

Greywater and your health

Keeping healthy while using greywater in the garden

Depending on who you talk to, greywater is a godsend during dry periods or too much of a health risk to worry about using. If you are going to use greywater in your garden, take a couple of minutes and read this brochure. It outlines what greywater is, the risks in using greywater and common sense precautions needed to use greywater safely.

So what is greywater?

Greywater is all the waste water produced in the household including water from the sink, bath, shower, washing machine and dishwasher but not the toilet. Each source produces greywater of varying quality and quantity. The table below shows the water quality of each source and how much water a household produces each day.

What is the concern about greywater?

As table 1 shows on page 3, greywater from the kitchen, bath, basin and shower often contain faecal bacteria or microbes from the stomach. If these are present, water borne diseases such as *Cryptosporidium*, *Giardia*, *Campylobacter* could also be present. These diseases can survive for a long time and re-infect people through contact. The Ministry of Health and the local Hutt Valley Health are concerned about greywater being used in the garden because greywater systems need regular maintenance to work properly. The health agencies are worried people will not maintain the systems enough to stop them failing and may expose the wider community to diseases.

Regional Council rules for using greywater

Greater Wellington is responsible for managing wastewater discharging to land. Under Greater Wellington's rule four in its Discharge to Land says it is a permitted activity if greywater discharges:

"(a) do not exceed a maximum daily volume of 2000 litres (an average household produces around 1000 litres a day);

(b) is more than 20 metres from any surface water body, farm drain, water supply race, or the coastal marine area; and

(c) does not cause ponding on, or runoff from the disposal area." (2003 plan)

As long as you follow these rules, you will not need a resource consent.

Using greywater safely

The Kapiti Coast District Council recommends using greywater in times of extended dry weather, when there are no other options available. A well designed greywater system will minimise health risks but needs regular maintenance. Hair, soap and other debris in greywater quickly fill filters and could overload the system. If you want a hassle free water resource, greywater may not be for you. If you are prepared to keep the system running smoothly, the *Making greywater work for you* diagram outlines how to keep healthy when using greywater

Making your greywater system work for you

Avoid producing or using smelly unhygienic water

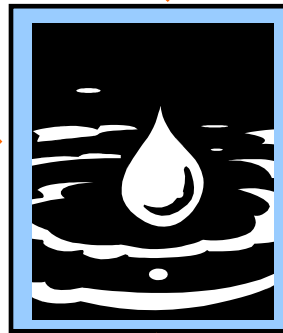
- ⑩ Greywater systems work best with fairly clean water. Bathwater and shower water is fine but laundry water from washing soiled nappies is best diverted to the sewer.
- ⑩ Storing greywater longer than 24 hours allows bacteria to multiply. Use it as quick as you can.

Keep the greywater system well maintained.

- ⑩ Key to avoid creating a smelly nuisance.
- ⑩ The filter catches lint, hair and soap scum. This will fill quickly and could need weekly cleaning.

Avoid contaminating soil with toxic chemicals.

- ⑩ Many household cleaners are toxic to plant and soil life. Divert this water to the sewer instead.
- ⑩ Automatic dishwasher greywater is best diverted to the sewer.



Avoid placing micro-organisms on plants

- ⑩ Avoid watering plant foliage where people could pick them up and ingest them.
- ⑩ Don't water lawns or food gardens but water trees and shrubs through sub surface irrigation.

Avoid contaminating surface water and groundwater.

- ⑩ Discharge greywater below ground or into mulch filled basins
- ⑩ Don't apply greywater to soil if the soil is too wet.
- ⑩ Spread the greywater around, so it can soak in and the soil can aerate between watering

Avoid direct contact or consumption.

- ⑩ Keep your greywater systems away from your drinking water.
- ⑩ Label the greywater system so children understand not to drink or play in it.
- ⑩ Use gloves cleaning the filters and wash your hands after using greywater.
- ⑩ Don't allow greywater to pond on the surface or run off the property

Collecting greywater from your house: How much will you get?

Most homes produce around 100 to 200 litres of greywater per person per day. This is enough to water four fruit trees or a dozen shrubs. Use the table below as a guide on how much water each water source produces and the quality of the water.

Source	Quality	Quantity
Sources with their own pumps		
Washing machine	Good. First wash contains medium concentrations of soap and nappy washes contain high levels of bacteria. Improve quality of water by using garden friendly soaps.	Top loading machines produce 110 – 180 litres per load. Front loaders use around 40 litres per load.
Automatic Dishwasher	Poor. This water can contain high levels of solids, which may block up filters or system. The chemicals in water are often toxic to plants. Recommend diverting this water to the sewer.	This produces 20 to 40 litres per load.
Gravity flow sources		
Shower, requires professional replumbing and may be impossible in houses with concrete slabs. May be possible to collect water form the gully trap.	Excellent. Minimal concentration of soap and shampoo isn't toxic to plant life. The hair can block up the system. It can contain faecal bacteria, so divert water to sewer if someone is ill.	An average shower produces 75 litres per day per person for low flow and 150 litres per person per day for high flow
Tub, requires professional replumbing and may be impossible in houses with concrete slabs. May be possible to collect water form the gully trap.	Similar qualities to shower water	An average bath produces 100 to 150 litres per bath.
Bathroom sink, requires professional replumbing and may be impossible in houses with concrete slabs. May be possible to collect water form the gully trap.	Good. Soaps, shaving cream can be high. Liquid soaps can reduce chemical loadings to the garden.	Average water use is around 4-20 litres per person per day.
Kitchen sink, requires professional replumbing.	Average. The water is high in solids, greases, fats and soap. It also contains faecal bacteria. This can block up the greywater system. Recommend to divert water to the sewer.	Produces 20 to 35 litres per person per day.

Table 1. A breakdown of each greywater source in terms of quality and quantity

Designing the greywater irrigation system

Now you know how much greywater you are producing each day its time to get the greywater out to your garden where it is needed. There are a number of books available on designing greywater systems, in particular an American author Art Ludwig, wrote two excellent books "Builder's Greywater Guide" and "Create an Oasis with Greywater." Both of these are available in the Waikanae, Otaki and Paraparaumu libraries. Before building your greywater irrigation system, take a moment and read through these books. They offer excellent advice on common pitfalls and successful designs.

Irrigation needs

The second step is to mark out where the plants are in relation to the greywater sources and work out how much water your chosen plants, trees and shrubs need. At the end of this you will be able to see challenges faced in watering plants. On average a plant needs around 22 litres per m² covered per week. For example a fruit tree with a canopy of 7m² needs around 150 litres a week, or the greywater collected from one load off a washing machine.

Greywater is alkaline in nature and some plants may not grow well in it. The table below lists plants suitable and unsuitable for using greywater with. Talk to your garden centre about plants that grow well in alkaline conditions.

Plants that may struggle with greywater dosing			Plants that could do well with greywater dosing		
Azaleas	Begonias	Bleeding Hearts (Dicentra)	Agapanthus	Fan and Date Palms	Oleander
Camellias	Ferns	Foxgloves	Australian Tea Tree	Honeysuckle	Olives
Gardenias	Hydrangeas	Impatiens	Bermuda Grass	Ice Plant	Rose
Oxalis	Philodendrons	Primroses	Bougainvillea	Juniper	Rosemary
Rhododendrons	Zylosma	Violets	Cottonwood	Oaks	

Table 2 Plant tolerance to the alkaline greywater

Soil test

A soil test tells you how much greywater you can put in your soil without it ponding on the surface. In the area you will use greywater, dig holes to the depth it will discharge. Place a ruler in the hole to record how fast the soil absorbs water.

Fill hole 2-3 times to saturate soil and record how many centimetres the water moved in a given time. When the water drops at the same rate for different tests that is how fast water percolates through soil. If soil takes hours to drop a few centimetres, or less than a minute, or the hole fills with water, your soil isn't suitable for using greywater. Table 3 shows how much water you can apply to the soil without overloading it.

Soil infiltration rate, Min/cm	Loading Rate litres/Day/ m ²
0-12	105
13-18	63
19-24	42
25-48	21

Table 3 Safe loading rates for different soils

Getting the greywater to the garden

When designing a greywater system always remember simple is better. Greywater systems need regular maintenance and cleaning. Hair, soap suds and grit can quickly block up pipes, filters and pumps. The more complex the system the parts that can block up and fail.

Though there are a number of potential greywater sources, this brochure only includes designs for using water from the washing machine. Other sources need the help of the plumber.

Washing machine greywater: large volume, simple plumbing

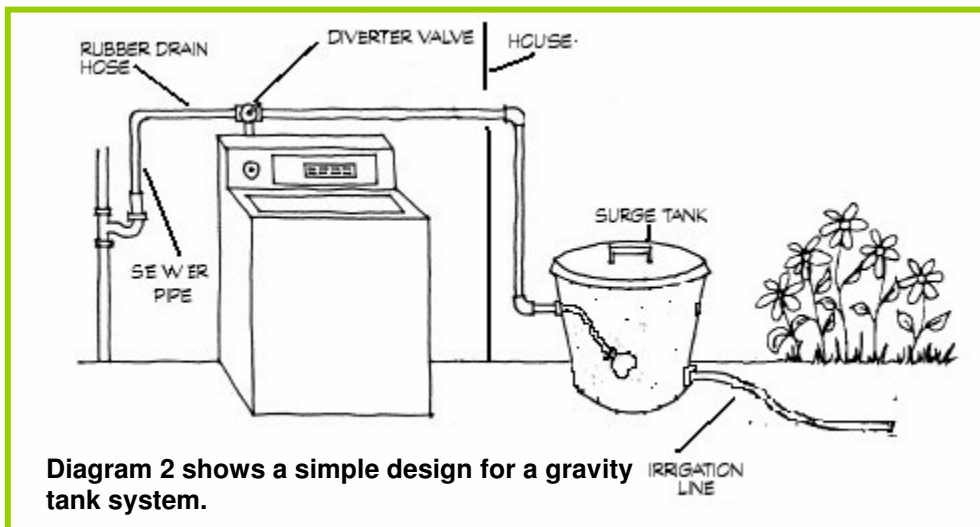
During the summer drought of 2003, people ran a hose from the washing machine out to the garden to save their prized plants. Though this works it can shorten the life of the washing machine pump and stop the washing machine working properly. Also, if you move the hose from plant to plant there is a risk of the old greywater rushing back to the washing machine and tainting your clothes. The following designs protect your health, your washing machine and future washing.

Drumless (use the pump from the washing machine)

If you want the washing machine to pump the water directly on to the garden, you must connect the drain pipe to a larger diameter (40mm) polythene pipe outside. The large diameter pipe reduces the siphoning effect by having an air pocket. The siphon effect prevents the machine filling up and it has to use more water than it normally would. If the outside pipe is the same size, there is a risk of siphoning water needed for the rinse cycles.

The pump can pump about 300 mm above the height of the washing machine, so don't get too ambitious on how you pump the water. Pump it too high and the water may not come out and you may damage the pump.

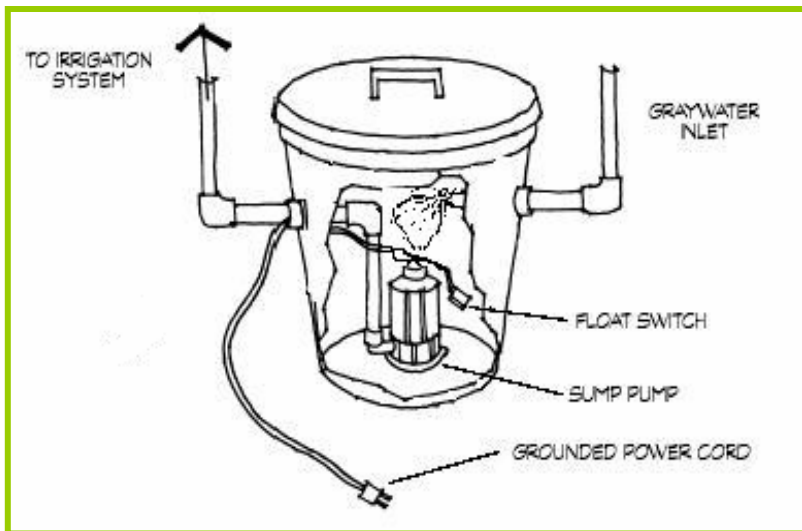
Gravity Tank (no pump)



This approach captures the greywater into a surge tank for temporary storage. From the tank, a hose can move from garden to garden depending on where you need it. Diagram 1 shows the basic components of the gravity tank system. The three-way diverter valve enables you to divert wastewater to the sewer if it is of low quality. The filter bag (a stocking or a sock) catches lint and scum as

the greywater enters the tank. It is important to check the filter regularly to keep the system working well.

Drum, pump and filter



Remember if you are going to use a pump, be prepared for regular maintenance to keep the system running well.

Diagram 3 shows the system with a pump and filter attached. As you see the pantyhose filter can be replaced as it clogs up.

Diagram 3 shows a design for a pump driven system.

Disposal

When disposing of the greywater, remember the health agencies recommend subsurface disposal and Regional Council state no disposal can cause surface ponding.

Here are three options

Mulch Basins Mound up soil around the drip line to create a 200mm deep basin. In-fill with mulch and remember to keep the trunk free of mulch. This delivers greywater to where it is needed and prevents it running off site or surfacing.

Mulch Swale A mulch swale is similar to the mulch basin except it a basin following the contours of the landscape.

Mini leachfields deliver water through subsurface trenches filled with either sawdust or gravel.

Look in the Create an Oasis with Greywater book for further details.

Plants and greywater toxicity

Greywater contains chemicals from cleaning products such as detergents, fabric softeners and bleaches. Be careful when irrigating with greywater as you may be contaminating your soil with chemicals toxic to plants and the soil. Table 4 below from the Create an Oasis with Greywater shows how chemicals in greywater can be toxic to your garden.

Be aware of the greywater you are putting onto the garden. You can improve the greywater quality by avoiding:

- all modern detergents that whiten, brighten, soften or have "enzymatic powers."
- bleach in any form or anything with chlorine in it.
- cleaners or detergents containing boron (no Borax products), though a plant nutrient, it can build up to toxic levels very quickly.

Good substitutes are baking soda, vinegar and ammonia. Ammonia is a good substitute for bleach to cut grease, etc.

Effects of disposing in environment			
Material	Temperate Soil	Ocean	Freshwater
Water	Beneficial	No consequence	No consequence
Organic Compounds	Beneficial food for soil microbes	At high levels, microbes reduce oxygen in water consuming waste and ecosystem suffers.	
Nitrogen	Beneficial; may leach into groundwater if in excess	Excessive nitrogen causes algal and weed problems	
Phosphorus	Very beneficial; helps with root growth in plants	Excessive phosphorus causes weed and algal problems	
Sulphur	Beneficial	No consequence	
Sodium	Undesirable; damages soil structure, reduces water absorption	No consequence	Little consequence
pH	pH raising desirable	No consequence	Little consequence
Chlorine	Undesirable	No consequence	Little consequence
Boron	Highly toxic to plants at wash water concentrations	No consequence	Little consequence
Pathogenic organisms	Harmlessly biodegrade under proper conditions	Diluted but could spread disease	Likely to spread disease
Industrial toxins	Disastrous	Disastrous	Disastrous

Table 4 Toxic elements in greywater (table from *Create an Oasis with Greywater*)