The West Australian Greywater Guide

A source of practical information on how to best reuse domestic greywater in Western Australia

WATER CORPORATION

Review Process

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THIS DOCUMENT WAS PREPARED FOR WATER CORPORATION BY JOSH BYRNE & ASSOCIATES

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Executive summary

The West Australian Greywater Guide is a source of practical information on how to best reuse domestic greywater in Western Australia.

Greywater is wastewater from baths, showers, spas, bathroom basins, washing machines and laundry tubs. Greywater is a resource that can be used to irrigate gardens and lawn, and for internal household use such as toilet flushing and laundry use when treated adequately. This alternative water source is important given the increasing demands on potable water supply from decreased rainfall and population growth. The benefits of using greywater as an alternative water source for both new and existing homes include reducing potable water demand, reducing wastewater discharge, reducing household bills and supporting a healthier garden particularly during the drier months.

This guide provides advice for the application of greywater reuse within households of the Swan Coastal Plain, however information is provided on the application within the heavier soils of the Perth Hills and regional areas in Western Australia (WA). The target audience is broad and includes developers, planners, architects, builders and the general public.

Included in the guide is information on: greywater and its benefits; regulatory guidance (in particular the *'Code of Practice for the Reuse of Greywater in Western Australia'* (Department of Health, 2010); types of greywater systems and technology; application, landscape and irrigation considerations for implementation; design and technical considerations; indicative costs; installation and maintenance advice; water quality; greywater use in regional areas of WA; and including greywater in planning and design.

Case studies and working examples are interspersed within the guide, to provide direction on greywater reuse considering the prevailing residential building market, retrofit, location and regulatory constraints.

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1. Introduction

Greywater is an alternative source of water that can be used to irrigate gardens and reduce demand on scheme water supplies that are currently constrained by climate change impacts and population growth.

1.1. Perth's changing climate

Perth's average rainfall has been decreasing since the mid-1970s because of our changing climate, reducing runoff into dams by more than half. There is compelling evidence that this drying and warming shift will continue to worsen (BOM and CSIRO, 2018) and when combined with population growth, there is increasing pressure on our valuable drinking water sources, making them more expensive and energy intensive as we become reliant on desalination and deep underground aquifers.

Around 70% of total scheme water use in Perth is residential, with the average household using approximately 277,000 litres per year (Water Corporation, 2010). Approximately 40% of all residential water use is for watering lawns and gardens (Water Corporation, 2010).

Alternative, fit-for-purpose water sources, such as greywater, need to be considered to alleviate the pressure on scheme water and still meet Perth resident's preferences for green gardens and cool neighbourhoods.

What is greywater?

Greywater is domestic wastewater from baths, showers, spas, bathroom basins, washing machines, laundry tubs and kitchens, although kitchen greywater must be treated before use as it can contain elevated levels of greases, oil and detergents (Department of Health, 2010; DWER, 2019). Greywater can be diverted to the garden via simple low-cost technology to provide an alternative water source, particularly in summer. With treatment, greywater can also be used for flushing toilets and washing clothes.

Benefits of using greywater

40% of all residential scheme water is used for garden irrigation and greywater reuse can help meet these water requirements without increasing scheme water demand. This is important, as currently greywater resources are not being fully utilised due to a lack of knowledge and understanding.

Scheme water savings

Greywater reuse cuts the amount of scheme water used for irrigation of gardens and lawns, reducing pressure on this supply. Water savings will vary depending on the volume of greywater generated, the type of reuse system, garden water demand and maintenance.

Additional nutrients for plants

The nutrient content of greywater, primarily nitrogen and phosphorus, benefits many garden plants growing in Western Australia's nutrient poor soils. Some Western Australian plant species are sensitive to phosphorus, check with your local Waterwise garden centre for further information.

Restriction-free water supply

Typically, a consistent amount of water is used in homes for showering and laundry each day. Reusing this water can provide a regular supply of irrigation water for gardens and lawns that is not limited by water restrictions, resulting in greener gardens and landscapes.

Creating cool and green neighbourhoods

A consistent supply of greywater for irrigation helps to green and cool our neighbourhoods. One unfortunate response to reduce scheme water use has been to replace lawns and gardens with paving and artificial turf making our neighbourhoods hotter, harder and less biodiverse.

Achieving targets for increased wastewater recycling in WA

A combination of water efficiency measures, development of new water sources and increasing the amount of wastewater recycled is required to ensure Perth's water supply is resilient and used wisely. Wastewater recycling, including greywater reuse, is currently around 10% in the Perth metropolitan area (AWA, 2018). There is an ambitious State target to increase wastewater recycling to 30% by 2030 (Water Corporation, 2019) and greywater reuse can play its part in achieving these targets, alongside larger reuse schemes.

Reduction of wastewater volumes

Water used in bathrooms and laundries that goes 'down the drain' is currently mixed with toilet water and must undergo significant treatment to be purified before being discharged into the environment. Using greywater where it is produced reduces the amount of wastewater that needs to be treated via wastewater treatment plants, saving energy (and greenhouse gas emissions) through reduced pumping and processing.

1.2. Purpose of the West Australian Greywater Guide

The West Australian Greywater Guide is a source of practical information on how to best reuse domestic greywater in Western Australia. The principle focus is sewered urban areas in the Swan Coastal Plain as this represents the majority of applications. Some information is provided on the application within the heavier soils of the Perth Hills and regional areas in Western Australia (WA). The information contained in this Guide is relevant to a broad audience including developers, planners, designers (consultants, architects and landscape designers/architects), builders and plumbers, homeowners, state and local government agencies.

1.3. Stakeholder benefits

Developers

Developers who incorporate greywater reuse into their project will be contributing towards Water Sensitive Urban Design (WSUD) outcomes through a reduced reliance on scheme water for garden irrigation. In addition, projects may be eligible for credit towards certain sustainability rating schemes such as the Waterwise Development Program[1].

Designers: Consultants, Architects, Landscape Designer/Architects

Greywater reuse can attract credits towards a development's sustainability rating as it promotes best practice water efficiency and can enhance urban greening and cooling. It reduces the amount of scheme or groundwater required for landscape irrigation, demonstrating a commitment to current best practice environmental design for both the client and local community.

Builders and Plumbers

Builders and plumbers can play an important role in the uptake of greywater reuse when interacting with clients as their recommendations can impact on decisions to install a greywater system. Greywater reuse is likely to increase in popularity due to climate change and provide a commercial opportunity for industry.

Homeowners

Homeowners who choose to install a greywater reuse system will have an alternative water source for their gardens that can be used outside of restrictions and will reduce their water bill. As with rainwater tanks, a greywater system can increase the resale value of a property and will also appeal to those wishing to make a commitment to saving water without sacrificing the health of their garden.

1 https://www.watercorporation.com.au/home/business/saving-water/waterwise-programs/waterwise-development-program

2. Regulatory guidance

There are several important regulatory requirements to ensure the effective installation and use of greywater in WA.

2.1. State government

The *'Code of Practice for the Reuse of Greywater in Western Australia'* (latest edition 2010) published by the Department of Health sets out the regulatory requirements for the responsible reuse of greywater in WA. Key requirements and guidance from the Code are detailed throughout this document.

The design, construction, installation, replacement, repair, alteration and maintenance of a non-drinking water service must be in accordance with all relevant Australian Standards (AS/NZS 3500) and the Plumbing Code of Australia. All installations require the services of appropriately licensed persons as required by the Plumbing Licensing Boards regulation of 2000 and the Health Act of 2016.

2.2. Local government

Local Government is responsible for greywater system installation and operation approvals. This approvals process is typically administered by Environmental Health Officers in each Local Government Authority, in accordance with compliance to the Code.

2.3. Technical standards and specifications

There are a number of resources available regarding greywater standards, building codes and the Residential Greywater Ready Plumbing Guidelines (JBA 2013).

Greywater system designers and installers should be fully aware of the requirements set out in the Code and relevant plumbing regulations to ensure the installation of a compliant greywater system. Greywater systems should be designed and installed by an experienced greywater professional[2]. It is illegal to install a system not approved for use in WA and certain steps in the installation process must be undertaken by a licensed plumber.

2.4. Non-sewered areas

The Code details regulations for greywater in non-sewered areas. To summarise:

- Primary onsite wastewater systems should be sized to receive the total wastewater flow.
- Primary systems must be able to operate efficiently with the separation of greywater.
- Greywater diversion devices must have an overflow pipe to ensure greywater is fed back to the primary system if there is a filter blockage.
- Specific rules apply for those with composting toilets.
- Both the greywater system and the primary system must be one approved by the Department of Health[3] and their installation and the operation approved by the relevant Local Government Authority.

For more information please refer to the Perth Hills retrofit case study.

The Greywater and Wastewater Industry Group

The Greywater and Wastewater Industry Group (GWIG) is the peak industry group representing greywater and wastewater suppliers, installers and service technicians in Western Australia. Formed in 2010, GWIG is a non-profit organisation made up of industry professionals such as designers, manufacturers and installers of greywater systems, as well as consultants, researchers and service organisations to the plumbing trade. The expertise and experience of its membership enables the industry to rapidly respond and address current and emerging issues in water re-use, as well as to provide advice on industry best practice. GWIG actively promotes the responsible installation of greywater reuse systems through legislative change to achieve greater water savings in our community.

2 https://www.gwig.org/
3 Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulation 1974

3. Greywater systems and technology

There are various methods of greywater reuse; Greywater Diversion Devices and the required system components are the focus of this Guide.

3.1. Methods of greywater reuse

The Code approves three different methods of greywater reuse in Western Australia. These include:

Manual bucketing

A bucket can be used to manually collect shower and laundry water for reuse. There are no restrictions on the amount of water collected in a bucket for irrigation or reuse indoors (e.g. for toilet flushing). This is because volumes are low and, due to the effort involved, application is likely to be restricted to hot weather.

Diversion straight onto the garden

A Greywater Diversion Device (GDD) typically diverts greywater without storage or treatment to the garden via subsurface or substrata (under mulch) drip irrigation, or subsurface trench to minimise potential contact. There are two types of GDD: a Gravity GDD and a Pump GDD, further explained in Section 3.2. GDD's must have a WaterMark Licence, which demonstrates compliance with the Australian Technical Specification ATS5200. The emphasis of this Guide is on GDD as they are the most commonly used.

Treatment systems

A Greywater Treatment System (GTS) provides a level of treatment so greywater can be used for hand watering, through above-ground sprinklers and for non-potable applications such as toilet flushing and cold water laundry (assuming the required water quality standards are met).

System approvals

A greywater system is classified as a type of sewage disposal system and therefore must be approved and licensed through the Department of Health (DoH). Once a system has gained DoH approval (as a licenced product), installation at a particular site is administered by local government. Details on DoH approved GDD and GTS can be found via the GWIG website[4]. Conditions of approval may vary depending on the design.

3.2. System components

A typical, complete greywater reuse system can consist of three main elements:

1. Greywater drainage collection pipework
2. Greywater unit (Greywater Diversion Devices are detailed in this pack)
3. Irrigation area (detailed in Section 4)

Greywater drainage collection pipework

The greywater drainage collection pipework comprises the network of wastewater pipes, typically PVC, located alongside or under the house. These pipes direct the greywater from the various sources such as shower/s and washing machine to the greywater unit located external to the building and typically below-ground. All work required to connect to the drainage plumbing must be done by a licensed plumber. Refer to the *Residential Greywater-Ready Plumbing Guidelines*[5] (2013), for installing greywater ready drainage plumbing for new buildings. A case study of how to retrofit the drainage plumbing in an existing dwelling is included in this Guide.

There must be an overflow and manual diversion to the main sewerage system (whether utility sewer, septic tank or other form of onsite wastewater system) from any type of greywater unit to allow for diversion of water during periods of winter rain, maintenance; and in the case of overflow or power failure where the flowrate into the system exceeds the capacity of the tank and/or pump.

Greywater unit (GDD)

There are two main types of GDD:

1. Gravity devices

Rather than use a pump, greywater flows from the device into the irrigation field using gravity. These systems are suitable if the property has sufficient slope, bearing in mind that underground systems may still need a pump to raise water from an underground collection

4 https://www.gwig.org/
5 https://www.gwig.org/

point back to ground level for dispersal. The greywater may be dispersed by either dripline or slotted pipe laid in shallow trenches. For dripline irrigation, at least two metres of vertical head pressure is required (refer to Section 4.4). For piped trench systems a minimal fall of 1:60 is all that is required to disperse greywater into the soil.

2. Pumped devices

Pumped devices often incorporate a surge tank to cope with sudden influxes of greywater, after which it is then pumped to the irrigation field (typically dripline). The surge tank acts as a temporary holding tank and not as a storage tank, as untreated greywater cannot be stored for more than twenty-four hours as prescribed by the Code. Some pump systems are activated by a float switch as soon as greywater enters the tank, while others collect greywater for up to 24 hours and the pump is then activated using an internal timer.

Both gravity-fed and pumped devices should include a filter (or settling tank for gravity systems) at the entry point of the system to remove solids such as hair and lint. This helps to protect the pump and prevent clogging of irrigation drippers or dispersal trenches. Greywater from GDD's must be discharged subsurface/sub-strata (beneath at least 100mm of soil or mulch) as prescribed by the Code.

4. Landscape, application and irrigation

A number of variables need to be considered by the homeowner and greywater professional to ensure the system is designed to suit the specific site.

4.1. Local climate

The local climate needs to be considered when designing and installing a greywater system, in particular evaporation and rainfall. For example Perth has a 'Mediterranean' climate with hot dry summers and mild winters with moderate rainfall. It is important that the greywater system is able to be switched off during winter with greywater diverted to the main sewerage system during this time. Regional areas of WA will have different climatic contexts to consider.

4.2. Soil and site assessment

A site assessment is required to ensure greywater is suitable for the property. Key considerations include: topography, geology (including original site soil and imported fill), flood potential and proximity to environmentally sensitive areas (including water bodies). Further detail can be found in the Code.

A soil assessment may also be required to ensure soil features are suitable for greywater. In particular: soil depth to groundwater/ bedrock; permeability, texture and porosity; and soil features such as pH, salt and dispersion.

There are different greywater application rates for different soil types. The Department of Health (2010) Code of Practice for the Reuse of Greywater in Western Australia, provides information on soil types and design irrigation rates, see Table 7: Recommended Design Irrigation Rate (DIR) for Irrigation Systems.

4.3. Calculation of application area

The amount of greywater generated by a household needs to be calculated to ensure there is adequate garden area for dispersal. A 'simple calculation method' is normally used as outlined in the Code, although this figure can vary depending on occupants and their water consumption.

If the area available on the property is greater than the application area required then a greywater system will generally be approved by the local government. However, the area intended to be irrigated may not be the same as the area approved as less greywater may be produced in modern (more water efficient) homes and in households with less occupants than bedrooms. Further, different plants have different irrigation needs.

Greywater can still be used where there is limited garden area, by diverting suitable volumes, but the benefits of greywater reuse may be reduced (i.e. the investment in a system may not be recovered). A greywater professional will be aware of these factors and is qualified to design a greywater system that will successfully irrigate any specific garden area or determine when greywater reuse may not be appropriate.

Application area from The Code

The Code requires a minimum application area to ensure the greywater is adequately dispersed across the garden area. The area is based on 3 factors:

1. The number of bedrooms in the property, and hence the maximum likely number of occupants. Bedroom 1=2 people; all other bedrooms = 1 person.
1. A fixed amount of greywater produced by each occupant daily in both the laundry (40L/person/day) and bathroom (60L/person/day) (based on AS/NZS 1547:2000).
1. Soil type/ permeability (the ability of the wastewater to percolate downwards through the soil profile, and not pool or run off). This is expressed as a 'Design Irrigation Rate' (DIR) of x mm/day, where for example x=10 mm/day on the Swan Coastal Plain and x=2 on heavy clay soils.

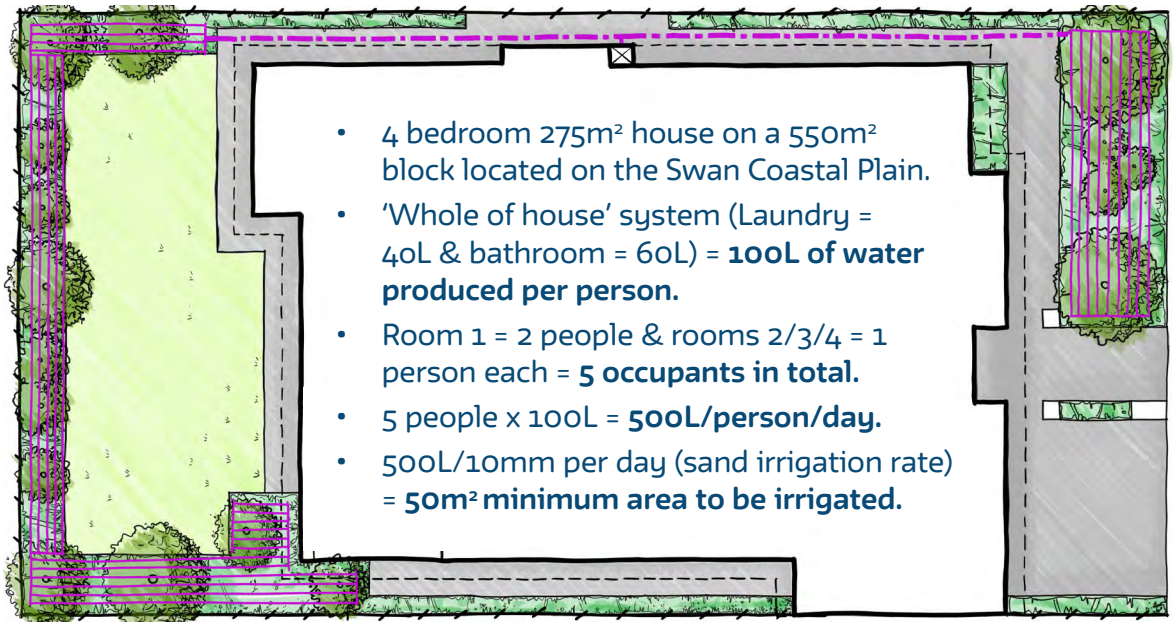
Application area calculation

Application Area required (m^2)

=

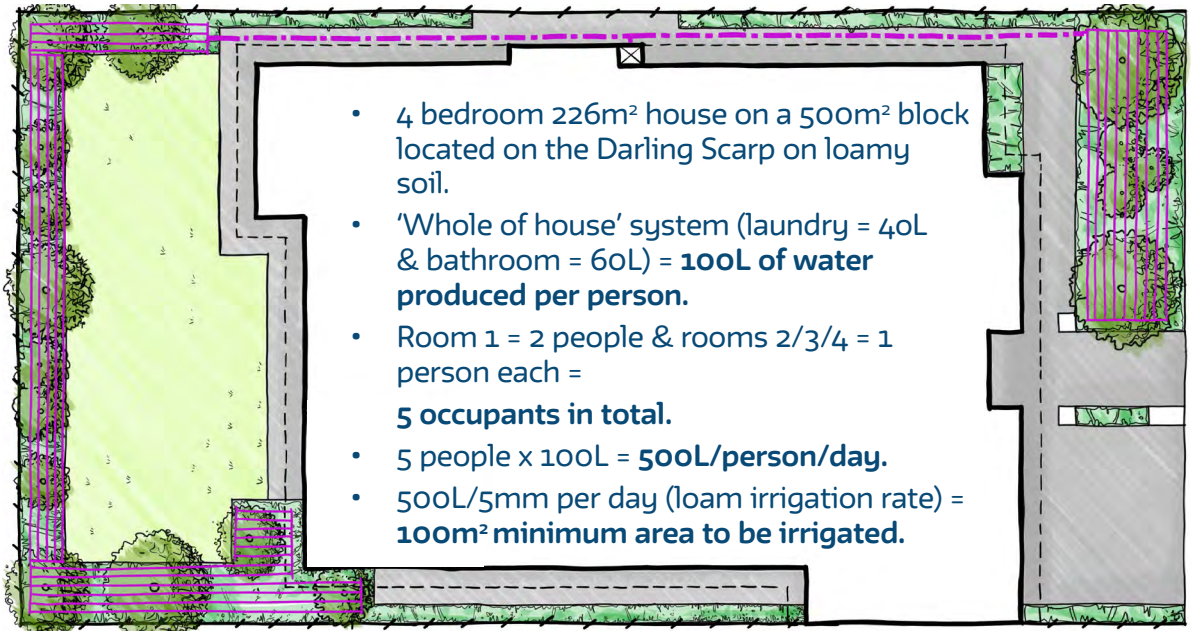
$$\frac{\text{Expected greywater volume (L/day) Design}}{\text{Irrigation Rate (mm/day)}}$$

Example of general application rate calculation for sandy soils



- 4 bedroom 275m^2 house on a 550m^2 block located on the Swan Coastal Plain.
- 'Whole of house' system (Laundry = 40L & bathroom = 60L) = **100L of water produced per person.**
- Room 1 = 2 people & rooms 2/3/4 = 1 person each = **5 occupants in total.**
- 5 people x 100L = **500L/person/day.**
- 500L/10mm per day (sand irrigation rate) = **50m^2 minimum area to be irrigated.**

Example of general application rate calculation for loamy or gravelly soils



- 4 bedroom 226m^2 house on a 500m^2 block located on the Darling Scarp on loamy soil.
- 'Whole of house' system (laundry = 40L & bathroom = 60L) = **100L of water produced per person.**
- Room 1 = 2 people & rooms 2/3/4 = 1 person each = **5 occupants in total.**
- 5 people x 100L = **500L/person/day.**
- 500L/5mm per day (loam irrigation rate) = **100m^2 minimum area to be irrigated.**

4.4. General irrigation system design: dripline, layout, setbacks

Use of dripline

The Code requires greywater from GDDs to be dispersed into the garden via lilac (purple) coloured dripline, installed on the surface of the soil and covered with a 100mm layer of mulch to prevent human contact. The lilac colour coding of the dripline is required by Australian Standards to identify the pipe as carrying recycled water and reduce the likelihood of cross-connection with other water pipework.

Using dripline is the most efficient method of dispersing irrigation water, as the emitters pass water directly to where it is most needed – the root-zone. Emitters set into dripline used for scheme water (coloured brown or black) are generally smaller than those used for greywater (coloured lilac) and will clog. Protection strategies include:

- Using pre and/or post-pump filters to ensure solids don't enter the dripline (follow individual manufacturer's recommendations for what works best with their system).
- Incorporating flush valves to allow the system to be flushed out with clean water.
- Incorporating an air release or vacuum breaker valve to prevent the pipe sucking dirt back into the emitters.

Locking clamps should also be installed on barbed fitting designed for use with clamps (some barbed fittings are self-securing).

When using dripline with gravity GGD's, at least two metres of vertical head pressure is required for the drippers to emit water. Frequent flushing with scheme water (at greater flow and pressure) will be needed to flush scum and debris from the insides of the pipes and drippers.

Layout

A mainline, generally 25mm lilac polyethylene, will run from the GDD to the garden. One or more supply pipes (supply manifold) of the same diameter will tee-off the mainline to service various garden areas. Driplines (laterals) in 13 or 16mm lilac polyethylene with a typical dripper spacing of 300mm are attached to this manifold and generally run in parallel 300mm apart on sandy soils and up to 600mm apart on less permeable soils. For trees, a spiral of dripline around the base of the tree delivers water evenly across the root zone.

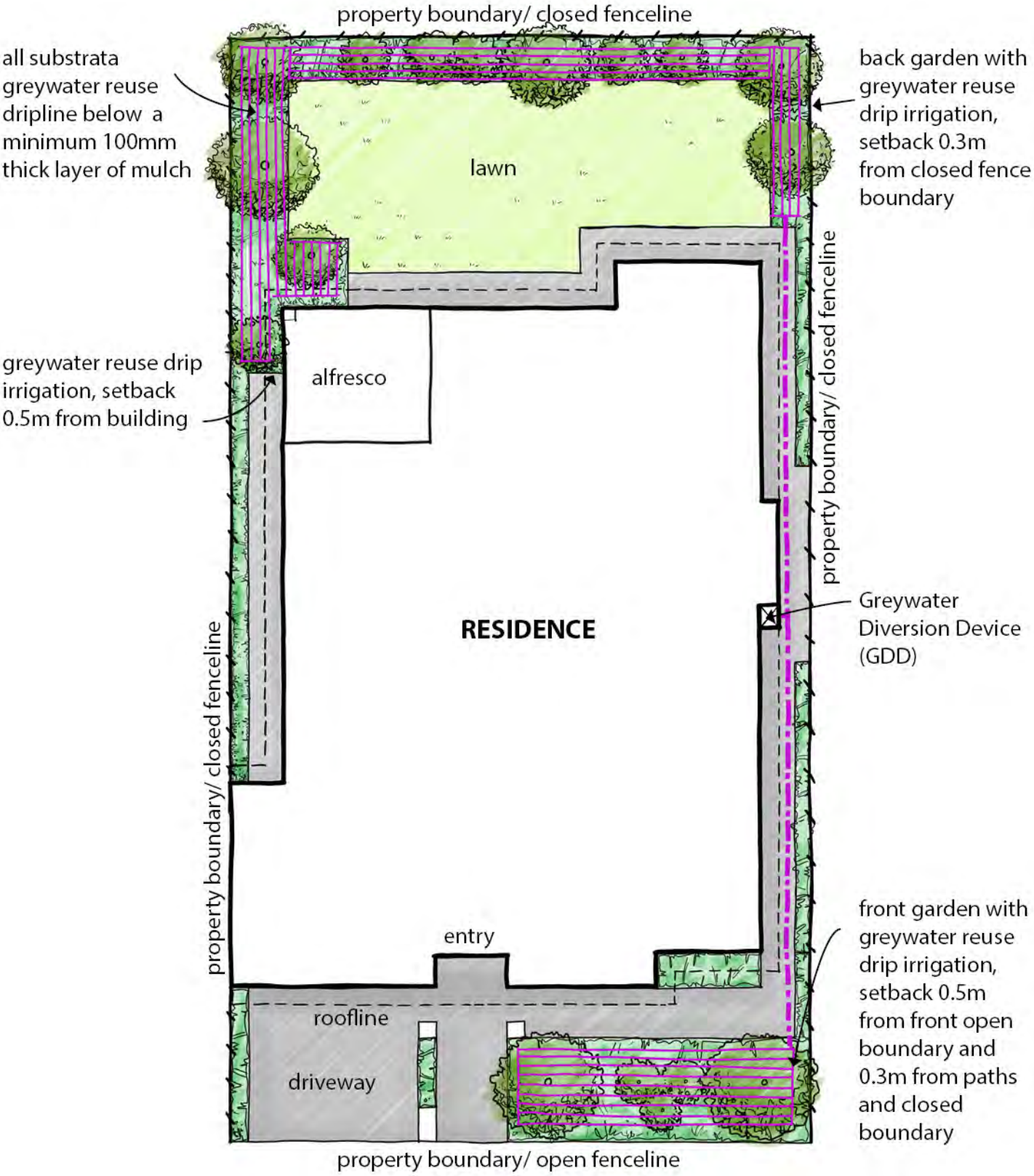
Each length of dripline that is not attached to the supply manifold must be able to be opened for regular flushing of sediment accumulating in irrigation lines. Areas with several parallel rows of dripline can be connected to a second length of solid-wall mainline pipe, called the collector or flush manifold, and will end in a manual flush valve. Dripline should not loop back into the supply manifold, or connect back into itself to create a 'closed circuit' as this will result in sediment accumulating and clogging of drippers.

A vacuum breaker valve should also be included at the highest point of the irrigation line. This allows air to enter through the one-way valve as the water drains out of the line avoiding the potential for dirty water and soil being sucked back through the drippers and blocking them.

Setbacks

Greywater irrigation dripline must be setback from buildings, property boundaries, paths and driveways, retaining walls and pools to comply with the Code. Horizontal setback distances for drip irrigation areas are detailed in the Code and provided in the example below. Calculation of the area to be irrigated with greywater (the dispersal area) is defined by the actual borders or boundaries and not from the setback lines.

Example setbacks in greywater use



4.5. Using multiple irrigation zones within the garden

There is a limit to the length of dripline and hence irrigation area that can be supplied at any one time by the pump in a greywater system. This will be dependent on the model of greywater system (and pump type) installed.

Where there is an adequate supply of water available, multiple irrigation zones can be used with the water supply being switched sequentially between the different areas using an indexing valve. The indexing valve can be configured so that different areas can receive different amounts of water. For example: a four-outlet model could supply the same lawn area with two outlets, whilst the other two outlets each supplied a separate area of garden beds.

Indexing valves can either be pressure-activated, where the output is directed to a new zone each time the pump turns on (and hence a positive water pressure is detected); or volumetric, where the output will move onto a new zone after a certain number of litres have passed through the valve. A greywater professional can advise on the most appropriate valve type based on the application.

4.6. Plants selection and vegetation

Edible crops

Greywater can be used to irrigate above-ground food crops but should not come into direct contact with edible parts of fruit or vegetable crops for example potatoes, onions or strawberries. Fruit trees and vines are acceptable, as are shrub-type herbs that grow clear of where the greywater is being applied.

Using greywater under lawns

Greywater can also be used to irrigate lawn areas. Attention must be given to the following items:

1. Care must be taken to protect the emitters from root intrusion, either by:
    - Using a brand of dripline where the emitters (drippers) are impregnated with copper oxide that will last the life of the dripline,
    - Wrapping the dripline in geotextile material, or
    - Using a disc filter before the dripline (a 'techfilter') where the discs are impregnated with a pre-emergence herbicide such as Trifluralin and need to be replaced annually.
2. Lawns require more water per square metre than trees and garden beds so an irrigation design including lawn must ensure that the supply of water will be enough by closer spacing of the dripline.
3. Installing dripline under lawn may limit the ability to practice certain lawn care activities such as coring for decompaction as this may result in physical damage of the dripline. Coring is particularly beneficial on high traffic lawn areas.

Native plants

Western Australian native species have adapted to cope with the low nutrient levels in soils and some can be adversely impacted by greywater, in particular those from the Proteaceae family.

4.7. Greywater top up

A scheme water or bore water top-up is recommended for times when a dwelling may be unoccupied, for example when the occupants are away on holiday, or to increase the total amount of water irrigating an area during very hot periods with high evaporation rates. This will ensure that the plants still receive water and do not become stressed.

Connecting the scheme water supply directly to the GDD or greywater irrigation system is not permitted in order to avoid back-flow contamination of the scheme water supply. A dedicated irrigation line controlled by an irrigation controller with an adjustable valve located before the pipe discharge into the connection to the sanitary plumbing drainage is preferred. Alternatively, an external garden tap or separate pipe with adjustable gate valve should be installed for future connection to

a battery operated irrigation timer, plumbed to discharge water above the connection to the greywater sanitary plumbing drainage. Greywater top up can also be achieved through direct top up via a Reduced Pressure Zone Device (RPZD) into the GDD, refer to AS/NZS 3500.1:2003 for more detail.

Water top up may be connected to the greywater sanitary plumbing drainage via a number of methods including a trapped tundish (preferred), overflow relief gully or other suitable waste trap/ gullies.

To ensure no contamination of the water source via backflow (refer to AS/NZS 3500.2:2003 for further details), scheme water top up must meet the following requirements:

- Connection shall be above the level of the water seal.
- The top of the tundish or waste pipe riser will be above the flood level rim of the fixture.
- Have an air gap of a size twice the internal diameter of the discharging pipe.
- Be located in an accessible location for maintenance.
- Pipework to have a nominal 55mm air gap (Refer to AS/NZS 3500.1:2003 - Table 4.3 for minimum air gap requirements).

Case study

Small 'cottage lot' on the Swan Coastal Plain

This case study details the incorporation of a greywater system into the design of a new home. The owners of a 350m² block in Perth's northern suburbs were offered an incentive by the land developer for installing a greywater system and other environmental initiatives into the design of their new home.

Given the small size of the block and footprint of the house there was limited space remaining for garden areas, with only a small area at the front plus an internal courtyard being available. The solution was a laundry-only greywater system that would reuse the water from the washing machine.

System make and model

The G-Flow is a low-cost above-ground unit suitable for this application. An extension to the washing machine's own drain hose is threaded through an underground sleeve and pumps the water into the unit. Alternatively, a gravity feed of wastewater could be fed through a conventional pipe under slab if the GDD was buried inside a service pit. In existing homes the washing machine drain hose is passed through the external wall by drilling a hole in a suitable location.

An overflow pipe is connected to the main sewer line, and a diversion valve allows water to be sent direct to sewer without going through the unit (e.g. in case of a power failure).

Irrigation area

The total irrigated garden area was 10m² made up of planters in the courtyard plus two small garden beds. An additional strip intended for greywater was assessed by the greywater professional and deemed to be too narrow to comply with the 300mm setback requirement in the Code.

Greywater calculations prepared for submission to Council showed the minimum Application Area as 20m² (4 bedroom house, hence assumed occupants = 5; laundry only 5 x 40L/day = 200L/day; Soil Category 1 = Sands on the Swan Coastal Plain, with a Design Irrigation Rate of 10mm/day; Minimum area required = 200/10 = 20m²). As the available area was only half of this, the system is run on a plug-in timer for only 12 hours a day.

Cost of installation

Under $1500 including preparation of plans, the G-Flow and dripline irrigation. The application fee (currently $236) is not charged by City of Stirling.

Outcome/Water savings

A cost effective irrigation system that can regularly water all the garden beds and keep them green through summer.

Acknowledgments: WaterCraft WA

5. Design and technical considerations

A correctly designed, installed and maintained greywater system can provide numerous benefits to both the homeowner and environment. Engaging the services of a greywater professional can ensure that the installed system performs efficiently, provides an adequate amount of water to the garden, and satisfies the requirements within the Code.

In this section examples and case studies are provided on the design and technical considerations for an existing home and a new home, taking into consideration the information provided in the previous sections. Most of the examples of system design included here assume that all available greywater is connected. It is possible to have shower only or laundry only greywater systems where the total volume of water would be proportionally reduced.

5.1. Feasibility of a greywater system

Key feasibility considerations include:

- Available garden area and number of household occupants.
- Available budget. A typical whole-of-house system witth irrigation can cost around $5000 excluding dual plumbing.
- Time to plan and implement a system. Pipework for a new house will need to be laid before the concrete slab.
- Expert advice. An experienced greywater professional can advise on an appropriate system layout and ensure the whole design (including areas to be irrigated, dimensions of garden beds, proximity to garden beds/pools/property boundaries) complies with the Code.

5.2. Existing home

Retrofitting an existing home requires professional advice on design to work with the existing plumbing and existing garden layout.

5.3. Use in older homes with through-wall waste pipes

The G-flow unit is also suitable where the waste pipe comes out of the wall rather than under the slab – for example behind the laundry trough in an older home. In this case, wastewater can simply gravity feed into the unit.

A summary of greywater system design criteria set by the Code.

- Untreated greywater must not be stored for more than 24 hours, as it may start to smell.
- Appropriate setbacks from buildings, property boundaries, paths etc. must be used to apply the water in the required areas.
- Untreated greywater must be applied to the garden by subsurface/substrata irrigation (i.e. no sprayers can be used).
- Avoid ponding of greywater, so it is quickly absorbed by the soil.
- An overflow and diversion point into the primary sewerage system is required (in case of malfunction, or when the systems is not in use).
- Greywater is to be confined within the property boundary and is not permitted for use on verges.

Case study

Greywater retrofit in White Gum Valley

In this case study a greywater reuse system was installed at an existing single story, three bedroom, one bathroom family home. The building was a brick-on-concrete slab construction on a 600m² block in White Gum Valley, Fremantle.

The owner gave consent for the tenant (2 adults and 1 child) to retrofit a greywater diversion system to provide irrigation for a renovated backyard garden. The system was configured to collect greywater from the bathroom and laundry. The greywater system forms part of a larger comprehensive water efficient design approach to the house and garden which includes hydro-zoning and a plumbed 2,500L rainwater tank (to toilets and washing machine). The garden won the Sustainable Residential Category at the 2011 WA Landscape Industry Awards. The system was monitored in order to quantify the volume of greywater dispersed to the garden over a period of nine months.

System make and model

GreyFlow PS Plug'n'Play by Advanced Wastewater Systems. This unit includes an automated filter backflush system to minimise routine maintenance, whereby air is regularly blown through the filter pads to dislodge hair, lint and other debris that may clog the filters over time. The submersible pump stops whilst the blower is operating so that incoming greywater flowing across the filter pads washes away the dislodged debris into the sewer. During this process some greywater capture is lost but the need for manual filter cleaning is all but eliminated.

Irrigation area

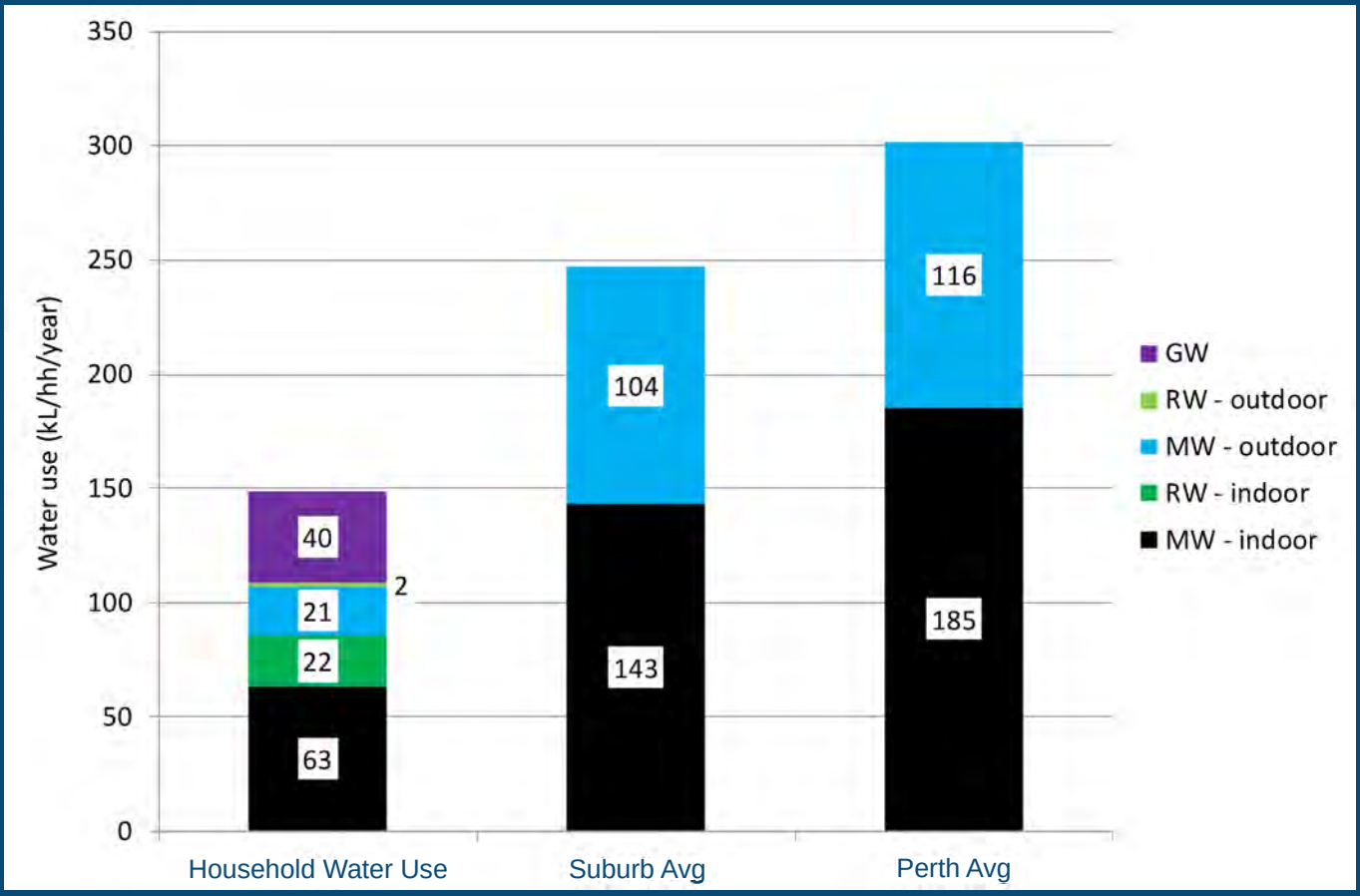
Greywater dripline was laid out over an area of 40m². The garden irrigation was automated by a multi-station programmable controller, which also operated a dedicated greywater 'top up' line to supply water to the greywater hydro-zone for periods when the house was unoccupied and irrigation was required, or when greywater volumes were inadequate to meet plant water demand.

Cost of installation

Approximately $2,150 which included the plumber's charges and excludes power point installation. The City of Fremantle refunded the standard local government fee ($236) upon a final satisfactory inspection.

Approvals process

Approximately six weeks for all local government approval processes, half a day to install greywater unit with all plumbing and electrics and one day to install the irrigation system.



Outcome/Water savings

The system was monitored for nine months and the water savings achieved by the integrated approach to water efficiency, rainwater and greywater when compared to the local suburb and Perth average is shown in the graph above.

Acknowledgments: Byrne (2017)

Case study

Perth Hills retrofit in a non-sewered area

This case study describes a greywater reuse system that was retrofitted to an existing 4 bedroom, single story, brick-on-concrete slab house on a 1,000 m² non-sewered block in the Perth hills. Both laundry and bathroom greywater was diverted from the wastewater stream into a greywater diversion system to provide irrigation for lawn and gardens.

The design professional had to ensure pipework was sized correctly to comply with Plumbing Regulations. Appropriately sized Drainage, Waste and Vent (DWV) pipe was used where the greywater diversion device was close to the greywater sources. Greywater collected from the en suite had to travel further and required the use of 100mm DWV pipe.

System make and model

The GRS-H Filter system from Water Installations, Mundaring is used to filter greywater for whole of house diversion from bathroom/laundry, removing any hair or lint before passing into the infiltration area. Fibre filter bags 500mm long are used and if blocked or too much water enters, a safety overflow device is fitted to direct greywater to the existing sewer or septic tank system as required.

Cleaning of the filter should occur fortnightly or weekly if excessive laundry and bathroom use has occurred. This device redirects wastewater from the existing system to a disconnector gully return or directly to sewer via a reflux valve.

The previous image demonstrates the filter body before the pump pit and the overflow pipework to the existing septic tank system. Overflow was sent to a Disconnector Gully (DG, or trap) – seen in front of the black pump pit - which was also charged by a single hand basin. A DG is required for at least one fixture so that any backup from the sewer or septic tank system can escape and pass outside of the house.

Irrigation area

Lawn 70m² and gardens 30m² = total of 100 m². This was laid out as two separate zones as different dripline was used in each area:

- Tiran dripline was used for the garden areas and trees as it is non pressure-compensating. Each dripper emits 8 L/hr.
- Netafim XR dripline was used for the lawn irrigation, as it is pressure-compensating. Each dripper emits 2 L/hr and is impregnated with a copper compound to prevent root intrusion,

A K-Rain indexing valve was installed to automatically switch from one zone to another each time the pump was activated.

The manifold system used in this case study, shown below, includes a Biomatt filter (L) and KRain switching device (to the R). The Biomatt

traps coarse material, such as hair, which may inadvertently pass through the main filter body and be pumped out.

Cost of installation

Approximately $7,000 which included the complete system, all labour, plumber's charges and power point installation, all irrigation to lawn and garden beds, Council fees and inspection, testing and commissioning, and handover to client.

Approvals process

Approximately three weeks from contract signing to handover. This included a couple of weeks for local government "approval to construct", one day to install the greywater unit with all plumbing and electrics and one day to install the irrigation system, test and commission. Council inspection was arranged for another time and day and handover and training to the clients took place soon after.

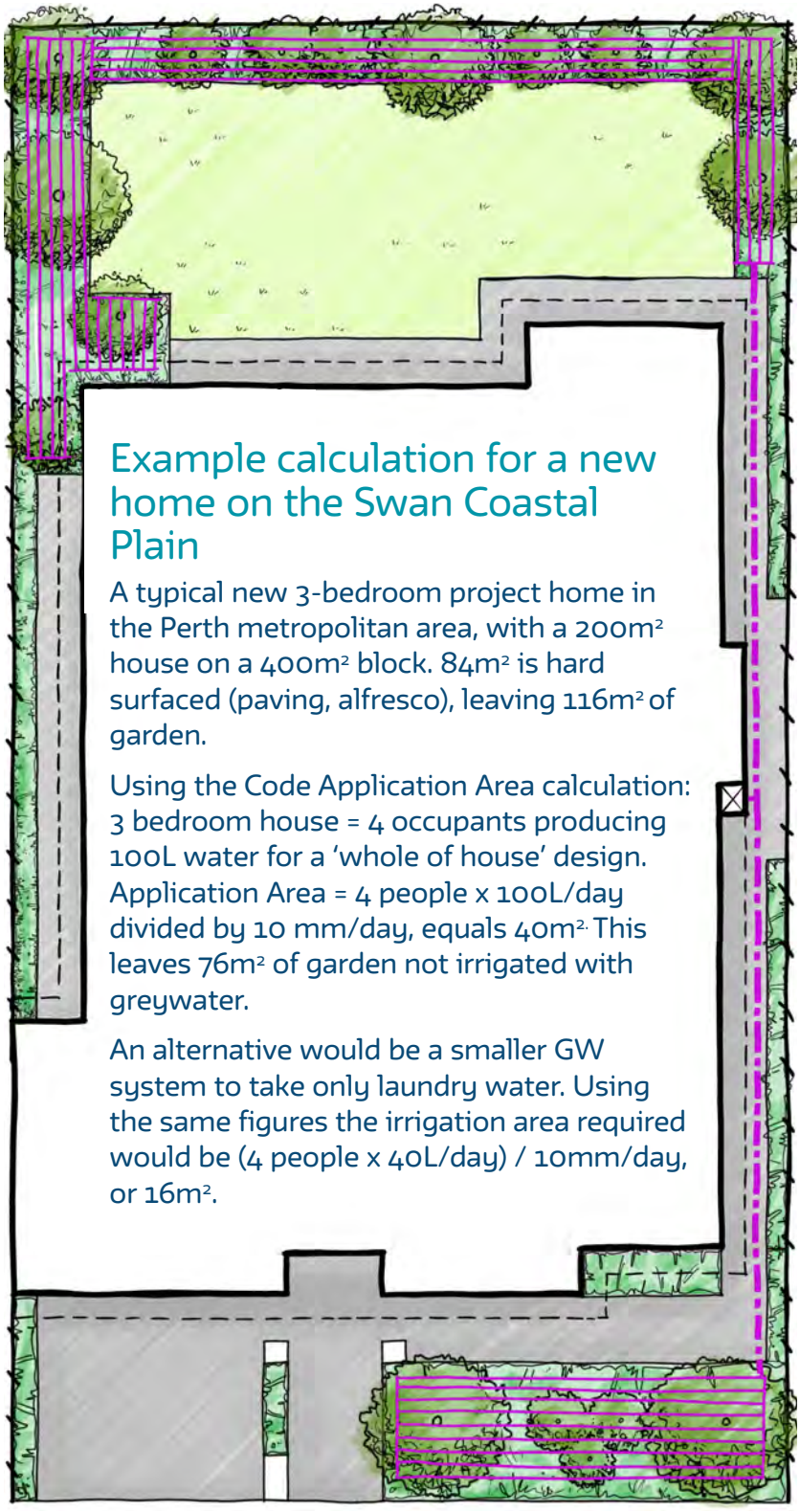
Outcome/Water savings

A family of four occupy this house. Based on the Department of Health allowance of 100L/person/day approximately 400L of greywater could be produced daily, throughout the year on non-rainy days, as system is switched off during rainy periods. Bureau of Meteorology (2019) state Perth receives an average of 80 days of rain, therefore maximum greywater produced (400L x 285 days) is approximately 114,000L (114kL) annually.

The filter body is protected by a large valve box (with purple cover) and the lid for the pump pit is foot trafficable.

5.4. New home

The current residential trend in the Perth and Peel region is for smaller lots with larger dwellings and smaller gardens, making it harder to comply with regulations for the use of untreated greywater. A greywater professional should be engaged to provide advice on a greywater system for the proposed new build and utilise the *Residential Greywater-Ready Plumbing Guidelines* (JBA, 2013).



Example calculation for a new home on the Swan Coastal Plain

A typical new 3-bedroom project home in the Perth metropolitan area, with a 200m² house on a 400m² block. 84m² is hard surfaced (paving, alfresco), leaving 116m² of garden.

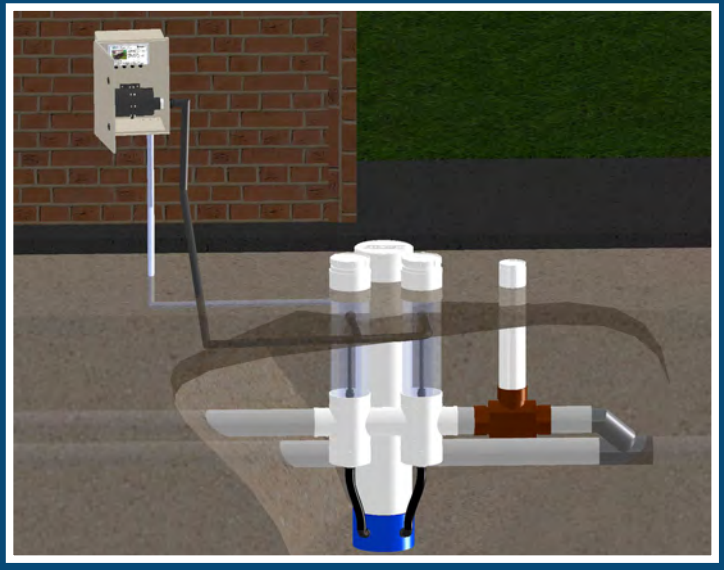
Using the Code Application Area calculation: 3 bedroom house = 4 occupants producing 100L water for a 'whole of house' design. Application Area = 4 people x 100L/day divided by 10 mm/day, equals 40m². This leaves 76m² of garden not irrigated with greywater.

An alternative would be a smaller GW system to take only laundry water. Using the same figures the irrigation area required would be (4 people x 40L/day) / 10mm/day, or 16m².

Case study

New dwelling example: Josh's House

A case study in sustainable housing, Josh's House is a 3 bedroom, 2 bathroom family home in the Fremantle suburb of Hilton. Josh's House has a 10 star energy efficiency rating, harvests and recycles water as part of an integrated approach to reduce scheme water demand and has productive garden areas.



System make and model

A direct diversion system called the Grey Flow by Advanced Wastewater Systems was installed. It is a pumped system that has the advantage of an automatic filter back flush device to reduce maintenance. It also has a very practical two-stage installation process which begins with the installation of a sump and dual interceptor unit (referred to as the 'Builder's Kit') as part of the initial drainage plumbing works, followed by the installation of the pump, controls and irrigation at a later stage during landscaping.

Irrigation area

The greywater system is based on an occupancy rate of four people, generating up to 100 litres per day in the bathroom and laundry, that's 400 litres in total per day. Located on the sandy soils of Swan Coastal Plain, greywater is applied at a maximum rate of 10mm of water per day over an area of 40m^2. This area includes fruit trees, shrubs and other ornamental plantings. The greywater is disbursed via purple coloured substrata dripline irrigation, which is installed on the surface of the soil and covered with a 100mm layer of mulch. The dripline has drippers spaced at 300mm intervals along the length and the driplines spaced at 300mm apart. The drippers are high-flow, clog resistant and designed to be self-flushing. The dripline is installed between a supply pipe and a collector pipe. A manual flush valve has been fitted to the collector pipes on each bed to allow for the occasional flushing of the irrigation lines to clear out any muck that may accumulate. A vacuum breaker valve has

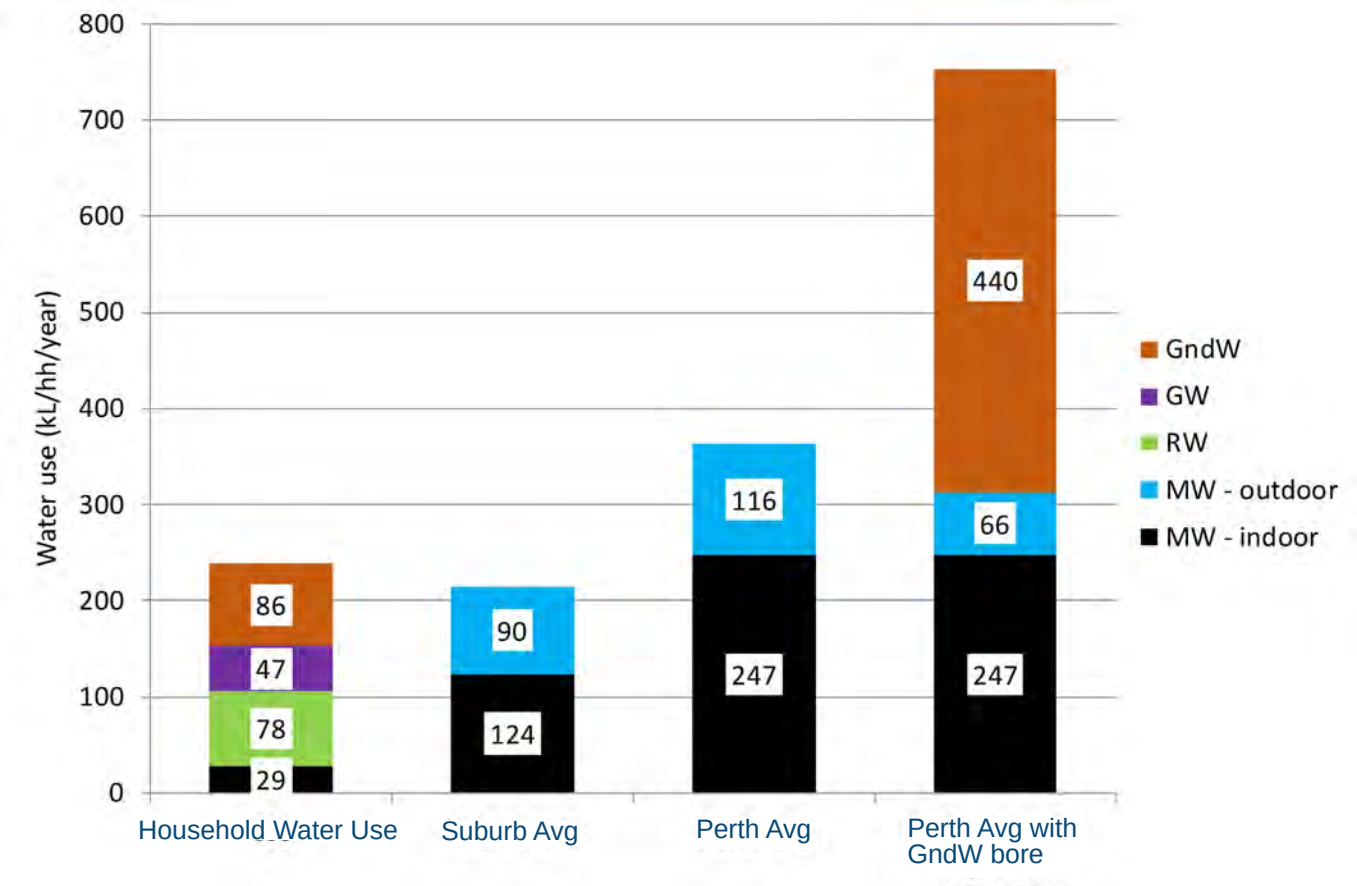
also been included at the highest point of the irrigation line. This allows air to enter through the one-way valve as the water drains out of the line avoiding the potential for dirty water being sucked back through the drippers that can lead to them becoming blocked with grit. Greywater irrigation drip lines are setback from paving, retaining walls, neighbouring properties and buildings to comply with the Code.

Cost of installation

Greywater ready plumbing by builder/ plumber on and above standard single line wastewater drainage, including additional set out requirements, increased drainage line, reflux valve and additional number of vents: $1,550. Grey Flow greywater system stage 1 – 'Builders Kit' (supplied and installed by builder/ plumber): $900. Grey Flow greywater system stage 2 – pump, controls and irrigation (supplied and installed by contractor): $2,500. Local Government approval fees: $200 (rebate offered by City of Fremantle if the system complies with the Code of Practice).

Approvals process

Coordinated with building construction program.



Outcome/Water savings

The alternate water systems installed at Josh's House, including a rainwater tank, bore and greywater, significantly reduce the demand for scheme water, resulting in 92% reduction in scheme water consumption than the average Perth household. Source: Byrne (2017)

5.5. Indicative costs

The table below sets out indicative costs to supply and install various types of greywater reuse systems for a typical home. It includes cost ranges for pumped greywater diversion devices (GDD) and also greywater treatment systems (GTS) for both garden-only and in-house use. Installations outside the Perth metropolitan area may also incur additional costs, for example due to travel and freight charges.

Type	GDD (pumped)	GTS
Purchase Price	$750[6] -2,500[7]	$8,000-10,000
Installation (unit only)[8]	$250-1,000	$1,500-4,000
Install dripline (40-50m)	$750-1,000	N/A as used in-house or to sprinklers
Retrofit plumbing (1-2 fixtures)[9]	$400-1,000	$400-2,000[10]
Greywater-ready plumbing (laundry, new house)	$200-500	See below
Greywater-ready plumbing (whole house, new)	$750-1,500	$750-1,500
LGA fees[11]	$240	$240
Consultancy fees to assess sites and prepare application to council with plans	$100-500	$100-500

6 A smaller system scaled for a laundry or similar
7 A larger system that would handle the whole house
8 Scale of installation costs will vary with unusual soil or ground conditions and the size of the greywater system
9 There are often site-specific factors such as ease of access to the drainage lines on retrofits
10 Additional cost for the GTS is due to the pump and pressure line requirements.
11 Some council waive or reimburse the fee, which is set by State Government.

6. Installation and maintenance

An experienced greywater professional can ensure your system is installed and maintained to the appropriate standard for optimal performance.

6.1. Use an experienced greywater installer

An experienced greywater professional should always be used to design and install a greywater system. Contact details for qualified professionals can be found on the GWIG[12] website.

6.2. Maintenance

All greywater reuse systems require regular maintenance to ensure reliable long-term operation. This maintenance however is less than that required for a residential swimming pool and can be broken down into the component parts of a reuse system - pump, filter/s, irrigation system, landscape (plant and soil health) and diversion to sewer. A partnership between the owner and the installer is the most effective way to maintain a system as the installer can advise on the frequency of inspection and maintenance depending on the design features/technology of the specific unit.

Gloves should be worn when carrying out any maintenance work on a greywater reuse system and avoid contact with sensitive skin. Wash hands with soap and water immediately afterwards.

Pump

The greywater pump requires occasional inspection to ensure it is operating effectively and there are no blockages, which can cause clogging and eventual pump failure.

Filters

The filter at the inlet of the GDD removes a variety of materials that may clog the pump or irrigation system and result in overflow to sewer, wasting greywater.

Depending upon the specific model of GDD installed there may be a coarse primary filter (e.g. sponge, mesh or a screen bag) before the pump to remove hair, lint and gross particles, and a secondary filter (e.g. disc type) after the pump to remove finer particles which could potentially clog the dripline emitters. Instructions on how to clean these filters, and how often, will be described in the operating manual supplied by the manufacturer.

New technologies which incorporate automatic filter back-flushing systems have become available in recent years and reduce the frequency of manual cleaning for the primary filter.

Irrigation system and flushing dripline

Any dripline system must incorporate the ability to flush water through and clean out the

12 https://www.gwig.org/

inside of the pipes by adding flush valves to the downstream end of pipes. This can be done either individually or via a manifold connecting several together.

Air release or vacuum breaker valves release air from the dripline when water enters the pipe, and allow air to freely re-enter the pipe when the water is shut off, thereby preventing a vacuum from being created which can suck debris back into the drippers.

Both the vacuum breakers and flush valves should be periodically inspected when the system is running to ensure they are operational. They can also be readily opened and visually inspected, removed and cleaned out, or parts replaced, as required. Knowing where these valves are located in an established garden by means of an 'as-constructed' diagram can help with ongoing maintenance.

The dripline should be periodically inspected for leaks and clogged drippers, with any exposed dripline re-covered with mulch to a depth of 100mm. Signs of damage or faulty dripline include water spraying from breaks in the line, water logging of the ground, excessively green vegetation and or dry/desiccated vegetation.

Soil and plant health inspection

Periodic inspection of plant and soil health is recommended and soil and leaf tissue analysed if there are concerns. There is limited data on any long-term impact resulting from the regular application of greywater to sandy soils. By the end of the summer some plants may show signs that the increased alkalinity from irrigation with greywater is limiting their uptake of essential trace elements, evident by yellowing of leaves and other symptoms related to chlorosis. Using detergents designed for greywater application (refer Section 7) and switching off systems to 'rest' the soil when irrigation isn't necessary is the best way to minimise negative impacts on soil health.

Diversion to sewer

The ability to divert greywater to the primary sewerage system is mandatory to divert low-quality water away from the garden or to avoid over-watering during winter. A full system flush is recommended at either the start or end of winter. This is achieved by opening the manual flush valves and running higher pressure scheme water through the entire irrigation network until lines run clear.

Scheme water top-up

A scheme water top-up may be required for garden irrigation when the dwelling is unoccupied.

7. Water quality

One of the most common concerns with a greywater system is the quality of greywater. This depends on what products (detergents, shampoos, cleaning products) are used inside the home.

7.1. Water quality

As greywater is water from the shower and bath, basins and washing machine it may contain soap, hair, lint, grease and household cleaning products. Despite this, it is still a suitable and beneficial source of water for irrigation. Greywater cannot be stored for later use.

A greywater system must include the ability to easily turn off the discharge into the irrigation system, so that water with low microbiological quality (e.g. from washing nappies or if someone is sick), or high levels of chemicals (e.g. from solvents or harsh cleaning chemicals) flows straight to sewer. This is normally done by switching off the pump or by manually opening the diverter valve (depending on the system).

7.2. Product selection

Residents with a greywater system should always use "eco", "garden-friendly" or "greywater-friendly" products that are biodegradable and low in salts and phosphorus. There has been an increase in the availability of these products, partly due to the removal of phosphorus from detergents. Using greywater-friendly shampoos, soaps and detergents minimises the potential negative impact that greywater can have on some plant species and soil types.

7.3. Chemicals in the water

Alkalinity and dissolved salts

Soaps and detergents are highly alkaline (i.e. pH is >10), to help dissolve dirt and grease. Most plants prefer a more neutral pH of between 6 and 7. As salts, typically including sodium but also calcium and magnesium, build up in the soil profile there is a loss of permeability and the ability to absorb water. This is more problematic with heavy soils (loam and clay) rather than free draining (sandy) soils. Regardless of your soil type, the following considerations can help minimise issues related to pH and salt accumulation.

- Powdered detergents generally contain the most salt as it is used as a 'builder' or 'filler' to carry the active ingredients. Concentrated powders contain less, and liquid detergents the least.
- The potential impact depends on the amount used. To avoid overload don't use more detergent than necessary for the size of the wash and hardness of the water. You may be able to reduce the amount used by 50% for lightly soiled loads and get the same results.
- Turning the system off in the winter (i.e. diverting the water to the overflow and sewer) gives the soil a rest and allows rainwater to naturally flush out any salt build up.
- Increasing the amount of organic matter in the soil, such as using compost, can buffer pH change and improve soil health.

Nutrients

Phosphorus and Nitrogen are nutrients essential to plant growth. However, their presence in wastewater and also in garden runoff from excessive domestic application of fertiliser, contributes to high nutrient levels in rivers. The use of phosphates in both powdered and liquid laundry detergent has been banned in Australia since 2014, although they are still used

in dishwasher detergent. A range of other more benign ingredients such as sodium citrate is now used to replace phosphorus. Look for 'NP' on the label to show that the pack contains "No Phosphorus".

Bleaches and disinfectants

Avoid running bleaches and disinfectants through a greywater system and onto your garden as these kill beneficial soil micro-organisms. Always divert greywater to sewer when using these types of products.

Other contaminants

Fats and oils, as well as paints, can cause clogging and reduce soil permeability so avoid running these through a greywater system.

7.4. Water quality and plant health

The greywater irrigation system needs to accommodate existing plants and vegetation for retrofit situations, and new plantings for new homes. An experienced greywater professional can provide advice at the design stage to ensure a successful outcome.

Periodic inspection of the health of plants and soil receiving greywater is always good practice and should be part of a maintenance regime. This is particularly important for some Western Australian natives species which might be phosphorus-sensitive, such as members of the Proteaceae family (e.g. Banksias, Grevilleas and Hakeas).

8. Suitability for regional areas

Different climates and soil types need to be considered when designing greywater reuse systems in regional areas. For example, in northern WA, water use for garden irrigation can be much higher than in the Perth metropolitan area (Water Corporation, 2010), and so the potential benefits from greywater reuse are also greater. Some of the most important factors for consideration are outlined here.

8.1. Climate

Many areas of WA experience low and inconsistent rainfall, as well as high levels of evapotranspiration resulting in a higher water demand for plant survival than in Perth. While there is greater potential to make scheme water savings, any greywater reuse system must be designed with particular attention to meeting plant water requirements.

8.2. Soil type and permeability assessment

While the Swan Coastal Plain predominantly comprises highly permeable sands, regional areas in the state tend to be much less sandy and contain varying amounts of clay. The percentage of clay is described by the degree of reactivity (swelling/contracting) and also impacts the soil's permeability. In addition, clay soils are structurally affected by both pH and the amount of salts in any applied water.

The local scheme water supply in some regional areas, particularly where it is sourced from groundwater, can also contain elevated concentrations of dissolved minerals (salts). This is exacerbated in hot and dry climates as salts can build up in the soil over time due to evaporation which requires occasional flushing with fresh water to reduce this effect.

A correct assessment of the soil type and its permeability by a greywater professional in accordance with the relevant *Australian Standard* (AS/NZS 1547:2012) will ensure that the greywater irrigation area is correctly sized for the available water.

8.3. Management

Over the longer term, management is the key to successful greywater reuse in regional areas:

- Use low salt detergents and other household products.
- Regularly apply soil conditioner and mulch to the irrigation area to increase humus content and to improve / maintain soil structure and permeability as well as buffer pH.
- Design the garden and greywater irrigation system to allow for zones of the garden to be rested from greywater application.
- Select salt and alkaline tolerant plant species for landscaping.
- Consider diverting laundry greywater (which is typically the most concentrated) directly to sewer so that only greywater from the shower and bathroom enters the greywater re-use system.
- Consider increased setbacks from the building beyond the recommended 0.5 metre limit for delivery of the greywater via sub-surface/strata irrigation.

9. Greywater in planning and design

This section is intended for architects, builders and consultants seeking to include greywater reuse specifications or design guidelines in a project.

The following text provides a brief description of greywater requirements (mandatory or recommended) for inclusion in design guidelines. Pertinent notes regarding responsibilities are provided in *italics*:

Install greywater-ready plumbing

Install greywater-ready sanitary drainage plumbing as described in the *Residential Greywater-Ready Plumbing Guidelines* (JBA, 2013) to allow for the future connection of a greywater reuse system as an alternative water source.

When installing the greywater-ready plumbing also consider the greywater reuse system location, power supply, greywater irrigation top-up water source and any routing of greywater irrigation to minimise site disturbance during installation.

Note: *The term greywater-ready refers to the installation of separate sanitary plumbing that collects greywater from sources suitable for greywater reuse, separate from all the other wastewater sources.*

Installation of greywater-ready plumbing does not require approval from the Local Government's Environmental Health Officer (EHO).

Approved greywater reuse units

Only approved Greywater Diversion Devices (GDD's) listed by the Department of Health (2016) are permitted to be installed.

Installation of greywater reuse units

Greywater Diversion Devices (GDD's) must be connected to the sewer by a licensed plumber in accordance with the manufacturer's specifications and the Department of Health (2010) *Code of Practice for the Reuse of Greywater in Western Australia.*

Note: *Drip irrigation for greywater reuse does not need to be installed by a licensed plumber.*

Approval to install a GDD is required from the Local Government's Environmental Health Officer (EHO) prior to installation. Where a Greywater Treatment System (GTS) is to be installed, the unit will also require commissioning before final approval from the EHO is issued.

Landscape and irrigation

Greywater is to be dispersed via sub-surface/strata irrigation below a minimum of 100mm of soil or mulch respectively. Drip irrigation specifically designed for greywater irrigation should be installed by an experienced greywater professional.

Note: *More details on the regulatory requirements for installing greywater sub-surface/strata, including calculating irrigation areas, required setbacks, soil and site assessment criteria are available in the Department of Health (2010) "Code of Practice for the Reuse of Greywater in Western Australia". Alternatively, a greywater professional can advise on system implementation to comply with these regulations.*

10. References and resources

Australian Water Association (2018). Water Corporation expands Perth wastewater treatment plant capacity. Water Source. https://watersource.awa.asn.au/business/assets-and-operations/water-corporation-expands-perth-wastewater-treatment-plant-capacity/ (Accessed 26/3/2019).

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Water Corporation (2010). Perth Residential Water Use Study 2008-2009.

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Additional information

- The Greywater & Wastewater Industry Group (https://www.gwig.org/) (refer to GWIG website for access to resources and greywater professionals).
- AS/NZS 1547 On-site Domestic Wastewater Management (Standards Australia, 2012)
- AS/NZS 3500 Plumbing and Drainage Parts 1 – 4 (Standards Australia, 2018), specifically:
  - AS/NZS 3500.1 Plumbing and Drainage Part 1: Water services (Standards Australia, 2018)
  - AS/NZS 3500.2: Plumbing and drainage Part 2: Sanitary plumbing and drainage (Standards Australia, 2018)
- ATS 5200 Technical Specification for Plumbing and Drainage Products – Procedures for Certification of Plumbing and Drainage Products (Australian Building Codes Board, 2013)
- ATS 5200:460 Technical Specification for Plumbing and Drainage Products – Greywater Diversion Device (American National Standards Institute, 2005)
- HB 326 – 2008, Urban Greywater Installation Handbook for Single Households (Standards Australia, 2008)

11. Appendix

- Fact Sheet 1 - What is a greywater system?
- Fact Sheet 2 - Is greywater suitable for my property?
- Fact Sheet 3 - How should I use greywater in my garden?
- Fact Sheet 4 - Greywater is safe

WATER
CORPORATION

Fact sheet 1

What is a greywater system?

Gwig
Greywater and Wastewater Industry Group

WATER CORPORATION

What is a greywater system?

Greywater is a type of wastewater from washing machines, showers, baths, wash basins, spa baths, laundry tubs, and kitchens. Blackwater is the wastewater from toilets, urinals or bidets.

Greywater from the laundry and bathroom can be diverted to the garden via simple, low cost technology to provide an alternative water source to reduce scheme water demand and meet garden irrigation requirements without restrictions. Kitchen greywater must be treated before reuse in gardens as it can contain elevated levels of greases, oil and detergents. With additional treatment, greywater can also be used for flushing toilets and washing clothes.

Methods of greywater reuse

Three different methods of greywater reuse are approved for use in Western Australia. These include:

1. Manual bucketing

A bucket can be used to manually collect shower and laundry water for reuse. As water volumes are likely to be low there are no restrictions on the collection of greywater in a bucket to be used for irrigation or reuse indoors (e.g. for toilet flushing).

2. Diversion straight onto the garden

A Greywater Diversion Device (GDD) typically diverts greywater without storage or treatment to the garden via sub-surface irrigation or diverts greywater to the sewer. There are two types of GDD: a Gravity GDD where there is a slope downwards from the house to the garden; and a Pumped GDD where the garden is uphill or area too flat for a gravity system to work. GDDs must have a WaterMark Licence, which demonstrates compliance with the Australian Technical Specification ATS5200.

3. Treatment systems

A Greywater Treatment System (GTS) provides a level of treatment so that water can also be used through above-ground sprinklers in addition to non-potable applications such as toilet flushing and cold water laundry.

Details on Department of Health approved GDD and GTS can be found via the GWIG website[1]. Conditions of approval may vary depending on the design.

Code of Practice

The *'Code of Practice for the Reuse of Greywater in Western Australia'* (latest edition 2010) published by the Department of Health sets out the regulatory requirements for the safe and environmentally-friendly reuse of greywater in Western Australia.

All greywater systems should be installed by an experienced greywater professional to ensure the system is compliant with the Code and relevant plumbing regulations and guidelines.

[1]https://www.gwig.org/

Fact sheet 2

Is greywater suitable for my property?

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Is greywater suitable for my property?

Answering a few key questions can help to determine whether installing a greywater system is feasible. In particular, whether you have an existing home or are building a new home, the size of your house and garden, your budget and whether you have sought professional advice.

Using greywater for irrigation is generally feasible as one of the water-saving strategies adopted for a new home. If you are looking to install a greywater system in an existing home please refer to the information and case studies in the West Australian Greywater Guide for details on how to best proceed.

Greywater suitability 9 point checklist		
Is the garden large enough to make a system worthwhile?		
1	A 'whole of house' greywater system includes baths, showers, laundry: allow for a minimum garden area of 10m² per person for sandy coastal plain, or minimum 20m² in areas with less permeable soils.	
2	Laundry only: allow a minimum 4m² per person in coastal plain or 8m² elsewhere.	
3	"Garden areas" means trees, shrubs, garden beds and small lawns but not paving or the verge.	
Is it within your budget?		
4	Check Department of Health approved systems and cost estimates.	
5	All-up, a typical whole-of-house system should be around $5000 including irrigation.	
6	Your builder will add a cost for additional pipework.	
Do you have enough time to plan and implement a system?		
7	All greywater systems need to be considered at the design stage for new houses.	
8	Pipework separating greywater from other wastewater sources must be designed and laid before the concrete floor slab goes down.	
Get some advice		
9	An experienced greywater professional can design a system that is practicable, site specific and complies with the "Code of Practice" (Department of Health, 2010).	

Fact sheet 3

How should I use greywater in my garden?

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How should I use greywater in my garden?

The reuse of greywater for irrigation requires consideration of the following variables:

- Local context: climate, soil, garden type and composition, new home, old home, occupants.
- Calculation of greywater volumes and design irrigation rate to determine required application area.
- Greywater dispersal areas in the garden/ lawn and irrigation requirements.

Once these have been assessed by a greywater professional[1] an irrigation system can be designed that is best suited for the specific site and also matches vegetation requirements for volume and distribution. If the system is designed correctly then everything else should be accounted for.

Calculation of greywater application area

A simple calculation is used to determine the area required for greywater dispersal.

Application area calculation

Application Area required (m^2)

=

$$\frac{\text{Expected greywater volume (L/day)}}{\text{Design Irrigation Rate (mm/day)}}$$

Expected greywater volume per day is determined by the number of bedrooms in the property (maximum likely number of occupants: bedroom 1=2 people; all other bedrooms = 1 person) multiplied by a fixed amount of greywater produced by each occupant daily in both the laundry (40L/person/day) and bathroom (60L/person/day) (based on AS/NZS 1547:2000).

Design Irrigation Rate (DIR) is determined based on soil type. Sandy soils of the Swan Coastal Plain have a DIR of 10mm/day and heavy clay soils have a DIR of 2mm/day.

Generally, if the available garden area is greater than the application area required then a greywater system will be approved by local government.

Irrigation

The unique context of the Swan Coastal Plain requires an expert with a local appreciation of irrigation for ultimate success of a greywater system. Components of irrigation design include: pump sizing and specification, layout, soil and plant assessment, and maintenance requirements.

Greywater is ideally suited to the irrigation of trees, shrubs and garden beds with dripline buried beneath 100mm of mulch, or in deeper pipes or trenches. Greywater system manufacturers may make specific recommendations for the design of an irrigation system to ensure adequate performance given flow rates of the specific pump used, including: type of dripline, length of dripline between supply and flush and total length of dripline in irrigation area.

The dripline suited to greywater (large emitter orifice) can be used with scheme water, but the opposite is not true due to the smaller sized aperture of the drippers being prone to clogging.

If the ground is already moist from rain it may not need irrigating. As with scheme irrigation, turn the greywater system off in winter and restart it as the weather warms up.

[1]https://www.gwig.org/

Fact sheet 4

Greywater is safe.

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Greywater is safe.

Always use a professional installer with greywater experience.

An experienced greywater professional should always be used to design and install a greywater system. GWIG can provide details of qualified greywater professionals.

How to maintain pump and dripline

A reliable and effective greywater system depends on maintenance and protection of:

- The pump against clogging due to debris in the greywater – typically hair and lint, but also other solids washed down the drain.
- The dripline, to ensure solids don't enter and clog the emitters (drippers) - either suspended in the stream of pumped water or sucked in from the surrounding soil.

Maintenance is most effective when undertaken in partnership between the owner and the installer. The installer can advise on the frequency of inspection and maintenance depending on the components of the specific unit.

Soil and plant health inspection

The nutrient content of greywater, primarily nitrogen and phosphorus, can benefit many garden plants growing in Western Australia's nutrient depleted soils. Plants and soil should be regularly inspected to ensure there are no signs of deterioration from use of greywater.

Diversion to sewer

A greywater system must be able to divert to the sewerage system to ensure low quality water is not used on the garden or to avoid over-watering during winter.

Water quality and household product selection

Greywater is water from the shower and bath, basins and washing machine and may contain soap, hair, lint and household cleaning products. Despite this, it is still a suitable source of water for irrigation. It is important to ensure the greywater system is switched off and flows to the sewer, not the garden, when washing nappies, if someone is sick and when high levels of chemicals are being used.

Residents with a greywater system should always use "eco", "garden-friendly" or "greywater friendly" products that are biodegradable and also low in salts and phosphorus. Bleaches, disinfectants and strong chemicals should not be used as they kill beneficial soil micro-organisms. Using greywater-friendly products minimises the potential negative impact that greywater can have on some plant species, in particular to some WA native species, and soil types. Periodic inspection of the health of plants and soil receiving greywater is always good practice and should be part of a maintenance regime.

Certain elements in greywater can cause problems, such as having high levels of alkalinity from soaps and detergents and using products containing Phosphorus and Nitrogen. Using the correct amount of liquid detergents containing no phosphorus, turning off the greywater system in winter and increasing soil organic matter can combat issues caused by high alkalinity and Phosphorus.