

Rainwater

Rainwater is a valuable natural resource that has been collected by Australian households for domestic use since colonial times.

Opportunities for rainwater collection and use vary with location. Urban households typically have a connection to a reticulated, treated (mains) water supply but can significantly lower mains water usage by installing a rainwater harvesting system.

Most rural households have to source all their water on their property, and rainwater often provides a better quality household supply than river, bore or dam water.

Benefits

Using rainwater can reduce water bills, provide an alternative supply during water restrictions and help maintain a green, healthy garden. Depending on tank size and climate, mains water use can be reduced by up to 100%. This in turn can help:

- reduce the need for new dams or desalination plants
- protect remaining environmental flows in rivers
- reduce infrastructure operating costs.

Rainwater harvesting also decreases stormwater runoff, thereby helping to reduce local flooding and scouring of creeks.



Photo: Michelle McAulay & DSEWPac

Costs

Apart from the up-front cost, there are ongoing electricity costs if a pump is part of the system, and ongoing maintenance for the homeowner.

Rebates are available from some state, territory and local governments. Go to www.yourenergysavings.gov.au to check the state or territory rebates available for your property, and contact your council directly to find out if they offer rebates. The rebate amount usually depends on the tank volume and the types of household uses for the water.

Rainwater use

Rainwater collected from a well-designed, well-maintained system can be suitable for all domestic uses. The more uses, the greater the savings in mains water. Bear in mind that the amount of water used for drinking and cooking is relatively small, and that state and territory health departments recommend using the public reticulated water supply for drinking and cooking because it is filtered, disinfected and, generally, fluoridated. For more information, consult your state or territory health department.

Different end uses each require a different rainwater quality.

Rainwater quality requirements for household water uses

| End use | Required quality | | | |
|------------------------|------------------|-----------|-------------------------|--|
| | Clear | Odourless | Low in dissolved solids | No human pathogens, toxins or heavy metals |
| Garden/Lawn irrigation | | | | |
| Toilet flushing | ✓ | ✓ | | |
| Clothes washing | ✓ | ✓ | | |
| Showering/Bathing | ✓ | ✓ | ✓ | |
| Drinking | ✓ | ✓ | ✓ | ✓ |

Health and safety

Rainwater tanks can impact adversely on human health in two main ways:

- indirectly, by providing a breeding place for disease-carrying mosquitoes
- directly, if the rainwater is consumed by the household, or others if it flows back into a municipal reticulated water supply. Pathogens such as *Cryptosporidium* and *Giardia* may be present in rainwater, and in urban areas, lead and other compounds pose a risk of chemical contamination. The absence of fluoride in rainwater should also be considered for children in the household.

Prevent mosquito breeding in the tank

To avoid creating a mosquito breeding habitat, ensure tank inlets and overflows are properly screened to exclude mosquitoes.

Drinking rainwater

If your rainwater is to be used for human consumption, the system must be designed, operated and maintained to ensure the water quality is suitable. Disinfecting the water before consumption should still be considered for those whose immune system is compromised.

Backflow prevention

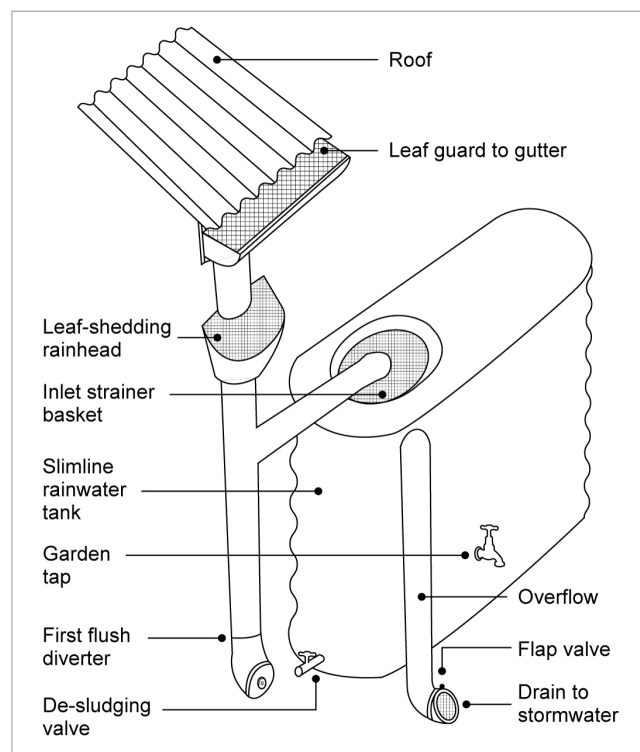
If rainwater and mains water are interconnected (such as for back-up), the mains water must be isolated from the rainwater system by a suitable backflow prevention device or a visible air gap, as required by the Plumbing Code of Australia. Most mains switchover devices already incorporate backflow prevention suitable for use with an above-ground tank.

If mains water is interconnected with rainwater from an underground tank, a testable backflow prevention device must be fitted on the mains water supply to the house. It normally needs to be tested annually.

Rainwater harvesting system checklists

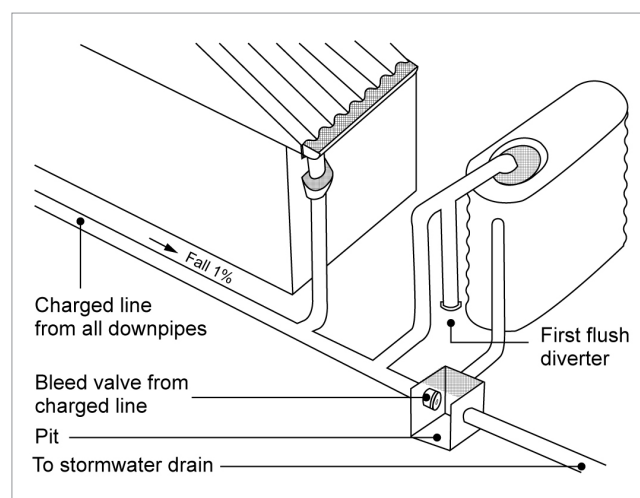
Use these lists to guide the design of a rainwater system suitable for your property and planned rainwater uses. A rainwater harvesting system has the following components:

- roof and gutters
- collection system, including leaf-shedding rain-heads and first flush diverters
- tank
- supply system, possibly including pump and filters.



The components of a rainwater harvesting system.

A 'charged line' system is needed if the pipe does not slope downwards along its length to the rainwater tank. The pipe can go down, often underground, and then up again, usually at the tank. The term 'charge' comes from the water being pushed up the pipe by the pressure of the water in the pipe.



In a charged line rainwater system the water is pushed into the tank by water pressure in the pipe.

Water

Rainwater

Roof and gutters

Rainwater can be collected from most roof types, depending on the quality of rainwater required.

For garden or lawn irrigation:

- collect from any roof material except unsealed asbestos
- ensure all gutters fall towards the outlets
- preferably fit an effective leaf screen to the gutters
- use gutter outlets that fit to the underside of the gutter.

For all other uses, also:

- prevent vegetation from overhanging the roof
- clean the roof and gutters before installing the system
- fit a good quality leaf screen to gutters or use a leaf-shedding gutter.

For drinking water, also avoid collecting rainwater:

- from sections of roof containing lead flashing or asbestos sheeting, and from roofs painted with pre-1980 paint – if they cannot be avoided, seal properly by preparing the surface and painting with a suitable potable-quality roof sealant, and do not collect rainwater from the first few rainfall events after sealing
- in areas where airborne toxins are present from nearby activities such as crop-dusting and chemical processing.

Leaf-shedding rain-heads

If no leaf screen is fitted to gutters, fit leaf-shedding rain-heads to the downpipes. These devices employ a sloping screen to intercept leaves and reduce excessive leaf build-up in first flush diverters and tank inlet strainer baskets. They are essential if the tank has no inlet strainer (e.g. a bladder tank). Install the rain-heads higher than the tank inlet but at a height that can be easily accessed for maintenance.



Photo: John Caley (Ecological Design)

Gutter leaf screens keep leaves out of the rainwater collection system.



Photo: John Caley (Ecological Design)

Leaf-shedding rain-heads intercept leaves and reduce excessive leaf build-up.

First flush diverters

The first rain after a dry spell washes some of the accumulated dust and bird droppings off your roof and into your rainwater tank, accumulating as sediment in the bottom of the tank and lessening the quality of the water. First flush diverters intercept the first roof runoff and prevent it from entering your rainwater tank, in one of two main ways:

- storing the first rainwater runoff and slowly draining it (e.g. to the garden)
- diverting the first rainwater runoff and then closing.

First flush diverters are typically sized to divert about 10L per 50m² of roof plan area. A diverter may be required by local government regulation.

First flush diverters should be installed for all drinking water systems and are beneficial for systems supplying other internal uses. For garden irrigation supply, their main benefit would be the reduced need for desludging the tank.

Installation details include ensuring:

- the first flush diverter is securely mounted
- there is enough clearance to easily remove parts that need cleaning.

Rainwater tanks

Choose a rainwater tank that suits your needs.

Tank size

When deciding the best size for your tank consider:

- **uses to be supplied** — maximise the uses of rainwater to get the best value from your rainwater tank
- **average amount of water consumed by these uses** — available from your water supplier or try the calculator on the Hunter Water website www.hunterwater.com.au
- **local rainfall pattern** — find the annual rainfall in your area on www.bom.gov.au — in areas with highly variable rainfall, much bigger tanks are required for the same supply of rainwater
- **area of roof draining to the tank** — 1mm of rainfall on 1m² of roof area = 1L of rainwater
- **security of water supply you desire** — a larger tank volume leaves fewer periods without rainwater.

Approximate tank sizes for a four person household with mains water and evenly spread rainfall

| Use | Target volume (L) |
|---|-------------------|
| Toilet flushing and use on a small garden | 2,000–3,000 |
| Toilet flushing, clothes washing and small garden | 3,000–5,000 |
| Whole of house water supply | 5,000–20,000 |

Where average rainfall is highly seasonal or no mains water is available, much larger tanks are typically required.

Use the Alternative Technology Association Tankulator at <http://tankulator.ata.org.au> to help evaluate the effect of different tank sizes on water savings.

Tank materials

Common tank materials include polyethylene, fibreglass, concrete and steel.

Steel tanks are strong and can be made to a custom size. They are available in stainless, Zinalume[®] or Colorbond[®] steel. Smaller tanks are prefabricated; tanks over 30kL are usually assembled on site. Prefabricated steel tanks are usually coated internally and under the base with a polymer film to prevent corrosion. The polymer lining commonly used in Australia should be protected from direct sunlight as it is not UV stabilised. Suppliers generally require steel tanks to be installed on a concrete slab, pavers or a stand.

Plastic tanks are durable, relatively lightweight and relatively inexpensive. They can be buried partially or completely if designed for underground installation.

Concrete tanks are strong and have the best bushfire resistance. They are available prefabricated in above-ground or underground models or can be constructed on site to meet specific site and homeowner requirements.

Tank types

Round, above-ground rainwater tanks are usually the cheapest type of prefabricated tank per litre of volume. However, in recent years a range of innovative systems has been developed to provide rainwater storage capacity where space is limited.

Slimline tanks may be installed along a fence line or at the side of your house (check local government planning regulations). They usually need a properly formed concrete slab for support, depending how tall they are relative to their width.



Slimline tanks installed along a wall save space while saving water.

Storage walls are very slim modular slimline tanks (typically plastic) that lock together to fit into tight spaces. They are generally the most expensive tank type.



Storage walls fit into tight spaces.

Water

Rainwater

Underground tanks save on space and usually have greater catchment potential than above-ground tanks. However, this option requires excavation and if the water is to be used inside the house, the Plumbing Code of Australia also requires that a testable backflow prevention device is fitted on any mains water supply to the house and tested annually. Underground tanks cost a similar amount to slimline tanks (excluding installation).



Source: Polymaster Pty Ltd

Underground tanks can capture all runoff water and save space.

Bladders are sealed, flexible sacks that are suitable for subfloor spaces with as little as 600mm height clearance. Their installation is more technically involved than a standard tank but they can be especially good for renovations where space is limited. Underfloor bladders may be able to collect from a larger roof catchment than above-ground tanks if inlet pipes can be routed under the floor from downpipes on both sides of the house. Bladder tanks save on outdoor space and cost a similar amount to slimline tanks.



Photo: EcoSac® Bladder Tank by Waterplex

Bladder tanks can fit under a floor with as little as 600mm clearance.

Tank details

For water quality, ease of maintenance and public health:

- ensure the inlet strainer is mosquito proof and can be easily removed for cleaning
- fit a vector-proof flap valve to overflow if open to the air
- fit a separate valve to the bottom of the tank to allow easier desludging.

For drinking water, also:

- fit the outlet 100mm above the bottom of the tank or use a floating outlet
- if possible, provide shade for the tank.

Gravity feed

Gravity can be a reliable, silent way to supply rainwater without external power. The tank can be placed on a stand, or a garden tap fitted near the bottom of a tank to provide sufficient pressure to fill a watering can or a pool, or slowly water a lower garden by hose. If the rainwater collection area and tank are more than 15m higher than the house, gravity pressure can be sufficient for all domestic uses. Lower, the pressure may not be enough for some fixtures and appliances including most modern mixer taps, washing machines and 'instant' gas heaters.

Header tank

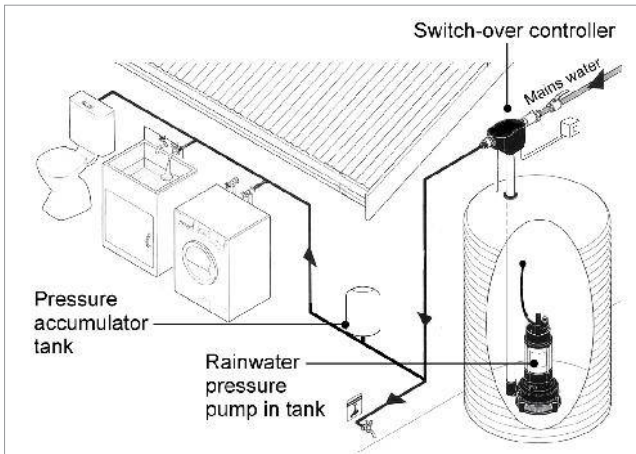
Household systems can incorporate a small header tank located at a higher elevation, perhaps at roof height. A low-powered pump is used to transfer the water from the main rainwater tank to the header tank. The rainwater can then be delivered by gravity to the household. These systems can be much more efficient than mains pressure pump systems. However, water pressure will be low from a header tank less than 15m above the water outlet. The water supply pipes in the house also need to be sized to suit low pressure supply.

Pump systems

Pressure pumps

A suitable pressure pump delivers water at or near mains pressure, to make full use of your rainwater. Rainwater pumps are either submersible or free-standing.

A submersible pump in the rainwater tank saves space and emits much less pump noise. A free-standing pump is often cheaper and available in a greater range of pumping capacities, but needs a weather protected spot near the tank and an enclosure to limit pump noise.

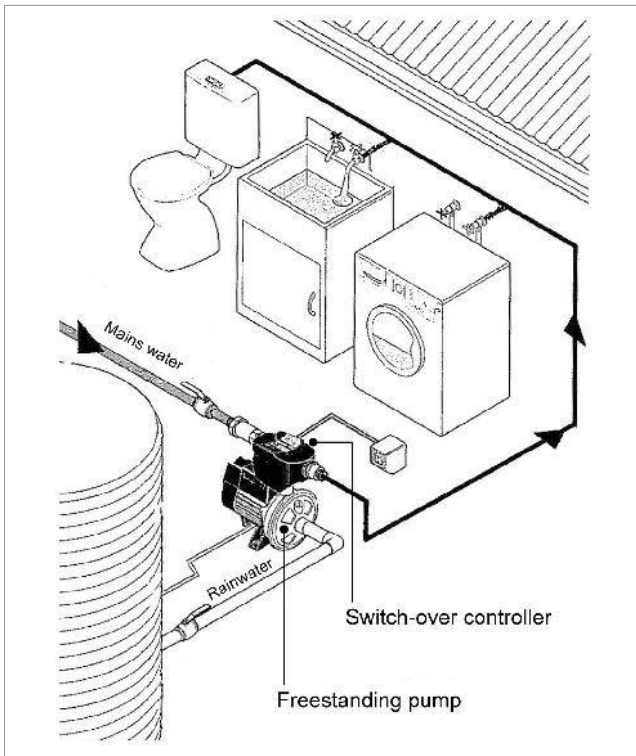


A submersible pump can be fitted in the rainwater tank.

Select a pump that delivers the expected flow rate while maintaining enough pressure at the most critical water supply point. Consider:

- the required minimum delivery pressure
- friction losses due to pipe, filters and controllers
- the pressure needed to lift the water to the height of the most critical water fixture.

Pump suppliers and hydraulic consultants can help with correct selection of the pump.



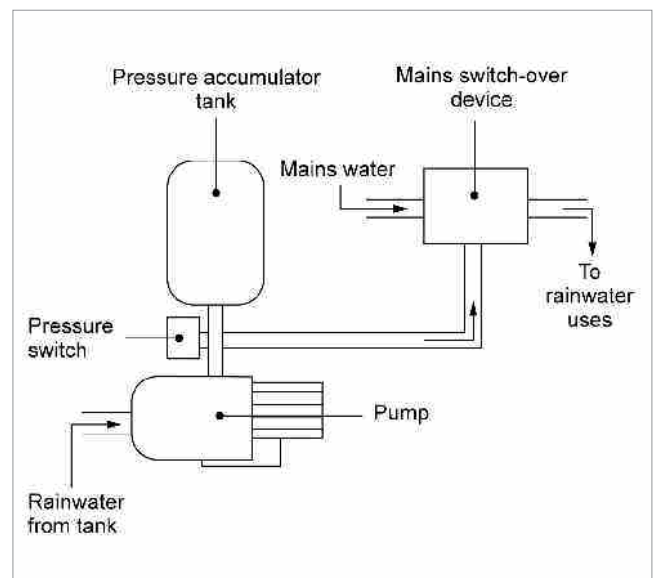
Free-standing rainwater pressure supply pumps are available in a range of capacities.

Pump controllers

A rainwater pump is typically supplied with a suitable controller to switch it on and off as required in response to the water flow. For outdoor water uses the controller is often mounted on the pump.

For whole-of-house rainwater supplies, a variable speed pump delivers a more even pressure at the expense of energy efficiency.

The most energy efficient pressure pump control system incorporates a pressure accumulator tank and a mechanical pressure switch.



An efficient pump control system incorporates a pressure accumulator tank with mechanical switch.

Mains switch-over devices

Some controllers also switch the supply from rainwater to mains water when the rainwater runs out. This type of controller is commonly used for rainwater supply to toilets, washing machines and other internal uses where a mains water supply is also available. They typically incorporate a float switch in the tank. It is good practice to place a mesh inline strainer between the pump and the controller to protect this type of controller from being damaged by foreign objects.

Water

Rainwater

Filters

It is beneficial to filter the rainwater supply to some fixtures.

Benefits of rainwater filters

| Fixture/Use | Filter | | |
|------------------------------------|---|---|---------------------------------------|
| | Tannin filter (if tannins from overhanging trees expected) | Sediment filter (e.g. 20 micron) | Sub 1 micron absolute filter |
| Irrigation and outdoor | | | |
| Hot water system | ✓ | ✓ | |
| Toilet cistern/ Washing machine | ✓ | | |
| Drinking water outlets (cold) | ✓ | ✓ | ✓ |

Consider the following when incorporating filters into the design:

- Ensure that the filter housing is accessible and that shut-off valves are installed so the water won't drain out of the pipework. Pleated sediment filters must be changed annually if they are part of a drinking water supply. Ceramic filters need to be removed for cleaning when the flow rate becomes too low.
- Filters reduce pressure and flow, and must be sized correctly and allow for the pressure drop in the pump selection.

Consult filter suppliers for advice on a suitable filter for the particular quality and flow rate required.

System maintenance

Regular maintenance is needed to ensure that your rainwater is safe for all requirements around the home, particularly for drinking.

Design and construct the system so that the maintenance schedule can be carried out.

Monthly:

- Check and clean tank inlet screens, outlet screens and leaf-shedding rain-heads.
- Check and clean the first flush diverter.

Annually:

- Check roofs and gutters and remove debris.
- Check filters annually and replace if necessary.
- Remove overhanging vegetation where possible.

3–5 yearly:

- Desludge your tank.

In the longer term, rainwater pumps typically need servicing or replacing after approximately 10 years of use.

References and additional reading

Contact your state, territory or local government for further information on saving water: www.gov.au

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