

Hawke's Bay Recreational Water Quality

A review of the 2015-2016 Season

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Environmental Science - Water Quality and Ecology

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A review of the 2015-2016 Season

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Prepared By:

Shane E. Gilmer - Resource Technician, Water Quality and Ecology

Anna Madarasz-Smith – Senior Scientist, Coastal Quality

Oliver Wade – Scientist, Coastal Quality

Reviewed By:

Stephen Swabey – Manager - Environmental Science

Approved By:

Iain Maxwell – Group Manager – Resource Management

Signed:



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Executive summary

The Recreational Water Quality Monitoring programme is an annual summer programme undertaken by Hawke's Bay Regional Council in conjunction with the Public Health Unit of the Hawke's Bay District Health Board and Territorial Local Authorities. During the 2015/2016 season (November to March), the microbiological water quality of 38 popular bathing areas was assessed. Water samples collected at these sites were analysed on a weekly basis for faecal indicator (Enterococci and/or *Escherichia coli*) contamination. The results were compared with the Ministry for the Environment (MfE) and Ministry of Health (MoH) Microbiological Water Quality Guidelines (2003). Trends in water quality over time were also analysed.

The sites were as follows:

- 17 marine sites (enterococci)
- 9 freshwater sites (*Escherichia coli*)
- 8 estuarine/lagoon/tidal freshwater sites (enterococci, *Escherichia coli*)
- 1 freshwater lake (*Escherichia coli*)
- 8 estuarine/coastal sites for shellfish gathering (Faecal coliforms)

All sites were monitored on a weekly basis (except for Clive River and Puhokio Stream, which were monitored fortnightly) to assess their suitability for contact recreation.

Marine sites

All of the 17 marine sites achieved 100% compliance with national guidelines, which is defined as when two consecutive samples collected within 24 hours fall within guideline values. This indicates that most coastal beaches are suitable for contact recreation most - if not all - of the time.

River sites

- Tutaekuri River at Guppy Rd was 100% compliant with contact recreation guidelines.
- Tukituki River at SH2, Tukituki River at Walker Rd (rainfall related), and Ngaruroro River at Chesterhope Bridge was worse than the contact recreation guidelines on one occasion (95% compliant).
- Nuhaka River at Opoutama Rd was worse than the contact recreation guidelines on two occasions during rainfall events (90% compliant).
- Wairoa River was worse than the contact recreation guidelines 4 times (80% compliant). Consequently, faecal source tracking samples were taken which also indicated a ruminant, with possible avian source of faecal contamination.

These results indicate the role rainfall can take in bacterial transport, affecting contact recreation values.

Estuarine sites

- Pandora Pond and Porangahau Estuary were 100% compliant with national guidelines for both enterococci and *E.coli*.
- Waipuka Stream and Kairakau Lagoon exceeded the contact recreation threshold 3 times (85% compliant). Consequently, faecal source tracking samples were taken which also indicated a ruminant and avian source of faecal contamination.

Shellfish gathering

Two of the 8 shellfish gathering sites (Mahia Beach opp. Mahia Golf club and Kairakau Beach) monitored in Hawke's Bay were 100% compliant with MfE and MoH guidelines. Three sites failed to comply with one of the guideline requirements, and Porangahau Estuary, Te Mahia and Maungawhio Lagoon failed to comply with both. Mahia Beach has been compliant for 5 consecutive years.

1 Introduction

Hawke's Bay's coastal waters, freshwater lakes and rivers are frequently used for a range of recreational activities. However, the suitability of these areas for contact recreation can be compromised through contamination by human and animal faecal matter, which may carry harmful illness-causing pathogens.

"Contact recreation" includes any activity that causes people to come into contact with water where a reasonable risk of inhaling or ingesting water exists. This can include swimming, surfing, kite-surfing, kayaking, diving and any other activity likely to result in immersion.

To monitor the risk associated with contact recreation, Hawke's Bay Regional Council (HBRC) undertake an annual Recreational Water Quality Monitoring Programme in collaboration with Territorial Local Authorities (TLAs) and the Public Health Unit of the Hawke's Bay District Health Board (PHU). Monitoring is carried out at several sites throughout the region to assess the microbiological water quality of areas commonly used for contact recreation. The results are then compared to Ministry for the Environment (MfE) and Ministry of Health (MoH) guidelines (2003).

The aims of the programme are to:

- Determine the suitability of the coastal, estuarine and freshwater sites for recreational use;
- Assist in safeguarding public health and the environment;
- Compare current water quality with that of previous seasons;
- Provide a baseline for future research; and
- Identify problems and target investigations to those areas requiring mitigation, remediation or further research and development.

1.1 Legislative responsibility

Two main sources of legislation define the monitoring required to assess the water quality of areas used for contact recreation, the Resource Management Act (1991) and the Health Act (1956). The responsibility for overseeing these Acts is shared between Regional Councils, TLAs and the District Health Boards (DHBs). The document 'Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas', MfE and MoH (2003) outlines how duties may be shared between the agencies involved.

HBRC has taken responsibility for the monitoring, and undertakes all routine monitoring and the facilitation of follow-up sampling when necessary. The TLAs have responsibility for erecting warning signs and undertaking sanitary surveys when requested by the PHU. The PHU, through its health protection officers and Medical Officer of Health, have responsibility for informing the public; usually through a press release and or location signage when an exceedance of the guidelines has occurred.

Updated results are also available from the HBRC website (<http://www.hbrc.govt.nz/Services/Environmental-Sciences/Water/Pages/rec-water-quality.aspx>), and the Land and Water Aotearoa website (LAWA) (<http://www.lawa.org.nz/explore-data/hawkes-bay-region/>).

1.2 Faecal Indicator Bacteria

The most common illnesses associated with swimming include gastroenteritis, respiratory illnesses, and skin and ear infections. These illnesses can be caused by a wide range of pathogenic organisms including viruses, bacteria and protozoan species – these include *Salmonella*, *Campylobacter*, *Cryptosporidium*, and *Giardia* (MfE and MoH, 2003). It is not feasible to analyse water samples for these pathogenic organisms. However, these pathogens are associated with enterococci and *Escherichia coli* (*E. coli*) bacteria that are specific to the gut of warm-blooded animals. Measurement of the concentration of these indicator bacteria gives an indication of the health risk associated with contact recreation arising from pathogenic organisms.

Samples were analysed for the indicator bacteria enterococci at marine sites. This is because it survives better in saline waters than *E. coli*, providing a better indication of actual bacterial levels and therefore the potential risk. Samples collected at freshwater sites were analysed for the indicator bacteria *E. coli*. At estuarine or freshwater sites subject to tidal influences, dual testing of indicator bacteria was undertaken. This ensured that the indicator organism appropriately indicated the risk of adverse health effects. Where electrical conductivity readings indicated a freshwater environment (<10,000 µS/cm), the laboratory analysis was conducted for *E. coli* only, otherwise both *E. coli* and enterococci levels were measured.

1.3 Guidelines

All sampling and evaluation of results was undertaken in accordance with the ‘Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas 2003’ (MfE and MoH). (Table 1-1).

Table-1-1: Water quality guideline values and indicator organisms used to assess marine and freshwater recreational areas (MfE and MoH, 2003).

Response Level	Marine Water Enterococci CFU/100 mL Single Sample	Freshwater <i>E. coli</i> CFU/100 mL Single sample	Shellfish gathering waters Faecal coliforms CFU/100 mL (over season)
Surveillance/Green Mode	<140	<260	Median concentration < 14/100 mL and 90% of samples < 43/100 mL
Alert/Amber Mode	140 - 280	260 - 550	N/A
Action/Red Mode	>280*	>550	Median concentration > 14/100 mL and/or 90% of samples > 43/100 mL

CFU = Colony forming units on an agar plate.

- Note: Two consecutive samples taken within 24 hrs exceeding 280 enterococci/100 mL are required before the specific action mode is initiated.

When water quality falls within the limits of the ‘surveillance mode’ (the ‘Green’ mode), the risk of contracting an illness from bathing is considered acceptable (MfE and MoH, 2003). If the water quality falls into the ‘Alert/Amber’ category (the ‘Amber’ mode) there is an increased risk of illness, but this risk is also considered acceptable. This result signals to agencies a requirement to conduct follow up sampling of the site to determine whether contamination levels have increased to the ‘Action/Red’ level (the ‘Red’ mode).

If levels of bacteria exceed the levels set out in the ‘Action/Red’ mode, then contact recreation in the water is deemed to pose an unacceptable health risk. At this stage the PHU informs the public of the elevated risk of illness through sign-posting, media releases and/or phone or website.

While freshwater exceedances are assessed for compliance on the result of a single sample, the guidelines require two samples taken within 24 hours to exceed the action level of 280 enterococci CFU/100mL for marine waters. For the purposes of this report we have reported on both:

- The strict two consecutive sample exceedance protocol; and

- Single sample exceedances.

It is important to note that health-based risk communication generally adopts a precautionary approach, which aims to protect the most vulnerable members of the public.

The recreational shellfish-gathering microbiological guideline values are also obtained from the MfE and MoH Guidelines (2003, section F). The guidelines state that:

- The season median faecal coliform concentration should not exceed 14 CFU/100 mL; and
- No more than 10% of samples per season should exceed 43 CFU/100 mL.

1.4 Annapolis Protocol and Beach Grading

The MfE and MoH guidelines (2003) use risk-based management of recreational waters. This is done by combining 1) an assessment of the potential inputs of adjacent land use and contaminated water to a site with 2) an assessment of the historical monitoring results (5 years) from the site to generate 3) a 'Suitability for Recreation Grade' (SFRG). These grades are described with site specific information in Section 4. They may be used to advise the public of the sites most suitable for swimming and other recreational activities.

1.5 Recommendations from 2014/2015 and actions

The 2014/2015 edition of this report made several recommendations for actions to be taken to improve the collation and communication of information on recreational water quality. Last year's recommendations and the actions taken in response to the recommendations were the following:

1. Faecal sterol analyses to be undertaken at Porangahau Estuary, Puhokio Stream and Clive River and Mahia Beach, or at any other problematic sites during the next season when an opportunity arises, even if rainfall has contributed to the exceedance.

Action taken: Faecal sterol analysis and PCR analysis undertaken at various sites, focusing on estuarine water quality (see results section).

2. Better dissemination of data to public through HBRC website.

Action taken: HBRC has redeveloped its website structure to provide an interactive, friendlier user interface. Results were made available on the LAWA website during the 2014/2015 season.

2 Methodology

2.1 Sampling

Thirty-eight sites within Hawke's Bay were sampled during the 2015/2016 season. These sites are commonly used for recreational purposes that include swimming, water skiing, rowing, diving, fishing, surfing and shellfish gathering.

Sampling of these sites was undertaken on a weekly basis, with the exception of the Clive River and Puhokio Stream, which were sampled fortnightly as they have a history of persistently poor water quality and are permanently signposted. Due to a 'Very Poor' and 'Poor' respectively, Suitability for Recreation Grading (SFRG), contact recreation at these sites is discouraged and permanent signs have been erected.

Sampling was scheduled for Monday of each week for a 20 week period over the summer season, between November and March. Samples were collected and stored in accordance with the sampling procedures outlined in sections D2 and E2 of the MfE and MoH guidelines (2003) until laboratory analysis. Associated environmental information was collected for each site at the time of sampling, including temperature, turbidity, electrical conductivity and the number of people present.

When sample results exceeded guideline values for freshwater sites, the rainfall data for that particular catchment was reviewed. If cumulative rainfall of more than 8 mm was recorded at any of the catchment rainfall station(s) over the preceding 72 hour period, it was assumed that the exceedance was related to rainfall, and follow-up sampling was not required. Previous research has shown that elevated bacterial levels caused by rain return to green mode levels within 3 days of heavy rain (Stansfield, 2002). Where exceedances were not related to rainfall (i.e., cumulative rainfall was less than 8 mm in 72hrs), follow-up sampling was conducted. Follow-up sampling was conducted for all exceedances in marine waters, regardless of antecedent rainfall, in accordance with MfE and MoH guidelines (2003).

The results of the sampling programme are available on the swimming tab on the HBRC website (<http://www.hbrc.govt.nz/Services/Environmental-Sciences/Water/Pages/rec-water-quality.aspx>). Or look for the swimming tab on the bottom of the HBRC home page.



Results were also uploaded to the Land and Water Aotearoa website (<http://www.lawa.org.nz/explore-data/hawkes-bay-region/>).

2.2 Sampling sites

Sites monitored under this programme are selected according to several criteria. Each site is either:

- A popular recreational site;
- An area identified as being used for 'Contact Recreation' under the Regional Coastal Environmental Plan (HBRC, 2008);
- A site that will provide information useful when determining the state of the environment;
- A site that will provide data useful to identify trends in coastal, estuarine and freshwater quality; or
- A site selected in co-operation with the TLAs and the PHU.

In general, many of these sites are used most heavily over a 2 week to 6 week period around Christmas and New Year. During this period, the population of the adjacent communities can increase by several orders of magnitude as holidaymakers arrive, leading to associated water quality issues resulting from overloaded septic tanks.



Figure 2-1: Hawke's Bay recreational monitoring sites.

2.3 Data analysis

The data derived from the previous seasons' monitoring were analysed to identify significant trends over time. Data from all the previous seasons were collated and any follow-up samples removed from the dataset. Temporal trend analysis (Mann-Kendal) was carried out using NIWA's water quality trends software (Time Trends 2013).

Test results were considered significant if they met both of the following criteria:

- The results were significant at 95% confidence level; and
- The slope of the line indicated a change greater than 1% per year in the variable concerned.

2.4 Suitability for Recreation Grade

The Suitability for Recreation Grade (SFRG) describes the general water quality of a site by combining 5 years of monitoring data (the Microbial Assessment Category - MAC) with a catchment risk assessment (the Sanitary Inspection Category - SIC), to produce a grade which indicates the *general* state of water quality at the site.

The SFRG grade descriptions can be used to indicate how suitable a site is for contact recreation, as follows (see also MfE & MoH, 2003):

Very Good – the site has generally excellent microbial water quality and very few potential sources of faecal pollution exist. Water is considered suitable for contact recreation almost all of the time.

Good – the site has water quality considered suitable for contact recreation most of the time. Swimming should be avoided during or following heavy rain.

Fair – the site has water quality generally suitable for contact recreation, but because significant sources of faecal contamination exist, extra care should be taken to avoid swimming during or following rainfall or if signs of pollution, such as discoloured water, odour, or debris in the water exist.

Poor – the site is susceptible to faecal pollution and microbial water quality is not always suitable for contact recreation. During dry weather conditions, ensure that the swimming location is free of signs of pollution, such as discoloured water, odour or debris in the water, and avoid swimming at all times during and for up to three days following rainfall.

Very Poor – the site is very susceptible to faecal pollution and the microbial water quality may often be unsuitable for contact recreation. Swimming at these sites is not recommended.

Follow-Up – there is contradiction between the bacterial levels observed in the MAC, and the *risk* outlined in the SIC, which requires further work. For example - the catchment risk based on the SIC appears low, but the 95% percentile of the observed bacteria levels is high; or the catchment risk is assessed as high, but the 95th percentile of the observed bacterial levels is low.

2.5 Faecal Source Tracking

Sites with known water quality issues are selected for faecal source tracking work. This involves collecting extra samples when bacteria concentrations are high, and processing these samples for Faecal Sterol (organic molecules) and Polymerase Chain Reaction (PCR) analyses.

PCR analysis uses bacterial DNA to identify which type of animals produced the faeces. A faecal sterol profile distinguishes the relative contribution made by different animal groups to a sample containing faeces. This sterol profile can discriminate between species, and both methods can discriminate between bacteria of an animal and a vegetative origin. Combined, these two approaches can give a high degree of confidence on the source of faecal bacterial contamination in a sample.

Sites tested this season include Wairoa River, Te Mahia, Maungawhio Lagoon, Waipuka Stream, and Kairakau Lagoon.

3 Results

3.1 Northern Region



Figure 3-1: Northern sub-region 2015-16 sites with SFRG's and long term trends in water quality.

Mahanga Beach



Mahanga Beach lies on the north-eastern side of the Mahia Peninsula. There is a small resident population and several holiday baches, however the area is expanding, with subdivision occurring inland toward Kaiwaitau Road. At present, the settlement is serviced solely by septic tanks. One public toilet exists.

Season summary

Mahanga Beach was sampled 20 times this season with 100% of samples within contact recreation guidelines.

Description of recreation value

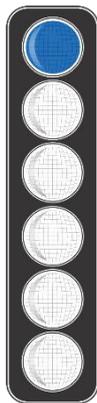
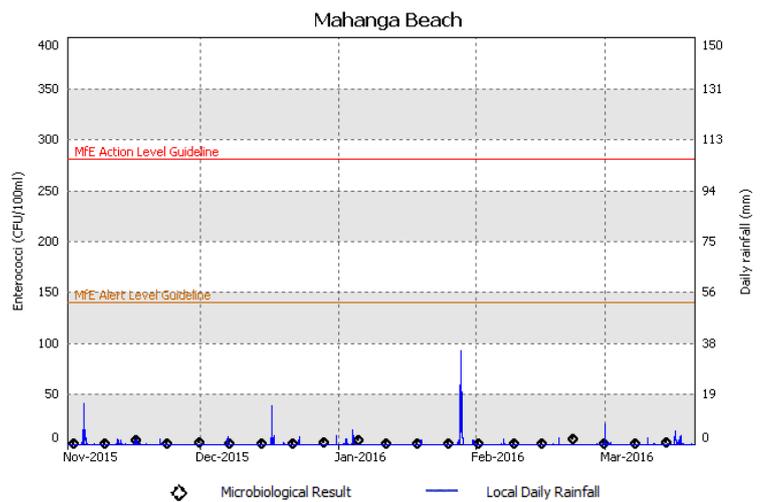
Mahanga Beach is a fine-grain sand beach with associated dune system. The beach is commonly used for swimming, surfing, fishing and picnicking.

Trend in recreational water quality over time

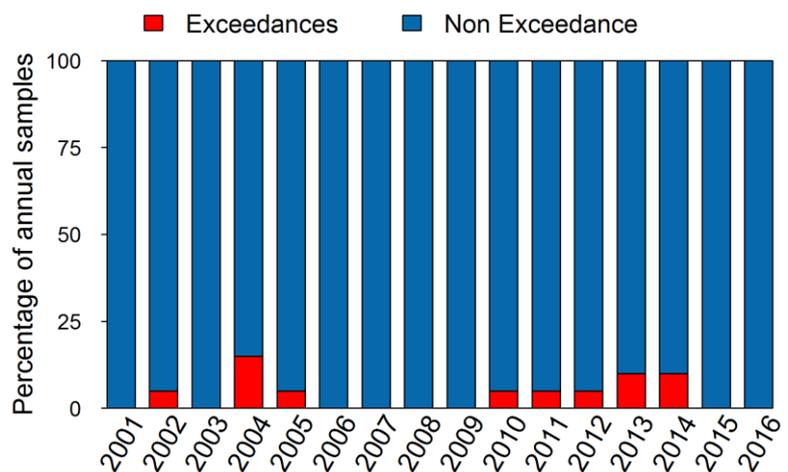
Elevated bacteria concentrations were generally observed after heavy and prolonged rainfall.

The SFRG for this season changed to 'Very Good' from 'Good'.

This has resulted from a decrease in the catchment risk assessment based on information obtained from faecal source tracking which has identified plant sources rather than human or bird sources.



Very Good



Historical Exceedances

Te Mahia at Boat Ramp



The Te Mahia at Boat Ramp site lies at the mouth of the Whangawehi Stream. This area is regularly used by the local community for recreational activities as well as being the downstream receiving environment of the largest catchment on the Mahia Peninsula. This catchment includes the forested area that will receive the Mahia community wastewater via land application. Te Mahia at Boat Ramp was added as a new site in 2010/11.

Season summary

Te Mahia was sampled 20 times this season of which 90% (18/20) were within contact recreation guidelines, and the remaining 10% (2/20) exceeded guideline values.

Description of recreation value

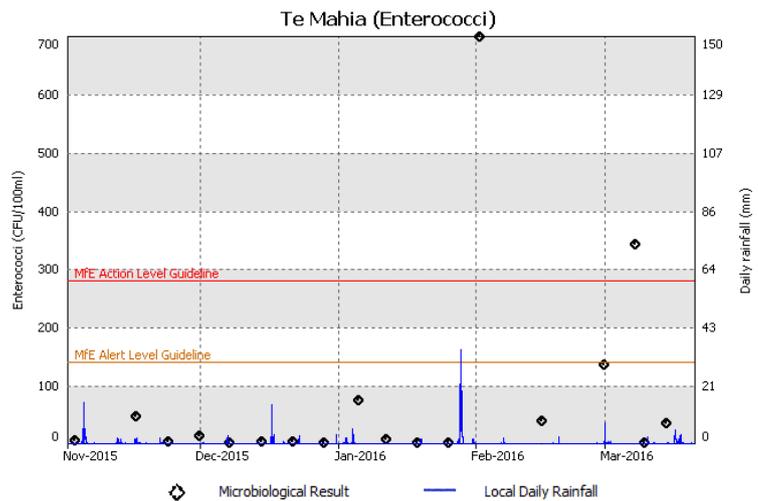
Te Mahia is a sandy estuarine environment with a boat jetty and launch ramp. The channel is used for boating access to the sea. The area is also used for swimming and fishing.

Trend in recreational water quality over time

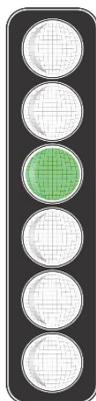
Elevated bacteria concentrations are generally observed in dry weather and after heavy and prolonged rainfall.

There was a significant trend in the water quality data, indicating a significant improvement. Faecal source tracking was undertaken twice at this site, and indicated ruminant and avian faecal origin.

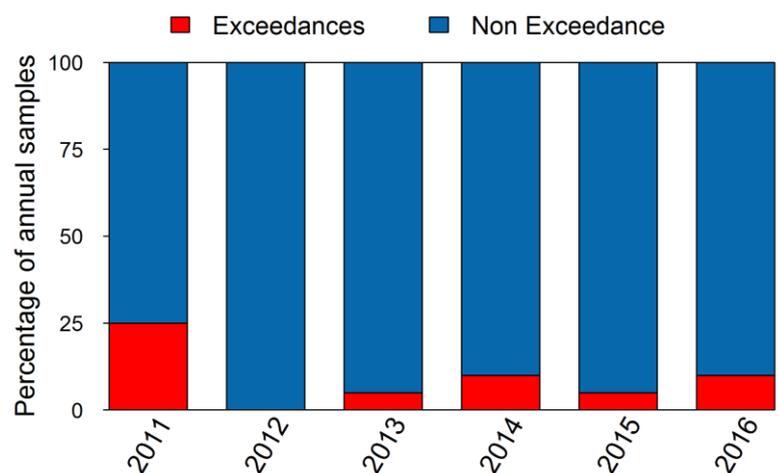
There was a SFRG change from 'Poor' to 'Fair', following 2 years of improving water quality.



Note: exceedance re-samples shown in the graph also.



Fair



Historical Exceedances

Maungawhio Lagoon



Description of recreation value

The lagoon has vast sand and mud flats, with a raised barrier dune system. The area is regularly used for swimming, picnicking, fishing and shellfish gathering.

Trend in recreational water quality over time

Elevated bacteria concentrations are generally observed after heavy rainfall.

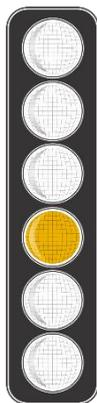
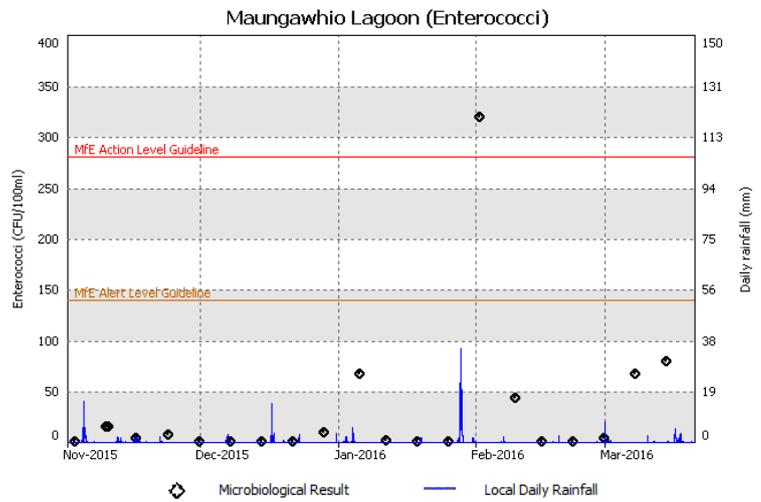
There was a significant improvement in recreational water quality. Faecal source tracking was undertaken and identified the ruminant faecal origin.

The SFRG for the site was upgraded from an interim 'Very Poor' grading to, 'Poor'. There is now 5 years of enterococci data.

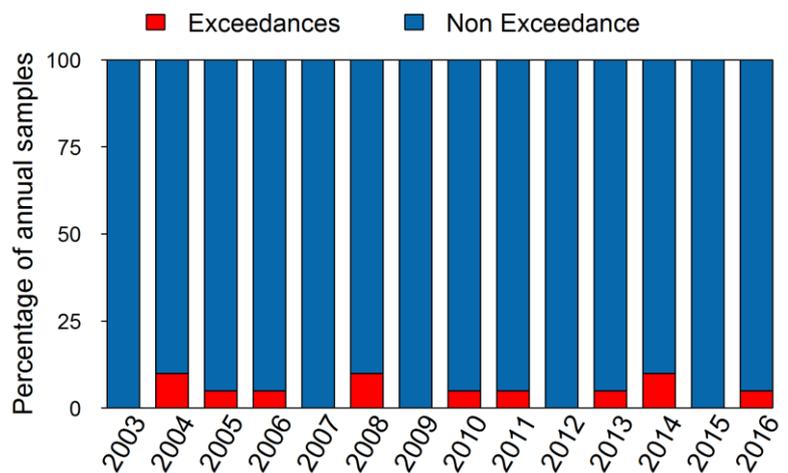
The Maungawhio Lagoon is located on the northern side of Mahia Peninsula. The estuary is formed at the mouth of the Kopuawhara River. The lagoon has been identified as a significant area in Hawke's Bay's Regional Coastal Environment Plan, and is important for fish spawning, breeding and roosting of water birds. Maungawhio Lagoon is also monitored for the impacts on water quality that may compromise consumption of shellfish. There is a freedom camping site here with a public toilet and changing room.

Season summary

Maungawhio Lagoon was sampled 20 times this season, of which 19 (19/20) were within contact recreation guidelines, and one exceeding.



Poor



Historical Exceedances

Wairoa River



The Wairoa River sample site is located at the ski club boat ramp upstream of the town bridge. The predominant land use within the catchment is agricultural with sheep/beef farming and some dairying. There are several discharges into the river, with meat works both upstream and downstream, and a municipal sewage discharge downstream of the site. Several storm water drains also flow into the river, and both active and closed landfills are located near the mouth of the river.

Season summary

Wairoa River was sampled 20 times this summer of which 80% (16/20) were within contact recreation guidelines. 20% (4/20) of samples exceeded the levels for safe contact recreation. An extra 1 exceedance sample was taken.

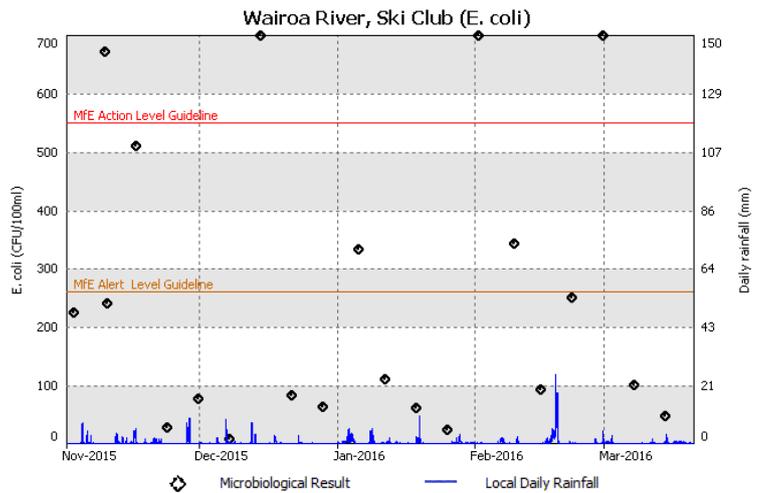
Description of recreation value

The Wairoa River site is located on the boat ramp of the ski club. The river provides calm water for skiers, rowers and other water sports. There is also a rowing club, which benefits from long stretches of flat water.

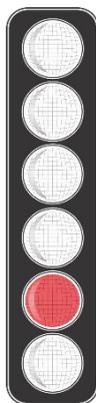
Trend in recreational water quality over time

Elevated bacteria levels are generally observed after heavy and prolonged rainfall. There was no significant change in water quality at this site. Faecal source tracking was undertaken to identify the faecal origin, a mixture of plant, avian and ruminant sources were identified.

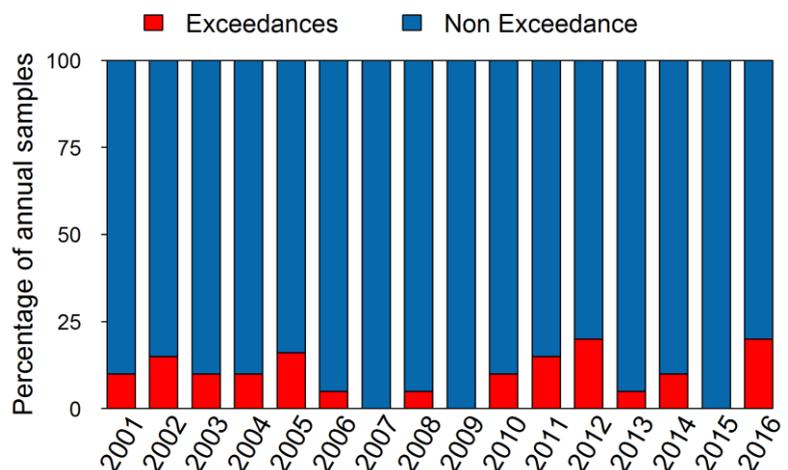
The SFRG remained at 'Very Poor' this season. The site has the highest 95th percentile indicator value of 2855 *E. coli* CFU/100 mL. An increase of 200 from last season.



Note: Exceedance re-samples are present in the season graph.



Very Poor



Historical Exceedances

Lake Tutira



Lake Tutira is the second largest lake in Hawke’s Bay, located approximately 50 km north of Napier. The surrounding land use is predominantly sheep/beef farming and some forestry. It is a popular camping and holiday area throughout summer.

Cyanobacteria (blue-green) algae are present in the lake and these can bloom rapidly. Cercarial dermatitis (Duck itch) is also present. There is permanent signage at the lake warning lake users of the water quality issues.

Season Summary

Lake Tutira was sampled 20 times this season 100% (20/20) were within contact recreation guidelines. An extra 1 exceedance sample was taken.

Description of recreation value

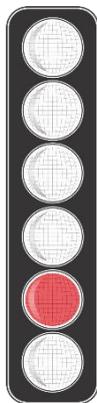
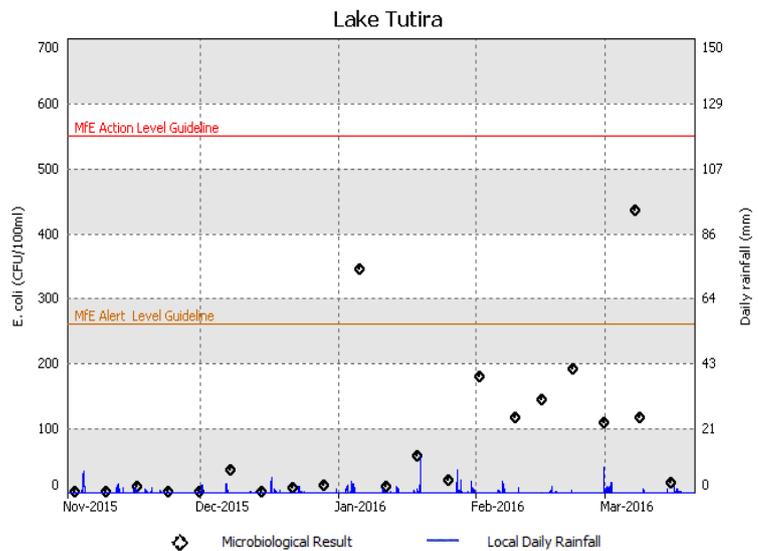
Lake Tutira is a designated country park, with a walking track around the shoreline. The lake is regularly used for canoeing, swimming, trout fishing and boating. There are several picnic areas and a popular campground.

Trend in recreational water quality over time

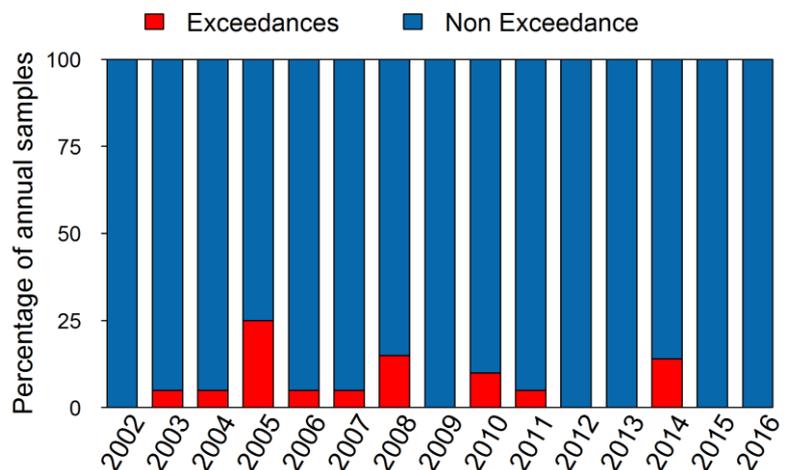
Elevated bacteria levels are generally observed after rainfall, when surface water runoff from adjacent farmland drains into the lake. High numbers of birds around the sampling area may contribute to elevated bacteria levels.

There has been no significant change in water quality at this site.

The SFRG remained unchanged this season with a grading of ‘Very Poor’. This is a manual grade to encompass all relevant risks to human health.



Very Poor



Historical Exceedances

3.2 Central Region

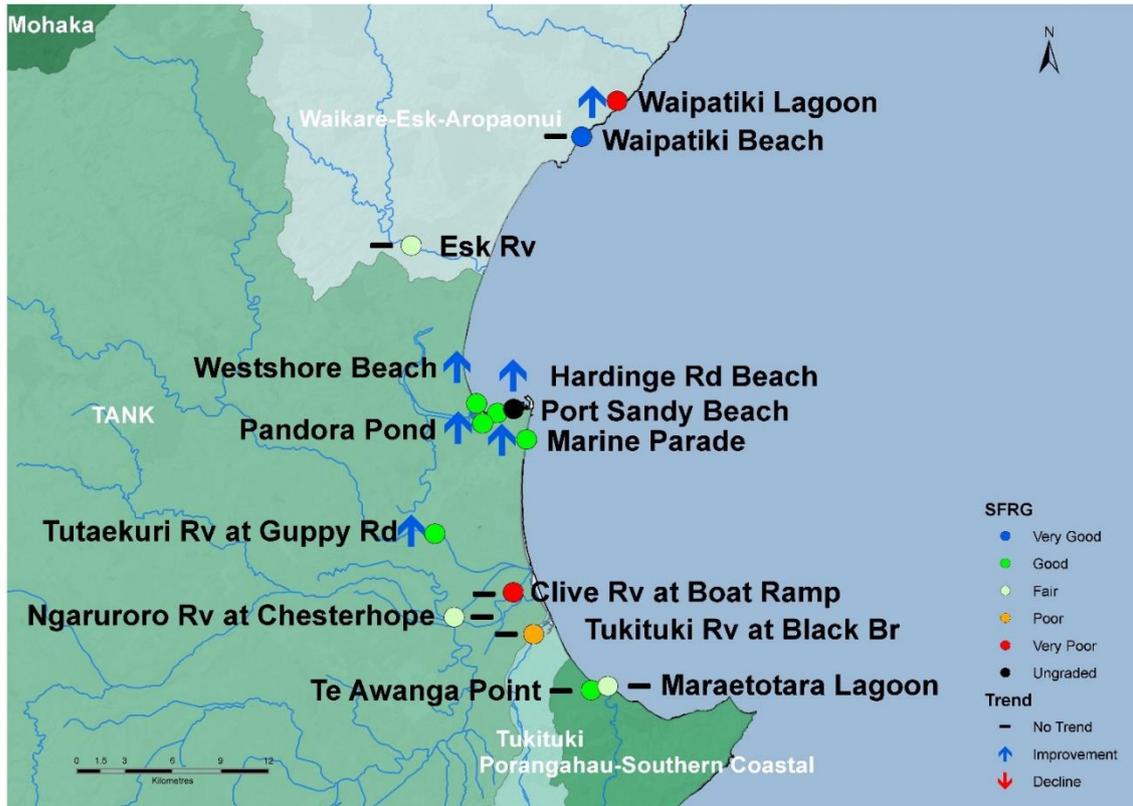


Figure 3-2: Central sub-region 2015-16 sites with SFRG and long term trends in water quality.

Waipatiki Beach



Waipatiki Beach is a small cliff-bound beach located approximately 20 km north of Napier. There is a small permanent community and holiday baches, and a popular campground. The area is currently being developed, and a community sewage treatment system was installed in 2006. The Waipatiki Stream has a steep pastoral and forested catchment with a lagoon behind the beach in the lower catchment which discharges into the coastal environment.

Season Summary

Waipatiki Beach was sampled 20 times this season 100% (20/20) of which were within contact recreation guidelines.

Description of recreation value

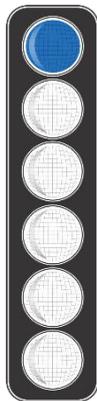
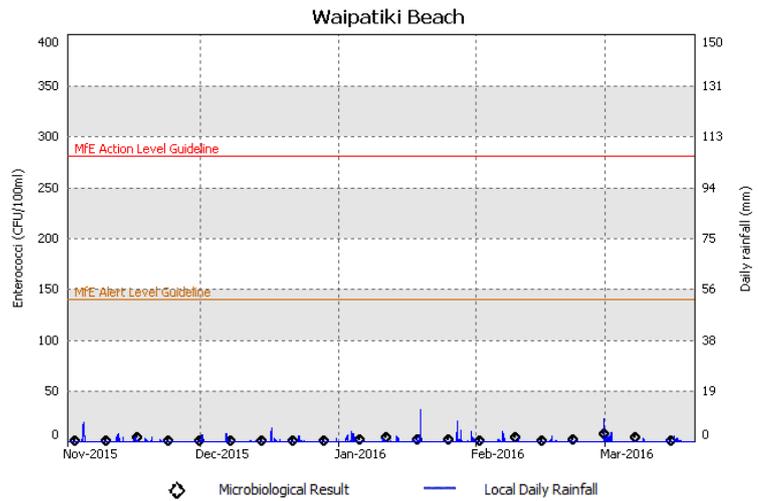
Waipatiki Beach is a medium sand beach that is commonly used for swimming, surfing, diving and other beach sports.

Trend in recreational water quality over time

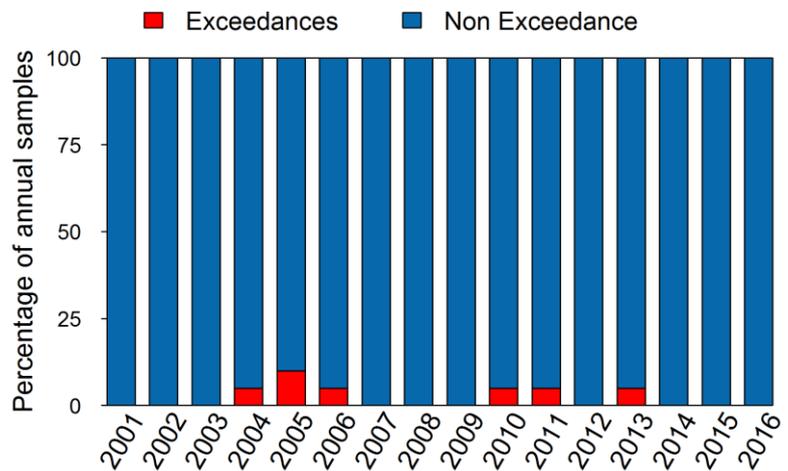
Elevated bacteria levels are generally not observed at this site.

There has been no significant change in water quality at this site.

The SFRG has upgraded to 'Very Good' from 'Good' which is a result of the MAC shift from category B to A.



Very Good



Historical Exceedances

Waipatiki Lagoon



Waipatiki Lagoon is at the mouth of the Waipatiki Stream. During normal flows the mouth of the lagoon is at the southern end of Waipatiki Beach however during low flows the mouth of the lagoon may become closed, restricting water flow. The Waipatiki Stream has a steep pastoral and forested catchment.

Season summary

Waipatiki Lagoon was sampled 20 times this season 100% (20/20) were within contact recreation guidelines.

Description of recreation value

Waipatiki Lagoon is a sandy and partly vegetated area. The lagoon is commonly used for swimming and is especially popular for children.

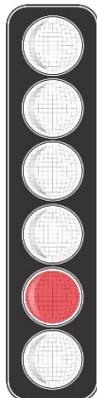
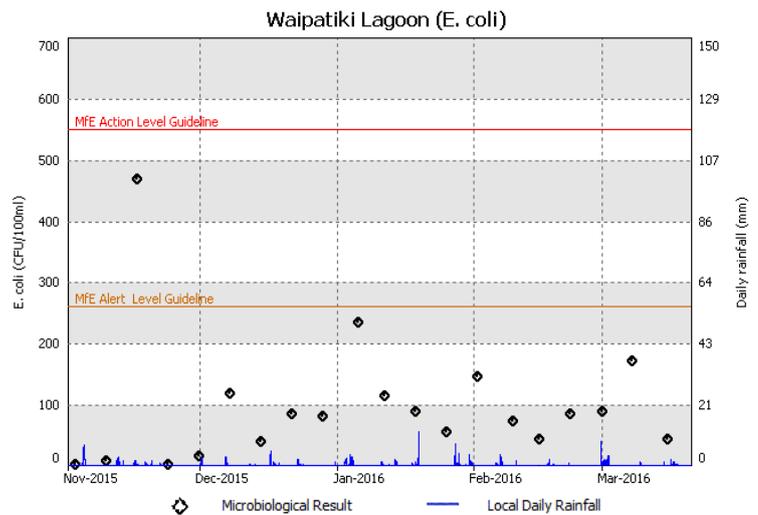
Trend in recreational water quality over time

Elevated bacteria levels are generally observed after heavy and prolonged rainfall, when increased surface water runoff enters the stream that discharges into the Lagoon.

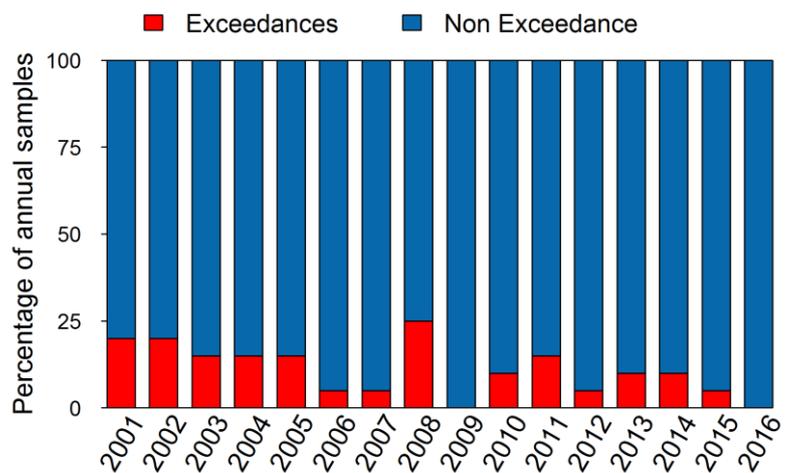
Faecal source tracking was undertaken in 2012/2013 and highlighted wildfowl as significant contributors of faecal contamination in this system.

There was a significant improving trend in recreational water quality.

The SFRG for this site has remained unchanged this season with a grading of 'Very Poor'.



Very Poor



Historical Exceedances

Esk River



Description of recreation value

The river is regularly used for canoeing, swimming and trout fishing. There are several picnic areas and a children's playground.

Trend in recreational water quality over time

Elevated bacteria levels are generally observed after heavy and prolonged rainfall, when surface water runoff from adjacent farmland drains into the river.

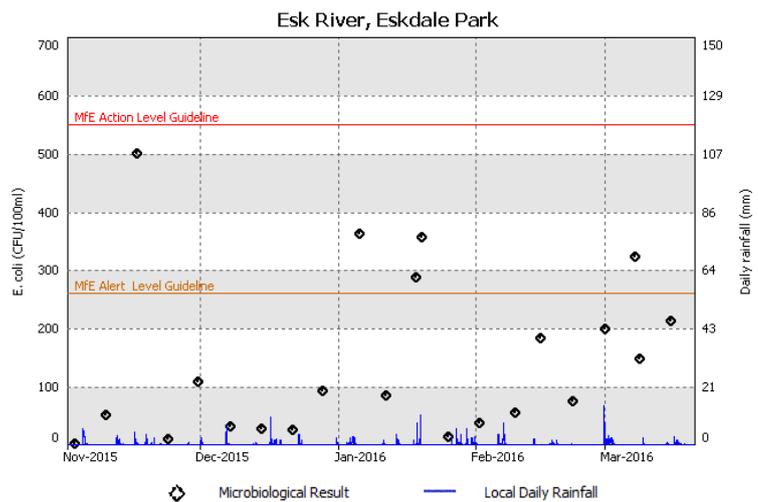
There has been no significant change in water quality at this site.

The SFRG remained unchanged this season with a grading of 'Fair'.

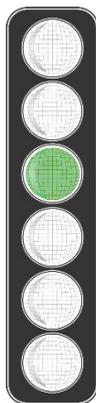
The Esk River is located along the Napier-Taupo highway in the Esk Valley, 15 minutes' drive from Napier. The surrounding land use is mostly sheep/beef farming, with some orchards and forestry. A piggery is also located upstream of the site. The immediate area surrounding the sample site comprises a park maintained by Hastings District Council, which includes a public toilet on the reserve.

Season Summary

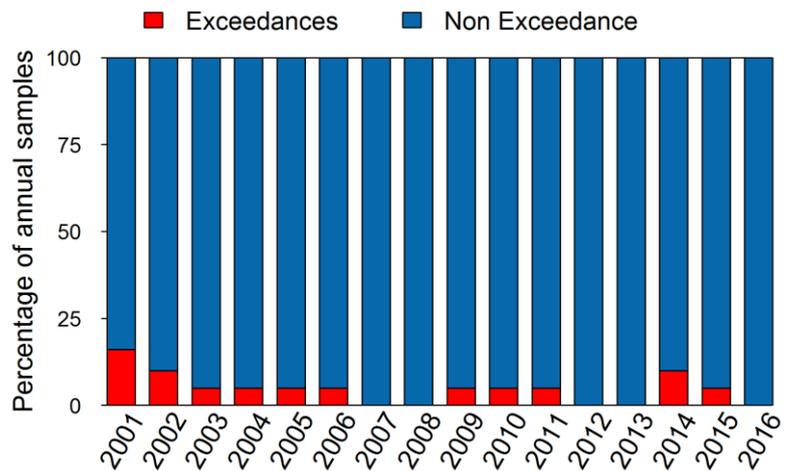
Esk River was sampled 20 times this season 100% (20/20) were within contact recreation guidelines. An extra 2 exceedance samples were taken.



Note: Exceedance re-samples are present in the season graph.



Fair



Historical Exceedances

Westshore Beach



Westshore Beach is located to the north of Napier City, and is popular with both locals and holidaymakers. A patrolled surf lifesaving club adds to the appeal of the beach. There are several storm water discharges into the marine area near the beach, but these do not appear to affect the water quality at this site.

Season Summary

Westshore Beach was sampled 20 times this season, 100% (20/20) were within contact recreation guidelines.

Description of recreation value

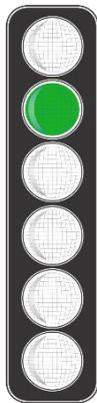
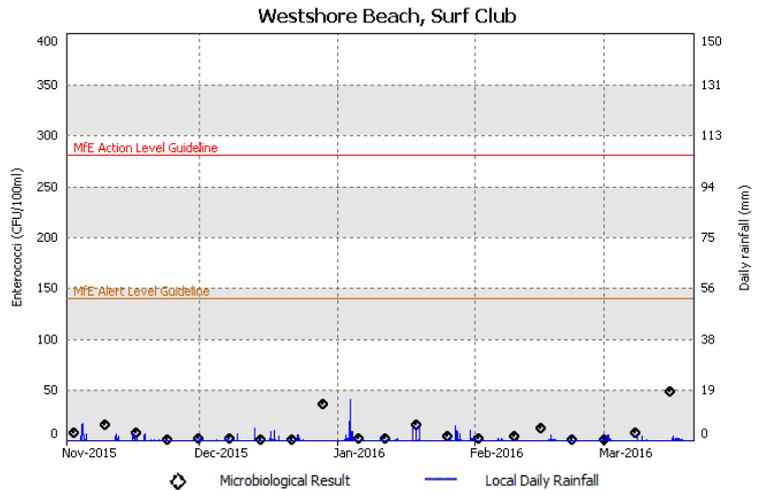
Westshore Beach has a surf club with a flagged area maintained throughout the summer. There is a reserve adjacent to the beach with a children’s playground.

Trend in recreational water quality over time

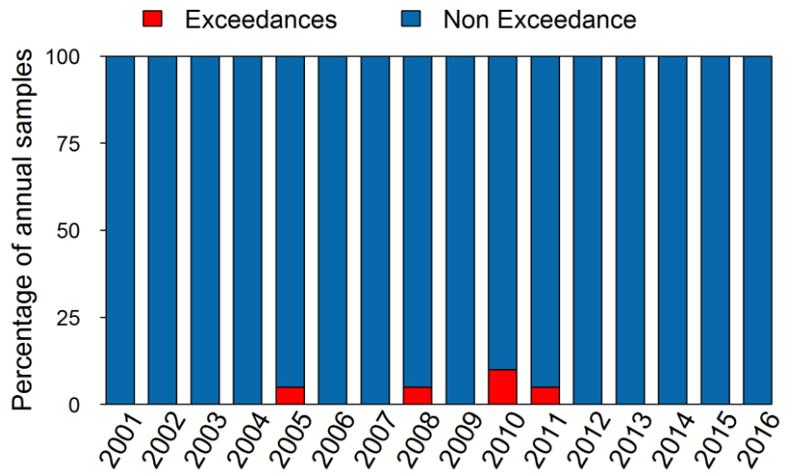
Generally, bacteria levels are good and seldom exceed guideline levels.

There was a significant improvement in recreational water quality over time.

There were no changes to the SFRG this season.



Good



Historical Exceedances

Pandora Pond



Description of recreation value

Pandora Pond is frequently used for recreational activities such as swimming, kayaking, rowing and sailing. Practice of waka ama is increasing, and there is now a storage facility there for the local club.

Trend in recreational water quality over time

Generally, bacteria levels are good and seldom exceed guideline levels.

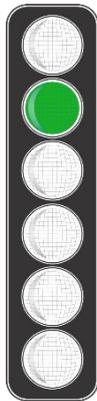
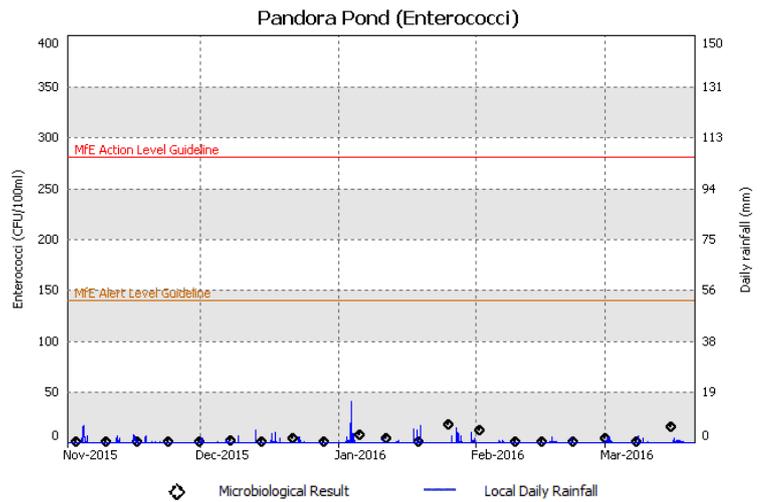
There was a significant improvement in recreational water quality over time.

There was no change in SFRG for the season.

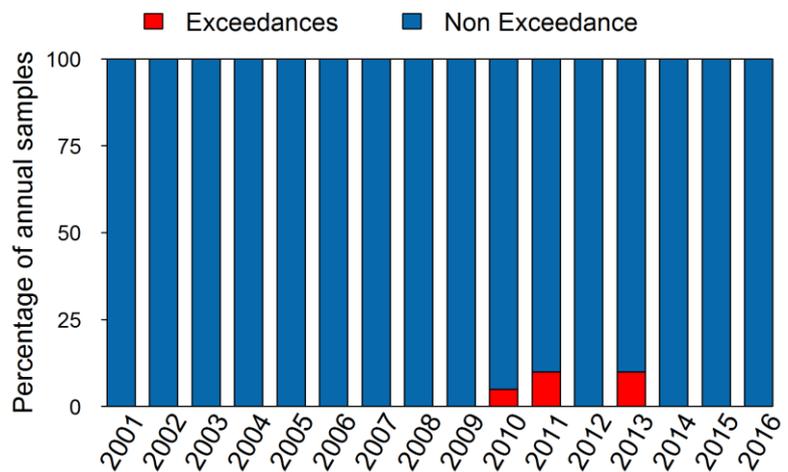
Pandora Pond is a small sheltered area of Ahuriri Estuary that is partially separated from the main estuary by a sand spit. It is close to Napier and the area adjacent to the pond has been extensively developed, encouraging increasing use. There are several storm water and industrial discharges into the Ahuriri Estuary adjacent to Pandora Pond.

Season Summary

Pandora Pond was sampled 20 times this season of which 100% (20/20) were within contact recreation guidelines.



Good



Historical Exceedances

Hardinge Road Beach



The beach at Hardinge Road is close to Napier City, and several cafes and shops now border the area. The site is a central location for summer recreation, with many visitors daily. The beach is adjacent to the entrance to the Inner Harbour and the Port of Napier.

Season Summary

Hardinge Road Beach was sampled 20 times this season 100% (20/20) of which were within contact recreation guidelines.

Description of recreation value

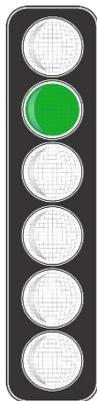
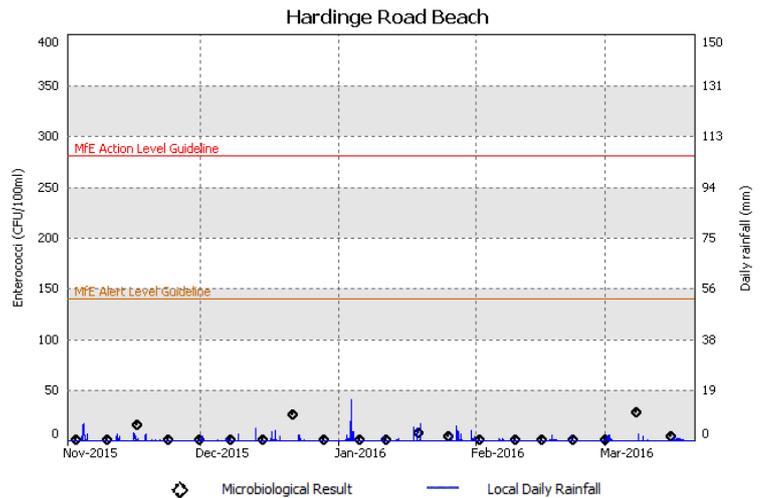
Hardinge Road Beach comprises a coarse sand and pebble mixture, with a grass-covered dune. Multiple facilities surround the beach including a children’s playground, beachfront boardwalk and restaurants. The beach is used for swimming, snorkelling and beach sports.

Trend in recreational water quality over time

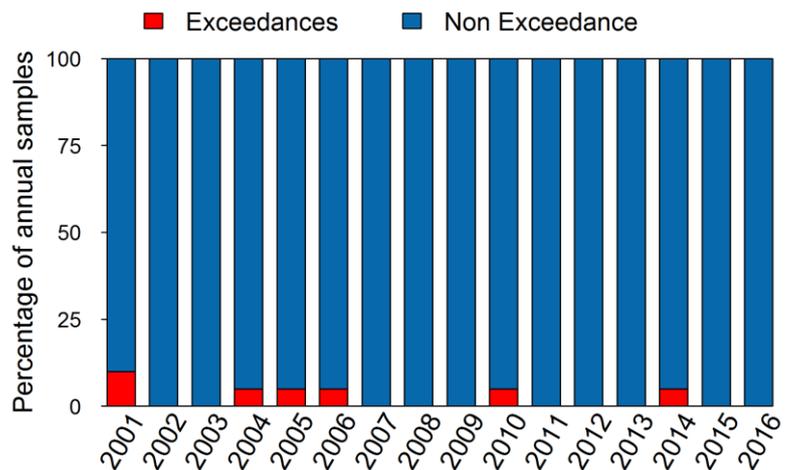
Generally, bacteria levels are good and seldom exceed guideline levels.

There was a significant improvement in recreational water quality over time.

The SFRG for this site has remained unchanged this year with a grading of ‘Good’.



Good



Historical Exceedances

Port Sandy Beach



Port Sandy beach is close to Napier city, and is nestled beside the port of Napier. The site is a central location for summer recreation, with many visitors daily. There is a public boat ramp in the corner of the beach which is protected by the port breakwater.

Season Summary

Port Sandy Beach was sampled 20 times this season 95% (19/20) of which were within contact recreation guidelines. One exceedance occurred on the 5th January 2016 (12,500 enterococci 100 mL), and would indicate a significant faecal source. This may have been an isolated event however an exceedance sample was taken.

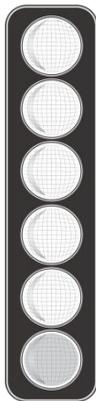
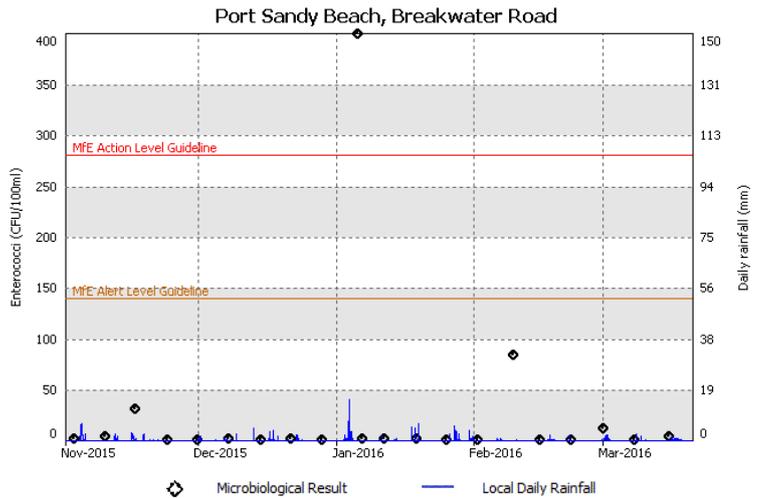
Description of recreation value

Port Sandy beach comprises a coarse/fine sand and pebble mixture, with a grass-covered dune. New planting of trees has occurred on the dune with the development of the car park. The beach is used for swimming, snorkelling and beach sports, and is popular with young families due to its protected nature.

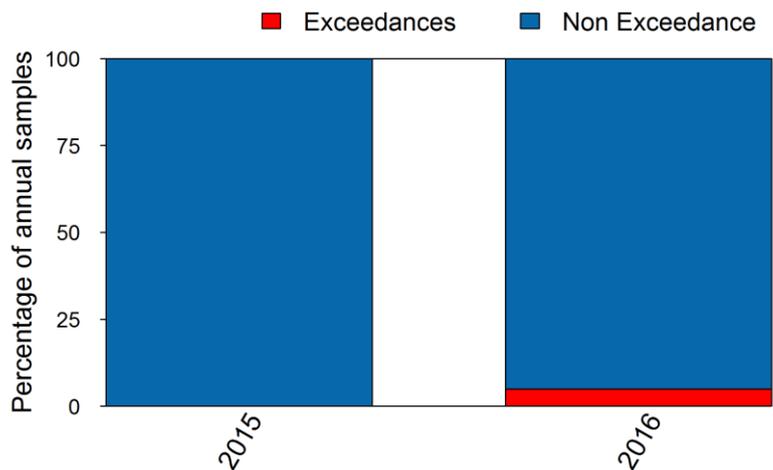
Trend in recreational water quality over time

This season was the second year in the recreational water programme. Therefore, no trends were analysed.

This site is currently ungraded for its suitability for recreation grade.



Ungraded



Historical Exceedances

Marine Parade



Description of recreation value

Marine Parade Beach comprises a coarse greywacke pebble beach. The beach has a steep drop-off and swimming within the flagged area is recommended. There is a coastal pathway, public toilet, bike hire shop and saltwater pool complex next to the site.

Trend in recreational water quality over time

Elevated levels of bacteria can occur infrequently after prolonged heavy rainfall events.

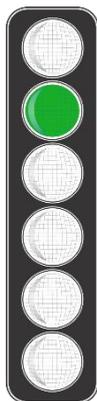
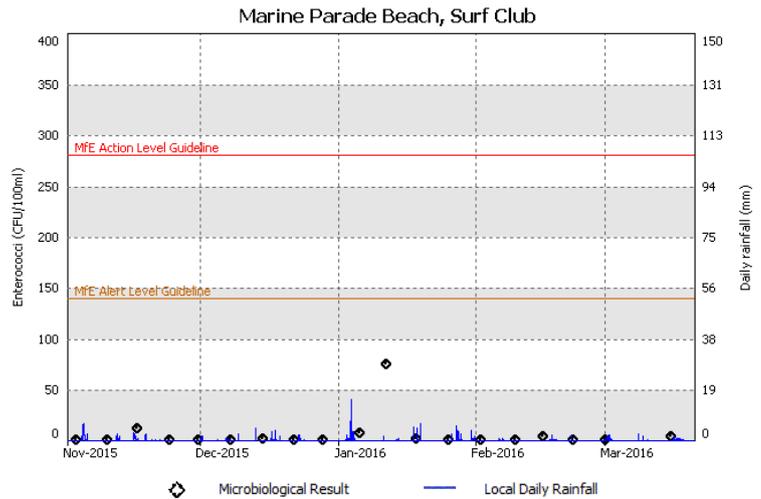
There was a significant improvement in recreational water quality over time.

Marine Parade has had the interim grading removed as the site has been on the programme for 5 years.

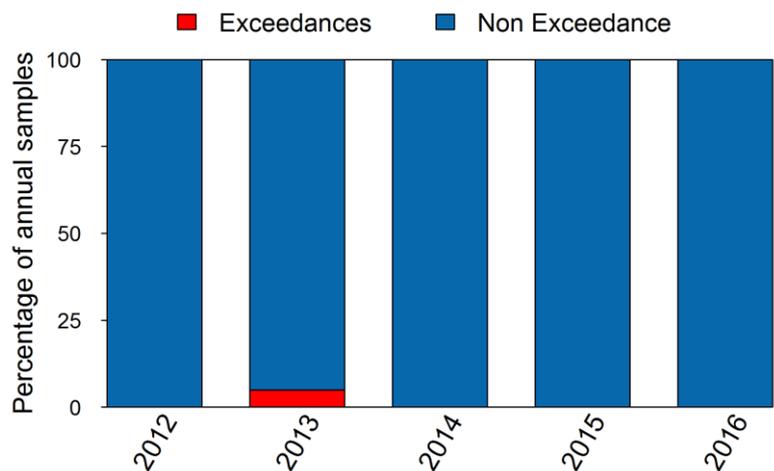
This site is adjacent to Marine Parade in Napier, in front of the Pacific Surf Club flagged area. Due to the proximity to metropolitan and residential areas of the city it was added to the monitoring programme in 2011 as a permanent site. The site experiences a high number of bathers throughout the summer.

Season Summary

Marine Parade Beach was sampled 20 times this season 100% (20/20) of which were within contact recreation guidelines.



Good



Historical Exceedances

Tutaekuri River



The Tutaekuri River site is close to Napier and accessed at the end of Guppy Road in Taradale. During the summer months it is a popular bathing spot. The river drains a predominantly agricultural catchment, with some intensive horticultural activities in the lower reaches.

Season Summary

Tutaekuri River was sampled 20 times this season 100% (20/20) of which fell within green mode.

Description of recreation value

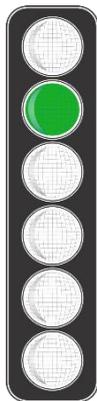
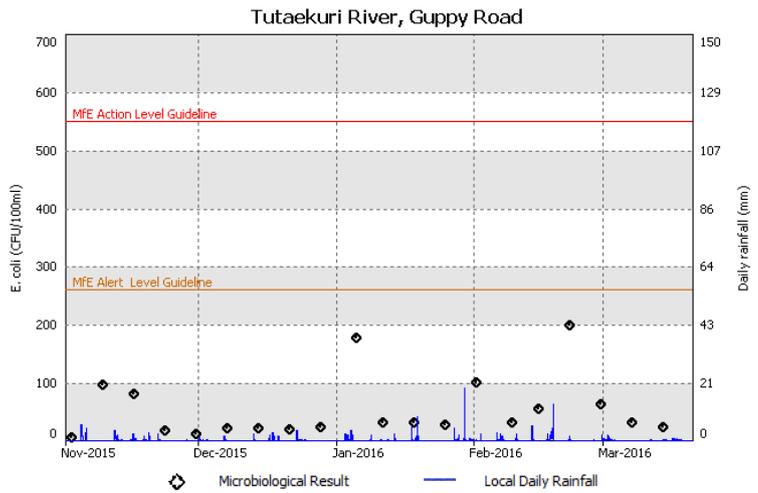
The Tutaekuri River is a relatively low flow river which is used by families for swimming. The river hosts a variety of users, including motor bikers, walkers, cyclists and swimmers. One of the Hawke's Bay cycle ways goes along the stop bank and there is a bike park upstream from the site.

Trend in recreational water quality over time

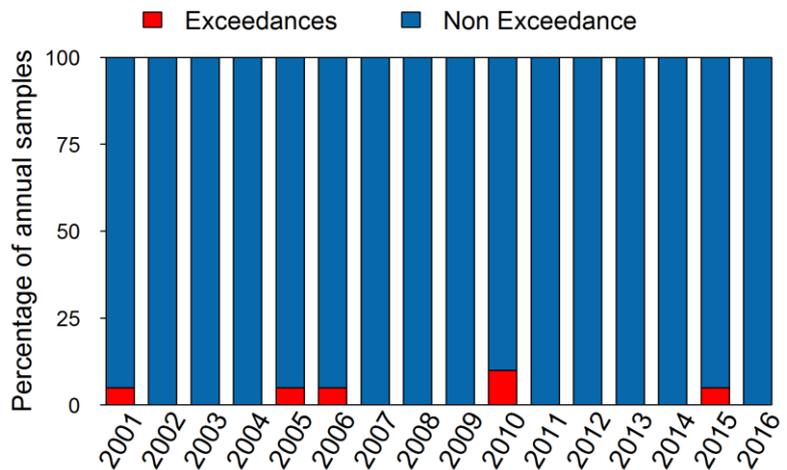
Elevated bacteria concentrations may occur following rainfall events at this site, during which surface runoff from the catchment transport bacteria to the river.

There was a significant improvement in recreational water quality at this site.

The SFRG for this site has upgraded to 'Good' from 'Fair', due to a MAC category shift from C to B.



Good



Historical exceedances

Ngaruroro River



The Ngaruroro River at Chesterhope Bridge site is located between Napier and Hastings on Pakowhai Rd. The Ngaruroro catchment is predominantly agricultural and is used for intensive horticulture in the lower reaches. The river is a popular bathing location during the summer for locals from Napier and Hastings.

Season Summary

Ngaruroro River at Chesterhope Bridge was sampled 20 times this season 95% (19/20) of which were within contact recreation guidelines, and 5% (1/20) which exceeded. An extra 1 exceedance sample was taken.

Description of recreation value

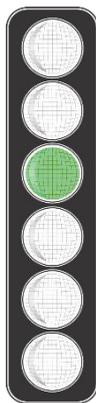
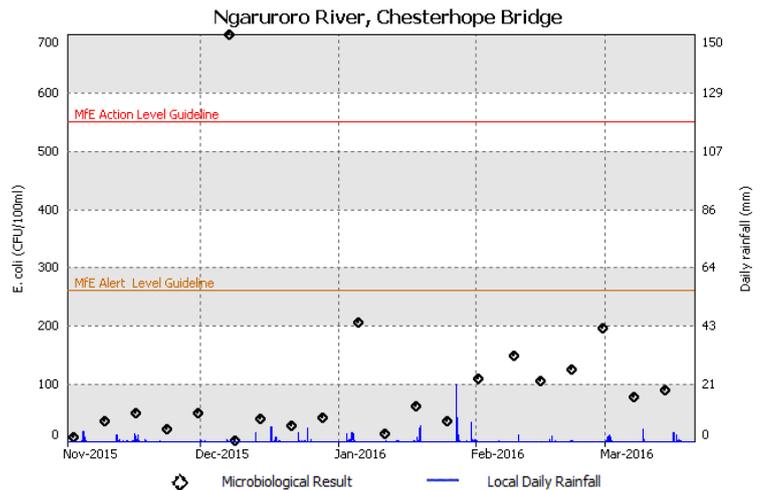
The Ngaruroro River is bordered largely by grassy flats with good access by car. Beside the bridge there is a deep swimming hole. There are many access points to the river along this run, which provides great family picnicking and swimming areas.

Trend in recreational water quality over time

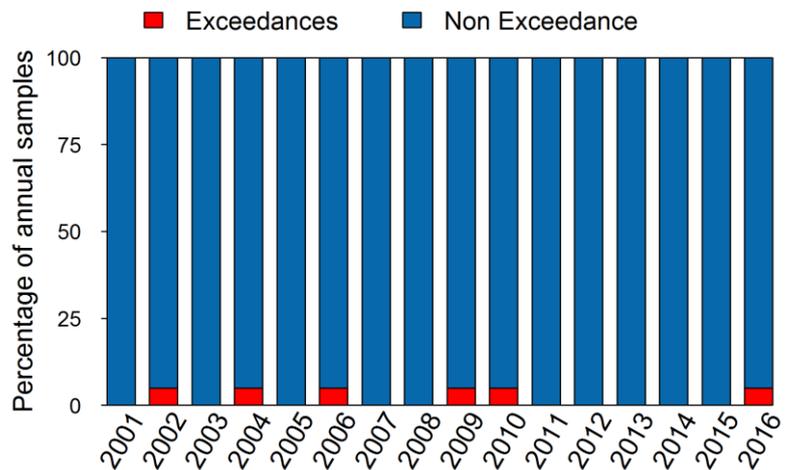
Elevated concentrations of bacteria generally follow rain events when increased surface runoff enters into the river from the surrounding catchment.

There was no significant trend in water quality.

There were no changes to the SFRG.



Fair



Historical exceedances

Tukituki River at Black Bridge



Description of recreation value

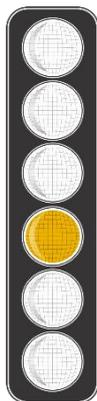
The Tukituki River is widely used for swimming and fishing. A Hawke's Bay cycle way goes along the stop bank and grassy flat areas are present for picnicking. This reach of the river is used extensively for white baiting during the season.

Trend in recreational water quality over time

Elevated concentrations of bacteria generally follow rain events, when increased surface runoff enters the river from the surrounding catchment.

There was no trend in water quality at this site over time.

The SFRG for this site remained unchanged this season at 'Poor'.

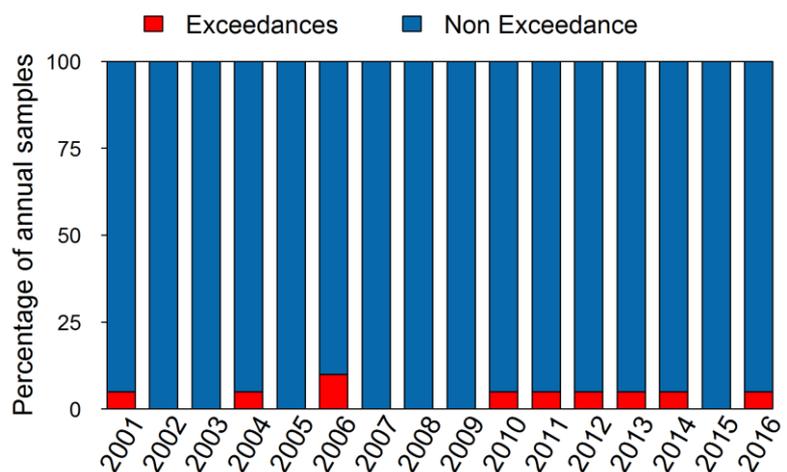
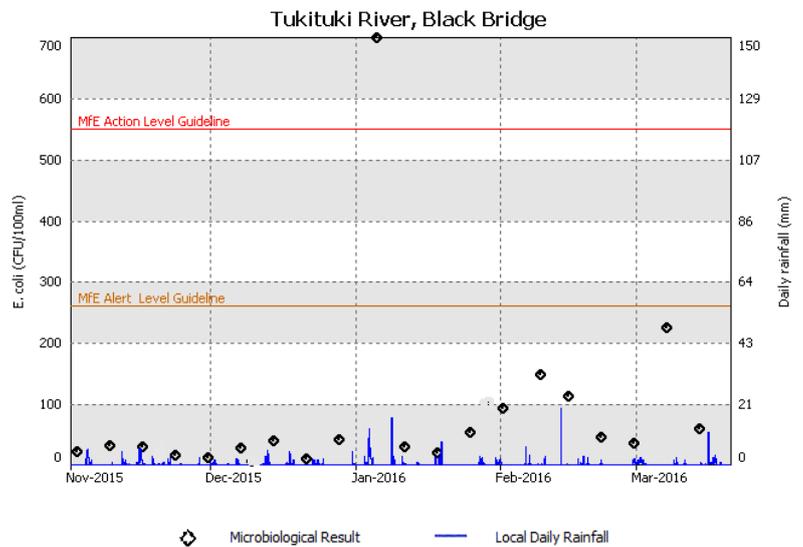


Poor

The Tukituki River at Black Bridge site is located at Haumoana. The large catchment of the Ruataniwha Plains is utilised for pastoral agriculture, horticulture and viticulture. The river enters an estuarine environment at Haumoana. The sampling site at Black Bridge is regularly used for swimming, fishing and other recreational activities.

Season Summary

Tukituki River at Black Bridge was sampled 20 times this season 95% (19/20) of which were within contact recreation guidelines and 5% (1/20) exceeding the red mode.



Historical exceedances

Clive River at SH2 Bridge



Description of recreation value

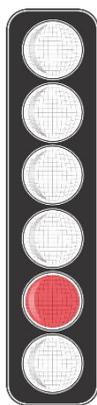
The river is used for rowing, water skiing, jet skiing and fishing. There is a free camping site and picnic tables.

Trend in recreational water quality over time

Elevated concentrations of bacteria generally occur after rain events, during which increased surface runoff enters the river from the surrounding catchment.

There was no significant trend in the data for this site.

The SFRG for this site has remained unchanged this season with a grading of 'Very Poor'.



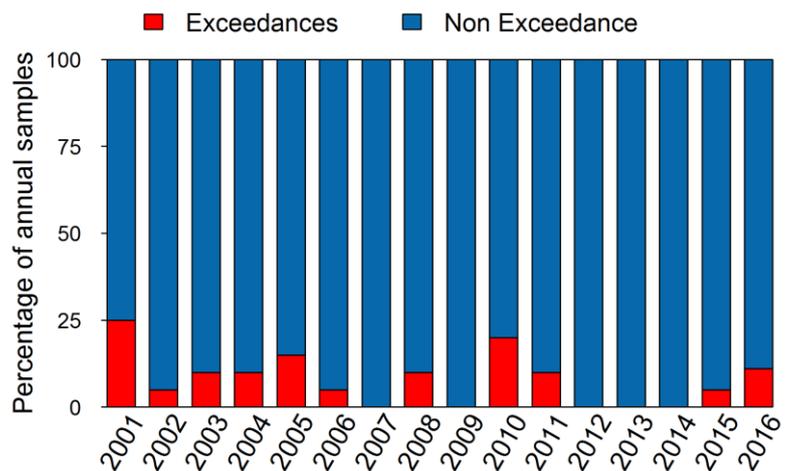
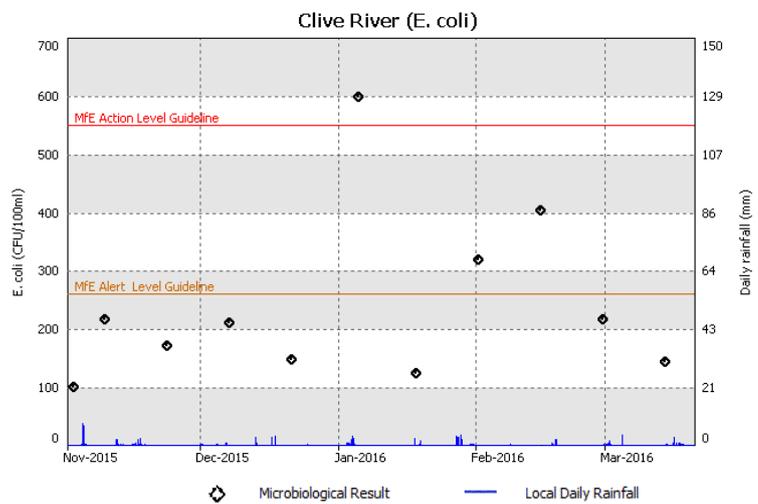
Very Poor

The Clive River at SH2 Bridge site is downstream of the road bridge at the boat ramp. The area includes a large body of relatively calm water that hosts many different user groups. This site is sampled fortnightly as it is permanently signposted. The catchment is characterised by pastoral, horticultural, viticulture, industrial and urban land use. The river is the main receiving environment for storm water from Hastings City and Havelock North.

Season Summary

Electrical conductivity measurements are used to determine the indicator bacteria used on the day of sampling. The Clive river was sampled 11 times this season (fortnightly).

The graph shows only the *E. coli* results to display the most sampled indicator. On days when *E. coli* were used (<10,000 µS/cm), 91% (10/11) were within contact recreation guidelines, while 1 sampled exceeded (9%).



Historical exceedances

Maraetotara Lagoon



The Maraetotara River passes through predominantly pastoral land to enter the coast via the Maraetotara Lagoon at Te Awanga. The Te Awanga camping ground is situated beside the northern embankment of the lower Maraetotara River, and the sample site is beside the main car park. Te Awanga is popular due to its diverse coastal features and close proximity to the Cape Kidnappers gannet colony.

Season Summary

Maraetotara Lagoon was sampled 20 times this season of which 90% (18/20) were within contact recreation guidelines, and 10% (2/20) exceeded. An extra 6 exceedance samples were taken.

Description of recreation value

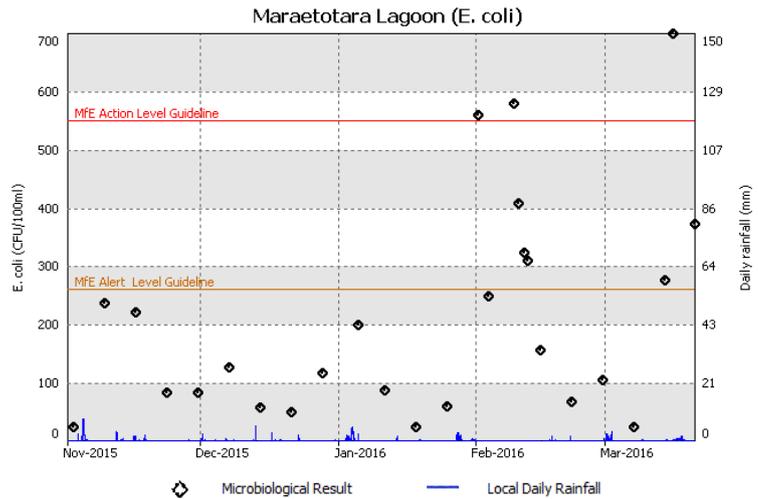
Maraetotara Lagoon is a calm estuarine barrier lake with a small outflow. The area is commonly used by families, and is popular throughout the summer for swimming and kayaking.

Trend in recreational water quality over time

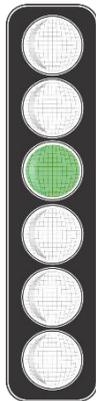
Elevated concentrations of bacteria generally follow rain events, which increase surface runoff from the surrounding catchment.

There was no significant trend in the data for this site.

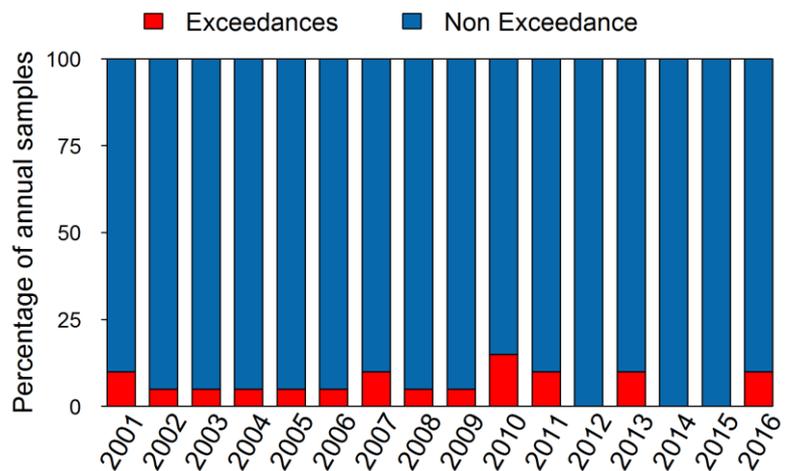
There were no changes in the SFRG.



Note: All exceedance re-samples are present in the season graph.



Fair



Historical exceedances

Te Awanga Point



The Te Awanga site is located adjacent to the Maraetotara Lagoon and has been included in the sampling programme to reflect the high number of users at this locality. It has a recognised surf break that at times attracts large numbers of surfers. The site has a reef environment as well as being the discharge point for the Maraetotara River.

Season Summary

Te Awanga Beach was sampled 20 times this season 100% (20/20) of which were within contact recreation guidelines.

Description of recreation value

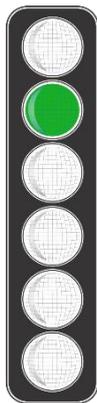
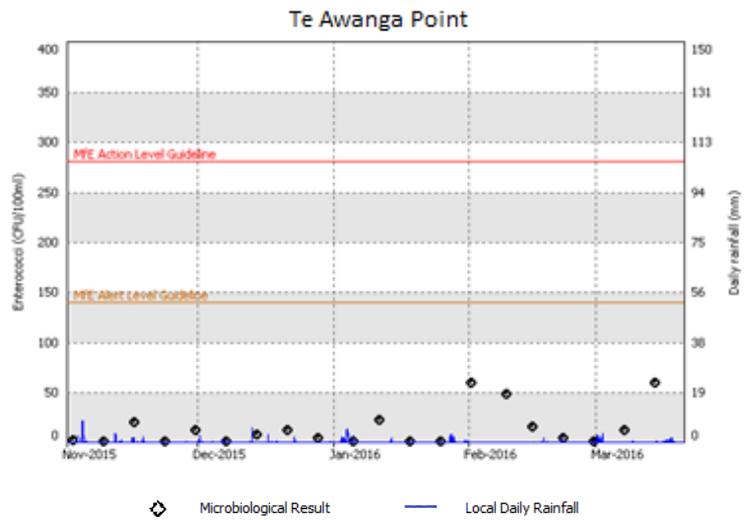
Te Awanga is a coarse gravel/pebble beach with sparse patches of sand. There is a sub-tidal reef beyond the point that generates surf. Other sporting activities enjoyed here are boating, kayaking, swimming and fishing.

Trend in recreational water quality over time

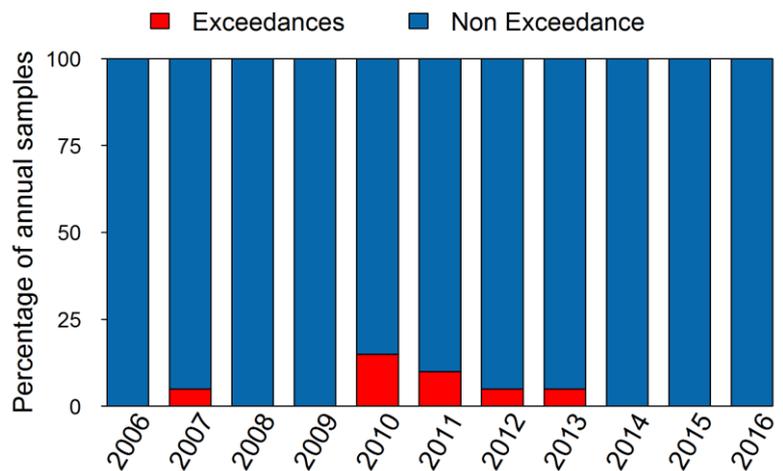
Elevated concentrations of bacteria may follow rain events, during which increased flow from Maraetotara Lagoon discharges into the coastal area.

There was no significant trend in the data for this site.

The SFRG was upgraded from 'Fair' to 'Good' due a MAC category shift from C to B.



Good



Historical exceedances

3.3 Southern Region

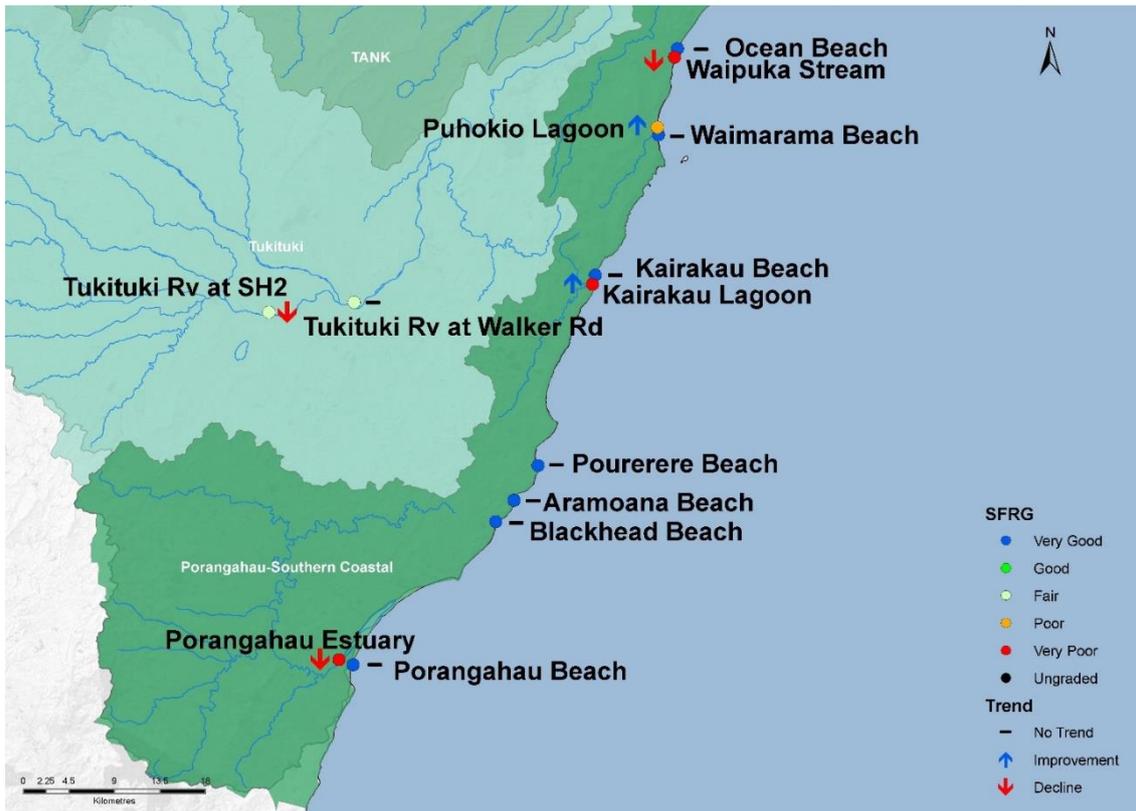


Figure 3-3: Southern sub-region 2015-16 sites with SFRG and long term trends in water quality.

Ocean Beach



Ocean Beach is an expansive beach on the southern side of Cape Kidnappers. The Beach is popular due to its largely unmodified coastal environment and proximity to Napier and Hastings. The Waipuka Stream discharges into the southern end of the beach. The beach has a small community of baches, which use individual septic tanks. Samples at this site are taken in the main swimming area, immediately in front of the surf lifesaving tower.

Season Summary

Ocean Beach was sampled 20 times this season 100% (20/20) of which were within contact recreation guidelines.

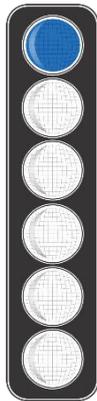
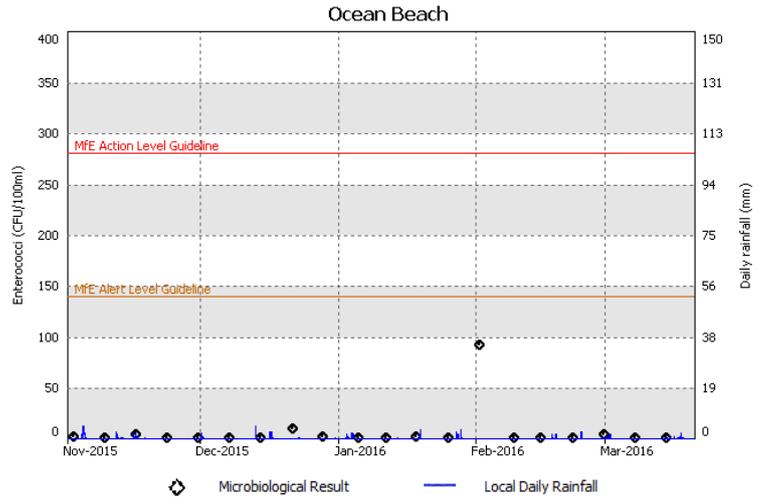
Description of recreation value

Ocean Beach is a sand beach with a nationally important dune structure that stretches north east to Cape Kidnappers. The beach is popular throughout the summer and there are weekend lifeguard patrols from November until March.

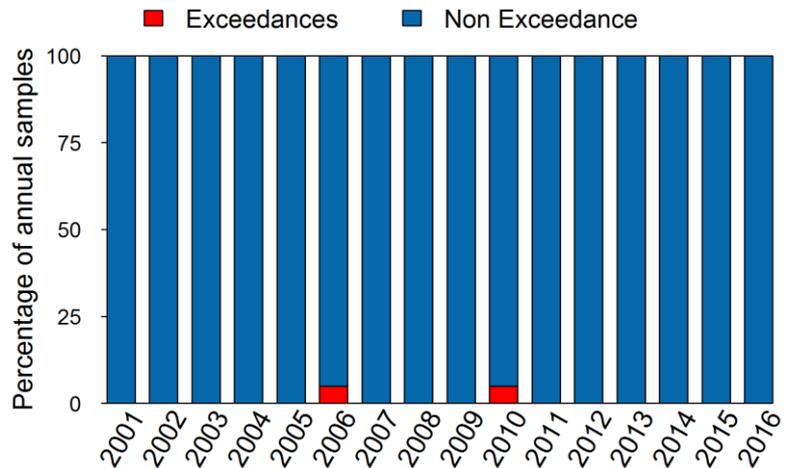
Trend in recreational water quality over time

There has been no significant change in water quality at this site over time.

The SFRG for this site has remained unchanged this season with a grading of 'Very Good'.



Very Good



Historical exceedances

Waipuka Stream



Description of recreation value

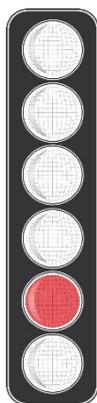
Waipuka Stream forms a small lagoon on Ocean Beach. The area is used by families because it has shallow, constant depth and the water temperature is consistently approximately 3°C warmer than the sea.

Trend in recreational water quality over time

Elevated concentrations of bacteria occur after rain events, when surface runoff to the stream from the surrounding catchment increases.

There was a significant decline in recreational water quality over time.

Last season and again for 2015/16 faecal source tracking determined the source as wild fowl (geese) within the catchment. The SFRG has remained unchanged at 'Very Poor'.

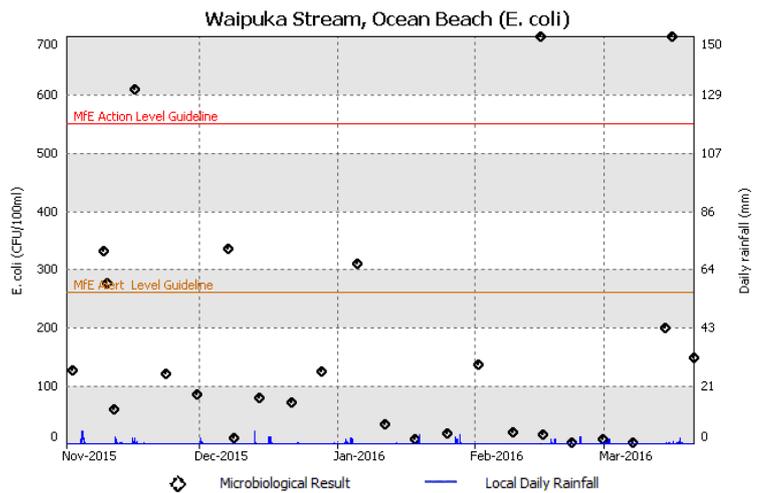


Very Poor

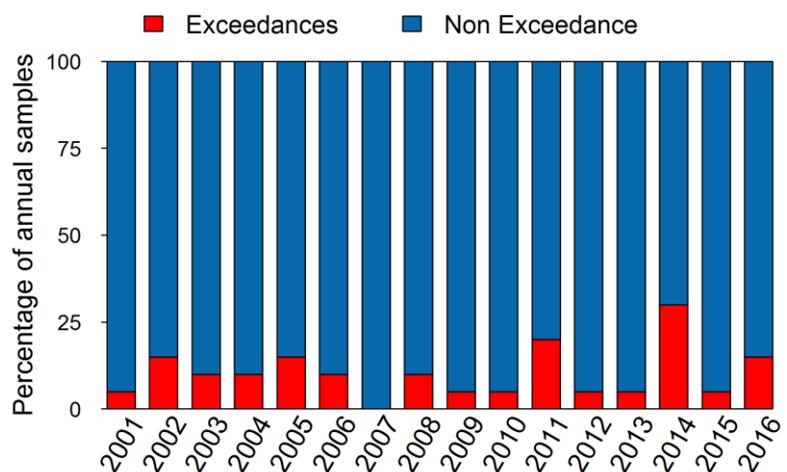
Waipuka Stream enters the sea at Ocean Beach. The catchment comprises steep pastoral land, with limited vegetation cover. The stream also passes by a small community of baches near its mouth, and often forms a lagoon, which is popular with small children. The mouth of the lagoon periodically closes with sand during summer low flows.

Season Summary

Waipuka Stream was sampled 20 times this season of which 70% (14/20) were in green mode, 15% were in amber mode and the remainder 15% (3/20) in red mode. There were 6 exceedance samples taken during the season.



Note: Exceedance results on graph.



Historical exceedances

Waimarama Beach



Waimarama Beach lies to the south of Napier City. Its proximity to both Hastings and Napier (45 minutes' drive), makes the area popular for both locals and visitors to the Bay. Waimarama Beach area has a large resident population as well as numerous visitor baches and a campground. Over the summer holiday period the population increases significantly, placing extra pressure on septic systems. The Puhokio Stream discharges into the centre of the beach.

Season Summary

Waimarama Beach was sampled 20 times this season of which 100% (20/20) were within contact recreation guidelines.

Description of recreation value

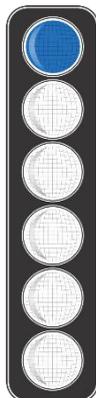
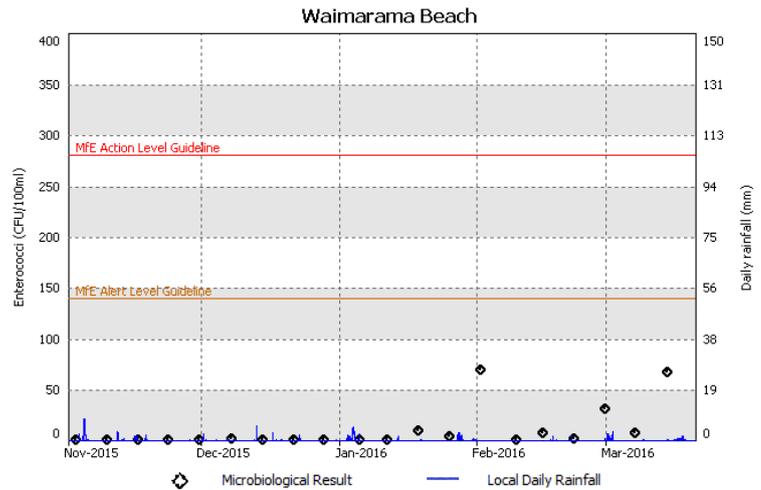
Waimarama Beach is a sand beach with intact dune systems. There are weekend lifeguard patrols at the southern end of the beach from November through until March. There is an offshore island, Bare Island, which is a common attraction for fisherman and divers. Surfing and other beach sports are common throughout the year.

Trend in recreational water quality over time

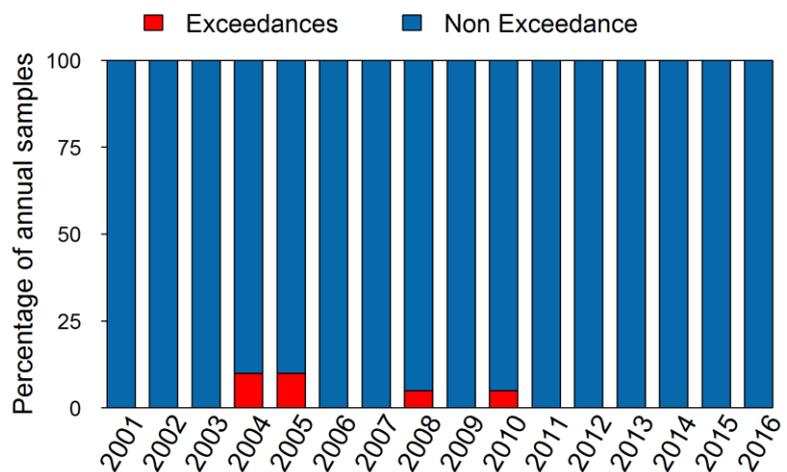
Bacteria levels generally remain within recommended guidelines. Heavy and prolonged periods of rain can cause increased surface runoff from the Puhokio catchment.

There has been no significant change in water quality at this site over time.

The SFRG for this site has remained at 'Very Good'.



Very Good



Historical exceedances

Puhokio Stream



The Puhokio Stream passes through the Maraetotara catchment, the Waimarama settlement and discharges into Waimarama Beach approximately halfway along the beach. The catchment is predominantly agricultural. The stream discharges into an estuarine environment.

In the past, the stream has shown high levels of faecal contamination, sourced from both agriculture and on-site wastewater treatment system malfunction.

Season Summary

Puhokio Stream was sampled 11 times (fortnightly) this season of which 63.64% (7/11) were in green mode, 36.36% (4/11) in amber mode. There was 1 exceedance sample taken during the season.

Description of recreation value

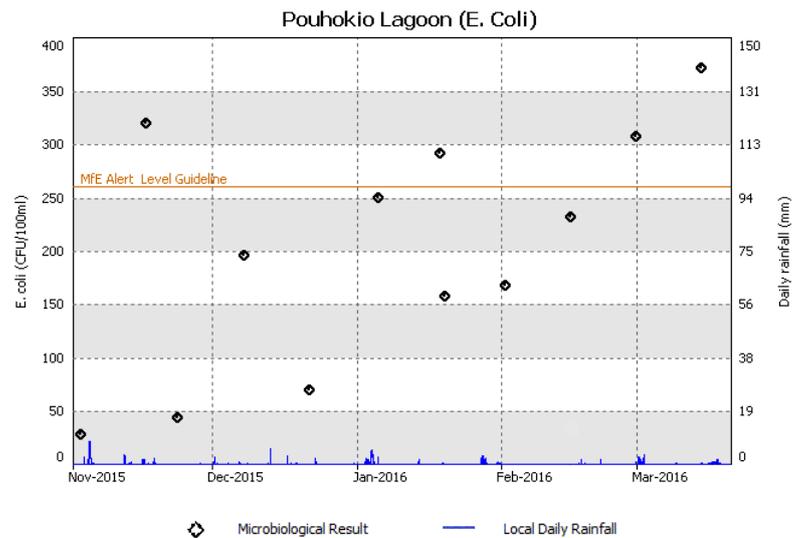
The warm temperatures and slow flowing lagoon makes it particularly popular with children. The area is also extensively used by walkers.

Trend in recreational water quality over time

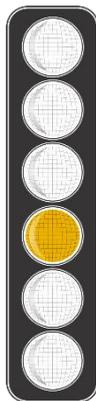
Elevated levels of bacteria are generally found during all conditions.

There was a significant improvement in recreational water quality over time.

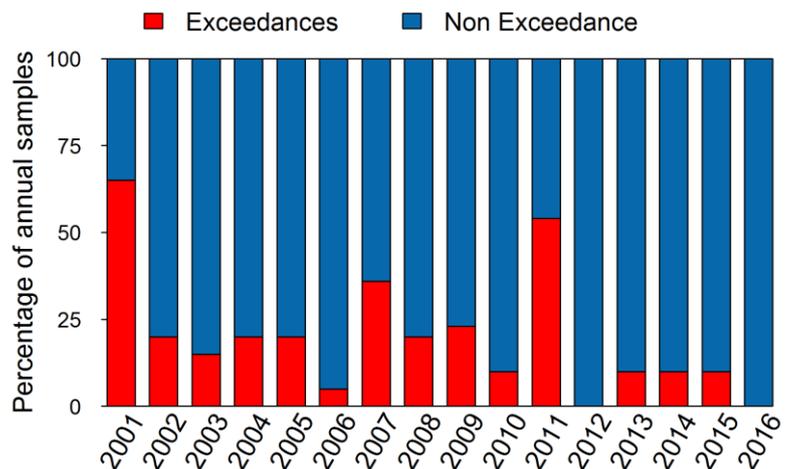
Upgraded this season from 'Very Poor' to 'Poor'. The Puhokio Stream had the largest improvement in the 95th percentile change throughout the region. A MAC category shift from D (2215) to C (520).



Note: exceedance re-sample on the graph.



Poor



Historical exceedances

Kairakau Lagoon



Kairakau Lagoon is a 40-minute drive from Hastings through Elsthorpe. The lagoon is formed at the mouth of the Mangakuri River, which passes through a predominantly pastoral catchment before discharging into the ocean at Kairakau Beach. There is a small local community of baches and some permanent residents. The Kairakau Beach campground is popular during the summer and is serviced by two public toilets and individual septic systems. New toilets were built by the camp ground during 2012.

Season Summary

Kairakau Lagoon was sampled 20 times this season: 85% (17/20) were within contact recreation guidelines, and the remaining 15% (3/20) were in red mode.

Description of recreation value

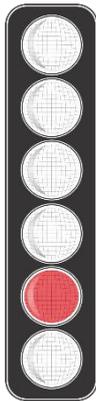
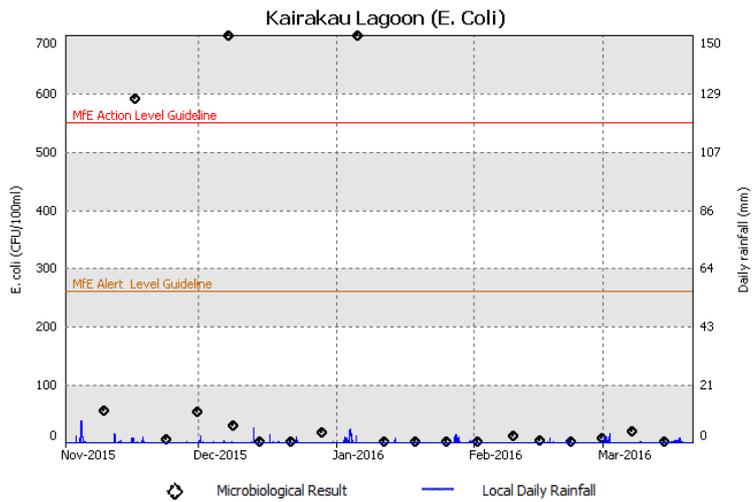
The lagoon is bordered by the campground, and is frequently used for fishing, boating and swimming. It is particularly used by children.

Trend in recreational water quality over time

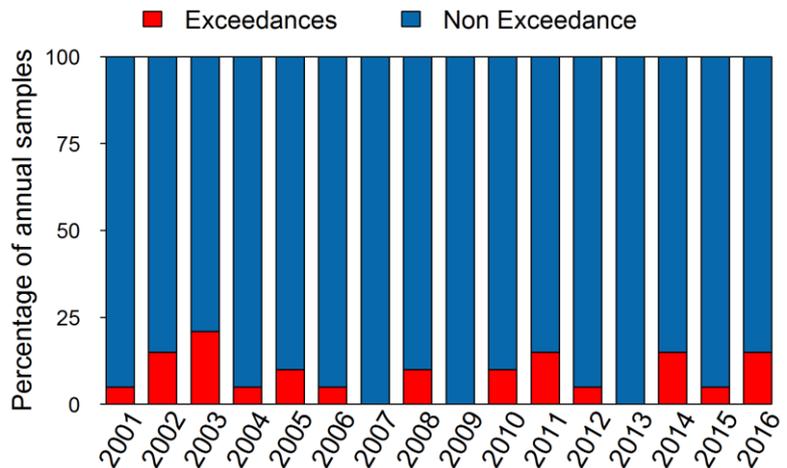
Elevated levels of bacteria were observed this season during dry and periods of heavy rainfall.

There was a significant improvement in recreational water quality over time. Faecal source tracking was undertaken and indicated ruminant and dog sources.

There were no changes made to the SFRG this season.



Very Poor



Historical exceedances

Kairakau Beach



Kairakau Beach is a 40-minute drive from Hastings through Elsthorpe. The settlement is located in front of a cliff ridge up to 150 metres high. There are three small rocky islands offshore. The islands: Hinemahanga, Waimatai and Tokaroa are of cultural significance. There is a small settlement of holiday baches with some permanent residents and a camping ground serviced by individual septic tanks. The Kairakau Lagoon discharges at the southern end of the beach.

Season Summary

Kairakau Beach was sampled 20 times this season 100% (20/20) of which were within contact recreation guidelines.

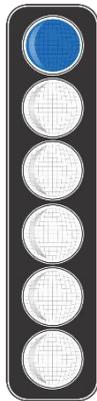
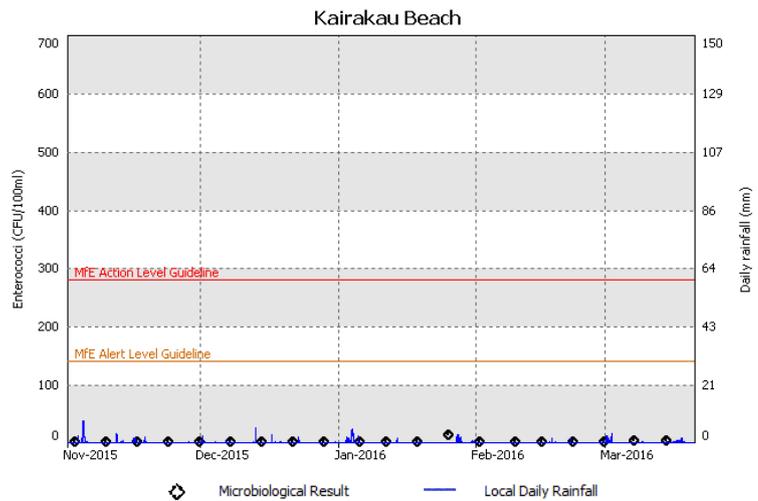
Description of recreation value

Kairakau beach is a sand beach and has an established fenced vegetated dune. There are multiple designated access points to protect the dune structure and there is a public toilet. The beach is a popular spot for fishing, boating, surfing and diving.

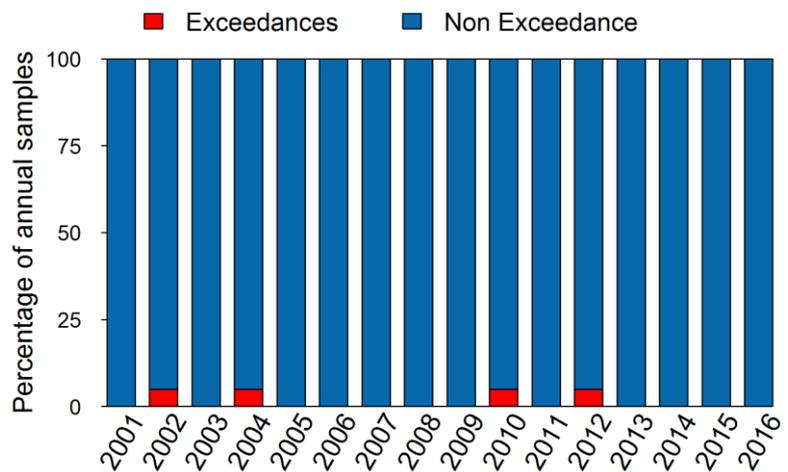
Trend in recreational water quality over time

There was no significant change in water quality at this site over time.

There were no changes made to the SFRG this season.



Very Good



Historical exceedances

Pourerere Beach



Description of recreation value

Pourerere Beach is sand with an extensive dune system and small wetland area. The beach is very popular and supports multiple user groups. The beach is busy during summer months with allocated beach camping. There is a public toilet and changing rooms beside the camping area. Common activities include swimming, surfing, diving and fishing.

Trend in recreational water quality over time

Bacteria levels at Pourerere Beach have generally remained within guideline values with only a single exceedance during 2005-6.

There was no significant change in water quality at this site over time.

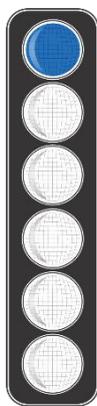
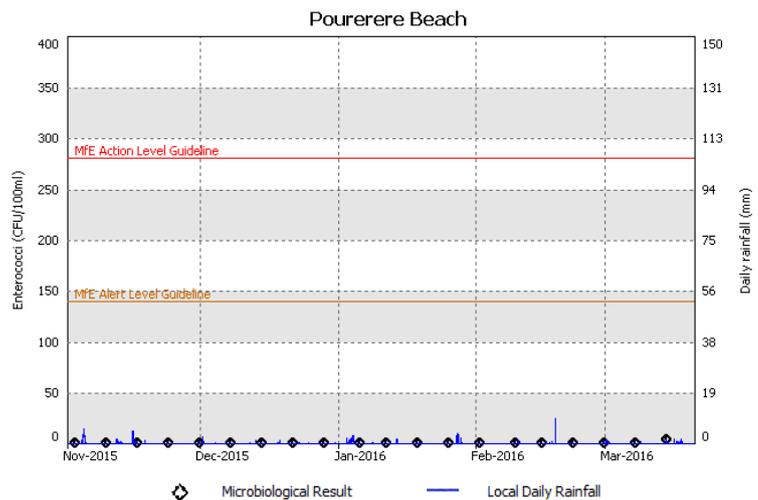
Pourerere Beach had the lowest 'A' grade MAC score in the region of 7.55.

There were no changes made to the SFRG this season.

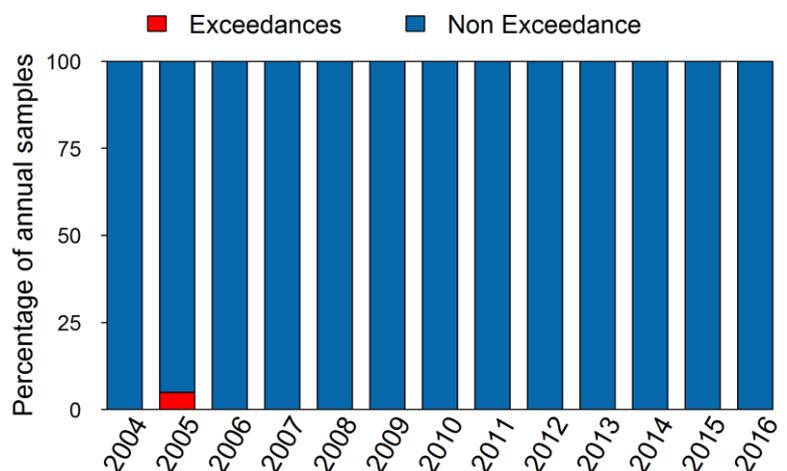
Pourerere Beach in southern Hawke’s Bay is a popular holiday destination. The community has several holiday homes as well as some permanent residents. The settlement is serviced solely by individual septic tank systems. The catchment is largely pastoral with some cropping. There is a commercial crayfish (*Jasus edwardsii*) fishing fleet based here.

Season Summary

Pourerere Beach was sampled 20 times this season 100% (20/20) of samples were within contact recreation guidelines.



Very Good



Historical exceedances

Aramoana Beach



Description of recreation value

Aramoana Beach is a fine grain sand beach with an intact dune system.

There is a sub-tidal reef system that offers diving inside and outside of the reserve. The beach is popular for swimming and fishing along with other beach sports.

Trend in recreational water quality over time

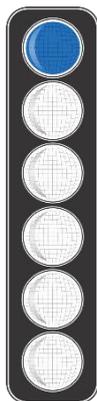
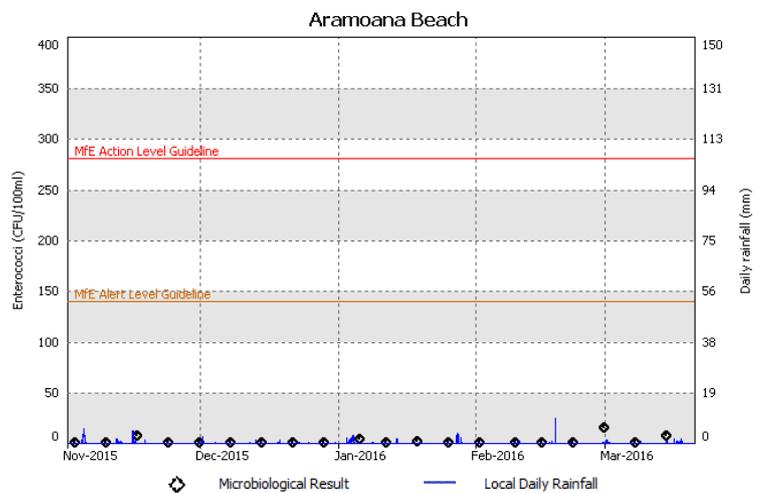
There has been no significant change in water quality at this site over time.

There were no changes made to the SFRG this season.

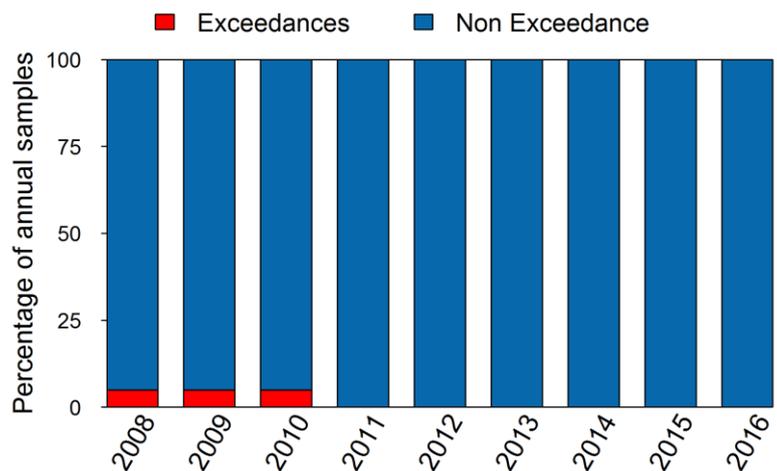
Aramoana Beach is located at the northern boundary of the Te Angiangi marine reserve. The catchment is largely pastoral, with some cropping. The coastal community uses individual septic systems, while a subdivision is serviced by a secondary treatment system. The Te Angiangi reserve is increasing in popularity and receives higher numbers of visitors each year. There is an established wetland formed by the Oupoto Stream, running parallel with the beach. There is vehicle beach access and a car park area there.

Season Summary

Aramoana Beach was sampled 20 times this season 100% (20/20) of which were within contact recreation guidelines.



Very Good



Historical exceedances

Blackhead Beach



Blackhead Beach is the main access point to the Te Aniangi Marine Reserve, and is popular throughout the summer months. The steep catchment is largely pastoral, with a pine plantation. There is vehicle beach access and a car park area. There is a small settlement with holiday baches and two camping grounds with some permanent residents. Wastewater is managed using individual septic tanks.

Season Summary

Blackhead Beach was sampled 20 times this season 100% (20/20) of which were within contact recreation guidelines.

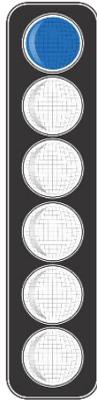
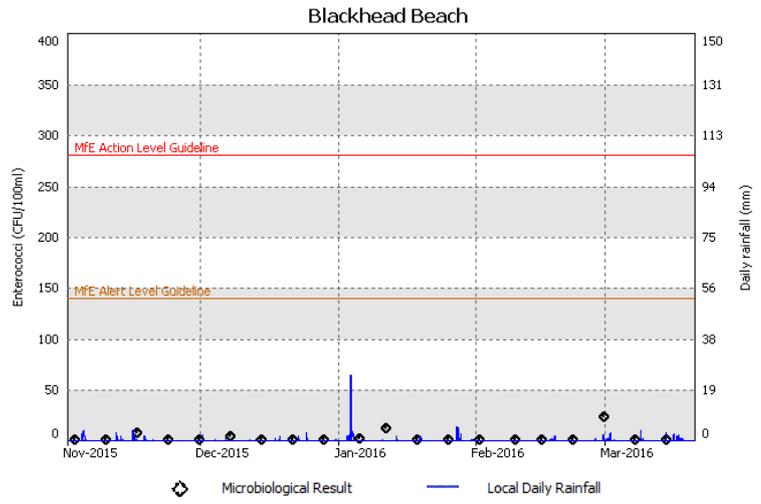
Description of recreation value

Blackhead Beach is a fine-grain sand beach with a small dune system. The beach supports a range of activities, including swimming, surfing, diving and fishing. There are also two boat launching areas through a channel.

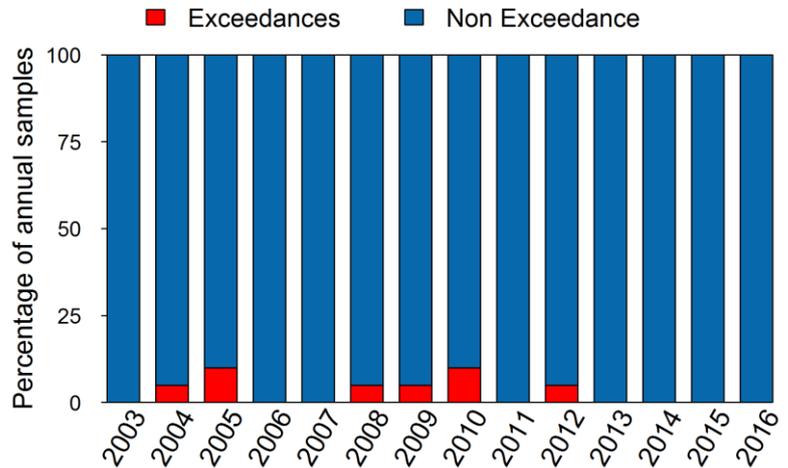
Trend in recreational water quality over time

There was no significant change in water quality at this site over time.

There were no changes made to the SFRG this season.



Very Good



Historical exceedances

Porangahau Beach



Porangahau Beach (Te Paerahi) is located approximately 40 kilometres south east of Waipukurau along SH52. There is a coastal settlement with baches, a campground, golf course and country club. The catchment is largely pastoral with some cropping. There are many permanent residents within the community. The Porangahau township is serviced by a community sewage treatment system which discharges upstream into the river. There are no direct discharges in the vicinity of the beach, the Porangahau River discharges approximately 10 kilometres north along the beach.

Season Summary

Porangahau Beach was sampled 20 times this season 100% (20/20) of which were within contact recreation guidelines.

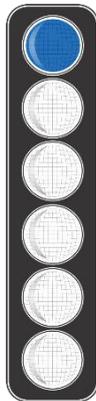
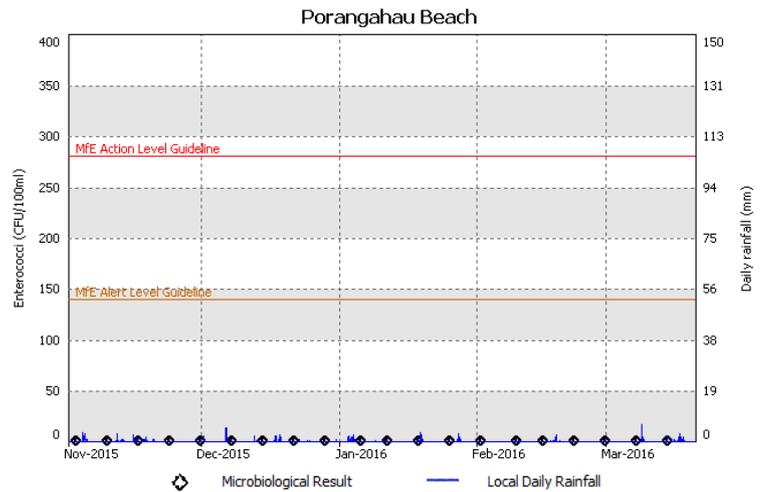
Description of recreation value

Porangahau Beach is a fine-grain sand beach with an extensive dune system. There are also intact wetland areas within the dune system between the coast and the estuary. The beach is popular for swimming, fishing, diving and other recreational activities.

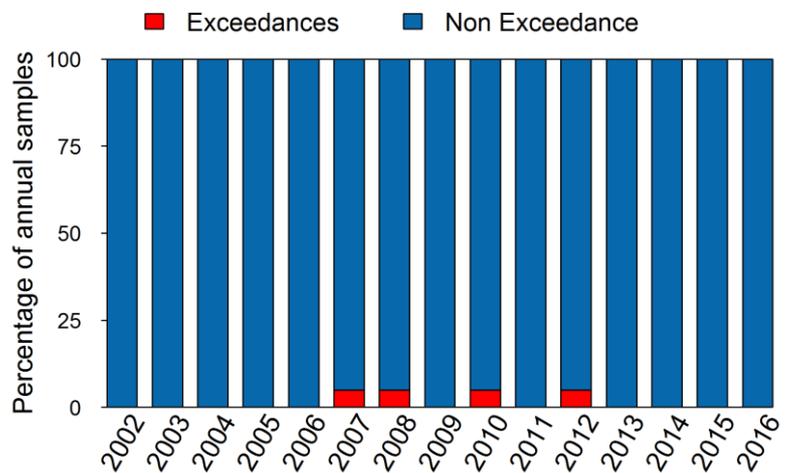
Trend in recreational water quality over time

There was no significant change in water quality at this site over time.

There were no changes made to the SFRG this season.



Very Good



Historical exceedances

Porangahau Estuary



The Porangahau Estuary is a high-use recreational area during the summer months. The estuary downstream is of national significance and the largest unmodified estuary on the south-east coast of the North Island. The estuary has a mix of sand and mud flats with a shallow intertidal channel. The sample location is on the downstream side of the Beach Road bridge. The town community wastewater plant's discharge is upstream at Porangahau township.

Season Summary

Porangahau Estuary was sampled 20 times this season 100% (20/20) of which were within contact recreation guidelines.

Description of recreation value

The immediate area around the sampling site is reserved for swimming. Boats are launched 30 m downstream of the bridge and the jet skiing area starts from there to the sea.

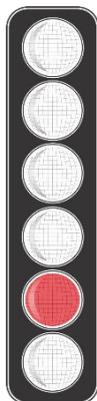
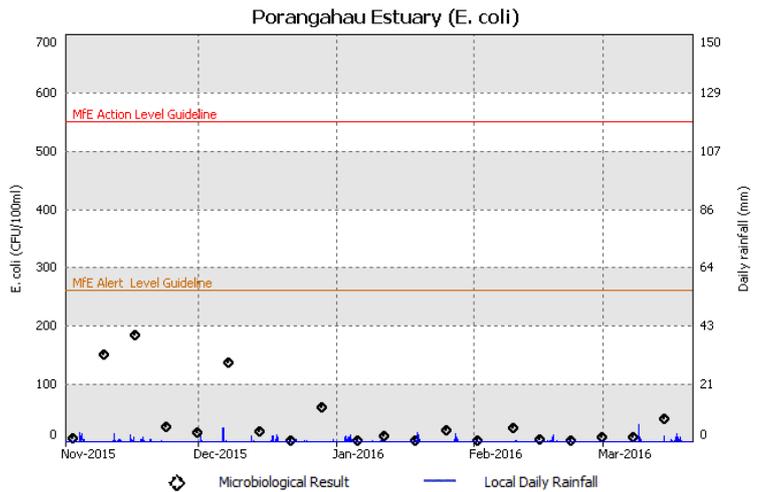
Trend in recreational water quality over time

Elevated levels of bacteria are generally found after heavy or prolonged periods of rain, during which large quantities of surface water can drain into the river from the surrounding catchment.

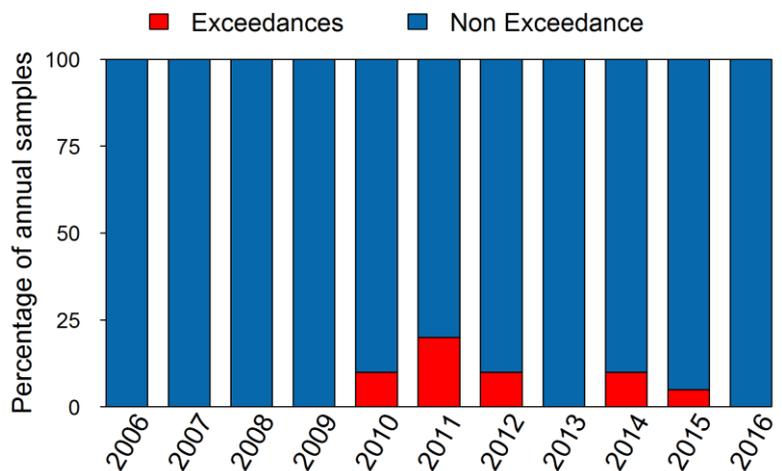
Faecal source tracking was undertaken last season, and indicated ruminant sources.

A significant decline in recreational water quality has been observed.

The SFRG was unchanged this season at 'Very Poor', the site remained in MAC category D (865).



Very Poor



Historical exceedances

Tukituki River at Walker Rd



Description of recreation value

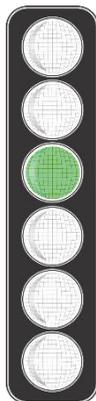
The Tukituki at Walker Road is largely a cobble-bed river. This area is popular with fishermen and also attracts swimmers and walkers during the summer months.

Trend in recreational water quality over time

Elevated levels of bacteria are generally found after heavy and prolonged periods of rain, which cause increased surface runoff water to enter the river from the mainly pastoral farming dominated catchment.

There has been no significant change in water quality at this site over time.

The SFRG remained unchanged at 'Fair'.

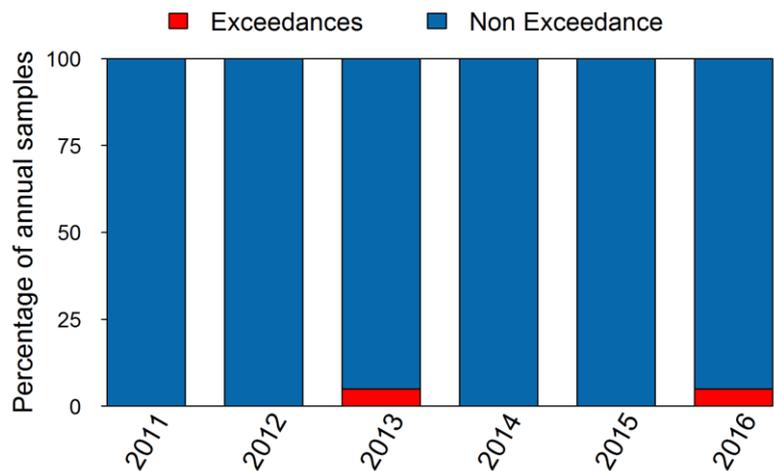
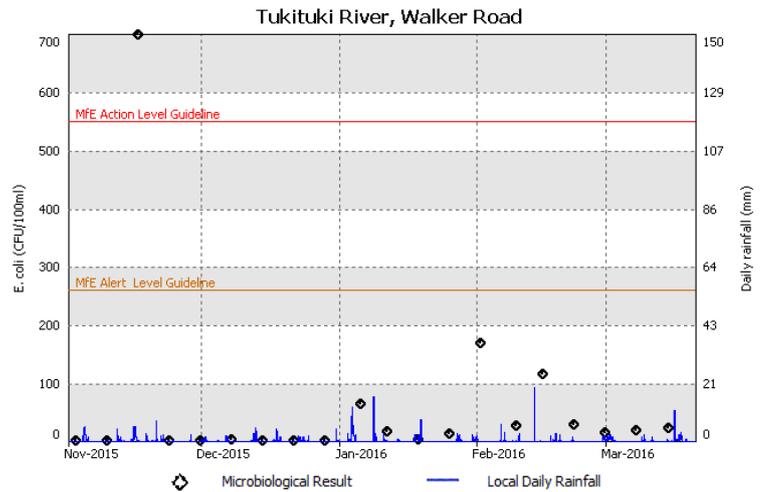


Fair

The Tukituki River at Walker Road site is east of Waipawa, downstream of the confluence of the Tukituki and Waipawa Rivers. This site is downstream of the central Hawke's Bay sewage discharge. The sampling site was identified as having high value in the recreational usage survey (Madarasz-Smith, 2010).

Season Summary

The Tukituki River at Walker Road was sampled 20 times this season of which 95% (19/20) of samples were within contact recreation guidelines, and 5% (1/20) exceeded. The red mode exceedance on the 16th November was 812 *E.coli* and was scaled for the map.



Historical exceedances

4 Shellfish gathering sites

Hawke's Bay Regional Council monitors water quality at locations favoured for shellfish gathering as part of the Recreational Water Quality Programme. Water at popular shellfish gathering sites (see **Figure-4-1**) is monitored for faecal contamination to determine the relative risk to the public from consuming shellfish from that site. The guidelines (2003) use faecal coliform indicator to denote the potential presence of pathogenic bacteria, viruses and protozoa in the water that shellfish are exposed to.

The MfE and MoH guidelines (2003) stipulate that for consumption of shellfish collected from a site to be considered safe, two criteria must be met:

- No more than 10% of that season's faecal coliform results should be more than 43 CFU/100 mL
- The median faecal coliform value for the season must not exceed 14 CFU/100 mL.

It is important to note that monitoring for shellfish gathering is based on the water quality of the surrounding waters, not on the shellfish themselves. Additionally, the Ministry for Primary Industries does not recommend collecting shellfish from areas where sewage or storm water is discharged and after heavy rain (www.foodsmart.govt.nz).

There is some concern regarding the relevance of the current guidelines (which are based on post season performance criteria) for recreational shellfish gatherers. Additionally, the process for issuing warnings around whether a site complies or fails to comply with guidelines requires assessment of a full season. These concerns were addressed in a recent paper to MfE (Bolton-Ritchie et al. 2013). Until such time that these are addressed through a national review, Hawke's Bay Regional Council will continue to monitor sites in line with the current MfE & MoH, 2003 guidelines.

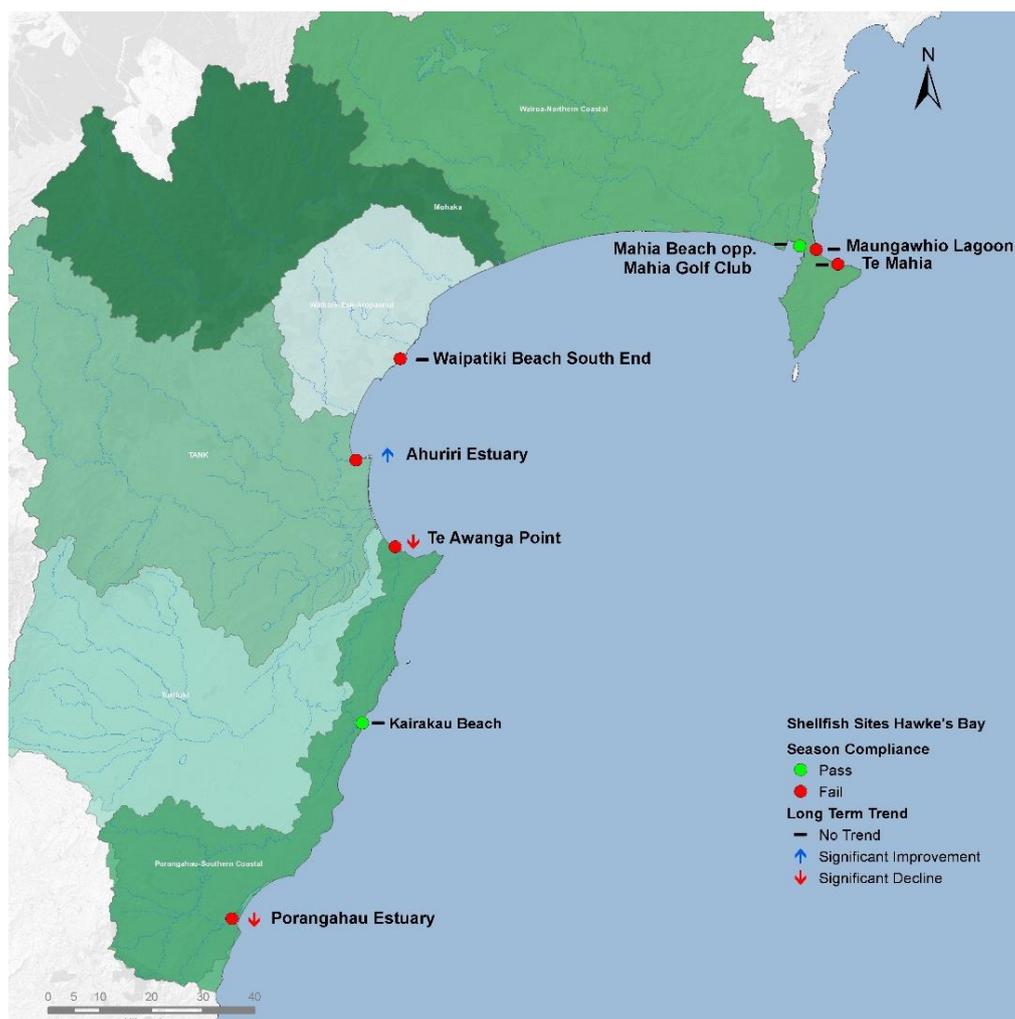


Figure-4-1: Shellfish monitoring sites in Hawke's Bay and levels of compliance.

Table 4-1: Shellfish Trends and catchment risk 2015-16 season.

Site	Trend p value	Percent annual change	SIC category and primary Impact	95 th Percentile for Faecal Coliforms
Ahuriri Estuary	0.015	-4.231	<i>Moderate</i> , urban storm water (Pandora Pond) and agriculture.	128.5
Kairakau Beach	0.413	0.0	<i>Very Low</i> , no primary impact, secondary is private sewage disposal.	58
Mahia Beach	0.409	0.0	<i>Moderate</i> , urban storm water.	109.2
Maungawhio Lagoon	0.619	0.0	<i>High</i> , Intensive agriculture.	724
Porangahau Estuary	0.024	10	<i>High</i> , unrestricted stock access/agriculture.	388
Te Awanga Point	0.04	5.49	<i>Moderate</i> , agriculture, birds.	216
Te Mahia	0.35	-3.86	<i>Moderate</i> , river and agriculture.	2925
Waipatiki Beach South End	0.35	0.0	<i>Low</i> , river – focal point of drainage.	107

Maungawhio Lagoon



Maungawhio Lagoon

Elevated bacteria levels generally occur during the holiday period when there is heavy loading on individual septic systems, or during heavy rainfall in the Kopuawhara River catchment, or during both situations.

2015-2016 season summary table	
No of samples where concentration exceeded 43 CFU/100 mL	9
Proportion of samples where concentration exceeded 43 CFU/100 mL	45%
Median concentration (CFU/100 mL)	24

Results above guideline thresholds are indicated in red.

The Maungawhio Lagoon is located on the northern side of Mahia Peninsula. The estuary is formed by the Kopuawhara Stream. The area is an important habitat for both fish spawning and breeding and for water birds. There is a freedom camping site here, with a public toilet and changing room. The lagoon has been identified as a significant area in Hawke's Bay's Regional Coastal Environment Plan (1999).

This site is located on a well-known Pipi (*Paphies australis*) and Cockle (*Austrovenus stutchburyi*) bed that from which significant volumes are harvested throughout the year.

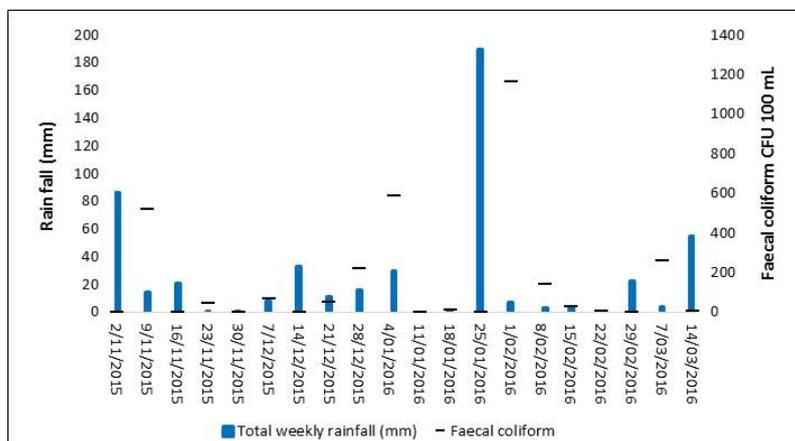
Season summary

The site was sampled 20 times this season and has ***failed to comply*** with both compliance thresholds for safe shellfish gathering

Long term trends

The period analysed included 7 years and 5 months during calendar years 2008 to 2016 and included 149 observations/samples.

There has been no significant change in water quality at this site over time.



Season Results

Shellfish compliance	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Maungawhio Lagoon	N/A	N/A	No	No	No	Yes	No

Mahia Beach opp. Mahia Golf Club



This site is a dedicated shell fish monitoring area, situated between Mahia Beach and Opoutama Beach recreational water quality sites. It is accessed by the beach access path opposite the golf course.

The site is located on a well-known Tuatua (*Paphies subtriangulata*) bed that is fished heavily during summer.

Season summary

The site was sampled 20 times this season and **complied** with thresholds in both criteria for safe shellfish gathering.

Mahia Beach opp. Mahia Golf Club

Elevated bacterial levels generally coincide with the holiday period, when septic systems are overloaded and/or during heavy and prolonged rainfall within the Opoutama Stream catchment.

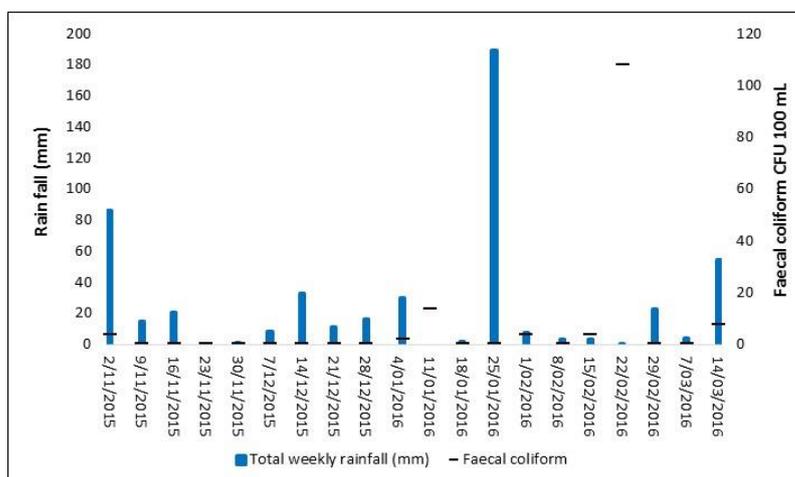
Long term trends

The period analysed included 10 years and 5 months during calendar years 2005 to 2016, and included 218 observations/samples.

There has been no significant change in water quality at this site over time.

2015-2016 season summary table	
No of samples where concentration exceeded 43 CFU/100 mL	1
Proportion of samples where concentration exceeded 43 CFU/100 mL	5%
Median concentration (CFU/100 mL)	0.5

Results above guideline thresholds are indicated in red.



Season Results

Shellfish compliance	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Mahia Beach	Yes	No	Yes	Yes	Yes	Yes	Yes

Te Mahia



Te Mahia

Elevated levels of bacteria are generally found after prolonged periods of rain causing surface water runoff into the catchment. The catchment is largely pastoral with an area of pine and native forest.

2015-2016 season summary table	
No of samples where concentration exceeded 43 CFU/100 mL	10
Proportion of samples where concentration exceeded 43 CFU/100 mL	50%
Median concentration (CFU/100 mL)	52

Results above guideline thresholds are indicated in red.

Te Mahia is both a recreational monitoring site (see Section 4.1) and a shellfish gathering site. The shellfish sample is taken at the boat ramp, along with the recreational water sample. Reefs at the mouth of the estuary provide habitat for a range of shellfish.

Season Summary

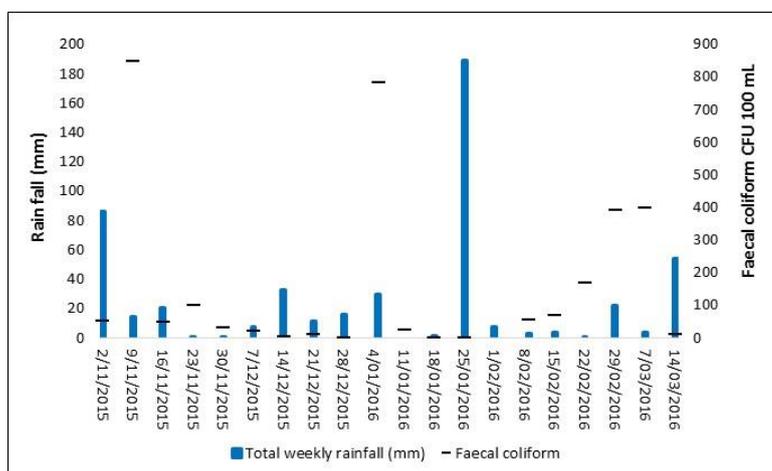
The site was sampled 20 times this season and has **failed to comply** with both compliance thresholds for safe shellfish gathering.

The sample taken 1/2/2016 was removed from the season graph (45,200 Faecal coliform CFU/100 mL).

Long term trends

The period analysed included 5 years and 5 months during the calendar years 2010 to 2016 and included 115 observations/samples.

There was no significant change in water quality at this site over time.



Season Results

Shellfish compliance	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Te Mahia	N/A	No	No	No	No	No	No

Waipatiki Beach South end



Waipatiki Beach South End

Elevated levels of bacteria are generally found after prolonged periods of rain causing increased surface water runoff into the Waipatiki Stream catchment. The catchment is largely pastoral and serviced by a community land irrigation sewage system.

2015-2016 season summary table	
No of samples where concentration exceeded 43 CFU/100 mL	3
Proportion of samples where concentration exceeded 43 CFU/100 mL	15%
Median concentration (CFU/100 mL)	8

Results above guideline thresholds are indicated in red.

Waipatiki Beach is both a recreational monitoring site (see Section 4.2) and a shellfish gathering site. The shellfish sampling site is located at the southern end of the beach adjacent to the mouth of the Waipatiki Lagoon, where the reef provide habitat for a range of shellfish.

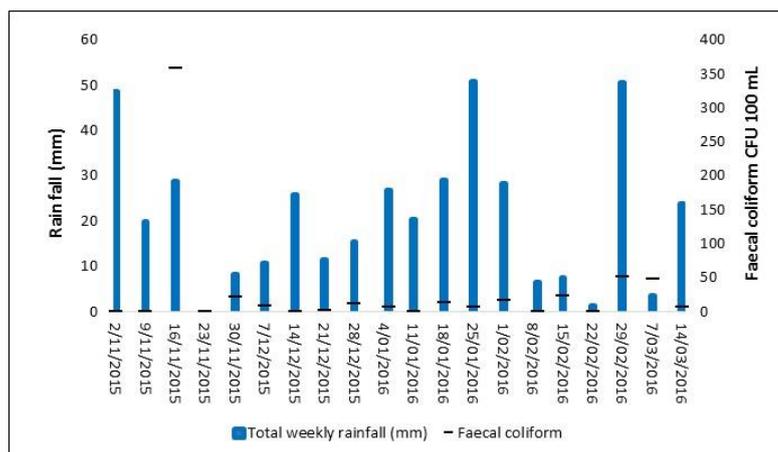
Season Summary

The site was sampled 20 times this season and ***failed to comply*** on one criteria. The proportion of samples above 43 FC/100 mL was greater than 10%.

Long term trends

The period analysed included 10 years and 5 months during the calendar years 2005 to 2016 and included 215 observations/samples.

There was no significant change in water quality at this site over time.



Season Results

Shellfish compliance	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Waipatiki Beach	Yes	No	No	Yes	Yes	No	No

Ahuriri Estuary



Ahuriri Estuary

Elevated levels of bacteria are generally found after prolonged periods of rain cause increased surface water runoff to enter the Ahuriri catchment.

2015-2016 season summary table	
No of samples where concentration exceeded 43 CFU/100 mL	4
Proportion of samples where concentration exceeded 43 CFU/100 mL	20%
Median concentration (CFU/100 mL)	6

Results above guideline thresholds are indicated in red.

The Ahuriri Estuary has two sample sites: one is for recreational water quality (see Section 4.2) beside the waka ama facility on Pandora Pond. The second is a shellfish monitoring site on the northern side of the estuary approximately 50 metres upstream of the Pandora road bridge. The shellfish bed receives considerable harvesting pressure throughout the year for cockles (*Austrovenus stutchburyi*).

Season Summary

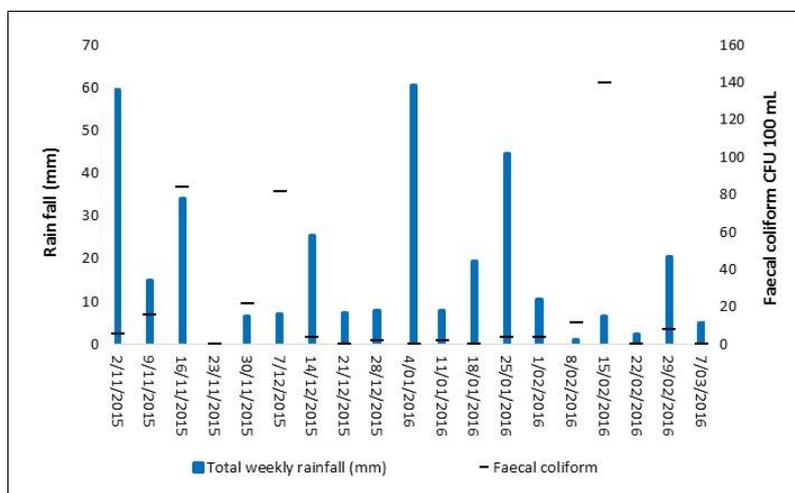
The site was sampled 19 times this season and has ***failed to comply*** with one of the compliance thresholds for safe shellfish gathering. The proportion of samples above 43 FC/100 mL was greater than 10%.

The Ministry of Health (MoH) does not recommend collecting shellfish from areas subject to urban and commercial discharges, and this area is permanently signposted to this effect.

Long term trends

The period analysed included 10 years and 5 months during the calendar years 2005 to 2016 and included 213 observations/samples.

There was a significant change in water quality at the site (-5.4% annual change), indicating an improvement in water quality over time.



Season Results

Shellfish compliance	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Ahuriri Estuary	No	No	No	Yes	Yes	No	No

Te Awanga Point



Te Awanga Point

Elevated levels of bacteria are generally found after prolonged periods of rain causing increased surface water runoff in the Maraetotara River catchment.

Te Awanga is both a recreational monitoring site (see Section 4.2) and a shellfish gathering site. The shellfish sample site is adjacent to the mouth of the Maraetotara Lagoon and consists of a sub-tidal reef structure that harbours a community of mussels (*Perna canaliculus*).

Season Summary

The site was sampled 20 times this season and has **failed to comply** with one guideline criteria for safe shellfish gathering. The proportion of samples above 43 FC/100 mL was greater than 10%.

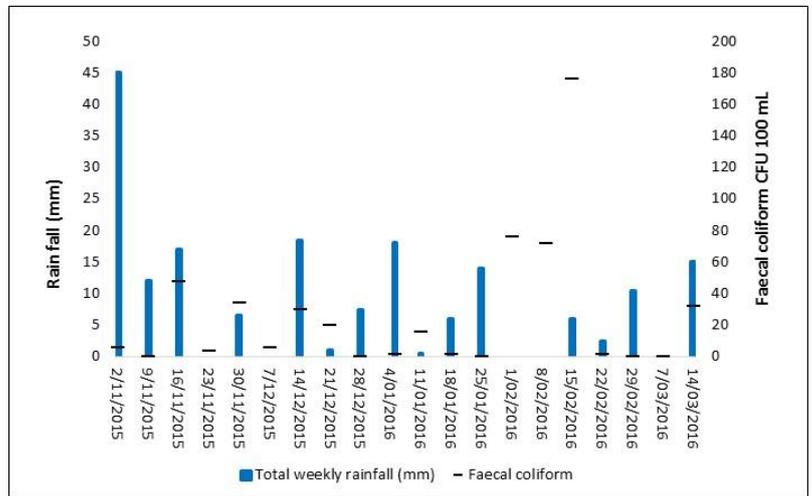
Long term trends

The period analysed included 10 years and 5 months during the calendar years 2005 to 2016 and included 218 observations/samples.

There was a significant change in water quality at the site (5.14% annual change), indicating a decline in water quality over time. This decline was not observed in the enterococci data.

2015-2016 season summary table	
No of samples where concentration exceeded 43 CFU/100 mL	4
Proportion of samples where concentration exceeded 43 CFU/100 mL	20%
Median concentration (CFU/100 mL)	6

Results above guideline thresholds are indicated in red.



Season Results

Shellfish compliance	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Te Awanga Point	No						

Kairakau Beach



Kairakau Beach

Elevated levels of bacteria are generally found after prolonged periods of rain causing increased surface water runoff into the Mangakuri River catchment. The catchment is largely pastoral and serviced by individual septic systems.

Kairakau Beach is both a recreational monitoring site (see Section 4.3) and a shellfish gathering site. There are sub-tidal reef structures at each end of the beach. Shellfish gathering is popular in this area throughout summer.

Season Summary

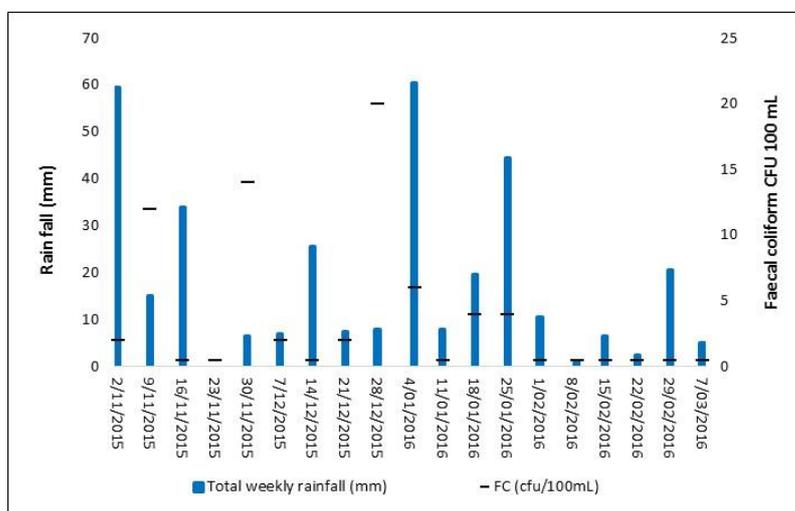
The site was sampled 19 times this season and **complied** with both criteria for shellfish gathering.

Long term trends

The period analysed included 10 years and 5 months during the calendar years 2005 to 2016 and included 215 observations/samples.

There was no significant change in water quality at this site over time.

2015-2016 season summary table	
No of samples where concentration exceeded 43 CFU/100 mL	0
Proportion of samples where concentration exceeded 43 CFU/100 mL	0%
Median concentration (CFU/100 mL)	0.5



Season Results

Shellfish compliance	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Kairakau Beach	No	Yes	Yes	Yes	No	Yes	Yes

Porangahau Estuary



Porangahau Estuary

Elevated levels of bacteria are found in both dry weather and after periods of rain causing increased surface water runoff into the Porangahau River catchment.

Porangahau River is both a recreational monitoring site (see Section 4.3) and a shellfish gathering site. The sample location is on the downstream side of the Beach Rd bridge. The estuary downstream of the site is of national significance.

There are several beds of cockles (*Austrovenus stutchburyi*) in the estuary, which are harvested throughout the year.

Season Summary

The site was sampled 20 times this season and has **failed to comply** with both criteria for safe shellfish gathering.

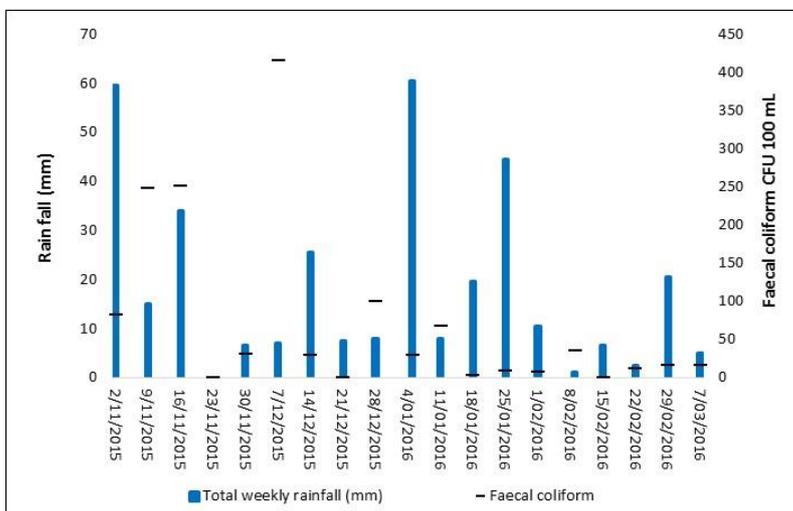
Long term trends

The period analysed included 7 years and 5 months during the calendar years 2008 to 2016 and included 94 observations/samples.

There was a significant change in water quality at the site (9.4% annual change), indicating a decline in water quality over time. This decline was also observed in the *E. coli* data.

2015-2016 season summary table	
No of samples where concentration exceeded 43 CFU/100 mL	5
Proportion of samples where concentration exceeded 43 CFU/100 mL	25%
Median concentration (CFU/100 mL)	30

Results above guideline thresholds are indicated in red.



Shellfish compliance	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Porangahau Estuary	N/A	N/A	N/A	No	No	No	No

5 Nuisance Algal Growths

5.1.1 Background

Hawke's Bay Regional Council monitors the spatial extent and prevalence of nuisance algae (cyanobacteria) in the region's rivers using best practices outlined in the New Zealand Guidelines for Cyanobacteria in Recreational Fresh Waters (MfE and MoH, 2009).

Cyanobacteria (commonly known as blue-green algae) are photosynthetic organisms that are integral parts of many terrestrial and aquatic ecosystems. The most prevalent cyanobacteria species in Hawke's Bay Rivers belong to the genus *Phormidium*. *Phormidium* occurs naturally in New Zealand environments, but under favourable conditions it can multiply, forming blooms. In lakes, cyanobacterial species tend to float in the water column (planktonic), whereas in rivers *Phormidium* tends to form dense mats attached to the river bed (benthic) (see Figure 5-1).

As the *Phormidium* mats become thicker, bubbles of oxygen gas become entrapped within them. This facilitates the detachment of the mat from the substrate and these loose mats can accumulate along the river margin during high flows. As flow recedes, these mats become exposed and may pose a health risk.

The main catchments that tend to experience *Phormidium* growth in Hawke's Bay are the Tukituki and Mohaka Rivers. Lake Tutira is also known to experience high concentrations of planktonic cyanobacteria.

Table 5-1: The guideline levels of benthic cyanobacteria.

Alert status		
Percentage cover		
Green	Amber	Red
< 20	20 - 50 %	> 50 %

5.1.2 Health risks

Some cyanobacterial species produce toxins, known as cyanotoxins. However, the rates of toxin production can vary, both within a mat, and between mats on the same river, meaning that identifying the health risk from any cyanobacteria present can be difficult. It is not currently understood what triggers toxin production in an algal mat. NZ Guidelines (MfE and MoH, 2009) assume that increased algal coverage is likely to increase the risk of exposure and concomitant overall risk.

There are four different forms of cyanotoxins:

- **Hepatotoxins** - These affect the liver and other internal organs.
- **Neurotoxins** - These act as neuromuscular blocking agents, leading to respiratory arrest.
- **Endotoxins (Lipopolysaccharides)** – These are contact irritants, and can cause severe dermatitis and conjunctivitis where people come into contact with algae through swimming. They may also cause stomach cramps, nausea, fever and headaches if consumed. Their presence in wind-blown dust can cause asthma.
- **Non-specific toxins** – These are relatively slow acting general toxins which progressively damage most organs, including the liver.

Dogs appear particularly susceptible to cyanobacterial poisoning, which is likely to be in part behavioural. Dogs may become attracted to the musty smell of *Phormidium* when scavenging along the river edge. A possible dog poisoning was reported in January 2016 from Horsehoe Bend, Tukituki River, however diagnostic confirmation was not possible. In previous cases (Hutt River, Wellington), poisoning has been associated with the neurotoxins *anatoxin-a* and or *homoanatoxin-a* (Wood et al. 2007), which can result in the rapid onset of illness and ultimately death.



Figure 5-1: *Phormidium* (Black mats) alongside green filamentous algae (bright green), Tukituki River at Walker Road.

5.1.3 Monitoring programme

All river sites in the Recreational Water Quality Monitoring programme that have suitable conditions for *Phormidium* growth are visually monitored for cyanobacteria on a weekly basis using a rapid assessment of coverage. These sites are:

- Esk River at Eskdale Park
- Tutaekuri River at the expressway bridge (Guppy Rd)
- Ngaruroro River at Chesterhope Bridge
- Maraetotara River at the Te Awanga Bridge
- Tukituki River at Black Bridge
- Tukituki River at SH2 Waipukurau
- Tukituki River at Walker Rd

Additionally, after periods of prolonged, low flows (which facilitate algal accrual periods), HBRC monitors *Phormidium* growth weekly at several sites along the Tukituki River which have historic records of prolific growth. Monitoring is triggered by an absence of a 'flushing flow' (more than 3x median flow rate) for a period of 2 weeks after December 1st. This criterion aligns with the guidelines (MfE and MoH, 2009) recommendation for regional specific action plans for monitoring.

These sites include:

- Tukituki River at SH2 Waipukurau
- Tukituki River at Walker Road
- Tukituki River at Tamumu Bridge
- Tukituki River at Patangata Bridge
- Tukituki River at Red Bridge

This year two additional sites were added during the season after delimiting surveys found high levels of *Phormidium*, and weekly monitoring was deemed necessary:

- Tukituki River at Horseshoe Bend
- Waipawa River at Walker Rd

Weekly monitoring for the 2015/16 season began on 14 January 2016 and continued until 2 May 2016.

The growth of algae is monitored in accordance with the guidelines (MfE and MoH, 2009) using a bathyscope (see Figure 5-2) along four transects with 20 observations per site. The overall algal abundance is calculated as a proportional area (<https://www.mfe.govt.nz/sites/default/files/nz-guidelines-cyanobacteria-recreational-fresh-waters.pdf>).

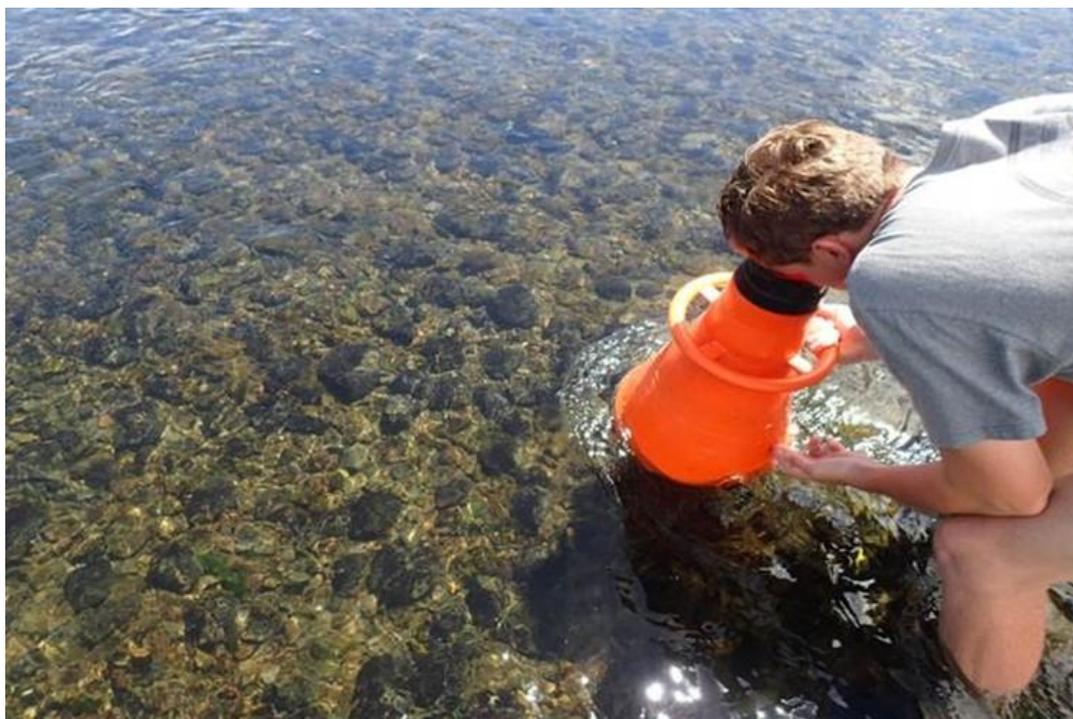


Figure 5-2: *Phormidium* monitoring in the Tukituki River at Walker Road (2015) using a bathyscope. *Phormidium* is the black algae on the substrate in the photo.

5.1.4 Results

Phormidium growth in Hawke’s Bay is seasonal and is inconsistent in its annual distribution. In general, a pattern of increasing *Phormidium* coverage was seen across monitored sites through January and February, followed by decreasing coverage at most sites from March/April. This monitoring season was extended as river flows were still low during May, and *Phormidium* coverage persisted with the lack of flushing flows.

The Waipawa River at Walker Rd site reached the red alert threshold twice (see Table 5-2: Phormidium 2015-16 season results).

. The Public Health Unit (PHU) issued a warning advising against using the site for contact recreation. Signage was erected at Horseshoe Bend and Walker Rd for the duration of the season, and at Tamumu Bridge site during amber alert exceedances.

Table 5-2: Phormidium 2015-16 season results.

Site	Alert status		
	Green	Amber	Red
Tukituki River at Walker Rd	12	8	
Tukituki River at SH2	20		
Tukituki River at Horseshoe Bend ¹	18	1	
Tukituki River at Patangata Bridge	20		
Tukituki River at Tamumu Bridge	13	7	
Tukituki River at Red Bridge	19	1	
Waipawa River at Walker Rd ¹	2	9	2

¹. Sites added during the season, therefore fewer weeks were sampled.

5.1.5 Health warnings

When levels of cover are within the surveillance/green alert status (see Table 5-1), monitoring occurs weekly. When levels exceed the green status, but are within the amber/alert status, the results are published on the B4USwim website (<http://www.hbrc.govt.nz/Services/Environmental-Sciences/Water/Pages/rec-water-quality.aspx>), and are communicated to the PHU. Any levels that exceed the amber/alert status and fall into red/action status are communicated to the PHU, who generally issue a public media release, usually in newspapers, and erect signage at the specific site.

Because *Phormidium* varies widely in spatial distribution, and the presence of the algae does not necessarily mean presence of the toxins, caution is advised to all river users for all rivers within Hawke’s Bay. HBRC has worked to educate the general public on what to look for through various media releases, and is committed to ongoing community updates as events arise from monitoring.



Figure 5-3: Warning sign erected at the Tukituki Horseshoe Bend.

6 Conclusions

Overall this season has observed the highest number of changes to site trends and grading. This is likely to be related to the climate conditions Hawke's Bay has been experiencing, including several years of below average rainfall.

6.1 Marine sites

Water quality in the coastal environment throughout Hawke's Bay is generally of a high standard, supporting recreational usage and meeting community expectations. In total 99% of samples collected at marine sites were within guideline levels for safe contact recreation using the more stringent single sample exceedance threshold. All marine sites (100%) complied with the two consecutive exceedance guideline threshold outlined in the guidelines (MfE and MoH, 2002).

Marine recreational sites in Hawke's Bay are generally suitable for contact recreation most - if not all - of the time.

6.2 Freshwater sites

Freshwater sites also generally had good water quality, and were considered suitable for contact recreation. In total 87.8 % of samples collected at freshwater sites were within guideline levels for safe contact recreation

Faecal source tracking was undertaken in the Wairoa River on three occasions during the season and highlighted a mixture of plant, avian and ruminant sources.

In general, water quality at most freshwater sites can be considered 'Fair' to 'Good' for contact recreation, with any exceedances generally associated with rainfall events, where surface runoff can contribute to the bacterial levels in the river. This supports the HBRC and PHU message to avoid swimming for up to three days following rain.

6.3 Estuarine/Lagoon sites

Estuaries and lagoons generally have more variable bacterial water quality. These areas are the receiving environment for the entire freshwater network, and the slow-flowing, warmer waters generally facilitate bacterial growth. Additionally, high densities of bird life in estuarine and lagoon waters can contribute high levels of direct faecal contamination. In total 89.81 % of samples collected at the estuarine sites were within guideline levels for safe contact recreation

Faecal source tracking was undertaken at Te Mahia, Maungawhio Lagoon, Waipuka Stream and Kairakau Lagoon. Major sources are identified below:

Site	Faecal sources identified
Te Mahia	Mixed avian, plant possible ruminant
Maungawhio Lagoon	Ruminant
Waipuka Stream	Avian
Kairakau Lagoon	Ruminant

Although estuaries and lagoons generally present the highest risk to users because of poor bacterial water quality, these areas are more popular with families than high-energy coastal beaches. This suggests further work is required to understand and reduce pollution in these areas (where applicable). Effective communication about the availability of information on the B4USwim website offers one option for educating people using waterways for recreation.

6.4 Nuisance algal growth

Phormidium growth is difficult to predict each year, and it can grow in various locations in the region. HBRC will continue to monitor *Phormidium* in accordance with the guidelines (MFE & MOH 2009) and also throughout the SOE monthly programmes. Difficulties in predicting when *Phormidium* growth may be harmful (toxin carrying) means that it is feasible only to communicate the risk of *Phormidium* through publicity in the media.

Caution by all river users of the risk of *Phormidium* within Hawkes' Bay throughout the summer months is advised.

6.5 Beach Grades for Hawke’s Bay Recreational Sites

SFRG	Sites	Comments
Very Good	Aramoana Beach Blackhead Beach Kairakau Beach Ocean Beach Porangahau Beach Pourerere Beach Waimarama Beach Mahanga Beach Waipatiki Beach	Generally large open coastal beaches of southern Hawke’s Bay with high flushing and dilution.
Good	Hardinge Rd Beach Marine Parade Westshore Beach Pandora Pond Opoutama Beach Te Awanga Beach Tutaekuri River	Generally urban beaches or beaches, with settlements or freshwater inputs. Highest performing fresh water site.
Fair	Mahia Beach Tukituki River at SH2 Tukituki River at Walker Rd Ngaruroro River Esk River Te Mahia Maraetotara Lagoon	More work required to understand why these beaches do not have higher grading’s. Plan Change in process that may deal with possible sources. More work programmed through the TANK Plan Change process to determine sources of faecal contamination. Fair grade reflects susceptibility to rainfall related contamination.
Poor	Tukituki River at Black Bridge Maungawhio Lagoon Puhokio Lagoon Kairakau Lagoon	 Generally depositional, coastal lagoons with limited flushing and warmer temperatures.
Very Poor	Clive River Wairoa River Porangahau Estuary Waipatiki Lagoon Waipuka Stream Lake Tutira	Bird and plant sources of bacteria highlighted from source identification work. Ruminant sources highlighted from source work. Working with Land Management to progress. Faecal source work has highlighted waterfowl sources, working with land management. Manually altered SFRG due to unpredictable cyanobacterial blooms and duck itch.

6.6 Trends in water quality and suitability for recreation grading

The Suitability for Recreation Grade process takes a risk-based approach to grading. This means that irrespective of actual water quality, if catchment risks are high due to issues like sewage discharge, the final grade is likely to be conservative. Additionally, small changes in the 95th percentile of indicator data can readily shift sites between microbiological assessment categories (MAC), causing a change in the grading.

The following table outlines trends observed in the 2015/2016 season, any changes observed to the SFRG, and or description of the relative significance.

Table 6-1: Summary of sites with changes following 2015-16 season.

Site	Significant statistical trend observed?	Change in SFRG observed?	Significance
Hardinge Rd Beach	Improvement	No	Statistically significant improvement in water quality over time.
Kairakau Lagoon	Improvement	No	Statistically significant improvement in water quality over time.
Mahanga Beach	No	Yes	Improvement, SFRG grade change from Good to Very Good.
Mahia Beach	Improvement	No	Significant Improvement in water quality over time.
Marine Parade	Improvement	No	Significant Improvement in water quality over time.
Maungawhio Lagoon	Improvement	Yes	Changed from Interim Very poor, to Poor and a statistical improvement.
Opoutama Beach	Improvement	Yes	Statistically significant improvement in water quality and SFRG change from fair to Good.
Pandora Pond	Improvement	No	Statistically significant improvement in water quality over time.
Puhokio Lagoon	Improvement	Yes	Statistically significant improvement and SFRG upgrade from Very Poor to Poor.
Tutaekuri River	Improvement	Yes	Statistically significant improvement and an SFRG grade change from Fair to Good.
Te Awanga Point	No	Yes	Improvement, SFRG grade change from Fair to Good.
Te Mahia	Improvement	Yes	Statistically significant improvement and an SFRG change from Poor to Fair.
Tukituki Rv At SH2	Decline	Yes	Improvement of SFRG Grade from Poor to Fair, but decline in long term statistical result.
Waipatiki Lagoon	Improvement	No	Statistically significant improvement in water quality over time.
Waipuka Stream	Decline	No	Statistically significant decline in water quality over time.
Westshore Beach	Improvement	No	Statistically significant improvement in water quality over time.

6.7 Shellfish sites

Microbiological Quality

Kairakau Beach and Mahia Beach were compliant for the season. Mahia Beach site (opposite the golf club) has the best compliance performance to date, remaining within guidelines for the past 5 years. This season 6 sites failed to comply with national guidelines for shellfish gathering waters. These sites are Porangahau Estuary, Ahuriri Estuary, Te Awanga Point, Waipatiki Beach, Te Mahia and Maungawhio Lagoon.

The tendency for sites to fluctuate between compliance and non-compliance year-on-year indicates the difficulty of providing accurate and consistent risk identification for recreational fishers. Regional councils have been working with the Ministry for the Environment and Ministry of Health to refine the shellfish gathering guidelines to better reflect human health concerns. However, at present there is no additional guidance, so this document reports on levels of compliance as outlined in Microbiological Water Quality Guidelines (MfE and MoH, 2003).

Other Marine Biotoxins

It is important to recognise that the MfE and MoH (2003) guideline concentrations can only be applied to microbiological contaminants sourced from water. Heavy metals, marine bio-toxins and other harmful organic contaminants may also pose a significant health risk to people consuming shellfish.

MPI takes green-lipped mussel (*Perna canaliculus*) flesh samples routinely on a fortnightly basis and results publicised via the DHB and signs erected at all boat ramps or adjacent sites. The flesh from wild mussels is collected from Opoutama Beach, Pania Reef and the Taikorai Rocks at Porangahau Beach. The flesh is tested for Paralytic Shellfish Poison (total saxitoxin dihydrochloride equivalent). No Paralytic Shellfish Poison was detected in mussels from these sites between November 1st 2015 and March 31st 2016. Consequently, no public warnings were required during this period.

7 Further work

The Recreational Water Quality Monitoring programme identifies areas where water quality issues may exist. The data and information derived from this monitoring programme assists with the development of policy and management regimes aimed at reducing the risks associated with recreational activities at these sites. During the current study, several opportunities arose to gather further targeted information to support this work programme

7.1 Northern Region

Mahia sites have shown variable water quality over the last three years, so continued faecal source tracking will be used to determine inputs at the Mahia isthmus. Further faecal source work is required at Maungawhio Lagoon to determine specific ruminant sources.

No further faecal source work is required at Wairoa River at this time.

7.2 Central Region

Continued efforts with faecal source tracking to determine the origin of issues at the Clive River at Boat Ramp and the Maraetotara Lagoon estuarine sites. Faecal sources will be tracked during dry-weather exceedance events.

7.3 Southern Region

The southern coastal areas of Porangahau Estuary, Kairakau Lagoon and Waipuka Stream have been identified as sites requiring follow-up work to assess state and faecal sources, to help identify potential mitigation techniques.

Porangahau Estuary and Kairakau Lagoon were identified as contaminated from ruminant sources, while Waipuka Stream from avian sources.

8 Acknowledgements

HBRC would like to thank Hawke's Bay District Health Board and Hastings District Council, for their ongoing support of the recreational water quality monitoring programme.

Victor Minter of Wairoa District Council, for taking exceedance re-samples during the holiday period in Mahia.

Hawke's Bay Water Testing for ongoing support.

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