

# THE BENEFITS OF GREYWATER RECYCLING SYSTEMS



## SUMMARY

Water scarcity is becoming an ever growing concern in the world today. Fresh, drinkable water is a natural resource which is being used more rapidly than it is being replenished.

A growing global population, agriculture and industry have and will place great demands on our water resources. A tremendous percentage of potable water is currently being used to flush toilets, for irrigation and washing laundry.

“Grey Water Recycling” allows a household/ company/ community to utilize slightly used water for secondary usage, as for example, flushing toilets, washing machine and irrigation.

“Grey Water Recycling” is now being seen more and more, but there is a greater need for education on this topic.

Homeowners, property managers and communities will find that through greywater recycling, they can save money and fresh water resources simultaneously.

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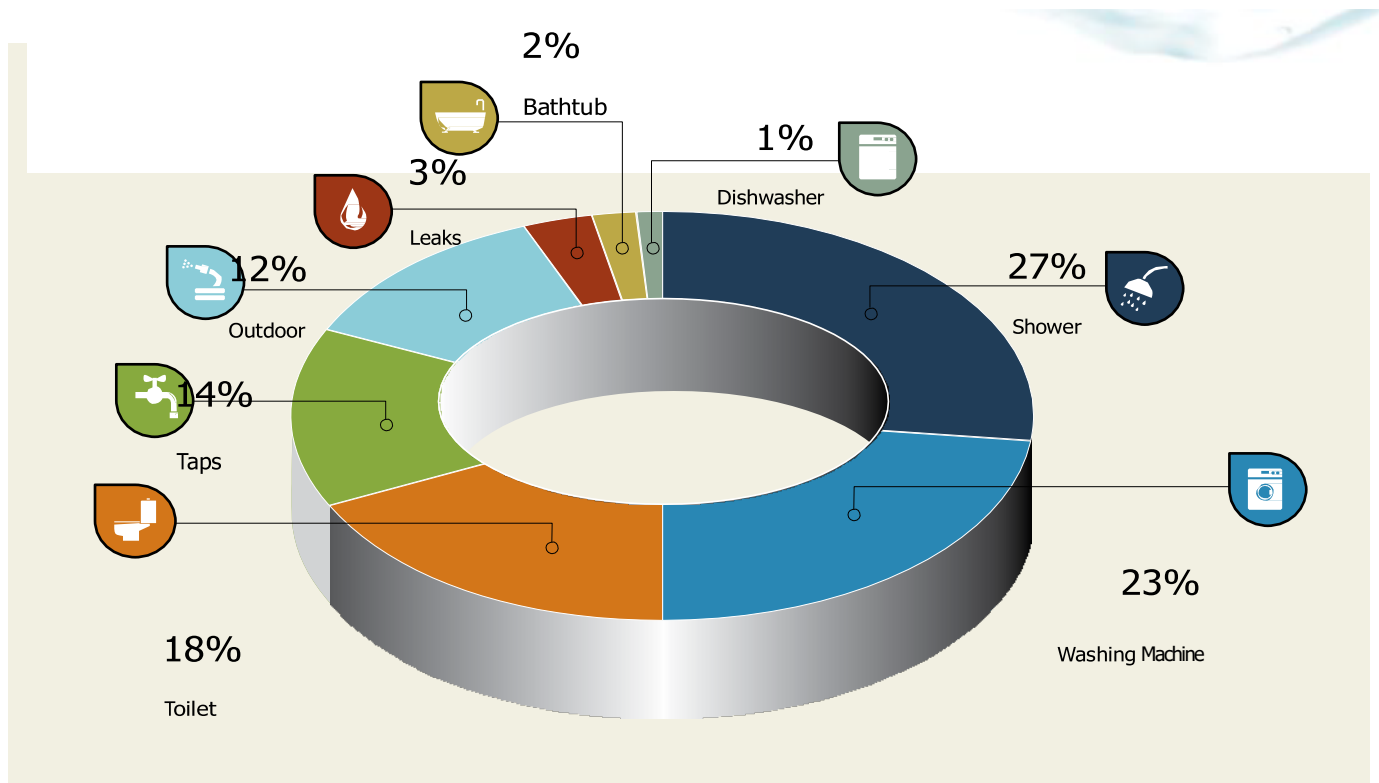
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## NEED FOR GREY WATER RECYCLING

### WATER AS A NATURAL RESOURCE

Water conservation and recycling have been topics of discussion for many years. A relatively new form of recycling is that of grey water. The demand for water is growing, while fresh water is becoming scarce. Conserving water on a completely voluntary and personal level is one way in which we can make small change that could possibly have a large impact. Grey water recycling is a conservation tool that could aid this problem.

Important is to know that potable water is water that can be consumed without any risk of short or long term harm. In most developing countries is the supplied water indeed potable, but only a fraction is being consumed or used in food preparation. Most of it is being used on washing, showering, flushing and landscaping.



(source: Watercare / Auckland)

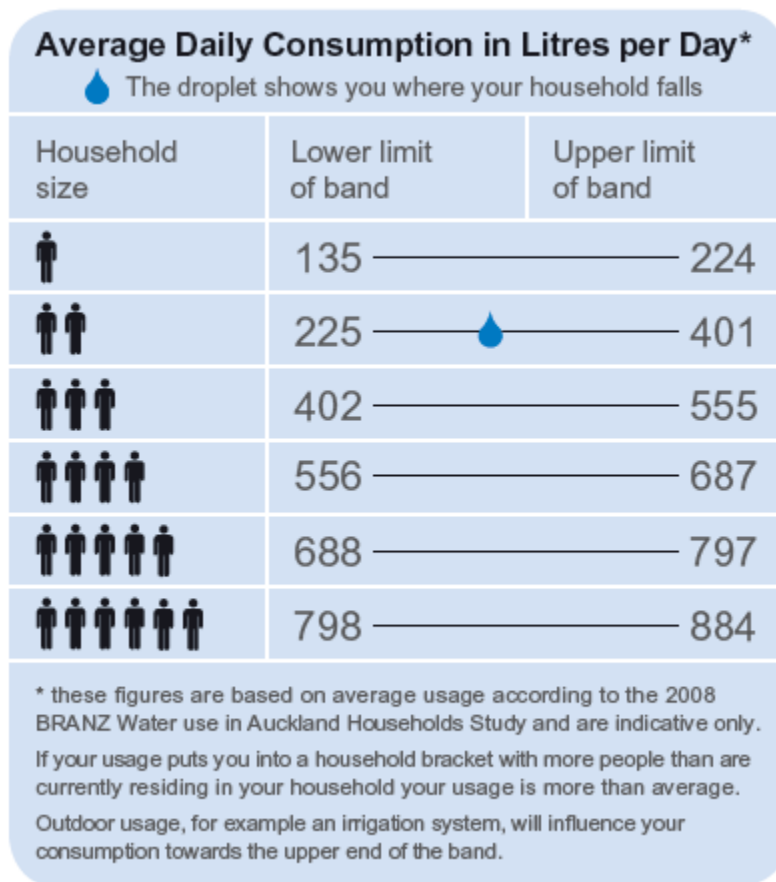
## WATER AS A RENEWABLE RESOURCE

Definition of a renewable resource is:

*A resource that can be totally replaced or is always available naturally, or that is practically inexhaustible.*

<http://www.businessdictionary.com/definition/renewable-resources.html#ixzz3dHgBUeLz>

Also fresh water is considered a renewable resource; the world's supply of clean, fresh water is steadily declining. Water demands are already exceeding supply in many parts of the world. As the world's population continues to rise, so will the demand!



(Source: Watercare / Auckland)

## FRESHWATER NEW ZEALAND

Source: Ministry of the Environment

<http://www.mfe.govt.nz/fresh-water/overview-fresh-water/about-fresh-water-nz>

### About fresh water in New Zealand

This page outlines the importance of fresh water in New Zealand and the need for careful management of our freshwater resources.

#### Importance of fresh water

Fresh water is one of New Zealand's most valuable natural assets. Our rivers, streams and lakes sustain natural ecosystems that are home to many of New Zealand's native species. They provide us with a safe drinking water supply and support a wide range of recreational activities such as fishing, swimming and boating.

**New Zealand has...**

**425,000 km**  
**OF RIVERS AND STREAMS**



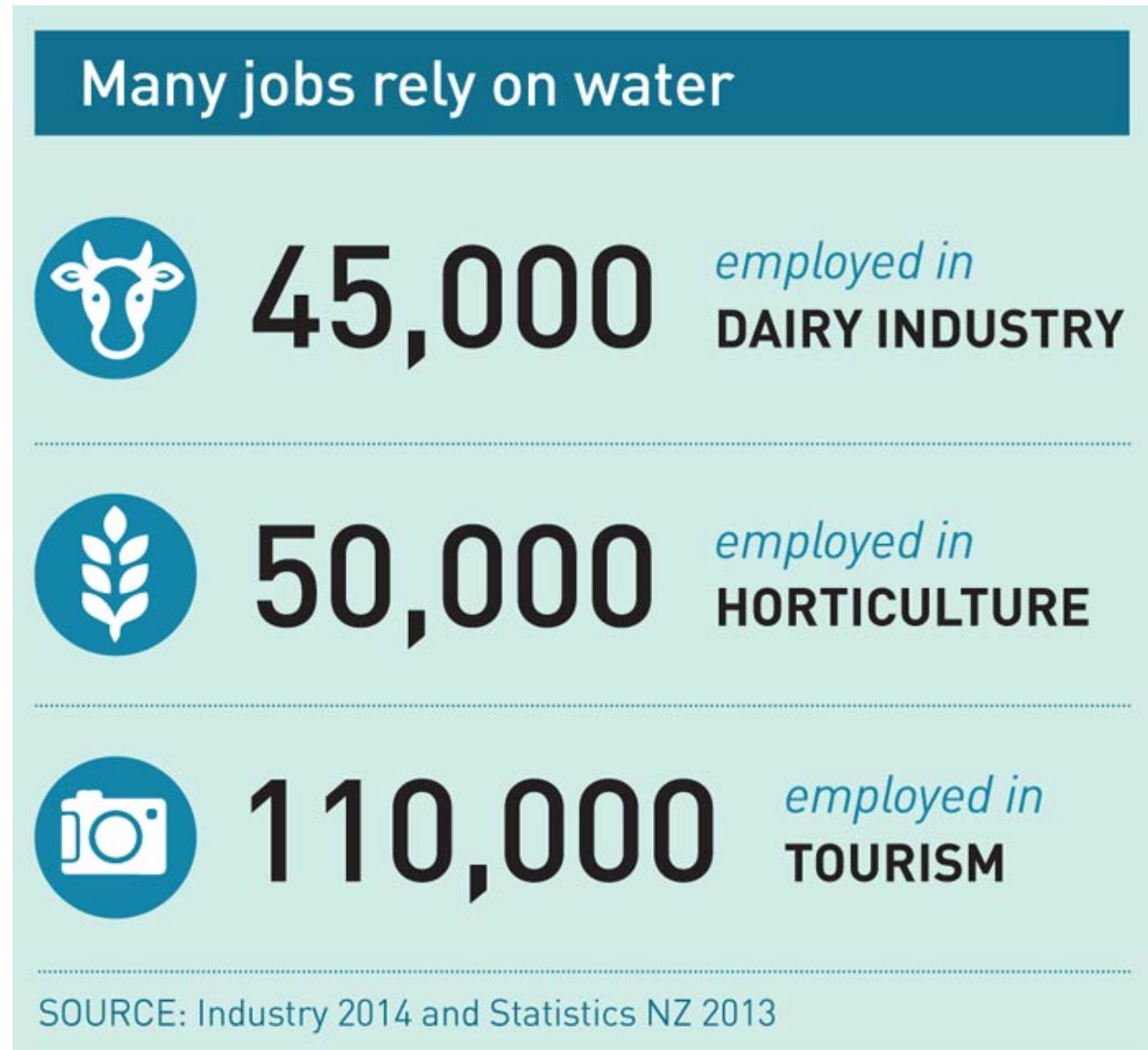
**4,000+**  
**LAKES**



**200+**  
**AQUIFERS**

SOURCE: MFE 2007

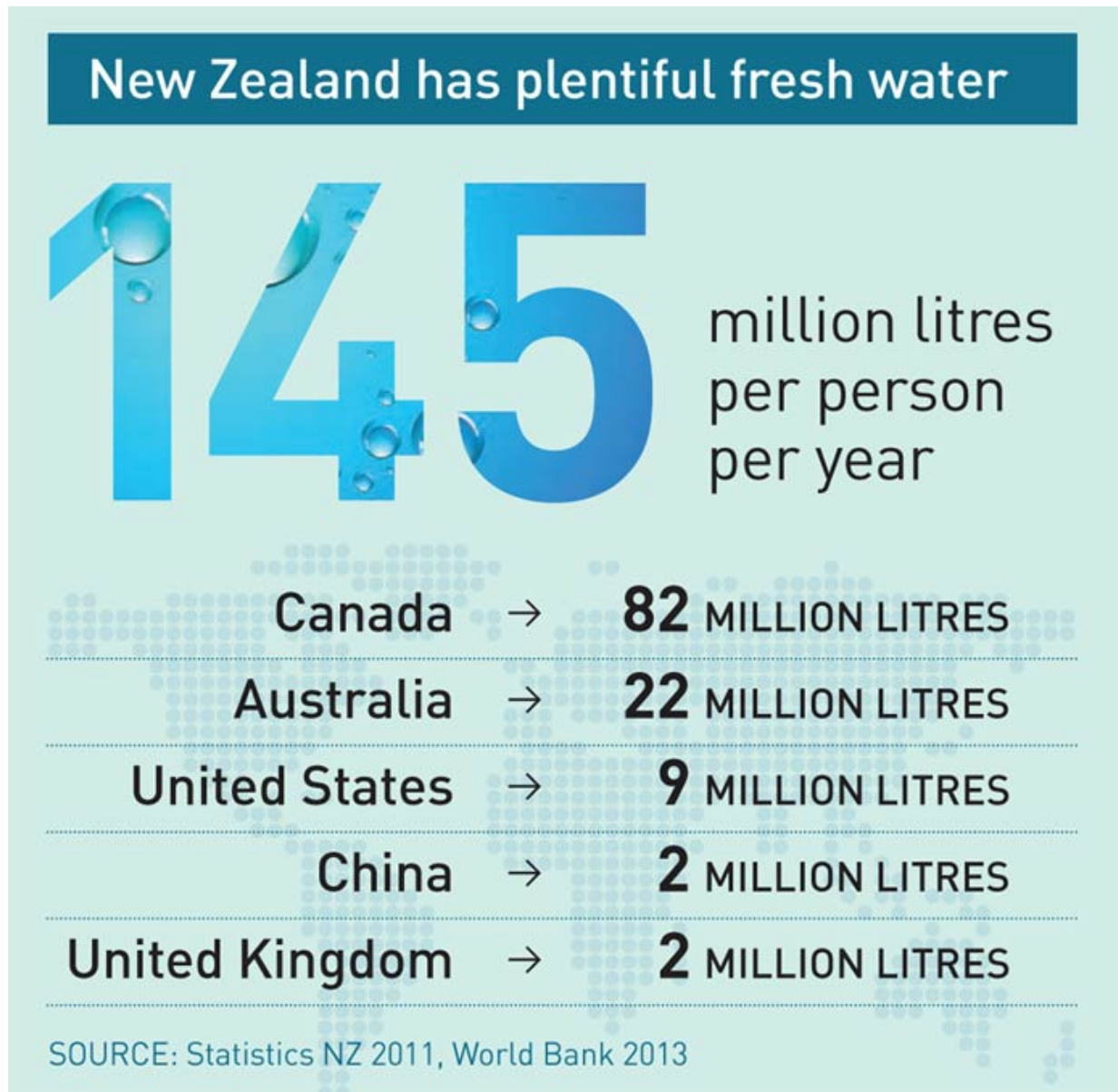
Fresh water is also a vital part of the New Zealand economy. It is used to irrigate crops and pastures, dispose of or dilute trade wastes and sewage, produce hydro-electric energy and makes New Zealand a unique and attractive place to live and visit.



For Māori, fresh water is a taonga, essential to life and identity. Māori have cultural, historical and spiritual links with many of the country's springs, wetlands, rivers, hot pools and lakes. This special relationship with water is recognized under the Treaty of Waitangi. Māori also value having healthy water bodies for mahinga kai (customary food and resource gathering).

## Why we need to manage fresh water

By international standards fresh water in New Zealand is both abundant and clean.

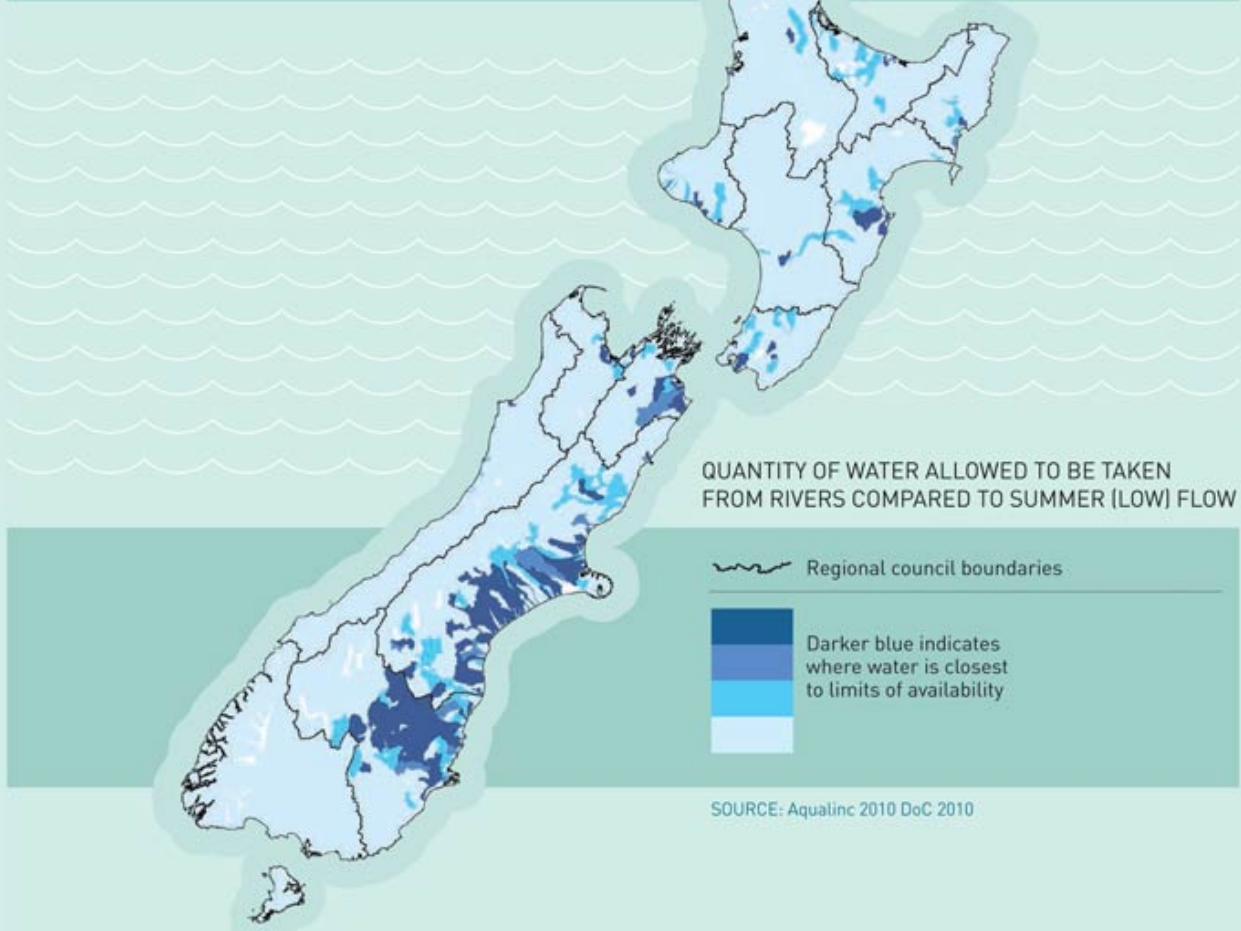


**However**, economic activities and a growing population are putting pressure on our freshwater resources. These pressures combined with current trends in **climate change** reinforce the need for careful management to protect fresh water in New Zealand. As a result, water quality and availability vary considerably. This has implications for aquatic life, the supply of drinking water, economic activities, cultural values and water-based recreation.

Water is not always where we need it,

when we need it

We need to **manage our water carefully** because in some places we are approaching limits to the amount of water we have available to use.





## FRESH WATER POLLUTION

Pollution can also affect the amount of fresh water available to us.

Definition of water pollution:

**Water** pollution is the **contamination** of **water** bodies (e.g. lakes, rivers, oceans, aquifers and groundwater). This form of environmental degradation occurs when pollutants are directly or indirectly discharged into **water** bodies without adequate treatment to remove harmful compounds.

(Source: Wikipedia)

Water pollution comes from two main sources:

- Point sources: single outlets, such as a sewage pipe or a drain.
- Non-point sources: more diffuse seepage, for instance from underground sources or from small streams flowing into rivers or lakes.

The contaminants can be in solid or liquid form.

Solid materials

These include clay, which clouds the water and reduces the amount of light penetrating it. Heavy deposits of clay or silt may form a layer on gravel river beds, smothering plants and animal life, and releasing unwanted nutrients. Sediments may also carry other pollutants (such as heavy metals, nutrients and pathogens).

Other solid materials are organic forms of nitrogen, phosphorus or carbon (for example, faecal matter and decaying plant matter). These use oxygen and add chemicals to the water, disturbing its natural balance. Solid contaminants are also known as 'particulates'.

Dissolved materials

These include toxic chemicals that directly affect the health of humans and/or aquatic species (for example, ammonia is toxic to fish). They also include nitrate and phosphate, which boost the growth of water plants such as algae and phytoplankton. In extreme cases, they may trigger blooms of toxic algae. These can clog streams, reduce water clarity in rivers and lakes, and starve fish of oxygen.

Most nitrate in the water from farmland comes from cattle urine, which is concentrated in patches of grazed pasture. Some of the nitrate in urine is washed down through the soil into the water table and eventually into streams and lakes. Phosphate is more readily held by the soil, and less of it reaches the waterways as dissolved phosphate.

Some effluents (from wool scours, timber treatment plants, urban storm-waters) contain dissolved zinc, lead, copper and chromium. These are highly toxic, and make water unsuitable for drinking and shellfish in river estuaries unsuitable for eating.

## Blue babies

In tap water, high levels of nitrate have long been considered a health risk for bottle-fed infants. The babies may suffer infant methemoglobinaemia, in which the blood fails to deliver oxygen. The skin turns blue-gray, and the baby may become irritable or lethargic. Coma and death can result if the condition is not recognised and treated. For this reason, nitrate levels in New Zealand's drinking water must be less than 11.3 parts per million.

## Regional differences

The central North Island's streams and lakes are naturally high in phosphorus, leached from volcanic rocks, but nitrogen levels tend to be low. Nitrate that enters the water via farm runoff therefore triggers unwanted plant growth. This is a problem in Lake Taupō and other clear-water lakes.

In the Central Volcanic Plateau, runoff from geothermal fields contains arsenic, boron, lithium and mercury, which are toxic.

Elsewhere, such as in Southland, waters are naturally low in phosphate and higher in nitrate. Runoff containing phosphorus from farming, industry and urban areas is therefore causing water quality problems in some Southland rivers.

Source: Te Ara, The Encyclopedia of New Zealand  
<http://www.teara.govt.nz/en/water-quality/page-2>

## URBANIZATION

It is believed that urbanization will require a significant investment in water infrastructure in order to deliver water to people and to process the large concentrations of waste water. This contaminated waste water will have to be treated or it could possible pose a serious public health risk.

# GREYWATER

## **SOURCES / USAGE / ADVANTAGES**

### SOURCES

The definition of greywater (or graywater) is variable, for example:

- **Oxford Dictionary**
  - The relatively clean waste water from baths, sinks, washing machines, and other kitchen appliances.
- **Wikipedia**
  - Greywater gets its name from its cloudy appearance and from its status as being between fresh, potable water (known as "white water") and sewage water ("black water"). In a household context, greywater is the leftover water from baths, showers, hand basins and washing machines only. Some definitions of greywater include water from the kitchen sink. Any water containing human waste is considered black water.
- **In general**
  - Greywater is wastewater collected from the laundry (washing machines & laundry basins), shower and bath, hand basins.
  - Kitchen greywater can contain significant concentrations of organic material, particularly if the kitchen includes a garbage grinder unit and consequently is often excluded from the potential greywater sources.

Source: <http://www.greymatters.org.nz/Pages/WhatIsGreywater.aspx>

Greywater as described above can be recycled and reused.

### USAGE

Treated grey-water (if treated with the right system) can be reused for such as:

- Toilet flushing
- Washing machine
- Lawn and garden irrigation (please note that each district in NZ has its own rules and regulations regarding irrigation with greywater)

## ADVANTAGES

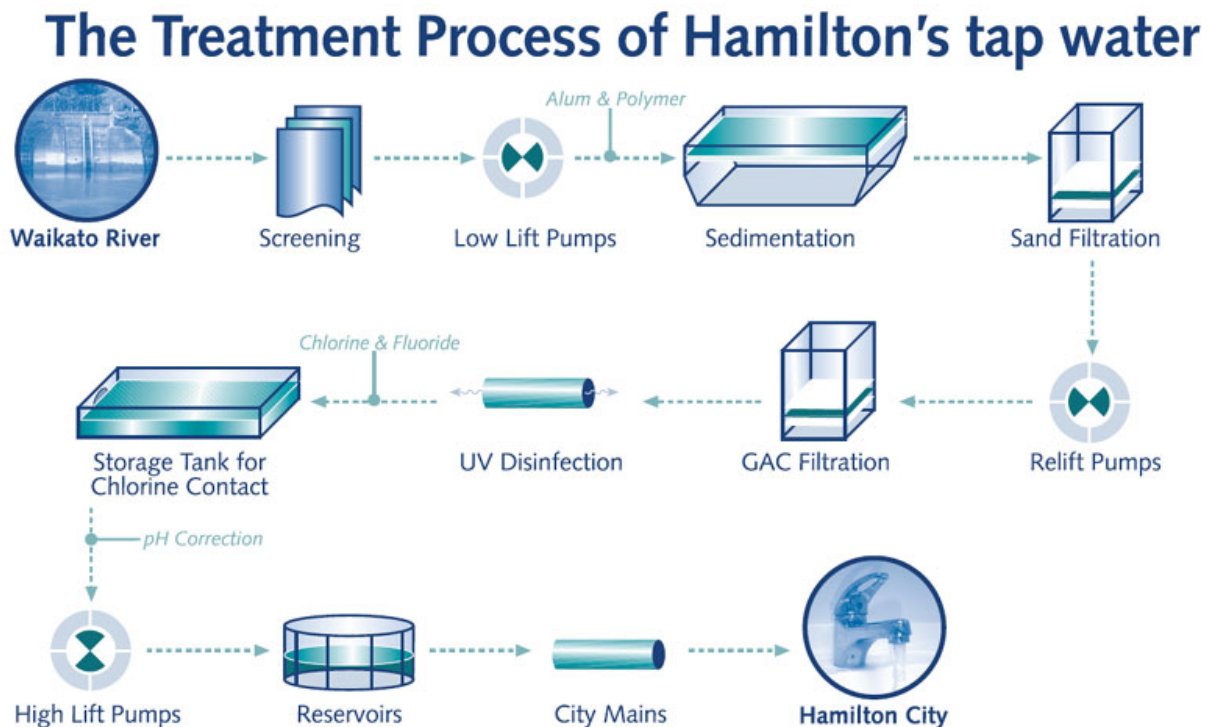
The advantages to greywater recycling are numerous. Homeowners / property managers are able to cut back on the amount for water that they use and in turn are able to save money if they are paying for municipal water.

The population on private wells, rainwater tanks and septic systems benefit as well, as the recycled water reduces the strain on their systems.

On a larger scale, many cities and towns have problems meeting the demand of potable water supply, the expense of expanding the water treatment - and wastewater treatment facilities.

One way to solve this problem is to implement greywater recycling systems which conserve, protect and somewhat regulate the water usage at the point where it is used. It is possible that greywater recycling can reduce or perhaps eliminate the need to expand public water treatment plants.

Water treatment and processes involved:



# GREYWATER RECYCLING SYSTEMS

## METHODS AND USAGE

(Below listed methods are the most common ones, there are a few other technics available)

### BUCKETING

The oldest and also cheapest way of recycling grey-water, required is a bucket and a lot of determination.

Problems are to figure out how to catch the grey water and also the reuse of it. Also a fair amount of greywater will be getting lost.

### FILTRATION

Greywater will be filtered and then stored (please note, greywater can only be stored for 24 hours), to be used up for secondary use, flushing toilets, irrigation.

Problems:

Not suitable for washing clothes.

Filtration will only separate coarse particles; viruses, bacteria and fine organic matters will remain in the treated grey-water. Thus not suitable for irrigation of vegetables, filter has to be cleaned on a regular base. Occurring greywater and possible volume of use don't match, especially during winter time when there is no demand for irrigation. Odor may occur.

System is not suitable for an urban environment.

### FILTRATION AND CHEMICAL TREATMENT

Filtration as above, filtered greywater will be treated with chemicals (chlorine tablets for example) in order to eliminate bacteria and viruses.

Questionable if it is suitable for washing clothes.

Chemically treated greywater is over a longer time not suitable for irrigation as it will harm plants. Regular top up of chemical treatment is necessary in order to avoid odor problem.

## FILTRATION AND BIOLOGICAL TREATMENT (TERTIARY TREATMENT)

Coarse filtration of the greywater (hair, lint, etc.) and collection of it in a treatment tank, biological treatment (bacteria) to break down organic matters, membrane filtration in order to hold back bacteria and viruses, transfer into a holding tank (clear water tank).

System has to be sized right in order to get the most benefit out of it. Treated water can be used for flushing toilets, washing machine, and irrigation (if required).

Perfect balance as Shower, Bathtub and taps account for ~43% of water usage, toilet and washing machine for ~41% (source: Watercare / Auckland, diagram page 2).

Suitable in an urban environment as treated water will be used up inside the house and no surface for irrigation required.

No odor problems.

### POINTS TO CONSIDER

- Sizing of the system
- Maintenance requirements
- Space requirements
- Water back up (top up) if not enough treated greywater is available
- Power requirements

## SUMMARY

Water is precious and we should be more careful of how we use it. It might not be only environmental reasons why we should look into the option of grey water recycling, but also financial ones.

Increasing population in our main centers put additional pressure on the existing infrastructure and resources, especially during summer time or a drought. A greywater recycling system could save up to 40% of potable and sewage water in each house, which has an impact on the infrastructure the district or community, has to provide (pipe, water treatment, sewage treatment, etc.)

Households, buildings or commercial enterprises (laundries, for example) could save on fees and rates for water and sewage, which will only go up in the next couple of years.

And last but not least, if you have the right system you are helping the environment.

## **SOURCES**

- Watercare / Auckland
- BRANZ
- Hamilton City Council
- Wikipedia
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