BRANZ

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RESIDENTIAL GREYWATER SYSTEMS

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- Certain types of wastewater from households (greywater from baths, showers and bathroom basins and sometimes from laundry tubs and washing machines) can be reused for subsurface garden irrigation and flushing toilets.
- There are proprietary greywater reuse systems available in New Zealand. Greywater systems are not normally designed from scratch because of potential health and regulatory issues.
- Check with local and regional authorities before installing a system at a dwelling, as requirements for these systems vary across the country. Greywater systems must be installed by a certifying drainlayer.

1 INTRODUCTION

1.0.1 Greywater – the wastewater from laundry and bathroom basins, showers, baths and sometimes washing machines – can usually be reused for subsurface garden irrigation and flushing toilets.

1.0.2 Greywater reuse systems operate differently from rainwater collection systems as the water is wastewater and must be managed differently. Most systems use the water immediately or within 24 hours. Untreated greywater should not be stored for any longer. Treatment systems are available, depending on the intended water use and the required water quality.

1.0.3 Greywater is primarily used for watering the garden or irrigating land. Treated greywater is used for flushing toilets. Greywater must not be used as a potable source of water (for drinking, cooking, food preparation or mouth hygiene) or for washing, bathing or swimming.

1.0.4 The benefits of reusing greywater include:

- less reliance on mains water supply and a reduced volume of wastewater entering the sewer system
- reduced demand on the water supply network
- savings for houses with water meters
- increased resilience for homes during droughts, emergencies, natural disasters and local water restrictions
- for households relying completely on rainwater, reusing greywater means tank water is saved for potable needs
- more-efficient use of water as a natural resource at a national level.

2 GENERAL REQUIREMENTS

2.0.1 There are no specific national guidelines or legislation covering greywater reuse from end to end.

2.0.2 Requirements covering the installation (and operation) of on-site wastewater systems are enforced by local territorial authorities. Rules covering the discharge of water into the general environment are managed by regional councils.

2.0.3 The installation of greywater systems is not covered directly by a single Building Code compliance document. The Building Code has specific requirements for systems managing wastewater (foulwater). Applications to install a greywater system must be given building consent as an Alternative Solution by the local building authority, which may have specific requirements. Some local councils promote the reuse of greywater, some may restrict the reuse of certain types of greywater in their area and some may not currently have a policy for greywater reuse.

2.0.4 A resource consent may be needed to allow greywater discharge for irrigation onto the property or into the wider environment. Some regional councils may set conditions or prohibit the discharge of untreated wastewater. Some may not have any set rules for greywater discharge.

2.0.5 If considering installing a greywater system, always consult with local and regional authorities at the outset.

2.1 GREYWATER SYSTEMS

2.1.1 Systems handling greywater must meet the relevant requirements of Building Code clauses G12 *Water supplies* and G13 *Foul water* and associated Acceptable Solutions and Verification Methods. AS/NZS 3500.2.2021 *Plumbing and drainage – Part 2: Sanitary plumbing and drainage* section 7 specifies requirements for the installation of greywater plumbing and drainage.

2.1.2 All pipework must be adequate to carry the water through the system while avoiding the likelihood of blocking and of leaking in areas where the water is not intended for use. The system must not allow foul air to build up or enter the home.

2.1.3 Any pipes underground must be built and installed to avoid the penetration of plant roots or groundwater. They must be able to withstand any loads and normal ground movement.

2.1.4 Reasonable access must be provided for easy cleaning, maintenance and clearing blockages.

2.2 WATER SUPPLIES INTO HOMES

2.2.1 Treated greywater can be used for flushing toilets in the home.

2.2.2 New Zealand Building Code clause G12 *Water supplies* stipulates that all buildings with water outlets and toilet facilities must have safe water supplies.

2.2.3 Greywater piped into the home for flushing toilets must:

- be supplied at adequate flow rates so that the toilets operate correctly
- provide reasonable access for maintenance so that its components can be isolated for testing and maintenance
- not leak
- be clearly marked as non-potable.

2.2.4 Where a non-potable water supply is installed in or outside a home, it must be installed and clearly labelled as non-potable in line with AS/NZS 3500.1.2001 *Plumbing and drainage – Part 1: Water services* sections 9.6 and 9.7, Acceptable Solution G12/AS1 section 4 and NZS 5807:1980 *Code of practice for industrial identification by colour, wording, or other coding* Part 2. Lilac-coloured piping indicates a non-potable supply.

2.2.5 All private water supplies must be designed so there is no risk of contaminating mains water with other water sources or mixing potable and non-potable water supplies. They must be installed by a certifying plumber.

2.2.6 The plumbing and drainage must be designed so that sewage/blackwater cannot enter the greywater system or any associated treatment system.

2.3 IRRIGATION AND DISPOSAL OF WATER

2.3.1 Greywater collection systems must avoid contaminating local supplies of potable water, soils, groundwater, waterways and kai moana or shellfish-gathering areas.

2.3.2 If planning to use the system for irrigation, always check with the local and regional authorities for any restrictions on the distribution of greywater, such as maximum allowed discharge rate and minimum distance of discharge from a boundary, waterway, wells, bores and tidal areas or the sea. Greywater discharge may be restricted in areas where kai moana or kai awa are traditionally collected.

2.3.3 Check that the local soils are suitable for irrigation. Clay soils will tend to hold the water and may pond. Untreated, ponded greywater can contaminate the soil and present a health risk as it contains chemicals and bacteria.

2.3.4 Excess greywater (for example, when the area of land irrigated by the system is overloaded by heavy rainfall or surface flooding) or unwanted greywater (if the household wastewater contains something undesirable) can be diverted into the sewer or an on-site blackwater treatment system. If connected to a sewer, the connection must not damage the sewer and must be connected in a manner approved by the utility supplier.

3 SPECIFICATIONS

3.0.1 Greywater reuse systems operate differently from rainwater collection systems because the water is wastewater and is managed differently. Most systems use the water immediately or within 24 hours.

3.0.2 The water collected for reuse is generally from bathroom handbasins, showers, baths and sometimes laundry tubs and washing machines. The wastewater from kitchen sinks and dishwashers is not collected or reused as it can contain fat, grease and oils, harsh cleaning chemicals, high levels of sodium from some detergents and *Campylobacter* bacteria from raw meat.

3.0.3 Most greywater systems have the following components (Figures 1 and 2):

- A manual or electronic diverter so that the household can choose whether to divert water to the greywater system or to the sewer via a disconnector gully trap with a grating.
- Pipework that runs the greywater by gravity into a surge tank. This collects the outpouring of water and then controls how it is delivered for use. (The simplest systems divert wastewater directly into the garden for irrigation without a surge tank.)
- Water supply from the surge tank driven by gravity or pump (a submersible pump that pumps the greywater automatically once it enters the surge tank).
- Access to treat the system to control unwanted bacteria and other micro-organisms.

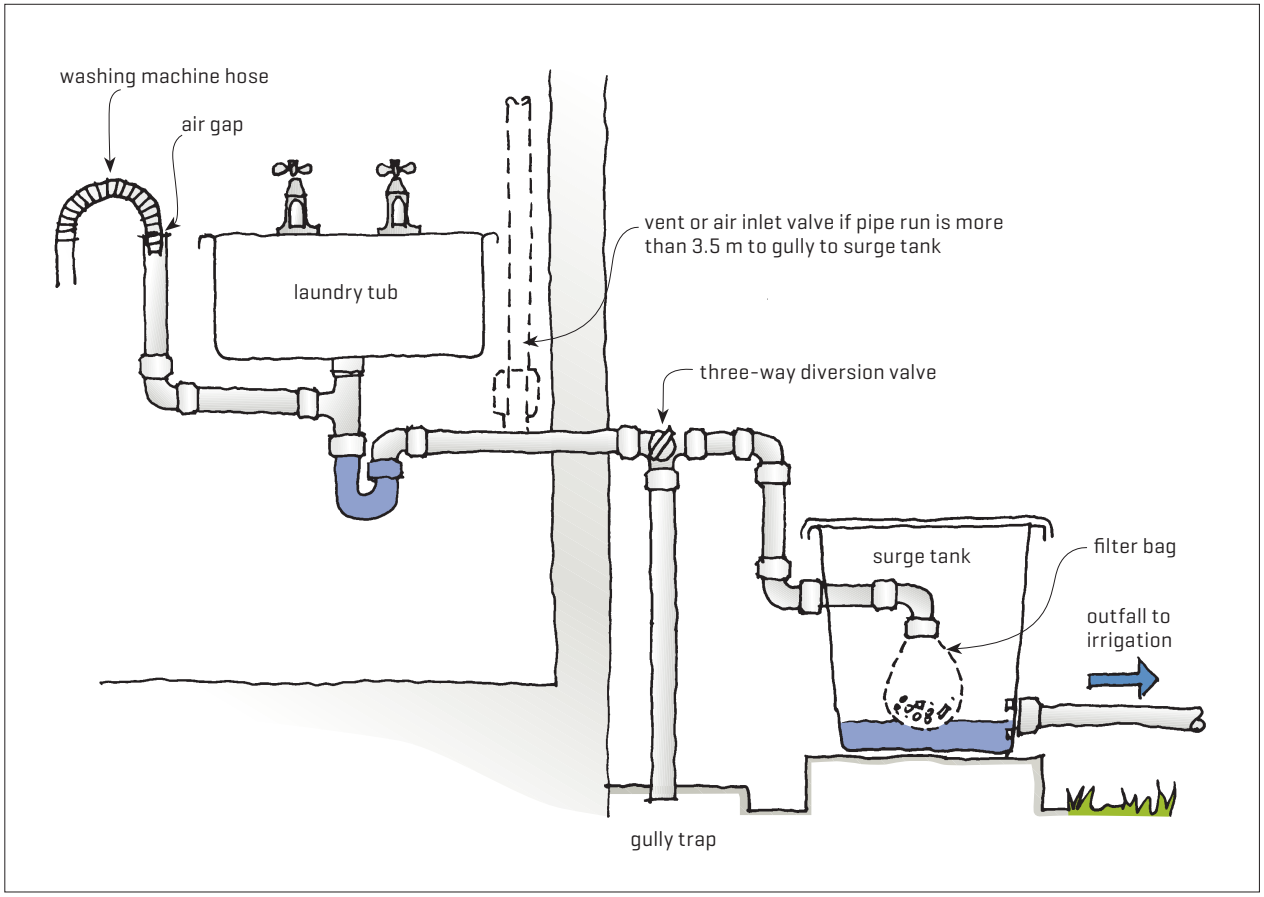

Figure 1. Diversion of water from a washing machine and laundry tub for gravity-fed irrigation. Gravity diversion systems can be installed when there is sufficient fall between the surge tank and the irrigation system.

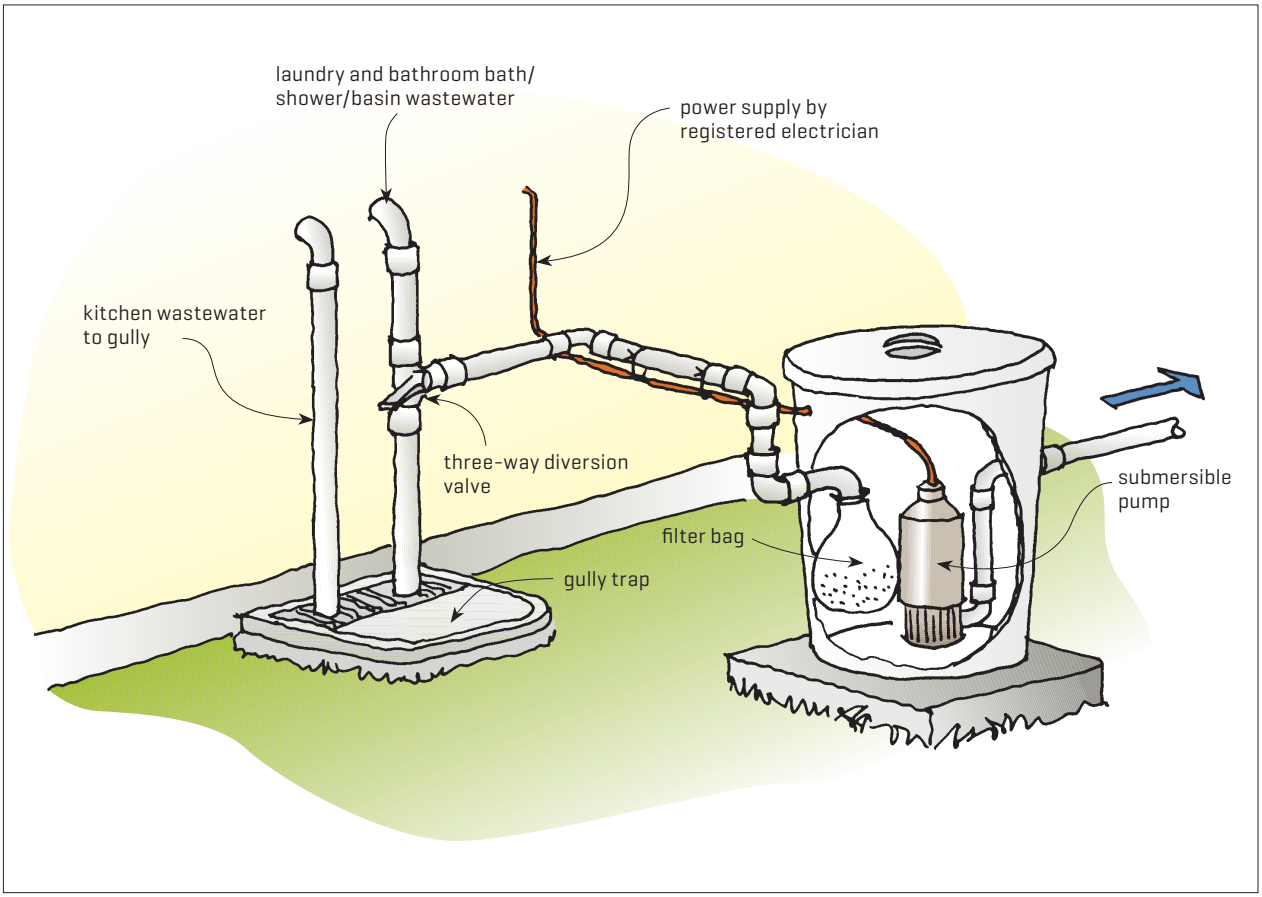

Figure 2. In this system, a submersible pump moves the water on from the surge tank.

- Filtering to remove solids, such as lint and hair, to reduce the likelihood of the system clogging.
- An approved place to use the water (irrigation or for flushing toilets).
- An overflow to the sewer or an on-site blackwater system (with protection from sewage surcharge by installing a reflux valve).

3.0.4 More-complex systems may include biological and/or chemical water treatment so that the water can be stored for later use or indoors for flushing toilets. Storing untreated greywater is not recommended. The water will become foul quickly, bacteria will multiply to high levels and the system will likely become a health hazard.

3.0.5 There are many proprietary greywater systems available in New Zealand. Their manufacturers usually recommend what their systems can and cannot be used for. Using a proprietary system is recommended because of the potential health and regulatory issues.

3.0.6 Greywater systems are not normally designed from scratch.

3.0.7 Choose an appropriate system for the household. This will depend on:

- the amount and source of greywater (the volume of greywater produced by a typical household is 100–200 litres per day but is variable)
- what it will be used for (irrigation and/or flushing toilets)
- the size of the site.

3.0.8 The system itself should be maintained and treated regularly. Systems with automatic disinfection are generally more effective than those requiring action from the householder, such as adding chlorine every day.

3.0.9 Where there is also a rainwater collection system installed, rainwater is a preferred option for toilet flushing because it is cleaner.

3.0.10 The whole system must be securely sealed and vermin-proof.

3.0.11 AS/NZS 3500.2:2021 section 7.4 specifies that all pipework greater than DN 80 connected to a diversion device of a greywater treatment system be marked 'GREYWATER' every metre or less.

3.0.12 Recent BRANZ research into the level of microbes found in greywater recommends that greywater from showers is treated before use.

4 PIPEWORK TO THE SURGE TANK

4.0.1 Plumbing in new houses can be installed to allow greywater separation. Suitable plumbing can also be added during major renovations of some houses. The type of ground-floor construction will affect the plumbing arrangement and layout from the house to the surge tank.

4.0.2 Suspended timber floors allow a greater fall for wastepipes and flexibility in pipe arrangement and allow for future changes.

4.0.3 Pipe layouts are fixed in concrete floors. They are almost impossible to alter and may restrict the options for a greywater system installed subsequently.

4.0.4 A three-way valve between the point of collection and the surge tank is standard (Figures 1 and 2). It allows the occupants to divert the water to the wastewater drain if there is something in it that house occupants do not want to go into the greywater system or garden. Some proprietary systems divert greywater to waste automatically – for example, if a sensor detects there is already enough water in the garden.

4.0.5 The surge tank holds the surge of greywater but does not store it for any length of time. The surge tank should be vented and have an overflow with a trap that discharges directly into the sewer or on-site blackwater treatment plant. It should be sealed and vermin-proof.

4.0.6 For systems using pumps, the surge tank can be partially or completely below ground. Ensure that the difference in height between the discharge and the pump will not overwhelm the pump (less than 300 mm is recommended). Discharge into a 40 mm open pipe to avoid the possibility of water being siphoned back from the pump chamber or surge tank.

5 FILTERING THE GREYWATER

5.0.1 Any solid matter in the water, such as lint and hair, should be managed.

5.0.2 The greywater can be filtered to remove solid matter before it reaches the surge tank. This will reduce the likelihood of clogging further downstream. The inlet to the surge tank should have a filter, which can be as simple as a muslin bag.

5.0.3 Alternatively, for systems for irrigation, filtering can be managed further down the system (Figure 3) or design the system so that any solid matter can travel end to end by specifying larger pipes with outfalls into mulch basins.

6 GREYWATER FOR IRRIGATION

6.0.1 Greywater that has not been disinfected will contain bacteria. This water can be used for irrigation, but it is important to minimise any health risks while using it by:

- ensuring it does not pond on the surface
- irrigating beneath the surface using soakaways – do not apply the water with sprays or sprinklers
- avoiding greywater irrigation on vegetables – it is suitable for shrubs, flowers and trees, including fruit trees
- keeping children's play equipment or areas away from irrigation areas.

6.0.2 Greywater can contain chemicals from cleaning products, detergents, medicines and bleaches. These can contaminate the soil and kill plants. The water also tends to be strongly alkaline and will not be suitable for

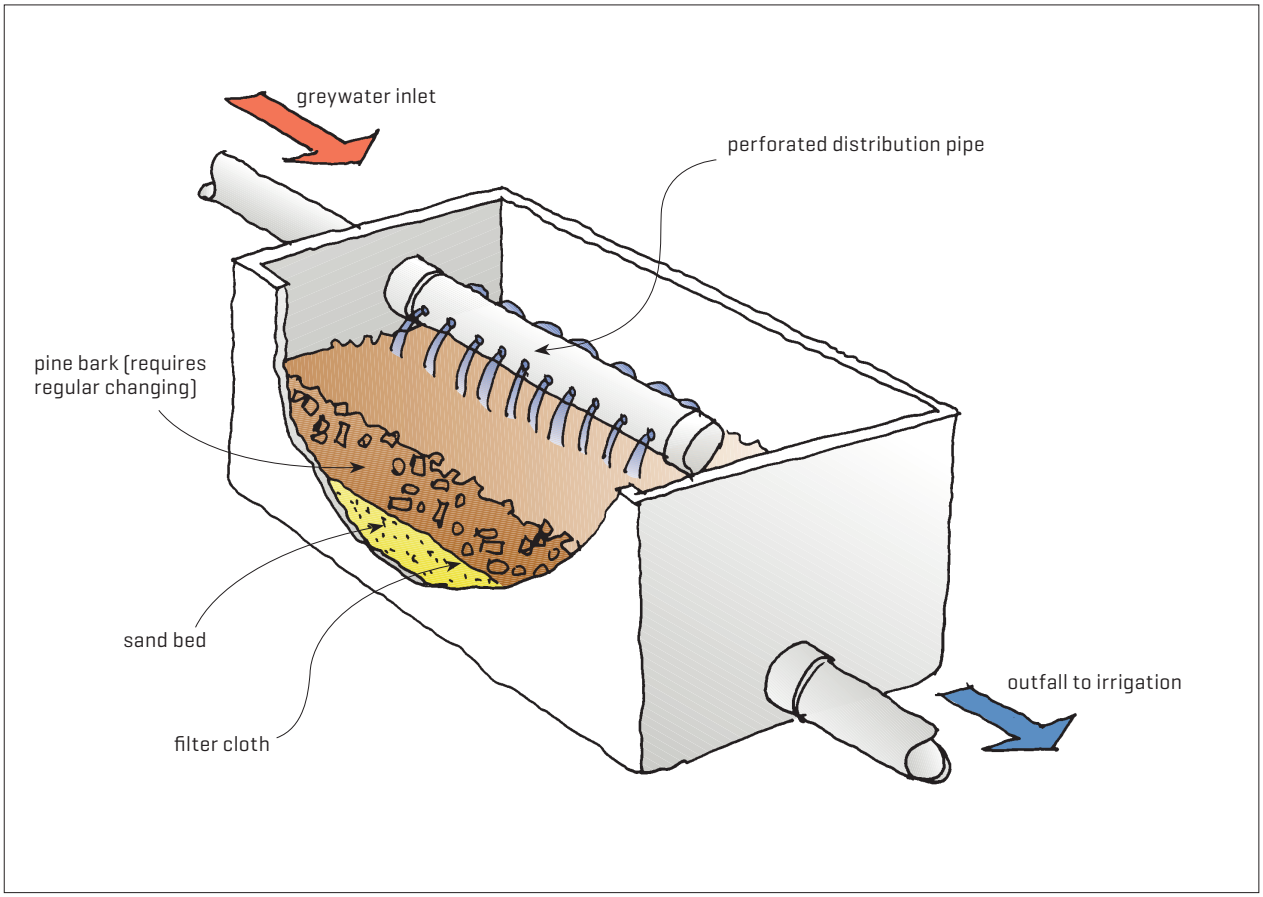

Figure 3. Proprietary filtering unit using a top layer of pine bark, a separating filter cloth and a sand layer. The water flows continuously through the filter to the irrigation system. The filter material should be replaced every few months or when there are signs of clogging.

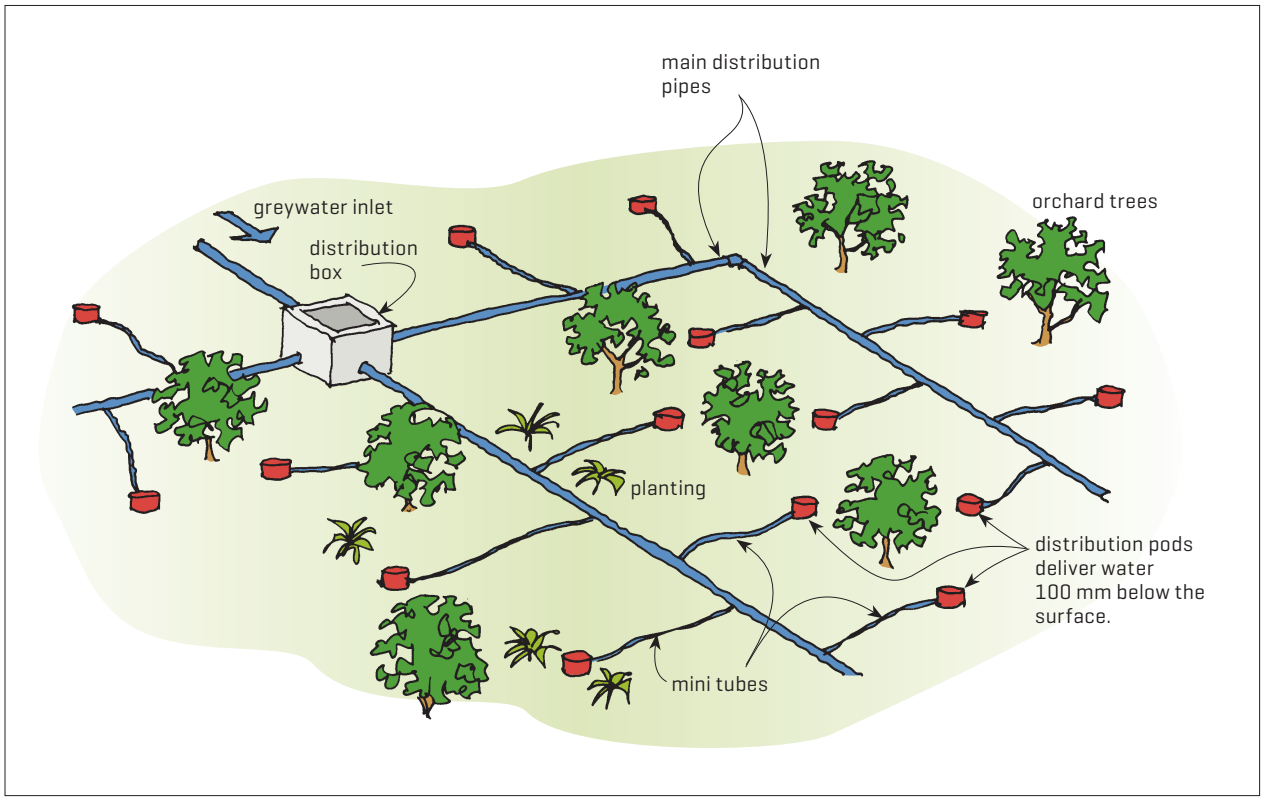

Figure 4. Example of a proprietary greywater irrigation system that uses a distribution box that diverts water to different parts of the dispersal area to allow areas to rest.

plants that thrive in acidic soils. The greywater quality can be improved by avoiding:

- harsh detergents, softeners and whiteners
- bleaches or chemicals containing chlorine (greywater from laundries may have higher concentrations)
- cleaners containing boron.

6.0.3 Several types of irrigation system are available. These include:

- subsoil gravity-fed trenches filled with large aggregate laid to a consistent fall to ensure the water reaches the extremities
- mulch-filled swale irrigation system of an open trench with small diameter perforated pipes covered in pine bark mulch – an adequate cover of mulch must be ensured at all times to prevent exposure to people, animals and the air.

6.0.4 The garden or land benefits from occasional resting from greywater irrigation. A distribution box and branched drain network (often with a pump that may require mains water top-up) can direct the water to different areas at different times (Figure 4) but this set-up is more suitable for larger areas such as orchards.

6.0.5 All irrigation systems must be designed so that the greywater can be diverted into a sewer or on-site blackwater treatment system if the land is overloaded by heavy rainfall or surface flooding or if the system needs maintenance.

6.0.6 The underground parts of the greywater irrigation system, such as subsurface watering systems, must be:

- protected from plant roots and from groundwater entering
- robust enough to withstand loads above it or normal ground movement.

7. GREYWATER TREATMENT

7.0.1 If used for toilet flushing, the greywater should be filtered and treated to reduce harmful bacteria to safe levels.

7.0.2 The particles, chemicals and microbes found in greywater depend on the household and the occupants' lifestyles. For example, households with young children may have more faecal matter in their washing machine water. Water from households mainly using environmentally friendly cleaning products may contain different chemicals from households using other products.

7.0.3 Domestic greywater treatment systems can reduce solids, bacteria numbers and chemicals in the water. Treatment processes can involve fine filtering, settlement of solids, anaerobic or aerobic digestion and chemical or UV disinfection.

7.0.4 Proprietary systems that treat greywater to an acceptable water quality for toilet flushing are available in New Zealand (Figure 5). They are generally multi-chamber tanks that reduce solids by settling, floating and filtering. The water is treated by chlorination or UV and pumped into the toilet cistern. If an on-site wastewater system is also installed, make sure that the chlorination is compatible.

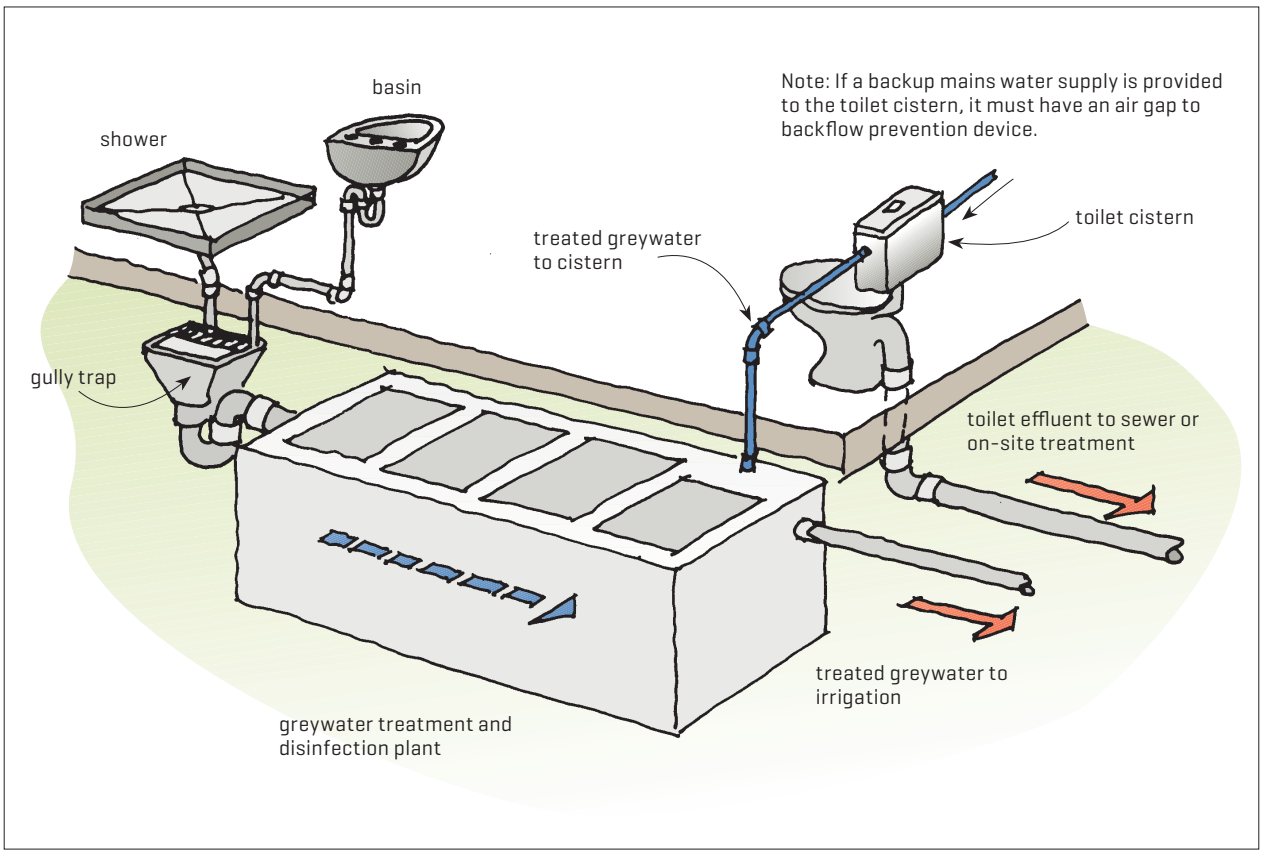

Figure 5. Example of greywater treatment in a proprietary system for use in toilet flushing and irrigation.

7.0.5 Toilet cisterns should also have an alternative source of water supply (mains or rainwater tank) that can be turned on during maintenance on the greywater system or when demand is high. Ensure that the full length of pipework is identified as non-drinkable and use a backflow prevention device.

8 MAINTENANCE

8.0.1 Regular maintenance in line with the system manufacturer's instructions ensures systems operate properly. The main tasks are cleaning or replacing filters (although some filters are self-cleaning).

9 MORE INFORMATION

BRANZ Level Sustainable Building Series *Water*

BRANZ Study Report SR420 *Microbial water quality of commercial and residential greywater sources*

BRANZ Study Report SR384 *Calculating potential network savings through employing rainwater and greywater systems*

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