Air quality 2007/08

Key points:

- The region had low air pollution levels – there was only one night in Wainuiomata and in Tawa (winter 2007) and three nights in Masterton (winter 2008) when high air pollution was recorded.
- Particulate matter (PM_{10}) was the only air pollutant measured to exceed the national environmental standards for air quality.
- Air quality is worst during cold, clear and calm weather, especially in valleys where pollution can become trapped overnight.
- Domestic fires are the main contributors to air pollution in winter.

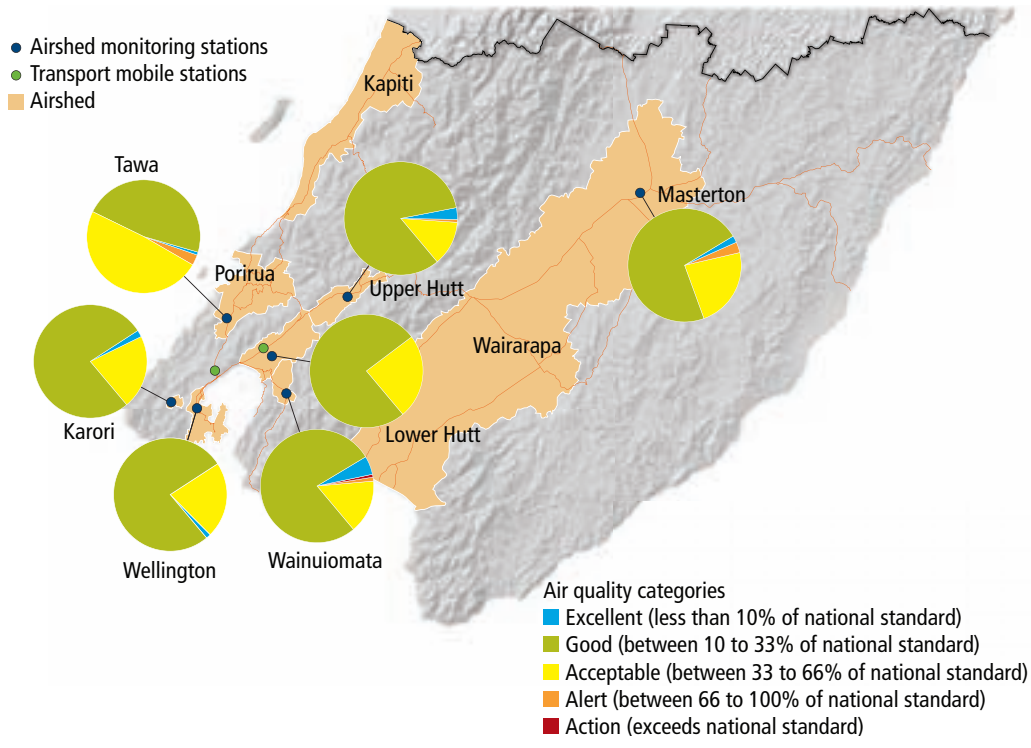
What happened in 2007/08?

Regional air quality

Greater Wellington continued monitoring air quality at selected sites in the region and installed monitoring stations in Tawa and in Karori. Three key pollutants are measured – particulate matter (PM_{10}), carbon monoxide and nitrogen dioxide – with the results compared against the national environmental standards and guidelines. These standards and guidelines are designed to protect those who are particularly vulnerable to the effects of air pollution, such as children and the elderly.

Monitoring during the 2007 calendar year showed that air pollution levels in the region were low. Carbon monoxide concentrations were mostly "excellent" and reflect the national trend towards more modern, lower emission petrol vehicles. Nitrogen dioxide levels were generally "excellent", except for the central Wellington site where levels were mostly "good".

Levels of PM_{10} measured throughout the region were for the most part "good". However, there were 11 days in Masterton, seven days in Tawa, three days in Wainuiomata, and two days in Upper Hutt where air quality reached the "alert" level. There was also one day in Wainuiomata and in Tawa where the national standard was exceeded.

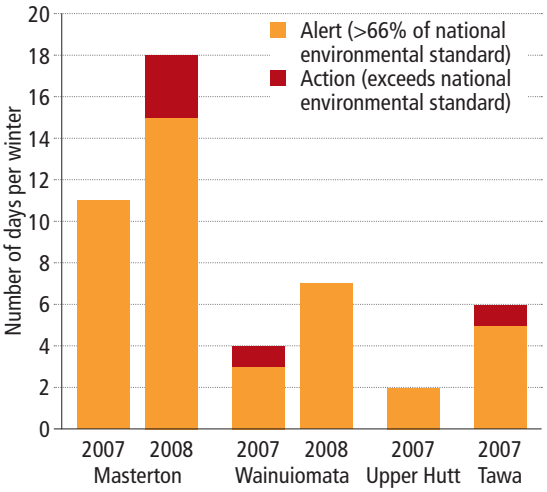


The pie graphs show the percentage of days during 2007 that PM_{10} levels fell into the five different air quality categories. The "excellent" category has the lowest level of risk to human health and the "action" category the highest risk. An "action" result also means that the national environmental standard has been exceeded.

Winter air quality

Masterton, Upper Hutt, Wainuiomata and Tawa are susceptible to pollution from domestic fires on still, cold and clear evenings. Smoke containing particulate matter (PM_{10}) builds up in valleys and is not dispersed until the following morning when the ground heats up and the air starts to circulate.

A single chimney may cause nuisance smoke. Valley areas with many households using their wood burners can lead to the build-up of particulate matter (PM_{10}) on cold, still evenings.



This graph shows the number of days during the last two winters when particulate matter (PM_{10}) concentrations were in the "alert" or "action" air quality categories. Greater Wellington's long-term target is to always achieve "acceptable" or better air quality by 2016.

Roadside air quality

Vehicle exhaust fumes contain pollutants that, in sufficient concentrations, can harm people's health. Greater Wellington has a permanent monitoring station at the corner of Vivian and Victoria Streets in central Wellington. Temporary stations are currently set-up beside State Highway 2 at Melling Bridge in Lower Hutt and at Ngauranga Gorge in Wellington.

Although levels of carbon monoxide and nitrogen dioxide are higher than at the residential areas we monitor, the air quality measured at the roadside sites in 2007 was well within the national environmental standards and does not pose a risk to people's health.

Photo courtesy of GNS Science

Traffic travelling past the Ngauranga Gorge monitoring site. Peak concentrations of carbon monoxide and nitrogen dioxide measured at the site coincide with rush hour traffic but do not exceed national environmental standards or guidelines.

Scientific studies

We are continuing to work with GNS Science to identify the sources of particulate pollution in the region, so that we can develop effective strategies to improve air quality where needed. The studies examine both fine particulate matter ($PM_{2.5}$) and coarse particulate matter ($PM_{10\text{-}2.5}$) and provide valuable information about the impact particulate emissions from domestic wood burners, vehicles and natural sources, such as sea-salt and wind-blown dust, have on air quality

Areas investigated so far include Masterton, Upper Hutt and Seaview. In Masterton, domestic fires were found to be responsible for about 80 per cent of PM_{10} on nights when the national standard was exceeded. Wainuiomata also experiences winter particulate pollution and we are currently investigating the contributing sources in this area.

Samples of particulate matter from the Seaview industrial area in Lower Hutt that were collected between July 2005 and July 2007 show that sea-salt and soils are the major contributors to PM_{10} in air. Other sources are local industry (producing zinc and sulphur-containing particulate), road dust, motor vehicles and, in winter, domestic fires in the Hutt Valley.

What is Greater Wellington doing?

- Monitoring air quality at selected sites around the region, including Wellington, Lower Hutt, Upper Hutt, Wainuiomata, Karori, Tawa and Masterton.
- Investigating possible locations in the Kapiti airshed for an air quality monitoring station.

What can you do?

- Keep your vehicle tuned and serviced to reduce smoke and fumes.
- Insulate your house effectively and burn only dry wood in your fireplace. After starting the fire, leave the air vent open for at least half an hour to create a hotter, cleaner burning fire.
- Don't burn rubbish or treated timber – in the fireplace or outside. Send paper and plastic for recycling and compost green waste.

More information

Some of the information on this card is a summary of the 2007 annual air quality monitoring report, which is available on our website at **www.gw.govt.nz/envreports**

If you would like to know more about air quality, visit our website or contact:

Tamsin Mitchell (Environmental Scientist, Air Quality)
Phone: 04 384 5708 Email: tamsin.mitchell@gw.govt.nz

Groundwater 2007/08

Key points:

- 2007/08 was an extremely dry year resulting in minimal recharge of the region's shallow aquifers and all-time low groundwater levels in many aquifers.
- High nitrate-nitrogen concentrations were recorded in some of the region's aquifers. Contamination levels are highest in shallow aquifers, correlating with more intensive landuse.
- A wet May and June in 2008 led to a recovery in groundwater levels in many aquifers across the region. However, groundwater levels in some deep confined aquifers continue to be at or below long-term minimum levels.
- A model of the middle section of the Wairarapa valley groundwater system has been developed. This model allows us to test various climatic and water abstraction scenarios that will help us determine water allocation limits.

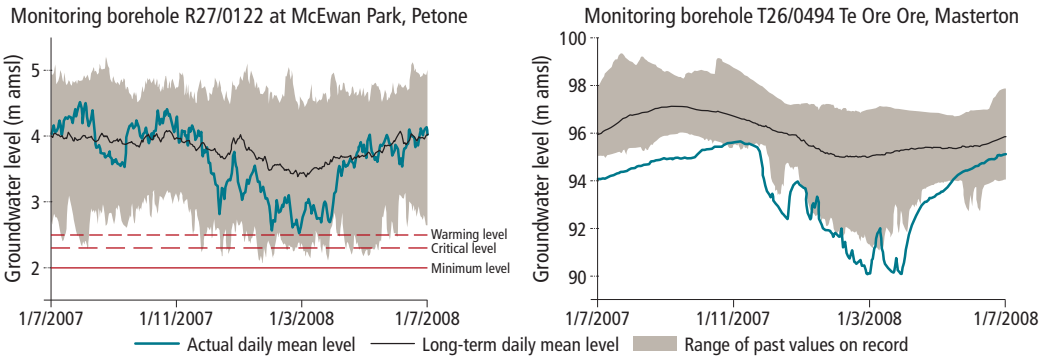
What happened in 2007/08?

Groundwater quantity

A relatively dry winter in 2007 followed an extremely dry autumn, significantly reducing the volume of water entering aquifers. This lack of winter recharge led to below average groundwater levels in spring 2007 in the region's main aquifers, particularly in the Wairarapa and Kapiti Coast.

The long dry summer of 2007/08 led to greater demand for groundwater for irrigation and municipal water supply and this was reflected in all-time low groundwater levels in many areas. There were a number of reports of shallow boreholes that do not fully penetrate aquifers 'drying up'. The low groundwater levels contributed to reduced flows in many rivers and spring-fed streams, and reduced water levels in wetlands.

Wetter conditions in May and June led to a recovery in groundwater levels in many shallow unconfined aquifers. However, many deeper confined aquifers – which respond to change more slowly – still recorded all time lows or below average levels during this period.



Groundwater levels at the Petone foreshore from the confined Waiwhetu aquifer (left) show the effects of above average groundwater pumping for public water supply throughout the summer months. Groundwater levels were maintained above the warning level set in the aquifer to safeguard against the effects of saline intrusion. The relatively dry year and long-term low groundwater levels are evident in the Te Ore Ore monitoring borehole near Masterton (right). Long term minimum levels were recorded throughout much of the year due to reduced recharge and groundwater abstraction in the aquifer. Groundwater levels can be seen to recover back towards average levels in May and June 2008 when it was very wet.

Wairarapa groundwater investigation

Significant progress has been made over the last year with the Wairarapa groundwater investigation, with one of three computer models (middle Wairarapa valley) completed. Extensive field operations were also carried out throughout the year, including the drilling of 11 monitoring boreholes, a seismic geophysics survey, isotope chemistry sampling to determine groundwater age, a springs survey and reading of meters on water takes. Work will continue next year on modelling the lower and upper parts of the Wairarapa valley.

Our groundwater model provides a tool which will allow us to test a range of climatic and water abstraction scenarios. The results will contribute to the sustainable management of the groundwater system in the Wairarapa by providing a basis for groundwater allocation provisions in the review of our regional plans, scheduled to begin next year.

Construction of a new shallow monitoring borehole in Te Ore Ore as part of the Wairarapa groundwater investigation. This borehole, and ten others constructed across the valley, will support existing monitoring sites to help us understand the complex hydrogeological systems in the Wairarapa. At this particular monitoring site, we hope to further explore the link between the Te Ore Ore aquifer and the Poterau Spring seen in the foreground.

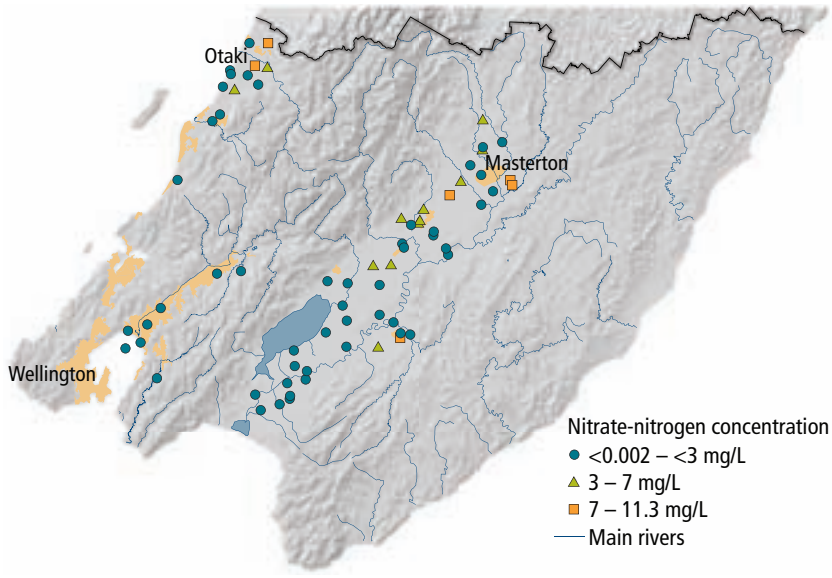
Groundwater quality

Greater Wellington monitored groundwater quality every three months at 70 sites across the region. Water samples were tested for a range of physical, chemical and microbiological variables including nutrients, metals and faecal bacteria.

The 2007/08 results showed that faecal bacteria (*E. coli*) counts were above the Ministry of Health drinking water standard for bacteria (<1 cfu/100 mL) in 11 boreholes located in Kapiti, Wairarapa and Wainuiomata. The highest bacteria count recorded was 600 cfu/100 mL at Te Horo beach. Nitrate-nitrogen concentrations were high (between 7-11.3 mg/L) in six boreholes but no concentrations exceeded the drinking water standard (11.3 mg/L).

Groundwater quality investigations

Targeted groundwater quality investigations continued in several areas in the Wairarapa, including an area of increasing rural-residential development with on-site wastewater disposal (Norfolk Road, Carterton) and an agricultural area in Te Ore Ore near Masterton. The results of these investigations, together with the results from other targeted investigations in the Wairarapa over the last four years highlight that nitrate-nitrogen contamination exists to various degrees. The greatest contamination is present in shallow groundwater in the intensively farmed Mangatarere (Carterton) and Te Ore Ore areas, with some boreholes exceeding the national drinking water standards for nitrogen and *E. coli* bacteria. Contamination is generally higher in the winter months when rainfall is greater, soils are more saturated and groundwater levels higher.



Nitrate-nitrogen concentrations recorded in Groundwater state of the environment monitoring boreholes. Boreholes were sampled quarterly over 2007/08 with the highest concentrations recorded in this period shown in the figure above. No results exceeded the Ministry of Health drinking water standard of 11.3 mg/L in the lower Wairarapa but concentrations in six boreholes were relatively high (7–11.3 mg/L).

What is Greater Wellington doing?

- Routinely monitoring groundwater levels at 129 sites across the region, with 11 new sites to come on-line in 2008/09.
- Monitoring groundwater quality at quarterly intervals at 70 sites across the region to check long-term changes in water quality.
- Targeted monitoring of nitrate concentrations in the areas of the region most vulnerable to contamination.
- Developing a groundwater model of the Wairarapa valley to improve our understanding and management of this large groundwater resource.
- Commencing investigations on the Kapiti Coast (where urban development and demand on groundwater in the shallow aquifer has grown) that will include monitoring of saline intrusion and nitrate-nitrogen concentrations.

What can you do?

- If you have your own bore for a domestic water supply, it's essential to have good well head protection, and to get the water tested regularly – we suggest annually. Greater Wellington staff can advise on how to get the water tested.
- Apply for resource consents before drilling any bore, and if you propose to take more than 20,000 litres of water per day.
- If you have a consented groundwater take, read your meter regularly – this will aid any future consent renewal and assist with modelling and management of the groundwater resource.
- Manage animal effluent disposal systems and fertiliser use to ensure that application rates are appropriate for the soil type and soil moisture conditions.

More information

Some of the information on this card is a summary of the 2007/08 annual groundwater monitoring report which is available on our website at **www.gw.govt.nz/envreports**

If you would like to know more about groundwater, visit our website or contact:

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Harbours, estuaries and beaches 2007/08

Key points:

- Testing of sediments from the Wellington Harbour sea floor found elevated concentrations of stormwater-derived contaminants.
- The Porirua Harbour is moderately eutrophic (nutrient rich) and has a moderate risk of sedimentation accumulation, signalling that there is room for improvement in the health of the harbour.
- The ecological condition of the Whareama Estuary is "fair" to "good" but the very muddy and poorly oxygenated sediments are not ideal for plants and animals.
- Castlepoint Beach is in good ecological condition.

What happened in 2007/08?

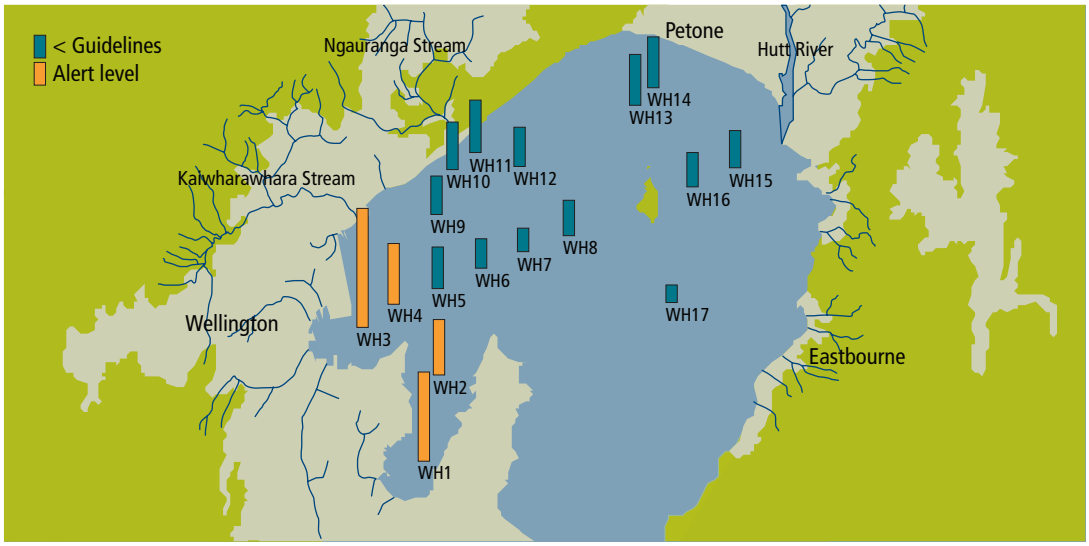
Wellington Harbour sediment quality investigation

We collected samples of sea floor sediment and benthic fauna (animals that live on or in the sea floor) from 17 locations in Wellington Harbour in late 2006. This was the first comprehensive survey of sediment quality in over 20 years, and provides an up-to-date picture of contaminant levels and the animals that live on or in the sea floor.

Tests on the sediment samples completed in 2007/08 revealed the presence of contaminants – such as heavy metals, organochlorine pesticides, polycyclic aromatic hydrocarbons (PAHs), and antifouling compounds. The highest contaminant concentrations are found in inner Lambton Basin and Evans Bay where some – including lead, copper, zinc, PAHs and the pesticide DDT – are above the "alert" levels of the national sediment quality guidelines. These areas of the harbour offer little flushing of contaminants and so act as natural sinks where contaminants accumulate over time.

Although the contaminated sediment poses little risk to people, most of the contaminants tested are persistent and toxic and could have adverse effects on sea floor marine life. Fortunately, our examination of the benthic fauna didn't show any clear evidence of harm. However, we don't know what the effects are on individual species or in areas closer to shore where sediment contamination will be higher.

Contaminants that run off hard surfaces such as roofs, roads and footpaths when it rains are a major contributor to the harbour seabed contamination. This urban runoff flows into roadside gutters and drains, then discharges into the harbour via stormwater outfalls or urban streams.



Average concentrations of total copper found in the surface sediments at 17 sites in Wellington Harbour (sampled in late 2006). Bars coloured orange indicate that copper is at a level where adverse biological effects could possibly occur and signal the need to limit further contamination. The primary sources of copper in urban stormwater are vehicle brake pad wear and architectural uses such as copper spouting.

Whareama Estuary and Castlepoint Beach monitoring

Ecological assessments of the Whareama Estuary and Castlepoint Beach were carried out in January. Based on the National Estuary Monitoring Protocol, they included an assessment of sediment grain size and chemistry, and sediment-dwelling plants and animals. The key findings were:

- Whareama Estuary: overall the intertidal habitat is generally in "fair" to "good" condition but the very muddy and poorly oxygenated nature of the sediments are a concern as they create poor conditions for plants and animals. Excessive inputs of sediment are largely a natural phenomenon given the erosion-prone mudstone soils in the catchment. Four sediment plates have been placed in the estuary and will be read annually to provide a measure of sedimentation rates.
- Castlepoint Beach: the intertidal habitat is generally in good condition. The beach sediments consist of well-oxygenated sands and support animals commonly found in exposed beach environments, such as crustaceans and beetles.

Porirua Harbour surveys

Last summer we carried out a survey of the types of vegetation and substrate (e.g. mud, sand, gravel) in the intertidal areas of the Porirua Harbour. We also undertook an ecological assessment at two intertidal sites within each arm of the harbour, the Onepoto Arm and the Pauatahanui Arm.

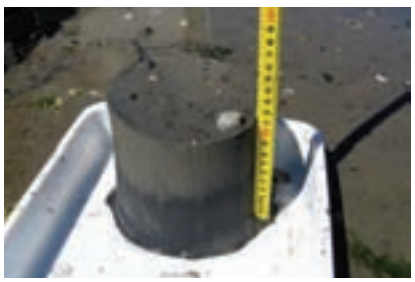
The surveys showed that both arms of the harbour are moderately eutrophic (nutrient rich), meaning that there is a greater likelihood of nuisance growths of sea lettuce and other algae. When assessed in December 2007, approximately 70 per cent of the inter-tidal area of each arm had at least some algal cover.

Both arms of the harbour have a moderate risk of sediment accumulation and so sediment plates were buried at five intertidal (between low and high tide) and subtidal (below low tide) locations to enable sedimentation rates to be monitored. Excessive sediment entering the harbour is not desirable because it may lead to infilling with mud, reducing the harbour's biodiversity, recreational and other values.

We are concerned about the loss of habitat, particularly in the Onepoto Arm which has minimal saltmarsh vegetation. Sediment in the southern end of the Onepoto Arm also has the highest heavy metal concentrations, a result of contaminant inputs from urban stormwater.

The types and number of organisms living in and on the sediment indicate that the harbour is still in reasonable condition, but ongoing management and monitoring is required of nutrients and sediment entering the harbour from subdivision sites, urban stormwater and agricultural runoff.

Burying sediment plates in the Porirua Harbour. The depth to each sediment plate will be measured each year, allowing us to determine the rate of sedimentation.



Measuring the depth of oxygenated sediment in a sediment core sample from the Porirua Harbour. The greater the depth of oxygenated sediment, the better the conditions for plant and animal life in the sediment.

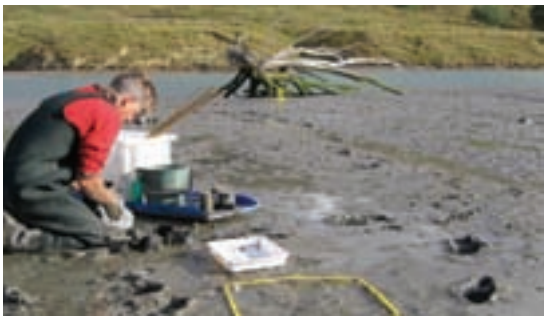


Photo: Wriggle Coastal Management

One of the monitoring sites in the Whareama Estuary, on the eastern Wairarapa coast. At each site, sediment samples are collected for laboratory testing and the algae and animals living in and on the sediment are identified and counted.

Lake Onoke assessment

An ecological assessment of Lake Onoke carried out in September 2007 identified the lake as being in a relatively poor condition, reflecting the high level of past modification for drainage. The lake is at moderate risk of further degradation from a range of stressors – such as stock grazing, vehicle damage to Onoke Spit dune vegetation, and high nutrient, sediment and pathogen inputs from land use intensification.

Greater Wellington is looking to implement a programme to monitor the health of the lake in 2009.

What is Greater Wellington doing?

- Regularly monitoring microbiological water quality at 77 coastal sites (see *Recreational water quality* report card).
- Periodically monitoring sediment quality and ecological health in sensitive estuarine and harbour environments, particularly those likely to be impacted by urban stormwater.
- Reviewing the Regional Policy Statement, with a view to promoting low impact urban design and improved management of stormwater discharges.

What can you do?

Save the drain for rain: Stormwater drains go from the roadside directly to streams or the coast. Never put rubbish, paint, oil or any other waste into stormwater drains. Paints (oil and water-based) and thinners are toxic to aquatic life, and discolour streams and coastal water.

More information

The information on this card is a summary of the more detailed 2007/08 annual coastal monitoring report, which is available on our website at **www.gw.govt.nz/envreports**

If you would like to know more about the coast, visit our website or contact:

Juliet Milne (Team Leader, Environmental Science)
Phone: 04 384 5708 E-mail: juliet.milne@gw.govt.nz

Natural hazards 2007/08

Key points:

- A severe drought in the Wairarapa caused concern for farmers.
- A number of storm events caused flooding and landslips around the region.
- Three tornadoes struck the Kapiti Coast.

A natural hazard is any natural process (e.g. flood, earthquake, tsunami) that can adversely affect human life or property. On their own, these natural events do not constitute a hazard; they become hazardous when they have the potential to affect a community.

The Wellington region has one of the most physically diverse environments in New Zealand and, with the exception of volcanic and geothermal activity, is subject to the full range of natural hazards experienced in New Zealand.

What happened in 2007/08?

Drought

Drought conditions prevailed over the region during a very dry summer and autumn, despite the occasional thunderstorm. The drought was caused by a La Nina episode that led to warm sunny weather, with lower than average rainfall. The Wairarapa was particularly affected by drought conditions that started in November and continued until May. This followed a cool dry spring in which pasture growth was below normal, leading to a severe shortage of silage and hay. Many farmers were forced to sell underweight lambs. More information on the drought can be found in the *Rainfall and river flows* report card.

Photo: Pete Nikolaison

Dry conditions in the Wairarapa through summer and autumn forced many farmers to sell stock.

Earthquakes

Although the Wellington region is crossed by numerous faults, there was very little seismic activity during 2007/08, with only 13 moderate sized (over magnitude three (M 3.0)) earthquakes recorded and no reports of serious damage. The most widely felt local earthquake was a M 4.0 that occurred in the early hours of 3 May, on a fault 10 km west of Porirua.

A further 56 earthquakes that occurred outside the region were also reported to have been felt. Sixteen of these earthquakes were moderate to large (M 5-6.9) and one, that had an epicentre some 1,800 km northeast of Wellington, was very large (M 7.8). This earthquake was the largest to occur in the New Zealand region in 2007/08 and resulted in the Pacific Tsunami Warning Centre issuing a tsunami bulletin on 9 December 2007.

The second largest earthquake felt in the Wellington region in the past 12 months (M 6.8) occurred on 20 December 2007 in a deep submarine canyon – the Hikurangi Trench – off the east coast of the North Island. This earthquake caused substantial damage in Gisborne and was widely felt in the Wellington region. Two large aftershocks in the following days were also felt in Wellington.

Floods

Floods are the most frequent and costly natural hazard in the Wellington region. The 2007/08 year was relatively uneventful in terms of large floods, however, there were a number of extreme rainfall events that led to localised flooding.

On 7-8 January, a strong northwesterly brought sustained heavy rain to the western foothills of the Tararua Range for a 48 hour period. Greater Wellington's monitoring stations measured rainfall depths of up to 350 mm, producing record 24 hour and 48 hour rainfall totals. The storm caused flooding in the rivers and streams on the Kapiti Coast. The Waikanae River experienced the sixth largest flood since 1975. Significant floods also occurred in the Waitohu and Mangaone streams. A camping ground in Waikanae and three homes adjacent to the flooded streams were evacuated.

A severe rainstorm event on 7-8 January on the Kapiti Coast saw the Waikanae River flood properties in Otaihanga and threaten a number of homes.

On 11 February, a thunderstorm caused surface flooding in Wellington City, Hutt Valley and Porirua and cut power to 21,000 households on the Kapiti Coast and Pauatahanui after lightening struck the Pauatahanui sub-station. Lightening also damaged several houses in the suburb of Korokoro in Lower Hutt after a chimney was struck and caused bricks to fly into neighbouring houses.

Two large storms followed in quick succession on 29 April and 1 May bringing heavy rain to Wellington City and the Kapiti Coast, resulting in surface flooding in Kapiti, Wellington City and Porirua and slips in many hill suburbs. A number of shops and homes in Otaki, Waikanae, Paraparaumu, Raumati Beach and Johnsonville were flooded when stormwater drains, unable to cope with the high rainfall, became blocked and overflowed into surrounding properties. Our rain gauge at Karori recorded 80 mm, which is the second highest 24 hour measurement in the last 25 years.

Tornadoes

Onlookers at Raumati South view the spectacular twister that occurred on the Kapiti Coast on 15 February.

Squally southerly conditions in February and June spawned three tornadoes on the Kapiti Coast. The first occurred in the early evening of 15 February. It started as a waterspout that formed near Kapiti Island and slowly moved south, coming onshore at Queen Elizabeth Park. It evaporated soon after and no damage was reported. The second tornado occurred on 2 March and was similar to the first event, except that it remained at sea as a waterspout. The third occurred on 12 June during a storm event and was more serious, ripping up trees and damaging property. One property on Mazengarb Road had 20 mature pine trees uprooted.

Landslips

Landslips in the region are most commonly caused by heavy, sustained rainfall, particularly if the ground is already saturated. All of the severe meteorological events that caused flooding in the past 12 months also triggered slips in hill suburbs and in road cuttings around the region. The largest slip occurred at Ngawi, on the South Wairarapa Coast, in the evening of 9 May. The slip occurred during a torrential rainstorm, in which 100 mm of rain fell. An estimated 10,000 m^2 section of hillslope failed, causing a large debris flow containing mud and boulders to badly damage four properties and block a road. South Wairarapa District Council removed almost 1,000 cubic metres of material from the road and affected houses.

On 17 May a much smaller slip occurred in Athol Crescent in central Wellington, threatening to undermine an apartment building. It is thought that a leaking water main contributed to the slope failure. Building residents were evacuated – with some unable to return for over a month – until the cliff face beneath the building was stabilised. It is not uncommon for leaky water pipes to contribute to landslips in urban areas, highlighting the need to manage water drainage on developed hillslopes.

What is Greater Wellington doing?

Greater Wellington helps manage the impacts from natural hazards on communities through floodplain management plans, natural hazard policies in the Regional Policy Statement, conducting research and collecting information on hazard events, and by coordinating regional Civil Defence Emergency Management activities and public education programmes.

What can you do?

Be prepared: You need to be able to look after yourself for a minimum of three days in a natural disaster. Put together an emergency survival kit containing: drinking water (3 litres per person per day); non-perishable food (canned or dried); cooker (camping or BBQ); torch; radio; spare batteries; first aid kit and essential medication; blankets or sleeping bags; baby supplies; pet supplies; warm clothing; rain gear and walking shoes or boots. See **www.getthru.govt.nz** for a full checklist of items and other useful tips to *Get Ready* and *Get Thru*.

More information

Check out our online database of natural hazards in the Wellington region at **www.gw.govt.nz/hazards**

We have also prepared a number of fact sheets about the natural hazards that affect our region. They are a great way to learn more about hazards and what you can do to prepare for them. Read them online at **www.gw.govt.nz/em/hazard.htm** Alternately, you can email hazards@gw.govt.nz or phone 04 384 5708 to order a set or if you have any further questions about natural hazards.

Rainfall and river flows 2007/08

Key points:

- La Nina conditions led to a drought in the Wellington region from late spring 2007 through until autumn 2008, with very low rainfall in the Wairarapa, Tararua Range and parts of the Hutt Valley.
- The onset of the drought was unusually early, with particularly low rainfall during November and record-low December river flows in some parts of the region. This led to restrictions on water takes from rivers very early in the summer.
- The drought was one of the worst five droughts of the last 40 years in the Wairarapa and Hutt Valley, in terms of the number of days with a significant soil moisture deficit.

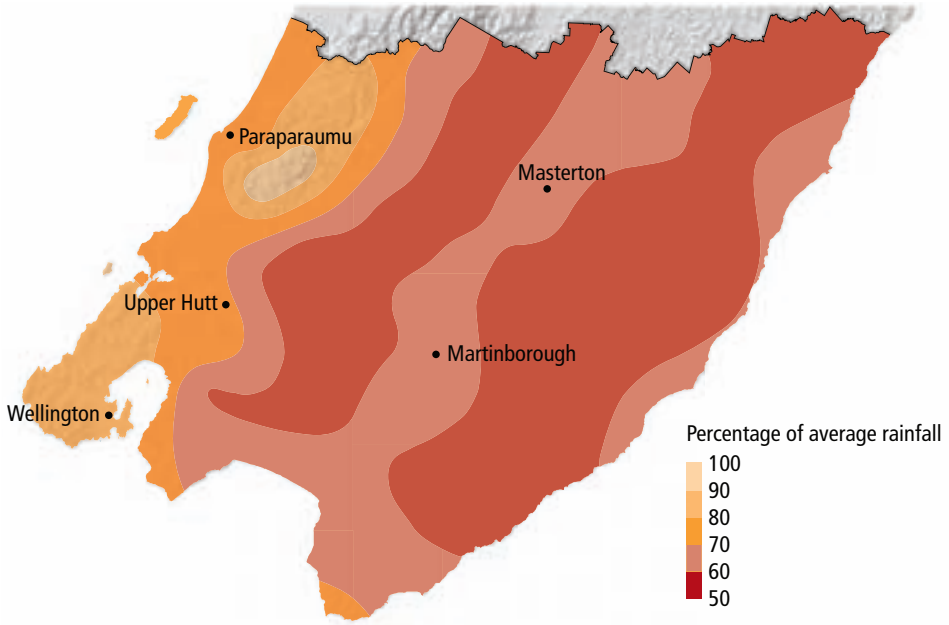
What happened in 2007/08?

La Nina brings a drought

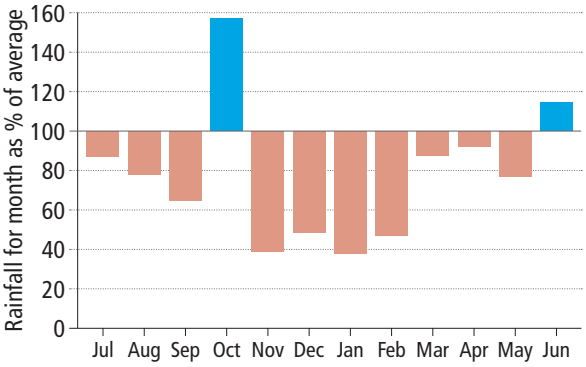
La Nina conditions caused drought in many parts of New Zealand in early 2008, and the Wellington region was no exception. Following an El Nino that caused an autumn drought in 2007, spring was in general drier and more settled than usual as a La Nina episode set in. Rainfall during November 2007 was particularly low – in most parts of the Wairarapa it was the driest November in more than 20 years. By December, river flows and soil moisture were very low for the time of the year throughout the Wellington region.

The areas with the lowest rainfall compared to average were the eastern Wairarapa hills, the Wairarapa plains, the eastern Tararua Range, the Wainuiomata catchment and northern and eastern parts of the Hutt Valley. In these places, rainfall over the period November 2007 to March 2008 was 50-70 per cent of the long-term average. Low river flows were experienced in all the major rivers of the Wellington region.

Due to particularly low rainfall in the eastern Tararua Range the Ruamahanga River had its lowest flow since 1985. The drought was broken by rainfall in many places towards the end of March 2008, although in the eastern Wairarapa hills drought conditions persisted through until May. By June, river flows and soil moisture had returned to about normal levels for the time of the year.



Rainfall during the period November 2007 to March 2008 as a percentage of the long-term average. Rainfall was only about half the long-term average in eastern Wairarapa and in the Wairarapa foothills of the Tararua Range.



Monthly rainfall during 2007/08 at our monitoring station 'Kaitoke Headworks' in the northern Hutt Valley. Blue bars indicate above average rainfall and pink bars indicate below average rainfall. Rainfall at this location was particularly low during November to February – less than half the average for those months.

How bad was the drought?

An analysis of information from NIWA suggests that this year's drought ranks in the worst five droughts of the last 40 years in the Wairarapa and Hutt Valley, in terms of the number of days with a significant soil moisture deficit. However, the drought was not as severe or prolonged as the droughts of 1997/98 in the Wairarapa, 2001 in the Hutt Valley and eastern Wairarapa, and 2002/03 on the Kapiti Coast and Wairarapa plains. The severe effects of the 2007/08 drought on activities such as farming in eastern Wairarapa were partly a result of very low rainfall leading up to summer – reducing the usual spring grass growth.

Severe low flows occurred in some rivers of the Wellington region in summer 2007/08. By late January the Waipoua River upstream of Paierau Road had dried up into a series of pools. It is a natural occurrence for the river to lose flow into the gravels at this location, although it only stops flowing completely during very dry years. The river started flowing again further downstream.

Water take restrictions to protect river flows

Low water flows can place pressure on the aquatic ecosystems of rivers and streams, because the amount of habitat is reduced and water temperatures are increased. In order to protect aquatic life, as well as cultural and recreational values of waterways, Greater Wellington sets minimum flow policies in its Regional Freshwater Plan. The policies mean that abstractions from rivers and streams may be restricted or banned during times of low flow.

During the 2007/08 drought, very low river flows led to Greater Wellington imposing restrictions on direct takes from most of the rivers and streams in the region. Due to the low spring rainfall, the restrictions were implemented very early in the summer – for some rivers there were restrictions in force in December. By January, there was a full ban on direct takes for irrigation from many Wairarapa rivers and streams.

Minimum flows are set at an appropriate level for protecting ecosystem, cultural and recreational values of waterways. During 2007/08, Greater Wellington completed assessments of minimum flow requirements for sustaining these values of the lower Ruamahanga River. During the next year we plan to carry out scientific investigations such as habitat surveys to check the minimum flows for the Waiohine and Waingawa rivers.

Photo courtesy of ONTRACK

A summertime flood: the Kapiti Coast was spared from the worst of the drought, but experienced a flood on 7-8 January. Unusually heavy and persistent rain fell on the coast and in the foothills for more than two days, resulting in very high stream flows. This picture is of the Waitohu Stream, which had its largest flood in more than 10 years. For more information see the *Natural hazards* report card.

What is Greater Wellington doing?

- Monitoring rainfall, river flows and lake levels at more than 70 automatic recording stations across the region. In 2007/08 we installed new rain gauges in Makara, Parkvale, Mauriceville and Kiriwhakapapa. We also installed lake level monitoring equipment in Lake Kohangatera and Lake Kohangapiripiri, to help improve our understanding of the Pencarrow lake system.
- Assessing compliance with resource consents to take water from rivers and streams, and issuing water restrictions when appropriate.
- Operating a flood warning system, which involves monitoring river levels, forecasting flood peaks, and issuing warnings to people who may be affected.

What can you do?

Conserve water by watering your garden deeply once or twice a week during dry spells, rather than watering lightly every day. This encourages deeper-growing roots, making the plants more resistant to drought. You can also check our website to see how much rainfall there has been in your area.

More information

Some of the information in this card is a summary of the more detailed 2007/08 annual hydrology monitoring report which is on our website at **www.gw.govt.nz/envreports**

River flow, lake level, soil moisture and rainfall data, along with other environmental monitoring data, are posted on our website: **www.gw.govt.nz/monitoring**. The information is updated frequently throughout the day.

For more information, please contact:

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Recreational water quality 2007/08

Key points:

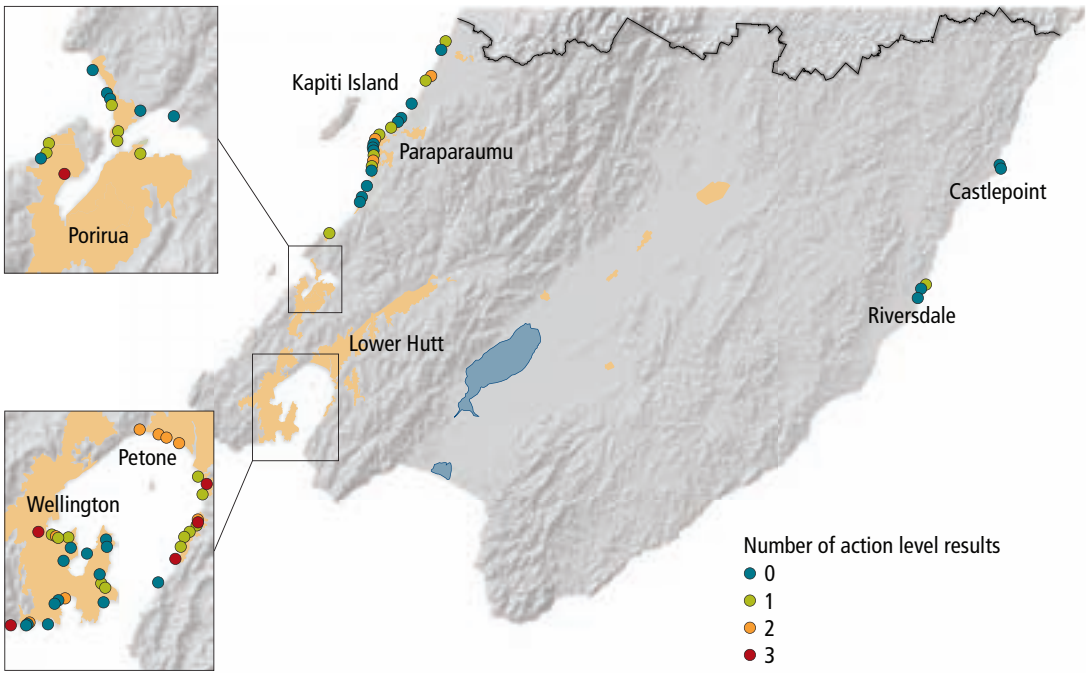
- Coastal water quality was suitable for swimming on all sampling occasions at 34 of the 77 beaches monitored during the 2007/08 bathing season.
- River water quality was suitable for swimming on all sampling occasions at five of the 21 swimming spots monitored weekly during the 2007/08 bathing season.
- Water quality, especially in rivers, was most likely to be unsuitable for swimming during and shortly after rain.
- The hot, dry summer led to extensive toxic blue-green algal growth in some rivers, especially the Hutt River.

What happened in 2007/08?

Coastal water

Recreational water quality was good at most beaches throughout the region last summer. Although 43 of the 77 sites monitored exceeded the "action" guideline of the national recreational water quality guidelines (280 enterococci/100 mL), 26 of them exceeded the guideline only once. Eleven sites exceeded the guideline on two occasions and six sites exceeded three times. Health warning signs were erected at Titahi Bay in mid December, at the rowing club in Porirua Harbour in early January and at Owhiro Bay in mid February after routine and follow-up sampling showed the "action" guideline was still being exceeded.

Sixty per cent of the 66 occasions where sites exceeded the "action" guideline coincided with at least 10 mm of rainfall in the three days prior to sampling and 36 per cent coincided with more than 10 mm of rainfall in the 24 hours prior to the day of sampling. The high correlation between rainfall events and elevated bacteria counts in coastal waters relates to runoff from the land entering stormwater systems, rivers and streams discharging to the coast. Pollution in rivers and streams can also affect water quality at some beaches during dry weather, as can re-suspension of sediments from wind and tidal action.

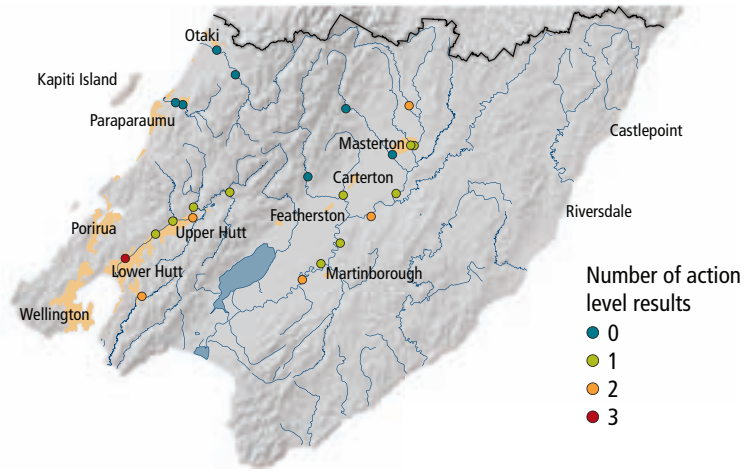


Summary of compliance with the recreational water quality guidelines for 77 coastal bathing sites monitored over the 2007/08 summer. For up-to-date results about bathing water quality, check our website at http://www.gw.govt.nz/on-the-beaches during summer.

Fresh water

Sixteen of the 21 freshwater sites monitored weekly last summer exceeded the "action" guideline for indicator bacteria (550 *E. coli*/100 mL). Ten sites exceeded the guideline once, five sites exceeded the guideline twice and one site (Hutt River at Boulcott) exceeded the guideline three times. As well as having the highest number of "action" level exceedances, the Hutt River at Boulcott also exceeded the "alert" level guideline (260 *E. coli*/100 mL) six times.

More than 80 per cent of the 23 "action" level results coincided with at least 10 mm of rainfall in the 72 hours prior to sampling. Rainfall events cause bacteria to be washed into rivers and streams via urban and agricultural runoff, and also stir up bacteria attached to stream sediment.



Summary of compliance with the recreational water quality guidelines for freshwater bathing sites monitored over the 2007/08 summer. Just one site on the Hutt River exceeded the guideline more than twice.

Toxic algae

Although river swimming spots were mostly safe from pathogens, the hot dry summer meant that some areas were affected by toxic blue-green algae (also known as cyanobacteria). Toxic algae growth was particularly widespread in the Hutt River with the middle and lower reaches of the river off limits for swimming for much of the summer.

Early in the New Year three dogs died after coming into contact with toxic algal mats in the Silverstream and Kennedy Good Bridge areas. Moderate amounts of blue-green algal growth were also recorded in the Wainuiomata, Waikanae and Waipoua rivers. Health warning signs were put up along the length of the Hutt River and along affected parts of other rivers from early January until the end of March. For more information on toxic blue-green algae go to **http://www.gw.govt.nz/toxic-algae**.

Last summer, warning signs – such as this one – were put up at the Hutt River at Silverstream where there was widespread toxic algae growth.

Contrary to their name blue-green algal mats are usually dark brown or black and grow attached to rocks on the river bed. Mats that come loose from the river bed can wash up on the river bank or form floating 'rafts' in shallow areas.

How do you tell if it is safe to swim?

Greater Wellington uses the national microbiological water quality guidelines "traffic light" system on our website to let people know whether water is suitable for swimming, surfing and other recreational activities.

Green (surveillance) for go – sampling indicates a low health risk.

Amber (alert) for caution – sampling indicates the health risk has increased, but is still within an acceptable range.

Red (action) for stop – sampling indicates the water poses an unacceptable health risk.

What is Greater Wellington doing?

- Together with the city and district councils in the region, Greater Wellington monitors and reports on:
  - The suitability of water quality for recreation at 23 freshwater sites and 77 coastal sites around the region. At most sites the water is sampled weekly during the 'bathing season' (from 1 November to 31 March) and the results are assessed against the national recreational water quality guidelines so that we can advise people whether or not, from a public health perspective, the water is suitable for swimming and other forms of contact recreation.
  - The suitability of water quality for shellfish gathering at nine coastal locations.
- Together with Regional Public Health and the region's city and district councils, Greater Wellington has produced a toxic algae information pamphlet and warning signs that can be put up where there is a risk to river users.

What can you do?

- Keep stock, especially cattle and deer, out of rivers and streams to prevent them fouling the water.
- Avoid swimming during and shortly after rain and in rivers where toxic algal mats are present.

More information

The information on this card is a summary of the 2007/08 annual recreational water quality monitoring report which is available on our website at **www.gw.govt.nz/envreports** If you would like more information about recreational water quality, visit our website at **www.gw.govt.nz/on-the-beaches** or contact:

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River and stream health 2007/08

Key points:

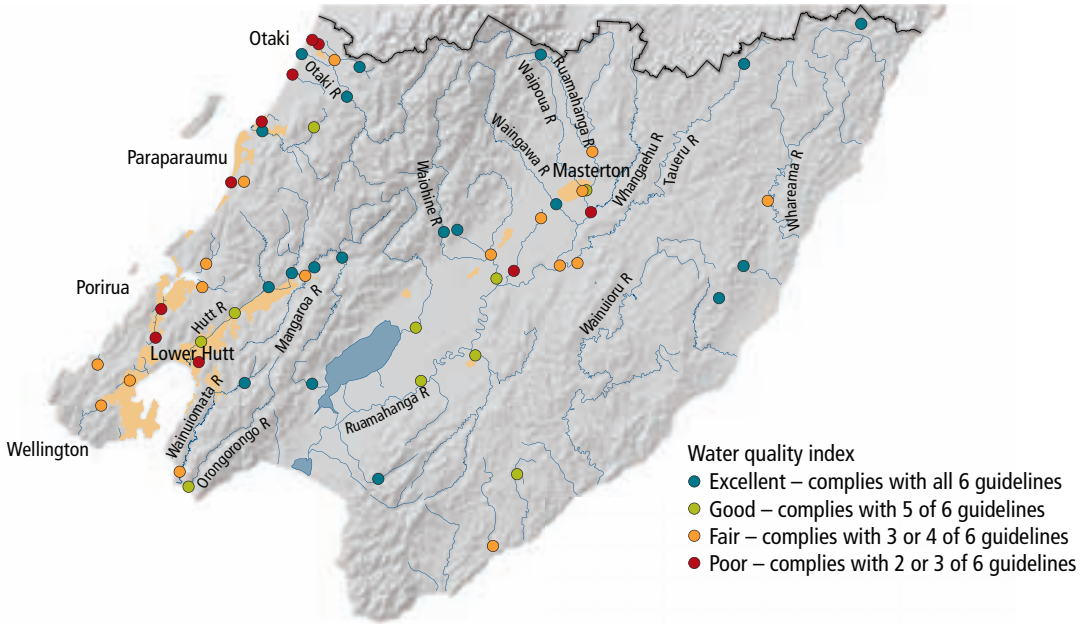
- Twenty-nine of the 56 river and stream sites monitored over 2007/08 had excellent or good water quality, with the remainder having fair or poor water quality.
- Water quality is typically poorest in urban streams and in the lower reaches of rivers and streams draining intensive agricultural catchments. Smaller streams tend to be affected the most by intensive land use.
- Riparian rehabilitation along three pilot project stream reaches has improved aesthetic values and, in some cases, aspects of habitat and water quality.

What happened in 2007/08?

Water quality monitoring

Monitoring during 2007/08 showed that 19 of the 56 river and stream monitoring sites had excellent water quality and complied with all six guidelines we use to measure overall stream health. A further 10 sites failed just one of the guidelines and are classed as having good water quality. Rivers and streams with excellent or good water quality are all located in catchments where the land cover is predominantly indigenous forest and human influences are minimal. These sites are typically on rivers and streams flowing out of the Aorangi, Tararua and Rimutaka ranges and include the Hutt, Otaki, Waikanae, Waiohine, Waingawa and Tauherenikau rivers and the upper reaches of the Waitohu, Wainuiomata and Ruamahanga rivers.

Water quality declines rapidly once rivers and streams flow out of the ranges and land cover changes from indigenous forest to urban and agricultural uses. Almost half of the river and stream sites monitored exceeded two or more guidelines and were classed as having fair or poor water quality, reflecting the large proportion of the region that is in agricultural, and to a lesser extent urban, land use. The water quality variable that exceeded guidelines at the most sites was dissolved reactive phosphorus (24 sites), followed closely by *E. coli* bacteria (22 sites) and water clarity (22 sites). Rivers and streams with poor water quality include the Whangaehu River and the Mangaone, Mangapouri, Ngarara and Porirua streams. These waterways have catchments heavily influenced by either intensive agricultural or urban land use, or a combination of the two.

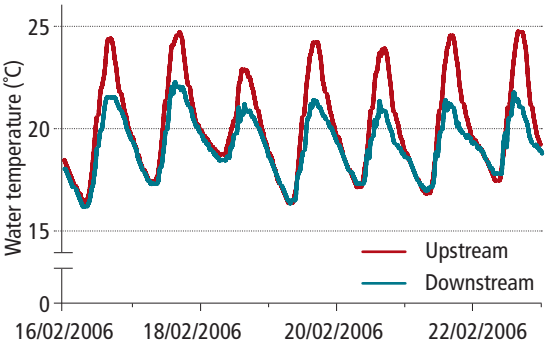


The level of compliance with guidelines for six key water quality variables (water clarity, dissolved oxygen, dissolved reactive phosphorus, nitrite-nitrate nitrogen, ammoniacal nitrogen and *E. coli)* gives us an overall picture of water quality in the region's rivers and streams. The water quality index ratings shown here are based on a comparison of median values from monthly data collected between July 2007 and June 2008 against national guideline values.

Riparian rehabilitation monitoring

Greater Wellington has been monitoring water quality and stream health in three catchments undergoing riparian rehabilitation since 2002. A recent report on the 2002-2007 monitoring results concluded that while the riparian vegetation is still of a relatively young age, some improvements are already apparent. Benefits observed so far include improved aesthetic values, increased vegetation cover and streambed shade, increased bank stability, improved aquatic habitat and reduced water temperatures. Further benefits are expected as riparian vegetation matures. However, it is also apparent that improvements at all three study streams are being limited by contaminants from agricultural and urban land use entering the streams above the rehabilitation areas.

Riparian rehabilitation along a reach of the Karori Stream in Wellington City has improved the aesthetic value of the area, and further benefits may occur as riparian plants mature and produce more streambed shade. However, stormwater inputs and runoff from the predominantly urban upstream catchment will probably limit some of the ecological benefits that can be expected to occur from riparian rehabilitation.



Daily variation in water temperatures upstream and downstream of a planted reach of the Enaki Stream, Carterton, for a week during February 2006. Maximum water temperatures are generally two to three degrees cooler in the planted section (downstream) than the unplanted section (upstream). This is important as many fish and stream invertebrate species can't tolerate warm water.

Urban stream classification

Our monitoring shows that urban streams have some of the poorest water quality in the region. We are classifying the region's urban streams according to their ecological health. The classification is based on fish and invertebrate life and will provide a basis for stronger protection of existing urban stream values as well as identification of those streams that will benefit most from restoration.

An example of an urban stream with high ecological value is the Kaiwharawhara Stream (pictured). Invertebrates collected from seven out of eight stream sampling sites in the Kaiwharawhara catchment indicated good or excellent invertebrate health relative to other urban streams. This stream also supports a high diversity of native fish with eight species recorded in recent years including shortjaw kokopu, giant kokopu, koaro and redfin bully (pictured).

The Kaiwharawhara Stream in Wellington City boasts relatively high ecological values, including a range of native fish (redfin bully pictured).

What is Greater Wellington doing?

- Monitoring stream and river health at 56 sites around the region.
- Investigating poor water quality in selected catchments and monitoring the ecological benefits of stream riparian planting projects.
- Helping Biosecurity NZ monitor selected river sites for the presence of the invasive freshwater alga, didymo *(Didymosphenia geminata)*. To date no didymo has been detected in the region.
- Providing advice to landowners about streamside management. In 12 high quality catchments we provide plants to landowners who have fenced off streams. Email riparian@gw.govt.nz or visit www.gw.govt.nz/streams if you'd like to know more.
- Supporting 25 care groups working on improving streamside and wetland environments across the region. New groups to start in 2007/08 were the Albemarle Stream, Makoura Stream, Waipahihi Stream and Whangaehu care groups.

What can you do?

- Keep stock, especially cattle and deer, out of rivers and streams.
- Don't pour paint, chemicals or any other waste into stormwater drains, rivers or streams.
- Join Greater Wellington's "Be the Difference" programme and learn some easy steps to help the environment for generations to come, with cleaner streams and less waste. Sign up on-line at www.bethedifference.gw.govt.nz

More information

Some of the information on this card is a summary of the 2007/08 annual freshwater quality monitoring report which is available on our website at **www.gw.govt.nz/envreports**

If you would like to know more about river and stream health, visit our website or contact:

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Soil health and contaminated land 2007/08

Key points:

- Just over half the soil quality monitoring sites tested last year had at least one soil quality indicator outside the target range for their pastoral land use and soil type. In the majority of instances the poor soil quality can be remedied with appropriate management.
- Over 26,000 poplars and willows were planted on 370 hectares of erosion-prone land, assisting with soil conservation in the region.
- A successful trial clean-up of contaminated sediments in the Waiwhetu Stream was completed, with a full clean-up of the stream planned to begin in March 2009.

What happened in 2007/08?

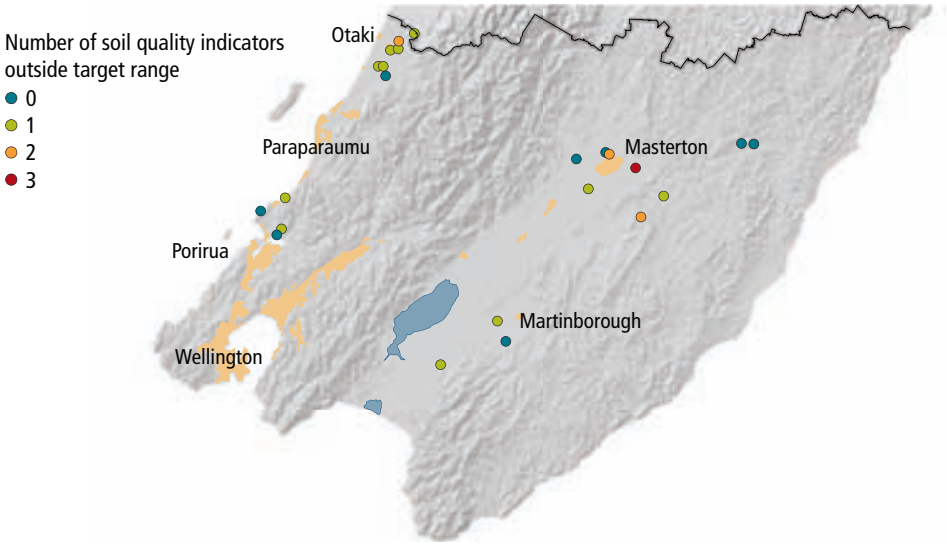
Soil quality monitoring

Greater Wellington began its soil quality monitoring programme in 2001, covering 118 sites on a range of land uses across the region. Last year we re-sampled 23 drystock/pastoral sites that had previously been sampled between 2001 and 2004. Soil health was assessed using a set of seven physical, chemical and biological properties – such as soil structure, nutrients, organic matter and heavy metal content.

The main findings from 2007/08 were:

- Fifteen out of the 23 sites sampled had at least one indicator outside the target range for drystock/pastoral farming and soil type, with just one site outside the target range for three or more soil quality indicators.
- Low macroporosity (an indication of soil compaction) was the soil quality indicator most often outside of target ranges. Other indicators outside target ranges were Olsen P (an indication of soil fertility) and total nitrogen. In most cases, Olsen P and nitrogen concentrations were too high.
- Heavy metal (arsenic, cadmium, chromium, nickel, lead and zinc) concentrations in the soil were slightly higher in 2007/08 compared with 2001-2004.

The low macroporosity values mirror findings from other regions around New Zealand, and generally result from the intensification of land use practices. Compacted soils combined with high nutrient levels increases the risk of nutrient and sediment-rich runoff contaminating nearby streams. There are land management practices that can be used to reduce soil compaction and high nutrient levels in soils. Greater Wellington will discuss the results of our monitoring with landowners so that they have the opportunity to adopt techniques or measures to improve soil quality and safeguard the productivity of the soil.



Summary of the results of last year's soil quality sampling. The sites sampled are colour-coded according to the number of indicators that tests found were outside the target range for their drystock/pastoral land use and soil type.

One of the soil quality monitoring sites – a drystock farm in the Wairarapa. At each site, samples (taken from a depth of 0-10cm) are tested for various parameters and the results compared with the optimum range for the soil type. The soil at this site was compacted but nutrient levels were satisfactory.

Soil conservation

Greater Wellington continues to work with landowners to help control soil erosion, particularly in the Wairarapa hill country. This includes the preparation of individual farm plans and soil conservation programmes. Last year we helped 139 landowners plant over 26,000 poplars and willows on 370 hectares of erosion-prone pastoral land. A further 42 hectares were established as conservation woodlots and 3 kilometres of shelterbelts were established to decrease the effects of wind erosion on alluvial soils within the Wairarapa valley. Greater Wellington also assists landowners fence and plant streamsides to improve water quality and increase biodiversity. Last year 3 kilometres of new fencing and planting, and 1.5 kilometres of maintenance planting were completed.

What can you do?

- Ensure that animal effluent disposal systems and fertiliser application rates are appropriate for your soil type.
- Compost your kitchen scraps and garden waste and add it to your soil.
- Plant trees on erosion-prone land to promote soil conservation, enhance biodiversity and provide shelter and shade for stock.
- Ensure hazardous waste – such as old paints and used oil – is taken to the hazardous waste collection facility at the landfill or to the household hazardous waste collection run by your city or district council.
- If you have any banned or unwanted agrichemicals, contact Greater Wellington to register for our annual agrichemical collections.

Waiwhetu Stream clean-up

The sediments in the bed of the lower reaches of the Waiwhetu Stream contain high levels of heavy metals and pesticides. This is a legacy of past practices when the stream was used to dispose of trade waste from the industries in Gracefield and Seaview.

A successful trial clean-up of a section of the stream was completed in March 2008. The clean-up method involved dividing an 80 metre length of the stream into two cells by driving sheet piles into the bed. The cells were then dewatered and the contaminated sediment excavated from the upstream cell. In all, 423 tonnes of contaminated sediment was safely taken to the Silverstream Landfill for disposal. The clean-up of the full 800 metre reach of the stream is planned to commence in March 2009. This work is being jointly funded by Greater Wellington, Hutt City Council and the Ministry for the Environment's Contaminated Sites Remediation Fund.

Contamination in this section of the Waiwhetu Stream in Lower Hutt was successfully cleaned up earlier this year. The stream was divided into two cells using sheet piles (left). The cells were then de-watered before the contaminated sediment was excavated from the upstream cell (right) and disposed of to landfill. The next stage of this project will be to remove the contaminants from the remainder of the stream.

What is Greater Wellington doing?

- Sampling and testing soils under various land uses to monitor the quality of soils across the region.
- Regulating large-scale vegetation removal and soil disturbance on erosion-prone land (district and city councils control vegetation removal and soil disturbance on all other land).
- Providing advice to landowners and subsidising tree planting, so landowners can reduce soil erosion on their land.
- Maintaining, on behalf of the city and district councils, a database known as the Selected Land Use Register, which contains a list of sites in the region that have (currently or historically) used, stored or disposed of hazardous substances (e.g. landfills, petrol stations, timber treatment sites).
- Leading the Waiwhetu Stream sediment clean-up project.

More information

The soil quality information on this card is a summary of the more detailed 2007/08 annual soil quality monitoring report, which is available on our website at **www.gw.govt.nz/envreports**

For any further information visit our website or contact:

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