



greater WELLINGTON

REGIONAL COUNCIL

Te Pane Matua Taiao

Our Environment at a Glance

Environmental Science Annual Summary Report 2013/14



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Our Environment at a Glance

Environmental Science Annual Summary Report
2013/14

Foreword

With an increasing watch on the state of New Zealand's natural resources the demand for accurate and timely information is growing. Communities are expressing a strong desire to ensure the sustainable management of our environment and this is driving research and monitoring to better understand the connections between ecosystems, health and economics.

Central government has responded to requests, both from communities and local government for an enhanced statutory base for managing our land and water resources with changes to the National Policy Statement for Freshwater Management (NPSFM) incorporating a National Objectives Framework (NOF). These direct how councils should establish objectives and set limits for fresh water, which includes identifying the values (for example irrigation, mahinga kai, swimming) that communities hold for the water in their areas. Together, councils and communities are required to make choices about what actions they will take to get the water quality they want.

To implement the NPSFM, Greater Wellington Regional Council (GWRC) has undertaken a collaborative community-based approach to setting objectives and limits. We have established five distinct super-catchments (whaitua) within the region, and are enlisting the support of local communities (through the formation of whaitua committees) to understand local needs and make recommendations on how the land and water resources will be managed within each whaitua.

GWRC is also facilitating a collaborative knowledge gathering process to provide robust and trusted information on our environment and the potential impacts of different land uses on water quality. In this process, traditional knowledge such as that held by Māori will be increasingly utilised. While science will have an important role in helping inform decision-making by the whaitua committees, there are many other important social, cultural and economic factors to consider, and this approach ensures that our science will be "on tap" rather than "on top".

This report provides a snapshot into environmental information from the Wellington region that is increasingly being used to underpin policy and community action.



Graham Sevicke-Jones

Department Manager, Environmental Science



Introduction

This report summarises the key findings from the work of the Environmental Science Department undertaken in the 2013/14 year. The report is divided into six sections – a regional overview and a section on each of the five whaitua (catchment areas) that make up the Wellington region.

The Wellington region has a land area of 8,111km² which is bound on three sides by almost 500km of coastline, and a northern border which extends from just north of Ōtaki on the Kāpiti Coast across to the mouth of the Mataikona River (approximately 15km north of Castlepoint) in the eastern Wairarapa. The region contains 12,300km of rivers and streams, three extensive ground water zones and 14 lakes/wetlands greater than 10 hectares in area.

We monitor the region's air, land and water resources through long term environmental monitoring programmes which measure:

- Air quality at five permanent locations
- Soil quality at over 100 sites
- Rainfall at 58 sites and river levels at 62 sites
- Groundwater levels at 146 sites and groundwater quality at 68 sites
- Water quality and ecosystem health at 55 river and stream sites
- Water quality and ecosystem health in five lakes
- Bacterial levels at 24 river and 61 beach spots popular for swimming and recreation
- The ecological health of several beach and estuary sites and our two harbours.

This report draws largely on the outcomes of these monitoring programmes. Full details on the 2013/14 monitoring results can be found in our Annual Data Reports, published online at www.gw.govt.nz/Annual-monitoring-reports/. We have also included a number of special interest stories, drawing from some of the many targeted investigations we undertake.

The information in this report provides a glance into the current state of our environment. Every five years we also do a comprehensive analysis of long term environmental trends, and whether those trends are getting better or worse. This was last done in June 2012 and the reports can be viewed at www.gw.govt.nz/ser/.

I trust this document provides a stimulating insight into the work of the Environmental Science Department.



Penny Fairbrother
Senior Science Coordinator

Contents

Regional Overview

Wellington Harbour and Hutt Valley

This area is home to nearly 70 percent of the people living in the Wellington region but makes up only 14 percent of the region's land area (1,183km²). It includes Wellington, Upper Hutt and Hutt cities, and the Wainuiomata Valley.

A central feature is Wellington Harbour (Te Whanganui ā Tara) which is important for its cultural, ecological, economic and recreational values. The harbour also acts as the 'sink' for urban and rural runoff from the entire Hutt Valley (Te Awa Kairangi) and much of Wellington City.

Te Awarua-o-Porirua Harbour

Te Awarua-o-Porirua Harbour (Porirua Harbour) forms a small but significant part of the region (just over 200km² or three percent of the Wellington region). The area is widely used for a range of recreational pursuits and is of significant cultural importance for tangata whenua.

Our focus is on the two arms of the harbour; Pauatahanui Arm and Onepoto Arm. Together these arms form the largest estuary in the lower North Island, providing valuable nursery areas, food and shelter for a huge variety of bird, fish and shellfish species.



Kāpiti Coast

Home to the towns of Ōtaki, Waikanae, Paraparaumu and Paekākāriki, the Kāpiti Coast makes up nine percent of the region's land area (694km²).

The Kāpiti Coast boasts long sandy beaches and is a popular holiday destination. The two major rivers are the Ōtaki and Waikanae, which flow from headwaters in the Tararua Ranges out to the west coast. The mild climate and good freshwater resources support a range of horticultural activities in this area.

Ruamāhanga

The Wairarapa Valley is the agricultural powerhouse of the region. Dairying, drystock farming, orchards and vineyards all play a significant role in the area's economy. This area covers a massive 3,555km² (44 percent of the entire region) and includes the towns of Masterton, Carterton, Greytown, Featherston and Martinborough.

The Ruamāhanga River is a central feature – with its headwaters in the Tararua Ranges north of Pukaha Mount Bruce, the river flows south and then southwest for 130km before emptying into Palliser Bay via Lake Onoke.

Wairarapa Coast

The Wairarapa Coast is the driest, windiest and least populated part of our region, even though it covers a significant land area of 2,478km² (30 percent of the entire region).

The area is dominated by hill country which drains to the east coast between Mataikona River in the north and Ngawi in the south, and includes the popular holiday beaches of Castlepoint and Riversdale.

Air

GWRC measures levels of particulate matter (PM10 and PM2.5), carbon monoxide and nitrogen dioxide in air at several locations across the region. The results from this monitoring are compared to national air quality standards or guidelines designed to protect human health.

Air quality in the Wellington region is generally very good. PM10 is the only pollutant that fails to meet the national standard, and only in the Ruamāhanga area.

Land

A nationally recognised system for monitoring and reporting terrestrial biodiversity has been developed and data collection for the Wellington region will begin in 2014/15.

This year our soil quality monitoring programme focussed on cropping and market garden sites, 11 of which are located on the Kāpiti Coast and 12 of which are located in the Ruamāhanga area. 17 (74%) of these sites met the target range for at least six of the eight indicators measured.

Learn about the Selected Land Use Register (SLUR), which holds details of 2026 sites in the region that are known or suspected to have been used for activities involving hazardous substances.

Water

Observations from around the world have long noticed the effects that earthquakes can have on groundwater levels. In the 2013/14 year there were three earthquakes of note that impacted groundwater levels in the Wellington region. Read more about this on page 13.

Learn about how GWRC monitors the environmental health of rivers, lakes, groundwater and estuaries and how they are faring. Find out about the 61 beach sites and 24 river sites that are monitored for swimming.

Regional Overview



Air quality

GWRC measures air quality at several sites within designated airsheds across the region. The results from this monitoring are compared to national air quality standards or guidelines designed to protect human health.

We routinely measure the following air pollutants:

Particulate matter

Particulate matter (particles in the air) can come from both natural sources such as soil, and as a result of combustion processes, ie, home fires and vehicle emissions. When we breathe in, the hairs in our nose and air passages remove larger particles. However particles less than 10 microns across (PM10) can penetrate into the lungs where they can cause problems and affect our health. PM2.5 are particles less than 2.5 microns across – that's 20 times smaller than the width of a human hair! The smaller the particle, the more deeply it can penetrate into the lungs.

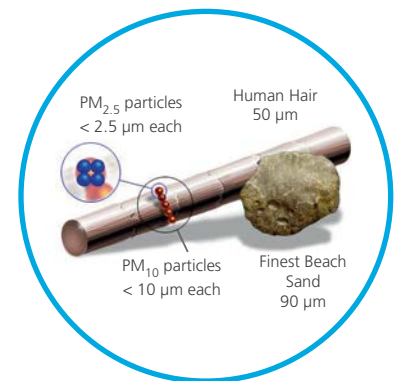


Figure courtesy of the Ministry for the Environment



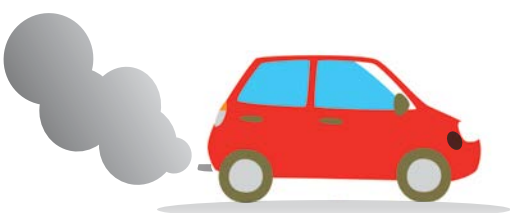
The total cost to our region of people being exposed to PM10 produced by human activities has been estimated as \$275 million per year (HAPINZ 2012)

Carbon monoxide

The most common sources of carbon monoxide are human activities. Carbon monoxide levels are generally highest in urban areas around busy roads, and during winter evenings from home fires. When you breathe in carbon monoxide it reduces the amount of oxygen in your bloodstream and getting to your body tissues, which is particularly bad for your brain and your heart.

Nitrogen dioxide

The main source of nitrogen dioxide is the burning of fossil fuels, especially petrol used in cars. In cities, cars contribute about 80 percent of ambient nitrogen dioxide. The main health effect of nitrogen dioxide is on the respiratory system, as it can increase the risk of infection in the lungs, aggravate asthma and affect lung development in children.



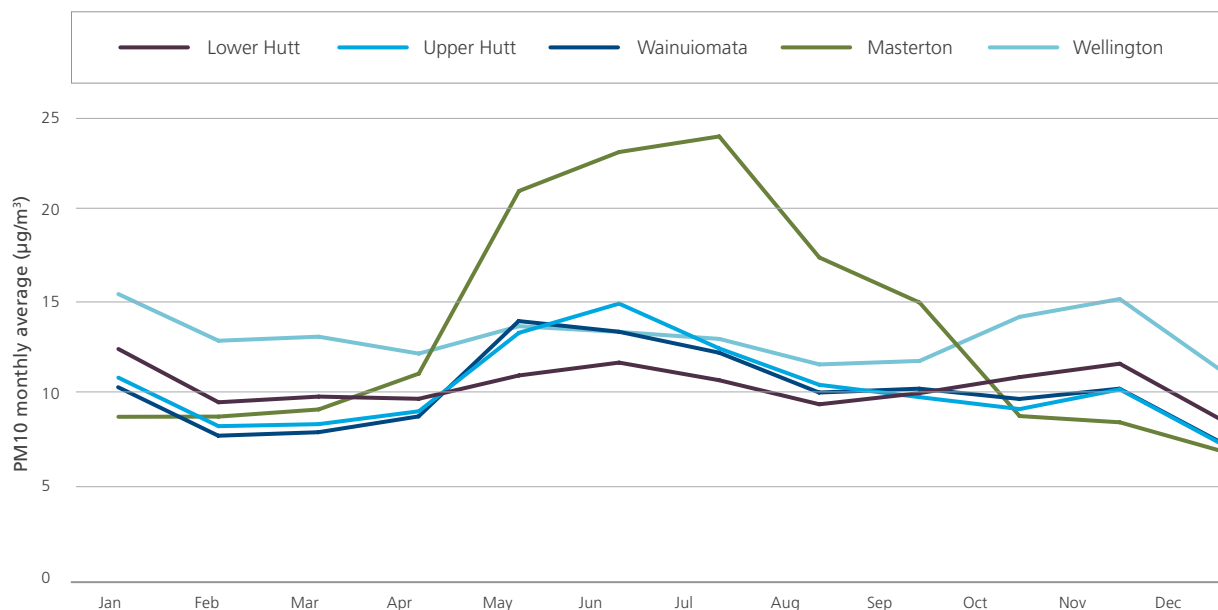
How clean is the region's air?

Air quality in the Wellington region is generally very good. PM10 is the only pollutant that fails to meet the national standard, and only in the Ruamāhanga.

PM10 concentrations are higher during the winter in inland valley areas (Masterton, Upper Hutt and Wainuiomata) where home fires are common and when it's cold, clear and still. Most of this PM10 is in the form of extra fine particles (PM2.5).

Wellington, Porirua and the Kāpiti Coast are not as prone to air quality issues because their mainly coastal location brings more wind and fewer frosts. However, there can be pockets of poor air quality due to home fires in low-lying areas under cold, clear and still conditions.

Emissions from transport are significant in the region but do not result in the breaching of national standards or guidelines for the pollutants we monitor.



PM10 levels peak during the winter months in Masterton and to a lesser extent in Upper Hutt and Wainuiomata due to smoke from home fires. Lower Hutt and central Wellington show little seasonal differences in PM10 – air quality at these sites is more heavily influenced by traffic which is constant all year round.

Terrestrial ecology

As reported last year, a monitoring and reporting system for terrestrial biodiversity has been in development nationally over the past few years.

This involves gathering data on plant and animal species from plots located on an 8km x 8km grid across the region. The Department of Conservation (DoC) is using the same system to monitor Crown land, while the Ministry for the Environment (MfE) uses the grid framework to measure vegetation for national carbon accounting purposes. There are 125 plots in the Greater Wellington region, of which 48 are being measured by DoC or MfE.

GWRC will measure birds, vegetation and pest animal species at the remaining 77 sites with data collection beginning in 2014/15.



The composition (number and types of plants) and structure (different growth stages) of all vegetation will be recorded in each plot



All birds seen and heard will be recorded over a two day period at various sampling points around the plot



Possum and rodent levels are measured using waxtags, while pellet counts are used to assess the numbers of goats, deer, rabbits and hares



An example layout of the different monitoring activities – the green square is a vegetation plot, the yellow dots are bird monitoring sites and pest monitoring lines are shown in blue

Soil quality

GWRC monitors soil quality at over 100 sites across the region in order to identify the effects of primary land uses on long-term soil productivity so that any issues can be detected early and managed as required.

Soil properties are measured and used as indicators of soil quality. These can be grouped into three categories:

Physical

The properties measured to determine physical condition are *bulk density* and *macroporosity*. These determine how compacted the soil is and therefore whether movement of water and air through the soil could be compromised. These properties can affect root and plant growth, and increase the potential for run-off and nutrient losses.

Chemical

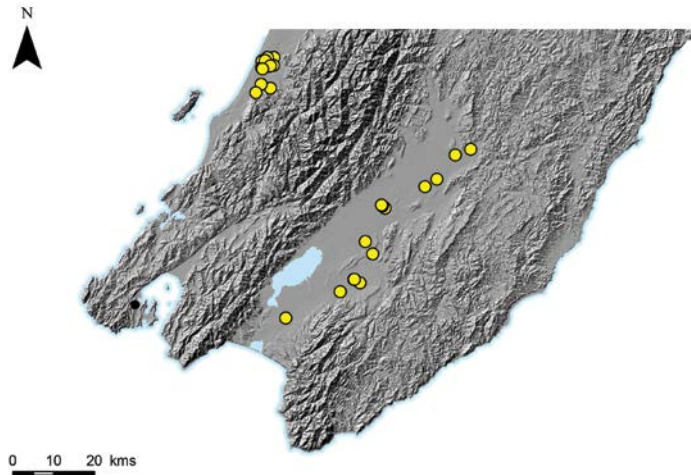
The properties measured to determine chemical make-up are *pH*, *total carbon*, *total nitrogen*, *anaerobic mineralisable nitrogen* and *Olsen P*. Most plants have an optimal pH range for growth as pH influences the availability of nutrients and the solubility of some trace elements. Total carbon is used as an estimate of the amount of organic matter which is important for retaining moisture and nutrients, and maintaining good soil structure. The other properties measure amounts of nitrogen and phosphorus in soil, both of which are essential nutrients for plants. However, too much of these can lead to increased nutrient losses to waterways.

Trace elements

The trace elements we measure are *arsenic*, *cadmium*, *chromium*, *copper*, *lead*, *nickel* and *zinc*. These trace elements can accumulate as a result of horticultural and agricultural practices and can become toxic at high levels.

Not all sites are sampled every year, and the frequency of sampling depends on the intensity of the land use. The 23 sites monitored in 2013/14 comprised predominantly of cropping and market gardens sites. Eleven of these sites are located on the Kāpiti Coast and the remaining 12 sites are in the Ruamāhanga area.

Location of sites monitored for soil quality in 2013/14



How healthy are the region's soils?

Soil quality at the sites monitored this year is generally good. 17 of the 23 (74%) sites sampled met the target range for at least six of the eight indicators measured. Five of the remaining six sites met the target range for at least four out of the eight indicators measured.

9%



Two sites met the target range for all eight indicators

39%



Nine sites met the target range for seven out of eight indicators

26%



Six sites met the target range for six out of eight indicators

4%



One site met the target range for five out of eight indicators

17%



Four sites met the target range for four out of eight indicators

4%



One site met the target range for three out of eight indicators

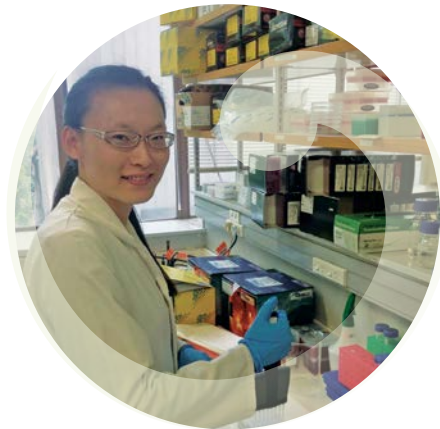
New project uses advanced DNA sequencing technologies to help maximise the productivity of land

The ability to predict both pathogen abundance and fertility of soil will be essential in maintaining and growing international trade in primary products. Pathogens (disease-causing organisms, ie, bacteria or viruses) in soil represent a significant biosecurity risk to crops and livestock, yet their distribution and factors affecting their prevalence are unknown. So too is the distribution of beneficial soil microbes which help maintain soil fertility and health.

In association with eight other regional councils, GWRC is contributing to a nationwide project investigating soil microbial DNA. The project will use advanced DNA sequencing technologies to map the distribution of important microbes and microbial genes, specifically:

- a. soil-dwelling pathogens identified as a risk to crops and livestock, and
- b. microbial genes beneficial to soil health and productivity.

These distribution maps will define locations within New Zealand with an elevated risk of soil-borne diseases and provide the first national map of soil ecosystem service potential, ultimately helping managers to maximise the productive potential of their land.



PhD Student Jieyun Wu
extracts soil microbial DNA at the
University of Auckland

Hazardous activities on land

GWRC holds a register of sites where activities involving hazardous substances have or may have taken place. This register, known as the Selected Land Use Register (SLUR), is held on behalf of the eight territorial authorities in the Wellington region.

Sites that are registered in SLUR are known or suspected to have been involved (either historically or currently) in the use, storage or disposal of hazardous substances and as a consequence may contain residues of these substances. Some sites will actually be contaminated, but many are not; therefore registered sites are classified into one of six categories¹:

Category I – Verified History of Hazardous Activity or Industry

Category II – Unverified History of Hazardous Activity or Industry

Category III – Contamination Confirmed

Category IV – Contamination Acceptable, Managed/Remediated

Category V – No Identified Contamination

Category VI – Entered on Register in Error

Registered sites are also categorised as per MfEs Hazardous Activities and Industries List (HAIL):

- A. Chemical manufacture, application and bulk storage
- B. Electrical and electronic works, power generation and transmission
- C. Explosives and ordnance production, storage and use
- D. Metal extraction, refining and reprocessing, storage and use
- E. Mineral extraction, refining and reprocessing, storage and use
- F. Vehicle refuelling, service and repair
- G. Cemeteries and waste recycling, treatment and disposal
- H. Land that has been subject to the migration of hazardous substances from adjacent land
- I. Land that has been subject to the intentional or accidental release of a hazardous substance

SLUR records other available information relating to the site such as the history of the activities that have (or may have) occurred on the site, the nature and concentration of hazardous substances and any remediation or mitigation measures that have taken place.

To find out whether a site is recorded on the register go to
www.gw.govt.nz/selected-land-use-register-slur-register-search/

¹. Refer to <http://www.gw.govt.nz/description-of-categories/> for the full category definitions

How many contaminated sites are in the region?

There are a total of 2026 sites registered on SLUR. The majority of sites (73 percent) fall into *Category I – Verified History of Hazardous Activity or Industry*.

A site classified as having a *Verified History of Hazardous Activity or Industry* has been confirmed as having hazardous activities associated with it. Assignment to this category does not mean the site is contaminated, merely that hazardous substances have been used, stored or disposed of on the site.

Category	Percentage of sites
I – Verified History of Hazardous Activity or Industry	73%
II – Unverified History of Hazardous Activity or Industry	<1%
III – Contamination Confirmed	5%
IV – Contamination Acceptable, Managed/Remediated	19%
V – No Identified Contamination	3%
VI – Entered on Register in Error	<1%

Most of the registered sites (82 percent) fall into HAIL classifications A, F or G.

- Industries typical of the sites under classification A include the bulk storage of chemicals for a variety of reasons (i.e. fuel, timber treatment, dry-cleaning, pesticide use).
- Industries typical of the sites under classification F include motor vehicle workshops, service stations, transport depots and railway yards.
- The bulk of sites under classification G consist of both historical or current landfill sites, as well as sites used for sewage treatment.

HAIL Classification	Percentage of sites
A. Chemical manufacture, application and bulk storage	38%
B. Electrical and electronic works, power generation and transmission	4%
C. Explosives and ordnances production, storage and use	3%
D. Metal extraction, refining and reprocessing, storage and use	5%
E. Mineral extraction, refining and reprocessing, storage and use	6%
F. Vehicle refuelling, service and repair	26%
G. Cemeteries and waste recycling, treatment and disposal	18%
H. Land that has been subject to the migration of hazardous substances from adjacent land	<1%
I. Land that has been subject to the intentional or accidental release of a hazardous substance	<1%

Rainfall and water levels

GWRC operates a network of monitoring sites to gather information on rainfall and water levels in the region's rivers, lakes and aquifers. This information is used for various purposes including:

- Developing water management policies including how much water can be safely taken from a water body
- Detecting changes and trends in the amount of water in various freshwater bodies and whether these can be related to things such as climate or land use changes
- Providing information during Civil Defence emergencies such as floods, or during periods of drought.

Rainfall is measured at 58 sites and water levels are measured at 62 river sites, 75 groundwater sites² (bores) and 11 lake and wetland sites. All of these sites have measuring equipment that automatically logs data every five to 15 minutes. This data is then uploaded directly to our database via radio or cellular telemetry every 30 minutes to three hours (or more often during an actively monitored flood event) to allow real time monitoring. This information is available on GWRC's website

<http://graphs.gw.govt.nz>

Many rainfall and river sites also have flood warning alarms that are automatically activated if a high intensity of rainfall occurs or if river levels rise above a certain threshold. These events are closely monitored by GWRC floodwarning staff and warnings are issued to authorities and landowners if high flood levels are predicted.

2. In addition to these automatic monitoring sites, we also measure groundwater levels manually at a further 71 bores

How much is being used and what's left?

The amount of water allocated through resource consents increased significantly between 1990 and 2010, but has largely remained stable since then. Most of the increase occurred in the Ruamāhanga area for irrigation purposes.

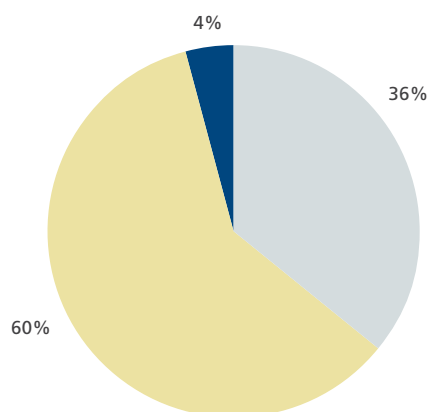
In the Wellington region as a whole, equal amounts of water are allocated to public water supply and irrigation (approximately 40 percent each of the total take). The remainder goes largely to water races (for stock watering) and hydroelectricity. However the proportions vary when you break it down for different parts of the region; on the western side where the major cities are public water supply is the dominant use, while in the Wairarapa area over half the usage is for irrigation.

Most of the region's major rivers are now fully allocated, which means that at normal to low flows there is only just enough water to meet all consented water takes while still maintaining the environmental health of these waterways.

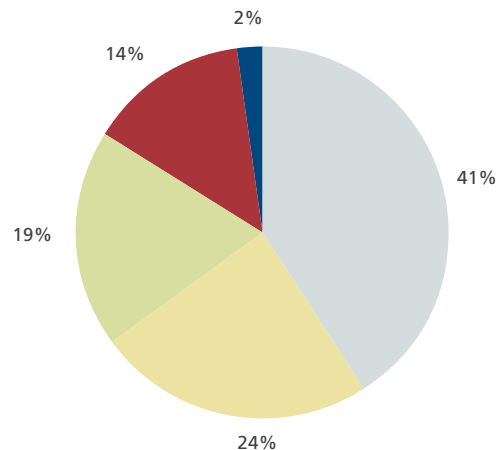
There is still water available in some of the high yielding groundwater systems under existing regional plan policies. However the amount of groundwater that can be safely allocated is likely to reduce in the future. This is because we now know much more about the linkages between groundwater and surface water, and how groundwater usage affects nearby river and stream levels.

Proportional use³ of surface water and groundwater resources in the Wellington region

Groundwater (total 137 million m³/year)



Surface water (total 276 million m³/year)



● Water supply
 ● Irrigation
 ● Water race
 ● Hydroelectricity
 ● Other

3. This graph is based on data from resource consents as at December 2010

Regional rainfall summary

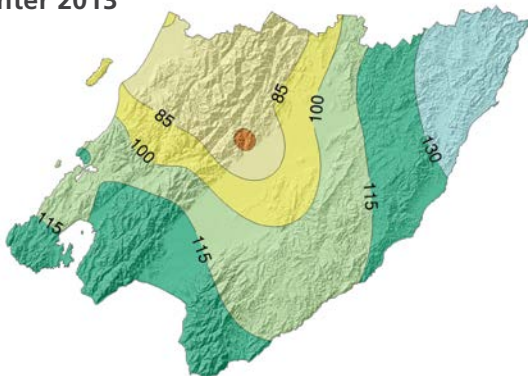
The maps below show seasonal rainfall during 2013/14 as a percentage of the long-term average. It is evident that the year was a mixed bag with an average winter followed by a wet spring, then a dry summer followed by a wet autumn.

Winter 2013 was notable only for the relatively low rainfall on the Kāpiti Coast (65-90 percent of normal) and in the Tararua Ranges (70-80 percent of normal). Northern Wairarapa and southern parts of the region were above average during this time. The spring months brought relatively wet conditions to the entire region, in particular in the north and north-east Wairarapa.

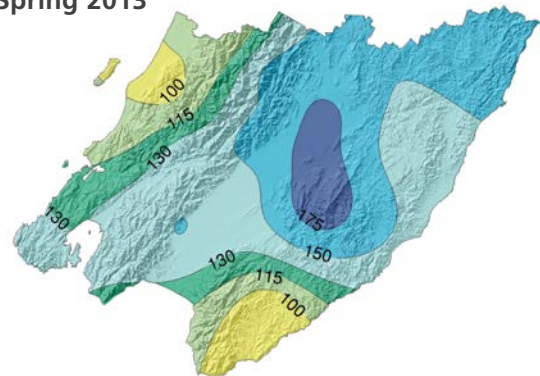
Summer saw below average rainfall everywhere, with the exception of the south-eastern corner of the region. Areas that suffered were the northern Wairarapa where as little as 70 percent of normal summer rainfall was received in the Whangaehu valley. Rainfall in the Kāpiti Coast and Porirua was also low with as little as 60 percent of normal rainfall recorded at Ōtaki, McKay's Crossing and Whenua Tapu.

Rainfall during autumn was consistently above average across the entire region.

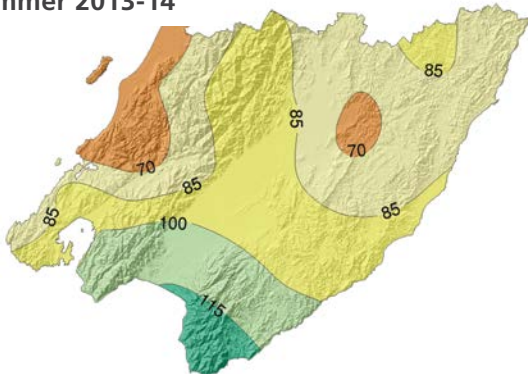
Winter 2013



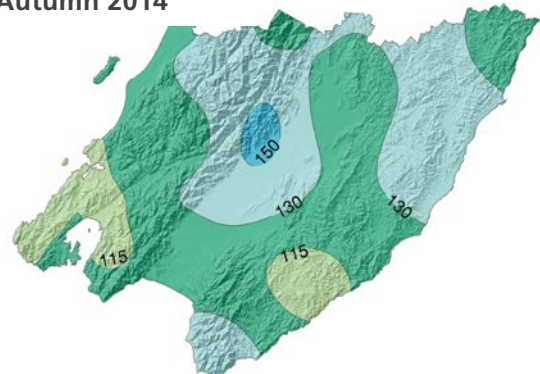
Spring 2013



Summer 2013-14



Autumn 2014



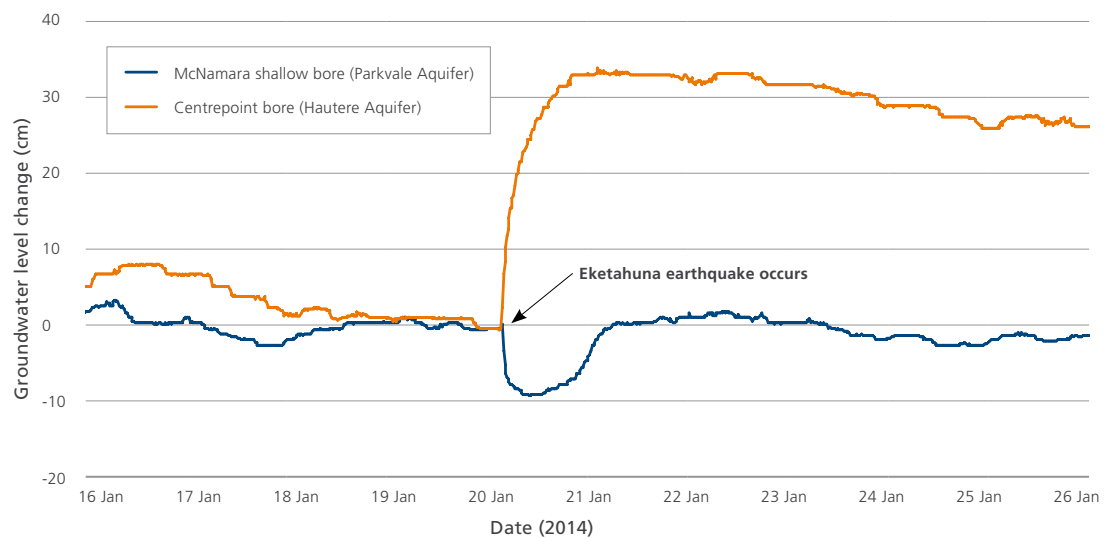
Seasonal rainfall shows the year was a mixed bag with an average winter followed by a wet spring, then a dry summer followed by a wet autumn

Effects of earthquakes on groundwater levels

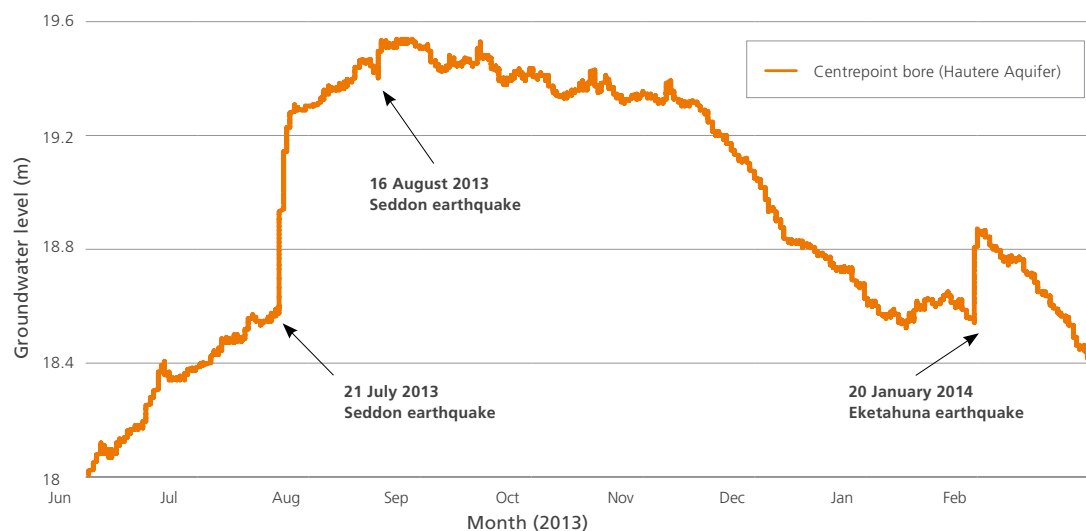
Observations from around the world have long noticed the effects that earthquakes can have on groundwater levels. Most notable in New Zealand were the Christchurch earthquakes that triggered immediate changes in groundwater levels in the Canterbury Plains and throughout New Zealand.

In the 2013/14 year there were three earthquakes of note that impacted groundwater levels in the Wellington region; the Seddon earthquakes on 21 July and 16 August 2013 (6.5 and 6.6 magnitude respectively) and the Eketahuna earthquake on 20 January 2014 (6.2 magnitude).

The Eketahuna earthquake affected groundwater levels in the Parkvale Aquifer in the Wairarapa (McNamara shallow bore) and Hautere Aquifer on the Kāpiti Coast (Centrepoint bore). Both aquifers experienced a sudden change in groundwater level, with the McNamara bore showing a decrease and the Centrepoint bore showing an increase. The McNamara bore returned to pre-earthquake levels after one day but the Centrepoint bore took about three weeks to return to normal.



The graph below shows actual groundwater levels in the Centrepoint bore over the period of all three earthquakes. The largest response was to the initial Seddon quake where there was a sharp rise in water level of about half a metre (50cm) over 24 hours.



What time of year is the wettest?

Common perception is that winter is our wettest season and when we are most likely to experience floods. But is it really?

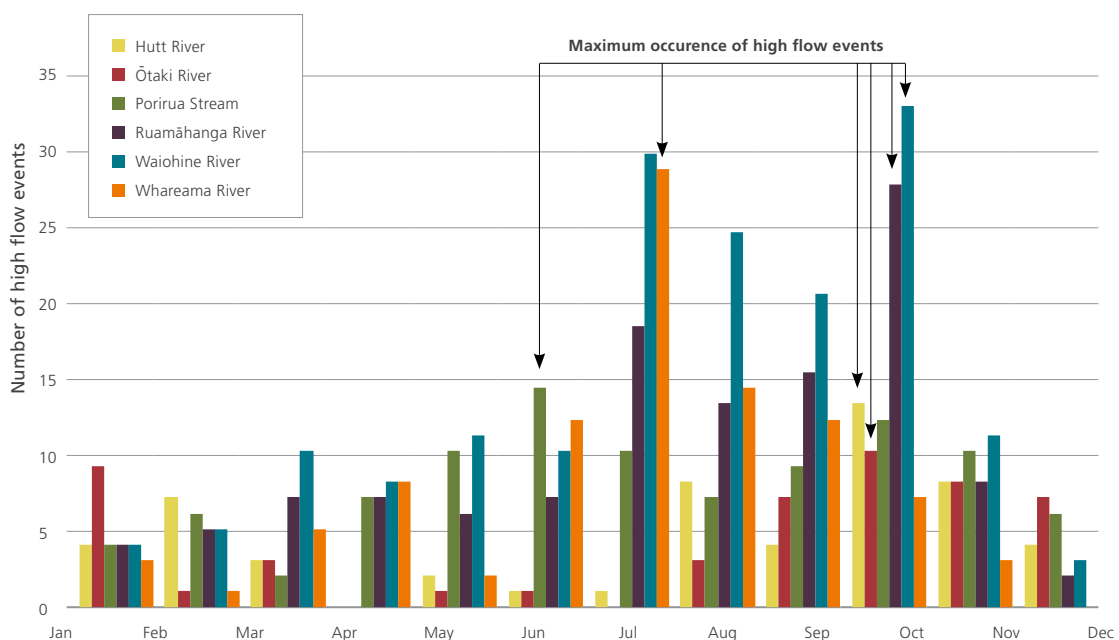
In the Wellington region heavy rainfall that produces high river levels and floods is often associated with:

- North or north-west rainfall associated with a frontal system
- Precipitation occurring from warm moist air rising and then cooling over high mountain ranges (orographic rainfall)
- East or north-east rainfall resulting from depressions or ex-tropical cyclones.

The first two types of rainfall can cause high flows in rivers draining both the western and eastern flanks of the Tararua Ranges. The third type can cause heavy rainfall across the entire Wairarapa area, particularly in the eastern Wairarapa Hills.

So what month produces the most 'high flow' events and floods? Analysis of river data shows that October is the month that generates the greatest number of high flow events in the Ōtaki, Hutt, Waiohine and Ruamāhanga rivers. This can be attributed to the high number of westerly and north-westerly fronts that hit the Tararua Ranges side on, resulting in elevated rates of rainfall during the spring months.

In contrast, Porirua and Whareama have the greatest number of high flow events in June/July. This is reflective of their geographical location, ie, their catchment areas are low altitude. The high flow pattern in these areas reflects the more common perception that winter is our wettest season.



Rivers and streams

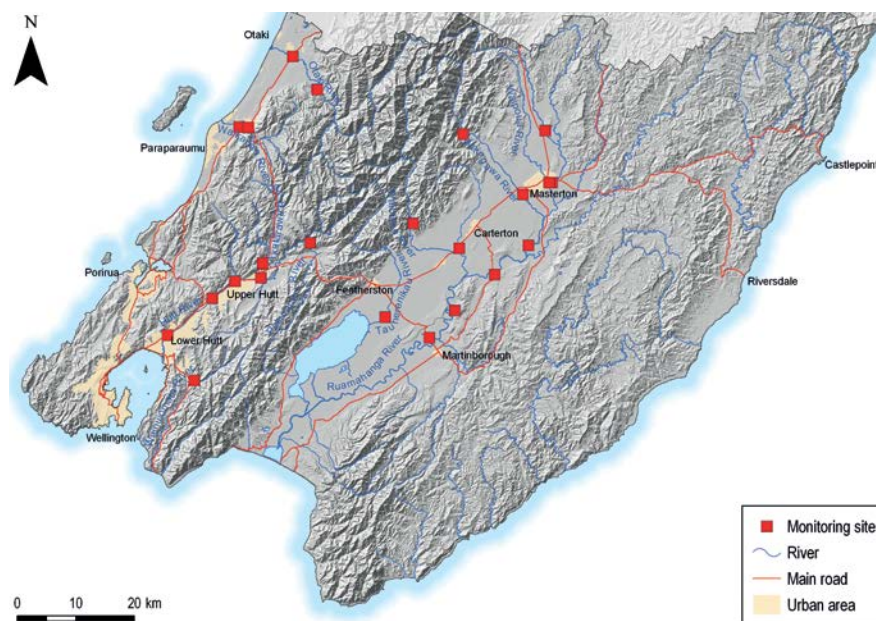
GWRC monitors bacterial levels in water at 24 river sites across the region. Sites are monitored weekly⁴ over the summer months (November to March). The results from this monitoring are compared to national water quality guidelines⁵ to determine the suitability of these sites for recreational purposes such as swimming.

The safety of water (for recreational purposes) is determined by measuring the indicator bacteria *Escherichia coli* (*E. coli*) to find out whether the water is contaminated by faecal material. Water that is contaminated by faecal material can contain many different types of pathogens (bacteria and viruses) which can make people sick.

While we are out taking water samples to measure bacterial levels, we also assess the amount of algae and cyanobacteria (also known as toxic algae) growing on the riverbed. The results from this monitoring are compared to national guidelines for nuisance algae⁶ and cyanobacteria⁷ cover.

Excessive amounts of algae can make waterways unpleasant to look at and swim in, whereas cyanobacteria can be a health risk as some types produce toxins which are harmful to humans and animals, especially dogs.

Location of freshwater recreational monitoring sites



4. Except four sites which are only monitored monthly

5. These guidelines are called the Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas (2003) and can be downloaded or viewed at <https://www.mfe.govt.nz/publications/water/microbiological-quality-jun03/>

6. These guidelines are called NZ Periphyton Guideline: Detecting, Monitoring and Managing Enrichment of Streams (2000) and can be downloaded or viewed at <https://www.mfe.govt.nz/publications/water/nz-periphyton-guide-jun00.pdf>

7. These guidelines are called the NZ Guidelines for Cyanobacteria in Recreational Fresh Waters (2009) and can be downloaded or viewed at <http://www.mfe.govt.nz/publications/water/guidelines-for-cyanobacteria/nz-guidelines-cyanobacteria-recreational-fresh-waters.pdf>

Regional Overview

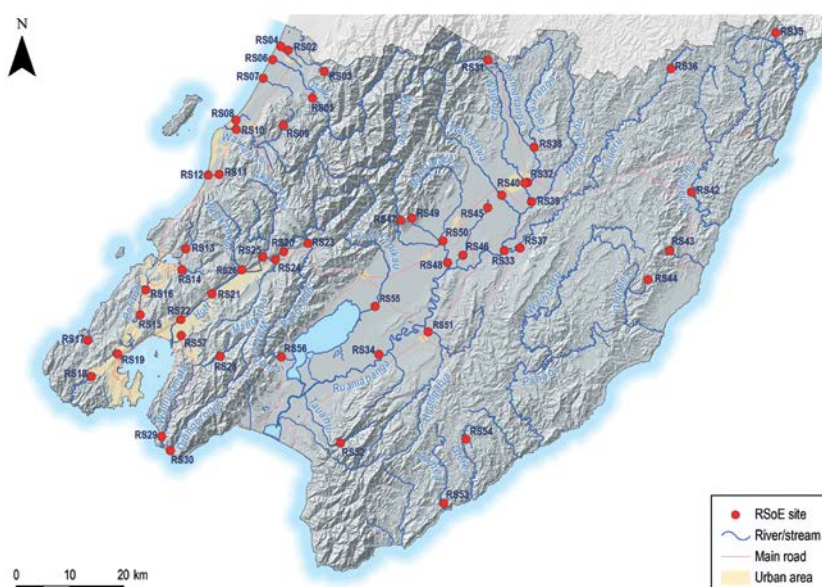
GWRC also monitors the environmental health of rivers and streams at 55 locations across the region. Sites are chosen to represent the major land uses and human activities in the Wellington region, as well as the natural diversity of our rivers and streams.

The monitoring programme involves monthly measurements of a number of water quality variables (such as dissolved oxygen, temperature, pH, conductivity, clarity and nutrient concentrations), and an annual assessment of invertebrate communities (the insects and bugs that live in the riverbed) and periphyton biomass (the amount of algae on the riverbed).

A Water Quality Index (WQI) is used to compare the water quality at each of the sites. The WQI is derived from the median values of six variables (clarity, dissolved oxygen, dissolved reactive phosphorus, ammoniacal nitrogen, nitrite-nitrate nitrogen and *E. coli*) and classifies water quality into one of four categories:

- **Excellent:** All six variables meet guideline values
- **Good:** Five out of six variables (one of which must be dissolved oxygen) meet guideline values
- **Fair:** Three or four out of six variables (one of which must be dissolved oxygen) meet guideline values
- **Poor:** Dissolved oxygen does not meet the guideline value and/or less than three of the six variables meet guideline values.

Location of freshwater quality monitoring sites



This year we introduced habitat quality monitoring into the programme, which involves monthly assessments of the sediment cover on the streambed and an annual assessment of habitat. The reason this is important is because good water quality on its own doesn't necessarily translate to a good environment for aquatic animals. Vegetation along the riverbank is important for providing shelter and shade, whereas too much sediment can smother aquatic life.

Water samples from ten sites located in urban areas with likely exposure to heavy metal inputs, or which discharge into sensitive downstream environments (ie, harbours and estuaries), are also analysed for dissolved concentrations of copper and zinc. Results are compared against ANZECC guidelines⁸.

Heavy metals are natural substances and some, such as copper and zinc, are essential trace elements for humans and animals. However, at higher concentrations they can lead to poisoning. Heavy metals are dangerous because they tend to accumulate, which means levels of these substances can easily build up in the body because they are not easily metabolised (broken down).

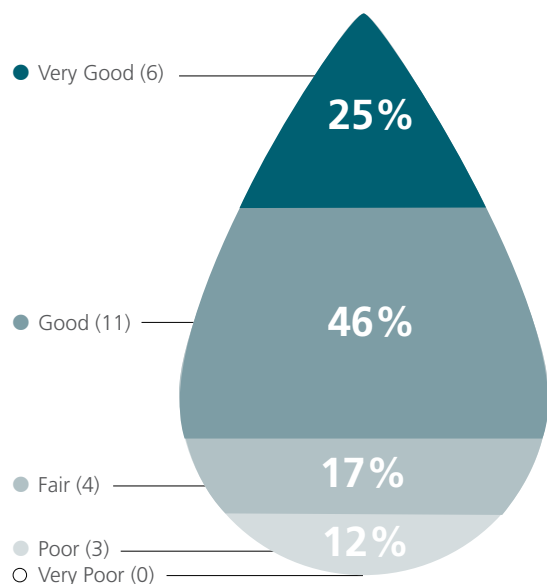
Is it safe to swim?

Recreational water quality

Recreational water quality in our rivers over summer is generally very good, except in poor weather conditions. Heavy rain flushes contaminants from urban and agricultural land into rivers and streams and disturbs the riverbed (causing re-suspension of sediment which often has bacteria and other pathogens attached). We advise people not to swim for at least two days after heavy rain, even if a site generally has good water quality.

The impact of rain on water quality is demonstrated by the weekly monitoring results; of the 420 individual samples taken between November 2013 and March 2014, only 15 (4%) did not meet the guideline and all but two of these samples were associated with rainfall (at least 10mm prior to sampling). This compares favourably to the 2012/13 season, where 30 (7%) of samples did not meet the guideline.

Each site is also given a *Suitability for Recreation Grade* (SFRG). SFRGs are based on monitoring results from the last five years, as well as an assessment of susceptibility of the surrounding area to faecal contamination. SFRGs are designed to describe the general suitability for recreational use at any given time, as opposed to the weekly monitoring results which only represent the water quality at the time of sampling.



In the Wellington region 17 river sites (71%) have an SFRG⁹ of "good" or better, only three sites (12%) are graded "poor" and none are graded "very poor"

8. These guidelines are called the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000) and can be downloaded or viewed at <http://www.environment.gov.au/system/files/resources/53cda9ea-7ec2-49d4-af29-d1dde09e96ef/files/nwqms-guidelines-4-vol1.pdf>

9. Note that these are 'dry weather' grades. This means that only samples taken during times of median flows or less are used to calculate the grades. Samples taken during higher river flows are excluded because it has been shown that high flows (caused by heavy rainfall) are strongly associated with high *E. coli* counts and can strongly influence the grade. Further, as people are unlikely to go swimming during periods of higher river flow due to poor weather and treacherous conditions, it is considered to be appropriate to exclude results collected during these times.

Algae

Of the 20 sites monitored for algae, only one site breached the filamentous (or 'stringy') periphyton guideline of no more than 30 percent cover of the visible stream bed, and on just one occasion. This compares very favourably to the 2012/13 season, where seven sites breached the guideline. Of particular note is the Wainuiomata River at Richard Prouse Park site which breached the guideline 15 times last season, but not once this season.

The same sites were also monitored for potentially toxic cyanobacteria. Not a single site in the region breached either the Alert or Action level of the cyanobacteria guidelines. Again this compares very favourably to the 2012/13 season, where eight sites throughout the region were affected by toxic algae blooms.

The up and down nature of rainfall and river flows this year may have been beneficial in terms of limiting algal growth in the region's waterways. The frequency of high river flow events is a key factor that controls the establishment and growth of periphyton and cyanobacteria. When river levels get high enough after rainfall the travelling water scours or 'flushes' periphyton and cyanobacteria from the riverbed.

Analysis of flows in the Ōtaki, Hutt, Wainuiomata, Waingawa, Waiohine and Ruamāhanga rivers showed all these waterways had relatively regular flushing flow events, even during February and March when conditions were drier than normal.



Filamentous or 'stringy' periphyton



Toxic algae forms mat-like growths on the rocks of riverbeds and is typically dark brown or black in colour

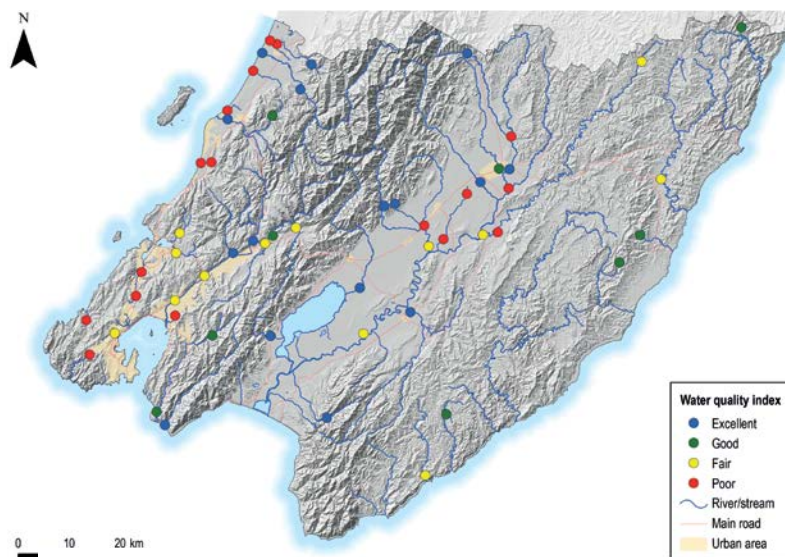
How healthy are the region's rivers and streams?

Water quality

Using the WQI, 16 out of the 55 sites (29%) are rated as being "excellent", nine (16%) are rated "good", 13 (24%) are rated "fair" and 17 (31%) are rated "poor". This compares unfavourably to last year where 31 out of 55 sites (56%) rated as "good" or "excellent" and only 11 sites (20%) rated as "poor". However, the wetter conditions experienced during the year may have contributed to the poorer water quality observed this year.

Most of the sites rated "excellent" are located in areas where the predominant land cover is indigenous forest. These tend to be on rivers flowing out of the Aorangi, Tararua and Rimutaka ranges and include the Ōtaki, Tauanui and Waiorongomai rivers, and the upper reaches of the Waitohu and Ruamāhanga rivers.

In contrast, sites rated "poor" are typically located on small rivers or streams in areas where the predominant land cover is pasture or urban. Sites with the poorest water quality during 2013/14 were the Mangaone Stream at Sims Road Bridge (Kāpiti) and Mangapouri Stream at Bennetts Road (Kāpiti).



WQI ratings for river and stream sites in the Wellington region. Sixteen sites (29%) are rated as being "excellent", nine sites (16%) are rated "good", 13 sites (24%) are rated "fair" and 17 sites (31%) are rated "poor".

Regional Overview

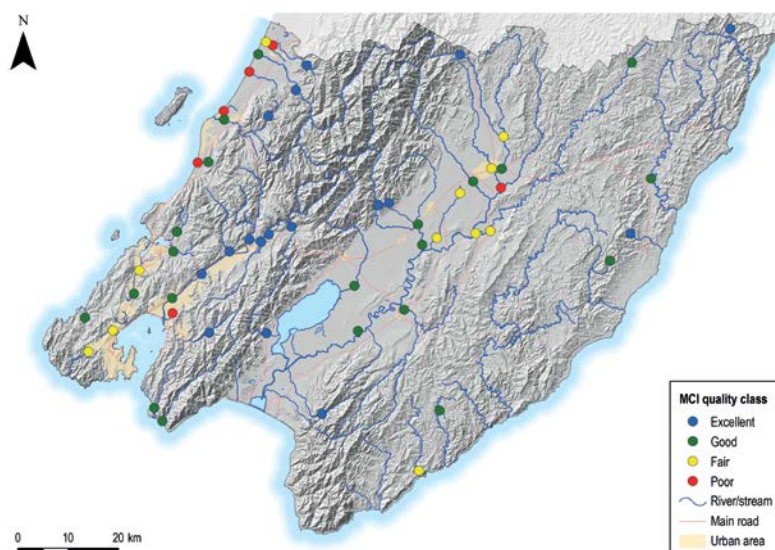
Invertebrates

The Macroinvertebrate Community Index (MCI) is used to classify the health of the river or stream into one of four classes based on invertebrate (the insects and bugs that live in the riverbed) community composition. Using the MCI, 17 out of the 55 sites (31%) are classed as “excellent”, 21 (38%) are classed “good”, 11 (20%) are classed “fair” and six (11%) are classed “poor”.

MCI class	MCI score
Excellent	≥120
Good	100-119
Fair	80-99
Poor	<80

All of the sites classed “excellent” on the MCI are hard bottomed (ie, the river or stream bed is stones or large gravel) and the vast majority are located in areas where the predominant land cover is indigenous forest. In contrast, all of the sites classed “poor” are soft-bottomed (ie, silty) and located in areas where the predominant land cover is pasture or urban.

There is a reasonable relationship between the MCI quality class and the WQI – sites with an “excellent” MCI quality class are likely to be rated as “excellent” or “good” on the WQI, and all sites with a “poor” MCI quality class were also rated “poor” on the WQI.



Two types of invertebrates commonly found in healthy rivers and streams – the swimming mayfly (*Nesameletus sp.*) which is a riverbed grazer, and the Dobsonfly larvae (*Archichauliodes diverus*) which is a predator of other invertebrates



MCI quality classes for river and stream sites in the Wellington region. 17 sites (31%) are classed “excellent”, 21 sites (38%) are classed “good”, 11 sites (20%) are classed “fair” and six sites (11%) are classed “poor”.

Algae

Assessment of periphyton biomass (algae) is limited to the 46 sites which are hard bottomed. Five of these sites exceeded the guideline (50mg/m² of chlorophyll a) which is designed to protect benthic biodiversity (insects, bugs and other life that live on the river or stream bed). This compares very favourably to the 2012/13 season, in which 13 sites exceeded the guideline. Of the five sites that exceeded the guideline, four are located in the Wairarapa in areas where the predominant land cover is pasture.

As stated previously, the up and down nature of rainfall and river flows this year may have been beneficial in terms of limiting algal growth in the region's waterways. Analysis of flows in the Ōtaki, Hutt, Wainuiomata, Waingawa, Waiohine and Ruamāhanga rivers show all these waterways had relatively regular flushing flow events, even during February and March when conditions were drier than normal.

Habitat quality

The sites with the highest habitat scores were all hard bottomed and located in areas where the predominant land cover is indigenous forest. These sites also tended to rate as "excellent" on the WQI and MCI. In contrast, sites with the lowest habitat scores tended to be soft bottomed, were all located in areas where the predominant land cover is pasture or urban and more likely to be rated as "fair" or "poor" on the WQI and MCI.

Unsurprisingly, the nine sites classed as soft bottomed had the highest amounts of sediment cover. Other sites that recorded high sediment cover tended to be located on smaller streams and also included a number of sites located in the erosion prone eastern Wairarapa Hills.

Heavy metals

Two sites (Porirua Stream at Wall Park and Karori Stream at Makara Peak) did not meet the guideline value for dissolved copper, and three sites (Porirua Stream at Wall Park, Karori Stream at Makara Peak and Waiwhetu Stream at Whites Line East) did not meet the guideline value for dissolved zinc.



Waitohu Stream (Kāpiti) at Forest Park is a good example of a pristine headwater site. It has a high habitat score and is rated as having excellent water quality and macroinvertebrate values.



Porirua Stream at Wall Park is an urban stream that has been heavily channelised. It has a low habitat score and is rated as having poor water quality. The stream also has issues with heavy metal contamination.

Using citizen science to enhance environmental monitoring

In addition to our routine monitoring of rivers and streams throughout the region, GWRC is working with three community groups to undertake parallel monitoring of water quality and stream health in the Mangatarere Stream (Wairarapa), Mawaihakona Stream (Upper Hutt) and the Waikanae River (Kāpiti Coast).

This is part of a National Institute of Water and Atmospheric Research (NIWA) project designed to investigate how well results from monitoring undertaken (at the same time and place) by the community align with results obtained by the regional council. The study will determine whether community-led monitoring can be used to extend the monitoring networks of regional councils and will lead to increased opportunities for local communities to become involved in freshwater management.

Kathryn Hicks, member of the Mawaihakona community monitoring team and Upper Hutt Forest and Bird, says "the key benefit for our team has been gaining skills and knowledge that can be applied to our own local restoration projects. Also, by contributing to a study which is highlighting the value of 'citizen science' and having built much closer relationships with our regional and local councils, it has led to support for ongoing monitoring by our team in the future."

Preliminary results are promising with good agreement between council and community results for water temperature, water clarity, *E. coli* and the proportion of pollution-sensitive macroinvertebrate (bugs and insects) species. Agreement was not so good for measurements of dissolved oxygen, nitrate and pH, however some of this has been attributed to problems with the monitoring kits which are being modified.

The first joint stream health assessment was undertaken in March 2014 and the project will continue for 18 months.



Environmental Scientist Summer Greenfield (left) explains invertebrate sampling to the Mawaihakona community monitoring team
Photo courtesy of Allan Sheppard

Lakes

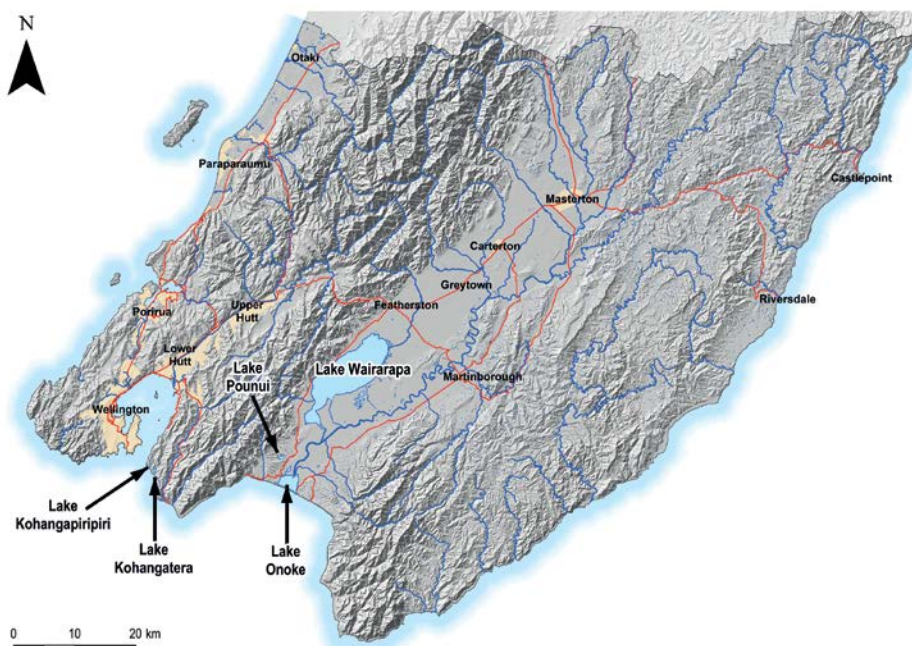
GWRC monitors the health of several lakes in the region. Two types of lake monitoring are routinely undertaken:

- 1. Monthly water quality monitoring:** Surface water samples are taken and analysed for a number of variables. Four of these variables; chlorophyll a (indicator of the amount of algae in water), Secchi depth (measures water clarity), phosphorus and nitrogen are used to calculate a Trophic Level Index (TLI). The TLI determines how nutrient enriched the lake is from “ultra-microtrophic” (practically pure) to “hypertrophic” (extremely high in nutrients). This type of monitoring is undertaken in Lakes Wairarapa and Onoke.
- 2. Periodic assessments of aquatic plant communities:** Surveys of submerged aquatic plants are used to calculate a LakeSPI (Submerged Plant Index) score. The LakeSPI method takes into account the diversity and quality of indigenous plants, as well as the degree of impact by invasive weed species. The LakeSPI provides an indication of the overall ecological condition of the lake from “excellent” (>75 percent of expected pristine state) to “poor” (≤20 percent of expected pristine state). This type of monitoring is undertaken in Lakes Kohangapiripiri, Kohangatera and Pounui.

In 2013/14 we monitored two of the region’s lakes:

1. Lake Wairarapa
2. Lake Onoke.

Location of the five routinely monitored lakes



How healthy are the region's lakes?

Water quality in Lake Wairarapa hasn't changed much since monitoring began in 1994. The lake is facing issues associated with nutrient enrichment and poor water clarity. Excessive algae growth can also occur at times. It is classed as "supertrophic" (or very high in nutrients) on the TLI. Lake Onoke has very similar water quality and faces the same sorts of issues. It is classed as "eutrophic" (or high in nutrients) on the TLI.



◀ Lake Wairarapa is facing issues associated with nutrient enrichment and poor water quality and is classed as "supertrophic"

Lake Onoke faces the same sorts ▶ of issues as Lake Wairarapa and is classed as "eutrophic"



Groundwater

Groundwater is the water found underground in the cracks and spaces in soil, sand and rock. It is stored in and moves slowly through these geological formations which are called aquifers. There are three major areas of groundwater in the Wellington region; the Hutt Valley, Kāpiti Coast and Ruamāhanga Valley.

Groundwater in the Wellington region is highly valued, especially for public drinking water supply and irrigation. In many areas, groundwater is linked to surface water bodies such as rivers, lakes and wetlands, and the successful protection of these waterbodies also requires careful management of our groundwater resources.

During the 2013/14 year, groundwater quality was measured quarterly at 68 sites over the region. Groundwater quality is assessed by measuring a number of different variables however the information in this report will focus on two key indicators of groundwater contamination:

Nitrate – Nitrate is an indicator of groundwater contamination arising primarily from land use intensification and is monitored for both health and environmental reasons. Excessive levels of nitrate in drinking water have been linked with blood disease in infants (commonly known as 'blue baby syndrome'). From an environmental perspective nitrate is a good indicator of general groundwater degradation. Also, groundwater that is rich in nitrate has the potential to elevate nutrient levels in the surface water it drains into. Nitrate concentrations are assessed against both the Ministry of Health (MoH) Drinking Water Standards (DWSNZ) and the Hickey (2013) threshold for aquatic toxicity.

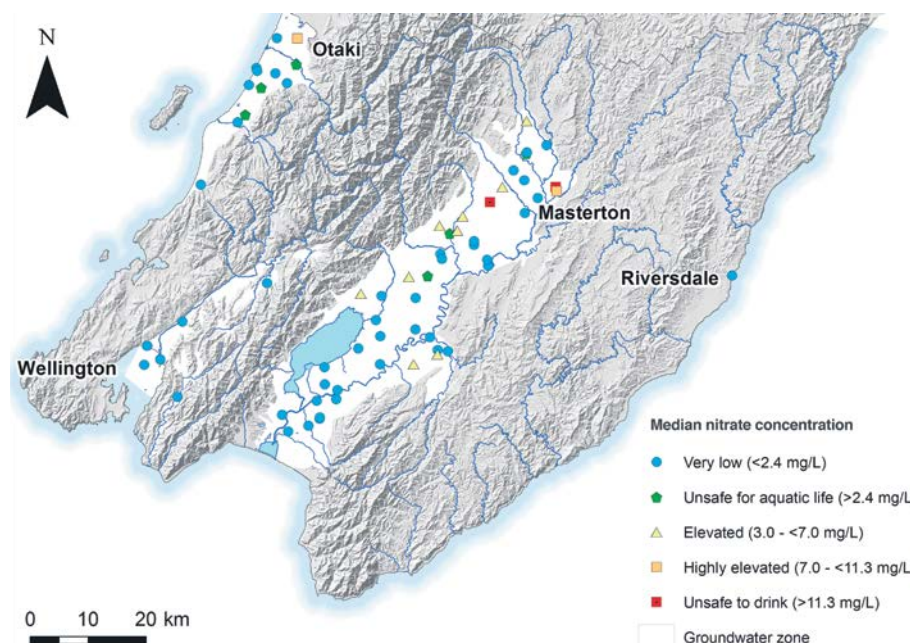
E. coli – *E. coli* is an indicator of contamination from faecal material and is monitored primarily for health reasons. Contamination can occur as a result of effluent disposal, including on-site wastewater disposal such as septic tanks, and poor bore head protection (allowing runoff from land, animals, general debris and other sources of contamination to get into the bore). *E. coli* monitoring results are assessed against the MoH DWSNZ.

How healthy is the region's groundwater?

From a drinking water perspective groundwater quality in the Wellington region is generally quite good, although two of the monitored bores had median nitrate concentrations exceeding the DWSNZ Maximum Acceptable Value (MAV) of 11.3mg/L. Both of these bores are in the Ruamāhanga area, and the median nitrate concentrations were only slightly above the MAV (11.35mg/L and 11.55mg/L).

A further 12 bores had elevated (3-11.3mg/L) median nitrate concentrations. These bores are all located in areas of intensive agriculture (Wairarapa) and horticulture (Kāpiti Coast).

Nitrate is toxic to aquatic life forms at lower levels than for humans. For river-dwelling animals such as insects and fish the toxicity threshold is 2.4mg/L. Twenty of the 68 (29%) monitored bores had median concentrations exceeding this threshold. However, nitrate is diluted (to varying degrees) when groundwater discharges into surface water.

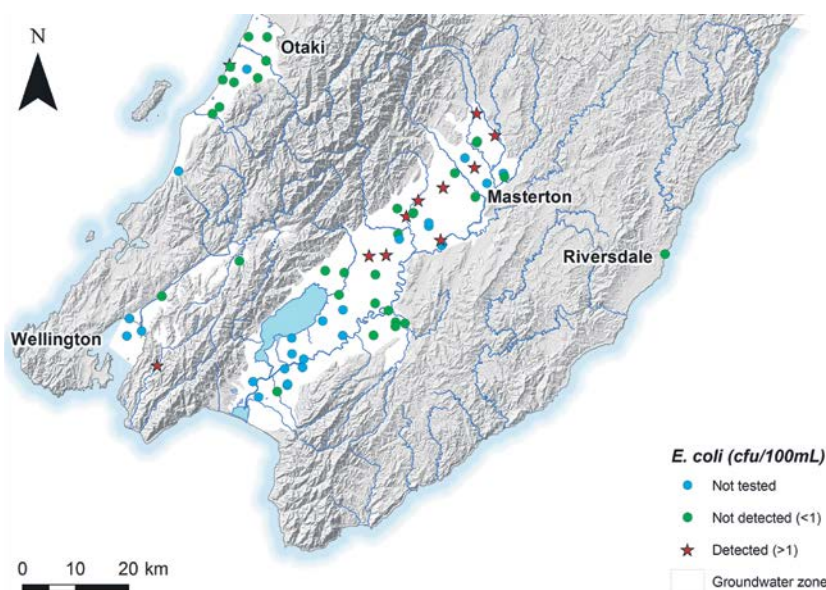


Two of the bores monitored in 2013/14 had median nitrate concentrations exceeding the drinking water standard of 11.3mg/L

Regional Overview

For drinking water supplies, *E. coli* counts should be less than 1cfu/100mL. *E. coli* was detected (ie, counts were equal to or greater than 1cfu/100mL) on at least one occasion in 11 of the 43 (26%) bores tested. This compares favourably to the 2012/13 results where *E. coli* was detected in 17 of the 43 (40%) bores tested.

Of the 11 bores that tested positive for *E. coli* this year, six are used for drinking water supply. If a positive *E. coli* result is found in a bore that is used for drinking water supply, the affected residents are informed so they can take precautionary measures such as boiling their drinking water.



E. coli was detected at least on one occasion in 11 out of 43 (26%) bores

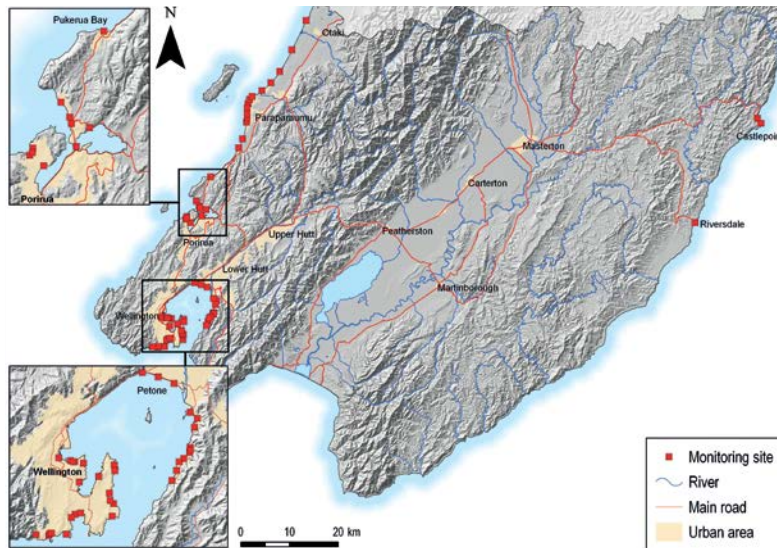
Estuaries and coasts

GWRC monitors bacterial levels in water at 61 coastal sites across the region. Sites are monitored weekly over the summer months (November to March) and monthly during the rest of the year. The results from this monitoring are compared to national water quality guidelines¹⁰ to determine the suitability of these sites for recreational purposes such as swimming and surfing.

The safety of water (for recreational purposes) is determined by measuring the indicator bacteria Enterococci to find out whether the water is contaminated by faecal material. Water that is contaminated by faecal material can contain many different types of pathogens (bacteria and viruses) which have the potential to make people sick.

10. These guidelines are called the Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas (2003) and can be downloaded or viewed at <https://www.mfe.govt.nz/publications/water/microbiological-quality-jun03/>

Location of coastal recreational monitoring sites

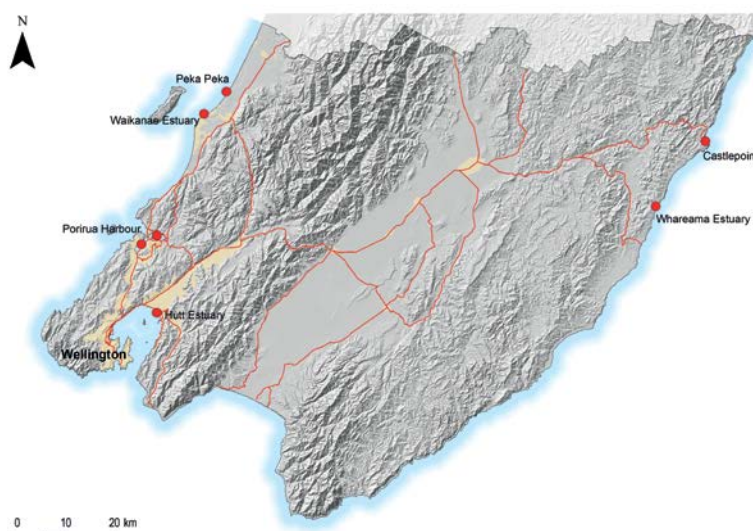


GWRC also monitors the ecological health of estuaries, harbours and sandy beaches at selected locations. The frequency of this monitoring varies, depending on the nature of the issues at the site.

In the 2013/14 year, we monitored five estuaries and two beaches; Waikanae Estuary, Porirua Harbour (Onepoto and Pauatahanui arms), Hutt Estuary, Whareama Estuary, Peka Peka Beach and Castlepoint Beach.

Estuaries are particularly at risk from pollution as they are the sink into which our rivers and streams drain. However, because water is flushed from the estuary at each low tide water quality is too variable to provide meaningful information about estuary health. Our monitoring therefore focusses largely on the health of sediment (the estuary floor) as pollutants will often deposit here as the water flows out to sea.

Location of the estuary and beach sites monitored in 2013/14

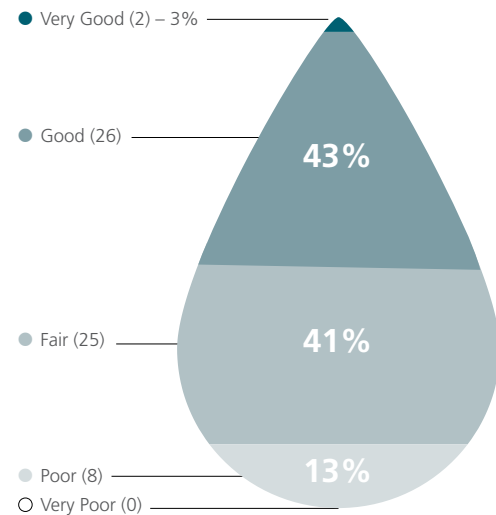


Is it safe to swim?

Water quality at our beaches over summer is generally very good. Winter results are often poorer but this is largely related to weather conditions. Heavy rain flushes contaminants from urban and agricultural areas into coastal waters and we advise people not to swim for at least two days afterwards, even if a site generally has good water quality.

The impact of rain on water quality is demonstrated by the weekly monitoring results; of the 1,220 individual samples taken over November 2013 to March 2014, only 71 (6%) did not meet the guideline and 44 (62%) of these were associated with rainfall (at least 10mm prior to sampling). This compares favourably to the 2012/13 season, where 94 (8%) of samples did not meet the guideline.

All sites are given a *Suitability for Recreation Grade* (SFRG). SFRGs are based on monitoring results from the last five years, as well as an assessment of susceptibility of the surrounding area to faecal contamination. SFRGs are designed to describe the general suitability for recreational use at any given time, as opposed to the weekly monitoring results which only represent the water quality at the time of sampling.



In the Wellington region 28 (46%) beach sites have an SFRG of "good" or better, 25 sites (41%) are graded "fair", eight sites (13%) are graded "poor" and none are graded "very poor"

How healthy are the region's estuaries and beaches?

All of the estuaries we monitor are in a "fair" condition, but many are facing issues that are threatening to affect overall ecological health and their ability to support life.

In Waikanae Estuary, high rates of sedimentation are the main issue, but sediment oxygenation is also starting to be affected. In Porirua Harbour and Whareama Estuary, excessive amounts of fine mud are causing poor sediment oxygenation and dense areas of macroalgae continue to be a problem in the Hutt Estuary.

Overall, the two sandy beaches (Peka Peka and Castlepoint) monitored this year are in excellent condition and do not appear to be facing any major threats to their ecological health.



In the Hutt Estuary dense areas of macroalgae growth is an ongoing problem



Castlepoint Beach on the Wairarapa Coast is in excellent condition

Air

Levels of the key pollutants PM10, carbon monoxide and nitrogen dioxide all meet national air quality standards.

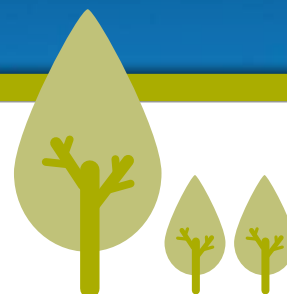
Being a largely urban area, air quality is heavily influenced by traffic. Levels of nitrogen dioxide peak during the morning and evening rush hours and are highest at the monitoring site in central Wellington.



Land

In spring 2013 and autumn 2014 a beech masting event occurred which resulted in plague numbers of rats. Thanks to our regular monitoring regime, we were able to quickly pick up the rapidly increasing rodent numbers and put in place extra pest control measures. Read more about this on page 34.

There are 1,225 sites in the Selected Land Use Register (SLUR) in this area. Most of the registered sites (82%) fall into class A (Chemical manufacture, application and bulk storage), class F (Vehicle refuelling, service and repair) or class G (Cemeteries and waste recycling, treatment and disposal).



Water

A key feature of this catchment is the Hutt River which is very popular for swimming, trout fishing and other recreational activities. Water quality is monitored at several locations and is generally very good. Unlike previous years, toxic algal blooms were not a problem in the Hutt River during the 2013/14 summer. The up and down nature of rainfall and river flows this year may have been beneficial in terms of limiting algal growth in the region's waterways. Analysis of flows showed that many of the major rivers had relatively regular flushing flow events, even during February and March when conditions were drier than normal.



Wellington Harbour and Hutt Valley



Investigation

Toxic algal blooms



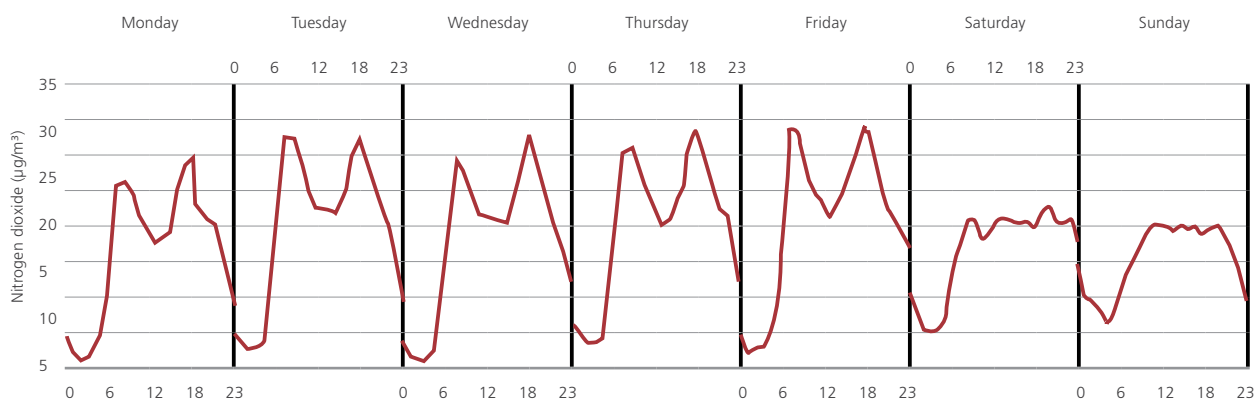
Understanding the drivers of benthic cyanobacteria (toxic algae) blooms in the Hutt River has been an ongoing focus for our scientists over the past year, especially the role that nutrients play in cyanobacteria growth.

Read more about this study on page 44.

Air quality

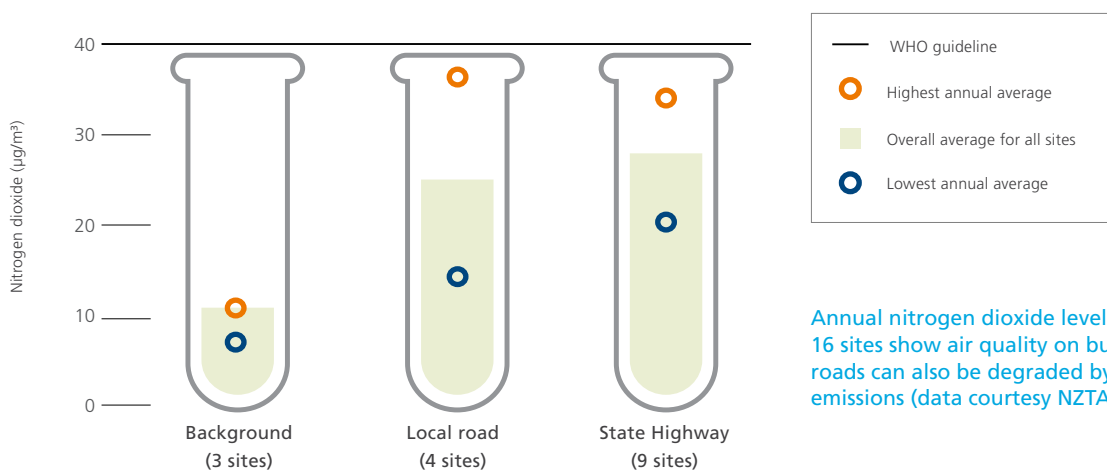
Levels of the key pollutants PM10, carbon monoxide and nitrogen dioxide met national air quality standards.

Nitrogen dioxide is a key indicator pollutant that represents the influence of vehicle emissions on air quality. While Wellington city does not have high traffic levels by international standards, our inner city monitoring site on the corner of Victoria and Vivian Street (which has been measuring nitrogen dioxide since 2005) clearly shows the effect of commuter rush hour during the working week. Despite this, the maximum hourly average for nitrogen dioxide recorded at this site was still well below the limit allowed by the national standard.



Nitrogen dioxide levels peak during morning and evening rush hour in Wellington city

As part of their national monitoring network, New Zealand Transport Agency (NZTA) also measure nitrogen dioxide levels at 20 sites across the region. Most of these sites are located in the Wellington Harbour and Hutt Valley area. Of particular interest are the local road sites where many people live, work and go to school. There is one site in Newtown close to a busy intersection where the annual level of nitrogen dioxide was very close to the World Health Organisation guideline. In contrast, background sites which are some distance from roads have low levels of air pollution from traffic. Overall these results show nitrogen dioxide levels can vary a lot and depend on congestion and sheltering effects, not just traffic numbers themselves.

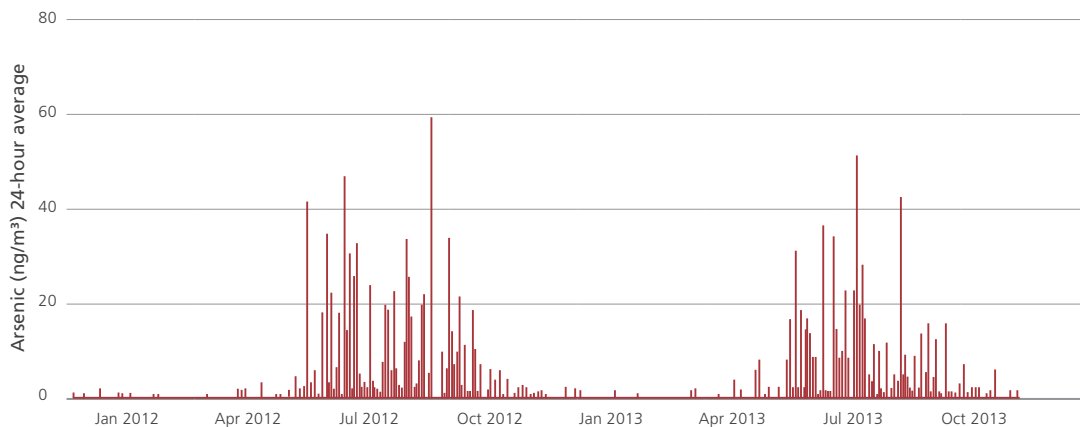


Annual nitrogen dioxide levels across 16 sites show air quality on busy local roads can also be degraded by traffic emissions (data courtesy NZTA)

Reducing levels of arsenic in air in Wainuiomata

The potential for high levels of arsenic in air arising from people burning timber offcuts treated with copper chrome arsenate (CCA) is an emerging issue of national concern as long term exposure to arsenic has been shown to increase the risk of lung cancer.

GWRC has now completed a two year project in collaboration with GNS Science which measured arsenic in the air in Wainuiomata. The results clearly showed that arsenic levels peak during winter months, and the primary source of this arsenic is wood smoke from home fires.



Daily arsenic levels peak in colder months (May to September) as a result of the burning of treated timber in home fires

Leading up to winter 2013 we undertook a campaign that included radio advertising and promotion through our website, which advised residents in the region to avoid burning treated timber of any kind in their home fires.

The 2013 average was 5.3 nanograms per cubic metre, which meets the national guideline of 5.5 nanograms per cubic metre and is an improvement from the previous year (7.1 nanograms per cubic metre). A contributing factor to the decrease was the slightly warmer and windier winter conditions in 2013, meaning that pollution from home fires would have been more readily dispersed leading to lower levels of both arsenic and particulate matter.

Overall Wainuiomata has good air quality. PM10 levels met the national standard and there were only a few days during the winter months when PM2.5 levels were above that recommended by World Health Organisation¹¹.

¹¹. New Zealand does not have a national standard for PM2.5

Terrestrial ecology

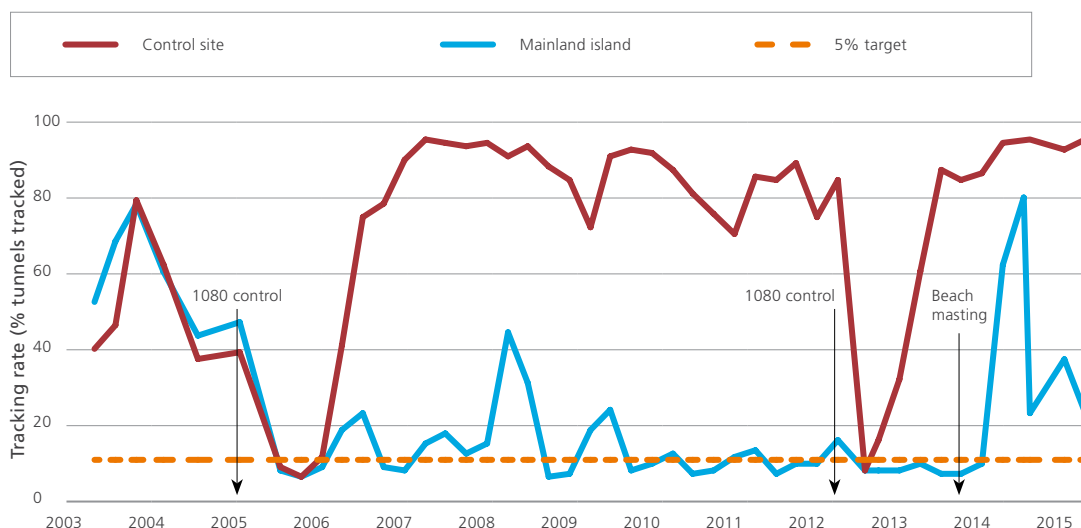
Beech masting event causes plague rat numbers

In the forest bordering Wainuiomata there is a 1,200 hectare mainland island with high native biodiversity values. This receives pest control on an ongoing basis to protect the indigenous plants and animals that live there. The rest of the area (including a nearby 'control' site) only receives pest control during the large scale aerial 1080 operations which are undertaken every five to seven years.

The drop in rat numbers resulting from the 1080 operations in 2005 and 2012 can be clearly seen in the figure below. However rat numbers can quickly increase after a 1080 operation, possibly because they are no longer competing with other pests (such as possums) for food, and hence the need for ongoing rodent control in between operations to protect vulnerable species.

A beech masting event occurred in spring 2013 and autumn 2014. Masting events produce extremely high amounts of seed and results in plague numbers of rodents. When the seeds run out, the rodents turn on our endangered birds and other native species such as bats and snails, with often devastating results.

Thanks to our regular monitoring regime, we were able to quickly pick up the rapidly increasing rodent numbers in the mainland island as a result of the beech masting. It was clear that the current regime was not coping with the rat population explosion that was occurring and extra pest control was put in place on the basis of this evidence.



Soil quality

The soil quality programme is agriculturally based so no sites in this area are monitored.

Hazardous activities on land

There are 1225 registered sites in Wellington and the Hutt Valley. The majority of sites (66 percent) fall into *Category I – Verified History of Hazardous Activity or Industry*.

Category	Percentage of sites
I – Verified History of Hazardous Activity or Industry	66%
II – Unverified History of Hazardous Activity or Industry	<1%
III – Contamination Confirmed	6%
IV – Contamination Acceptable, Managed/Remediated	24%
V – No Identified Contamination	3%
VI – Entered on Register in Error	<1%

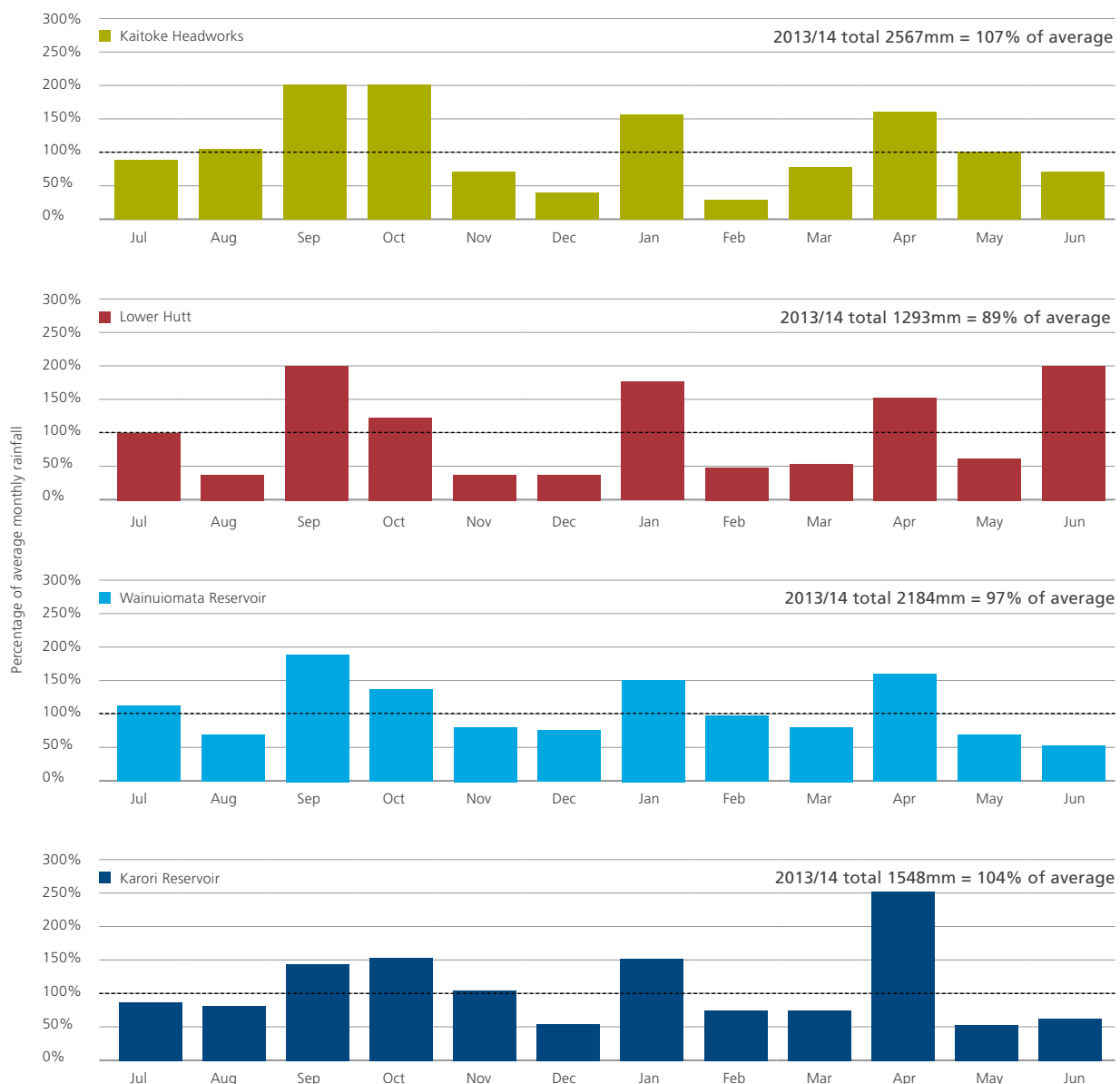
Most of the registered sites (82 percent) in Wellington and the Hutt Valley fall into HAIL classifications A, F or G.

HAIL Classification	Percentage of sites
A. Chemical manufacture, application and bulk storage	36%
B. Electrical and electronic works, power generation and transmission	5%
C. Explosives and ordinances production, storage and use	1%
D. Metal extraction, refining and reprocessing, storage and use	5%
E. Mineral extraction, refining and reprocessing, storage and use	6%
F. Vehicle refuelling, service and repair	26%
G. Cemeteries and waste recycling, treatment and disposal	20%
H. Land that has been subject to the migration of hazardous substances from adjacent land	<1%
I. Land that has been subject to the intentional or accidental release of a hazardous substance	<1%

Rainfall and water levels

Rainfall and river flows in this area have been monitored for many years, with the earliest rainfall records going back to 1878 and 1890 at Karori Reservoir and Wainuiomata Reservoir respectively.

In general, the Wellington Harbour and Hutt Valley area received an average amount of rainfall for the year. Rain gauges located at Kaitoke, Lower Hutt, Wainuiomata and Karori show a number of months where rainfall was well above average including September, October, January and April. However Lower Hutt also experienced some very dry months including August, November, December, February and March.



The Wellington Harbour and Hutt Valley area received an average amount of rainfall for the year but this was punctuated by some very wet months and some very dry months

Recordings from five monitoring sites show that on the whole river flows were slightly above average. As with rainfall, flows varied greatly throughout the year. The months of September, October, January and April were markedly above average, whereas the months of December, February and March saw significantly low flows in a number of rivers.

The table below shows monthly flows for five different sites as a percentage of the long-term average, ie, above 100 indicates an above average flow whereas below 100 indicates a below average flow for the month.

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Year
Hutt River (Taita Gorge)	107	66	190	146	103	39	128	43	58	167	129	68	109
Akatarawa River	93	51	163	138	101	40	132	34	51	114	138	65	99
Mangaroa River	129	77	221	148	133	47	123	46	57	127	105	63	119
Wainuiomata River	140	66	221	158	135	55	178	106	73	185	111	44	115
Orongorongo River	90	76	197	127	115	45	244	96	119	314	117	88	122

River flows varied greatly throughout the year with some months being markedly above average and some seeing significantly low flows in a number of rivers

During 2013/14, flood warning alarms were activated on eight occasions in the Hutt River. The largest event was recorded at Kaitoke on 24 May 2014, which peaked at a flow of 415 cubic metres per second. A flow of this magnitude is only expected to occur about every 25 years. This event was brought about by localised heavy rainfall and no other significant river flows were recorded elsewhere during this time.

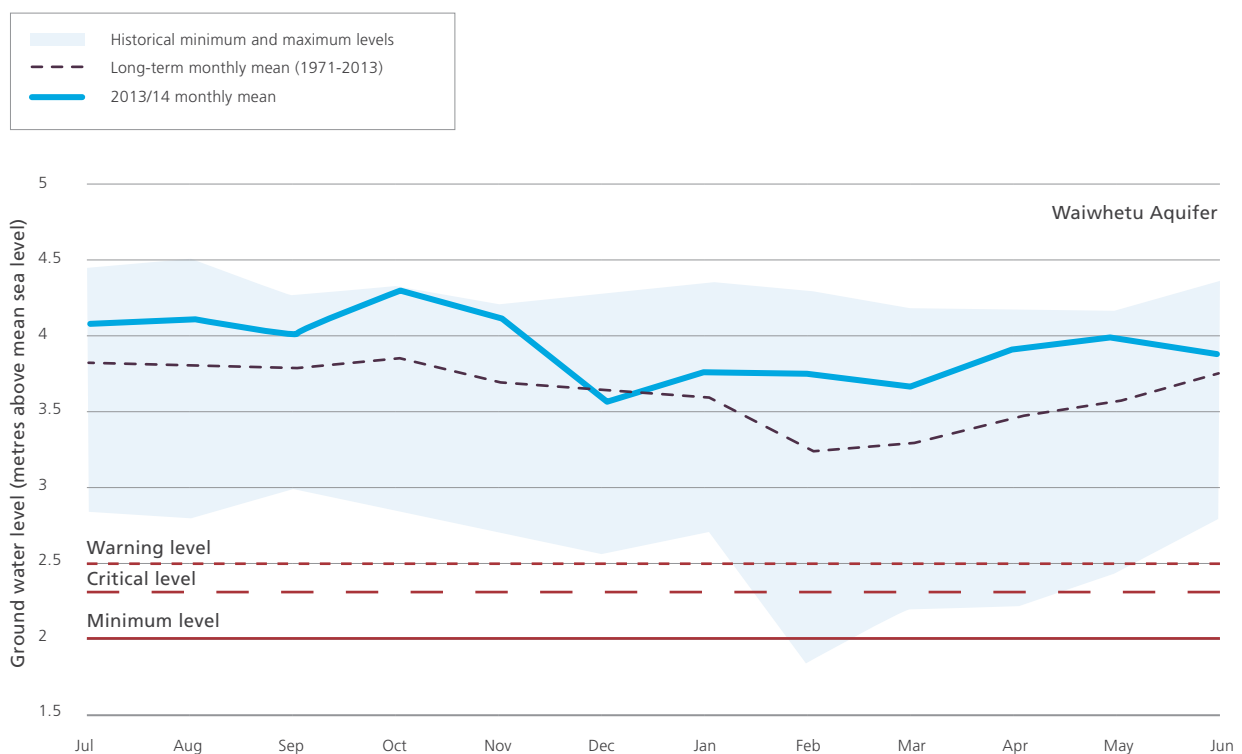
Flood warning alarms were also activated four times in the Akatarawa River, three times in the Orongorongo River, and once in the Mangaroa River, Wainuiomata River and Waiwhetu Stream. Although high river levels were reached there were no significant flood events as a result.

Wellington Harbour and Hutt Valley

Public water supply for Wellington, Lower Hutt, Upper Hutt and Porirua cities comes from three sources; the Hutt River, the combined flow of the Wainuiomata and Orongorongo Rivers and groundwater from the Waiwhetu Aquifer.

The Waiwhetu Aquifer is a natural underground reservoir beneath the Hutt Valley. Water from the Hutt River starts to flow underground near Stokes Valley, and from Melling southwards the water becomes naturally pressurised beneath a layer of hard clay. This pressurised (artesian) zone continues underneath Wellington Harbour and connects to several fresh water springs in the harbour floor.

The Waiwhetu Aquifer currently provides around 40 percent of the public water supply (to the cities) at a rate of about 60 million litres per day, and is fully allocated. The amount of groundwater that can be taken is limited so that enough water is left in the aquifer in order to maintain pressure and ensure that seawater cannot enter the aquifer through the springs in the harbour. Groundwater levels in the aquifer are monitored at various bores in the Lower Hutt Valley, and during the year maintained above average levels.

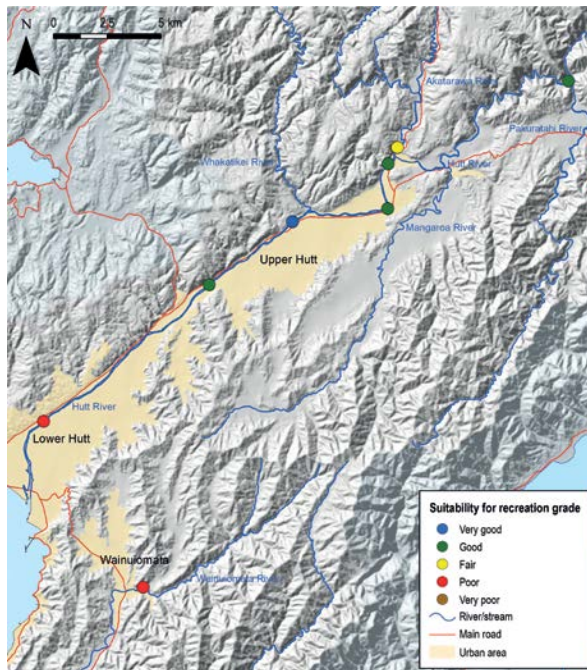


Groundwater levels in the Waiwhetu Aquifer showed no extremes and were consistently above average

Rivers and streams

Is it safe to swim?

SFRGs for freshwater recreational sites



Recreational water quality in the Wellington Harbour and Hutt Valley area is quite variable depending on the site. The majority of sites have an SFRG of “good” or better, but there are two sites that have an SFRG of “poor”.

The table below shows the results of the weekly sampling undertaken over the summer. Five out of the eight sites monitored exceeded the Action guideline at least once, however all but two of the exceedances were related to rainfall.

Monitoring results for freshwater recreational sites

Site Name	No. sampling weeks	No. sample results (<i>E. coli</i> /100mL)			SFRG
		Surveillance (≤ 260)	Alert ¹ (261-550)	Action ² (> 550)	
Pakurataki River at Hutt Forks	20	19	0	1	Good
Akatarawa River at Hutt Confluence	5	4	1	0	Fair
Hutt River at Birchville	20	19	0	1	Good
Hutt River at Moaribank Corner	20	19	0	1	Good
Hutt River at Poets Park	20	19	1	0	Very good
Hutt River at Silverstream	20	18	2	0	Good
Hutt River at Melling Bridge	20	18	1	1	Poor
Wainuiomata River at Richard Prouse Park	20	15	2	3	Poor

Table footnote 1: If a sample result falls within the Alert range the affected site is monitored daily until *E. coli* counts return to safe levels

Table footnote 2: If a sample result falls within the Action range, ie, exceeds 550/100mL, the affected site is monitored daily until *E. coli* counts return to safe levels. If the exceedance is not related to heavy rainfall public warnings are issued and the source of the contamination investigated.

Wellington Harbour and Hutt Valley

Seven of the eight sites were also assessed for algae and cyanobacteria cover. None of the sites exceeded either the periphyton or cyanobacteria guidelines.

This compares favourably to the 2012/13 season, where one site on the Wainuiomata River was affected by periphyton growth and all four sites on the Hutt River were affected by toxic algae blooms. The table below shows the results of the summer monitoring.

The up and down nature of rainfall and river flows this year may have been beneficial in terms of limiting algal growth in the region's waterways. Analysis of flows showed that many of the major rivers had relatively regular flushing flow events, even during February and March when conditions were drier than normal.

Compliance with periphyton and cyanobacteria guidelines

Site Name	No. of sampling weeks	No. of assessments	Filamentous periphyton cover		Mat periphyton cover		Cyanobacteria cover		
			Maximum (percent)	No. of occasions guideline exceeded (>30%)	Maximum (percent)	No. of occasions guideline exceeded (>30%)	Maximum (percent)	No. of occasions Alert level exceeded (20-50%)	No. of occasions Action level exceeded (>50%)
Pakurataki River at Hutt Forks	20	20	0.5	0	3.5	0	3.8	0	0
Hutt River at Birchville	20	20	12.5	0	4.5	0	7.5	0	0
Hutt River at Māoribank Corner	20	19	9.5	0	3	0	7	0	0
Hutt River at Poets Park	20	16	11.5	0	6.3	0	10.5	0	0
Hutt River at Silverstream	20	18	20.8	0	6.5	0	10.5	0	0
Hutt River at Melling Bridge	20	17	22.5	0	5.8	0	6.3	0	0
Wainuiomata River at Richard Prouse Park	20	19	26	0	34.8	0	9.3	0	0

How healthy are the rivers and streams?

Water quality in the Wellington Harbour and Hutt Valley area is variable depending on the site. Six sites (43%) are rated “excellent” or “good”, five sites (36%) are rated “fair” and three sites (21%) are rated “poor” (Makara Stream at Kennels, Karori Stream at Makara Peak and Waiwhetu Stream at Whites Line East). All three sites rated “poor” are located in areas where the predominant land cover is pasture or urban. The Waiwhetu Stream site has the poorest water quality in this area however it is also soft-bottomed, meaning it is more prone to weed growth and other issues which affect water quality.

Monitoring results for freshwater quality sites

Site number	Site name	Dominant land cover	Substrate type	WQI rating	Guideline compliance (median values)					
					DO	Clarity	<i>E. coli</i>	NNN	Amm N	DRP
RS17	Makara Stream at Kennels	Pasture	Hard	Poor	✓	✗	✗	✗	✓	✗
RS18	Karori Stream at Makara Peak	Urban	Hard	Poor	✓	✓	✗	✗	✗	✗
RS19	Kaiwharawhara Stream at Ngaio Gorge	Urban	Hard	Fair	✓	✓	✗	✗	✓	✗
RS20	Hutt River at Te Marua Intake Site	Indigenous forest	Hard	Good	✓	✗	✓	✓	✓	✓
RS21	Hutt River opposite Manor Park Golf Club	Indigenous forest	Hard	Fair	✓	✗	✗	✓	✓	✓
RS22	Hutt River at Boulcott	Indigenous forest	Hard	Fair	✓	✗	✗	✓	✓	✓
RS23	Pakuratahi River downstream from Farm Creek	Indigenous forest	Hard	Fair	✓	✗	✗	✓	✓	✓
RS24	Mangaroa River at Te Marua	Pasture	Hard	Fair	✓	✗	✗	✓	✓	✗
RS25	Akatarawa River at Hutt confluence	Indigenous forest	Hard	Excellent	✓	✓	✓	✓	✓	✓
RS26	Whakatikei River at Riverstone	Indigenous forest	Hard	Excellent	✓	✓	✓	✓	✓	✓
RS28	Wainuiomata River at Manuka Track	Indigenous forest	Hard	Good	✓	✓	✓	✓	✓	✗
RS29	Wainuiomata River downstream from White Bridge	Indigenous forest	Hard	Good	✓	✓	✓	✓	✓	✗
RS30	Orongorongo River at Orongorongo Station	Indigenous forest	Hard	Excellent	✓	✓	✓	✓	✓	✓
RS57	Waiwhetu Stream at Whites Line East	Urban	Soft	Poor	✓	✗	✗	✗	✗	✗

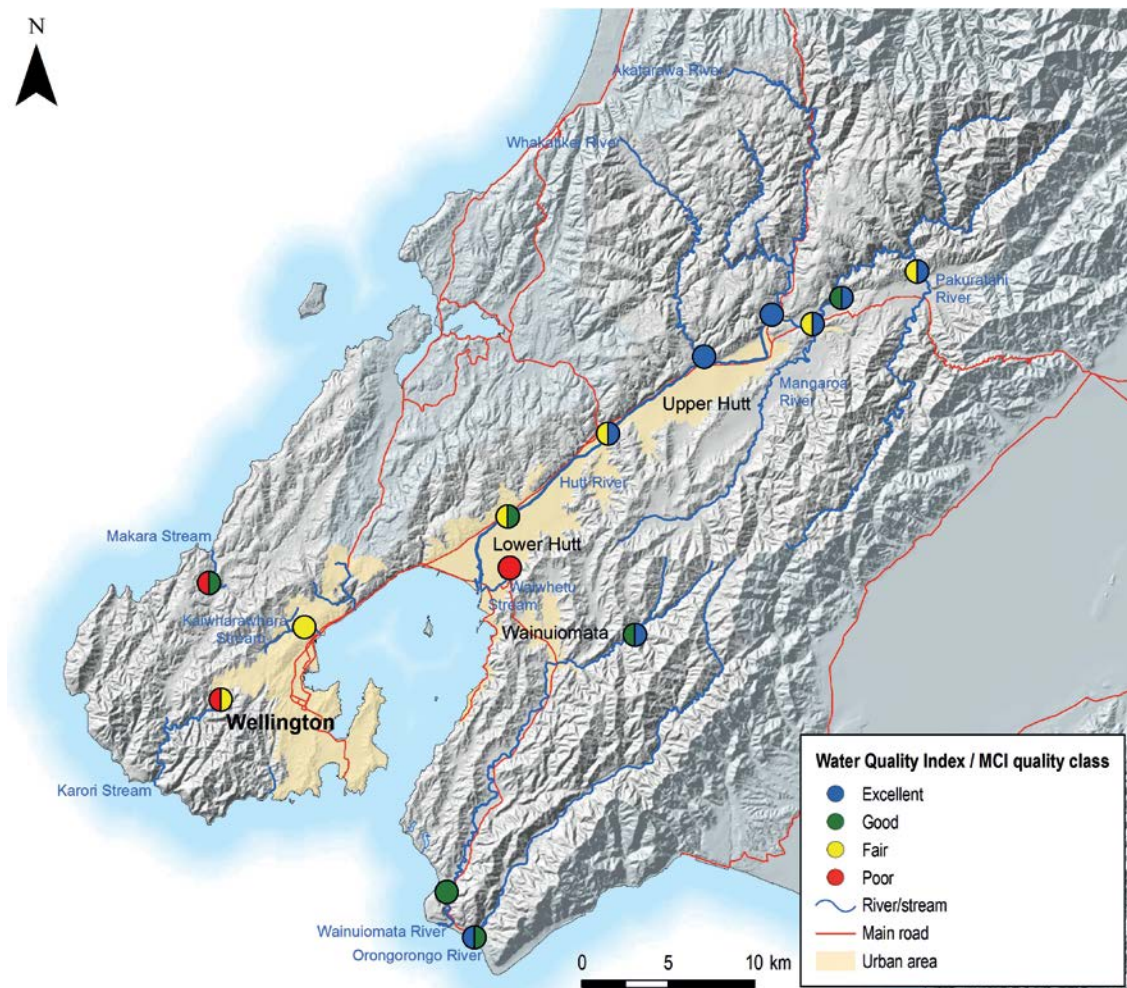
In contrast to the water quality results, seven out of the 14 sites (50%) are classed as “excellent” on the MCI and a further four sites (29%) are classed “good”, demonstrating that poor water quality on its own alone does not necessarily translate to a poor environment for aquatic animals. Of the three sites that rated “poor” on the WQI, only one (Waiwhetu Stream at Whites Line East) was classed “poor” on the MCI. This site also had a low habitat score, meaning the invertebrate communities (the insects and bugs that live in the riverbed) at this site are probably being affected by a number of factors, including pollution and a lack of good habitat.

Algal levels were within the guideline value (50mg/m² chlorophyll a) at all sites monitored, with the exception of the Wainuiomata River site located downstream from White Bridge which only just breached the guideline value.

Periphyton and invertebrate monitoring results for freshwater quality sites

Site number	Site name	Chlorophyll a (mg/m ²)	MCI score	MCI class
RS17	Makara Stream at Kennels	8.84	107.3	Good
RS18	Karori Stream at Makara Peak	12.77	91.8	Fair
RS19	Kaiwharawhara Stream at Ngaio Gorge	9.23	95.7	Fair
RS20	Hutt River at Te Marua Intake Site	0.48	128	Excellent
RS21	Hutt River opposite Manor Park Golf Club	6.55	127.7	Excellent
RS22	Hutt River at Boulcott	38.43	111	Good
RS23	Pakuratahi River downstream from Farm Creek	0.81	124.8	Excellent
RS24	Mangaroa River at Te Marua	11.74	127.5	Excellent
RS25	Akatarawa River at Hutt confluence	0.09	134.6	Excellent
RS26	Whakatikei River at Riverstone	10.97	138.5	Excellent
RS28	Wainuiomata River at Manuka Track	9.28	143.6	Excellent
RS29	Wainuiomata River downstream from White Bridge	50.66	109.5	Good
RS30	Orongorongo River at Orongorongo Station	2.04	106.7	Good
RS57	Waiwhetu Stream at Whites Line East	Not measured	51.2	Poor

WQI ratings and MCI classes for freshwater quality sites



What causes toxic algal blooms in the Hutt River?

Understanding the drivers of benthic cyanobacteria (toxic algae) blooms in the Hutt River has been an ongoing focus for our scientists over the past year, especially the role that nutrients play in cyanobacteria growth.

The nutrients nitrogen and phosphorus are the building blocks of algal growth and an important driver of cyanobacteria blooms. However the current research suggests that blooms are actually most common in rivers with low concentrations of phosphorus and moderate to high levels of nitrogen.

The Hutt River has low levels of phosphorus and moderate levels of nitrogen in the middle and lower reaches, and previous work has indicated that there is a large increase in nitrogen concentration in the area between Moonshine Bridge and Silverstream Bridge.

This year we collected water samples from streams, groundwater and the river in this area to better understand the nutrient inputs and their pathways. Groundwater from the Upper Hutt aquifer was identified as a key source of nitrogen (over 40 percent) in this part of the river. The source of nitrogen in the groundwater will be the focus of further investigations this coming year.



Sampling equipment (left) and measuring the flow in the Hutt River (right)

During the year we also partnered with Victoria University to trial the use of aerial photography taken by a small unmanned helicopter for monitoring the coverage of cyanobacteria in the Hutt River. In terms of proof-of-concept, the study successfully demonstrated that video sampling using an unmanned aerial vehicle can be used to assess benthic cyanobacteria abundance.



The remote-controlled helicopter which was used to trial aerial photography for monitoring coverage of toxic algae in the Hutt River



An aerial shot showing the plots used to assess the amount of toxic algae cover in the river

Keeping you and your best friend safe...

Cyanobacteria (toxic algae) has been around for billions of years and is a naturally-occurring part of the environment. It occurs in numerous rivers throughout New Zealand and the Wellington region, and has been a particular problem in the Hutt River.

Over the past eight years 11 dogs have died as a result of eating toxic algae in the Hutt River, although there has never been any recorded instance of serious human illness or death caused by toxic algae. It is unlikely that we will ever be able to permanently rid our waterways of cyanobacteria, so as users of the river we must be aware of it and able to recognise and avoid it.

In order to educate the community about benthic cyanobacteria blooms in the Hutt River, including how people can keep themselves and their dog safe, we delivered three public seminars at various locations in the Hutt Valley during November 2013.

New signage has been developed which aims to educate users of the river what to look out for, and is placed at prominent locations around the river during high risk periods when toxic algae is prevalent. For more information on toxic algae and what to look out for go to

<http://www.gw.govt.nz/toxic-algae-faqs/>

We have also revamped our website to provide river users with up-to-date water quality information (including toxic algae warnings) at over 80 popular river and beach sites. For more information go to

<http://www.gw.govt.nz/is-it-safe-to-swim/>



In rivers toxic algae is recognisable as dark brown or black mats growing on rocks in the riverbed



Toxic algae mats can come loose from the riverbed and wash up on the river bank or form floating rafts in shallow areas

Lakes

No lakes were monitored in this area in 2013/14.

Groundwater

Seven of the 68 bores monitored this year were in the Wellington and Hutt Valley area. The table below shows the results of this monitoring.

E. coli was detected in one bore in Wainuiomata. This bore has had problems with *E. coli* contamination for a number of years, however the reason for repeated contamination is unclear. Although the bore opening is located in a shed, it is large and uncovered, meaning that animals and other sources of bacterial contamination could potentially be getting in that way. This bore is not used for drinking water supply.

KEY

For *E. coli*:

YES = Counts ≥ 1 cfu/100mL

NO = Counts < 1 cfu/100mL

NA = Not assessed

For median nitrate:

Low (< 3 mg/L)

Elevated (3-7mg/L)

Highly elevated (7-11.3mg/L)



E. coli was detected in one of the three bores monitored however nitrate concentrations were all very low

Monitoring results for groundwater quality sites

Bore	Groundwater zone	Bore use	<i>E. coli</i> detected	Median nitrate
R27/0320	Hutt Valley	Fire	NA	0.002
R27/1171	Hutt Valley	Monitoring purposes only	NA	0.007
R27/1182	Hutt Valley	Monitoring purposes only	NA	0.695
R27/1183	Hutt Valley	Air conditioning	NO	0.265
R27/1265	Hutt Valley	Fire	NA	0.048
R27/6418	Wainuiomata	Irrigation	YES	1.680
R27/6833	Mangaroa	Drinking water and domestic	NO	1.870

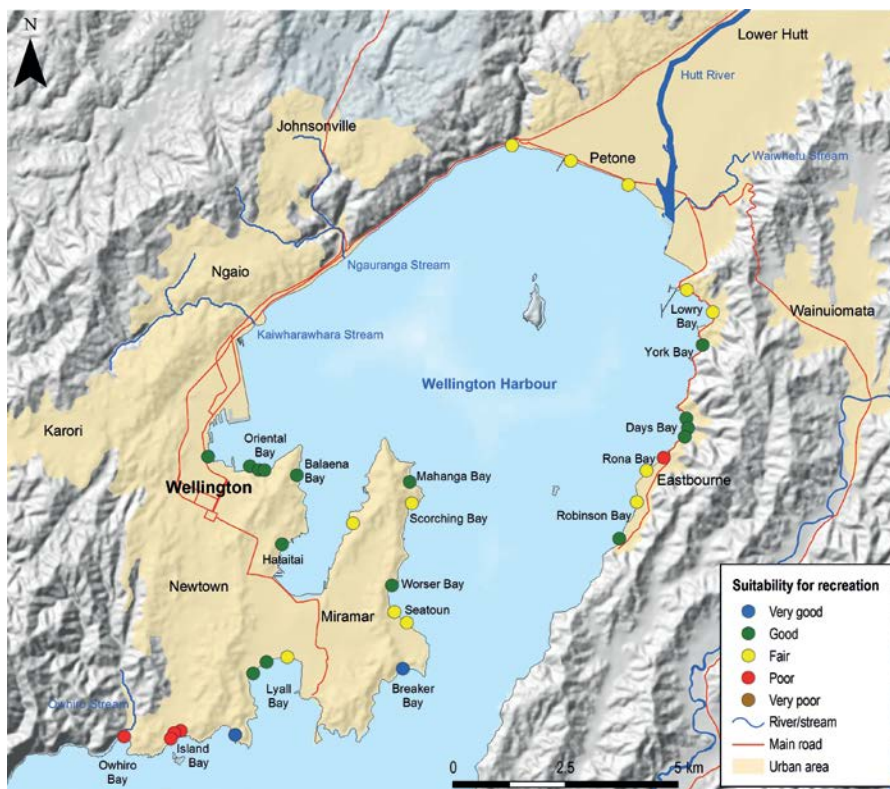
Estuaries and coasts

Is it safe to swim?

Recreational water quality in Wellington Harbour and the Hutt Valley is quite variable depending on the site. Half of the sites have good recreational water quality, with two sites (Breaker Bay and Princess Bay) being the only ones in the region with an SFRG of “very good”.

However, this area also contains some of the worst sites in the region. Three sites (Island Bay at Reef Street, Island Bay at Derwent Street and Owhiro Bay) exceeded the Action guideline five out of 20 weeks, and many of these exceedances were not related to rainfall. Investigations have identified urban stormwater discharges as a principal source of faecal contamination.

SFRGs for coastal recreational sites



Wellington Harbour and Hutt Valley

The table below shows the results of the weekly sampling undertaken over summer.

Monitoring results for coastal recreational sites

Site Name	No. sampling weeks	No. sample results (Enterococci/100mL)			SFRG
		Surveillance (≤ 140)	Alert ¹ (141-280)	Action ² (> 280)	
Aotea Lagoon	20	19	0	1	Good
Oriental Bay at Freyberg Beach	20	19	0	1	Good
Oriental Bay at Wishing Well	20	19	0	1	Good
Oriental Bay at Band Rotunda	20	20	0	0	Good
Balaena Bay	20	19	0	1	Good
Haitaitai Beach	20	18	0	2	Good
Shark Bay	20	17	1	2	Fair
Mahanga Bay	20	17	2	1	Good
Scorching Bay	20	18	0	2	Fair
Worser Bay	20	18	1	1	Good
Seatoun Beach at Wharf	20	17	0	3	Fair
Seatoun Beach at Inglis Street	20	18	1	1	Fair
Breaker Bay	20	18	0	2	Very Good
Lyall Bay at Tirangi Road	20	19	0	1	Fair
Lyall Bay at Onepu Road	20	19	1	0	Good
Lyall Bay at Queens Drive	20	18	0	2	Good
Princess Bay	20	20	0	0	Very Good
Island Bay at Surf Club	20	16	1	3	Poor
Island Bay at Reef Street	20	15	0	5	Poor
Island Bay at Derwent Street	20	12	3	5	Poor
Owhiro Bay	20	13	2	5	Poor
Petone Beach at Water Ski Club	20	15	4	1	Fair
Petone Beach at Sydney Street	20	17	2	1	Fair
Petone Beach at Kiosk	20	18	1	1	Fair
Sorrento Bay	20	18	1	1	Fair
Lowry Bay at Cheviot Road	20	18	1	1	Fair
York Bay	20	20	0	0	Good
Days Bay at Wellesley College	20	20	0	0	Good
Days Bay at Wharf	20	20	0	0	Good
Days Bay at Moana Road	20	18	1	1	Good
Rona Bay at Cliff Bishop Park	20	16	3	1	Poor
Rona Bay at Wharf	20	18	0	2	Fair
Robinson Bay at HW Shortt Recreation Ground	20	18	2	0	Fair
Robinson Bay at Nikau Street	20	18	2	0	Good

Table footnote 1: If a sample result falls within the Alert range the affected site is monitored daily until enterococci counts return to safe levels

Table footnote 2: If a sample result falls within the Action range, ie, exceeds 280cfu/100mL, the affected site is monitored daily until enterococci counts return to safe levels. If the exceedance is not related to heavy rainfall public warnings are issued and the source of the contamination investigated.

How healthy is Hutt Estuary?

High or increasing macroalgae cover can be a nuisance and can also impact on water and sediment quality. Macroalgae growth continues to be a problem in the Hutt Estuary, however nuisance conditions such as rotting blankets of sea lettuce are highly localised and generally subtidal (occur below the low tide mark). This indicates that the estuary is being well flushed.

Indicator	Sedimentation rate 2013/14 (mm)	Mean sedimentation rate (mm/yr)	RPD (cm)	Low density macroalgal cover (Macroalgae Coefficient)	High density macroalgal cover (% of estuary)
Result	-9.3	-4.2	1.5	4.8	52%

Monitoring results from Hutt Estuary. Good results are shaded in green, fair results are shaded orange and poor results are shaded red.



Macroalgae growth continues to be a problem in the Hutt Estuary

Wellington Harbour sediment survey

During the year we completed a report on the 2011 Wellington Harbour sediment survey. This was the second such survey, the first one having been undertaken five years previously in 2006. The purpose of these surveys is to determine the effects of stormwater pollution in the Wellington Harbour. Stormwater picks up a variety of contaminants (including heavy metals, hydrocarbons and insecticides) on its way to the sea, which can accumulate in the sediment of the harbour and can affect the animal life that lives on the harbour floor.

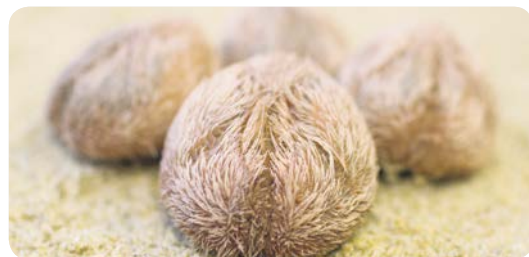
The results showed that the heavy metals copper, lead, zinc and mercury were above national guidelines at several sites within the harbour. Some of this is historic contamination from leaded petrol and when copper and mercury were widely used in anti-fouling paints. However copper, lead and zinc concentrations were also high in stormwater drains showing that stormwater is still a source of heavy metal contamination in the harbour.

Hydrocarbons (a product of burning fossil fuels) were highest in the inner harbour and Evans Bay. Most of this is historic contamination from the use of coal tar for sealing roads and the production of coal gas but stormwater also carries hydrocarbon contaminants, mostly from petrol, oil and tyre rubber.

The insecticide DDT was found throughout the harbour at concentrations higher than national guidelines. It is a legacy contaminant that is still entering the harbour from soil that is carried by rivers and streams to the sea, despite being banned in the 1980s.

There is little risk to those using the harbour for recreational activities such as swimming or boating because these contaminants are strongly bound to the sediment and do not significantly affect water quality.

The good news is that there is still an abundant and diverse community of sediment-dwelling animals (such as crustaceans, sea urchins, worms, starfish and shellfish) which is great for the health of the harbour. These animals are a food source for many other species and keep the sediment in good condition, just like worms do in your garden at home.



Wellington Harbour has an abundant and diverse community of sediment-dwelling animals including shellfish and sea urchins

It's still too early to say whether the situation is improving or worsening so a further survey will be conducted in 2016. In the meantime the Wellington City Council is preparing a plan for improving stormwater management. As a citizen there are also many things you can do to stop contaminants getting into our harbour such as:

- Dispose of paint, oil and other chemicals appropriately – don't pour them down the drain
- Wash your car on the lawn not the road
- Put litter and cigarette butts into rubbish bins
- Clean up your dog's mess
- Consider leaving the car at home and instead take the bus, bike or walk to school and work.

REMEMBER TO SAVE THE DRAIN FOR THE RAIN



Sediment sampling sites in Wellington Harbour

Air

Air quality was monitored at Tawa from 2007 to 2012 and found to be acceptable or better most of the time. Levels of the key pollutants PM10, carbon monoxide and nitrogen dioxide all met national air quality standards.

The monitoring equipment from the Tawa site is now being used at other locations where air quality is poorer and needs investigation. Future studies may be carried out to determine whether there are other parts of the Porirua Basin airshed that may be susceptible to poor air quality and therefore require regular monitoring.

Land

A regional ecosystem mapping project was completed during the year, which involved the identification of historic ecosystems in the region. Analysis of the Porirua Harbour area shows that the major ecosystem type in the catchment would have been kohekohe (also known as New Zealand mahogany) and tawa forest.

There are 224 sites in the Selected Land Use Register (SLUR) in this area. The area contains a proportionately higher number of sites in class C (Explosives and ordinances production, storage and use), mainly due to the historical use of sites for military training and base camps during war time periods.

Water

The focus of our environmental monitoring is on the two arms of the harbour; Pauatahanui Arm and Onepoto Arm. Together these arms form the largest estuary in the lower North Island and provide a home to a huge variety of bird, fish and shellfish species. Broad scale subtidal (below the low tide mark) habitat mapping was carried out for the first time this year, and showed that out of a total of 556 hectares, only 18 hectares (3%) is covered by seagrass.

Te Awarua-o-Porirua Harbour



Investigation

Community cockle count



In November 2013, 107 volunteers took part in the eighth cockle survey in the Pauatahanui Inlet. These surveys are undertaken every three years and constitute the longest running volunteer survey in New Zealand.

Read more about this study on page 61.

Terrestrial ecology

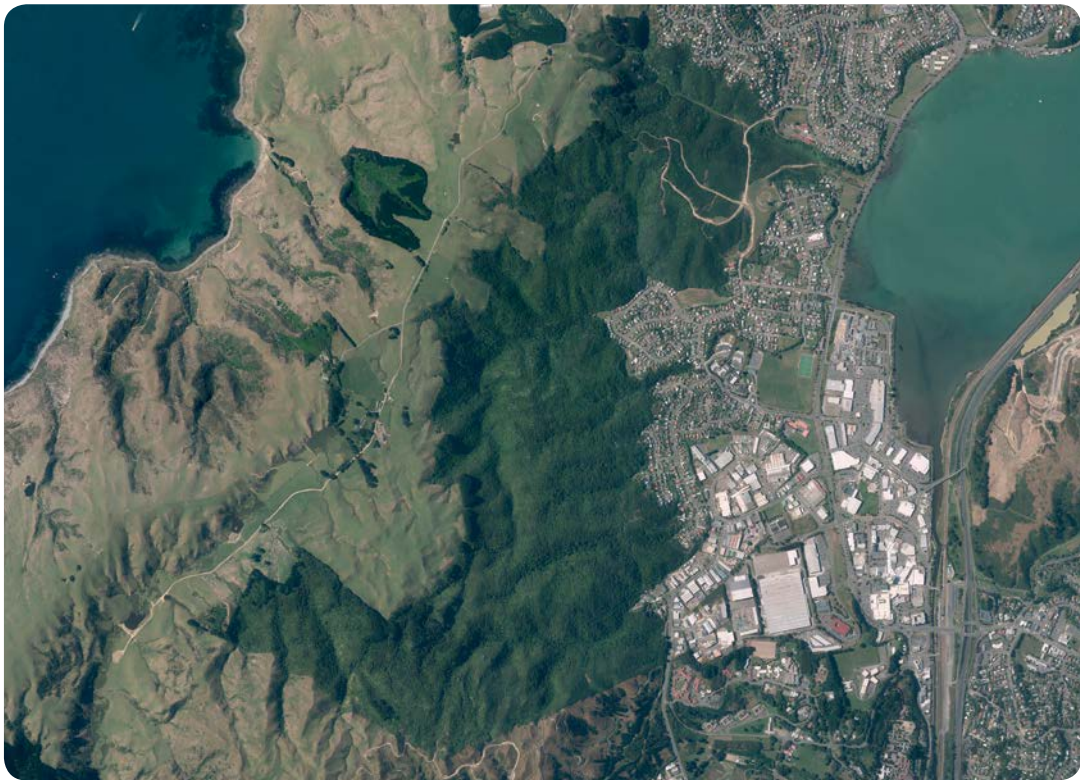
Historic forest types still present in Porirua Scenic Reserve

A regional ecosystem mapping project was completed during the year, which involved the identification of historic ecosystems in the region. Analysis of the Porirua Harbour area shows that the major historic ecosystem type was kohekohe (also known as New Zealand mahogany) and tawa forest (81 percent). Another 14 percent of the area contained tawa, kamahi and podocarp forest.

Porirua Scenic Reserve still contains both of these forest types with tawa, kamahi and podocarp forest inhabiting the upper slopes. Other remaining areas of kohekohe and tawa forest include Battle Hill Bush Reserve and Karahena Bay bush.

An analysis of the area of historic swampland surrounding Porirua Harbour was also completed. Taupo swamp is now less than half the size it was historically, while only 15 percent of the swamp and marsh wetlands bordering Pauahatanui Inlet are still present.

This analysis aids our understanding of the importance of remaining remnants and also provides knowledge on suitable species for re-vegetation and restoration projects.



Porirua Scenic Reserve still contains forest types that were present in historic times

Soil quality

The soil quality programme is agriculturally based so no sites in this area are monitored.

Hazardous activities on land

There are 224 registered sites in the Porirua Harbour area. Most of the sites (84 percent) fall into *Category I – Verified History of Hazardous Activity or Industry*.

Category	Percentage of sites
I – Verified History of Hazardous Activity or Industry	84%
II – Unverified History of Hazardous Activity or Industry	3%
III – Contamination Confirmed	2%
IV – Contamination Acceptable, Managed/Remediated	6%
V – No Identified Contamination	5%
VI – Entered on Register in Error	<1%

Almost all sites (93 percent) in the Porirua Harbour area fall into HAIL classifications A, C, F or G. In this catchment there are a proportionately higher number of sites in classification C. This is mainly due to the historical use of sites for military training and base camps during war time periods in this area.

HAIL Classification	Percentage of sites
A. Chemical manufacture, application and bulk storage	32%
B. Electrical and electronic works, power generation and transmission	1%
C. Explosives and ordnances production, storage and use	19%
D. Metal extraction, refining and reprocessing, storage and use	3%
E. Mineral extraction, refining and reprocessing, storage and use	3%
F. Vehicle refuelling, service and repair	25%
G. Cemeteries and waste recycling, treatment and disposal	17%
H. Land that has been subject to the migration of hazardous substances from adjacent land	0%
I. Land that has been subject to the intentional or accidental release of a hazardous substance	<1%

Rainfall and water levels

The table below shows an annual rainfall summary for three monitoring sites – Whenua Tapu, Battle Hill and Tawa Pool. Rainfall amounts were below average at the Whenua Tapu and Battle Hill sites, and normal at the Tawa Pool site. Rainfall at the Whenua Tapu and Battle Hill sites was particularly low during summer, recording only 60-66 percent of what would normally be expected.

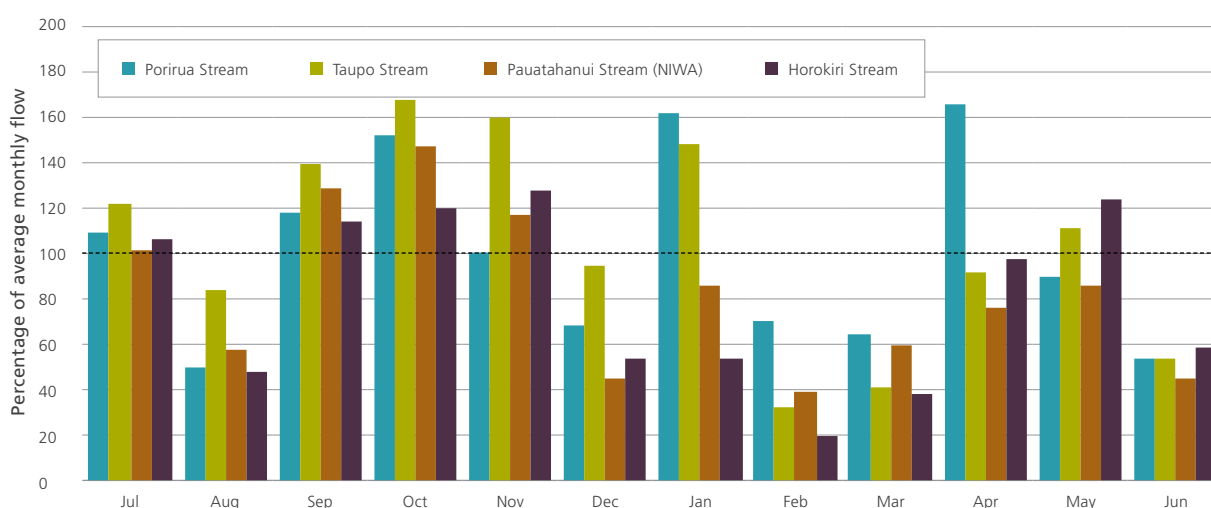
Site	2013/14 total rainfall (mm)	Long-term average (mm)	2013/14 as percent of average
Whenua Tapu	920	1065	86%
Battle Hill (Horokiri)	1102	1260	87%
Tawa Pool	1118	1136	98%

Annual rainfall amounts were below average at the Whenua Tapu and Battle Hill sites and normal at the Tawa Pool site

GWRC monitors stream flows into the Porirua Harbour, with the first monitoring site in this area established on the Porirua Stream in 1965. Average monthly flow throughout the year is shown in the graph below for the Porirua, Taupo, Horokiri, and Pauatahanui¹² streams.

During summer and early autumn (December to March) stream flows were relatively low, with the exception of Porirua and Taupo Streams during January. The Horokiri Stream recorded only 20 percent of its normal flow during February. Although quite a few months recorded lower than normal flows, regular rainfall kept the streams from reaching extreme low levels.

Unlike other parts of the region there are no significant groundwater aquifers in this area and very little water is abstracted from streams for irrigation or other uses.



Lower than average flows in the Porirua Harbour area were experienced in December, February and March

During 2013/14, flood warning alarms were activated three times in the Porirua Stream. The largest event occurred on 16 April but was not significant as the peak flow reached (25 cubic metres per second) is expected to occur at least once a year.

12. Note that the Pauatahanui site is operated by NIWA

Rivers and streams

Is it safe to swim?

Recreational water quality is not monitored in any of the streams in this area. This is because they are largely small tributaries and creeks which are not popular for swimming. Recreational water quality is monitored at ten beach sites in this area – refer to the *Estuaries and coasts* section.

How healthy are the rivers and streams?

None of the sites in the Porirua Harbour area have good water quality – all four are rated as either “fair” or “poor” on the WQI. This is a reflection of the land use (the predominant land cover is either pasture or urban for all sites) and the fact that they are all small streams and therefore affected more readily by pollution, ie pollutants are not diluted as quickly as they would be in larger streams or rivers.

Monitoring results for freshwater quality sites

Site number	Site name	Dominant land cover	Substrate type	WQI rating	Guideline compliance (median values)					
					DO	Clarity	<i>E. coli</i>	NNN	Amm N	DRP
RS13	Horokiri Stream at Snodgrass	Pasture	Hard	Fair	✓	✓	✗	✗	✓	✗
RS14	Pauatahanui Stream at Elmwood Bridge	Pasture	Hard	Fair	✓	✗	✗	✓	✓	✗
RS15	Porirua Stream at Glenside	Urban	Hard	Poor	✓	✗	✗	✗	✓	✗
RS16	Porirua Stream at Wall Park	Urban	Hard	Poor	✓	✗	✗	✗	✓	✗

Te Awarua-o-Porirua Harbour

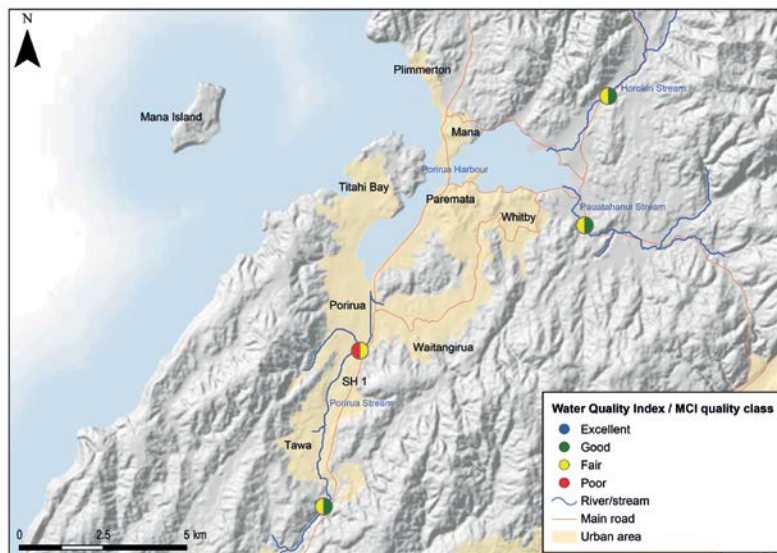
In contrast to the water quality results, three out of the four sites (75%) are classed as “good” on the MCI and the fourth site is classed as “fair”, demonstrating that poor water quality on its own alone does not necessarily translate to a poor environment for aquatic animals. The three sites classed as “good” on the MCI also had good habitat scores, meaning that although the water quality is not great the habitat is probably good enough to support a healthy invertebrate community (the insects and bugs that live in the riverbed).

Algal levels were within the guideline value (50mg/m² chlorophyll a) at all sites monitored.

Periphyton and invertebrate monitoring results for freshwater quality sites

Site number	Site name	Chlorophyll a (mg/m ²)	MCI score	MCI quality class
RS13	Horokiri Stream at Snodgrass	12.35	115	Good
RS14	Pauatahanui Stream at Elmwood Bridge	43.65	105.6	Good
RS15	Porirua Stream at Glenside	9.37	104.4	Good
RS16	Porirua Stream at Wall Park	10.85	87	Fair

WQI ratings and MCI classes for freshwater quality sites



Lakes

GWRC does not routinely monitor any lakes in this area.

Groundwater

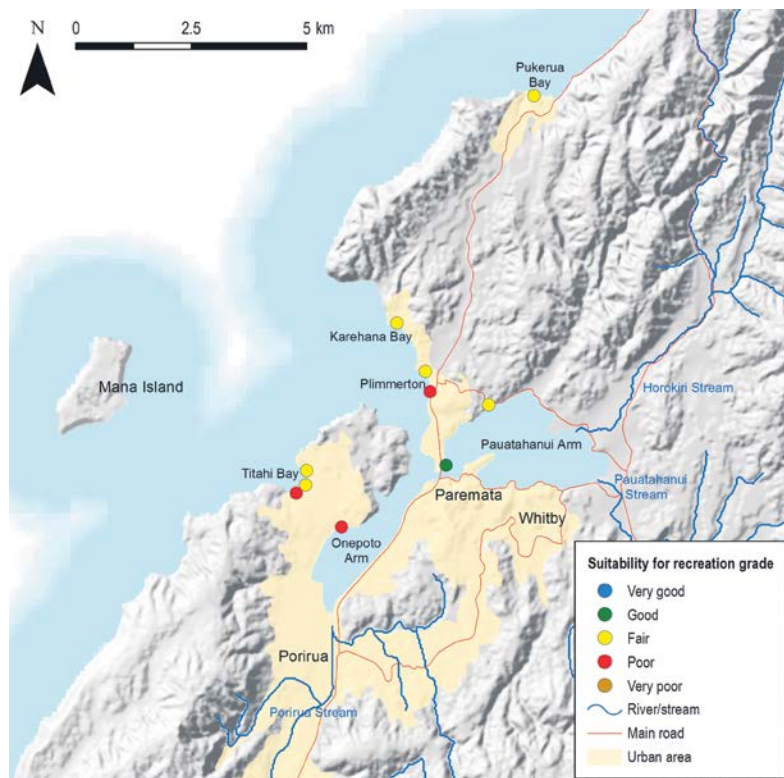
Groundwater quality is not monitored in this area because there are no known major aquifers.

Estuaries and coasts

Is it safe to swim?

Recreational water quality in Porirua is variable depending on the site. Most sites have an SFRG of “good” or “fair” but three have an SFRG of “poor”.

SFRGs for coastal recreational sites



Te Awarua-o-Porirua Harbour

The table below shows the results of the weekly sampling undertaken over summer. All sites exceeded the Action guideline at least once, however most were related to rainfall.

Monitoring results for coastal recreational sites

Site Name	No. sampling weeks	No. sample results (Enterococci/100mL)			SFRG
		Surveillance (≤ 140)	Alert ¹ (141-280)	Action ² (>280)	
Pukerua Bay	20	19	0	1	Fair
Karehana Bay at Cluny Road	20	19	0	1	Fair
Plimmerton Beach at Bath Street	20	17	2	1	Fair
South Beach at Plimmerton	20	18	0	2	Poor
Pauatahanui Inlet at Water Ski Club	20	19	0	1	Fair
Pauatahanui Inlet at Paremata Bridge	20	18	1	1	Good
Porirua Harbour at Rowing Club	20	15	2	3	Poor
Titahi Bay at Bay Drive	20	18	1	1	Fair
Titahi Bay at Toms Road	20	17	1	2	Fair
Titahi Bay at South Beach Access Road	20	17	1	2	Poor

Table footnote 1: If a sample result falls within the Alert range the affected site is monitored daily until enterococci counts return to safe levels

Table footnote 2: If a sample result falls within the Action range, ie, exceeds 280cfu/100mL, the affected site is monitored daily until enterococci counts return to safe levels. If the exceedance is not related to heavy rainfall public warnings are issued and the source of the contamination investigated.

How healthy is Porirua Harbour?

Overall sedimentation rates are low to moderate in the intertidal areas of Porirua Harbour. Monitoring results also show that sediment deposits or erodes at different rates throughout the harbour and can vary greatly from year to year.

Indicator	Median sedimentation rate 2013/14 (mm)	Median sedimentation rate (mm/yr)	Median RPD (cm)	Low density macroalgal cover (Macroalgae Coefficient)	High density macroalgal cover (% of estuary)
Result	-0.3	2.3	1.5	1.6	16%

Monitoring results from the Onepoto Arm of Porirua Harbour. Good results are shaded in green, fair results are shaded orange and poor results are shaded red.

Indicator	Median sedimentation rate 2013/14 (mm)	Median sedimentation rate (mm/yr)	Median RPD (cm)	Low density macroalgal cover (Macroalgae Coefficient)	High density macroalgal cover (% of estuary)
Result	-2.0	0.8	2.0	2.7	1%

Monitoring results from the Pauatahanui Arm of Porirua Harbour. Good results are shaded in green and fair results are shaded orange.

The Redox Potential Discontinuity (RPD) measures the layer of sediment that is well oxygenated and has a good population of animals (eg, worms, crustaceans and shellfish). It is the equivalent of having a healthy layer of topsoil (with lots of earthworms, slaters and other bugs) in your garden. The deeper the oxygenated layer, the healthier the sediment. The RPD results of 1.5cm and 2.0cm are still considered to be fair, but are verging on poor. This is a result of fine mud filling the pores in the sediment.

Broad scale subtidal (below the low tide mark) habitat mapping was also carried out this year. This is the first subtidal survey and complements the intertidal surveys carried out in 2008 and 2013. A healthy estuary should contain a large proportion of seagrass. In the past, dense seagrass cover was present in both arms of the harbour but has declined significantly over time. The results of the subtidal survey show that out of a total of 556 hectares, only 18 hectares (three percent) is covered by seagrass. This is possibly due in part to smothering by macroalgae. In the harbour, macroalgae is widespread with pockets of high density growth.

Pauatahanui Inlet community cockle count

In November 2013, 107 volunteers took part in the eighth cockle survey in the Pauatahanui Inlet. These surveys are undertaken every three years and constitute the longest running volunteer survey in New Zealand.

This valuable data series allows us to determine changes in the size and abundance of cockle populations in the Pauatahanui Inlet, and provides a good indication of the health of the estuary.

The results of the latest survey found that the population of cockles had increased from 277 million in 2010 to 336 million in 2013. And since surveys began in 1995, there has been an estimated 87 percent increase in the cockle population. Of particular interest was the marked increase in the number of juvenile cockles in 2013, which is an encouraging sign that environmental conditions are favourable for cockle growth and reproduction.

A similar series of surveys is planned for the Onepoto Arm of Porirua Harbour, with the baseline survey scheduled to be undertaken in 2015. Driven by Ngati Toa's desire to re-establish healthy populations of kai moana, the surveys will assess the abundance and size of a number of taonga shellfish species.



GWRC staff and volunteers counting cockles in Browns Bay, Pauatahanui Inlet
Photos courtesy of Helen Westerbeke, GWRC



Cockles (*Austrovenus stutchburyi*)

Air

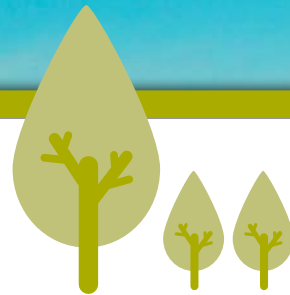
Air quality isn't monitored on a regular basis on the Kāpiti Coast. Limited monitoring has shown that high overnight PM10 concentrations can occur under certain weather conditions in areas such as Raumati South where the foredune ridge prevents emissions from home fires being dispersed out to sea.

One night in August 2012, NIWA drove their air quality monitoring vehicle around the airshed looking for potential air pollution hot spots. This confirmed that winter air quality was likely to be poorest in Raumati South, but that there is also potential for home fires to degrade air quality at Paraparaumu Beach. Further studies will be developed to look more closely at the air quality in the Kāpiti Coast airshed, and to determine whether establishing a permanent monitoring site is warranted.

Land

Eleven of the 23 sites monitored for soil quality were on the Kāpiti Coast. Some of the sites monitored in this area are showing signs of compaction.

There are 170 sites in the Selected Land Use Register (SLUR) in this area. Most of the registered sites (89%) fall into class A (Chemical manufacture, application and bulk storage), class F (Vehicle refuelling, service and repair) or class G (Cemeteries and waste recycling, treatment and disposal).



Water

Freshwater quality on the Kāpiti Coast is highly variable and is a good example of how water quality is affected by land use and stream bed type. Sites rated as "excellent" are all hard-bottomed (stony) and located in areas where the predominant land cover is indigenous forest. In contrast, sites rated "poor" are all soft-bottomed (silty) and typically located in areas where the predominant land cover is pasture or urban.



Kāpiti Coast



Investigation

Te Horo forest remnants important bird habitat



The proposed Peka Peka to Ōtaki motorway is a major roading development and a huge amount of research and monitoring has been undertaken to assess the potential environmental impacts and inform mitigation measures.

Read more about this study on page 64.

Terrestrial ecology

Monitoring identifies Te Horo forest remnants as important bird habitat

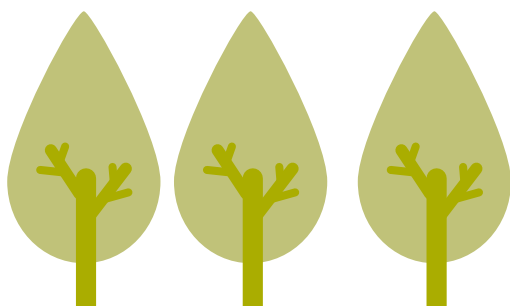
The proposed Peka Peka to Ōtaki motorway is a major roading development and a huge amount of research and monitoring has been undertaken to assess the potential environmental impacts and inform mitigation measures.

Our regional ecosystem mapping project identified the Te Horo forest remnants as a threatened ecosystem type, and monitoring has established that it provides important habitat for many bird species.

Subsequent discussions with New Zealand Transport Agency (NZTA) and roading contractors have ensured that any damage to these remnants caused by the motorway development will be offset by the restoration of other nearby remnants of the same type.



A totara forest remnant in Te Horo – remnants such as these are classified as threatened ecosystems and provide important habitat for bird species



Soil quality

Eleven of the 23 sites monitored this year were on the Kāpiti Coast. The table below shows the results of this monitoring. Indicators that do not meet the target range are highlighted in red.

Monitoring results for soil quality sites

Site	Soil Order	Land Use	Bulk density (Mg/m ³)	Macroporosity (%)	pH	Total carbon (%)	Total nitrogen (%)	AM nitrogen (mg/kg)	Olsen P (mg/kg)	No. trace elements outside target range
GW027	Recent	Pasture	1.26	9.1	6.1	2.60	0.24	107.0	102	0
GW044	Brown	Pasture	1.30	2.6	5.7	2.83	0.29	102.0	22	0
GW087	Recent	Pasture	1.49	2.5	6.2	2.43	0.24	90.9	142	0
GW090	Brown	Market Garden	1.15	16.9	6.4	2.91	0.30	46.5	41	0
GW092	Gley	Market Garden	1.24	18.4	6.9	2.05	0.21	33.0	162	0
GW093	Recent	Market Garden	1.49	7.7	6.4	1.30	0.14	20.4	130	0
GW094	Recent	Market Garden	1.35	16.8	6.1	1.49	0.17	22.9	194	0
GW107	Recent	Market Garden	1.57	7.4	6.4	1.40	0.15	16.2	196	0
GW108	Gley	Market Garden	1.12	17.5	5.9	4.81	0.35	38.3	159	0
GW111	Brown	Market Garden	1.35	13.9	7.3	1.32	0.14	39.3	184	0
GW112	Pallic	Market Garden	1.57	5.6	6.6	2.07	0.20	12.0	138	0
Target Range			0.4-1.4	6-30	5-7.6	2/2.5-12	0.25-0.70	20-250	20-35	0

Physical Properties: Some of the sites monitored in this area are showing signs of compaction. Two sites failed to meet the target range for both *bulk density* and *macroporosity*. A further two sites did not meet the target range for *bulk density* and one other site did not meet the target range for *macroporosity*.

Chemical Properties: The results within this category varied widely across the different properties. All sites met the target range for *pH*, however there were six sites that did not meet the target range for *total carbon*, all of which were below the lower limit of the target range. Soil carbon is used as an indicator of organic matter which is important in retaining moisture, nutrients and good soil structure. Soil organic matter levels are particularly susceptible when land is used for intense cultivation such as market gardening and cropping.

Nitrogen is an essential nutrient for plants, however very high nitrogen increases the risk of leaching to waterways. Two of the sites monitored did not meet the target range for *total nitrogen*, and a further two sites did not meet the target range for *anaerobic mineralisable nitrogen*. All four of these sites had nitrogen levels that were only slightly below the lower limit of the target range.

Ten of the 11 sites monitored failed to meet the target range for *Olsen P*. They all exceeded the upper limit of the range and many were significantly higher than the upper limit. Phosphorus is often strongly connected to soil, meaning any sediment from soil erosion is likely to be carrying phosphorus and contributing to nutrient enrichment of the surrounding waterways.

Trace elements: All sites met the target range for all trace elements measured. Target ranges for these trace elements are drawn from national guidelines.



KEY



No. sites meeting target range



No. sites not meeting target range

New soil map tool now available for the Ōtaki area

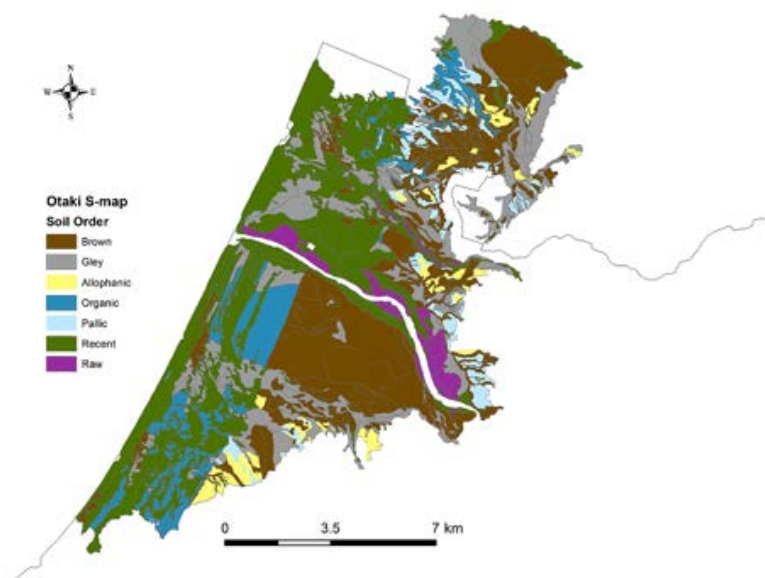
Many farmers and land managers are familiar with traditional soil maps which typically include local soil types based on local names. However, many soils have similar characteristics and properties to other soils around New Zealand. Landcare Research has therefore introduced national soil categories and developed S-map – a tool that integrates traditional soil mapping and digital techniques to produce web-based GIS maps of different soil types present in an area.

Using S-map online you can:

- Explore interactive soil maps
- Learn about the soil in your backyard or paddock
- View detailed information about a soil type or attribute
- Download soil factsheets for specific locations.

Readily available and nationally consistent soil information can ultimately help land managers to make improved soil and nutrient management decisions on-farm and for improved profitability and water quality outcomes.

Landcare Research, with the support of GWRC, has recently completed S-map for the Ōtaki area in the Kāpiti region. S-map is available at <http://smap.landcareresearch.co.nz/home>



Hazardous activities on land

There are 170 registered sites on the Kāpiti Coast. Most of the sites (90 percent) fall into *Category I – Verified History of Hazardous Activity or Industry*.

Category	Percentage of sites
I – Verified History of Hazardous Activity or Industry	90%
II – Unverified History of Hazardous Activity or Industry	0%
III – Contamination Confirmed	6%
IV – Contamination Acceptable, Managed/Remediated	4%
V – No Identified Contamination	<1%
VI – Entered on Register in Error	0%

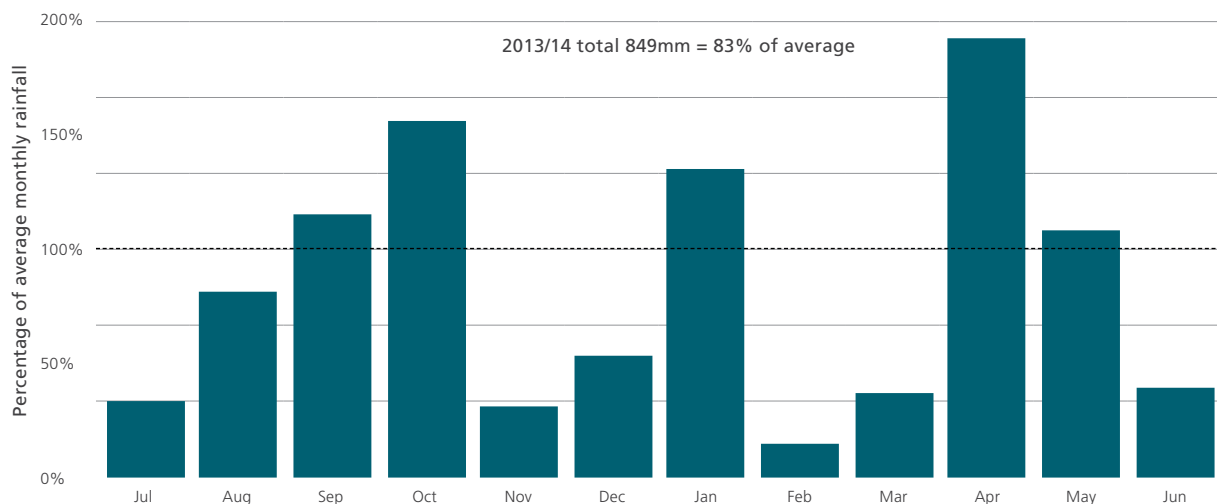
Most of the registered sites (88 percent) on the Kāpiti Coast fall into HAIL classifications A, F or G.

HAIL Classification	Percentage of sites
A. Chemical manufacture, application and bulk storage	48%
B. Electrical and electronic works, power generation and transmission	1%
C. Explosives and ordinances production, storage and use	1%
D. Metal extraction, refining and reprocessing, storage and use	4%
E. Mineral extraction, refining and reprocessing, storage and use	6%
F. Vehicle refuelling, service and repair	26%
G. Cemeteries and waste recycling, treatment and disposal	14%
H. Land that has been subject to the migration of hazardous substances from adjacent land	0%
I. Land that has been subject to the intentional or accidental release of a hazardous substance	0%

Rainfall and water levels

Rainfall on the Kāpiti Coast ranged from below average (around 80 percent of normal) at Paekakariki and Ōtaki to average at Waikanae.

The graph below shows the monthly rainfall at Ōtaki as a percentage of the long-term average. Although rainfall over the whole year was slightly below average (83 percent of normal), the year was punctuated by a couple of very wet months (October and April) and there were six months where rainfall was very low. Of particular note were the summer months of February and March where rainfall amounts were just 15 percent and 38 percent of normal. Only 11mm of rain was recorded in February – with 10mm of that falling on just one day.

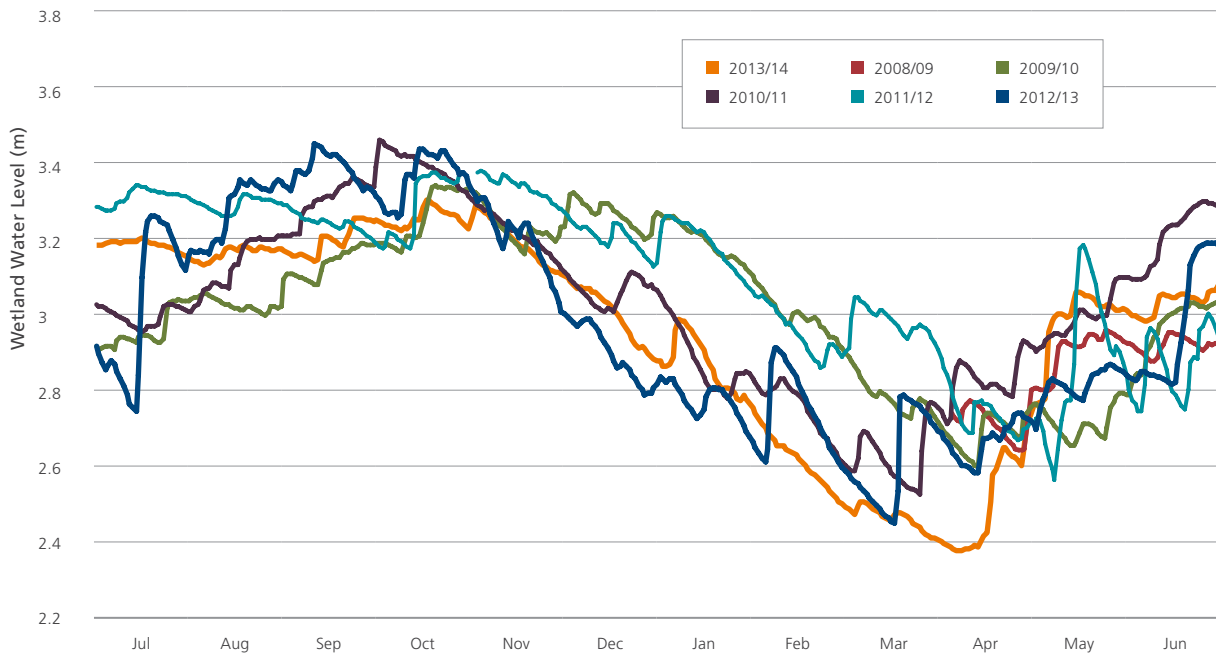


Below average rainfall was recorded at Ōtaki with February-March 2014 being particularly dry

Rivers and streams on the Kāpiti Coast experienced relatively low flows as a result of the below average rainfall. The Waikanae River fell to levels expected only once every five to eight years, while the Ōtaki River dropped to a level expected to occur every three years.

Of note were the low groundwater and wetland levels experienced through late summer and autumn on the Kāpiti Coast. The low rainfall conditions started a downward trend and abstraction from groundwater aquifers added to the pressure. Some groundwater monitoring sites recorded their lowest levels ever during February to April.

Although we have only been monitoring wetland levels for six years, the record low water levels measured in the Te Hapua wetland complex are consistent with anecdotal evidence that this period saw some of the lowest wetland levels seen in recent times.



Water levels in the Te Hapua wetland complex show that water levels during late summer and early autumn were the lowest since monitoring began in 2009

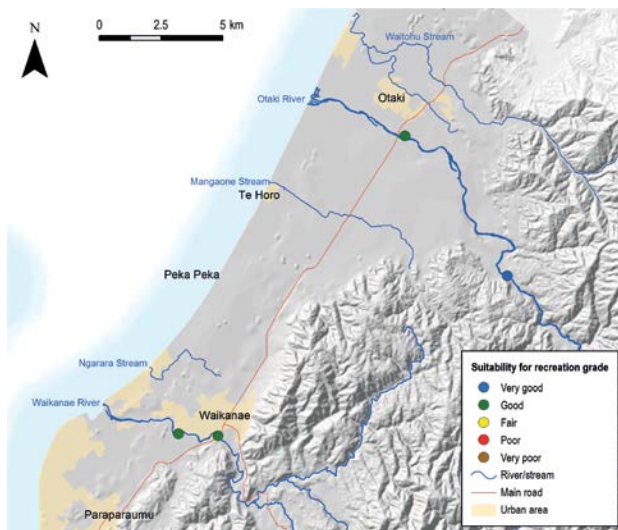
During 2013/14, flood warning alarms were activated four times in the Ōtaki River and three times in the Waikanae River however there were no significant flood events.

Rivers and streams

Is it safe to swim?

Recreational water quality on the Kāpiti Coast is generally good. All four sites have an SFRG of “good” or better.

SFRGs for freshwater recreational sites



The table below shows the results of the weekly sampling undertaken over summer. There were no exceedances of the Action guideline.

Monitoring results for freshwater recreational sites

Site Name	No. sampling weeks	No. sample results (<i>E. coli</i> /100mL)			SFRG
		Surveillance (≤ 260)	Alert ¹ (261-550)	Action ² (> 550)	
Ōtaki River at Pots	5	5	0	0	Very good
Ōtaki River at SH1	20	20	0	0	Good
Waikanae River at SH1	20	19	1	0	Good
Waikanae River at Jim Cooke Park	20	20	0	0	Good

Table footnote 1: If a sample result falls within the Alert range the affected site is monitored daily until *E. coli* counts return to safe levels

Table footnote 2: If a sample result falls within the Action range, ie, exceeds 550/100mL, the affected site is monitored daily until *E. coli* counts return to safe levels. If the exceedance is not related to heavy rainfall public warnings are issued and the source of the contamination investigated.

Three of the four sites were also assessed for algae and cyanobacteria cover. None of the sites exceeded either the periphyton or cyanobacteria guidelines. The table below shows the results of the summer monitoring.

The up and down nature of rainfall and river flows this year may have been beneficial in terms of limiting algal growth in the region's waterways. Analysis of flows showed that many of the major rivers had relatively regular flushing flow events, even during February and March when conditions were drier than normal. The exception was Waikanae River where there was an extended period between January and March 2014 without a flushing flow. It's possible that other environmental factors, such as water temperature or nutrient levels, inhibited growth during this time.

Compliance with periphyton and cyanobacteria guidelines

Site Name	No. sampling weeks	No. assessments	Filamentous periphyton cover		Mat periphyton cover		Cyanobacteria cover		
			Maximum (percent)	No. of occasions guideline exceeded (>30%)	Maximum (percent)	No. of occasions guideline exceeded (>30%)	Maximum (percent)	No. of occasions Alert level exceeded (20-50%)	No. of occasions Action level exceeded (>50%)
Ōtaki River at SH1	20	19	23.5	0	0	0	0	0	0
Waikanae River at SH1	20	20	9.5	0	0	0	6.5	0	0
Waikanae River at Jim Cooke Park	20	20	3.8	0	10.8	0	11.8	0	0

How healthy are the rivers and streams?

Freshwater quality on the Kāpiti Coast is highly variable and is a good example of how water quality is affected by land use and stream bed type.

Water quality was rated as "excellent" at four sites (36%) and "good" at one site (9%). All of these sites are hard bottomed and located in areas where the predominant land cover is indigenous forest. The remaining six sites (55%) are rated as having "poor" water quality. All of these sites are soft bottomed and typically in areas where the predominant land cover is pasture or urban.

Monitoring results for freshwater quality sites

Site number	Site name	Dominant land cover	Substrate type	WQI rating	Guideline compliance (median values)					
					DO	Clarity	<i>E. coli</i>	NNN	Amm N	DRP
RS02	Mangapouri Stream at Bennetts Rd	Urban	Soft	Poor	✗	✗	✗	✗	✗	✗
RS03	Waitohu Stream at Forest Park	Indigenous forest	Hard	Excellent	✓	✓	✓	✓	✓	✓
RS04	Waitohu Stream at Norfolk Crescent	Pasture	Soft	Poor	✓	✗	✗	✓	✗	✗
RS05	Ōtaki River at Pukehinau	Indigenous forest	Hard	Excellent	✓	✓	✓	✓	✓	✓
RS06	Ōtaki River at mouth	Indigenous forest	Hard	Excellent	✓	✓	✓	✓	✓	✓
RS07	Mangaone Stream at Sims Road Bridge	Pasture	Soft	Poor	✗	✗	✗	✗	✗	✗
RS08	Ngarara Stream at Field Way	Urban	Soft	Poor	✗	✗	✗	✓	✗	✗
RS09	Waikanae River at Mangaone Walkway	Indigenous forest	Hard	Good	✓	✓	✓	✓	✓	✗
RS10	Waikanae River at Greenaway Road	Indigenous forest	Hard	Excellent	✓	✓	✓	✓	✓	✓
RS11	Whareroa Stream at Waterfall Road	Indigenous forest	Hard	Poor	✓	✗	✗	✗	✓	✗
RS12	Whareroa Stream at Queen Elizabeth Park	Pasture	Soft	Poor	✗	✗	✗	✓	✗	✗

Using the MCI, six out of 11 sites (55%) are classed “excellent” or “good”, one site (9%) is classed “fair” and the remaining four sites (36%) are classed “poor” (refer table over page). The five sites classed as either “fair” or “poor” on the MCI also rated as having “poor” water quality. Further, they all had very low habitat scores meaning that the invertebrate communities (the insects and bugs that live in the riverbed) at these sites are probably being affected by a number of factors, including pollution and a lack of good habitat.

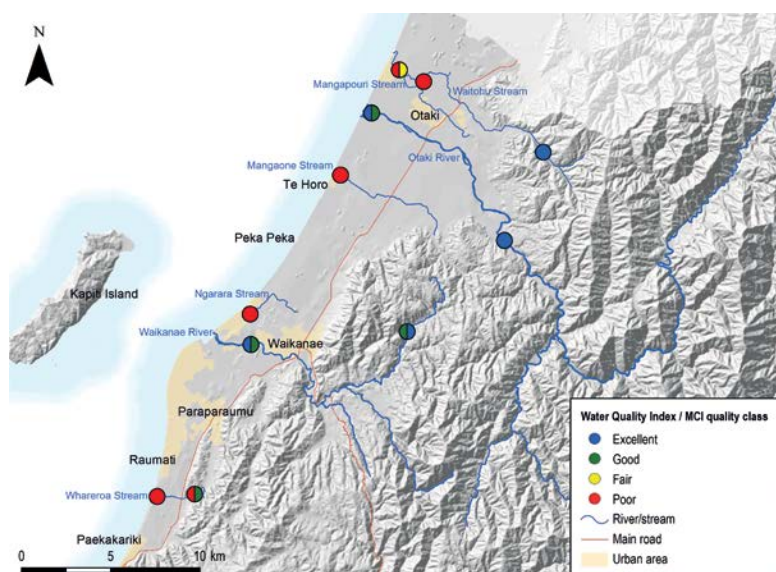
In contrast, one site (Whareroa Stream at Waterfall Road) was classed as “good” on the MCI but had “poor” water quality, demonstrating that poor water quality on its own does not necessarily translate to a poor environment for aquatic animals. This site also had a good habitat score, meaning that although the water quality is not great the habitat is probably good enough to support a healthy invertebrate community (the insects and bugs that live in the riverbed).

Algal levels were extremely low at all the sites monitored.

Periphyton and invertebrate monitoring results for freshwater quality sites

Site number	Site name	Chlorophyll a (mg/m ²)	MCI score	MCI class
RS02	Mangapouri Stream at Bennetts Rd	Not measured	77.6	Poor
RS03	Waitohu Stream at Forest Park	0.64	146.4	Excellent
RS04	Waitohu Stream at Norfolk Crescent	Not measured	81.7	Fair
RS05	Ōtaki River at Pukehinau	0.37	131	Excellent
RS06	Ōtaki River at mouth	15.35	116.5	Good
RS07	Mangaone Stream at Sims Road Bridge	Not measured	75.7	Poor
RS08	Ngarara Stream at Field Way	Not measured	72.9	Poor
RS09	Waikanae River at Mangaone Walkway	0.46	130.4	Excellent
RS10	Waikanae River at Greenaway Road	4.95	104.5	Good
RS11	Whareroa Stream at Waterfall Road	0.98	116	Good
RS12	Whareroa Stream at Queen Elizabeth Park	Not measured	73.6	Poor

WQI ratings and MCI classes for freshwater quality sites



Lakes

GWRC does not routinely monitor any lakes in this area however a year-long investigation of Lake Waitawa was undertaken during 2009/10 and is due to be repeated in 2014/15. Little was known about the state of water quality in Lake Waitawa prior to this, although anecdotally it was considered poor with a history of algal blooms and nuisance plant growths. The investigation¹³ verified that water quality in Lake Waitawa is severely degraded and it was classed as “supertrophic” (or very high in nutrients) on the TLI.

13. Further information on this investigation can be found in Perrie A and Milne J. 2012. Lake water quality and ecology in the Wellington region: State and trends. GWRC Publication No. GW/EMI-T-12/139. <http://www.gw.govt.nz/ser/>

Groundwater

Twelve of the 68 bores monitored this year were on the Kāpiti Coast. The table below shows the results of this monitoring.

One bore had a median nitrate concentration of 9.5mg/L which is in the highly elevated range. This bore is in an area of intensive horticultural and fertiliser use and has had high nitrate concentrations for a number of years. This bore is not used for drinking water supply.

The highest *E. coli* count (160cfu/mL) in the entire region was found in a bore (R25/5164) at Te Horo Beach. Te Horo Beach is a small settlement reliant on onsite wastewater treatment systems for effluent disposal, and previous studies have found that groundwater in this area can move from wastewater treatment systems to nearby bores relatively quickly. This bore is not used for drinking water supply.

KEY

For *E. coli*:

YES = Counts ≥ 1 cfu/100mL

NO = Counts < 1 cfu/100mL

NA = Not assessed

For median nitrate:

Low (< 3 mg/L)

Elevated (3-7mg/L)

Highly elevated (7-11.3mg/L)



Elevated nitrate concentrations were found in one of 12 bores



E. coli was detected in only one of the ten bores monitored

Monitoring results for groundwater quality sites

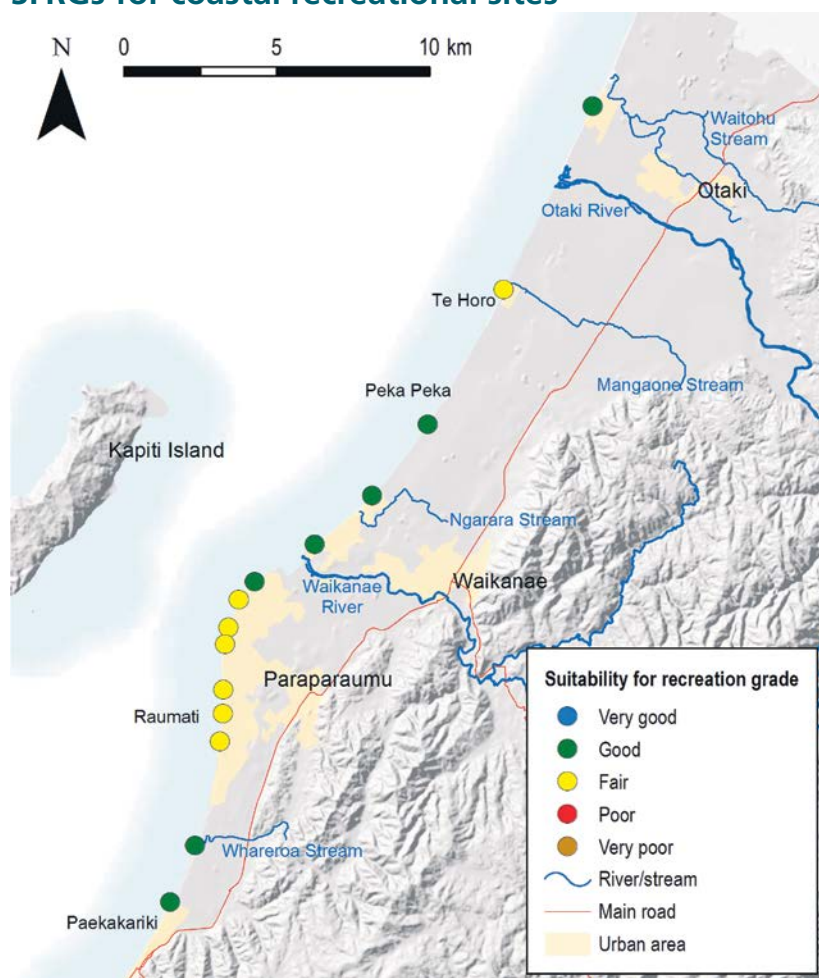
Bore	Groundwater zone	Bore use	<i>E. coli</i> detected	Median nitrate
S25/5125	Ōtaki	Irrigation	NO	2.500
R25/5233	Ōtaki	Dairy use	NO	1.540
S25/5322	Ōtaki	Irrigation	NO	9.500
R25/5100	Te Horo	Irrigation	NO	0.001
R25/5135	Te Horo	Irrigation	NA	0.001
R25/5164	Te Horo	Domestic	YES	0.385
R25/5165	Te Horo	Domestic	NO	0.390
R25/5190	Te Horo	Drinking water, domestic and stock	NO	2.450
S25/5200	Te Horo	Irrigation	NO	0.006
R26/6587	Waikanae	Irrigation	NO	0.810
R26/6624	Waikanae	Irrigation	NO	2.800
R26/6503	Raumati	Irrigation	NA	0.016

Estuaries and coasts

Is it safe to swim?

Recreational water quality on the Kāpiti Coast is generally quite good. Seven sites have an SFRG of “good” and the other seven sites have an SFRG of “fair”.

SFRGs for coastal recreational sites



The table below shows the results of the weekly sampling undertaken over summer. Three sites exceeded the Action guideline twice, and two sites exceeded the guideline once (out of 20 weeks). All but one of these were related to rainfall.

Monitoring results for coastal recreational sites

Site Name	No. sampling weeks	No. sample results (Enterococci/100mL)			SFRG
		Surveillance (≤ 140)	Alert ¹ (141-280)	Action ² (>280)	
Ōtaki Beach at Surf Club	20	19	1	0	Good
Te Horo Beach at Sea Road	20	19	1	0	Fair
Peka Peka Beach at Road End	20	20	0	0	Good
Waikanae Beach at William St	20	20	0	0	Good
Waikanae Beach at Ara Kuaka	20	20	0	0	Good
Paraparaumu Beach at Ngapotiki Street	20	19	1	0	Good
Paraparaumu Beach at Nathan Avenue	20	17	3	0	Fair
Paraparaumu Beach at Maclean Park	20	18	0	2	Fair
Paraparaumu Beach at Toru Road	20	17	1	2	Fair
Raumati Beach at Tainui Street	20	15	3	2	Fair
Raumati Beach at Marine Gardens	20	18	1	1	Fair
Raumati Beach at Aotea Road	20	18	1	1	Fair
Paekakariki Beach at Whareroa Road	20	19	1	0	Good
Paekakariki Beach at Surf Club	20	19	1	0	Good

Table footnote 1: If a sample result falls within the Alert range the affected site is monitored daily until enterococci counts return to safe levels

Table footnote 2: If a sample result falls within the Action range, ie, exceeds 280cfu/100mL, the affected site is monitored daily until enterococci counts return to safe levels. If the exceedance is not related to heavy rainfall public warnings are issued and the source of the contamination investigated.

How healthy is Waikanae Estuary?

High rates of sedimentation continue to be the main issue for Waikanae Estuary. Even though the sedimentation rate in 2013/14 was lower than it has been in previous years, a rate of 19mm is considered very high.

The Redox Potential Discontinuity (RPD) measures the layer of sediment that is well oxygenated and has a good population of animals (eg, worms, crustaceans and shellfish). It is the equivalent of having a healthy layer of topsoil (with lots of earthworms, slaters and other bugs) in your garden. The deeper the oxygenated layer, the healthier the sediment. An RPD of 1.5cm is still considered to be fair, but is verging on poor.

Macroalgae growth in the Waikanae Estuary is very low and not of concern at this site.

Indicator	2013/14 sedimentation rate (mm)	Mean sedimentation rate (mm/yr)	RPD (cm)	Low density macroalgal cover (Macroalgae Coefficient)	High density macroalgal cover (% of estuary)
Result	19.0	26.4	1.5	0.1	<1%

Monitoring results from Waikanae Estuary. Good results are shaded in green, fair results are shaded orange and poor results are shaded red.



High rates of sedimentation continue to be the main issue for Waikanae Estuary

How healthy is Peka Peka Beach?

Peka Peka Beach is in excellent condition and does not appear to be facing any major threats to its ecological health.

The high RPD and low mud content indicates the sediment is well oxygenated and very healthy.

The macroinvertebrate enrichment index is an indicator of enrichment. This low score is indicative of a diverse and thriving macroinvertebrate community which has not been affected by enrichment.

Indicator	RPD (cm)	Mud content (%)	Macroinvertebrate enrichment index
Result	>15	0.3-1.1	1.2-3.3

Monitoring results from Peka Peka Beach which is in excellent condition



Scientists from Wriggle Coastal Management undertake monitoring at Peka Peka Beach

Air

Levels of carbon monoxide and nitrogen dioxide meet national air quality standards however the pollutant PM10 failed to meet the national standard in Masterton. During winter 2014 there were 13 exceedances of the national standard for PM10 in east Masterton, but none in west Masterton.



Land

Twelve of the 23 sites monitored for soil quality were in the Ruamāhanga area. Some of the sites are showing signs of soil compaction and nine sites (75 percent) had high levels of phosphorous.

There are 386 sites in the Selected Land Use Register (SLUR) in this area. Most of the registered sites (83 percent) fall into class A (Chemical manufacture, application and bulk storage), class F (Vehicle refuelling, service and repair) or class G (Cemeteries and waste recycling, treatment and disposal).



Water

In contrast to the previous year when drier than normal conditions prevailed for eight consecutive months, the 2013/14 year was generally wetter than normal. Seasonal totals varied with winter and summer producing lower than normal rainfall in most parts, while spring and autumn brought rainfall well in excess of average across the entire area.

Lakes Wairarapa and Onoke continue to be a major focus area of study for the Environmental Science department. Water quality in Lake Wairarapa hasn't changed much since monitoring began in 1994. The lake is facing issues associated with nutrient enrichment and poor water clarity and is classed as "supertrophic" (or very high in nutrients). Excessive algal growth can also occur at times. Lake Onoke has very similar water quality and faces similar issues.



Ruamāhanga



Investigation

Birds still at home on Lake Wairarapa



Lake Wairarapa is home to a large number of wading birds that use the lake edge to feed and roost.

Read more about this study on page 86.

Air quality

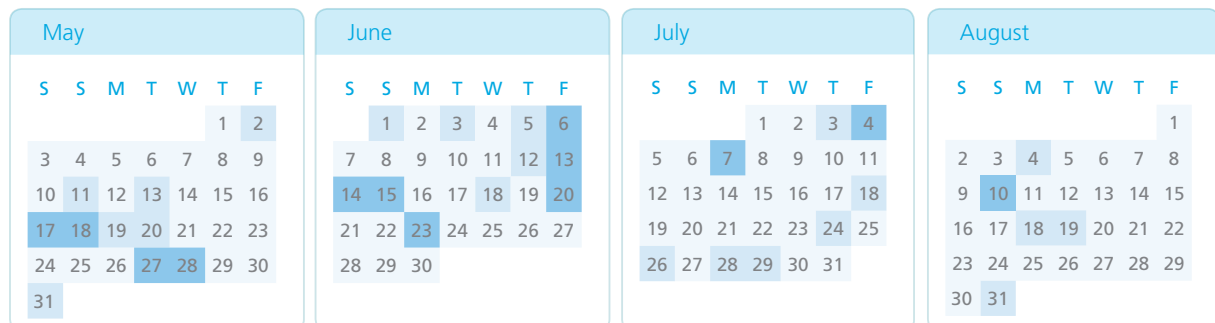
Levels of carbon monoxide and nitrogen dioxide met the national air quality standards however the pollutant PM10 failed to meet the national standard in Masterton.

PM10 exceedances in Masterton

GWRC has a permanent monitoring site in west Masterton. Depending on emission sources and topography air quality can vary greatly over short distances, and the national standard requires that air quality is measured in the worst location in an airshed. GWRC therefore established a second monitoring site in east Masterton as it is suspected that cold air flowing from west to east is trapping and transporting emissions from home fires to the east side of town.

In winter 2014, air quality was poorer at the second monitoring site in east Masterton than at the permanent site in west Masterton. There were 13 exceedances of the national standard for PM10 in east Masterton and none in west Masterton.

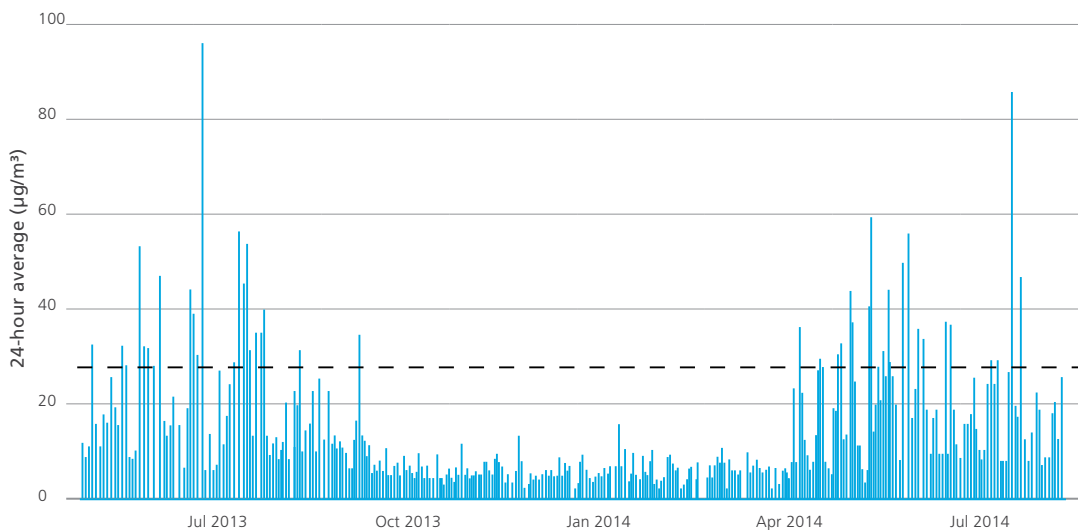
Air quality category



In winter 2014 there were 13 exceedances of the national standard for PM10 at the monitoring site in east Masterton

PM2.5 levels in Masterton

PM2.5 are particles less than 2.5 microns across and are produced by combustion processes, for example home fires and motor vehicle emissions. The smaller the size of the particle the more deeply it can penetrate the lungs, meaning PM2.5 is more strongly associated with adverse health effects. Although the national standard for PM10 was not exceeded once at the monitoring site in west Masterton, high levels of PM2.5 were recorded during the winter months due to smoke from home heating fires.



During winter 2014 there were 31 days where PM2.5 failed to meet the World Health Guideline limit¹⁴ (shown by the dashed line) at the monitoring site in west Masterton

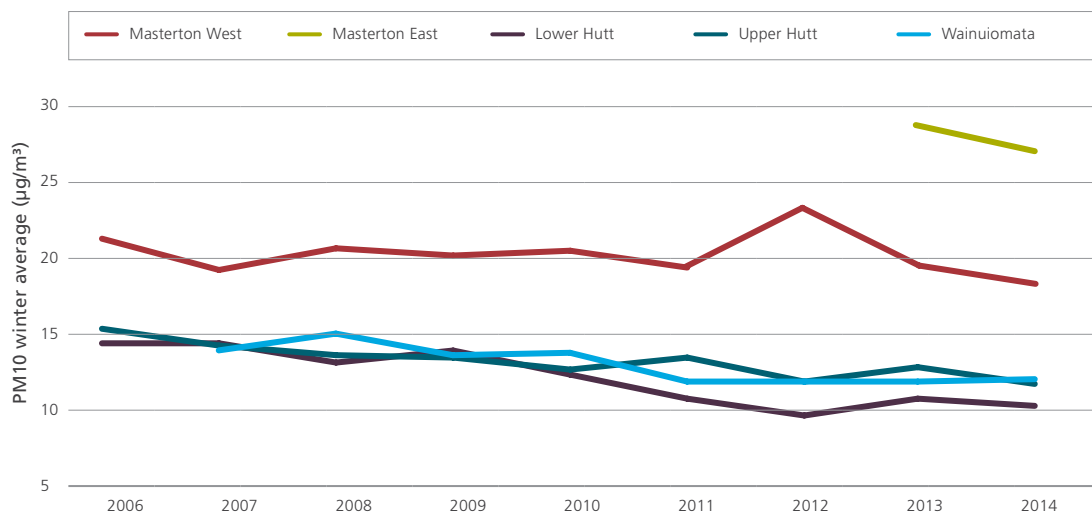


14. Note that New Zealand does not have a national standard for PM2.5

The impact of home fires on winter air quality

In areas where people depend on home fires for heating, PM10 levels are often high during the winter months especially in inland valley areas where cold, still conditions create a temperature inversion that traps smoke emissions close to the ground.

Sixty-seven percent of households in Masterton now use wood for home heating (NZ census 2013). Although this has dropped from around 70 percent in 2006, an increase in the number of dwellings means the actual number of houses using wood for home heating has increased slightly. The Hutt Valley and Wainuiomata also experienced a decline in the percentage of households using wood for home heating.



Levels of PM10 in Masterton during winter 2014 were the lowest on record

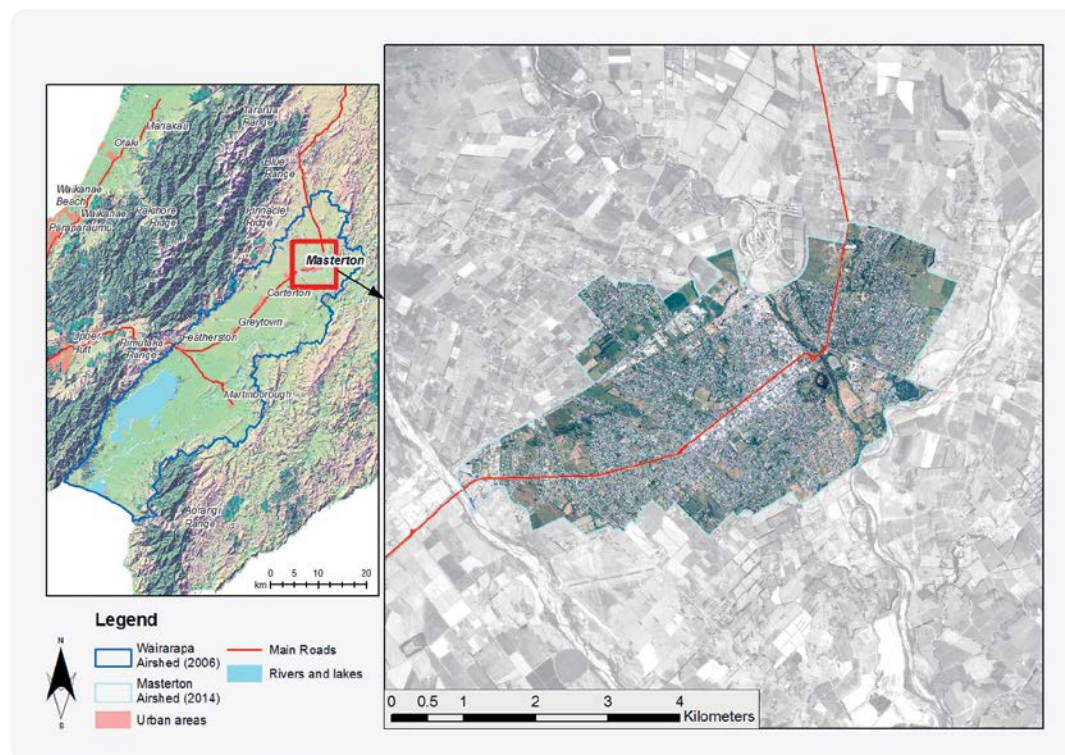
In Masterton there has been little change in winter PM10 levels between 2006 and 2013, apart from a peak in 2012 when minimum air temperatures were lower than in the other years. However, levels of PM10 in Masterton during winter 2014 were the lowest on record, which may be due to a combination of fewer cold days and replacement of older wood burners with lower emission models. A few more years of monitoring will be required to confirm this trend.

Resizing the Wairarapa airshed

The former Wairarapa airshed was the largest in the region, however only the urban parts of the airshed (primarily Masterton) are affected by air pollution, largely as a result of emissions from home fires. Because of this, the entire Wairarapa airshed was designated as polluted, restricting both new and existing industries needing to increase their emissions – even if they were located in a part of the airshed where air quality is good.

A major study was undertaken to model the impact of weather conditions on air emissions and predict how PM10 levels vary across the entire Wairarapa valley. The results showed that the Masterton urban area was the only place likely to breach the air quality standard for PM10.

An application was then submitted to MfE to reduce the airshed to contain the Masterton urban area only. The application was approved and the new Masterton airshed formally established on 1 September 2014. Resizing the airshed boundary will allow both the regional and district council to focus air quality improvement efforts in the area that needs it, and work towards reducing pollution levels by 2020 as required by the national air quality standard.



The new Masterton airshed is vastly smaller than the old Wairarapa airshed and will allow the regional and district council to focus air quality improvement efforts in the area that needs it

Terrestrial ecology

Birds still at home on Lake Wairarapa

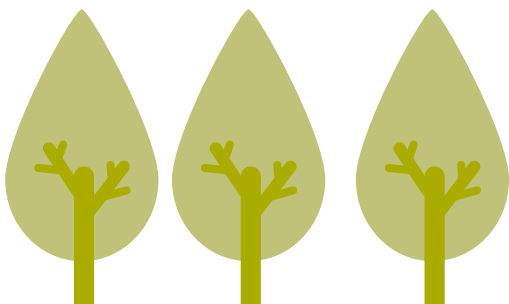
Lake Wairarapa is home to a large number of wading birds that use the lake edge to feed and roost. However the lake is also an important source of water for activities such as irrigation, and previous work has shown that even small changes to the lake volume can cause quite large changes to the shoreline because the gradient of the lake bed is very shallow.

In 1991 minimum lake levels were set, partly on the needs of the wading birds. Prior to this, the Department of Conservation (DoC) undertook surveys to assess the abundance of the different bird species living there. In 2011 GWRC re-started those surveys to determine whether or not there have been any changes in wader bird numbers since the lake levels were set.

Over the past 30 years quite a few species appear to have increased in number including the New Zealand dabchick, black shag, little black shag, black-fronted dotterel and black-billed gull. A smaller number of species appear to have declined in abundance over that time, including the South Island oystercatcher, pied stilt and spur-winged plover.



Over the past 30 years quite a few species living on Lake Wairarapa appear to have increased in number including the black shag



Soil quality

Twelve of the 23 sites monitored this year were in the Ruamāhanga area. The table below shows the results of this monitoring. Indicators that do not meet the target range are highlighted in red.

Monitoring results for soil quality sites

Site	Soil Order	Land Use	Bulk density (Mg/m ³)	Macroporosity (%)	pH	Total carbon (%)	Total nitrogen (%)	AM nitrogen (mg/kg)	Olsen P (mg/kg)	No. trace elements outside target range
GW016	Gley	Pasture	1.22	4.7	5.8	3.22	0.31	99.1	49	0
GW017	Pallic	Cropping	1.27	8.9	5.8	3.02	0.28	92.6	36	0
GW021	Gley	Pasture	1.26	2.0	5.6	3.80	0.37	122	39	0
GW022	Recent	Cropping	1.24	13.9	6.1	2.34	0.26	78.7	95	0
GW031	Pallic	Cropping	1.22	9.9	6.0	2.91	0.30	75	32	0
GW071	Gley	Cropping	1.21	9.7	6.4	2.81	0.29	48.4	86	0
GW075	Recent	Market garden	1.18	27.0	5.8	2.33	0.22	65.2	53	0
GW079	Gley	Cropping	1.61	0.5	6.9	1.66	0.18	30.5	69	0
GW080	Recent	Cropping	1.53	1.6	6.1	1.50	0.16	30	17	0
GW082	Gley	Cropping	1.11	22.8	6.2	3.78	0.36	69	48	0
GW085	Gley	Cropping	1.14	11.4	6.1	2.81	0.31	81.1	25	0
GW086	Gley	Cropping	1.34	5.1	5.8	2.97	0.32	71.2	35	0
Target Range			0.4-1.4	6-30	5-7.6	2-12	0.25-0.70*	20-250	20-35	0

Physical Properties: Some of the sites monitored in this area are showing signs of compaction. Two sites failed to meet the target range for both *bulk density* and *macroporosity*. A further three sites did not meet the target range for *macroporosity*.

Chemical Properties: The chemical condition of soil at the sites monitored is generally very good. All sites met the target range for *pH*, *total nitrogen* and *anaerobic mineralisable nitrogen*, and all but two sites met the target range for *total carbon*.

Nine of the 12 sites monitored failed to meet the target range for *Olsen P*. The majority of these sites exceeded the upper limit of the range but only a few were significantly higher than the upper limit. Phosphorus is often strongly connected to soil, meaning any sediment from soil erosion is likely to be carrying phosphorus.

Trace elements: All sites met the target range for all trace elements measured. Target ranges for these trace elements are drawn from national guidelines.

* This target range only applies for pastoral soils



Bulk density



Macroporosity

KEY

No. sites meeting target range



No. sites not meeting target range



pH



Total carbon



Total nitrogen



Anaerobic mineralisable nitrogen



Olsen P



Trace elements

Hazardous activities on land

There are 386 registered sites in the Ruamāhanga. The majority of sites (79 percent) fall into *Category I – Verified History of Hazardous Activity or Industry*.

Category	Percentage of sites
I – Verified History of Hazardous Activity or Industry	79%
II – Unverified History of Hazardous Activity or Industry	<1%
III – Contamination Confirmed	3%
IV – Contamination Acceptable, Managed/Remediated	16%
V – No Identified Contamination	1%
VI – Entered on Register in Error	<1%

Most of the registered sites (83 percent) in the Ruamāhanga fall into HAIL classifications A, F or G.

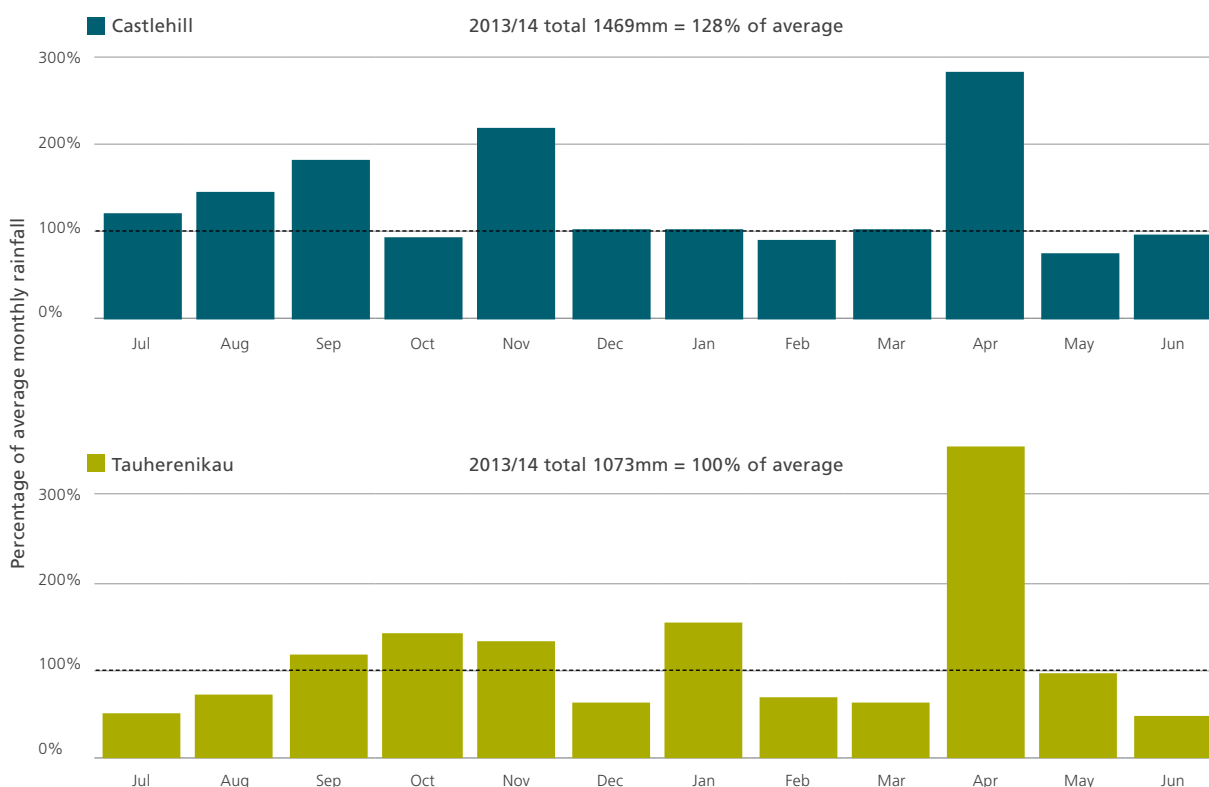
HAIL Classification	Percentage of sites
A. Chemical manufacture, application and bulk storage	42%
B. Electrical and electronic works, power generation and transmission	2%
C. Explosives and ordinances production, storage and use	1%
D. Metal extraction, refining and reprocessing, storage and use	7%
E. Mineral extraction, refining and reprocessing, storage and use	7%
F. Vehicle refuelling, service and repair	26%
G. Cemeteries and waste recycling, treatment and disposal	15%
H. Land that has been subject to the migration of hazardous substances from adjacent land	<1%
I. Land that has been subject to the intentional or accidental release of a hazardous substance	0%

Rainfall and water levels

In contrast to the previous year when drier than normal conditions prevailed for eight consecutive months, the 2013/14 year was generally wetter than normal. Seasonal totals varied with winter and summer producing lower than normal rainfall in most parts, while spring and autumn brought rainfall well in excess of average across the entire area.

Rainfall records from gauges located at Castlehill (north-east Wairarapa) and Tauherenikau (mid-valley) show the varied nature of the year's rainfall. April was a particularly wet month – at Castlehill it rained for 22 days and at Tauherenikau it rained for 21 days out of the month. Over 220mm of rain was recorded at both sites which equates to around three times what would normally be expected at this time of year.

The figure below shows monthly rainfall for both sites as a percentage of the long-term average, ie, above 100 percent indicates above average rainfall whereas below 100 percent indicates below average rainfall for the month.



Although the 2013/14 year was generally wetter than normal seasonal totals varied with winter and summer generally producing lower than normal rainfall, while spring and autumn brought rainfall well in excess of average

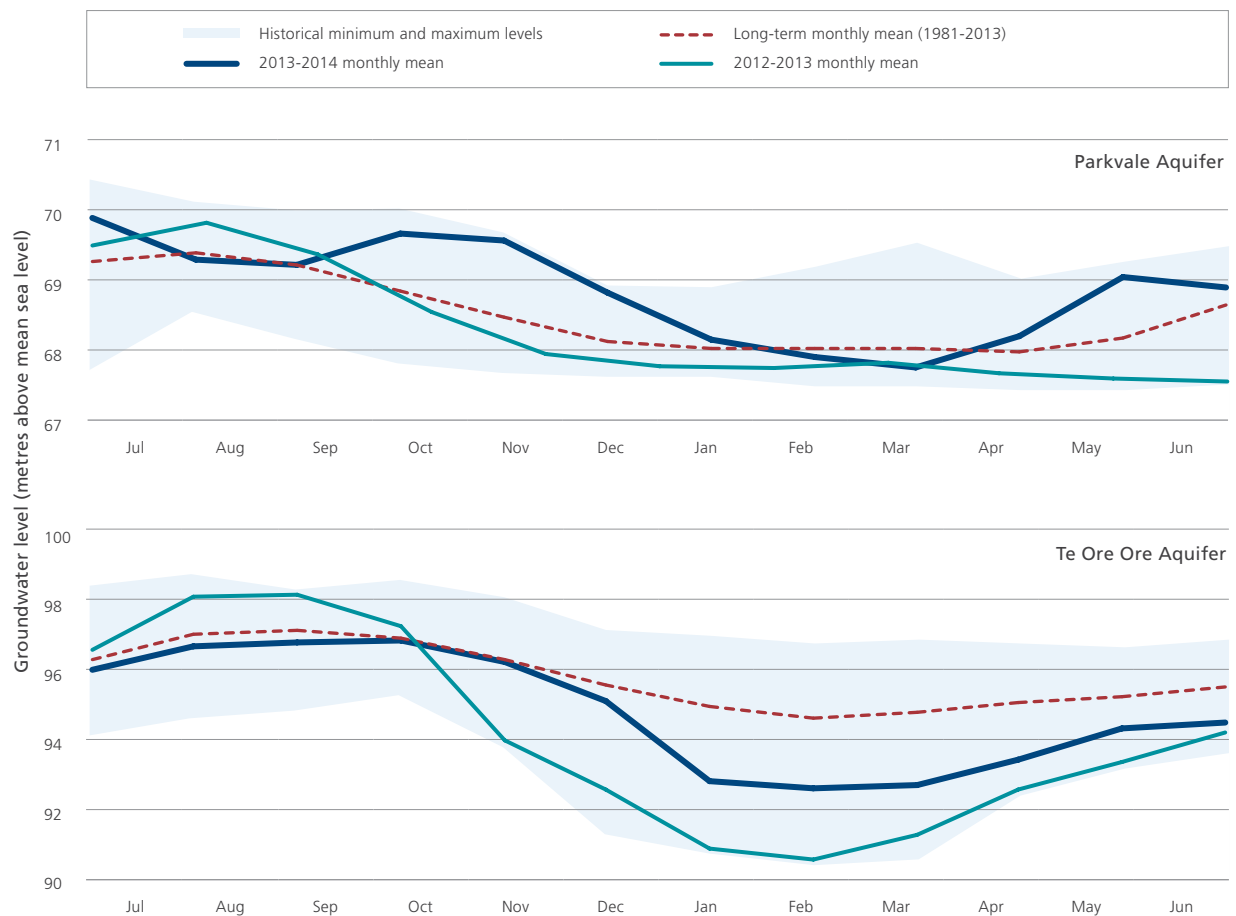
Water

During 2013/14, flood warning alarms were activated on 14 occasions in the lower reaches of the Ruamāhanga River at the Waihenga monitoring station near Martinborough. Further up the river floodwarning alarms were activated 14 times at the Wardells station and 11 times at the Mt Bruce station.

Flood warning alarms were also activated 11 times on the Waipoua River, once on the Waingawa River, nine times on the Waiohine River, twice in the Mangatarere Stream, four times in the Taueru River and once in the Huangarua River. The only event of significance was in the Taueru River on 12 July 2013 when the flow peaked at 359m³/s. This magnitude of flow is expected to occur only once every eight years.

Groundwater in the Wairarapa valley is used for public water supply and is also heavily relied upon for other uses such as stock watering and irrigation. As such, GWRC has an extensive monitoring network in this area which comprises approximately 30 bores in a number of different aquifers.

Groundwater levels in the Parkvale Aquifer reflect the wetter conditions during the year and were largely above average. However levels in the Te Ore Ore Aquifer were below average during summer and autumn, although not to the extent of the previous year which saw some record lows during the same period.



Groundwater levels in the Parkvale Aquifer were largely above average, whereas levels in the Te Ore Ore Aquifer were below average during summer and autumn although not to the extent of the previous year

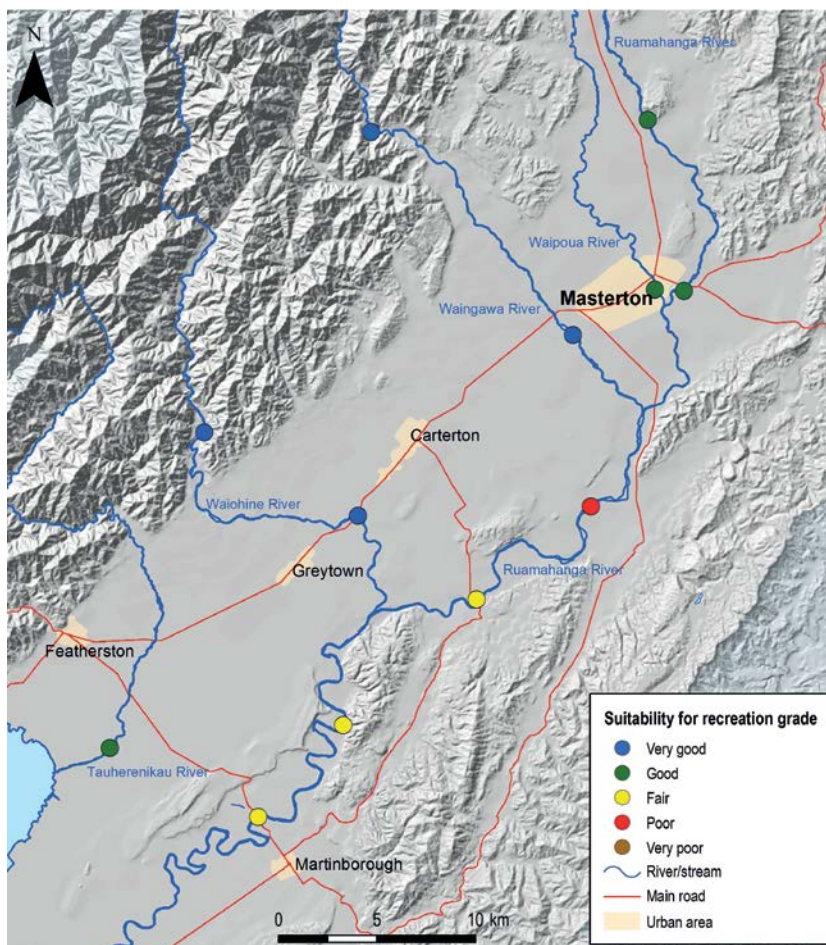
Rivers and streams

Is it safe to swim?

Recreational water quality in the Ruamāhanga area is quite variable depending on the site. The majority of sites have an SFRG of “good” or better, but there is one site that has an SFRG of “poor”.

In calculating the SFRG grades for several sites on the Ruamāhanga River, we have taken into account the effect of discharges from treatment plants that treat sewage from the townships of Masterton, Carterton and Greytown. While the treatment plants may be very good at removing *E. coli*, it is unknown whether the treated discharge is free of other pathogens such as viruses. We have therefore been very conservative in how we have determined the SFRG grades for the four downstream sites (Ruamāhanga River at The Cliffs, Kokotau, Morrisons Bush and Waihenga Bridge), erring on the side of caution.

SFRGs for freshwater recreational sites



The table below shows the results of the weekly sampling undertaken over summer. Seven out of the 12 sites monitored exceeded the Action guideline at least once, however all of the exceedances were associated with significant amounts of rainfall.

Monitoring results for freshwater recreational sites

Site Name	No. sampling weeks	No. sample results (<i>E. coli</i> /100mL)			SFRG
		Surveillance (≤260)	Alert ¹ (261-550)	Action ² (>550)	
Ruamāhanga River at Double Bridges	20	19	0	1	Good
Ruamāhanga River at Te Ore Ore	20	18	0	2	Good
Waipoua River at Colombo Road	20	19	0	1	Good
Waingawa River at Kaituna	20	19	1	0	Very good
Waingawa River at South Road	20	19	0	1	Very good
Ruamāhanga River at The Cliffs	20	20	0	0	Poor
Ruamāhanga River at Kokotau	20	19	0	1	Fair
Waiohine River at Gorge	5	5	0	0	Very good
Waiohine River at SH2	20	20	0	0	Very good
Ruamāhanga River at Morrisons Bush	20	19	0	1	Fair
Ruamāhanga River at Waihenga Bridge	20	19	0	1	Fair
Tauherenikau River at Websters	5	5	0	0	Good

Table footnote 1: If a sample result falls within the Alert range the affected site is monitored daily until *E. coli* counts return to safe levels

Table footnote 2: If a sample result falls within the Action range, ie, exceeds 550/100mL, the affected site is monitored daily until *E. coli* counts return to safe levels. If the exceedance is not related to heavy rainfall public warnings are issued and the source of the contamination investigated.

Ten of the 12 sites were also assessed for algae and cyanobacteria cover. Only one site breached the filamentous (or 'stringy') periphyton guideline and none of the sites breached the cyanobacteria guidelines. This compares very favourably to the 2012/13 season, where three sites were affected by periphyton growth and four sites were affected by toxic algae blooms. The table below shows the results of the summer monitoring.

The up and down nature of rainfall and river flows this year may have been beneficial in terms of limiting algal growth in the region's waterways. Analysis of flows showed that many of the major rivers had relatively regular flushing flow events, even during February and March when conditions were drier than normal.

Compliance with periphyton and cyanobacteria guidelines

Site Name	No. sampling weeks	No. assessments	Filamentous periphyton cover		Mat periphyton cover		Cyanobacteria cover		
			Maximum (percent)	No. of occasions guideline exceeded (>30%)	Maximum (percent)	No. of occasions guideline exceeded (>30%)	Maximum (percent)	No. of occasions "Alert" level exceeded (20-50%)	No. of occasions "Action" level exceeded (>50%)
Ruamāhanga River at Double Bridges	20	15	13.3	0	0	0	6.8	0	0
Ruamāhanga River at Te Ore Ore	20	14	9.8	0	2.3	0	9.3	0	0
Waipoua River at Colombo Road	20	19	15.3	0	47.3	0	12.5	0	0
Waingawa River at Kaituna	20	14	1	0	0	0	0	0	0
Waingawa River at South Road	20	13	2.8	0	0.8	0	3.3	0	0
Ruamāhanga River at The Cliffs	20	11	19	0	4.5	0	3.8	0	0
Ruamāhanga River at Kokotau	20	11	22.3	0	13.8	0	13	0	0
Waiohine River at SH2	20	15	4.3	0	0	0	0.5	0	0
Ruamāhanga River at Morrisons Bush	20	12	28.8	0	0	0	7.8	0	0
Ruamāhanga River at Waihenga Bridge	20	13	60	1	0	0	8.5	0	0

How healthy are the rivers and streams?

Water quality in the Ruamāhanga is variable depending on the site. Ten sites (50%) are rated “excellent” or “good”, four sites (20%) are rated “fair” and six sites (30%) are rated “poor”. This is largely a reflection of the type of land use – sites rated as “excellent” are typically in areas where the predominant land cover is indigenous forest, whereas the sites rated “poor” are all in areas where the predominant land cover is pasture.

The Mangatarere River at SH2 site (rated as “poor”) is downstream of a wastewater treatment plant which is influencing water quality at this site.

Monitoring results for freshwater quality sites

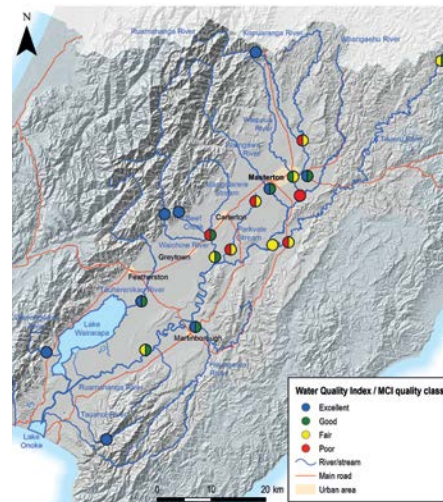
Site number	Site name	Dominant land cover	Substrate type	WQI rating	Guideline compliance (median values)					
					DO	Clarity	E. coli	NNN	Amm N	DRP
RS31	Ruamāhanga River at McLays	Indigenous forest	Hard	Excellent	✓	✓	✓	✓	✓	✓
RS32	Ruamāhanga River at Te Ore Ore	Pasture	Hard	Excellent	✓	✓	✓	✓	✓	✓
RS33	Ruamāhanga River at Gladstone Bridge	Pasture	Hard	Fair	✓	✓	✓	✓	✗	✗
RS34	Ruamāhanga River at Pukio	Pasture	Hard	Fair	✓	✗	✓	✓	✓	✗
RS36	Taueru River at Castlehill	Pasture	Soft	Fair	✓	✗	✗	✓	✓	✓
RS37	Taueru River at Gladstone	Pasture	Hard	Poor	✓	✗	✗	✗	✗	✗
RS38	Kopuaranga River at Stewarts	Pasture	Hard	Poor	✓	✗	✗	✗	✓	✗
RS39	Whangaehu River upstream of confluence	Pasture	Soft	Poor	✓	✗	✗	✗	✓	✗
RS40	Waipoua River at Colombo Road Bridge	Pasture	Hard	Good	✓	✓	✓	✗	✓	✓
RS41	Waingawa River at South Road	Indigenous forest	Hard	Excellent	✓	✓	✓	✓	✓	✓
RS45	Parkvale Tributary at Lowes Reserve	Pasture	Hard	Poor	✗	✓	✓	✗	✓	✓
RS46	Parkvale Stream at Weir	Pasture	Hard	Poor	✓	✗	✗	✗	✓	✗
RS47	Waiohine River at Gorge	Indigenous forest	Hard	Excellent	✓	✓	✓	✓	✓	✓
RS48	Waiohine River at Bicknells	Pasture	Hard	Fair	✓	✗	✓	✓	✓	✗
RS49	Beef Creek at Headwaters	Indigenous forest	Hard	Excellent	✓	✓	✓	✓	✓	✓
RS50	Mangatarere Stream at SH 2	Pasture	Hard	Poor	✓	✓	✗	✗	✗	✗
RS51	Huangarua River at Ponatahi Bridge	Pasture	Hard	Excellent	✓	✓	✓	✓	✓	✓
RS52	Tauanui River at Whakatomotomo Road	Indigenous forest	Hard	Excellent	✓	✓	✓	✓	✓	✓
RS55	Tauherenikau River at Websters	Pasture	Hard	Excellent	✓	✓	✓	✓	✓	✓
RS56	Waiorongomai River at Forest Park	Indigenous forest	Hard	Excellent	✓	✓	✓	✓	✓	✓

Using the MCI, thirteen out of 20 sites (65%) are classed as “excellent” or “good”, six sites (30%) are classed “fair” and only one site (5%) is classed “poor”.

There is a reasonable relationship between the MCI and the WQI. All five sites classed as “excellent” on the MCI also have “excellent” water quality, whereas sites classed as “poor” or “fair” on the MCI tended to have “poor” water quality.

Algal levels were high at four sites and within the guideline value at all the other sites monitored. All four of these sites are located in areas where the predominant land cover is pasture.

WQI ratings and MCI classes for freshwater quality sites



Periphyton and invertebrate monitoring results for freshwater quality sites

Site number	Site name	Chlorophyll a (mg/m ²)	MCI score	MCI class
RS31	Ruamāhanga River at McLays	0.48	150.6	Excellent
RS32	Ruamāhanga River at Te Ore Ore	6.5	113.8	Good
RS33	Ruamāhanga River at Gladstone Bridge	9.62	94.5	Fair
RS34	Ruamāhanga River at Pukio	0.71	103.3	Good
RS36	Taueru River at Castlehill	Not measured	108.9	Good
RS37	Taueru River at Gladstone	114.82	95.5	Fair
RS38	Kopuaranga River at Stewarts	248.71	98.3	Fair
RS39	Whangaeu River upstream of confluence	Not measured	62.2	Poor
RS40	Waipoua River at Colombo Road Bridge	13.45	97	Fair
RS41	Waingawa River at South Road	0.09	118.6	Good
RS45	Parkvale Tributary at Lowes Reserve	0.85	96	Fair
RS46	Parkvale Stream at Weir	50.55	91.1	Fair
RS47	Waiohine River at Gorge	0.08	136	Excellent
RS48	Waiohine River at Bicknells	0.45	117.1	Good
RS49	Beef Creek at Headwaters	2.08	134.5	Excellent
RS50	Mangatarere Stream at SH 2	19.96	113.3	Good
RS51	Huanguarua River at Ponatahi Bridge	136.19	103.8	Good
RS52	Tauanui River at Whakatomotomo Road	0.32	133.3	Excellent
RS55	Tauherenikau River at Websters	0.16	110.9	Good
RS56	Waiorongomai River at Forest Park	0.29	123.1	Excellent

Lakes

How healthy is Lake Wairarapa?

Lake health in Wairarapa is measured using the TLI which is used to determine how nutrient enriched the lake is. A number of variables are measured monthly at several different sites on the lake, but the TLI is derived from four key variables; chlorophyll *a*, Secchi depth, phosphorus and nitrogen.

Lake Wairarapa is classed as “supertrophic” meaning it has very high levels of nutrients which could lead to algal blooms. High phosphorus levels and poor water clarity are the major issues affecting water quality in Lake Wairarapa.

Monitoring results for Lake Wairarapa

Variable	2013/14 mean	TL Value ¹⁵	TL Class
Total nitrogen (mg/L)	0.779	4.5	Eutrophic
Total phosphorous (mg/L)	0.135	5.7	Supertrophic
Secchi depth (m)	0.19	6.4	Hypertrophic
Chlorophyll <i>a</i> (mg/m ³)	6.6	4.3	Eutrophic
Overall TLI		5.2	Supertrophic

How healthy is Lake Onoke?

Lake health in Onoke is measured using the TLI which is used to determine how nutrient enriched the lake is. A number of variables are measured monthly at a single site¹⁶ on the lake, but the TLI is derived from four key variables; chlorophyll *a*, Secchi depth, phosphorus and nitrogen.

Lake Onoke has similar water quality to Lake Wairarapa. It is classed as “eutrophic” meaning it has high levels of nutrients which could lead to algal blooms. High phosphorus levels and poor water clarity are the major issues affecting water quality in Lake Wairarapa.

Monitoring results for Lake Onoke

Variable	2013/14 mean	TL Value ¹⁷	TL Class
Total nitrogen (mg/L)	0.689	4.6	Eutrophic
Total phosphorous (mg/L)	0.072	5.1	Supertrophic
Secchi depth (m)	0.45	6.0	Hypertrophic
Chlorophyll <i>a</i> (mg/m ³)	3.8	3.5	Mesotrophic
Overall TLI		4.8	Eutrophic

15. Note that the TL value is a two-year mean

16. Note that as the monitoring site is located where the Ruamāhanga River enters the lake, it is unlikely to be representative of water quality across the whole lake

17. Note that the TL value is a three-year mean

Groundwater

48 of the 68 bores monitored this year were in the Ruamāhanga. The table below shows the results of this monitoring.

Two bores in the Ruamāhanga had median nitrate concentrations that exceeded the drinking water standard of 11.3mg/L.

Bore S26/0223 (Taratahi groundwater zone) had a median nitrate concentration of 11.55mg/L. It is located in an area of intensive land use, but further investigation is needed to determine the cause of nitrate contamination in this bore. Because this bore is used for drinking water supply, the affected residents were advised that the water shouldn't be consumed. However, given the median nitrate concentration is only slightly above the drinking water standard, in this case it would only be an issue for very young babies, old people and those who have predisposition to Methemoglobinemia (blue baby syndrome).

Bore T26/0489 (Te Ore Ore groundwater zone) had a median nitrate concentration of 11.35mg/L. Another bore (T26/0538) in the Te Ore Ore aquifer is also displaying highly elevated nitrate levels. A previous study¹⁸ has suggested that nitrate contamination in the Te Ore Ore aquifer is due to land use practises (largely fertiliser use) that occurred 20 or more years ago. Groundwater can be many years old, meaning that what we see today is often a result of what has occurred in the past. These bores are not used for drinking water supply.

Out of the nine bores that tested positive for *E. coli* (ie, ≥1cfu/100mL in at least one out of four samples), six are used for drinking water supply. The maximum *E. coli* count found in these bores was 22cfu/100 mL on a single occasion in bore S27/0136. Whenever a positive *E. coli* result is found in a bore that is used for drinking water supply, the affected residents are informed so they can take precautionary measures such as boiling their drinking water.

KEY

For *E. coli*:

YES = Counts ≥1cfu/100mL

NO = Counts <1cfu/100mL

NA = Not assessed

For median nitrate:

Low (<3mg/L)

Elevated (3-7mg/L)

Highly elevated (7-11.3mg/L)

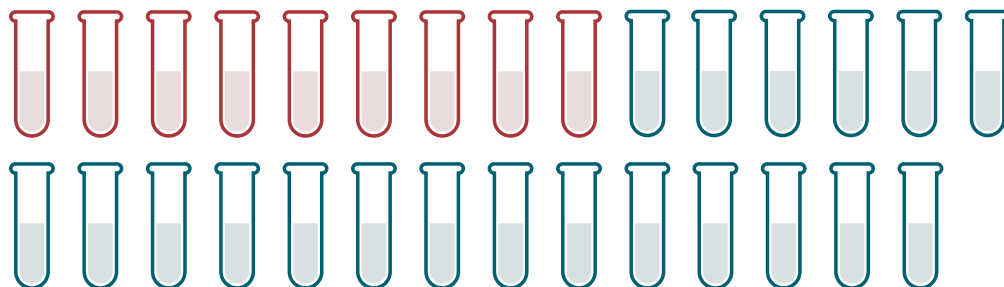
Not suitable for drinking (>11.3mg/L)

Monitoring results for groundwater quality sites

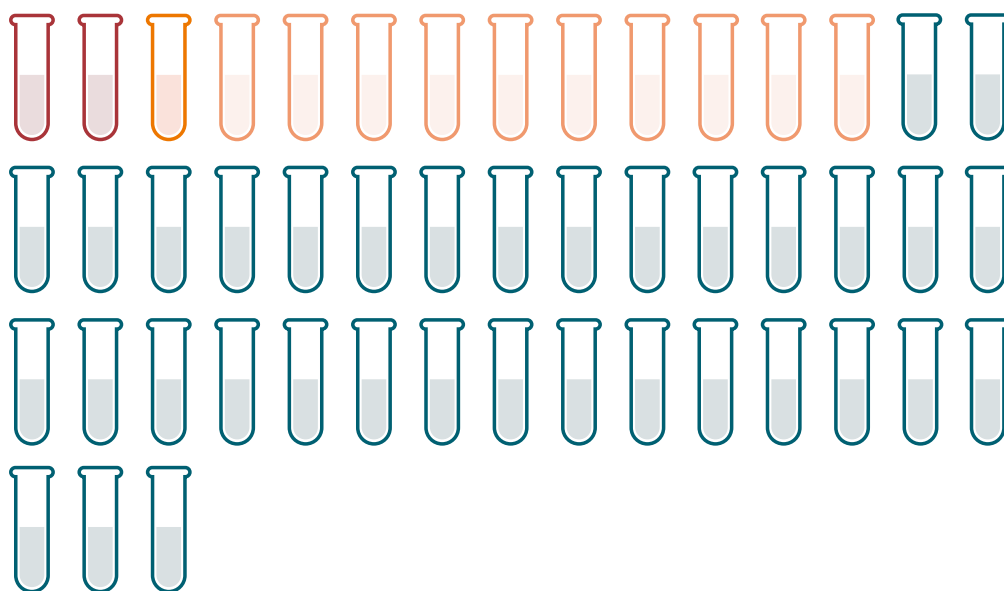
Bore	Groundwater zone	Bore use	<i>E. coli</i> detected	Median nitrate
T26/0003	Upper Ruamāhanga	Drinking water and domestic	YES	4.140
T26/0099	Upper Ruamāhanga	Drinking water and domestic	NO	2.900
T26/0206	Upper Ruamāhanga	Irrigation	NO	1.770
T26/0259	Upper Ruamāhanga	Public water supply	YES	1.180
T26/0087	Waingawa	Drinking water, domestic and stock	NA	1.960
T26/0413	Waingawa	Drinking water, domestic and irrigation	NA	0.002
T26/0430	Waingawa	Monitoring purposes only	YES	2.180
S26/0223	Taratahi	Drinking water and domestic	YES	11.550
S26/0299	Taratahi	Drinking water and domestic	NO	3.950
T26/0489	Te Ore Ore	Irrigation	NA	11.350

¹⁸ Van der Raaij, R. 2000. Nitrate contamination in the Te Ore Ore aquifers: A study using chemical isotopic and CFC data. Victoria University, Wellington.

Bore	Groundwater zone	Bore use	<i>E. coli</i> detected	Median nitrate
T26/0538	Te Ore Ore	Not used	NO	8.750
S26/0117	Mangatarere	Drinking water and domestic	YES	4.800
S26/0439	Mangatarere	Stock	NO	3.000
S26/0467	Mangatarere	Drinking water and domestic	YES	2.600
S26/0705	Mangatarere	Public water supply	NO	4.400
S26/0824	Mangatarere	Public water supply	NO	4.700
S26/0568	Parkvale	Irrigation	NA	0.010
S26/0576	Parkvale	Irrigation	NA	0.009
T26/0332	Fernhill-Tiffen	Domestic and stock	NO	0.615
S26/0756	Middle Ruamāhanga	Irrigation	NA	0.015
S26/0762	Middle Ruamāhanga	Domestic and stock	YES	0.010
S26/0457	Waiohine	Drinking water, domestic and irrigation	NO	0.875
S26/0846	Waiohine	Not used	NA	0.825
S27/0009	Tauherenikau	Domestic	NO	3.350
S27/0070	Tauherenikau	Public water supply	NO	0.595
S27/0136	Tauherenikau	Drinking water, domestic and irrigation	YES	3.200
S27/0156	Tauherenikau	Irrigation	NO	0.053
S27/0202	Tauherenikau	Irrigation	YES	2.550
S27/0283	Tauherenikau	Irrigation	NA	0.010
S27/0299	Tauherenikau	Irrigation	NO	0.335
S27/0344	Lower Ruamāhanga	Irrigation	NO	0.006
S27/0396	Lower Ruamāhanga	Public water supply	NO	0.345
S27/0495	Lower Ruamāhanga	Irrigation	NA	0.055
S27/0389	Martinborough	Irrigation	NO	0.003
S27/0522	Martinborough	Drinking water and domestic	NO	3.500
S27/0571	Martinborough	Irrigation	NO	6.450
S27/0681	Huangerua	Irrigation	NO	0.340
S27/0268	Lake Wairarapa	Irrigation and stock	NA	0.055
S27/0433	Lake Wairarapa	Irrigation	NA	0.100
S27/0435	Lake Wairarapa	Stock	NA	0.006
S27/0442	Lake Wairarapa	Drinking water, domestic and stock	NA	0.008
S27/0602	Lake Wairarapa	Irrigation	NA	0.012
S27/0607	Lake Wairarapa	Irrigation	NA	0.051
S27/0614	Lake Wairarapa	Irrigation	NA	0.055
S27/0615	Lake Wairarapa	Irrigation	NA	0.055
S27/0585	Onoke	Irrigation	NA	0.050
S27/0588	Onoke	Public water supply	NO	0.010
S27/0594	Onoke	Irrigation	NA	0.026



E. coli was detected in nine of the 29 bores monitored



Out of the 48 monitored bores, two had median nitrate concentrations exceeding the drinking water standard, one had nitrate concentrations in the highly elevated range and a further ten had nitrate concentrations in the elevated range

Estuaries and coasts

There are no monitored sites in Coastal State of the Environment monitoring programme in this area.

Air

Air quality isn't monitored in this area because the eastern Wairarapa hills are very exposed with no major known sources of air pollutants.

Land

Twelve sites have been identified as important breeding and/or feeding sites for threatened and at risk bird species. These comprise two sites on the Pahaoa River, the lower reaches of the Opouawe River and nine coastal sites including Castlepoint and Riversdale Beach.

There are only 21 sites in the Selected Land Use Register (SLUR) in this area. All of these sites fall into class A (Chemical manufacture, application and bulk storage), class F (Vehicle refuelling, service and repair) or class G (Cemeteries and waste recycling, treatment and disposal).

Water

As with other parts of the region, monthly rainfall varied greatly with some months (September, November and April) recording very high rainfall and other months (December, March, May and June) recording quite low rainfall.

Fresh water quality on the Wairarapa Coast is quite good. All sites are rated as "good" or "fair" and there are no sites rated "poor". All sites fail the guideline value for water clarity, however this is not surprising as soil stability is a major problem in the eastern Wairarapa Hills due to its steep slopes and the dominance of highly erodible mudstone soils.

The three monitored beach sites at Castlepoint and Riversdale have some of the best water quality for swimming in the region.

Wairarapa Coast



Investigation

Maurioho waterfall



With local iwi wanting to become more engaged in the management of our region's natural resources, GWRC has committed to a partnership that will ensure the cultural values of our region are assessed in conjunction with mana whenua. The Maurioho Stream experience was a great beginning to the exciting possibilities our partnership can provide.

Read more on page 109.

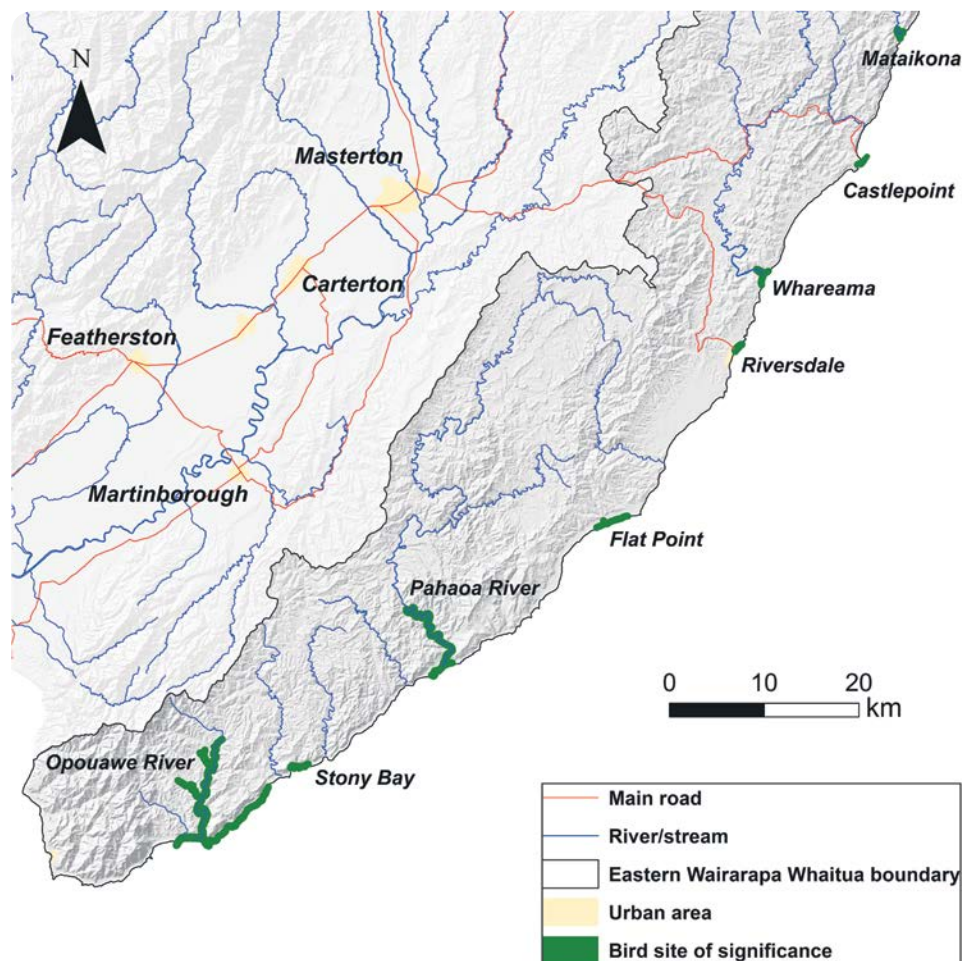
Terrestrial ecology

Regional sites of significance for threatened bird species identified and protected

Twelve sites have been identified as important breeding and/or feeding sites for threatened and at risk bird species. These comprise two sites on the Pahaoa River, the lower reaches of the Opouawe River and nine coastal sites including Castlepoint and Riversdale Beach.

Castlepoint's coastline supports a colony of red-billed gulls that make up 80 percent of the breeding population in the region. It also has one of the region's largest nesting colonies of white-fronted terns. Riversdale Beach is unique for being the only place in the Wellington region where New Zealand dotterels are breeding.

These sites of significance for indigenous birds will be included in the proposed Regional Plan due to be released later in 2015. This will ensure these areas are preserved and protected, and the future of some of our most treasured native species.



Twelve sites have been identified as important for threatened and at risk bird species, and will be included in the Regional Plan as sites of significance

Soil quality

None of the sites monitored this year were within this area.

Hazardous activities

There are 21 registered sites on the Wairarapa Coast. Most of the sites (90 percent) fall into *Category I – Verified History of Hazardous Activity or Industry*

Category	Percentage of sites
I – Verified History of Hazardous Activity or Industry	90%
II – Unverified History of Hazardous Activity or Industry	0%
III – Contamination Confirmed	5%
IV – Contamination Acceptable, Managed/Remediated	5%
V – No Identified Contamination	0%
VI – Entered on Register in Error	0%

All sites on the Wairarapa Coast fall into HAIL classifications A, F or G.

HAIL Classification	Percentage of sites
A. Chemical manufacture, application and bulk storage	24%
B. Electrical and electronic works, power generation and transmission	0%
C. Explosives and ordnances production, storage and use	0%
D. Metal extraction, refining and reprocessing, storage and use	0%
E. Mineral extraction, refining and reprocessing, storage and use	0%
F. Vehicle refuelling, service and repair	28%
G. Cemeteries and waste recycling, treatment and disposal	48%
H. Land that has been subject to the migration of hazardous substances from adjacent land	0%
I. Land that has been subject to the intentional or accidental release of a hazardous substance	0%

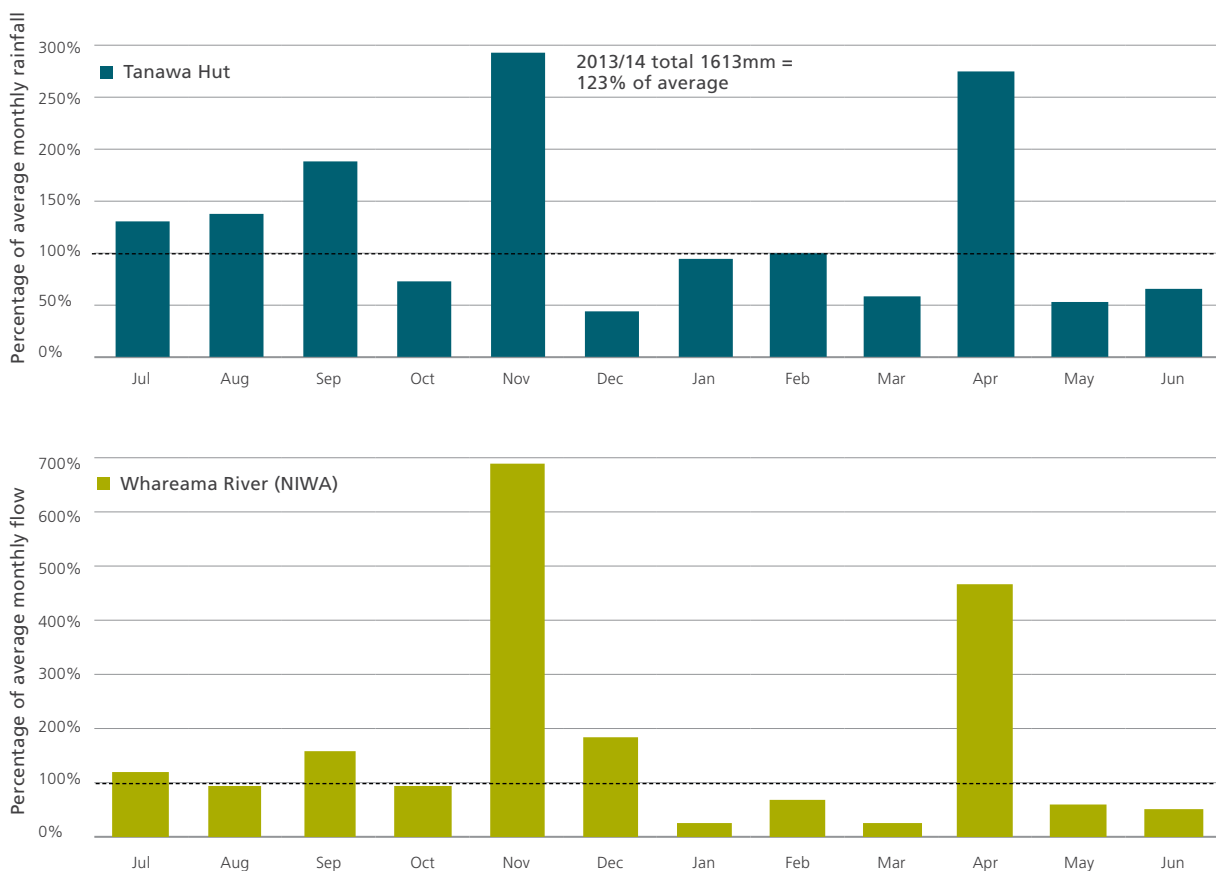
Rainfall and water levels

As with other parts of the region, monthly rainfall varied greatly with some months (September, November and April) recording very high rainfall and other months (December, March, May and June) recording quite low rainfall.

A total of 1613mm of rain was recorded at the Tanawa Hut site over the year. This is the largest amount of rain recorded at this site in ten years. In November 210mm of rain was recorded and 168mm of this fell over a four day period from the 26th to the 29th. This included an intense 24 hour period (28th November) in which a staggering 123mm of rain fell.

In contrast to November where the total rainfall largely resulted from just two events, the above average total for April was an accumulation of rain occurring over many days. Of the 30 days in April 20 registered rainfall, and between the 6th and 22nd there were only three days without rain.

As expected, river flows in the Whareama River mirror the rainfall pattern. The exceptionally high rainfall in November meant that flows in the Whareama River were almost seven times what would normally be expected.



High flows in the Whareama River during November and April corresponds with exceptionally high rainfall over the same period

Rivers and streams

Is it safe to swim?

Recreational water quality is not monitored in any of the rivers or streams in this area. This is because the eastern Wairarapa hill country can be very dry during summer with low flows in many waterways, meaning that they are not widely used for swimming. Recreational water quality is monitored at three beach sites at Castlepoint and Riversdale – refer to the *Estuaries and coasts* section.

How healthy are the rivers and streams?

Overall, water quality on the Wairarapa Coast is quite good. All sites are rated as “good” or “fair” and there are no sites rated “poor”. All six sites fail the guideline value for water clarity, however this is not surprising as soil stability is a major problem in the eastern Wairarapa Hills due to its steep slopes and the dominance of highly erodible mudstone soils.

Monitoring results for freshwater quality sites

Site number	Site name	Dominant land cover	Substrate type	WQI rating	Guideline compliance (median values)					
					DO	Clarity	<i>E. coli</i>	NNN	Amm N	DRP
RS35	Mataikona Tributary at Sugar Loaf Road	Indigenous forest	Hard	Good	✓	✗	✓	✓	✓	✓
RS42	Whareama River at Gauge	Pasture	Soft	Fair	✓	✗	✗	✓	✓	✓
RS43	Motuwaireka Stream at headwaters	Indigenous forest	Hard	Good	✓	✗	✓	✓	✓	✓
RS44	Totara Stream at Stronvar	Exotic forest	Hard	Good	✓	✗	✓	✓	✓	✓
RS53	Awhea River at Tora Road	Pasture	Hard	Fair	✓	✗	✓	✓	✓	✗
RS54	Coles Creek Tributary at Lagoon Hill Road	Indigenous forest	Hard	Good	✓	✗	✓	✓	✓	✓

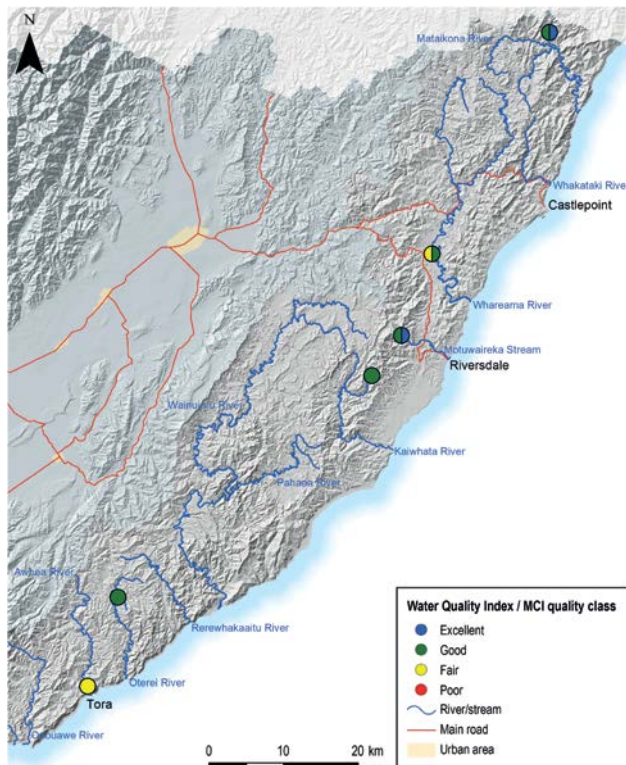
Using the MCI, two sites (33%) are classed as “excellent”, three sites (50%) are classed “good” and one site is classed “fair”. There is a reasonable relationship between the WQI and MCI at these sites. Sites that had “good” water quality were classed as “excellent” or “good” on the MCI.

Algal levels were extremely low at all the sites monitored.

Periphyton and invertebrate monitoring results for freshwater quality sites

Site number	Site name	Chlorophyll a (mg/m ²)	MCI score	MCI class
RS35	Mataikona Tributary at Sugar Loaf Road	0.03	127.5	Excellent
RS42	Whareama River at Gauge	Not measured	105.9	Good
RS43	Motuwaireka Stream at Headwaters	0.84	135.9	Excellent
RS44	Totara Stream at Stronvar	1.82	104	Good
RS53	Awhea River at Tora Road	7.73	98.8	Fair
RS54	Coles Creek Tributary at Lagoon Hill Road	9.17	105.9	Good

WQI ratings and MCI classes for freshwater quality sites



Maurioho waterfall – How a taniwha brought iwi and regional council together to assess stream health for cultural use

Many years ago the great taniwha Ngārara-huarau travelled far up the Pahaoa searching for his sister. Along the way he was startled by a high waterfall which impeded his progress, but with huge effort he was able to get past it and take up residence in the hill above. He lived there for many years until local iwi, Kahungunu ki Wairarapa, trapped and killed him leaving only his bones as a feature of the hill country landscape.

It was only recently that Kahungunu ki Wairarapa rediscovered this waterfall; named Maurioho (which means to startle, astonish or shock). Because of the legend of Ngārara-huarau the site holds special significance to Kahungunu ki Wairarapa, and they are interested in knowing if the water is suitable for cultural uses such as cleansing and restoring health.

This provided an opportunity for GWRC to work in partnership with iwi, so in February several of our staff joined PJ Devonshire (CEO, Kahungunu ki Wairarapa) and the landowners on a site visit to the legendary waterfall.

During the visit we were able to explore the waterfall and conduct a simple assessment of habitat, water quality and ecology. Key indicators that were important to iwi, such as tuna (eels) and water clarity, were incorporated into the assessment. Hearing stories about the history and significance of the site complemented the modern scientific approach and created a more holistic context in which to view the stream.

With local iwi wanting to become more engaged in the management of our region's natural resources, GWRC has committed to a partnership that will ensure the cultural values of our region are assessed in conjunction with mana whenua. The Maurioho Stream experience was a great beginning to the exciting possibilities our partnership can provide.



Monitoring Officer Brett Cockeram (left) shows PJ Devonshire and Mike Grace (Senior Policy Advisor Tangata Whenua, GWRC) a simple method for measuring the clarity of water
Photo courtesy of Hayley Vujcich, GWRC

Lakes

GWRC does not routinely monitor any lakes in this area.

Groundwater

Sections of the eastern Wairarapa coastline contain some groundwater areas which are important for domestic water supply (ie, showers and toilets in rural houses that are not connected to a public water supply) and stock watering.

Limited groundwater monitoring is conducted on the coast – just one bore at Riversdale. In the past, contamination from onsite wastewater treatment systems in this area made the groundwater largely unsuitable for drinking. Riversdale now has a community sewerage scheme that many houses are connected to.

Monitoring results for groundwater quality sites

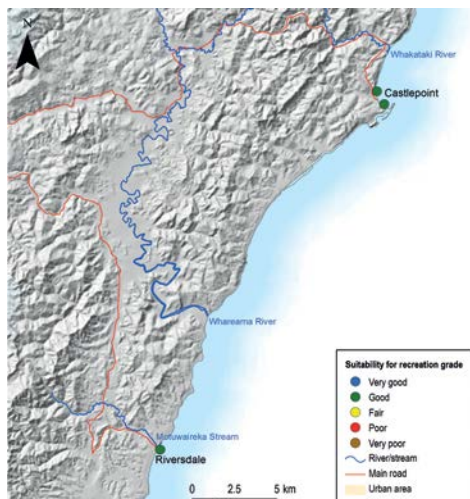
Bore	Groundwater zone	Bore use	<i>E. coli</i> detected	Median nitrate
T27/0063	Riversdale	Monitoring purposes only	NO	1.230

Estuaries and coasts

Is it safe to swim?

The three sites monitored on the Wairarapa Coast have some of the best recreational water quality in the region. All three sites have an SFRG of “good”.

SFRGs for coastal recreational sites



The table below shows the results of the weekly sampling undertaken over summer. None of the three sites exceeded the Action guideline.

Monitoring results for coastal recreational sites

Site Name	No. sampling weeks	No. sample results (Enterococci/100mL)			SFRG
		Surveillance (≤ 140)	Alert ¹ (141-280)	Action ² (> 280)	
Castlepoint Beach at Castlepoint Stream	20	20	0	0	Good
Castlepoint Beach at Smelly Creek	20	20	0	0	Good
Riversdale Beach between the flags	20	20	0	0	Good

Table footnote 1: If a sample result falls within the Alert range the affected site is monitored daily until enterococci counts return to safe levels

Table footnote 2: If a sample result falls within the Action range, ie, exceeds 280cfu/100mL, the affected site is monitored daily until enterococci counts return to safe levels. If the exceedance is not related to heavy rainfall public warnings are issued and the source of the contamination investigated.

How healthy is Castlepoint Beach?

Castlepoint Beach is in excellent condition and does not appear to be facing any major threats to its ecological health.

The Redox Potential Discontinuity (RPD) measures the layer of sediment that is well oxygenated and has a good population of animals (eg, worms, crustaceans and shellfish). It is the equivalent of having a healthy layer of topsoil (with lots of earthworms, slaters and other bugs) in your garden. The deeper the oxygenated layer, the healthier the sediment. An RPD of 15cm is very good.

High levels of mud are undesirable because it fills the pores in the sediment and affects oxygenation. Less than 2 percent mud content is considered to pose a very low risk to sediment health.

The macroinvertebrate enrichment index is an indicator of enrichment. This low score is indicative of a diverse and thriving macroinvertebrate community which has not been affected by enrichment.

Indicator	RPD (cm)	Mud content (%)	Macroinvertebrate enrichment index
Result	>15	0.3-1.4	1.2-3.3

Monitoring results from Castlepoint Beach which is in excellent condition

How healthy is Whareama Estuary?

The erosion prone soils in this area, combined with large areas of land under pasture, means that excessive build-up of fine muds in Whareama Estuary is resulting in sediments that are low in oxygen and high in toxic sulphides. The sulphides are a product of the incomplete decay of plant and animal material (due to a lack of oxygen) and give the sediment a rotten-egg smell.

This is reflected in the monitoring results below which show high rates of sedimentation and a relatively low Redox Potential Discontinuity (RPD). The RPD measures the layer of sediment that is well oxygenated and has a good population of animals (eg, worms, crustaceans and shellfish). It is the equivalent of having a healthy layer of topsoil (with lots of earthworms, slaters and other bugs) in your garden. The deeper the oxygenated layer, the healthier the sediment. An RPD of 1cm is still considered to be fair, but is verging on poor.

Indicator	Sedimentation rate 2013/14 (mm)	Mean sedimentation rate (mm/yr)	RPD (cm)
Result	20.0	11.2	1.0

Monitoring results from Whareama Estuary. Poor results are shaded in red and fair results are shaded orange.



Excessive build-up of fine muds in Whareama Estuary is resulting in sediments that are low in oxygen and high in toxic sulphides

For further information

The information in this report is based largely on the outcomes of our long term environmental monitoring programmes. Full details on the 2013/14 monitoring results can be found in our Annual Data Reports, published online at www.gw.govt.nz/Annual-monitoring-reports.

Air Quality State of the Environment monitoring programme – Annual Data Report 2014 (in publication)

Soil Quality State of the Environment monitoring programme – Annual Data Report 2013/14

Groundwater State of the Environment monitoring programme – Annual Data Report 2013/14

Rivers State of the Environment monitoring programme – Annual Data Report 2013/14

Lakes State of the Environment monitoring programme – Annual Data Report 2013/14

Coastal State of the Environment monitoring programme – Annual Data Report 2013/14

Hydrology State of the Environment monitoring programme – Annual Data Report 2013/14

On the Beaches 2013/14 – Annual recreational water quality monitoring report



The Greater Wellington Regional Council's purpose is to enrich life in the Wellington region by building resilient, connected and prosperous communities, protecting and enhancing our natural assets, and inspiring pride in what makes us unique



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