On the Beaches

Recreational Water Quality of the Wellington Region, 2005–2006

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Contents

Introduction

Will I get sick if I swim?

Regional councils and local authorities monitor recreational water quality to identify risks to public health from disease-causing organisms and inform the public of these risks. People can then make informed decisions about where, when, and how they use rivers and the marine environment for recreation.

Recreational water quality monitoring in the Wellington Region over 2005-2006 was once again a joint effort involving the Greater Wellington Regional Council and its constituent local councils, in particular the Kapiti Coast District Council, Porirua City Council, Hutt City Council, and Wellington City Council. Choice Health and Hutt Valley Health were consulted on occasions when the results of the monitoring indicated a serious health risk might exist. During the summer bathing season, weekly water test results were collated by the Greater Wellington Regional Council and displayed at www.gw.govt.nz/on-the-beaches.

This report summarises the results of routine sampling undertaken over the 2005-2006 summer bathing season.

Kapiti Island from Paekakariki Beach

The Recreational Water Quality Monitoring Programme

Aims of the Programme

The aims of the recreational water quality monitoring programme are to:

1. Determine the suitability of selected marine and freshwater sites for contact recreation;
2. Assist in safeguarding public health and the environment;
3. Provide a mechanism to determine the effectiveness of regional plans;
4. Provide information to assist in the determination of spatial and temporal changes in the environment (State of the Environment Monitoring); and
5. Provide information to assist in targeted investigations where remedial action or mitigation of poor water quality is desired.

Microbiological Water Quality Indicators and Guidelines

Water contaminated by human or animal excreta may contain a diverse range of pathogenic (disease-causing) micro-organisms such as bacteria, viruses, and protozoa (e.g., salmonella, campylobacter, cryptosporidium, giardia, etc). These organisms may pose a health hazard when the water is used for recreational activities such as swimming. The most common illness from swimming in contaminated water is gastroenteritis, but recent evidence shows that respiratory illness and skin infections are also quite common. In most cases, the ill-health effects from exposure to contaminated water are minor and short-lived, although the potential for more serious diseases such as Hepatitis A, Giardiasis, Cryptosporidiosis, Campylobacteriosis, and Salmonellosis cannot be discounted.

In 2003 the Ministry for the Environment (MfE) and the Ministry of Health (MoH) finalised microbiological water quality guidelines for recreational waters which are based on an assessment of the risk from exposure to contaminated water. These guidelines use bacteriological indicators associated with the gut of warm-blooded animals to assess the risk of faecal contamination and therefore the potential presence of harmful pathogens. The indicators used are:

- Freshwater (including estuarine waters): *Escherichia coli (E. coli)*
- Marine waters: Enterococci

Compliance with the MfE/MoH (2003[1]) microbiological water quality guidelines should ensure that people using water for contact recreation are not exposed to significant health risks. In essence, the guidelines are "trigger" values to help water managers determine when management intervention is required. The "trigger" values underpin a three-tier management framework analogous to traffic lights, as outlined in the following tables.

[1] The guidelines were published in June 2002 and updated in June 2003.

Fresh Waters

Mode	Guideline (***E. coli*** count in colony-forming units (cfu) per 100 mL)	Management Response
Green/Surveillance	Single sample ≤ 260	Routine monitoring
Amber/Alert	Single sample > 260 and ≤ 550	Increased monitoring, investigation of source and risk assessment
Red/Action	Single sample > 550	Closure, public warnings, increased monitoring and investigation of source

Marine Waters

Mode	Guideline (Enterococci count in colony-forming units (cfu) per 100 mL)	Management Response
Green/Surveillance	Single sample ≤ 140	Routine monitoring
Amber/Alert	Single sample > 140	Increased monitoring, investigation of source and risk assessment
Red/Action	Two consecutive samples[2] within 24 hours > 280	Closure, public warnings, increased monitoring and investigation of source

Periphyton Guidelines

As part of the monitoring of recreational water quality in fresh waters, the presence of periphyton (algae) in the river is also assessed. Excessive amounts of periphyton can reduce the amenity value of waterways by decreasing their aesthetic appearance, reducing visibility, and being a physical nuisance to swimmers. The MfE (2000) periphyton guidelines provide two maximum thresholds for periphyton cover in gravel/cobble bed streams managed for aesthetic and recreational values; 30% filamentous algae >2 cm long, and 60% cover for diatoms/cyanobacteria >0.3 cm thick. These thresholds relate to the visible areas of stream bed only.

Monitoring Protocol

Ninety-nine sites (23 fresh water, 76 marine) were monitored during the 2005–2006 bathing season, which is defined as the period between 1 November 2005 and 31 March 2006 inclusive. The sites were the same as those monitored over 2004-2005 and were selected on the basis of their use by the public for contact recreation; in particular, swimming, canoeing, rafting, surfing, and boating.

Sites were sampled weekly during the bathing season. On each occasion a single water sample was collected 0.2 metres below the surface in 0.5 metres water depth and analysed for *E. coli* (fresh waters) or enterococci (marine waters) indicator bacteria using membrane filtration methods. These analytical methods provide a result in 24 hours, therefore enabling prompt re-sampling in the event that a result exceeds recommended guideline values. Measurements of water temperature and turbidity, and visual estimates of periphyton cover, were made at each freshwater site. Observations of weather and the state of the tide, and visual estimates of seaweed cover, were made at each marine site. An estimate of the daily rainfall in the catchment adjoining each site over the bathing season was made by obtaining records from the nearest rain gauge. A list of field and laboratory methods can be found in Appendix 1.

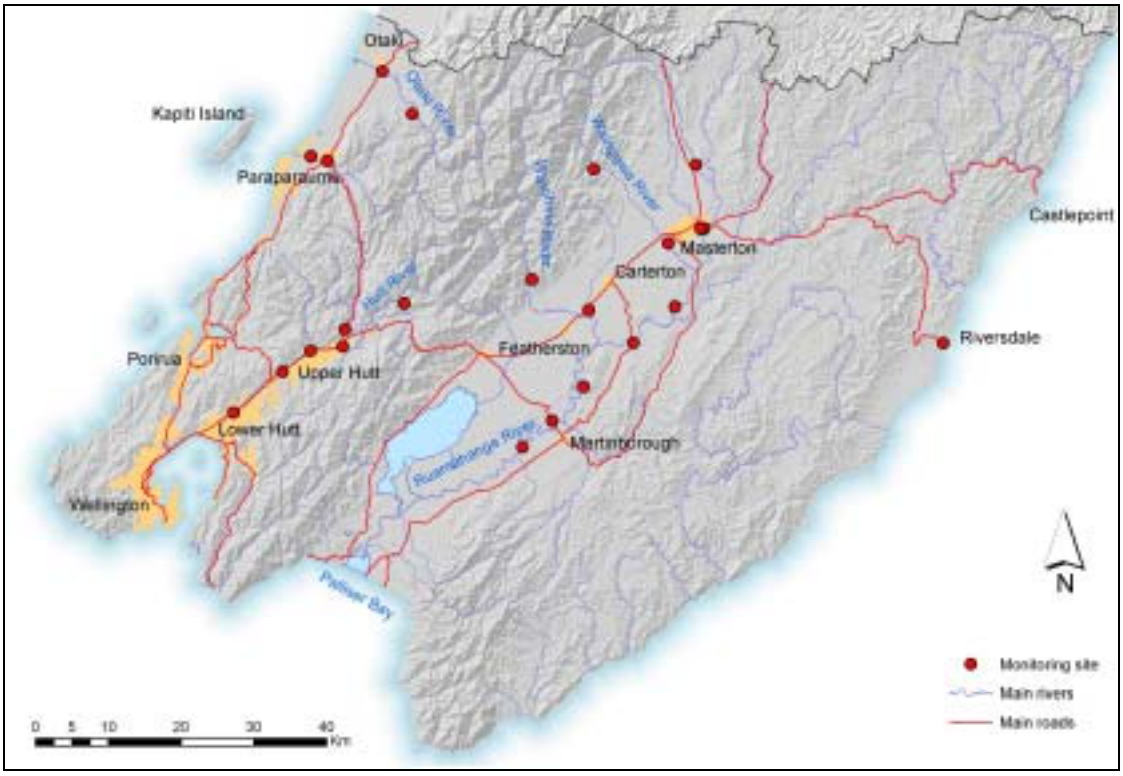
[2] In this report, a single result >280 cfu/100 mL is counted as an action event. This is in line with recent guideline amendments proposed by the Ministry for the Environment (2005).

Recreational Water Quality in Fresh Waters, 2005–2006

Recreational water quality was monitored at 23 freshwater sites across the Wellington Region over 2005-2006, as follows:

- Kapiti Coast District – 4 sites
- Hutt Valley – 6 sites
- Wairarapa – 13 sites

The locations of the monitoring sites are shown in the figure below. A complete site list can be found in Appendix 2.



Freshwater recreational water quality monitoring sites in the Wellington region

Results

Kapiti

Four freshwater sites on the Kapiti Coast were monitored during the 2005-2006 bathing season; the Otaki River at The Pots and State Highway 1, and the Waikanae River at State Highway 1 and Greenaway Road. None of these sites exceeded the action guideline of 550 cfu/100mL during the bathing season.

The Otaki River at State Highway 1 exceeded the guidelines for filamentous periphyton cover on four occasions during the bathing season, twice in November and twice in February.

Cyanobacteria (Blue-Green Algae)

Over the 2005-2006 bathing season, extensive mats of cyanobacteria were present in certain reaches of several of the rivers monitored for contact recreation:

- Otaki River
- Waikanae River
- Hutt River
- Waipoua River

The Hutt River was affected for much of the summer, with extensive thick, dark-brown/ black mats of *Oscillatoria* sp. present on the river margins in the Boulcott-Avalon area during a period of extended low river flows in November 2005. *Phormidium* sp. was found in the Otaki River and the Waikanae River around the same time. *Phormidium* sp. was also found in the Waipoua River and the Wainuiomata River.

The presence of extensive cyanobacteria mats is linked with environmental conditions conducive to their growth, including low river flows and warm weather. Cyanobacteria are capable of producing cytotoxins that can adversely affect humans and animals, in particular, dogs. It is for this reason that Regional Public Health and local councils erected health warning signs restricting access to affected rivers in the region over the summer.

Cyanobacteria mats in the Hutt River at Melling Bridge, 18 November 2005

Hutt

The Hutt River at Maoribank was the only one of the six monitoring sites in the Hutt River catchment not to exceed the action guideline of 550 cfu/100mL during the bathing season. The Hutt River at Silverstream exceeded the action guideline on six occasions (almost 30% of all samples collected). The action level events in the Hutt River catchment are summarised below:

- 30 November 2005 – Hutt River at Silverstream (680 cfu/100 mL).
- 13 December 2005 – Hutt River at Silverstream (620 cfu/100 mL) and Boulcott (720 cfu/100 mL).
- 20 December 2005 – Hutt River at Birchville (960 cfu/100 mL), Poets Park (3,600 cfu/100 mL), Silverstream (10,000 cfu/100 mL) and Boulcott (1,300 cfu/100 mL).
- 3 January 2006 – Hutt River at Silverstream (2,300 cfu/100 mL) and Boulcott (5,000 cfu/100 mL).
- 7 February 2006 – Hutt River at Silverstream (600 cfu/100 mL).
- 24 March 2006 – Hutt River at Birchville (2,300 cfu/100 mL), Silverstream (3,700 cfu/100 mL) and Pakuratahi River at Forks (900 cfu/100 mL).

With the exception of the elevated *E. coli* result at Silverstream on 7 February, all breaches of the action guideline coincided with significant rainfall (19 mm-43.5 mm) in the upstream catchment in the 72 hours prior to sampling. On several occasions, the Greater Wellington Regional Council collected follow-up samples from the sites that exceeded the action guideline. The follow-up sampling results were:

- 1 December 2005 – Hutt River at Silverstream (220 cfu/100 mL).
- 21 December 2005 – Hutt River at Birchville (760 cfu/100 mL), Poets Park (240 cfu/100 mL), Silverstream (300 cfu/100 mL) and Boulcott (380 cfu/100 mL).
- 28 March 2006 – Hutt River at Birchville (140 cfu/100 mL), Silverstream (260 cfu/100 mL) and Pakuratahi River at Forks (280 cfu/100 mL).

The follow-up sample results indicate that many *E. coli* counts did not drop below the surveillance guideline (≤ 260 cfu/100 mL), most notably the rain-affected (6 mm in 24 hours) re-sample taken from the Hutt River at Birchville on 21 December.

The Pakuratahi River at Hutt Forks was the only monitoring site in the Hutt River catchment to exceed the guidelines for periphyton cover during the bathing season. On 28 March, periphyton covered 70% of the visible river bed at this site.

Wairarapa

The Waingawa and Waiohine rivers were each monitored at two sites; the Waingawa at Kaituna and South Road, and the Waiohine at the Gauge (in the Waiohine Gorge) and State Highway 2. The *E. coli* counts at these sites did not exceed the action guideline of 550 cfu/100mL on any occasion during the bathing season.

Waiohine River Gorge

Results from the Waipoua River at Colombo Road exceeded the action guideline on two occasions during the bathing season:

- 21 December 2005 – 8,100 cfu/100 mL.
- 5 January 2006 – 1,340 cfu/100 mL.

The elevated *E. coli* count on 21 December 2005 was not rainfall-related, but the elevated result of 5 January 2006 coincided with 86 mm of rainfall in the catchment in the 72 hours prior to sample collection. No follow-up samples were taken by the Greater Wellington Regional Council.

All seven Ruamahanga River sites exceeded the action guideline of 550 cfu/100mL on at least two occasions during the bathing season. These action events are summarised below:

- 29 November 2005 – Bentleys Beach (570 cfu/100 mL).
- 21 December 2005 – Double Bridges (6,800 cfu/100 mL), Te Ore Ore (7,600 cfu/100 mL), The Cliffs (5,200 cfu/100 mL), Kokotau (4,100 cfu/100 mL), and Morrisons Bush (900 cfu/100 mL).
- 5 January 2006 – Te Ore Ore (5,020 cfu/100 mL), The Cliffs (3,100 cfu/100 mL), Kokotau (2,040 cfu/100 mL), Morrisons Bush (1,160 cfu/100 mL), Waihenga (1,560 cfu/100 mL), and Bentleys Beach (1,580 cfu/100 mL).
- 21 March 2006 – Double Bridges (740 cfu/100 mL).
- 28 March 2006 – Waihenga (600 cfu/100 mL), and Bentleys Beach (800 cfu/100 mL).

The action level *E. coli* counts each coincided with rainfall in the catchment in the 72 hours preceding sample collection. There was very heavy rainfall (67.5 mm-124.5 mm) prior to sample collection on 21 December and 5 January when five and six sites respectively, breached the action guideline. No follow-up samples were taken by the Greater Wellington Regional Council.

Riversdale Lagoon was the only site monitored in the eastern Wairarapa. Almost 30% of the weekly sampling results from this site exceeded the action guideline during the bathing season:

- 1 November 2005 – 2,560 cfu/100 mL.
- 16 November 2005 – 8,240 cfu/100 mL.
- 30 November 2005 – 2,120 cfu/100 mL.
- 20 December 2006 – 1,250 cfu/100 mL.
- 22 February 2006 – 780 cfu/100 mL.
- 29 March 2006 – 600 cfu/100 mL.

At least three of the action level events are likely to be rainfall related. Considerable rainfall (6.8 mm-17 mm) was recorded at Castlepoint in the 72 hours prior to sample collection on 1 November, 20 December and 29 March. A number of people were observed swimming in the lagoon on 30 November, prompting the Masterton District Council to erect a health warning sign at the site. This warning sign was removed the following week after a follow-up sample and the next routine sample returned *E. coli* counts below the surveillance guideline of 260 cfu/100 mL.

The Ruamahanga River at both The Cliffs and Morrisons Bush were the only monitoring sites to exceed periphyton guidelines during the bathing season. These sites both exceeded the guideline for filamentous cover on one occasion in late February.

Discussion

Fourteen of the 23 freshwater sites (61%) monitored over the 2005-2006 summer bathing season exceeded the action guideline. Twelve of these 14 sites exceeded the guideline on two or more occasions. In contrast, just five sites exceeded the guideline on more than one occasion over the 2004-2005 summer (Milne 2005).

Distribution of water samples with ***E. coli*** counts greater than the action guideline in terms of their geographic origin and the number of times a site exceeded the guideline

No. of Times Site Exceeded the Action Guideline	No. of Sites in each Exceedance Category			Total No. of Sites (23)	% of Sites
	Kapiti (4 sites)	Hutt (6 sites)	Wairarapa (13 sites)		
0	4	1	4	9	39.1
1	0	2	0	2	8.7
2	0	1	7	8	34.8
3	0	1	1	2	8.7
4	0	0	0	0	0
5	0	0	0	0	0
6	0	1	1	2	8.7

A total of 36 sample results exceeded the action guideline across the 23 freshwater sites during the 2005-2006 summer bathing season. The majority (80%) of these guideline breaches were associated with some rainfall in the three days prior to sampling, and over 70% coincided with significant (≥ 10 mm) rainfall. This finding is consistent with previous observations; elevated *E. coli* counts in fresh water are typically related to diffuse-source runoff, urban stormwater (including sewer overflows), and re-suspension of sediments during rainfall events.

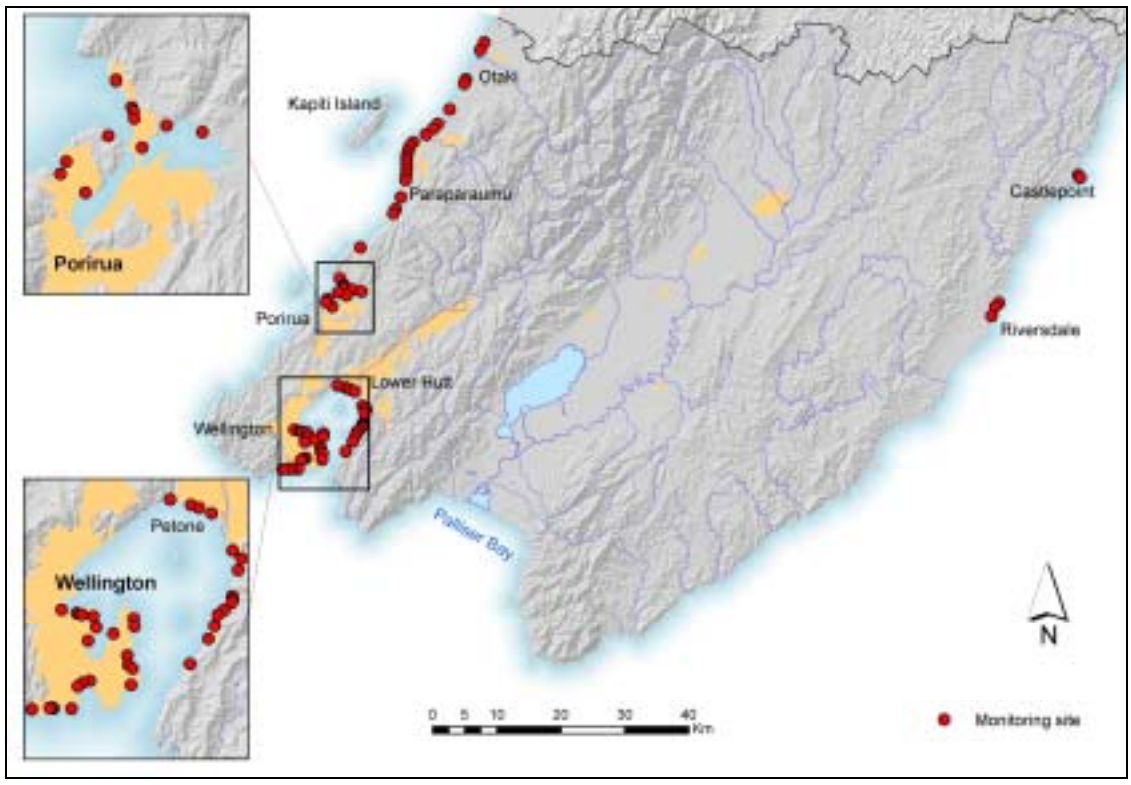
The high correlation between rainfall events and high bacteria counts supports advice from the Greater Wellington Regional Council and the MoH to avoid swimming and other contact recreation activities during and for up to several days after heavy rainfall.

Recreational Water Quality in Marine Waters, 2005–2006

Recreational water quality was monitored at 76 marine sites across the Wellington Region over 2005-2006, as follows:

- Kapiti Coast District – 20 sites
- Porirua City – 14 sites
- Hutt City – 15 sites
- Wellington City – 22 sites
- Wairarapa – 5 sites

The locations of the monitoring sites are shown in the figure below. A complete site list can be found in Appendix 2.



Marine recreational water quality monitoring sites in the Wellington region

Results

Kapiti

Results from six of the 20 marine sites monitored along the Kapiti Coast were below the action guideline of 280 cfu/100 mL throughout the bathing season. These six sites included all three sites at Paekakariki Beach. Most of the 14 sites that exceeded the guideline did so on more than one occasion. Elevated results from the five sites along Paraparaumu Beach accounted for 16 of the 30 action events. The action events are summarised below:

- 1 November 2005 – Paraparaumu Beach at Toru Road (350 cfu/100 mL).

- 6 December 2005 – Paraparaumu Beach at Ngapotiki Street (365 cfu/100 mL), Nathan Avenue (1525 cfu/100 mL), Maclean Park (3,130 cfu/100 mL), Toru Road (2,340 cfu/100 mL) Wharemauku Road (675 cfu/100 mL), Raumati Beach at Tainui Street (470 cfu/100 mL), Marine Gardens (830 cfu/100 mL), Aotea Road (1,160 cfu/100 mL) and Hydes Road (445 cfu/100 mL).
- 21 December 2005 – Otaki Beach at Rangiuru Road (355 cfu/100 mL), Te Horo Beach South of Mangaone Stream (385 cfu/100 mL) and Kitchener Street (320 cfu/100 mL).
- 30 January 2006 – Paraparaumu Beach at Ngapotiki Street (325 cfu/100 mL).
- 31 January 2006 – Waikanae Beach at Ara Kuaka Carpark (405 cfu/100 mL).
- 8 February 2006 – Paraparaumu Beach at Ngapotiki Street (335 cfu/100 mL).
- 13 February 2006 – Te Horo Beach South of Mangaone Stream (740 cfu/100 mL).
- 27 February 2006 – Paraparaumu Beach at Ngapotiki Street (320 cfu/100 mL), Nathan Avenue (340 cfu/100 mL), Toru Road (655 cfu/100 mL) Wharemauku Road (595 cfu/100 mL), Raumati Beach at Tainui Street (605 cfu/100 mL), Marine Gardens (420 cfu/100 mL).
- 8 March 2006 – Te Horo Beach South of Mangaone Stream (315 cfu/100 mL).
- 22 March 2006 – Waikanae Beach at Williams Street (485 cfu/100 mL) and Ara Kuaka Carpark (650 cfu/100 mL).
- 28 March 2006 – Paraparaumu Beach at Ngapotiki Street (420 cfu/100 mL), Nathan Avenue (440 cfu/100 mL), Maclean Park (415 cfu/100 mL) and Toru Road (370 cfu/100 mL).

Two thirds of the enterococci counts that exceeded the action guideline – including all of the elevated results recorded in December, February and March – coincided with rainfall events in the 72 hours prior to sample collection. The elevated results recorded along Paraparaumu Beach and Raumati Beach on 27 February may also in part be attributed to the influence of rivers further up the coast as a strong north-westerly wind was present during sampling.

The Kapiti Coast District Council collected additional samples following all exceedances of the action guideline. The results of the majority of these follow-up samples complied with the surveillance guideline (≤ 140 cfu/100 mL), indicating that no further management action was required. The exceptions were the results of follow-up sampling undertaken at Paraparaumu Beach at Ngapotiki Street on 31 January (1,120 cfu/100 mL) and 1 February (305 cfu/100 mL). A health warning sign was subsequently erected at this site but removed a few days later after the results of a further sample collected on 2 February complied with the surveillance guideline. A follow-up sample collected from Waikanae Beach at Williams Street on 23 March also returned an elevated enterococci count (335 cfu/100 mL). A further sample was collected the next day and the results complied with the surveillance guideline.

Porirua

None of the 14 sites monitored in Porirua City exceeded the action guideline of 280 cfu/100 mL during the bathing season, although there was an inconclusive result for the Pauatahanui Inlet at Browns Bay on 7 February 2006. A follow-up sample was collected the next day and the results complied with the surveillance guideline.

Onepoto Arm of the Porirua Harbour from the Porirua Rowing Club

Heath warning signs were erected at the Porirua Rowing Club and several other locations along the Onepoto Arm of the Porirua Harbour following a sewer overflow to the harbour on 22 November. The Porirua City Council undertook additional bacteriological water sampling along the western margin of the Onepoto Arm on a daily basis during and following the overflow event. All but one of the health warning signs were removed on 29 November after two consecutive sample results complied with the surveillance guideline. The last remaining sign was removed on 5 December.

Hutt

Nine of the 15 marine sites monitored in Hutt City exceeded the action guideline of 280 cfu/100 mL during the bathing season, as follow:

- 22 November 2005 – Petone Beach at the Water Ski Club (420 cfu/100 mL).
- 28 February 2006 – Lowry Bay at Cheviot Road (360 cfu/100 mL).
- 21 March 2006 – York Bay (400 cfu/100 mL).
- 28 March 2006 – Petone Beach at the Water Ski Club (520 cfu/100 mL) and the Kiosk (480 cfu/100 mL), Days Bay at the wharf (320 cfu/100 mL), Rona Bay at Cliff Bishop Park (2,000 cfu/100 mL) and the wharf (380 cfu/100 mL), Robinson Bay at HW Shortt Recreation Ground (540 cfu/100 mL).

With the exception of Lowry Bay on 28 February, all of the high enterococci counts coincided with rainfall in the 72 hour period prior to sampling. Follow-up samples collected by the Hutt City Council were all well below the surveillance guideline of ≤ 140 cfu/100 mL.

Emergency repairs to the Hutt Wastewater Treatment Plant's main outfall pipe may have affected water quality at some of the Hutt beaches in February. From 8-18 February, the Hutt City Council discharged treated wastewater (sewage) from outfalls

along the Eastbourne coast and municipal and industrial wastewater into the Waiwhetu Stream near the Hutt River mouth. On a lesser scale, wastewater was also discharged from Sunshine Bay, Mahina Bay and Burdans Gate on 20 February. During this time, the Hutt City Council undertook additional bacteriological water sampling at various coastal locations. This included additional sampling on 10 and 12 February at all 15 Hutt City beaches routinely sampled during the summer bathing season. Two of the bathing sites recorded enterococci counts above the action guideline of 280 cfu/100 mL:

- 10 February 2006 – Sorrento Bay (1,200 cfu/100 mL) and Lowry Bay (590 cfu/100 mL).
- 12 February 2006 – Sorrento Bay (300 cfu/100 mL).

The Hutt City Council and Regional Public Health erected health warning signs closing the Petone foreshore, Sorrento Bay and Lowry Bay to swimming and shellfish gathering on 13 February. The Petone foreshore was reopened later in the day following receipt of the results of samples collected on 10 February. Sorrento Bay and Lowry Bay remained closed until routine bathing water samples collected on 14 February and extra samples collected on 16 and 18 February confirmed that enterococci counts at these sites were below the surveillance guideline.

Petone Beach

Wellington City

Results from 17 of the 22 marine sites monitored in Wellington City remained below the action guideline of 280 cfu/100 mL throughout the bathing season. The action guideline was exceeded on one occasion at each of the remaining five sites, as follow:

- 30 January 2005 – Lyall Bay at Tirangi Road (600 cfu/100 mL).
- 27 February 2006 – Oriental Bay at Band Rotunda (>400 cfu/100 mL) and Mahanga Bay (>400 cfu/100 mL).
- 27 March 2006 – Oriental Bay at Wishing Well (>400 cfu/100 mL) and Kio Bay (320 cfu/100 mL).

The elevated enterococci counts all coincided with rainfall in the preceding 72 hours, although in the case of the elevated counts recorded on 30 January and 27 February, the rainfall was minimal (0.2 mm).

Follow-up samples were collected by the Wellington City Council following all but one of the action level events. All of the follow-up sample results complied with the surveillance guideline (≤ 140 cfu/100 mL), indicating no further management action was required.

A sewage spill incident occurred in the vicinity of the Michael Fowler Centre on 3 March. Water sampling conducted in response to the spill identified a high enterococci count in the adjacent Aotea Lagoon (1,900 cfu/100 mL). Subsequently, health warning signs were erected. The signs were removed on 8 March after further water sampling indicated enterococci counts complied with the surveillance guideline.

Wairarapa

Two sites were sampled at Castlepoint Beach and three sites were sampled at Riversdale Beach. Both Castlepoint Beach sites exceeded the action guideline of 280 cfu/100mL on one occasion as follows:

- 4 January 2006 – Castlepoint Beach at Smelly Creek (367 cfu/100 mL).
- 8 March 2006 – Castlepoint Beach at Castlepoint Stream (356 cfu/100 mL).

The 4 January result followed 5.8 of rainfall in the 72 hours preceding sample collection. Only 0.4 mm of rainfall was recorded in the same period prior to sampling on 8 March. No follow-up samples were taken by the Greater Wellington Regional Council.

Discussion

Recreational water quality was good at the majority of the Wellington region's beaches throughout the 2005–2006 bathing season. Although 29 of the 76 marine sites monitored (39%) exceeded the action guideline, as the table below identifies, the majority of these (20 sites) exceeded the guideline on only one occasion.

Distribution of water samples with enterococci counts greater than the action guideline in terms of their geographic origin and the number of times a site exceeded the guideline

No. of Times Site Exceeded the Action Guideline	No. of Sites in each Exceedance Category					Total No. of Sites (76)	% of Sites
	Kapiti (20 sites)	Porirua (14 sites)	Hutt (15 sites)	Wellington (22 sites)	Wairarapa (5 sites)		
0	6	14	7	17	3	47	61.8
1	5	0	7	5	2	19	25.0
2	5	0	1	0	0	6	7.9
3	2	0	0	0	0	2	2.6
4	1	0	0	0	0	1	1.3
5	1	0	0	0	0	1	1.3

A greater number of sites remained below the action guideline of 280 cfu/100mL for the duration of the bathing period in 2005-2006 (62%) compared to 2004-2005 (48.7%) (Milne 2005[3]). However, the total number of action events over the 2005-2006 bathing season (49) compares closely with the 51 action events observed over the 2004-2005 bathing season (Milne 2005). This is due to the influence of four Kapiti sites exceeding the action guideline on three or more occasions over the 2005-2006 summer.

A total of 46 breaches of the action guideline were recorded across the 76 sites during the 2005-2006 summer bathing season. The majority (67 %) of these breaches were associated with some rainfall in the three days prior to sampling and 34 % were associated with heavy (≥ 10 mm) rainfall. This finding is consistent with previous observations; elevated enterococci counts in marine waters are typically related to urban stormwater (including sewer overflows), diffuse-source runoff into rivers and streams and re-suspension of sediments during rainfall events.

The high correlation between rainfall events and high bacteria counts supports advice from the Greater Wellington Regional Council and the MoH to avoid swimming and other contact recreation activities during and for up to several days after heavy rainfall.

[3] The statistics provided here differ slightly from those presented in *On the Beaches 2004-2005*, and reflect the results of a recent quality assurance audit of the 2004-2005 bathing data.

References

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[4] Published June 2002, updated June 2003.

Appendices

Appendix 1: Laboratory and Field Methods

Determinant	Method	Detection Limit
Escherichia coli at 44.5°C	APHA Standard Methods (20th Edition) 9213D, Membrane filter on mTEC agar, Urea substrate	1/100 mL
Enterococci at 41°C	US EPA Method 1600, Membrane filter on mEI agar	1/100 mL
Water temperature	Western: Dissolved oxygen meter (YSI 55) Wairarapa: Conductivity meter (YSI 33)	0.1°C
Turbidity	APHA Standard Methods (20th Edition) 2130B	0.1 NTU
Periphyton cover	Mean % from 10 estimates taken along a transect using a 20 cm diameter hoop	1%
Seaweed cover	Visual estimate within 5 m radius around sample point, including both floating and attached	5%

Rainfall Stations

Freshwater Recreational Sites

- Kapiti Coast District - Taungata Peak
- Hutt – Kaitoke Headworks (Pakuratahi River) and Te Marua (Hutt River)
- Wairarapa – Mount Bruce (Ruamahanga River), Kaituna (Waipoua River, Waingawa River), Phelps (Waiohine River) and Castlepoint (Riversdale Lagoon)

Marine Recreational Sites

- Kapiti Coast District – Otaki Depot (Otaki Beach, Te Horo Beach), Waikanae Water Treatment Plant (Peka Peka Beach, Waikanae Beach), Kapiti Aerodrome (Paraparaumu Beach, Raumati Beach, Paekakariki Beach)
- Porirua City – Whenua Tapu
- Hutt City – Shandon
- Wellington City – Wellington Airport
- Wairarapa – Castlepoint

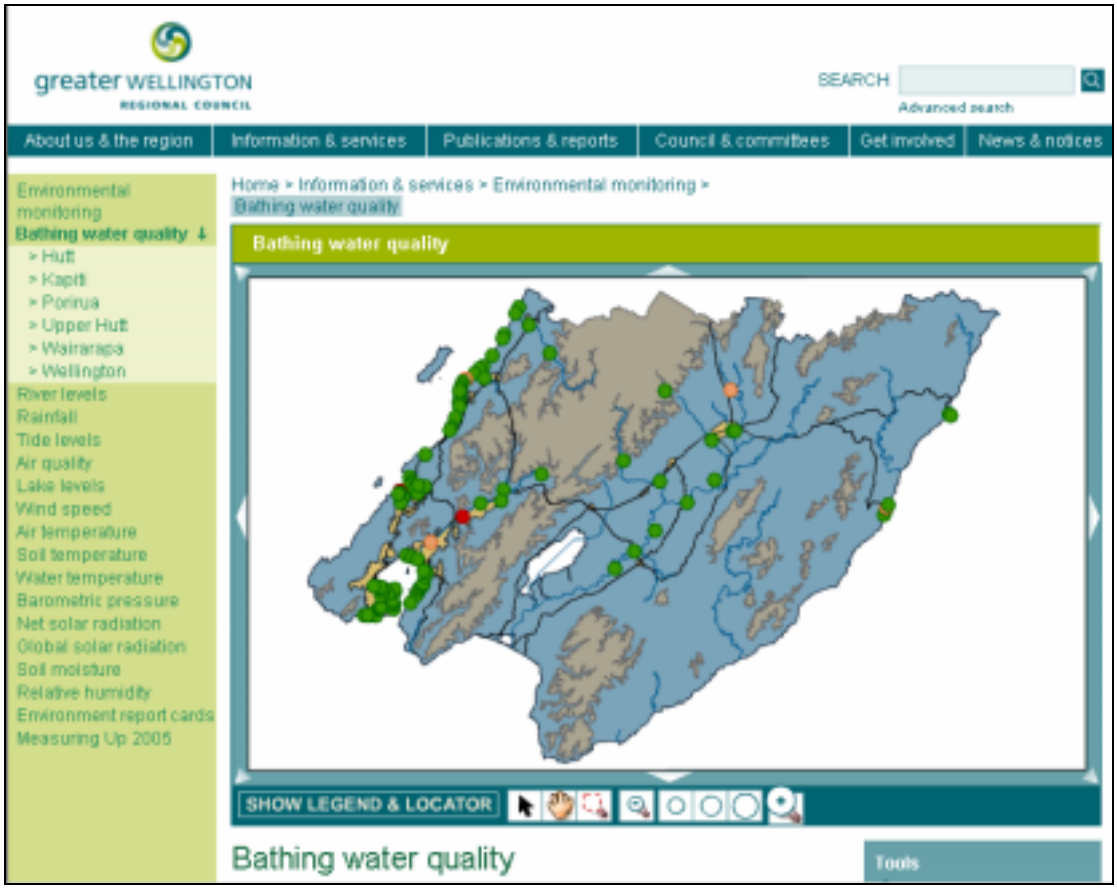
Appendix 2: List of Recreational Water Quality Monitoring Sites

Area	Site Name	NZ Map Grid		Type
		Easting	Northing	
Hutt	Petone Beach @ Water Ski Club	2665765	5996304	Marine
Hutt	Petone Beach @ Sydney Street	2667067	5995961	Marine
Hutt	Petone Beach @ Settlers Museum	2667577	5995770	Marine
Hutt	Petone Beach @ Kiosk	2668348	5995425	Marine
Hutt	Sorrento Bay	2669654	5993098	Marine
Hutt	Lowry Bay @ Cheviot Road	2670228	5992605	Marine
Hutt	York Bay	2669999	5991874	Marine
Hutt	Days Bay @ Wellesley College	2669639	5990243	Marine
Hutt	Days Bay @ Wharf	2669677	5990027	Marine
Hutt	Days Bay @ Moana Road	2669605	5989834	Marine
Hutt	Rona Bay @ N end of Cliff Bishop Park	2669132	5989367	Marine
Hutt	Rona Bay @ Wharf	2668753	5989084	Marine
Hutt	Robinson Bay @ HW Shortt Rec Ground	2668542	5988387	Marine
Hutt	Robinson Bay @ Nikau Street	2668154	5987569	Marine
Hutt	Camp Bay	2667013	5986001	Marine
Hutt	Hutt River @ Silverstream Bridge	2677619	6004887	Freshwater
Hutt	Hutt River @ Boulcott	2670941	5999283	Freshwater
Kapiti	Otaki Beach @ Surf Club	2688639	6050044	Marine
Kapiti	Otaki Beach @ Rangiuru Road	2688028	6048783	Marine
Kapiti	Te Horo Beach S of Mangaone Stream	2685797	6044192	Marine
Kapiti	Te Horo Beach @ Kitchener Street	2685513	6043648	Marine
Kapiti	Peka Peka Beach @ Road End	2683233	6039620	Marine
Kapiti	Waikanae Beach @ William Street	2681406	6037299	Marine
Kapiti	Waikanae Beach @ Tutere St Tennis Courts	2680673	6036577	Marine
Kapiti	Waikanae Beach @ Ara Kuaka Carpark	2679532	6035693	Marine
Kapiti	Paraparaumu Beach @ Ngapotiki Street	2677561	6034477	Marine
Kapiti	Paraparaumu Beach @ Nathan Avenue	2677051	6033889	Marine
Kapiti	Paraparaumu Beach @ Maclean Park	2676712	6032982	Marine
Kapiti	Paraparaumu Beach @ Toru Road	2676595	6032430	Marine
Kapiti	Paraparaumu Beach @ Wharemauku Road	2676521	6031785	Marine
Kapiti	Raumati Beach @ Tainui Street	2676549	6030944	Marine
Kapiti	Raumati Beach @ Marine Gardens	2676535	6030156	Marine
Kapiti	Raumati Beach @ Aotea Road	2676433	6029244	Marine
Kapiti	Raumati Beach @ Hydes Road	2676337	6028550	Marine
Kapiti	Paekakariki Beach @ Whareroa Road	2675617	6025843	Marine
Kapiti	Paekakariki Beach @ Surf Club	2674810	6023988	Marine
Kapiti	Paekakariki Beach @ Memorial Hall	2674452	6023305	Marine
Kapiti	Otaki River @ The Pots	2695461	6040455	Freshwater
Kapiti	Otaki River @ State Highway 1	2691326	6046120	Freshwater
Kapiti	Waikanae River @ State Highway 1	2683770	6034011	Freshwater
Kapiti	Waikanae River @ Greenaway Road	2681549	6034626	Freshwater
Porirua	Pukerua Bay	2669309	6017968	Marine
Porirua	Karehana Bay @ Cluny Road	2666113	6013074	Marine
Porirua	Plimmerton Beach @ Bath Street	2666726	6012030	Marine
Porirua	Plimmerton Beach @ Queens Avenue	2666790	6011888	Marine
Porirua	South Beach @ Plimmerton	2666830	6011588	Marine
Porirua	Pauatahanui Inlet @ Water Ski Club	2668094	6011307	Marine
Porirua	Pauatahanui Inlet @ Motukaraka Point	2669506	6011052	Marine

Area	Site Name	NZ Map Grid		Type
		Easting	Northing	
Porirua	Pauatahanui Inlet @ Browns Bay	2668059	6009547	Marine
Porirua	Paremata Beach @ Pascoe Avenue	2667137	6010447	Marine
Porirua	Porirua Harbour @ Rowing Club	2664911	6008661	Marine
Porirua	Titahi Bay @ Bay Drive	2664152	6009883	Marine
Porirua	Titahi Bay at Toms Road	2664130	6009571	Marine
Porirua	Titahi Bay @ South Beach Access Road	2663926	6009396	Marine
Porirua	Onehunga Bay	2665816	6010895	Marine
Upper Hutt	Pakuratahi River @ Forks	2694308	6014337	Freshwater
Upper Hutt	Hutt River @ Birchville	2686216	6010807	Freshwater
Upper Hutt	Hutt River @ Maoribank Corner	2685902	6008412	Freshwater
Upper Hutt	Hutt River @ Poets Park	2681482	6007807	Freshwater
Wairarapa	Ruamahanga River @ Double Bridges	2734363	6033494	Freshwater
Wairarapa	Ruamahanga River @ Te Ore Ore	2735543	6024638	Freshwater
Wairarapa	Waipoua River at Colombo Road	2735010	6024610	Freshwater
Wairarapa	Waingawa River @ Kaituna	2720341	6032867	Freshwater
Wairarapa	Waingawa River @ South Road	2730565	6022599	Freshwater
Wairarapa	Ruamahanga River @ The Cliffs	2731492	6013902	Freshwater
Wairarapa	Ruamahanga River @ Kokotau	2725774	6008913	Freshwater
Wairarapa	Waiohine River @ Gauge	2711871	6017655	Freshwater
Wairarapa	Waiohine River @ State Highway 2	2719683	6013431	Freshwater
Wairarapa	Ruamahanga River @ Morrisons Bush	2718938	6002829	Freshwater
Wairarapa	Ruamahanga River @ Waihenga	2714631	5998182	Freshwater
Wairarapa	Ruamahanga River @ Bentleys Beach	2710556	5994533	Freshwater
Wairarapa	Riversdale Lagoon	2768314	6008860	Freshwater
Wairarapa	Castlepoint Beach @ Castlepoint Stream	2781366	6029287	Marine
Wairarapa	Castlepoint Beach @ Smelly Creek	2781670	6028931	Marine
Wairarapa	Riversdale Beach @ Lagoon Mouth	2768974	6009275	Marine
Wairarapa	Riversdale Beach Between the Flags	2768445	6008680	Marine
Wairarapa	Riversdale Beach South	2767844	6007246	Marine
Wellington	Aotea Lagoon	2659007	5989395	Marine
Wellington	Oriental Bay @ Freyberg Beach	2659942	5989176	Marine
Wellington	Oriental Bay @ Wishing Well	2660140	5989098	Marine
Wellington	Oriental Bay @ Band Rotunda	2660265	5989087	Marine
Wellington	Balaena Bay	2660980	5988979	Marine
Wellington	Kio Bay	2661163	5988311	Marine
Wellington	Hataitai Beach	2660654	5987442	Marine
Wellington	Shark Bay	2662233	5987909	Marine
Wellington	Mahanga Bay	2663490	5988828	Marine
Wellington	Scorching Bay	2663539	5988360	Marine
Wellington	Worser Bay	2663097	5986535	Marine
Wellington	Seatoun Beach @ Wharf	2663152	5985946	Marine
Wellington	Seatoun Beach @ Inglis Street	2663428	5985706	Marine
Wellington	Breaker Bay	2663335	5984682	Marine
Wellington	Lyall Bay @ Tirangi Road	2660770	5984942	Marine
Wellington	Lyall Bay @ Onepu Road	2660309	5984828	Marine
Wellington	Lyall Bay @ Queens Drive	2660013	5984580	Marine
Wellington	Princess Bay	2659609	5983216	Marine
Wellington	Island Bay @ Old Bait Shed	2658484	5983228	Marine
Wellington	Island Bay @ Surf Club	2658400	5983302	Marine
Wellington	Island Bay @ Reef St Recreation Ground	2658252	5983254	Marine
Wellington	Owhiro Bay	2657145	5983174	Marine
	Inactive Site			
Porirua	Porirua Harbour @ Te Hiko Street	2664347	6007493	Marine

For More Information

During the summer bathing season, weekly water test results are displayed on Greater Wellington Regional Council's web site: www.gw.govt.nz/on-the-beaches



Opening screen at www.gw.govt.nz/on-the-beaches