Sustainable Living Programme
2009 Edition

Valuable Water – an introduction

Water is essential to life on Earth. At first impression, it seems plentiful on this 'blue' planet. It covers 71% of the earth's surface. However, less than 3.5% of this is fresh, salt-free water and much of it is frozen in glaciers and ice-caps, leaving only 1% as potential drinking water in streams, lakes and in underground reserves. Much of this 'fresh' water is inaccessible to people or has become too polluted for use without treatment. The freshwater store in underground aquifers is in many areas being extracted for human use faster than nature recharges those aquifers, creating a problem for future years. This may be compounded in some regions by the effects of climate change. It's a precious resource that we can not take for granted.

People can not live without water. We value it to drink, to cook, to wash with and to swim in, for livestock and gardens, for its appearance, sounds, coolness and distinctive touch. Natural water systems provide key services to the functioning of the planet, such as moving energy (heat moving within oceans drives the weather patterns), spreading nutrients, dispersing pollutants and clearing rain-floods. Flowing, fresh water supports plant life, fish and provides home to many creatures, disperses plant seeds and animal young (e.g. insect larvae and young fish).

If you are keen to study natural stream-life, with family or school involved, get information from Environmental Monitoring and Action Project See their website http://www.emap.rsnz.org/studyareas/hydrology.html
In Auckland region, also see http://www.waicare.org.nz (look for manuals, fact sheets); in Wellington, teachers of 8-12 year olds have access to the Regional Council's education material *Take Action for Water*, including a 'Stream Report Card'; http://www.gw.govt.nz/section44.cfm
In Christchurch information about where the water comes from is found here: http://www.waterlink.org.nz/info/index.html
In rural areas contact NZ Landcare Trust about NZ Stream Health Monitoring and Assessment Kit: 03 349 2630; http://www.landcare.org.nz
Regional Councils manage water resources through the Resource management Act (RMA) & most also offer information about fresh water e.g. Canterbury Regional Council http://www.ecan.govt.nz/Our+Environment/Land/Living+Streams/
(Photo by Angela McIlroy shows a stream culvert joining a city river. The over-hanging native NZ vegetation seen here provides shade and food for river life - including whitebait)

Flowing water has been valued for many centuries by the first peoples of Aotearoa (*Tangata Whenua*) for its life force (*mauri* – a spiritual concept meaning essence of being or the power that makes it what it is). *Te Reo Maori* uses different words to distinguish types of water (*momo wai*) of varying quality.

Water from these different sources should not be mixed, and there are cultural traditions and practices (*tikanga* and *matauranga*) focussed on keeping water clean and protecting its *mauri*. Maori traditions avoid release of human wastes to water, even if treated, preferring land disposal. From their perspective some of the greatest dangers to water quality are from harmful agricultural and urban activities, and water shortages created by seasonal over-use below minimum flows, which threatens aquatic life and thus food gathering potential.[1]

Water supply

Different cities across NZ have quite different water sources. In Christchurch very clean water is pumped from underground natural aquifers, fed by mountain-snow-melt river water; whilst in Hamilton a plentiful but less clean source is the Waikato River (and further down the same river it's helping to supply Auckland). Water that is taken from the Waikato River has to undergo extensive and expensive treatment before it can be used in households. The more water used, the more expensive it gets to supply, and the less remains in the rivers (or in Christchurch's case, in the shallow groundwater aquifer that supplies the city's springs and streams) and the harder it is for the reduced-flow in stream to support animal and plant life.

Once we have used this water in our homes, most of it goes back into rivers or estuaries, and eventually the sea. The largest part of liquid wastes from toilets, washing, bathing, etc. goes through a wastewater treatment plant, while some surface flows go directly into the rivers through the storm water system, without any treatment. The water going through the wastewater treatment plant again causes costs and the release of treated water into a river or estuary increases the load of contaminants such as nitrates and phosphates it has to cope with.

[1] http://www.mfe.govt.nz/publications/water/managing-waterways-jul01/the-maori-perspective-jul01.pdf

Conserving water by reducing domestic demand will not only help protect our natural ecosystems, but will result in reduced water supply energy cost.

The water cycle

Drinking-quality water is a scarce resource globally (only 1% of the total), but nature steadily renews the supply through rainfall, particularly on mountains that catch the prevailing ocean winds. The diagram below illustrates the water cycle.

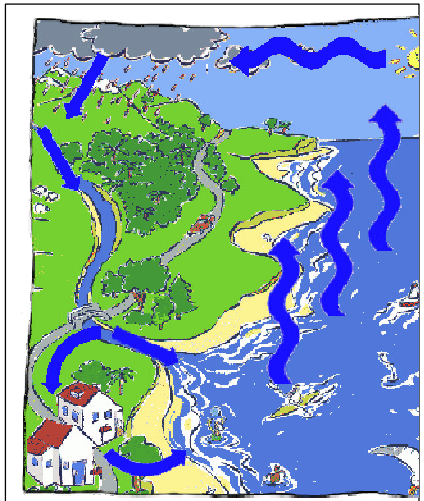


Illustration (from Greater Wellington Council) shows sunshine-powered evaporation from the sea, forming clouds, air rising to cross mountains, cooled air releasing rain, rain & snow falling across the land, feeding streams and aquifers. These are used in part to supply human needs, with treated discharges going back to rivers or estuaries and hence the sea. Human needs are dependent on the natural cycle or loop .

The Auckland Regional Council (ARC) also provides detailed information on water cycle & human impact. See http://www.arc.govt.nz/albany/fms/main/Documents/Plans/Newsletters/The%20Big%20Clean%20Update/The%20Big%20Clean%20Update%20June%202006.pdf

Research is showing that we can not continue to be profligate with our water use as our climate changes and population increases.

In New Zealand, about two thirds of our community-piped water supplies are taken from lakes and rivers, and a third from groundwater 'aquifers'. Both surface and underground waters can easily be polluted by human activity. Pollution sources include pastoral and crop farm nitrogen fertilisers, herbicide sprays and animal manures (in New Zealand, farm animals in total produce 40 times more urine and faeces than the human population, mostly onto land but some washes into waterways). Soil erosion into rivers is common in deforested pastoral hill-country, especially after storms and cyclones. Waste water discharges from abattoirs and dairy factories; household chemicals such as moss-killers, herbicides, detergents, oil and paints; wood preservative chemicals, mine drainage and spoil heaps, as well as other industrial activities can affect groundwater and streams. Impacts can last, sometimes for years after a mine or industry closes. Also, in populated areas, oily and metal-polluted run-off in the 'storm water', gathered from roads and urban hard surfaces after rain, reduces stream quality.
In some areas treated wastewater is discharged into estuaries or the sea. Check out how the wastewater is disposed of in your area.

What happens upstream will affect downstream …… inevitably

All the land area supplying a particular stream is known as the **water catchment** of the stream. Rain falling on healthy soils is absorbed and usually remains clean as it flows downhill. Sediments are trapped or filtered out by natural wetlands (metaphorically like the kidneys of the land), but few wetlands have survived pressures for land development near urban areas. It is very important, therefore to be aware of where our liquid waste materials flow, as they can easily pollute water catchments, especially through surface storm-water. Road side drains are only intended for rain!

Here is a little of the science relating to urban water pollution and stress on its natural life:

- If dissolved oxygen in the stream or river falls below 60% of saturation, fish will die, and below 40% most everything else. Materials that are decaying, such as sewage effluent, soil and plant debris (including algae), will use up oxygen fastest;
- Phosphate levels, from detergents and sewage, can be raised to ten times above natural levels in urban streams. It feeds fast algae growth in warm weather, which can suddenly use up oxygen (a process called eutrophication, which kills animal life in that water).
- Nitrogen compounds from fertiliser run-off, sewage and decaying organic matter, at 100 times higher than in nature in some urban streams, also feed algae and can be toxic to stream animals.
- Low flow and un-shaded streams can more easily overheat, killing aquatic life, starting with the native fish (over 17° Centigrade) and invertebrates (over 21°C).
- Sediment reduces water clarity, reduces food production efficiency of plants and clogs the gills of fish.
- Oil films and paints are visible by colour sheens when they enter streams. However, the invisible pollutants are often the most deadly: for example, dissolved metals such as zinc and copper, acids, detergents, herbicides and pesticides.

N.B. If you see a pollution incident, or abandoned chemical containers in water, contact the regional council: they may have a 24hr 'pollution hotline' listed in the telephone book.

The Ministry for the Environment has published a State of the Environment Report on issues in river water quality around NZ; and also proposals for human drinking water source standards. For information contact: MfE 04 917 7511 or 7400 or see website http://www.mfe.govt.nz/issues/water/

Waste water

Waste water from toilets is known as '**black water'**, or 'foul water'. It contains bacteria that are naturally found in all people's digestive systems, but capable of multiplying rapidly in numbers to become a health hazard. It needs to be treated, to make it less hazardous, before the water carrying it is released, whether to land, river or sea. Therefore if you have a septic tank in use at home, rather than a sewer pipe connection, it is important to have the tank pumped out at no more than two-year intervals, or as your Regional Council specifies, to reduce the risk of overflow and stream pollution by 'raw' sewage.

Another important issue is keeping stormwater down pipes (from the roof) out of the gulley traps beside the house that collect water from sinks, baths, and washing machine and send it to the sewers. Not every DIY house-renovation and extension project gets this right, and the impact is overloaded public sewer pipes after heavy rain. They should feed into the stormwater drains. Building inspectors look out for this construction error.

Wastewater from baths, showers and laundry contain some bacteria, plus water softeners and detergents, but are less hazardous than sewage and are known as **'grey water'**. Grey water should therefore not be stored, or the bacteria in it will multiply. There are, however, systems which can filter and store the water for reuse in the toilet and garden. (See: www.ecoplus.co.nz, www.newwater.co.nz as examples)

Current practice

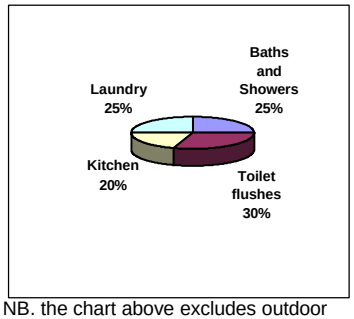
Piped water supplies and sewerage systems, maintained by local authorities and companies which they own (such as MetroWater in Auckland), have contributed to greatly improved public health by controlling water-borne diseases. In 2004, only 74% of the New Zealand population had connections to safe drinking water supply systems, and 11% were not connected to a community supply – using their own well, rainwater from roof collection or a tanker supply. Despite improvements in water treatment, by 2004 there were still over 900,000 New Zealanders whose drinking water supplies did not meet national health standards. The main culprits are diarrhoea-causing E.coli bacteria (from animal faeces) and other micro-organisms, such as Cryptosporidium and Giardia.

A new Bill, **The Health (Drinking Water) Amendment Act 2007, w**as enacted in October 2007 and its commencement date is 1 July 2008. It aims to protect public health by improving the quality of drinking-water provided to communities. Collected rainwater, for example, now has to be filtered & sterilised.

For information on water grading where you live, see the *Register of Community Drinking Water Supplies in New Zealand*, available at your library, or ask at the local Council offices.

Annual water use per person has increased hugely in the past century. This is mostly because of demand from garden and farmland irrigation, large livestock numbers for meat and dairy production, industrial processes, water-borne sanitation (flushing toilets) and the water-hungry appliances we have.

Water use indoors
Typically, *inside* a NZ home:



NB. the chart above excludes outdoor & garden uses, which are the most water-hungry in summer time!

What water use do our home appliances and activities require?

Water efficient (approx 40% better)	…**compared to water inefficient**
Front-loading clothes washer 60 litres/load	Top-loading washer 170 litres/load
Half-flush on toilet cistern 3 litres	Full flush 6 to11 litres
A low-flow shower 35 to 55 litre	A bath 180 litres, full-flow shower 130 litres
10 litre bucket to wash car or house windows	Hose running at 15 litres per minute
Cleaning teeth using mug of water for brush	Tap running at 15 litres per min.
Modern dishwasher 30 litres per load	Old dishwasher 50 litres

Around our homes this translates to between 180 and 260 litres of water per person each day. Note that a garden sprinkler can deliver up to 900 litres an hour. Summer garden water use can raise total *average* demand, inside plus outside, to 800 litres per person per day. Contrast this to parts of many developing countries, where people are limited to what they can carry, or about 25 litres/day!

A slowly dripping tap can waste 1 to 10 litres of water a day, whilst a major leak in the underground pipe supplying your house could lose huge amounts. How do you know if there is an underground pipe leak? Reading your road-side water meter twice on one day when there is little water use in the house (or overnight) can give you warning of major pipe leaks, as would puddles appearing at the same spot in the garden on dry days. You are responsible for repair of leaks on the house-side of this meter. If it is a digital-style rather than dial meter, as pictured on our slides, look at the first three red numbers (litres), ignoring both the fourth red one at the far right (tenths of a litre) and the four white numbers at the left (cubic metres).

Options for improvement

Some local authorities have introduced a charge for water by metered flow instead of a flat rate related to house value. This is usually done by allowing the first few hundred litres per day for a base or fixed charge, plus a charge by volume for all water used above that level. In these areas, annual water demand has dropped between 15% (Tasman District, and Auckland) and 35% (Rotorua). It makes sense, and saves the household useful cents, for us to take some extra care and make a few changes of habit or of equipment to conserve this liquid asset.

We can make a difference in our homes, by conserving the water we use and making sure that what we tip down the drain isn't going to harm the natural water environment.

For challenging information on global contrasts in water use, see Anita Roddick's book *Troubled Water,* or Vandana Shiva *Water Wars ;* or Tony Clarke & Maude Barlow *Blue Gold.*

Examples:
- 2,500 gallons of water per pound of beef steak produced in USA;
- 50 glasses of irrigation water to produce one glass of orange juice; - 25 million people die each year from contaminated drinking water, equivalent to population of Canada.
- Western Europeans consume an average 85 litres of bottled water per person per year (46% of world consumption) at a price hundreds of times higher than tap water, per litre.

For more information on global water issues visit:
http://www.un.org/waterforlifedecade/
World Water Day is held in March
http://www.worldwaterday.net/