Wastewater reuse

On-site wastewater reuse can reduce water use in both urban and rural households. At present, most homes use potable (drinkable) water for practically everything in the house and garden.

> *We are literally flushing our drinking water down the toilet!*

The articles *Reducing water demand*, *Rainwater* and *Outdoor water use* also have information on reducing potable water use.

Opportunities to reuse wastewater and regulation of its treatment vary according to where you live. Urban households typically have a connection to a centralised, or reticulated, sewage system, whereas rural households manage their wastewater on site. Check with your local council or state health authority for advice on the regulations in your area.

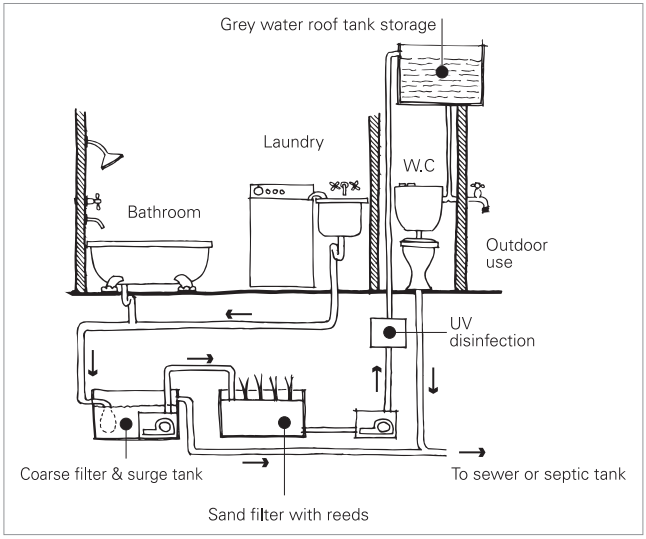
Two types of wastewater are created in a home: greywater and blackwater.

Greywater is wastewater from non-toilet plumbing fixtures such as showers, basins and taps.

Blackwater is water that has been mixed with waste from the toilet. Because of the potential for contamination by pathogens and grease, water from kitchens and dishwashers should be excluded from greywater and considered as blackwater.

Each wastewater type must be treated differently and can be used in various ways. Greywater is ideal for garden watering, with the appropriate precautions, such as using low or no sodium and phosphorus products and applying the water below the surface. Appropriately treated greywater can also be reused indoors for toilet flushing and clothes washing, both significant water consumers.

Blackwater requires biological or chemical treatment and disinfection before reuse. For single dwellings, treated and disinfected blackwater can be used only outdoors, and often only for subsurface irrigation. Check with your local council or state health department on local requirements.



A wastewater reuse system.

Advantages of reuse

By using wastewater as a resource rather than a waste product you can:

- reduce water bills
- use fewer water resources
- irrigate the garden during drought or water restrictions
- cut down the amount of pollution going into waterways
- help save money on new infrastructure for water supplies and wastewater treatment
- decrease demand on infrastructure for sewage transport, treatment and disposal, allowing it to work better and last longer.

Disadvantages of reuse

The disadvantages of reusing wastewater also need to be considered. Currently, the main disadvantage for most households is the financial cost of installing and maintaining a reuse system. The attractiveness of the investment would depend on:

- the extent of centralised wastewater treatment services available
- the price of water in your area (urban) or scarcity of water (rural)

- whether you are replacing an existing system or starting from scratch
- the length of time you intend to live in your current house
- the type of system — annual operating and maintenance costs vary between systems
- whether a restriction free, reliable water supply is valuable to you — wastewater reuse is often a much more reliable secondary source of water than common rainwater tank installations. (see *Rainwater*)

If your house is frequently unoccupied for a fortnight or more, for example a holiday home, select carefully to find a reuse system that can cope with intermittent use. Most systems that include biological treatment do not function properly if used intermittently.

Calculating wastewater volume

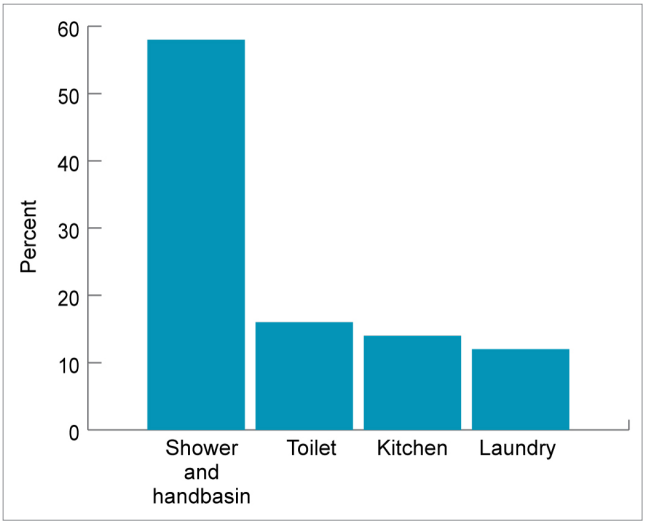
The table indicates the approximate amount of wastewater produced by one person each day in an average home with WELS 3 star rated fixtures. (see *Reducing water demand*)

Wastewater produced in an average home with WELS 3 star rated fixtures

Wastewater type	Wastewater source	L/person/day
Blackwater	Toilet	20
Greywater	Shower	63
	Hand basin	6
	Washing machine	13
	Laundry tap	2
Other	Kitchen tap	12
	Dishwasher	5
Total greywater		**84**
Total wastewater		**121**

Reuse water quality

The quality of reused water depends on the treatment system, the water's previous use and the chemicals used in the home. A number of things can simplify treatment requirements.



Many different indoor locations generate wastewater.

For greywater:

- Minimise the use of cleaning chemicals. Use natural cleaning products where possible.
- Use low or no sodium laundry detergents, soaps and shampoos.
- Use a lint filter. Clean and replace as necessary to ensure water can flow through it easily.
- Do not dispose of household chemicals down the sink. Contact your local council or water authority for information on chemical collection services.

For blackwater:

- Minimise the use of cleaning chemicals. Use natural cleaning products where possible.
- Do not dispose of household chemicals down the toilet.
- Use a sink strainer in the kitchen to help prevent food scraps and other solid material from entering your wastewater.

Wastewater reuse in urban areas

Consider reusing wastewater in an urban, sewered area if:

- you wish to further reduce water use beyond already implemented efficiency measures for indoor and outdoor water use (see *Reducing water demand; Outdoor water use*)
- water supplies in your area are often limited by frequent restrictions or droughts
- your large garden needs to be watered often or would not survive extended water restrictions.

Remember to check with your local council or water authority before you reuse wastewater, as standards and permission requirements vary.

Wastewater reuse in rural areas

Rural households typically have greater scope for reusing wastewater because:

- without a centralised treatment service, investment in an on-site wastewater treatment system is a necessity
- installing a reuse system in a new house, or adapting an existing treatment system to allow reuse, may not incur significant additional expenditure
- water supply may be restricted, placing a premium on using water resources in the most efficient manner (see *Reducing water demand; Rainwater*)
- large blocks of land in rural areas allow more scope for on-site disposal of wastewater.

NOTE: The septic tank system, the most prevalent on-site wastewater treatment system in rural Australia, does not actively treat wastewater to remove disease-causing pathogens. Effluent from a septic tank should be disposed of underground at soil depths greater than 300mm.

Reusing wastewater outdoors

Reusing wastewater outdoors can reduce a household's potable water use by 30–50%. (see *Outdoor water use*)

> *Reusing wastewater outdoors can reduce a household's potable water use by 30–50%.*

However, a number of precautions need to be taken to ensure it is safe and environmentally sound.

Avoid watering vegetables with reuse water if they are to be eaten raw. There is a chance that some pathogenic organisms may still be present even after treatment.

To maintain the health of your garden, the level of reuse of wastewater needs to be balanced with the amount of water, solids and nutrients that the plants and soil in the garden can absorb.

If excess wastewater is applied:

- excess nutrients may run off or leach through the soil to enter waterways, contributing to algal blooms and other water quality problems
- soils and plants may become waterlogged and inhibit plant growth
- soils can become physically clogged with organic and suspended material or damaged by salts in the wastewater
- salinity may increase in problem areas when greywater contributes to rising watertables.

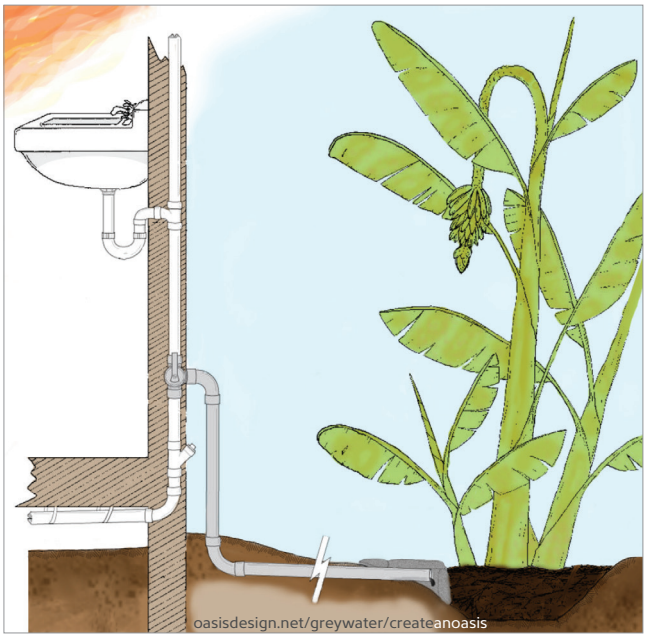
Avoid these problems by:

- planning your garden carefully (see *Outdoor water use*; the appendix *Landscaping and garden design*)
- using phosphate-free and salt-free liquid or environmentally friendly detergents
- pre-filtering to remove solids.

Adjust the amount of wastewater to conditions in the garden. Do not irrigate if the soil is already saturated (*see 'Wet weather storage' below*).

Greywater treatment for outdoor use

Greywater can be reused in gardens with little or no treatment. Subsurface irrigation systems — slotted drainage pipe or special driplines — spread water evenly around the garden and are safer for untreated greywater.



Simple greywater subsurface reuse.

Slotted drainage pipes and greywater driplines spread greywater evenly around the garden.

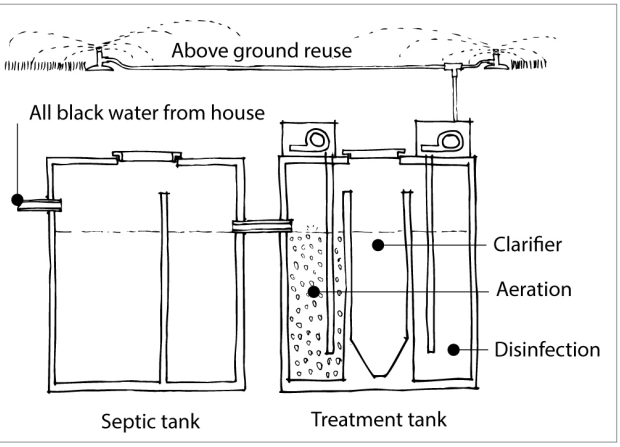
Blackwater treatment systems for outdoor reuse

Outdoors is the only place where treated and disinfected blackwater can be safely reused. There are many different types of blackwater treatment systems suitable for outdoor use. Contact your local council for a list of accredited treatment systems for your area.

Currently the most common wastewater treatment and reuse system in Australia is the aerated wastewater treatment system and many commercial models are available in all states. After the wastewater solids have settled, the effluent is aerated to assist bacterial breakdown of organic matter, followed by a further stage of disinfection, usually using chlorine pellets.

On-site wastewater treatment systems using microfiltration are now available for domestic use. These systems require no chemicals but do need energy.

Some treatment systems use worms and microbes, and little energy and no chemicals, to treat all household wastewater. They produce effluent suitable for subsurface irrigation and compost as a by-product.



There are many commercial models of aerated wastewater treatment systems available in Australia.

Wet weather storage

Wastewater reused in the garden needs to be disposed of or stored when it is not required during periods of high rainfall.

If storage is not an option, excess wastewater can be directed to a sewer in an urban area. In rural areas with enough space, subsurface disposal to a trench in the garden is recommended.

Storage maximises the usefulness of wastewater but it needs to be treated and disinfected before storage.

Storage requirements depend on:

- climate
- household demand for reuse water
- presence/size of disposal area
- maximum daily wastewater output.

Reusing greywater indoors

In homes with access to a reliable rainwater supply, it is generally more economical just to use greywater outdoors and rainwater indoors. However, if you are unable to collect enough rainwater, treated greywater can reliably reduce indoor water use.

> *Treated greywater can be reused for toilet flushing and clothes washing, two of a household's biggest users of water.*

Appropriately treated greywater can be reused for toilet flushing and clothes washing, which are two of the biggest users of water in an average household. (see *Reducing water demand*)

Reusing treated greywater for toilet flushing can save approximately 50L of potable water in an average household every day. Reusing treated greywater in a clothes washer can save approximately 90L of potable water in an average household every day.

A greywater treatment and disinfection system, approved in your state, must be installed to reuse greywater indoors for toilet flushing and clothes washing. These systems give a suitable level of treatment and meet local regulations.

NOTE: Wastewater from the kitchen sink and dishwasher can be classed as greywater but requires more complex treatment before reuse. Many states in Australia do not allow water from kitchens to be included in greywater for reuse, and permit greywater only from showers, hand basins and laundries.

Greywater can be directly diverted from the shower or bathroom sink for toilet flushing as long as it is used immediately and not stored for more than 24 hours before reuse or disposal to sewer. It requires coarse filtration.

Precautions

Greywater must be treated and disinfected before storage and general reuse because it:

- can contain significant numbers of pathogens that spread disease
- begins to turn septic and smell if stored for longer than 24 hours untreated.

Dissolved organic material in greywater reused for washing clothes may discolour clothing. An activated carbon filter can overcome this problem.

Treatment systems for indoor greywater reuse

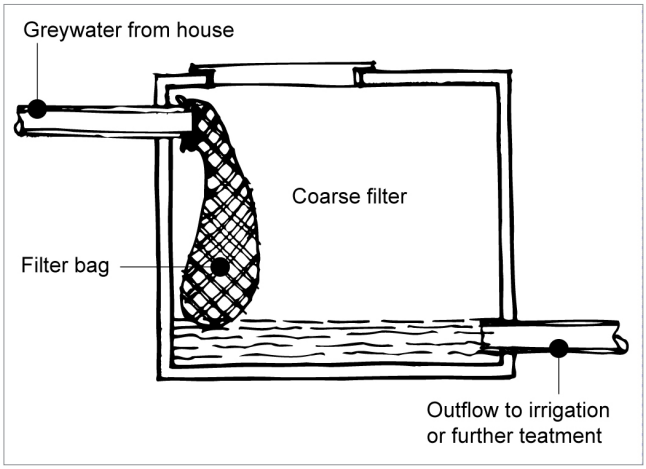
A number of proprietary on-site greywater treatment systems are available for purchase in Australia. Your council or state health department can advise which are accredited for use in your area.

The treatment processes may employ biological, chemical or mechanical means. The qualities of treated water they produce can vary considerably, as can their initial cost and energy consumption.

With council approval, it is possible to build your own biological treatment system for greywater treatment. 'References and additional reading' at the end of this article has more details.

Biological greywater treatment generally consists of several steps:

1. Coarse filtration to remove large particles, including hair, and prevent clogging. It can be as simple as a waterproof box and a filter bag or stocking attached with rubber bands. Check the stocking or bag frequently and replace it when full.
2. Fine filtration and biological treatment, using a sand filter and reed bed combination. Microbes in the sand break down organic matter in the water and the reeds take up nutrients. The basic structure is a waterproof box filled with coarse sand laid over a gravel bed. It is designed so that greywater percolates either vertically or horizontally through the media.
3. Any greywater reused indoors must be disinfected. All disinfection systems require frequent maintenance. Chlorine, although the most common disinfectant, has been found to have adverse environmental impacts. Alternatives such as UV or ozone disinfection should be used where possible but they do require electric power to operate. UV sterilisers disinfect the water as it passes through them and use about 20–40W of electric power depending on the water flow rate they can treat. Ozone systems use about 50W of power and operate for about 30 minutes six to eight times a day depending on water usage.



Systems for treating greywater can be quite simple to build.

UV sterilisers disinfect water as it passes through them.

References and additional reading

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

Australian Coordinator for Recycled Water Use in Horticulture. Guidelines for recycled water in Australia. www.recycledwater.com.au

Booker, N. 2001. Greywater and blackwater treatment strategies. Environment design guide, TEC 11. Australian Institute of Architects, Melbourne. www.environmentdesignguide.com.au

Greywater system buyers guide. 2010. ReNew, 102. www.renew.org.au

Master Plumbers and Mechanical Services Association of Australia. 2008. Urban greywater design and installation handbook.

McQuire, S. 2007. Water not down the drain: a guide to using rainwater and greywater at home. Alternative Technology Association, Melbourne. www.savewater.com.au

National Water Commission. 2008. Requirements for installation of rainwater and greywater systems in Australia. Waterlines Report Series No 10.

Standards Australia. 2008. HB 326–2008: Urban greywater installation handbook for single households.

Sydney Metropolitan Catchment Management Authority (SMCMA). Water Sensitive Urban Design Program. www.wsud.org

Windblad, U and Simpson-Hebert, M (eds). 2004. Ecological sanitation, 2nd edn. Stockholm Environment Institute, Sweden. www.ecosanres.org

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