklist is the best guarantee of a properly-functioning RWH system. It should be prepared while you are designing and installing your system.

Mark all key events on your calendar, and store the details safely with your system's manuals and warranties.

The checklist should also address maintenance tasks that are related to the seasons: pollen season in the spring; leaf and needle shedding in the fall; and, freezing weather during the winter.

- Start immediately, and if a contractor has installed the system, insist on a start-up demonstration and tour
- As a practice run, clean the whole system and check all components before the water is used;
- Designate one person to take overall responsibility for all maintenance; and,
- Use a calendar and mark dates for major events including the start of pollen season, and for monitoring, maintenance, water testing and the replacement of parts such as particle filters and UV bulbs.

Am I physically capable and interested in cleaning and maintaining my RWH system?

If not, what would be the cost to hire a professional to conduct regular and seasonal maintenance?

Am I at home often enough, particularly during the winter, to protect my system from freezing?

Away for more than 40 days?

Shut the collection off, drain distribution lines and disinfect the lines when you return. Avoid using water that has been stored for more than a month without aeration or further rain-filling events.

Salt Spring Island Watershed Protection Alliance

5. Operation and Maintenance of a Non-Potable RWH System

5.2 ESTABLISHING YOUR MAINTENANCE SCHEDULE & CHECKLIST

If your house remains vacant and the RWH system is not being used for more than two or three days, it is recommended that the pump be turned off and the tank exit valve be closed. If the house remains vacant or you are away when normal seasonal maintenance is required, be sure to set the rain to be diverted from the storage tanks.

This checklist is intended to guide in the development of your own maintenance checklist that meets your particular needs. Use a new checklist each year as a way to document the present condition of each component of the system, anything unusual that you have observed, parts you have replaced, and all maintenance and repairs you have completed. Include a column to record the date of each action taken.

5. Operation and Maintenance of a Non-Potable RWH System

5.2 ESTABLISHING YOUR MAINTENANCE SCHEDULE & CHECKLIST

Pollen Season: The amount of pollen in the air can be determined early in spring (Feb-March) by laying a flat, shiny surface (such as piece of glass) horizontally on a table, and by observing the residue that collects. This simple test also helps to determine the stickiness of pollen in your area. Rigorous prevention is preferred by using diversion until pollen stops falling. Then proceed to clean your collection surface and gutters and the entire catchment system with clean water before you begin to store collected rainwater.

Fall Cleaning: It is important to clean roofs and gutters frequently between September and November, when the rainy season begins. For year-round RWH systems, this schedule also prepares catchment surfaces for the winter rainwater collection season, when ongoing maintenance is more difficult. Falling from the roof is always a danger. When cleaning the roof and gutters, wear proper footwear, stay well away from skylights, and use caution when working near the edges. It is best practice to be harnessed and secured by a belay system, which means the rope running from the roof climber's harness is secured by a cleat or a human partner on the ground. If in doubt, call a professional roof cleaner.

Cleaning the Storage Tanks: Never enter a tank to clean it, or for any other purpose. Water tanks are designated as a confined space, and only those with specific qualifications, training, and equipment should enter them. Unplug any pump or other system component before touching or servicing it.

Use hydrogen peroxide (according to the manufacturer's instructions) OR a solution of 10 to 20 per cent household bleach diluted in water:

- Use extreme caution, and wear gloves.
- Read and follow the manufacturer's instructions on the container.
- Harmful if swallowed or if it comes in contact with eyes, skin or clothing.
- In case of contact, flush promptly with abundant water.
- DO NOT use any other type of household cleaner that may contain soap or other chemicals.
- Never mix bleach and hydrogen peroxide together because they can react to form a noxious gas.
- DO NOT use any cleaner containing ammonia, or any household bleaches that contain whitening or scented additives.

Most people who collect rainwater in southern British Columbia stop collecting and divert rainwater during the pollen season. When pollen has stopped falling, they undertake their annual spring cleaning of roofs, gutters and the catchment system. This strategy is particularly important in heavily forested rural areas.