

Water Case Studies

The following case studies showcase innovative urban water design in single dwellings Australia. The first is an architect-designed major renovation of an existing dwelling, the second is a new house, the third is an owner-built retrofit of an existing dwelling.

CLOVELLY HOUSE, SYDNEY

A major renovation integrating environmentally sustainable strategies with contemporary design.

This case study is of interest for:

- > Collecting rainwater.
- > Water sensitive urban design.
- > Reusing greywater.
- > Conserving water.

The Clovelly House is a semi-detached terrace house on a 234m² property in Sydney that underwent a major renovation in 2004.

Water quality is matched with its intended use within the house using three sources of water:

- > Mains-supply.
- > Rainwater.
- > Treated greywater.

Only the kitchen uses water supplied by the mains. High efficiency fixtures in showers, baths and hand basins are supplied with rainwater, as is a small swimming pool. The laundry, toilets and garden taps are supplied with treated greywater.

The water saving measures are elegantly integrated into the building. The rainwater from 100m² of roof is collected in three specially shaped 1,000L tanks that form a garden wall. Greywater is treated in a lush green-wall that is also an attractive landscape feature. [See: 5.13 Green Roofs and Walls]



The innovative green-wall greywater treatment system treats wastewater from showers, baths and handbasins. The greywater is trickled through three plant boxes placed above each other, where the filtering materials treat and polish the water. The small size and simplicity of the greywater treatment system is made possible by excluding greywater from the washing machine – reducing both the volume and nutrient load of the greywater to be treated.



This vertical greywater filtering system treats water to be re-used in the toilet, washing machine and garden.

Monitoring has shown the treated greywater to be of drinking quality, showing that ultra-violet treatment required by specification is unnecessary.

Re-use of greywater from showers, baths and handbasins supplied by rainwater in the washing machine and toilet effectively enables the collected rainwater to be used twice. Wastewater from the laundry, kitchen and toilets are discharged to sewer.

A stormwater infiltration zone in the landscaping, and stormwater absorption tanks at the front and rear of the property are used to manage stormwater including overflows from the raintanks.

Outcomes of the project

- > Monitoring shows at least 80 per cent reduction in potable water use compared to the Sydney average.
- > Greywater treatment system, possibly the first of its kind in Australia, treats water to high quality with little additional energy beyond small pumps.
- > The rain tanks have reliably provided water even during drought.

See 11.4 Clovelly NSW Case Study for more details.

HEALTHY HOME, GOLD COAST

An advanced water system for a new house.

This case study is of interest for:

- > Collecting rainwater.
- > Reusing indoor greywater.
- > Conserving potable water.
- > Minimising wastewater discharge.

The healthy home is an innovative environmentally designed house on a 460m² urban site on the Gold Coast, completed in 2000.

The advanced water system includes rainwater harvesting for potable use, greywater collection and treatment, and solar water heating.

A roof area of 150m² supplies roof run-off via a first flush diverter to a 22KL concrete tank below the house. The water is filtered and disinfected using ultra-violet light to produce high quality drinking water for indoor use. Water pressure is maintained with the aid of a pump and pressure vessel. The water quality meets National Health and Medical Research Council drinking water guidelines. The tank is backed up by mains supply.

A second 1050L tank was added near the carport post occupancy, to collect run-off from the carport roof, to provide water for garden irrigation.

Greywater from the household is treated by a 6,000L aerobic wastewater treatment system (AWTS) with recirculating sand filter also located under the house. Greywater from the bathroom and laundry entering the tank is settled and treated anaerobically in a septic tank and then circulated by pump through an Envirotech sand filter within the tank. The treated water is disinfected with UV light.



Greywater system.

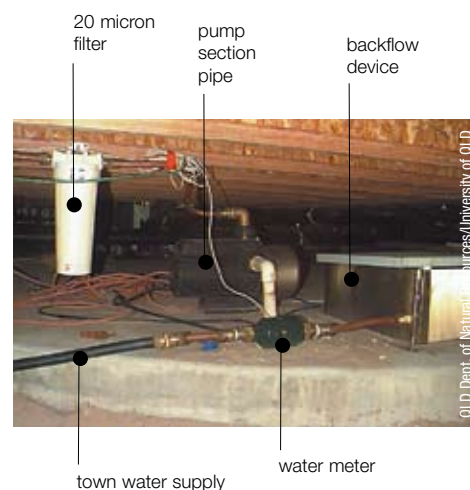
A second pump discharges treated and disinfected greywater to a storage tank for re-use in the garden.

Blackwater and wastewater from the kitchen are discharged straight to the sewer.

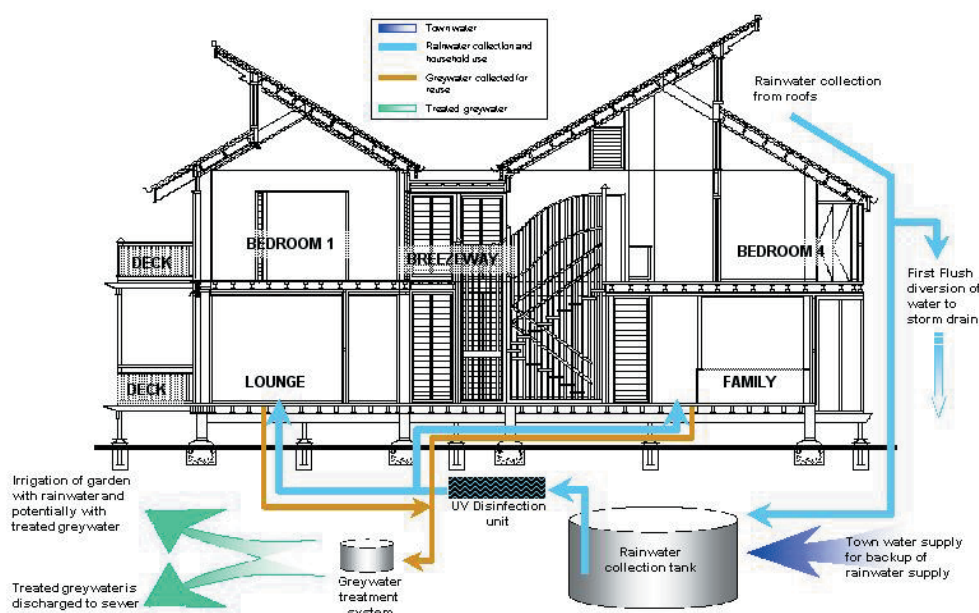
Rainfall: the Gold coast averages 1460mm per year.

Outcomes of the project

- > Town water savings of up to 50 per cent are achieved compared to an average Queensland household.
- > Chemical analysis has shown that the AWTS with recirculating sand filter effectively removes organic and suspended solids.
- > Disinfection and pumping water for indoor use consumes around 2.6 kWh of energy per day. The requirement for additional electricity for treatment and pumping of rainwater and greywater is a disadvantage of advanced water re-use systems compared with mains supply.
- > Significant reductions in potable water usage and stormwater run-off from the site have been shown.
- > The rainwater and greywater systems are not currently cost effective on the Gold Coast. Payback periods of 23 and 100 years respectively were calculated on the rain and greywater systems.



Source: QLD Department Natural Resources
www.healthyhomeproject.com



LISMORE RETROFIT, NSW

A single house retrofit for on-site wastewater management.

This case study is of interest for:

- > Reusing greywater outdoors.
- > Composting toilets.
- > Conserving potable water.
- > Minimising wastewater discharge.

This Lismore NSW home was retrofitted over a four year period to demonstrate the potential for on-site wastewater management in the urban environment.

It incorporates dry sanitation and greywater treatment systems.

On the steep 1250m² site, the owner-builder constructed a reed bed followed by an intermittent sand filter greywater treatment system that supplied subsurface irrigation for the garden. A 'Wheelibatch' dry toilet was installed with drained liquid (mostly urine) from the toilet directed to the reed bed. The home maintained its mains water supply.

Greywater from the home was diverted through a coarse gravel filter to the small sub-surface constructed wetland. The wetland was planted with *Phragmites australis*, with greywater passing through the lined basin filled with gravel and sand.

Schematic of wetland

Effluent from the wetland drained to a 4500L storage tank from where it passed through an intermittent sand filter.

The filter was constructed with a 400mm depth of coarse washed sand above 100mm of gravel. Treated greywater drained to a pump-out barrel and to sub-surface irrigation of a 100m² established garden.

The waterless toilet was designed as a batch system using two modified 240L mobile garbage bins. One bin sits under the pedestal while the second lies fallow. The ventilation system covers both bins. Liquid (urine) from the bins is drained to the greywater system.

Outcomes of the project

With two people living in the house, the system avoided an estimated 150kL of sewage and associated treatment and pumping per year.

Chemical analysis showed that with the addition of disinfection, the greywater system should meet NSW greywater guidelines for both indoor and outdoor re-use.

Source: Glen Marshall and Stuart White

ADDITIONAL READING

Veale, J, (2006), *Clovelly House, East Sydney, New South Wales*. The BDP Environment Design Guide August 2006. Royal Australian Institute of Architects.

Gardener T., H. Gibson, G. Carlin and A. Vieritz, (2000), *Water Sensitive Design to reduce the ecological footprint of urban development*, Proceedings of the Water Recycling Australia conference, Adelaide.

Gardner, T. Coombes, P., Marks, R., (2001), *Use of Rainwater at a Range of Scales in Australian Urban Environments*. Paper presented at the 10th International Rainwater Conference, Germany.

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