MARLBOROUGH DISTRICT COUNCIL

2021-2022

Recreational Water Quality Report

Technical Report No: 22-003
May 2022

Recreational Water Quality Report 2021-2022

MDC Technical Report No. 22-003

ISSN (Online)
1179-819X
ISBN (Online)
978-1-99-115025-7

File Reference/Record No: E370-007-001/22106996

May 2022

Report Prepared by:
Steffi Henkel
Environmental Scientist - Water Quality
Environmental Science & Monitoring Group

Approved by
Alan Johnson
Environmental Science & Monitoring Manager

Marlborough District Council
Seymour Square
PO Box 443
Blenheim 7240
Phone: 520 7400
Website: www.marlborough.govt.nz

Executive Summary

Eight coastal beaches and eight river swimming spots were monitored weekly from the beginning of November 2021 until the end of March 2022. Samples taken during the monitoring were analysed for the concentration of indicator bacteria, allowing assessment of the health risk to swimmers from waterborne diseases.

More than eighty percent of samples taken at each of the monitoring sites had indicator bacteria concentrations that indicated safe swimming water quality. The exception was the Rai River at Rai Falls, which had the highest indicator bacteria levels of all sites.

Bacteria concentrations at unsafe levels were generally caused by surface run-off as a result of rainfall.

Assessments of changes over time showed significant improvements of recreational water quality at three swimming sites, but also increases in indicator bacteria concentrations at two swimming spots.

Data from previous monitoring seasons was combined to assign Suitability for Contact Recreations (SFR) Grades and determine the state of recreational water quality according to the National Policy Statement for Freshwater Management (NPS-FM) (Table 1).

Type	Site	SFR Grade	NPS-FM state
Coastal Sites	Anakiwa	Good	
	Momorangi Bay	Good	
	Ngakuta Bay	Poor	
	Governors Bay	Fair	
	Picton Foreshore	Fair	
	Waikawa Bay	Fair	
	Waikutakuta/Robin Hood Bay East	Fair	
	Pukatea/Whites Bay	Good	
River Sites	Rai Rv at Rai Falls	insufficient data	
	Te Hoiere/Pelorus Rv at Pelorus Bridge	Good	Good
	Te Hoiere/Pelorus Rv at Totara Flat	Poor	Poor
	Ohinemahuta Rv at Onamalutu Domain	Fair	Fair
	Wairau Rv at Ferry Bridge	Fair	Fair
	Wairau Rv at Blenheim Rowing Club	Fair	Fair
	Taylor River at Riverside	Very Poor	Poor
	Waihopai River at Craiglochart #2	Poor	Poor

Table 1: SFR Grades and NPS-FM state of the swimming spot monitored during the 2021/22 Summer season

The majority of monitoring sites have Fair and Good grades/states, but a small number of sites are graded Poor or Very Poor. Poor or Very Poor gradings require Council to take action. Additional monitoring to identify and subsequently reduce contamination sources as well as projects, such as the Te Hoiere Catchment Restoration Project, are actions aimed at achieving improvements in water quality.

Table of Contents

1. Introduction

Swimming at a beach or taking a dip in a river to cool down are parts of a typical Kiwi summer and Marlborough is fortunate to have generally good water quality. Still, at times the water can contain microorganisms that can make swimmers sick.

In New Zealand, the most common illness associated with recreational water activities is Campylobacteriosis [3]. Other, less common diseases are Cryptosporidiosis and Giardiasis. All three illnesses can cause vomiting, stomach cramps and diarrhoea. It can take up to ten days before symptoms occur, which means that the source of infection is often difficult to determine.

The microorganisms causing these diseases can only multiply in a warm, dark and moist environment, such as the gut of warm-blooded animals. Therefore, the most common reason for their presence in water is contamination with faecal material, such as animal droppings and human waste.

To determine the risk to water users, Council takes weekly water samples from the most popular beaches and rivers during the summer months. Measuring the concentrations of all harmful microorganisms (pathogens) in these samples is both difficult and expensive. Instead, the samples are analysed for indicator bacteria. These are easier to measure and generally occur together with harmful microorganisms. E. coli are the indicator bacteria used for river samples, while Enterococci are the preferred indicator for coastal waters.

This report presents the results for the samples taken during the summer season of 2021/2022. It presents recreational water quality assessments for the swimming sites monitored and looks at changes in water quality over the years.

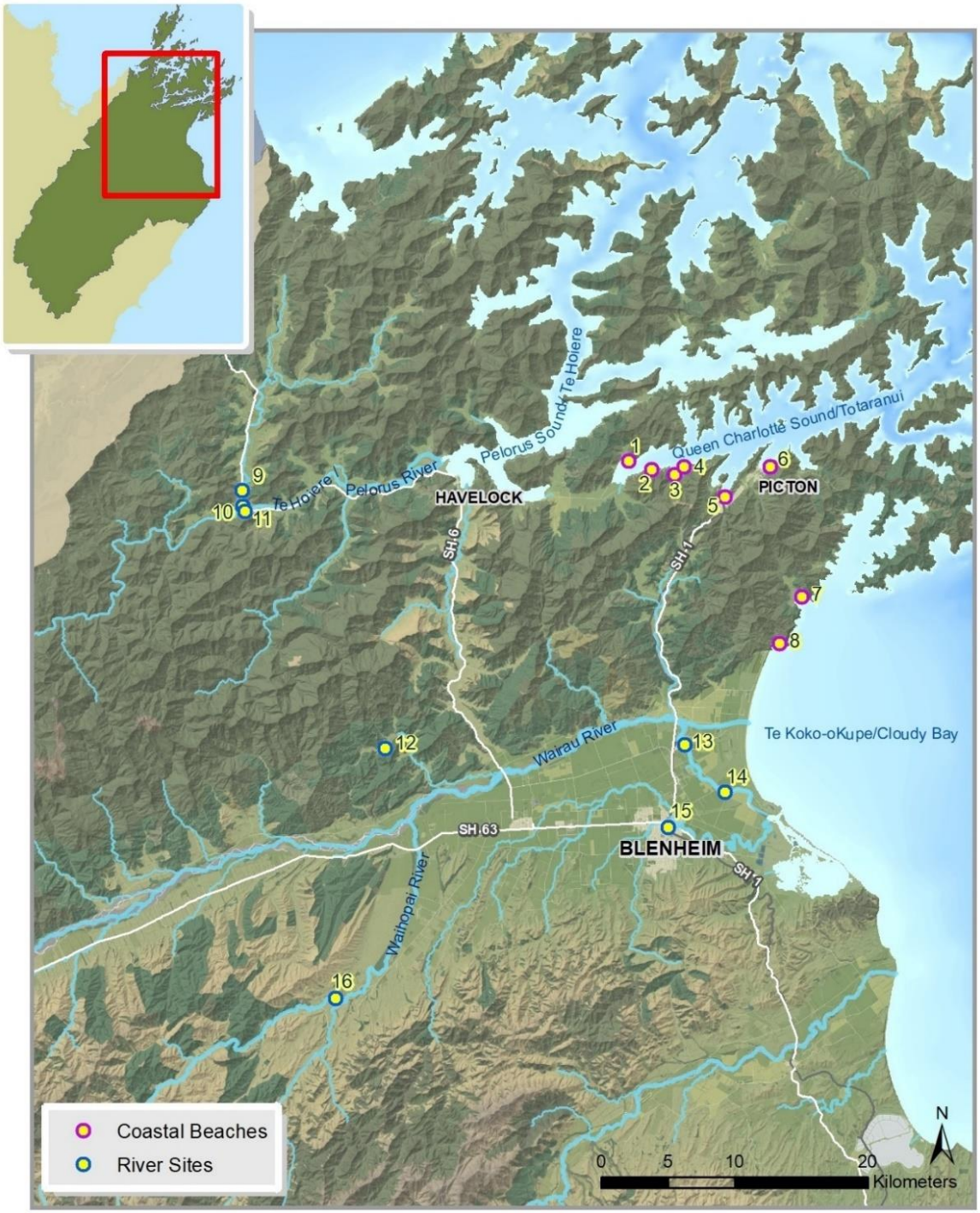
It is important to note, that this report is solely focused on health risks associated with faecal contamination. The results presented are only partially reflective of general water quality. Other risks to swimmers, such as the presence of toxic algae, high flows or strong currents are not covered.

2. Recreational Water Quality Monitoring

During the 2021/2022 summer season, council monitored eight coastal beaches and eight river sites (Image 1). These sites were the most popular swimming locations in a site usage survey carried out in 2017 [9].

These 16 sites were monitored weekly from the beginning of November until the end of March. This is the time when water temperatures are highest, and swimming in natural waters is most popular. Monitoring consisted of field measurements (water temperature and conductivity) and the taking of water samples. The water samples were analysed for faecal indicator bacteria by Hill Laboratories in Blenheim. Bacteria levels were measured using the Enteroalert method for Enterococci and Colilert method for E. coli. For both methods, the samples need to be incubated for 18 to 24 hours before analysis results are available. Once Council has received the analysis results, they can be viewed on the LAWA website (www.lawa.org.nz). LAWA is a viewing platform for environmental information collected by councils across New Zealand. Recreational water quality is presented in the "Can I Swim Here" module of the website. Other environmental information that can be found on LAWA, includes general water quality, water quantity, soil and air quality data.

The following sections provide a short introduction to the guidelines and limits used to assess sampling results for recreational water quality. These guidelines are found in a document that was jointly produced by the Ministry for the Environment and the Ministry of Health in 2003 [11]. The National Policy Statement for Freshwater Management contains limits for river swimming sites, which are closely linked to the 2003 guidelines.



	No.	Site	Easting	Northing
Coastal Beaches	1	Anakiwa	1677073	5431495
	2	Momorangi Bay	1678817	5430879
	3	Ngakuta Bay	1680514	5430489
	4	Governors Bay	1681310	5431030
	5	Picton Foreshore	1684298	5428815
	6	Waikawa Bay	1687695	5431090
	7	Waikutakuta/Robin Hood Bay East	1690115	5421285
	8	Pukatea/Whites Bay	1688425	5417793

	No.	Site	Easting	Northing
River Sites	9	Rai Rv at Rai Falls	1648018	5429266
	10	Te Hoiere/Pelorus Rv at Pelorus Bridge	1648077	5428091
	11	Te Hoiere/Pelorus Rv at Totara Flat	1648262	5427731
	12	Ohinemahuta Rv at Onamalutu Domain	1658791	5409896
	13	Wairau Rv at Ferry Bridge	1681274	5410163
	14	Wairau Rv at Blenheim Rowing Club	1684319	5406605
	15	Taylor Rv at Riverside	1680023	5403987
	16	Waihopai Rv at Craiglochart #2	1655029	5391098

Image 1: Monitoring Sites of the Recreational Water Quality Programme

3. Assessment of Monitoring Results

Our immune system can deal with small concentrations of most pathogens. Only if concentrations are too high do we become sick. There are many factors that influence the number of pathogens that are required to make us sick. One of these factors is the type of pathogen. In New Zealand, the most commonly notified disease caused by recreational water uses is Campylobacteriosis [3]. For this reason, guideline levels are based on the concentration of indicator bacteria that are present when persons contract Campylobacteriosis. However, some persons are more susceptible than others and the guideline values were set to protect roughly 99% of all users.

The risk to swimmers is particularly well studied for the indicator bacterium E. coli, which is used to assess the health risk in rivers. However, E. coli quickly die in saltwater and the risk for beach users might be underestimated. Therefore, the more robust indicator organism Enterococci is used for coastal beaches.

3.1. Guideline Values for Individual Samples

The 2003 Guideline document provides two guideline values for each of the two indicator bacteria. Using the guidelines values, sample results are categorised into three "Modes". Bacteria concentrations within the "Green Mode" indicate that the health risk to swimmers is low. If bacteria levels reach the "Alert mode", the infection risk is slightly increased. Although it is still safe for swimmers to take a dip, it is a flag for council to investigate the sources of increased faecal pollution. Once bacteria concentrations exceed the Action Guideline, the health risk is considered unacceptable. Table shows the range of indicator bacteria concentrations for the "Modes" and the associated guidelines.

Mode	Freshwater E. coli/100mL	Coastal Enterococci/100mL	Meaning
Green Mode	<260	<140	**Safe** for contact recreation
Alert Guideline	260	140	
Alert Mode	260 - 550	140 - 280	**Increased risk** for health
Action Guideline	550	280	
Action Mode	>550	>280	**Unsafe** for conctact recreation

Table 2: Modes in the Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas [11].

In Marlborough, most exceedances of the Action Guideline are caused by rainfall. Rainfall that hits the ground and is not absorbed by the soil flows over the surface and into the nearest stream or coastal area. This is referred to as surface run-off. If the water flows over animal droppings, it becomes contaminated with microorganisms and other pollutants. For this reason, rivers and streams usually have higher faecal bacteria concentrations during rainfall. Riparian buffer vegetation on stream banks can stop some of the pollution. However, even streams flowing through native bush will contain some faecal bacteria during rainfall, originating from native birds and other wild animals.

In urban areas, most surfaces will not allow rainfall to infiltrate into the ground. Therefore, the proportion of rainfall forming surface run-off is greater. The run-off collects in stormwater pipes that often discharge directly into streams and coastal waters. In addition to animal droppings, the main sources of contamination in urban areas are sewer overflows and damage to the sewerage infrastructure.

In small residential areas, private sewage treatment can also be a source of faecal contamination. These private systems require regular checks and maintenance to function properly. In Marlborough, it is the responsibility of the private landowner to ensure that their system is functioning.

The District Health Board and council have released a general recommendation to not swim in waterways for up to 48 hours following heavy rainfall or if the water is discoloured. This message is usually reinforced with a media release at the beginning of each summer season.

3.2. Suitability for Contact Recreation Grades (SFR Grades)

To determine the concentration of indicator bacteria, a sub-sample is injected into a growing medium and the medium is then placed into an incubator. This creates ideal conditions for the indicator bacteria to multiply. After 18 – 24 hours of incubation, the bacterial colonies can be counted, and a concentration calculated.

Unfortunately, this analysis methods results in a delay of at least one day before the bacterial concentration in a sample can be known. This means by the time analysis results are received, the concentration of indicator bacteria has likely changed. Particularly rainfall can cause significant changes in water quality within minutes. This means that the latest sampling results should not be used to decide whether it is safe to swim or not. To overcome this problem, a grading system, the SFR Grades, was developed. SFR Grades range from 'Very Good' to 'Very Poor' and provide an overall assessment of recreational water quality using monitoring data collected over several summer seasons. Table 2 lists the five SFR Grades and what they represent.

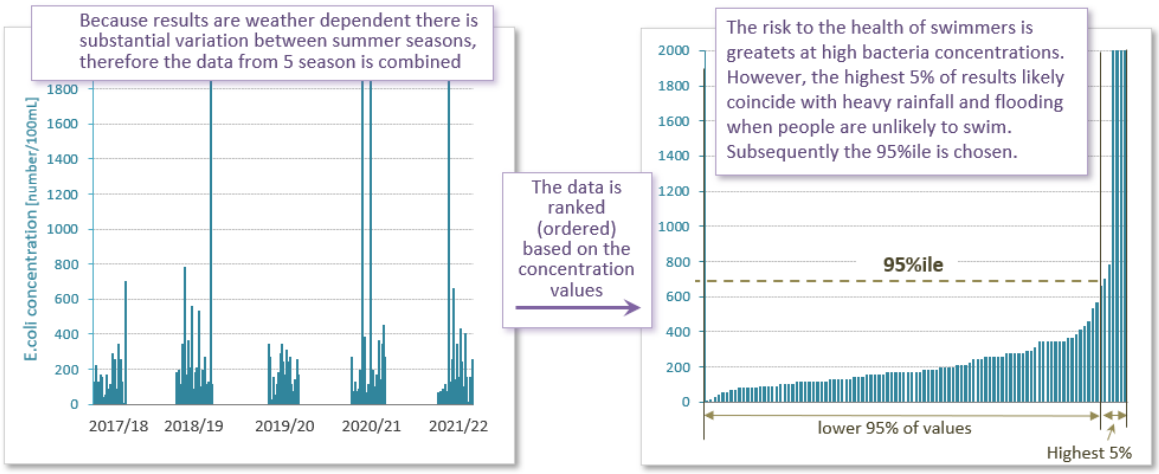
SFR Grade	Meaning
Very Good	Considered satisfactory for swimming at all times.
Good	Satisfactory for swimming most of the time with exceptions following rainfall.
Fair	Generally satisfactory for swimming. Caution should be taken during periods of high rainfall and swimming avoided if water is discoloured.
Poor	Swimming should be avoided, particularly by the very young, the very old and those with compromised immunity.
Very Poor	Generally swimming is not recommended.

Table 2: Suitability for Contact Recreation Grades (SFR Grades) and their meaning

Determining the SFR Grade for a swimming site is done in two parts. The first part is an assessment of the health risk from all potential faecal sources within the catchment [1] Based on the assessment, sites are assigned one of five **Sanitary Inspection Categories, SICs**. These categories range from 'Very Low' to 'Very High' (Risk). Direct discharges into rivers and coastal areas are the most obvious sources of faecal contamination, but faecal material can enter water bodies also from a variety of land use activities. If a swimming spot is surrounded by native bush, the health risk from waterborne diseases is considered to be minimal and the site is given a SIC of 'Very Low'. Extensive sheep and beef farms cause a slightly greater risk of faecal contamination, particularly if livestock can access streams. This results in a SIC of 'Low' or 'Moderate'. The highest health risk is generally associated with human sewage. Swimming spots influenced by residential and urban development are therefore assigned a SIC of 'Moderate' to 'Very High'.

The second part of the SFR grading is the **Microbiological Assessment Category, MAC.** The MAC is calculated from bacteria concentrations in samples taken at a site over a period of five years. MACs range from A to D and are based on the upper 95th percentile (95%ile) calculated with the Hazen method (Figure 2).

[1] A catchment is the land area from which all rainfall that falls onto it eventually flows to a river sampling site or into a coastal bay. It is also sometimes referred to as a drainage basin or watershed.



2003 Guidelines

MAC (Microbiological Assessment Category)	Coastal Enterococci/100mL*	Rivers E. coli/100mL*
A	<41	<131
B	41 - 200	131 - 260
C	201 - 500	261 - 550
D	>500	>550

2020 NPS-FM

Attribute State	Limits - Rivers E. coli/100mL*
Excellent	<130
Good	>130 - ≤260
Fair	>260 - ≤540
Poor	>540

* upper 95th Percentile (95%ile) of routine sampling over 5 consecutive summers

Figure 2: Calculation of the upper 95%ile, which is used to assign the Microbiological Assessment Category (MAC) and NPS-FM state based on the tables shown

The MAC is also used to determine the attribute state for river swimming sites in the National Policy Statement for Freshwater Management (NPS-FM). The NPS-FM limits are mostly equivalent to the MAC categories. The limit of 540 E. coli/100mL represent the "National Bottom Line", and rivers with MAC values above this limit require Councils to take action to improve water quality.

The calculation of the MAC requires a minimum of 20 sample results per season over a period of five consecutive summers. This means that it will take several years before new sites can be graded. On the LAWA website gradings are based on the MAC calculation only. In the 2003 national guidelines the SFR Grade combines the results from the SIC and MAC analysis (Table 3). The SIC allows adjustment of the grade based on the health risk from different sources of faecal contamination. For example, contamination from human sources generally presents a greater risk to swimmers than animal droppings. The MAC grading alone does not provide for this. The main argument against the inclusion of the SIC into the grading is that it introduces some subjectivity to the process. However, the use of genetic source tracking methods and site investigations allow the SIC category to be determined with greater certainty.

In this report the grading of sites is based on the 2003 guidelines using the MAC and SIC categories to determine the SFR Grade. The SFR Grades are updated after every summer season as new data becomes available.

SFR Grade (Suitability for Contact Recreation Grade)		MAC (Microbiological Assessment Category) A	B	C	D
SIC (Sanitary Inspection Category)	Very Low	Very Good	Very Good	*	*
	Low	Very Good	Good	Fair	*
	Moderate	*	Good	Fair	Poor
	High	*	*	Poor	Very Poor
	Very High	*	*	*	Very Poor

* unexpected result (further investigation is necessary)

Table 3: Assignment of SFR Grades from MAC and SIC results

4. Result Summary and Discussion

The following two sections summarise and analyse the monitoring results for the 2021/2022 summer season. Also discussed are changes over time and SRF Grades as well as NPS-FM states.

4.1. Coastal Beaches

Of the ten coastal sites that are usually part of the programme, two sites could not be monitored in the 2021/22 season. Landslides caused by a rainstorm in July 2021 resulted in road closures that lasted into the summer and restricted access to Okiwi Bay and Mistletoe Bay.

The eight beaches monitored had generally low Enterococci concentrations. At all sites, at least eighty percent of samples had bacteria concentrations in the green mode, which indicates safe recreational water quality (Figure 3).

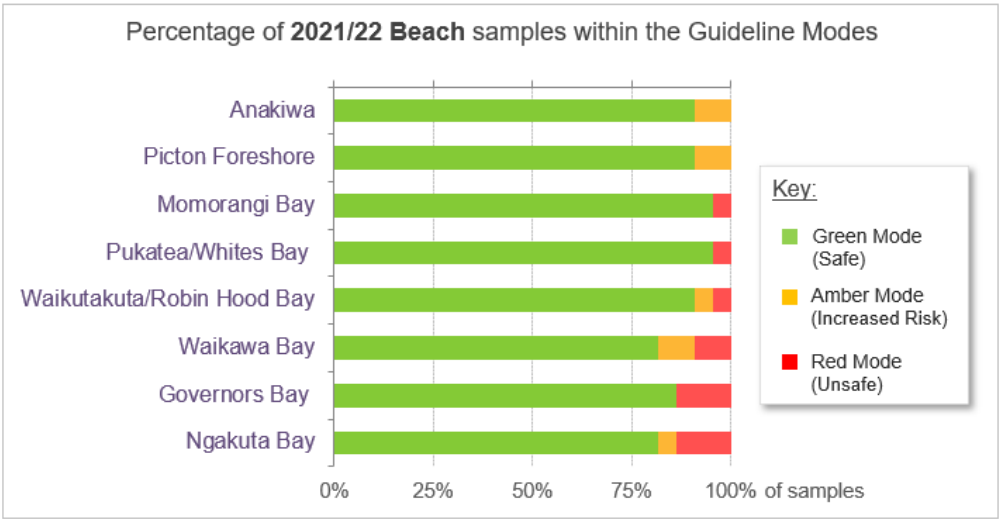


Figure 3: Percentage of samples within the recreational water quality modes for beaches monitored in the 2021/22 summer season

The coastal beaches with the best recreational water quality this summer were Anakiwa and Picton Foreshore. None of the samples taken from these two sites had Enterococci concentrations that were unsafe for swimmers. At the other beaches unsafe bacteria levels were generally associated with rainfall events. The only exception was a sample taken from Governors Bay in mid-March. Similar exceedances of guideline levels were observed in Governors Bay in March during previous summer seasons. Based on current investigation results, the most likely source is visiting boats.

Ngakuta Bay had the poorest recreational water quality. Comparison of the results with those from neighbouring bays, Momorangi and Governors Bay, shows that bacteria levels in Ngakuta Bay were often significantly higher as a result of rainfall (Figure 4). In mid-December, a sample from Ngakuta Bay had high Enterococci concentrations when no rainfall was recorded at Waikawa. However, Enterococci levels were also elevated in Momorangi Bay, which might indicate a localised shower that did not reach Waikawa.

Momorangi Bay has a community sewage treatment system installed and operated by the Department of Conservation. In contrast, each of the more than 200 dwellings in Ngakuta Bay have a separate sewage treatment system. The compliance department has been investigating possible sewage leaks. Additionally, a new State of the Environment monitoring site in the lower parts of Ngakuta Bay Stream is going to provide valuable information on river water quality in the Ngakuta catchment. This will assist in determining the causes for the high bacteria levels in the bay.

Enterococci concentrations in Governors Bay are likely influenced by the bay's proximity to Ngakuta Bay. Rainfall therefore caused comparatively high Enterococci levels in Governors Bay despite the absence of dwelling within the catchment.

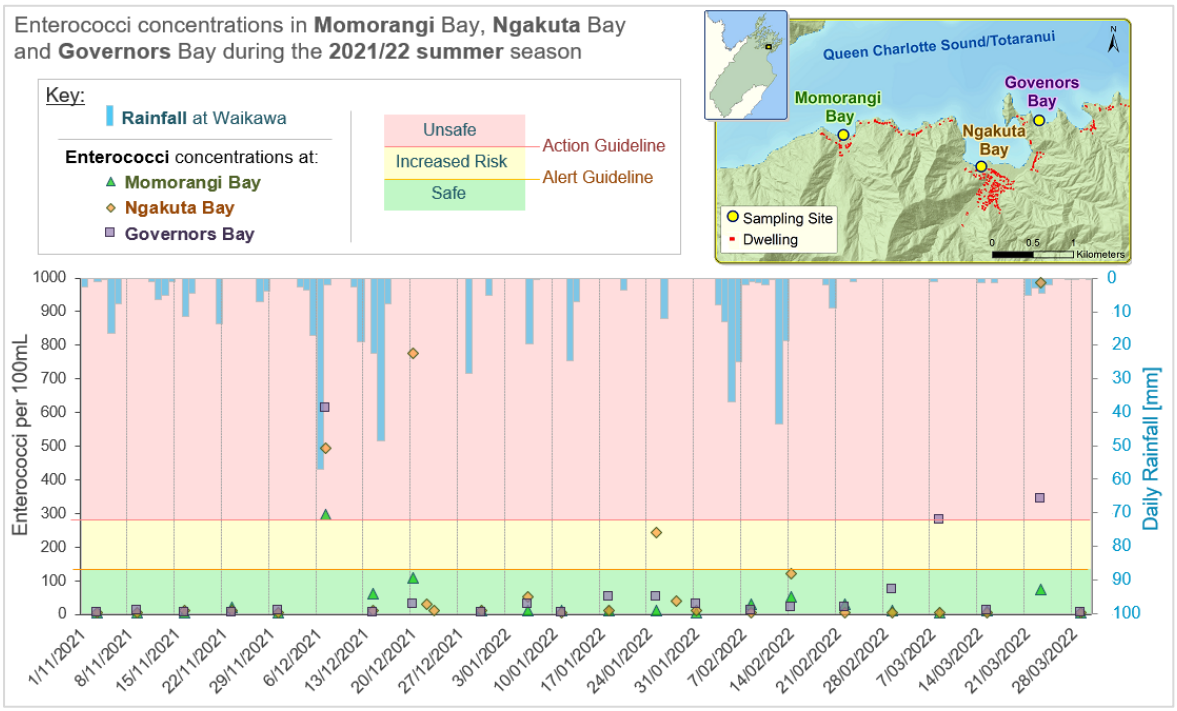


Figure 4: Enterococci concentrations in Momorangi Bay, Ngakuta Bay and Governors Bay during the 2021/2022 summer season

Figure 5 show the MAC (5-year 95th percentile) values, which are one of the measures that determine the SFR Grade for the beaches monitored. Also shown are changes over the last ten years.

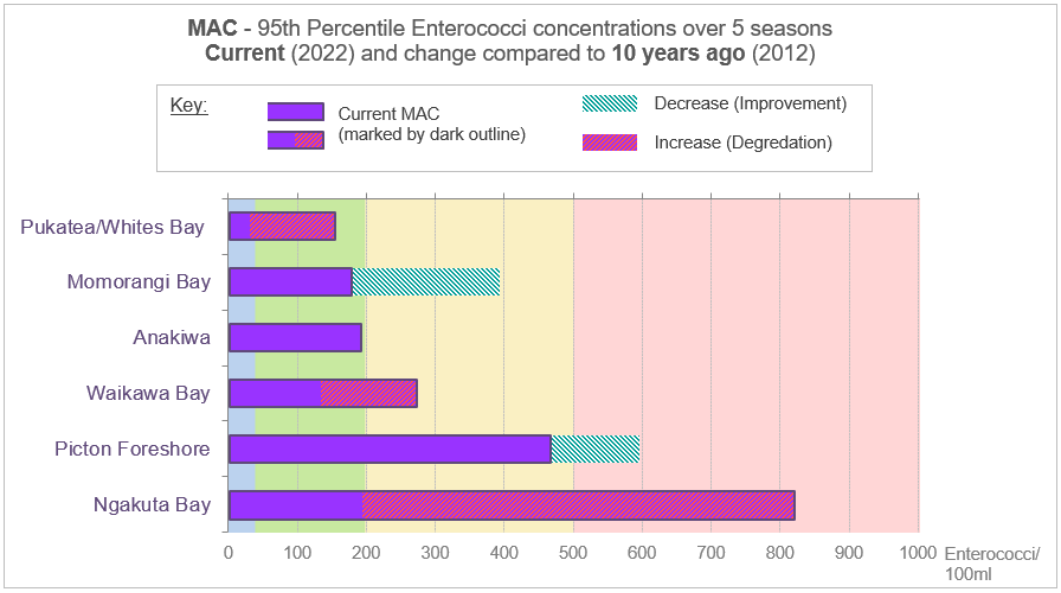


Figure 5: MAC values for the beaches monitored in the 2021/22 summer season with changes compared to the MAC values in 2012 (10 years ago).

Ngakuta Bay has seen the greatest change over the past ten years with significant increases in Enterococci concentrations. The increase in bacteria levels has caused the SFR Grade for this monitoring site to change from Good to Poor.

Increases in Enterococci concentrations were also observed in Waikawa Bay and Pukatea/Whites Bay, resulting in changes in SFR Grades from Good to Fair and Very Good to Good, respectively. Changes in the MAC values for Waikawa Bay have occurred within in the last three years. However, the changes are mirrored by similar increases at Picton Foreshore, which indicates that the change might be a result of natural influences such as fluctuations in rainfall patterns. Despite these recent increases, the recreational water quality in Picton Foreshore has improved when compared to MAC values calculated ten years ago. Upgrades and repairs of the Picton sewerage infrastructure have resulted in a significant reduction in bacteria levels in waterways and coastal water in and around Picton. The recreational water quality of the Picton Foreshore is now graded as Fair.

Substantial improvements in Momorangi Bay were also a result of repairs and upgrades to sewerage infrastructure, in this case by the Department of Conservation.

The MAC values for Waikutakuta/Robin Hood Bay and Governors Bay are not shown in Figure 5 as these sites are relatively new additions to the programme and were not monitored ten years ago. Both sites have MAC values in the C category and are graded as Fair.

4.2. River Sites

The Te Hoiere/Pelorus River at Pelorus Bridge had the best recreational water quality of the eight river sites monitored. All samples taken from this site had E. coli concentrations that were safe for swimming (Figure 6). Results for the other river spots show a varying number of samples within the Amber mode, but at most sites only one sample had unsafe E. coli concentrations. These were caused exclusively by rainfall within the catchments.

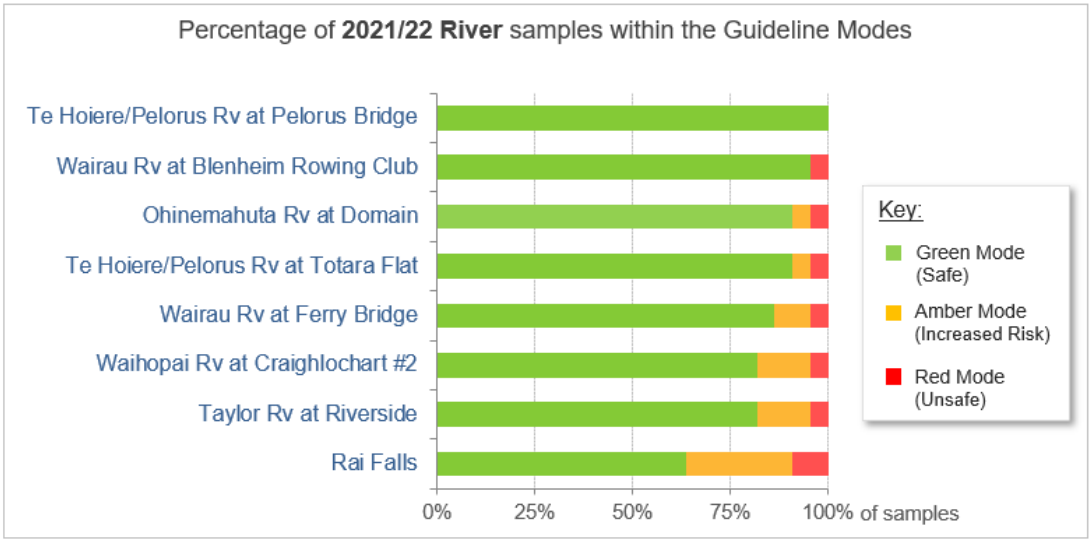


Figure 6: Percentage of samples within the recreational water quality modes for river sites monitored in the 2021/22 summer season

The Rai River at Rai Falls had the highest number of samples that exceeded guideline levels. Although unsafe E. coli concentrations at this site were related to rainfall events as well, comparison with the nearby Te Hoiere/Pelorus River at Pelorus Bridge shows that E. coli levels in the Rai River were consistently higher in all the samples taken (Figure 7). The elevated bacteria levels in the Rai River had follow-on effects on the Te Hoiere/Pelorus River downstream of the confluence with the Rai River causing increased E. coli concentrations at Totara Flat.

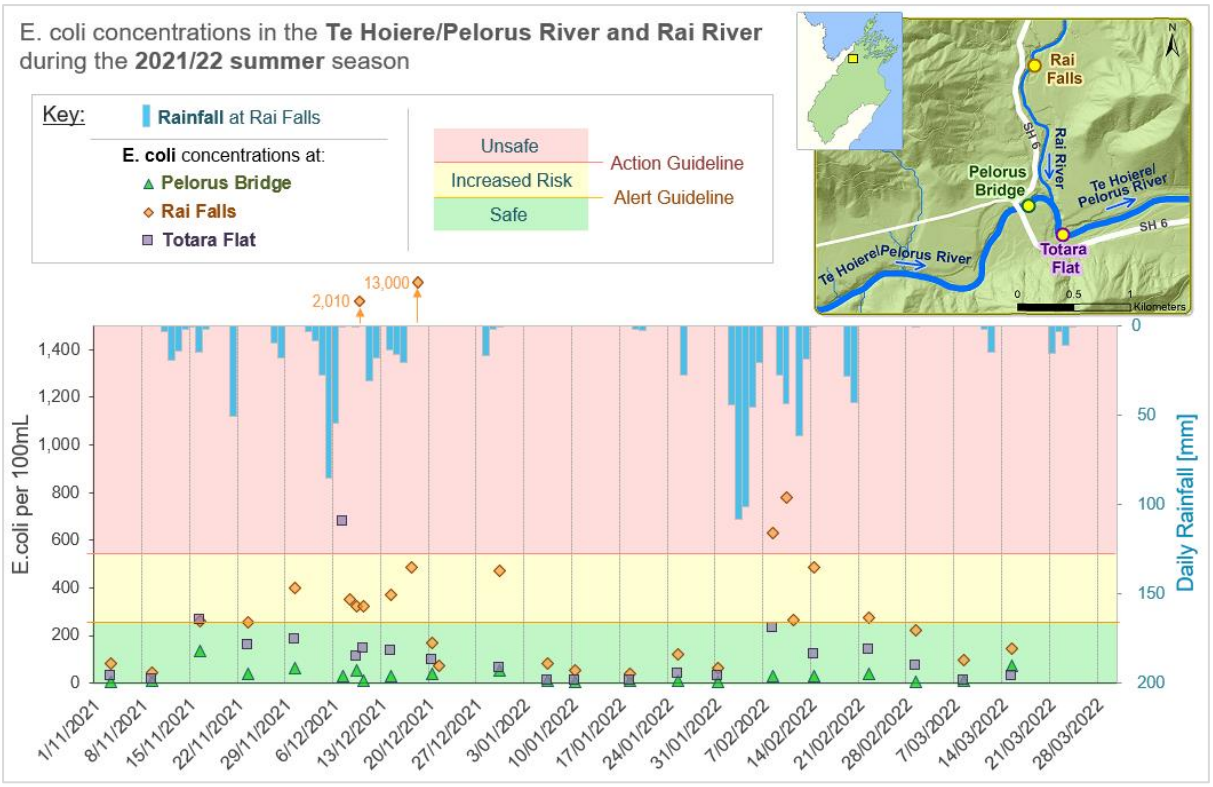


Figure 7: E. coli concentrations in the Te Hoiere/Pelorus River and Rai River during the 2021/22 summer season

In previous summer seasons, the site with the poorest recreational water quality had been the Taylor River at Riverside. However, water quality in the Taylor River has notably improved in the recent two summer seasons. This is confirmed by trend analysis showing a significant decrease in E. coli concentrations over the last five years (Figure 8). The improvements are a result of recent repairs to sewer and stormwater pipes that were damaged during the Kaikōura earthquake.

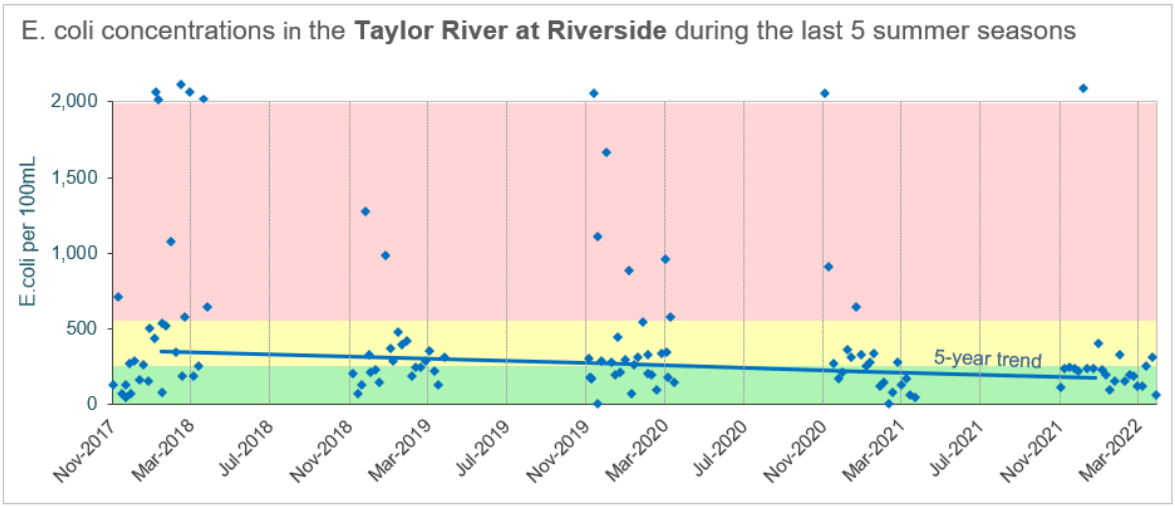


Figure 8: E. coli concentrations in the Taylor River at Riverside in the recent five summer seasons

Approximately 650m upstream of the Riverside monitoring site, the Henry Street footbridge is a popular spot for jumps into the Taylor River. It was decided to carry out additional monitoring of the Taylor River at the Henry Street bridge to assess the health risk to the swimmers there. The

monitoring showed that E. coli concentrations were very similar at both sites and monitoring of the Henry Street bridge will be discontinued.

Despite the recent improvements in recreational water quality, the Taylor River is currently still graded as Very Poor. The reason is that calculation of the SFR Grade is based on data over a period of five summer season, which includes earlier summers when E. coli concentrations were significantly higher.

Figure 9 shows the MAC values used to determine SFR Grades and NPS-FM states for long-term monitoring sites. MAC limits for SFR Grades and NPS-FM states are equivalent apart from a small difference in the threshold between Fair and Poor. Half of the river sites shown in the graph are graded good or fair, while the other half is graded poor or very poor. The MAC value for Ohinemahuta River at Domain is not included in Figure 9 as the sites was not monitored ten years ago. The site has a MAC in the C category and is graded Fair.

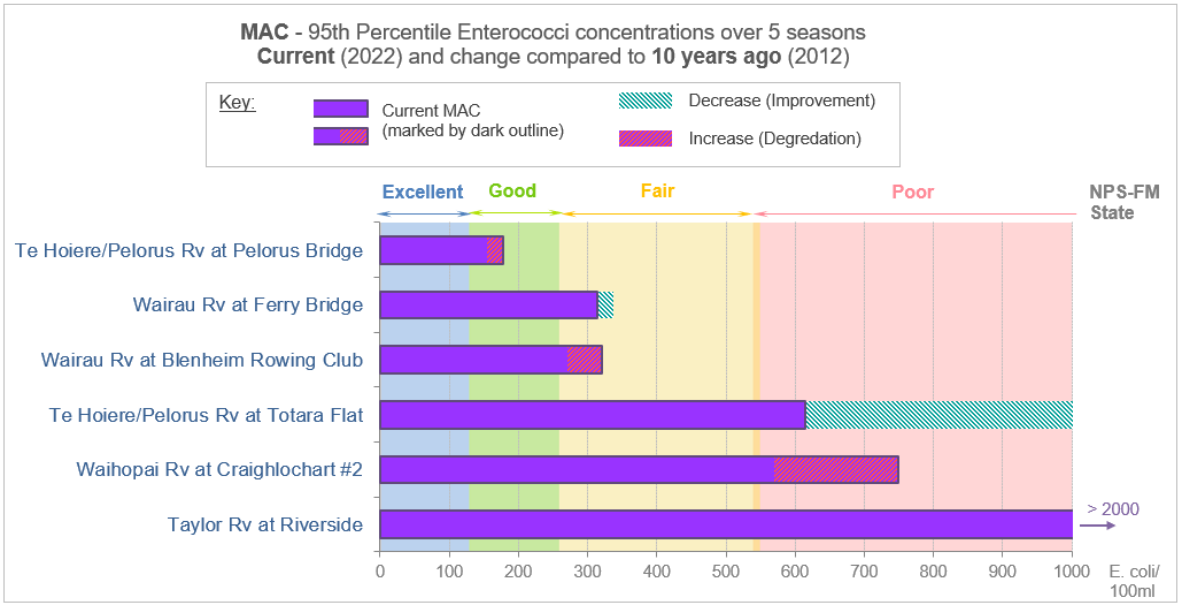


Figure 9: MAC values for the river sites monitored in the 2021/22 summer season with changes compared to the MAC values in 2012 (10 years ago)

Figure 9 also shows the changes of MAC values when compared to values ten years ago, in 2012. Generally, changes in MAC values that are a result of natural year-to-year variations in rainfall are small. However wider climatic cycles could also be responsible for larger changes. The notable increase in E. coli concentrations in the Waihopai River at Craighlochart #2 is potentially part of such a re-occurring climatic pattern.

Figure 10 shows that the MAC values for the Waihopai River site have oscillated between fair and poor gradings over the last twenty years. Although, recreational water quality at the site does at times fall into a fair grading, relatively small improvements could result in a consistent SFR Grade (and NPS-FM state) of Fair, which would represent acceptable water quality. At the start of 2022, three additional Waihopai River monitoring sites were established as part of the general monthly State of the Environment programme. The sites are located upstream of the swimming spot at Craighlochart #2 and will provide valuable insight into potential sources of E. coli in the river.

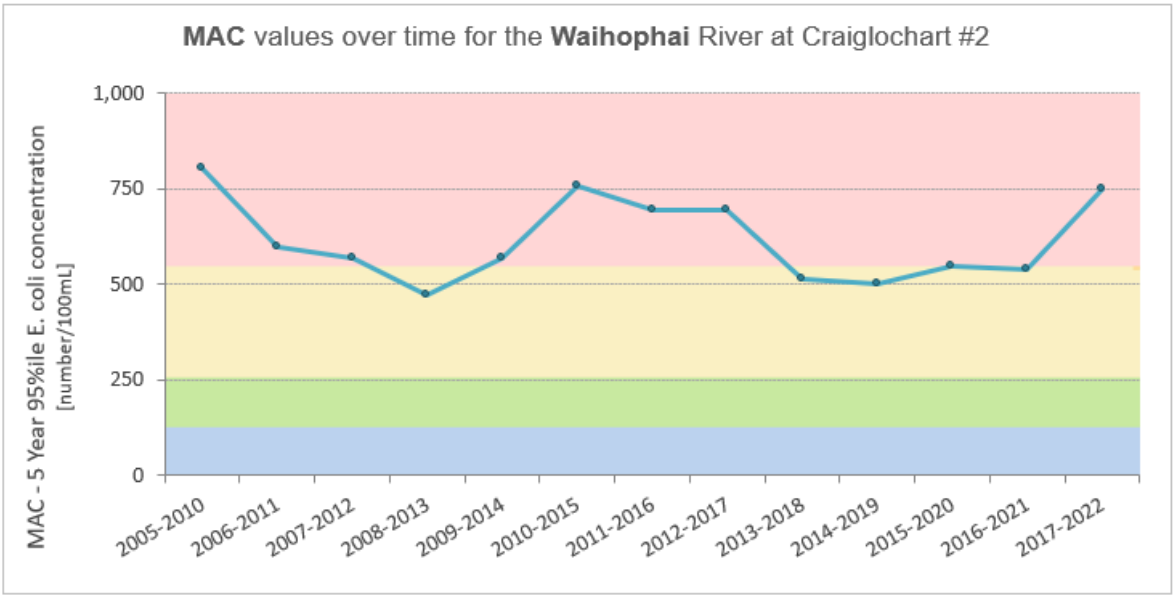


Figure 10: MAC values for the Waihopai River at Craiglochart #2 from 2010 until today

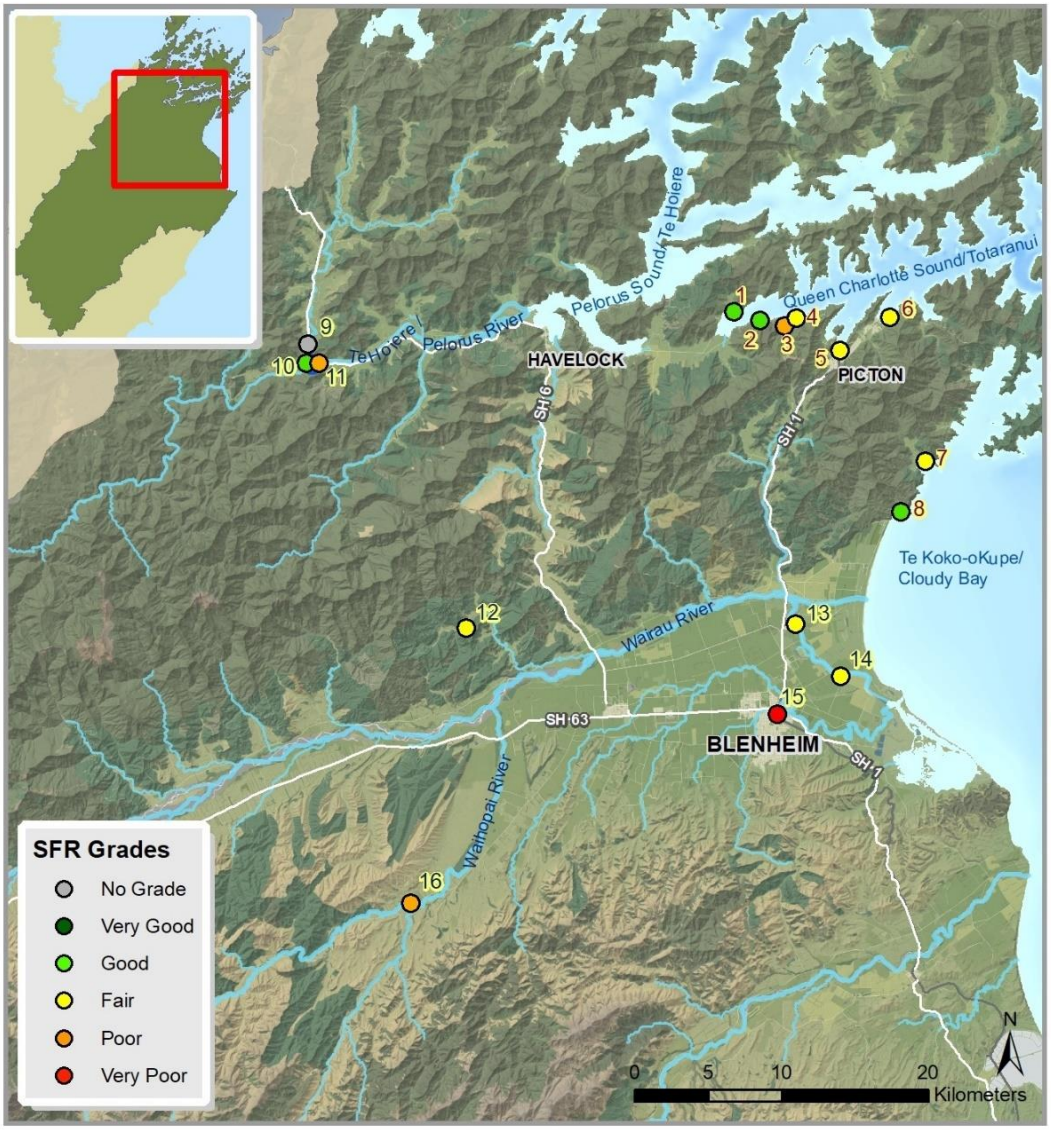
The most notable change in MAC values is a reduction in E. coli concentrations in the Te Hoiere/Pelorus at Totara Flat. The reason is a significant improvement in the water quality of the Rai River which flows into the Te Hoiere/Pelorus River just upstream of Totara Flat. Although the Rai River is part of the current monitoring programme, monitoring was ceased for several seasons following a site usage survey which showed a relatively small number of swimmers at this site. However, the new Marlborough Environment Plan (MEP) includes an objective for the swimming water quality at the Rai Falls and monitoring was therefore re-instated following the release of the MEP. Unfortunately, there is yet insufficient data to grade the Rai River, but recreational water quality is likely to be graded poor despite the improvements evident at Totara Flat. The Te Hoiere Catchment Restoration Project aims to improve water quality in the Te Hoiere/Pelorus catchment, which should see further reductions in E. coli concentrations in the Rai River and subsequently Totara Flat.

The Marlborough Environment Plan (MEP) contains an Anticipated Environmental Result (AER) that relates to river water quality at recreational sites (Table 4). The AER is closely linked to the NPS-FM. Four of the sites monitored meet the AER, while three site are currently not meeting it. There are several projects already mentioned that have the aim to improve water quality at the three sites not currently meeting the AER.

AER (Anticipated Environmental Result)	Monitoring Effectiveness	Current Progress	
		Achieved for	Not Achieved for
15.AER.1 Water quality in Marlborough's rivers, lakes and wetlands is suitable to support and sustain swimming, fishing, aquatic ecosystems and customary harvesting.	The 95th percentile E. coli level in waterbodies valued for primary contact recreation is <540 per 100 ml.	• Te Hoiere/Pelorus River at Pelorus Bridge • Wairau River at Ferry Bridge • Wairau River at Blenheim Rowing Club • Ohinemahuta River at Domain	• Te Hoiere/Pelorus River at Totara Flat • Taylor River at Riverside • Waihopai River at Craiglochart #2

Table 4: Anticipated Environmental Result for River Swimming Sites in Marlborough

Figure 11 shows the SRF Grades and NPS-FM states for all the swimming spots monitored in the 2021/22 summer season. The majority of sites is graded good or fair.



Type	No.	Site	Easting	Northing	SIC (Sanitary Inspection Category)	MAC (Microbiological Assessment Category)	SFR Grade (Suitability for Contact Recreation)	NPS-FM state (National Policy Statement - Freshwater)
Beach Sites	1	Anakiwa	1677073	5431495	Moderate	B	Good	
	2	Momorangi Bay	1678817	5430879	Moderate	B	Good	
	3	Ngakuta Bay	1680514	5430489	Moderate	D	Poor	
	4	Governors Bay	1681310	5431030	Low	C	Fair	
	5	Picton Foreshore	1684298	5428815	Moderate	C	Fair	
	6	Waikawa Bay	1687695	5431090	Moderate	C	Fair	
	7	Waikutakuta/Robin Hood Bay East	1690115	5421285	Moderate	C	Fair	
	8	Pukatea/Whites Bay	1688425	5417793	Low	B	Good	
River Sites	9	Rai Rv at Rai Falls	1648018	5429266	insufficiant data*			
	10	Te Hoiere/Pelorus Rv at Pelorus Bridge	1648077	5428091	Low	B	Good	Good
	11	Te Hoiere/Pelorus Rv at Totara Flat	1648262	5427731	Moderate	D	Poor	Poor
	12	Ohinemahuta Rv at Onamalutu Domain	1658791	5409896	Moderate	C	Fair	Fair
	13	Wairau Rv at Ferry Bridge	1681274	5410163	Moderate	C	Fair	Fair
	14	Wairau Rv at Blenheim Rowing Club	1684319	5406605	Moderate	C	Fair	Fair
	15	Taylor Rv at Riverside	1680023	5403987	High	D	Very Poor	Poor
	16	Waihopai Rv at Craiglochart #2	1655029	5391098	Moderate	D	Poor	Poor

* this site has been monitored less than 5 years

Figure 11: SFR Grades and NPS-FM states of Recreational Water Quality Sites monitored in the 2021/22 summer season

References

1. Badgley BD, Thomas FI, Hardwood VJ (2010) *The effects of submerged aquatic vegetation on the persistence of environmental populations of Enterococcus spp*. Environ Microbiol. 12(5): 1271-81
2. ESR (2015) *Human health risks of faecal pollution from different sources: A review of the literature*. Report prepared for Environment Canterbury, Report No: CSC15019
3. ESR (2019) *Notifiable Diseases in New Zealand: Annual Report 2017*. Prepared for Ministry of Health, Report No.: FW18030
4. MDC (2012) *Recreational Water Quality Report 2011-12*. Marlborough District Council, Technical Report 12-013
5. MDC (2013a) *Recreational Water Quality Report 2012-13*. Marlborough District Council, Technical Report 13-006
6. MDC (2013b) *Investigation into High E. coli Concentrations in the Taylor River during Low Flows*. Marlborough District Council, Technical Report 13-007
7. MDC (2014) *State of the Environment Surface Water Quality Monitoring Report*. Marlborough District Council, Technical Report 14-006
8. MDC (2016) *Recreational Water Quality Report 2016-17*. Marlborough District Council, Technical Report 16-003
9. MDC (2017) *Recreational Water Quality Site Usage Survey 2017.* Marlborough District Council, Technical Report 17-001
10. MDC (2018) *Recreational Water Quality Report 2016-17*. Marlborough District Council, Technical Report 18-005
11. MfE/MoH (2003) *Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas.* Ministry for the Environment
12. Solo-Gabriele H.M. et al. (2016) *Beach sand and the potential for infectious disease transmission: observations and recommendations*. Journal of the Marine Association of the United Kingdom 96(1), 101-120
13. Tiernan F (2016) *MDC's Stormwater Monitoring Network, Blenheim. Water Quality Results 2013-14*. Report prepared by SEE Ltd for Marlborough District Council

5. Appendices

5.1. Appendix 1: Results for the 2021/2022 summer season

Results are Enterococci concentrations for coastal sites and E. coli concentrations for river sites, both in MPN/100mL.

Site Type	Week	Sample Date	Anakiwa	Momorangi Bay	Ngakuta Bay	Governors Bay	Picton Foreshore	Waikawa Bay	Whites Bay	Robin Hood Bay East
Coastal	1	02/03 Nov 2021	5	5	5	5	228	501	5	5
	2	08/09 Nov 2021	5	5	5	10	93	135	5	5
	3	15/16 Nov 2021	5	5	10	5	5	5	5	5
	4	22/23 Nov 2021	5	20	10	5	31	20	5	10
	5	29/30 Nov 2021	5	5	5	10	5	5	5	5
	6	06/07 Dec 2021	73	295	495	613	62	538	288	1,872
	7	13/14 Dec 2021	63	63	10	5	10	233	5	10
	8	20/21 Dec 2021	5	108	776	31	10	20	10	5
	Follow-up	22/23 Dec 2021			31/10/40					
	9	29/30 Dec 2021	20	10	10	5	10	20	5	187
	10	05/06 Jan 2022	52	10	52	31	74	10	5	120
	11	10/11 Jan 2022	30	10	5	5	10	5	5	5
	12	17/18 Jan 2022	5	10	10	52	86	41	5	5
	13	24/25 Jan 2022	5	10	243	51	41	10	5	10
	14	31 Jan/01 Feb 2022	5	5	10	31	73	5	5	5
	15	08/09 Feb 2022	63	31	5	10	5	52	5	5
	16	14/15/16 Feb 2022	256	52	121	20	97	171	63	74
	17	21/22 Feb 2022	5	31	5	20	5	5	20	86
	18	28 Feb/01 Mar 2022	5	10	5	74	10	5	10	5
	19	07/08 Mar 2022	31	5	5	282	10	5	5	10
	20	14/15 Mar 2022	10	10	5	10	134	10	5	5
	21	22/23 Mar 2022	187	74	987	345	231	134	5	40
	22	28/29 Mar 2022	5	5	5	5	5	5	40	5

Site Type	Week	Sample Date	Pelorus Rv at Pelorus Bridge	Rai Rv at Rai Falls	Pelorus Rv at Totara Flat	Waihopai Rv at Craiglochart #2	Ohinemahuta Rv at Onamalutu Domain	Wairau Rv at Ferry Bridge	Wairau Rv at Blenheim Rowing Club	Taylor Rv at Riverside
River	1	02/03 Nov 2021	5	82	32	10	22	4	4	114
	2	08/09 Nov 2021	11	43	14	12	24	7	7	238
	3	15/16 Nov 2021	134	259	266	120	41	52	73	246
	4	22/23 Nov 2021	41	256	160	332	110	305	145	238
	5	29/30 Nov 2021	63	402	185	97	72	135	146	226
	6	06/07 Dec 2021	30	2,010	677	2,250	2,910	1,137	1,607	4,350
	Follow-up	08/09/10 Dec 2021	52 / 10	350 / 322 / 322	110 /145	246 / 173		173 / 74	134 / 110	183 / 226
	7	13/14 Dec 2021	31	369	135	209	97	189	171	240
	Follow-up	16/17 Dec 2021		13000 / 487						
	8	20/21 Dec 2021	41	171 / 74	97	145	10	41	135	240
	9	29/30 Dec 2021	52	474	63	529	84	110	158	408
	10	05/06 Jan 2022	10	85	10	121	10	52	31	228
	11	10/11 Jan 2022	5	52	10	41	5	31	5	201
	12	17/18 Jan 2022	10	41	10	41	5	52	5	97
	13	24/25 Jan 2022	10	121	41	41	5	20	10	156
	14	31 Jan/01 Feb 2022	5	63	31	85	10	63	20	327
	15	08/09 Feb 2022	31	631	231	86	85	74	171	156
	Follow-up	10/11 Feb 2022		780 / 265						
	16	14/15/16 Feb 2022	31	487	119	108	109	144 / 97	148	201
	17	21/22 Feb 2022	41	275	142	395	98	345	231	187
	18	28 Feb/01 Mar 2022	5	223	74	52	52	20	20	122
	19	07/08 Mar 2022	10	98	10	10	52	30	5	122
	20	14/15 Mar 2022	74	145	31	74	10	41	20	259
	21	22/23 Mar 2022	63	364	187	122	464	86	63	318
	22	28/29 Mar 2022	31	86	20	30	20	30	31	63