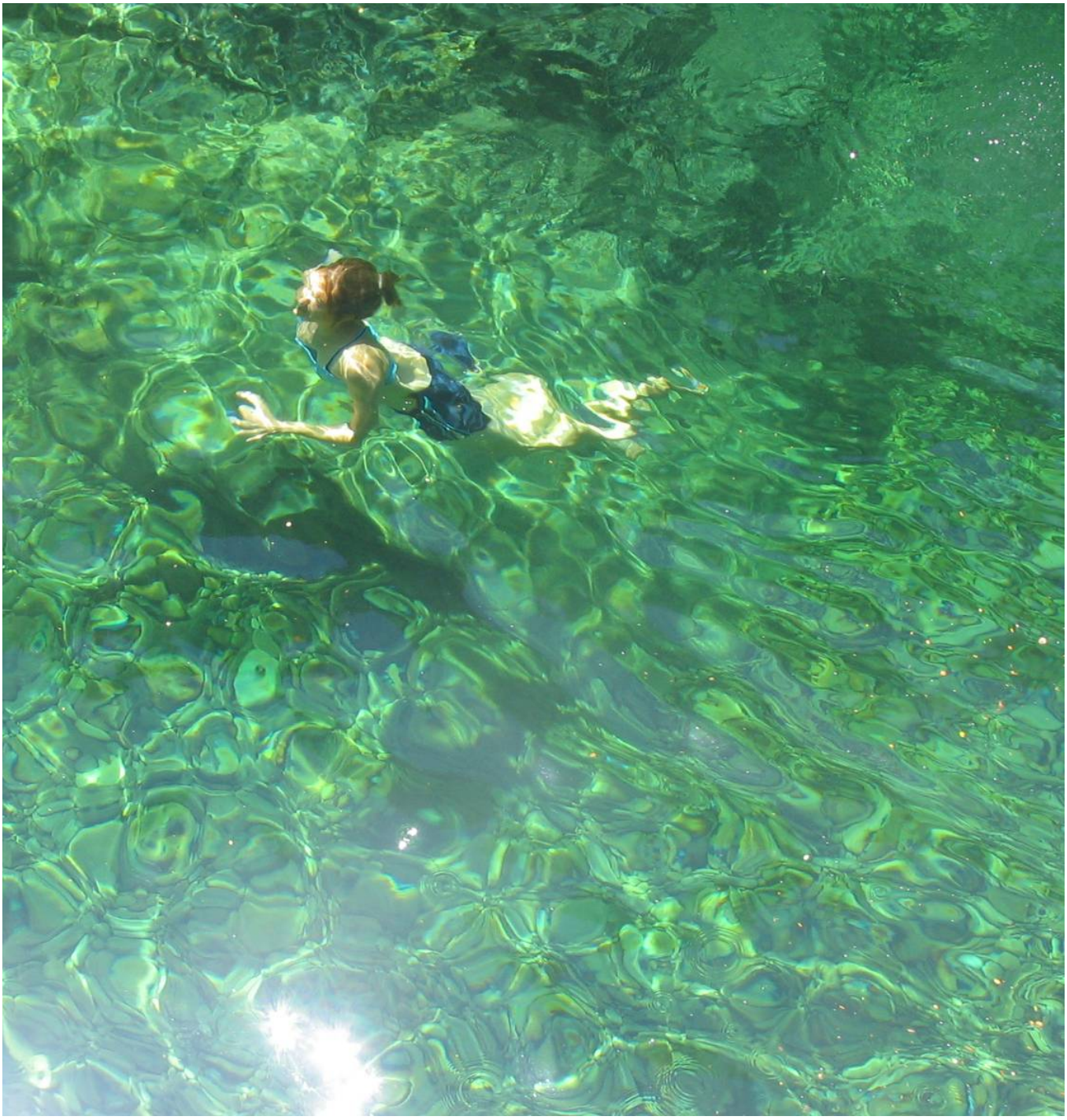
Recreational Water Quality Report, 2010-11

Technical publication No. 12-003

February 2012



MARLBOROUGH DISTRICT COUNCIL

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MDC Technical Report No: 12-003

ISSN 1179-8181 (Print)
ISSN 1179-819X (Online)

ISBN 978-1-927159-10-1 (Print)
ISBN 978-1-927159-11-8 (Online)

File Reference/Record No: E225-007/1258842

February 2012

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Executive Summary

Thirteen river locations and eighteen coastal locations in Marlborough are monitored on a weekly basis during the summer months (November to March inclusive) and assessed against the Ministry for the Environments (MfE's) bathing water guidelines.

Marlborough's rivers and coastal waters are generally of good quality and are safe for recreational activities. However rivers that drain urban and intensive agriculture areas and coastal beaches which are located in urban areas and/or which have a significant river flow to them are more prone to poor water quality and are sometimes not safe for recreational activities, even during dry weather. Wet weather events frequently result in exceedances of MfE's guidelines and therefore swimming following rainfall is not recommended, particularly in urban and intensive agricultural areas. The 2010-11 summer was particularly wet and resulted in poorer water quality at a number of sites compared with that seen for the previous summer.

During the 2010-11 summer, just under a quarter of river sites monitored were categorised as safe (i.e. compliant with both the alert and action level guidelines) for recreational use for more than 95% of the time. This is a decline from the previous year where just under half were deemed safe. The poorest performing sites were located on the Rai, Taylor and Wairau Diversion. The best site (100% compliant) was the Pelorus at the SH6 Bridge. Coastal water quality in Marlborough is generally very good and during the 2010-11 bathing water season, nearly half of the sites were categorised as safe for recreational use for more than 95% of the time. This is also a decline from what was seen the previous year when 80% of sites were deemed safe for 95% of the time. 100% compliance with the bathing water guidelines was achieved at Marfells Beach; Mistletoe Bay and Te Mahia. The poorest water quality was recorded for Moenui and the Wairau Diversion.

Suitability for recreation grades (SFRG's) have been derived using MfE's methodology and are based on the most recent five years of microbiological data and sanitary inspections classes. All of the river sites have sufficient samples to determine complete grades whilst fourteen of the eighteen coastal sites have sufficient samples to obtain beach grades. Regular monitoring of each site is recommended to allow for comparisons in recreational water quality each year and to assign complete Suitability for Recreation Grades (SFRG's) to each site. Two coastal sites had an improvement in their grades (Anakiwa improved from Poor to Good and Shelly Beach improved from Fair to Good), whilst one declined (Wairau Diversion declined from Good to Fair). The river sites showed one improvement in the beach grade where the Wairau at the Blenheim Rowing Club improved from Fair to Good. This is the first river site to be graded as Good in Marlborough. No river sites showed a decline in the beach grade.

Marlborough's coastal water quality was slightly poorer than that seen nationwide in 2010-11. Coastal water is of better quality than freshwater. Marlborough's freshwater quality compares favourably with freshwater sites nationally with most sites being suitable for swimming all of the time, however the percentage of sites that are of occasional high risk is greater than that seen nationally.

Microbial source tracking investigations have identified ruminants as the main source of faecal contamination in the Brown River and at Moenui Beach. Ruminants and specifically bovine ruminants are the primary source of faecal contamination at the Rai Falls. There are no immediate inputs from ruminants at Moenui Beach and thus the source is likely to come from the nearby catchments where agriculture and particularly dairying occurs i.e the Pelorus, Kaituna and Cullens Creek catchments. Improvements in land management practices will result in improved water quality in the inner Pelorus Sound. Microbial source tracking is a useful tool for assessing the sources of faecal contamination in freshwaters and coastal waters and it is recommended that a targeted programme be initiated to look at the source of faecal contamination at the worst sites.

Contents

1. Introduction

District councils are required under the Health Act 1956 to monitor environmental factors affecting public health and to abate conditions likely to be offensive or injurious to health. Water quality in our rivers and coastal areas can have an impact on public health when used for contact recreation purposes.

Regional councils have responsibilities under the Resource Management Act 1991 for the planning and management of natural resources including fresh and coastal waters. The Marlborough District Council as a unitary authority has responsibility for both district and regional functions.

Guidelines for the safe use of recreational waters are defined by the Ministry for the Environment in the Microbiological Water Quality Guidelines (MfE, 2003). The recreational waters in Marlborough are sampled in accordance with these guidelines. Results are sent to the Ministry for the Environment each year for national reporting. Recreational water quality is one of 22 national core environmental indicators. Environmental indicators are used to provide cost-effective, practical and meaningful information on high-priority environmental issues.

2. Objectives of the Recreational Water Quality Monitoring Programme

The objectives of the recreational water quality programme are:

1. To provide the results of monitoring to the public as soon as they become available. Towards this end, results are displayed on Councils website as soon as they become available from the laboratory (usually within 48 hours). Figure 1 below shows how results are presented on the website at: http://www.marlborough.govt.nz/Recreation/Swimming-and-Boating/Swimming-Locations.aspx

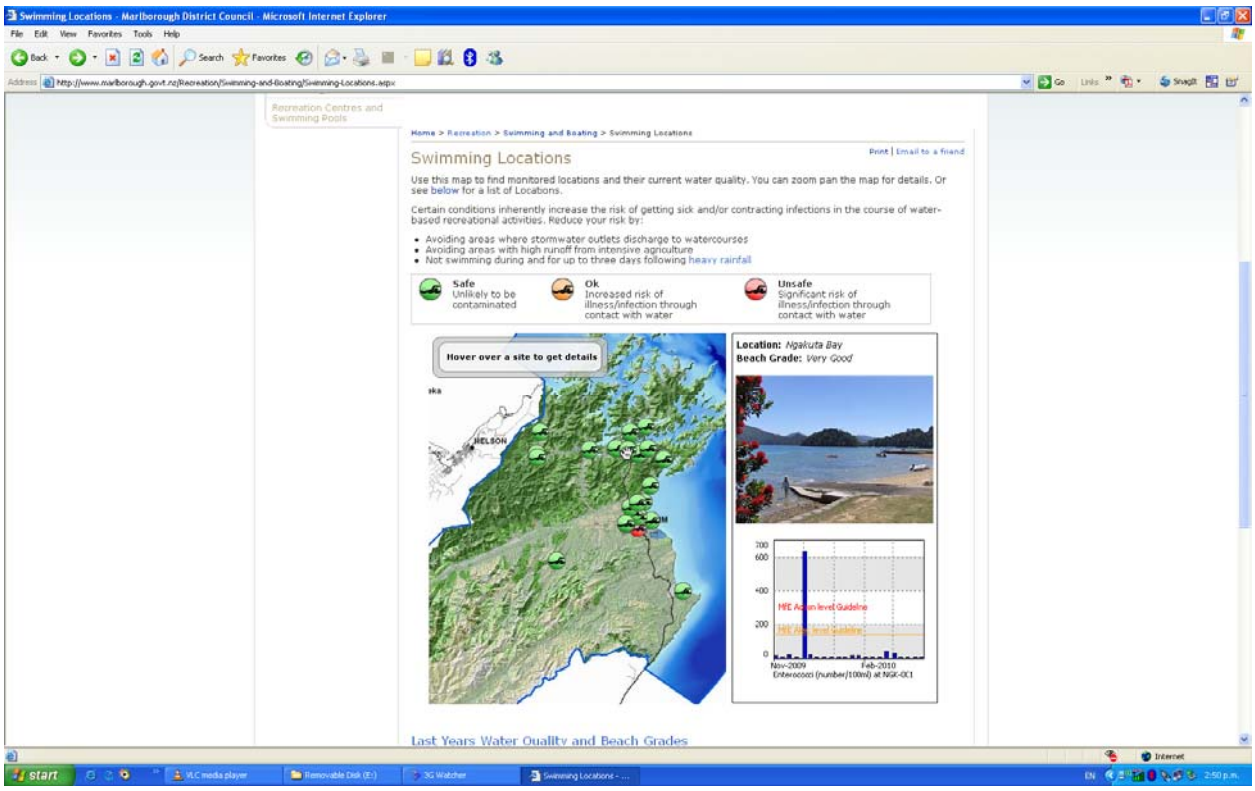


Figure 1: Screenshot of how recreational water quality results are displayed on the Council's website.

2. To assess the safety of each site in relation to the risk of contracting illness/infection at each site on a weekly basis and to inform the public as soon as possible. This includes taking follow-up samples where exceedances occur and reporting results to the District Health Board as shown in the flow chart in Appendix 1.

3. To grade bathing water sites using MfE's 2003 guidelines for grading swimming rivers and beaches.

4. To assess the results of annual monitoring to allow for national comparisons between bathing water sites and to enable long term trends in river and coastal bathing water quality to be determined.

5. To help identify sites which require additional investigation due to excessive faecal contamination in areas which are deemed high risk tot the public i.e. areas which receive high contact recreation use.

3. Sites

During the summer of 2010-11 a total of 13 freshwater bathing sites (Table 1) and 18 coastal water sites (Table 2) were monitored on a weekly basis from November to March inclusive, the location of these sites are shown in Appendix 2. Sampling takes place irrespective of weather or tide times, this ensures that trends over time take account of all conditions and are not skewed towards one condition. Details for each site (showing name, site ID and location) are shown in Tables 1 and 2.

Table 1: River Sites 2010-11

Site name	Site ID	Grid Reference (NZTM)
Taylor @ Hutcheson Street Bridge	TYR-5	1679716, 5404251
Taylor @ Riverside	TYR-16	1680023, 5403987
Opawa @ Malthouse Reserve	OPR-40	1683801, 5402597
Opawa @ Elizabeth Street Footbridge	OPL-1	1680393, 5404310
Wairau @ Blenheim Rowing Club	WRR-1	1684319, 5406605
Wairau @ Wairau Rowing Club	WRR-9	1682366, 5407875
Wairau @ Ferry Bridge	WRR-8	1681274, 5410163
Wairau Diversion @ Neals Road	WDV-1	1684047, 5411651
Pelorus @ Totara Flat	PLR-3	1648262, 5427731
Rai @ Brown River Reserve	RAR-2	1649232, 5436785
Rai @ Rai Falls	RAR-1	1648018, 5429266
Pelorus @ Pelorus Bridge	PLR-2	1648077, 5428091
Waihopai @ Craiglochart Bridge # 2	WHR-3	1655029, 5391098

Sites are chosen based on frequency of use, risk of contamination, importance (e.g. a high value kayaking/rowing site) and proximity to popular campgrounds/resorts. In general the beaches and rivers of Marlborough are suitable for contact recreational activities; however there are areas which are more susceptible to contamination which can lead to an increased risk of illness and infection, especially during and after periods of rainfall. Such areas are generally located in urban and areas of intensive agriculture.

Table 2: Coastal Sites 2010-11

Site name	Site ID	Grid Reference (NZTM)
Anakiwa	GRO-001	1677073, 5431495
Bobs Bay	PCT-3	1685171, 5430143
Hakahaka Bay	PTU-001	1693263, 5427510
Marfells Beach	MB-1	1700194, 5380089
Mistletoe Bay	OB-2	1681470, 5436007
Moenui	MOE-1	1666689, 5430394
Momorangi Bay	MOM-001	1678817, 5430879
Ngakuta Bay	NGK-001	1680514, 5430489
Oyster Bay	PTU-002	1693174, 5426985
Picton Foreshore	PCT-5	1684298, 5428815
Portage	POR-1	1686775, 5438697
Shelly Beach North	PCT-4A	1684586, 5428933
Te Mahia	TEM-1	1681395, 5436748
Tirimoana	TIR-5	1676233, 5430949
Waikawa Bay	WKB-1	1687695, 5431090
Wairau Bar	WRR-7	1688575, 5405201
Wairau Diversion	WDV-2	1686056, 5411923
Whites Bay	WB-1	1688425, 5417793

4. Sampling

The water quality at coastal sites is tested for the presence of enterococci[1] bacteria, whilst the water quality at freshwater sites is tested for *Escherichia coli* (*E. coli*)[2]. These are commonly known as 'indicator organisms' as they give an indication of the presence or recent presence of faecal contamination which may indicate the presence of pathogens in the water. The results are reported in cfu/100mL (coliform forming units) and give an indication of the number of bacteria present per 100mL of water. All testing is carried out by ELS Ltd (Environmental Laboratories Services Ltd). Coastal water samples are taken in water approximately 0.5m deep at a depth of approximately 0.1m from the surface. River samples are taken midstream where possible or as close to midstream as feasible, in order to obtain a sample representative of the well mixed zone, at a depth of approximately 0.1m from the surface. All samples are chilled and couriered to the laboratory for immediate processing. A 'blank' sample is included with the samples, the temperature of this sample is tested at the laboratory to ensure samples have been appropriately chilled in transit. All samples received must be less than 10°C.

4.1. Indicator Organisms

An indicator organism can be defined as an organism which is used to indicate the potential presence of another organism. *E. coli* is chosen as the indicator bacteria for freshwater as it is deemed to be a

[1] **Method:** US Environmental Protection Agency method (EPA) method 1600: Enterococci in water by membranes filtration using membrane-enterococcus Indoxyl-â-D-Glucose Agar (mEI), April 2005. Minimum detection 1 cfu/100mL.

[2] **Method:** APHA 21st Edition 9213D using mTEC. Minimum detection 1 cfu/100mL.

good indicator of recent sewage and/or faecal contamination. Enterococci are chosen as the indicator bacteria for coastal waters due to its higher survival rates in saline waters and as such it is deemed to be a good indicator of recent sewage and/or faecal contamination. When monitoring surface waters used for recreational purposes, the primary concern is the presence of organisms which can cause illness and/or infection in people.

Indicator organisms are monitored in recreational waters as it may not always be possible to identify specific disease causing organisms due to their low numbers, difficulty and expense of analysis among other reasons. Indicator organisms are preferred because 1) they are easy to sample and inexpensive to measure and 2) they can survive for several weeks and are therefore a definite indication of recent faecal contamination. *E. coli* and Enterococci are present in the gut of all warm blooded animals (including humans, mammals and birds), all of which are potential carriers of disease causing organisms in humans.

The number of Enterococci and *E. coli* present in a water sample (100mL) denotes the potential health risk of the waters to humans, it is not a direct measurement of the actual health risks, and therefore an exceedance of the guideline value will indicate that there is an increased risk to bathers in the area. Further details on how this risk is quantified are available in the Microbiological Water Quality Guidelines (MfE, 2003).

4.2. Guideline Values - Coastal

The guideline values for safe coastal recreational sites have been determined by MfE and are as follows:

	For a *single* sample		Requirement	
Acceptable *'Green Mode'*	< 140 Enterococci / 100mL	Highly likely to be uncontaminated	Routine monitoring	Safe ☺
Alert *'Amber Mode'*	140 - 280 Enterococci / 100mL	Potentially contaminated	Investigate likely causes	OK 😐
Action *'Red Mode'*	> 280 Enterococci / 100mL[3]	Highly likely to be contaminated	Further investigation, inform relevant interested parties	Unsafe ☹

These levels are based on keeping illness risks associated with recreational water use to less than 2% (MfE, 2003). In addition, the Ministry of the Environment has developed Suitability for Recreation Grades (SFRG's) for swimming beaches. These are defined using the Microbiological Assessment Category (MAC) and the Sanitary Inspection Category (SIC) as defined by MfE.

4.2.1. Microbiological Assessment Categories (MAC)

The Microbiological Assessment Category is assessed using data from the previous 5 years. A minimum of 20 samples over the bathing water season (November to March inclusive) for each year is required in order to establish a complete MAC, if there are less than 100 samples over this 5 year period then the MAC status is defined as being incomplete or interim. The MAC was assessed for the 18 sites. Of the 18

[3] Applies to *two* consecutive single samples (resampled as soon as practicable after receiving first result) greater than 280/100mL

sites assessed, 14 have adequate data over the past 5 years to calculate a complete MAC. The number of samples for each site ranges from 66 to over 100 for this 5 year period. Table 3 below defines the MAC grades for coastal sites.

Table 3: Microbiological Assessment Category (MAC) definitions for marine waters (MfE, 2003).

Grade	95th Percentile (Hazen method)	
A	≤ 40	Enterococci / 100mL
B	41 - 200	Enterococci / 100mL
C	201 - 500	Enterococci / 100mL
D	> 500	Enterococci / 100mL

4.2.2. Sanitary Inspection Category (SIC)

The SIC assigns a category to the site based on the risk of contamination associated with faecal sources in the vicinity. Figure 2 details this risk. The SIC classes were updated for all coastal water sites in 2009 (MDC, 2009a).

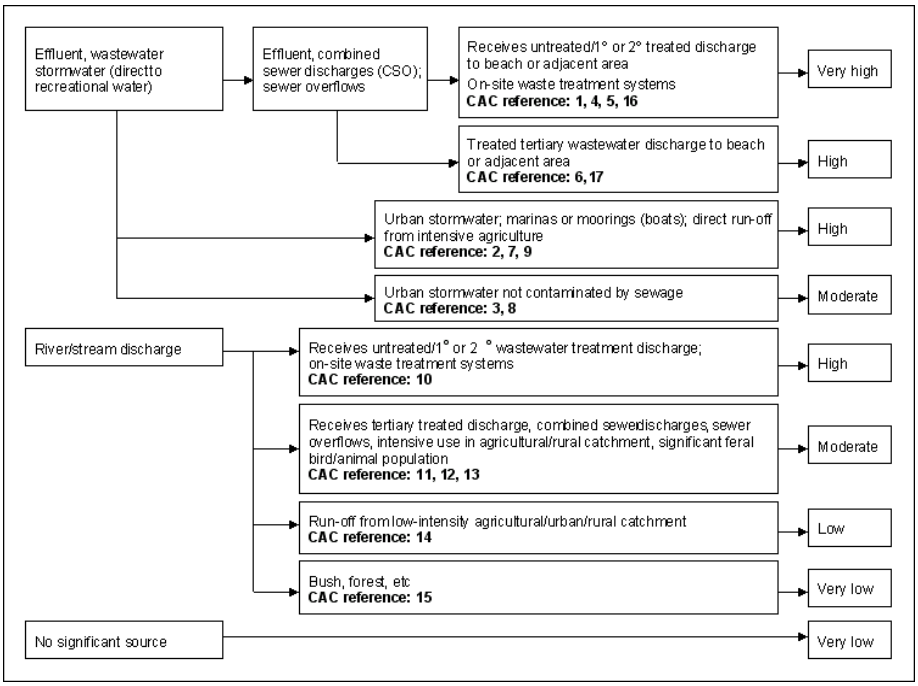


Figure 2: Sanitary Inspection Category for coastal water sites (MfE, 2003)

4.2.3. Suitability for Recreation Grades (SFRGs)

Bathing water sites are graded according to the SFRGs, as follows:

- Very Good,
- Good,

- Fair,
- Poor and
- Very Poor.

Suitability for Recreation Grades (SFRGs) are obtained using the MAC in conjunction with the SICs (figure 3) and are calculated using MfE's Recreational Water Quality Assessment software called 'Bathewatch'. There are between 21 and 22 weeks in the bathing water season so it is important to ensure each site is consistently monitored over the bathing water season to ensure accurate reporting of MAC grades and Suitability for Recreation Grades (SFRGs). Where there are inconsistencies between monitored data and results from the SIC a conservative 'follow-up' grade is assigned.

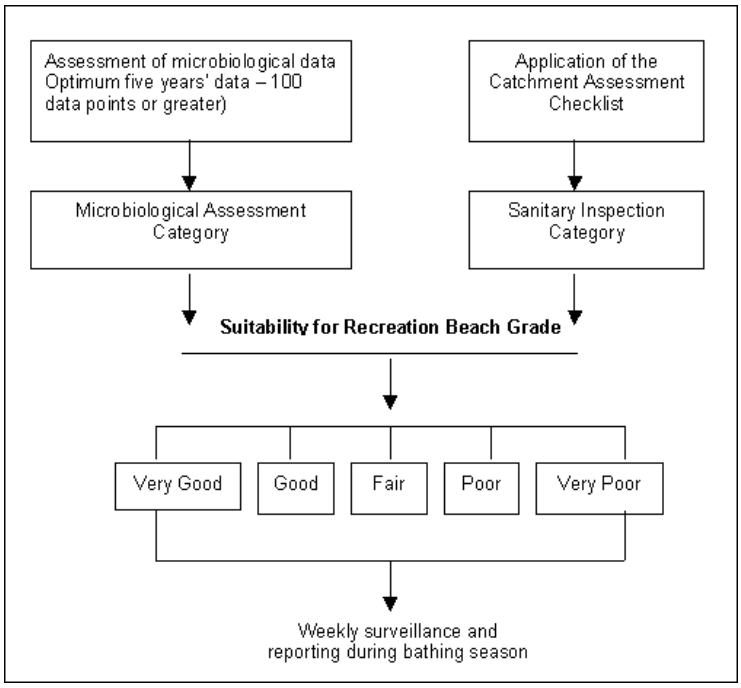


Figure 3: Requirements for grading swimming rivers (MfE, 2003)

4.3. Guideline values – Rivers

The guideline values for safe freshwater recreational sites have been determined by MfE and are as follows:

	For a *single* sample		Requirement	
Acceptable *'Green Mode'*	< 260 *E.coli* / 100mL	Highly likely to be uncontaminated	Routine monitoring	Safe ☺
Alert *'Amber Mode'*	> 260 < 550 *E.coli* / 100mL	Potentially contaminated	Investigate likely causes	OK 😐
Action *'Red Mode'*	> 550 *E.coli* / 100mL	Highly likely to be contaminated	Further investigatation, inform relevant interested parties	Unsafe ☹

These levels are based on an estimate that approximately 5% of *Campylobacter* infections could be attributable to freshwater contact recreation (MfE, 2003). In addition, the Ministry for the Environment has developed Suitability for Recreation Grades (SFRG's). These are defined using the Microbiological Assessment Category (MAC) and the Sanitary Inspection Category (SIC).

4.3.1. Microbiological Assessment Categories (MAC)

The Microbiological Assessment Category is assessed using data from the previous 5 years. A minimum of 20 samples over the bathing water season (November to March inclusive) for each year is required in order to establish a complete MAC, if there are less than 100 samples over this 5 year period then the MAC status is defined as being incomplete or interim. The MAC was assessed for all of the 13 sites; of the 13 sites assessed, all have adequate data over the past 5 years to calculate a complete MAC. The number of samples for each site ranges from 104 to 107 for this 5 year period. Table 4 below defines the MAC grades for freshwater sites.

Table 4: Microbiological Assessment Category (MAC) definitions

Grade	95th Percentile (Hazen method)
A	≤ 130 *E.coli* / 100mL
B	131 - 260 *E.coli* / 100mL
C	260 - 550 *E.coli* / 100mL
D	> 550 *E.coli* / 100mL

4.3.2. Sanitary Inspection Category (SIC)

The SIC assigns a category to the site based on the risk of contamination associated with faecal sources in the vicinity. Figure 4 details this risk. SIC classes for the freshwater bathing sites were assessed in 2009 (MDC. 2009b).

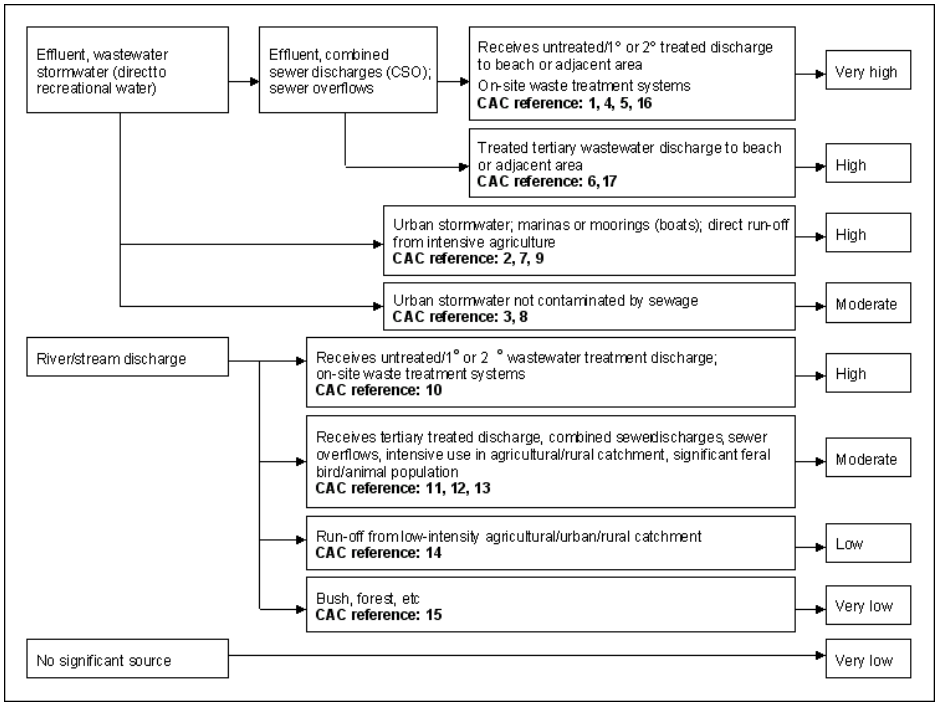


Figure 4: Sanitary Inspection Category for freshwater sites (MfE, 2003)

4.3.3. Suitability for Recreation Grades (SFRG)

Bathing water sites are graded according to the SFRGs, as follows:

- Very Good,
- Good,
- Fair,
- Poor and
- Very Poor.

Suitability for Recreation Grades (SFRGs) are obtained using the MAC in conjunction with the SICs (figure 5) and are calculated using MfE's Recreational Water Quality Assessment software called 'Bathewatch'. There are between 21 and 22 weeks in the bathing water season so it is important to ensure each site is consistently monitored over the bathing water season to ensure accurate reporting of MAC grades and Suitability for Recreation Grades (SFRGs). Where there are inconsistencies between monitored data and results from the SIC a conservative 'follow-up' grade is assigned.

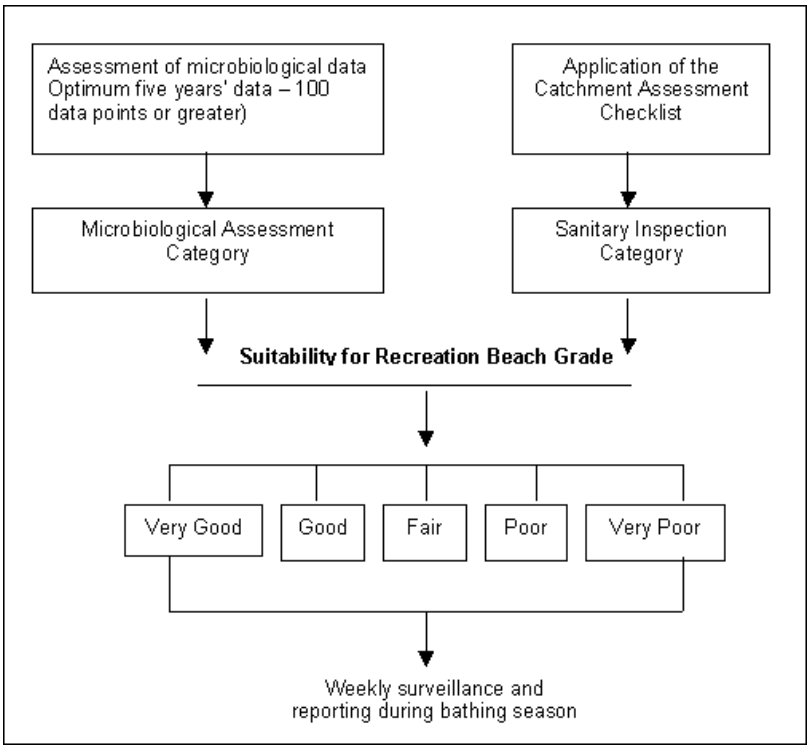


Figure 5: Requirements for grading swimming rivers (MfE, 2003)

5. Recreational Water Quality Results 2010-11

The results of the summer 2010-11 sampling are shown in Appendix 3. The results are graphed for each site and are shown in Appendix 4. The graphs show the enterococci or *E. coli* numbers alongside rainfall and are plotted against both the relevant alert and action level bathing water guideline standards as defined by MfE (2003).

5.1. Coastal

5.1.1. 2010-11 Summer Results

The percentage of time in which coastal sites were deemed safe or otherwise for swimming is shown in figure 6. Eight of the eighteen sites were deemed safe for swimming for more than 95% of the time, whilst three were deemed safe for swimming for 100% of the time. This is a decrease from fourteen and six respectively in 2009-10.

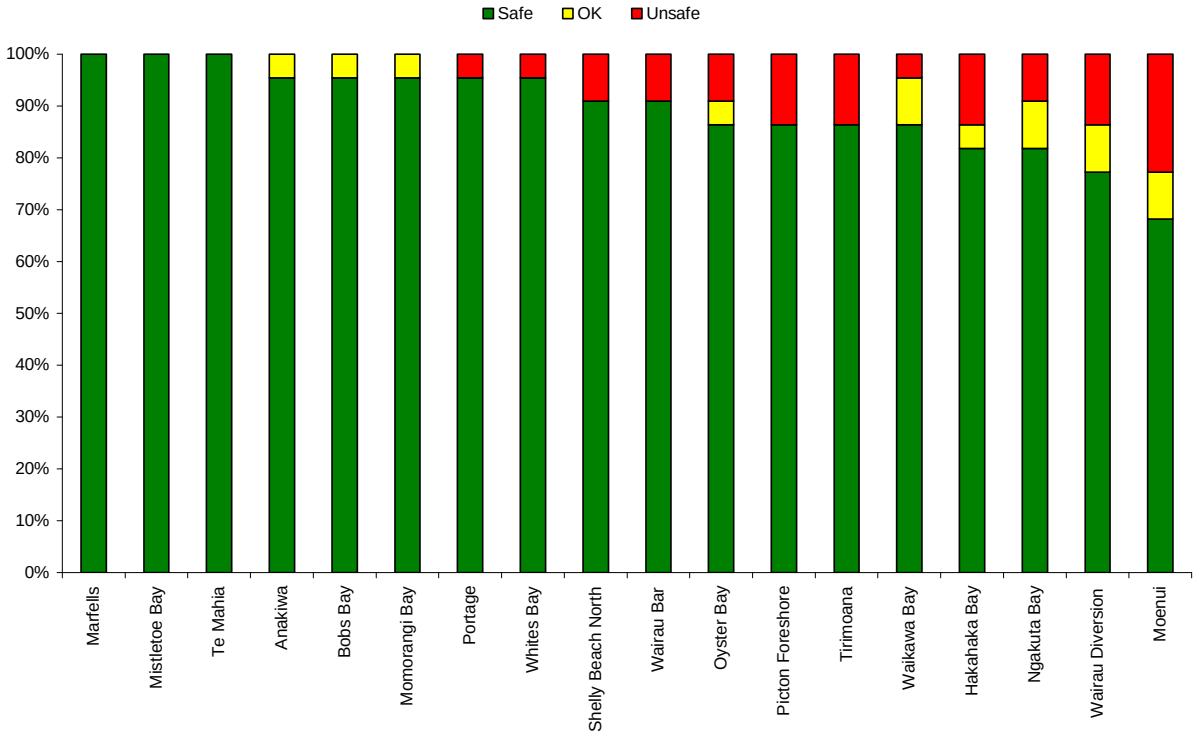
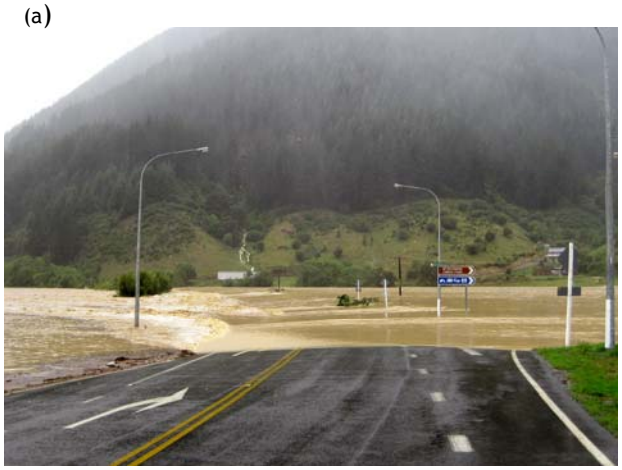


Figure 6: Coastal water bathing sites ranked according to the percentage of time they were suitable for contact recreation.

The deterioration in water quality at the coastal sites is largely due to heavy rainfall over the Christmas period during which a number of sewage pump station failed, in addition the heavy rainfall would have overloaded many septic tanks in proximity to the coast thereby contributing to the bacteria load in the coastal environment (Photos 1(a) – (d)).

(a)



(b)

(c) (d)

Photo 1: Flooding in (a) the lower Pelorus (b) Wakamarina (c) Kaituna Valley and (d) Marlborough Sounds as a result of heavy rain over the Christmas period 2010.

Moenui, the Wairau Diversion and Ngakuta Bay had the poorest water quality. Moenui has had consistently poor water quality over the last few years. Microbial source tracking shows that the primary source of faecal contamination is from ruminant sources (Cornelisen *et al*., 2012). Testing took place during both wet and dry weather.

Water quality in Ngakuta Bay is generally very good. The poor water quality in Ngakuta Bay this year is attributed to heavy rainfall over the Christmas period which would have overloaded septic tanks; that combined with the Christmas holiday period when occupation within the Bay is at its highest would have increased the bacteria load entering the Bay (photo 2). Similarly poor water quality at the Wairau Diversion can be attributed to the heavy rainfall experienced over the Christmas period.

Photo 2: Flooded streams overflowing into Ngakuta Bay, December 2010

5.1.2. Recent Trends

Overall there is an improvement with compliance with the bathing water guidelines over the last eight years (figure 7). Slight declines are observed for the 2007-08 and 2010-11 summers, most probably as a result of wetter summers in the region during that time. Excellent water quality, in terms of compliance with the bathing water guidelines, was achieved in 2006-07 and 2009-10 when compliance with the guidelines was achieved 95% of the time. Maximum rainfall from year to year will have some influence on water quality but will not solely be responsible for bathing water quality from year to year.

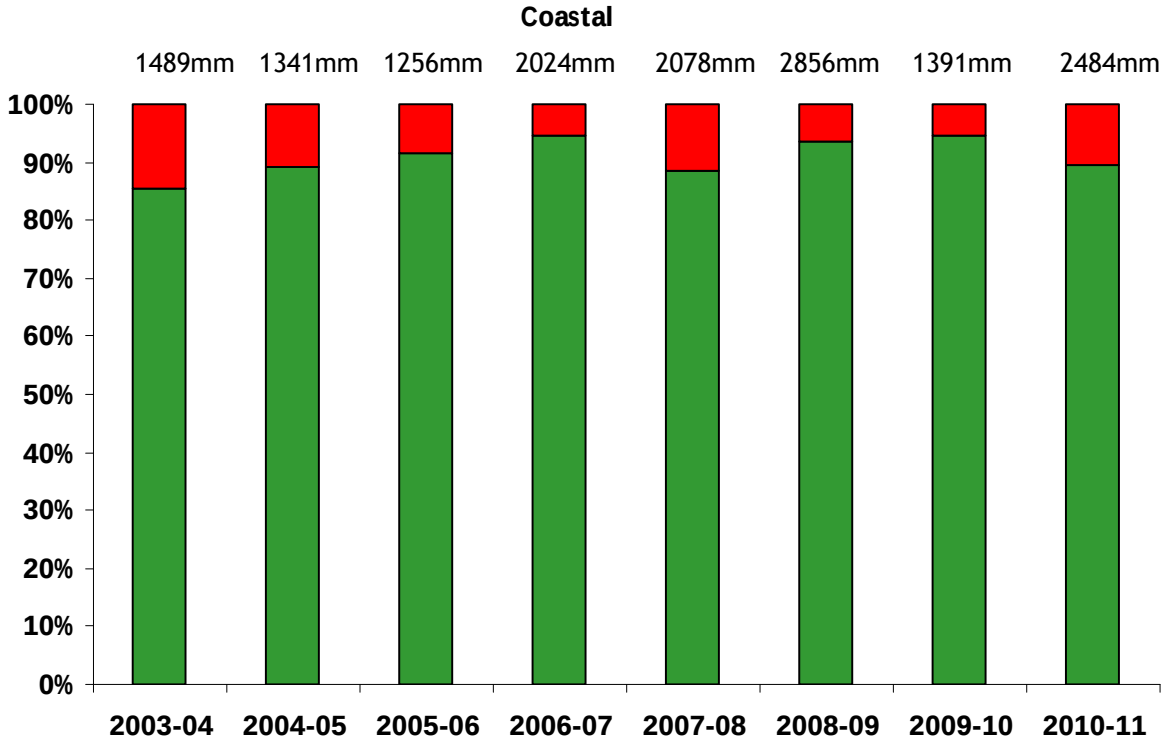


Figure 7: Percentage compliance with the bathing water guidelines from 2003 to 2011 at coastal sites. Compliance is denoted by the green bars and non-compliance with the red bars. Total summer rainfall from four key sites in Marlborough is shown above each bar for each summer.

Trends in water quality for each site are shown in Table 5. The table shows both the median and 95%ile for the last 8 years for each site. Water quality has significantly improved at Anakiwa, Picton Foreshore and Portage. There has been some improvement in water quality at Wairau Bar, Tirimoana, Shelly Beach and Momorangi. Microbial source tracking carried out at Momorangi did not identify humans or ruminants as sources (Cornelisen *et al*., 2012). The investigation did not look at birds as a source, however previous studies plus knowledge of the catchment indicates that birds such as ducks and seagulls at the site are the most likely cause of the contamination (MDC, 2008). Water quality has significantly declined at Moenui. As discussed earlier, ruminants have been identified as the main source of faecal contamination (Cornelisen *et al*., 2012). Faecal contamination from ruminant is most likely from the Pelorus, Kaituna and Cullens Creek catchment where dairying and drystock are the dominant farm practices. The remainder of the sites show no discernible trends or there is not enough data to show any trends. Some sites, while usually good, showed a decline in 2010-11 (e.g. Ngakuta Bay), however this can be attributed to the exceptional rainfall events in December and January.

Table 5: The median and 95%ile for each coastal site for each summer season from 2003 to 2011.

Median	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
Anakiwa	5	25	10	5	7.5	5	4	4
Bobs Bay	5	5	5	5	7.5	5	4	4
Hakahaka Bay					5	10	12	20
Oyster Bay					5	10	4	22
Marfells	5		5	5	5	5	4	4
Moenui	5	5	5	5	40	10	4	28
Momorangi Bay	40	46.5	20	40	87	7.5	12	12
Ngakuta Bay	5	7.5	5	5	5	5	4	12
Mistletoe Bay	91.5					5	4	4

Picton Foreshore	58.5	46.5	40	10	10	7.5	4	12
Portage	10	5	5	5	5	10	4	6
Shelly Beach North	15	5	5	5	10	5	4	6
Te Mahia	7.5	5	5	5	5	5	4	4
Tirimoana	10	10	5	5	5	5	4	16
Waikawa Bay	10	10	5	5	5	5	4	12
Wairau Bar	10	10	5	5	5	7.5	8	18
Wairau Diversion	64	10	5	10	10	20	22	22
Whites Bay	7.5	5	5	5	5	5	4	4
95%ile	**2003/04**	**2004/05**	**2005/06**	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**
Anakiwa	1227	1473	1835.45	332	1174	10	109.60	124
Bobs Bay	271.25	99	119	27	519	5	152.80	156
Hakahaka Bay					1216.6	227.5	402.40	2890
Oyster Bay					301.05	335.25	390.40	2680
Marfells	28				34.3	364.2	13.60	50.4
Moenui	99.2	155.85	109	57.5	2001	969.7	1438.00	3060
Momorangi Bay	1273.35	694	344	1175	1100	98.4	911.20	122.4
Ngakuta Bay	223	94	135.7	212.5	74.35	135.6	276.80	886
Mistletoe Bay						736	712.00	74
Picton Foreshore	1343.1	1767	2001	639.45	810.45	648.8	29.60	582
Portage	947.3	1550.5	183.75	802.8	10	375.75	732.00	512
Shelly Beach North	223	281.15	276.9	286.75	192.35	49.6	37.60	492
Te Mahia	93.1	234	532.5	90.6	32	420.6	441.20	4502
Tirimoana	1473	194.8	258.05	865	1387.2	185.4	72.00	418
Waikawa Bay	140.1	175.45	556.05	124	677.85	330.2	110.80	1744
Wairau Bar	450.3	2001	274	237.5	473.2	369.6	188.00	980
Wairau Diversion	814.8	217.3	173.8	32	762	208	156.80	1920
Whites Bay		392	36	15	77	442.3	12.00	242.4

Over this eight year period the worst sites are Picton Foreshore, Moenui, Momorangi Bay and Anakiwa (Figures 8 and 9). Of these Picton Foreshore and Anakiwa have shown significant improvements in recent years whilst water quality at Momorangi has shown some improvements. Water quality has declined at Moenui.

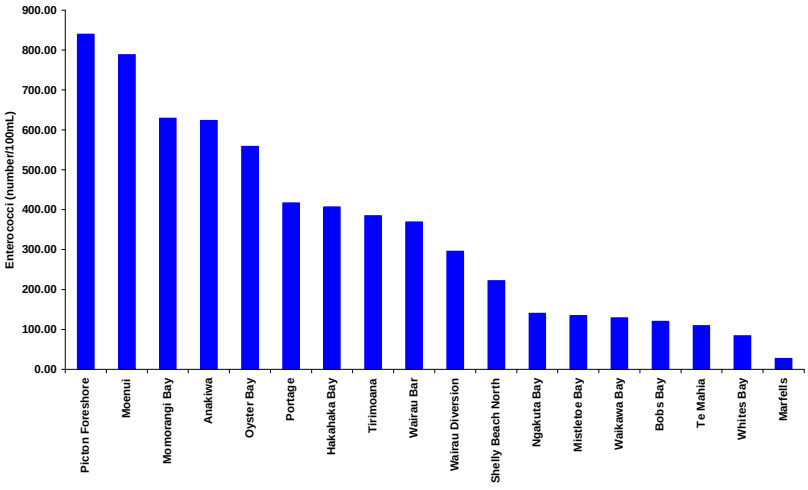


Figure 8: Coastal sites ranked according to the 95%ile numbers over 8 summers (2003-11)

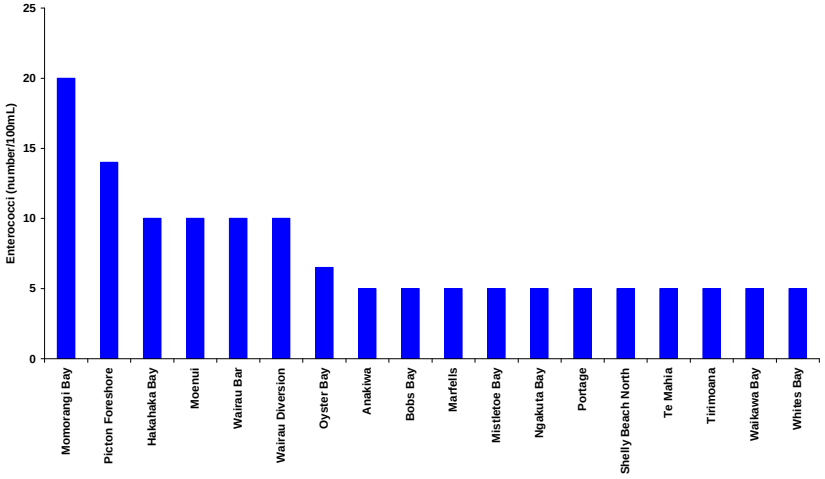


Figure 9: Coastal sites ranked according to the median numbers over 8 summers (2003-11)

5.1.3. Suitability for Recreation Grades (SFRGs) 2010-11

The Suitability for Recreation Grades have been calculated using the latest five years of microbiological data and the SIC classes which were reassessed in 2009. The SIC for Moenui was recalculated based on the information that intensive agriculture was the primary source of faecal contamination. Complete results are shown in Appendix 5. Fourteen of the eighteen sites have complete datasets over the last five years for the calculation of the MAC grade. The results are shown in Table 6.

Water quality at Shelley Beach deteriorated in 2010-11 from its 5 year average, however overall there was an improvement as the SFRG improved from Fair to Good. The beach grade for Anakiwa also improved from Poor to Good. The grade for the Wairau Diversion deteriorated from Good to Fair. Bathing water quality is notably poorer in the Wairau Diversion compared with the Wairau River.

Nearly half of all sites showed a deterioration in water quality against the five year MAC grade (Table 6). Only one, Momorangi showed an improvement. The deterioration in water quality at many of the sites can be attributed to the wet summer.

Table 6: Suitability for Recreation Grades for Marlborough's Coastal Bathing water sites

Site	MAC Grade* Summer season 2010-11	MAC Grade** long term (5 years)	MAC** dataset	MAC Trend	SFRG	Status of SFRG grade
Anakiwa	B	B	Complete	↔	Good	Complete
Bobs Bay	B	B	Complete	↔	Very Good	Complete
Hakahaka Bay	D	C	Interim	↓	Very Poor ¥	Follow-up
Marfells Beach	B	B	Interim	↔	Very Good	Complete
Mistletoe Bay	B	B	Interim	↔	Very Good	Complete
Moenui	D	D	Complete	↔	Very Poor	Complete
Momorangi Bay	B	D	Complete	↑	Poor	Complete
Ngakuta Bay	D	B	Complete	↓	Very Good	Complete
Oyster Bay	D	D	Interim	↔	Very Poor	Complete
Picton Foreshore	D	D	Complete	↔	Very Poor	Complete
Portage	D	C	Complete	↓	Very Poor¥	Follow-up
Shelly Beach North	C	B	Complete	↓	Good	Complete

Te Mahia	B	B	Complete	↔	Very Good	Complete
Tirimoana	C	C	Complete	↔	Fair	Complete
Waikawa Bay	D	B	Complete	↓	Good	Complete
Wairau Bar	D	C	Complete	↓	Fair	Complete
Wairau Diversion	D	C	Complete	↓	Fair	Complete
Whites Bay	C	A	Complete	↓	Very Good	Complete

* Based on the 95th percentile (Hazen) for the 2010-11 Bathing Water season.

** Calculated using MfEs' Bathewatch programme, includes the latest 5 years of microbiological data

¥ 'Follow-up' grades, the Bathewatch software detected inconsistencies between the MAC and the SIC. A conservative default grade was subsequently calculated by Bathewatch. A complete sample set (>100 samples over the last 5 years) and/or a recalculation of the SIC is required to confirm the SFRG.

Where there are apparent inconsistencies in the recorded microbiological data and the SIC, Bathewatch calculates the most conservative grade for the site and flags the grade as an 'Irreconcilable Follow-up Grade'. Hakahaka Bay and Portage had inconsistencies between the recorded microbiological data and the SIC. At Portage the SIC rates the site as being at 'very high' risk however the microbiological data shows that the site has moderate to high faecal contamination. The sewage system at Portage is currently being upgraded. The SIC will be recalculated once the upgrade has been completed. This may resolve the inconsistencies in the calculation of the beach grade. The inconsistency at Hakahaka Bay will most likely resolve once there is enough data to calculate a complete MAC.

Figure 10 shows the percentage of sites that fall within each SFRG grade. One third of all sites are graded as poor or very poor. Table 6 compares this years results with results over the long term (the past 5 years) and shows that whilst some sites showed an improvement; notably Anakiwa, Picton Foreshore, Shelley Beach and Wairau Bar, several showed a decline in water quality, namely Ngakuta, Portage and Te Mahia.

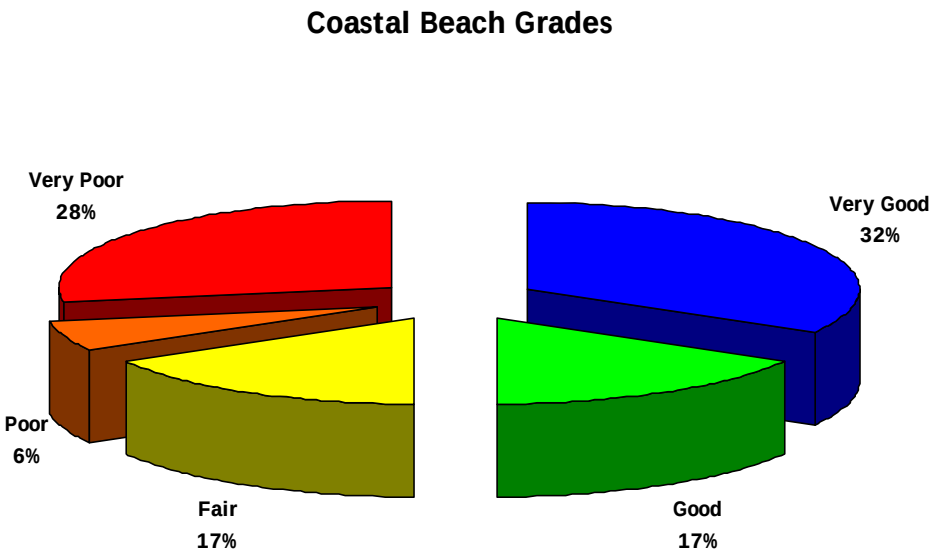


Figure 10: Pie-chart of SFRG's for the marine bathing water sites for the summer 2010-11.

5.1.4. Marlborough's Coastal Sites in a National Context

Results from the recreational monitoring programme are reported to the Ministry for the Environment (MfE) annually. MfE publish annual report cards which comment on the overall quality of coastal water across the country (www.mfe.govt.nz/environmental-reporting/report-cards/water-quality/2011/index.html). Recreational water quality in 2010-11, at a national level, was slightly worse than typical conditions (Figure 11). Under typical conditions, 1 per cent of sites are often high risk; 27 per cent of sites are generally low risk but occasionally high risk; and 71 per cent of sites are almost always low risk. For the 2010–2011 summer, 2 per cent of sites were high risk; 38 per cent of sites were low risk but occasionally high risk; and 60 per cent of sites were low risk. Risk is defined by how often a site exceeds the action level guideline (280 enterococci /100mL) as follows:

- more than 95 per cent of samples below the threshold are almost always low risk
- between 75 and 95 per cent of samples below the threshold are generally low risk but occasionally high risk
- less than 75 per cent of samples below the threshold are often high risk. This means that more than five samples over a 20 week summer period, or more than 25 samples over a five-year period, had shown high risk bacteria levels.

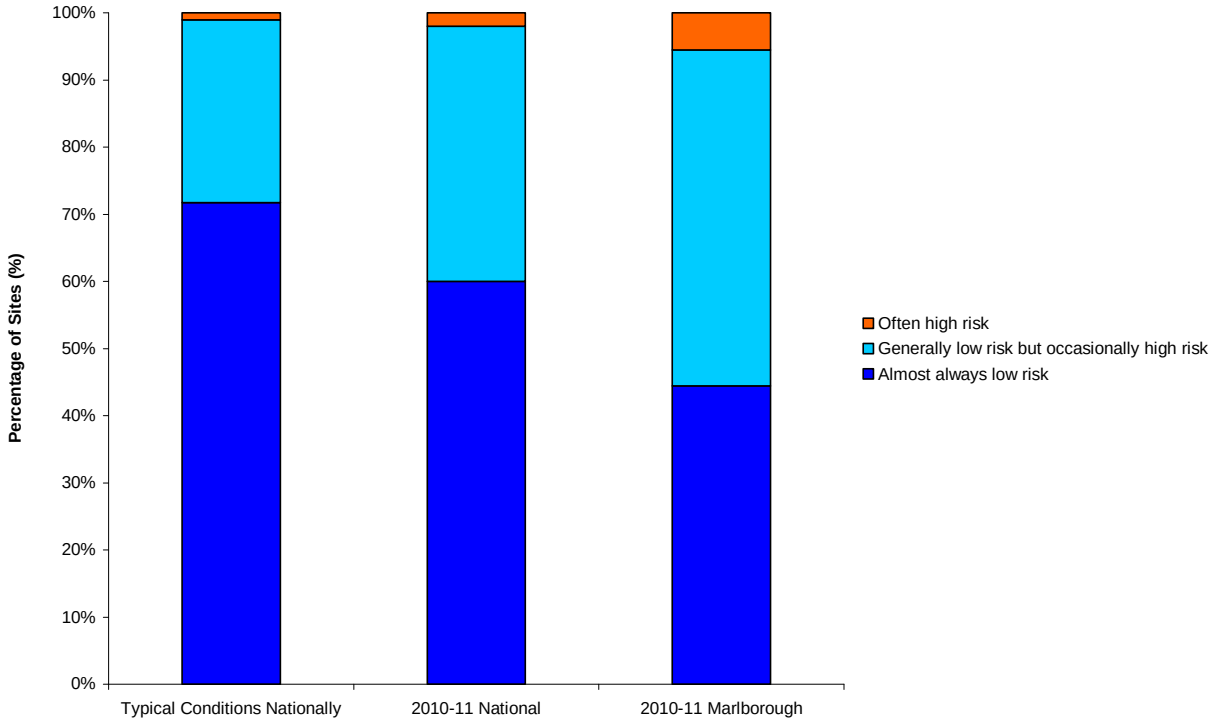


Figure 11: Exposure to risk at monitored recreational coastal beaches comparing typical conditions with the 2010-11 summer (from: www.mfe.govt.nz/environmental-reporting/report-cards/water-quality/2011/index.html)

Coastal water quality in Marlborough was also slightly worse than that seen nationally (figure 11). 44% of Marlborough's coastal sites met the action level guideline 95% of the time compared with 60% of beaches nationally meeting the guideline in 2010-11.

5.2. Rivers

5.2.1. 2010-11 Summer Results

The percentage of time in which river sites were deemed safe or otherwise for swimming is shown in figure 12. Only three of the thirteen sites were deemed safe for swimming for more than 95% of the time whilst only one was deemed safe for swimming for 100% of the time.

The best water quality was recorded at the Pelorus Bridge; despite heavy rainfall, bathing water quality did not exceed either the alert or action level guidelines at this site (figure 13). The remaining sites in the Pelorus catchment (Rai Falls, the Rai at Brown River Reserve and the Pelorus at Totara Flat) all exceeded the guidelines during heavy rain. Good water quality at the Pelorus Bridge site will be as a result of low development within the catchment and also good land management practices being used at both the campground and on farmland located upstream. The Wairau Diversion at Neals Road Bridge had the poorest water quality; poor water quality mostly occurred after heavy rainfall (figure 14). It is likely that most of the contamination is from runoff from land downstream of SH1 Bridge as the same degree of contamination is not seen at the sites on the Wairau River downstream of the SH1 Bridge.

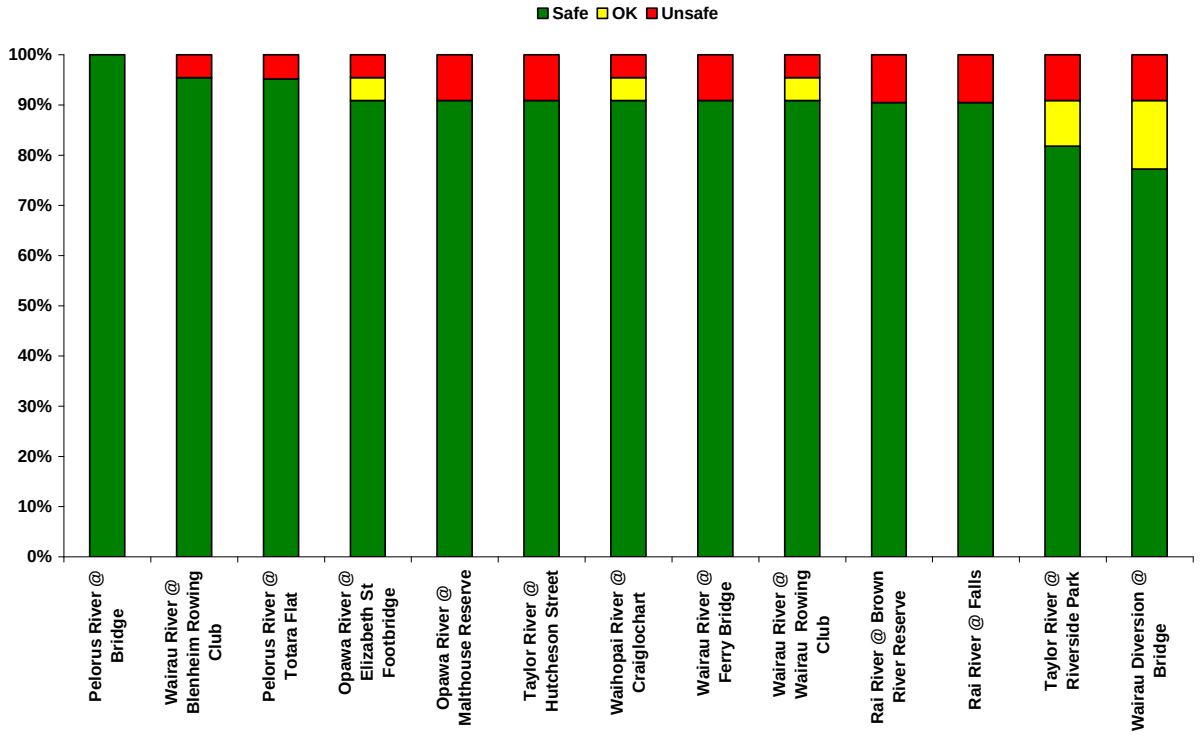


Figure 12: Freshwater bathing sites ranked according to the percentage of time they were suitable for contact recreation.

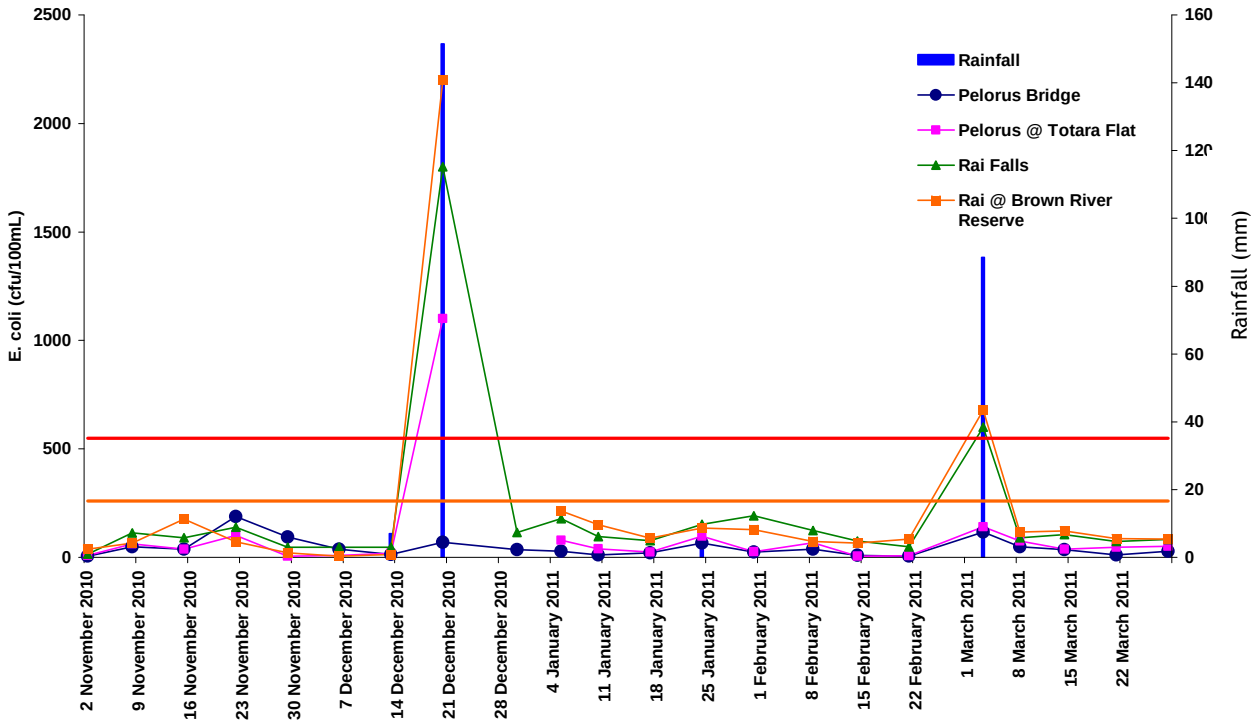


Figure 13: *E. coli* **numbers recorded in the Rai/Pelorus catchment.**

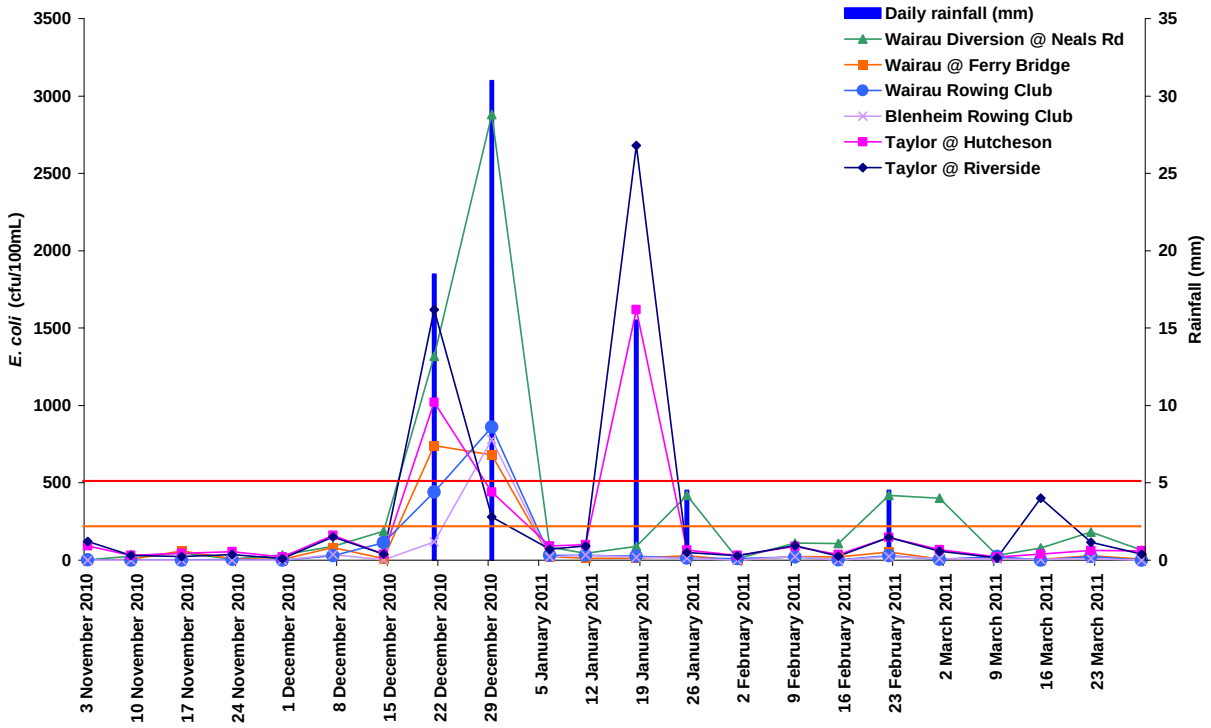


Figure 14: *E. coli* **numbers recorded in the Wairau catchment.**

5.2.2. Recent Trends

An overall improvement is observed in freshwater recreational water quality over an eight year period (figure 14) with the last two years showing the best and second best compliance record with the guidelines. Improvements in land management practices, such as the elimination of stream crossings in the Rai Catchment, have helped to improve overall bathing water quality in rivers. Diffuse pollution is the biggest contributor to bacteria loads in Marlborough's rivers and therefore land management practices need to be improved in order to see improvements in river water quality. Rainfall from year to year will have some influence on water quality but will not be solely responsible for bathing water quality.

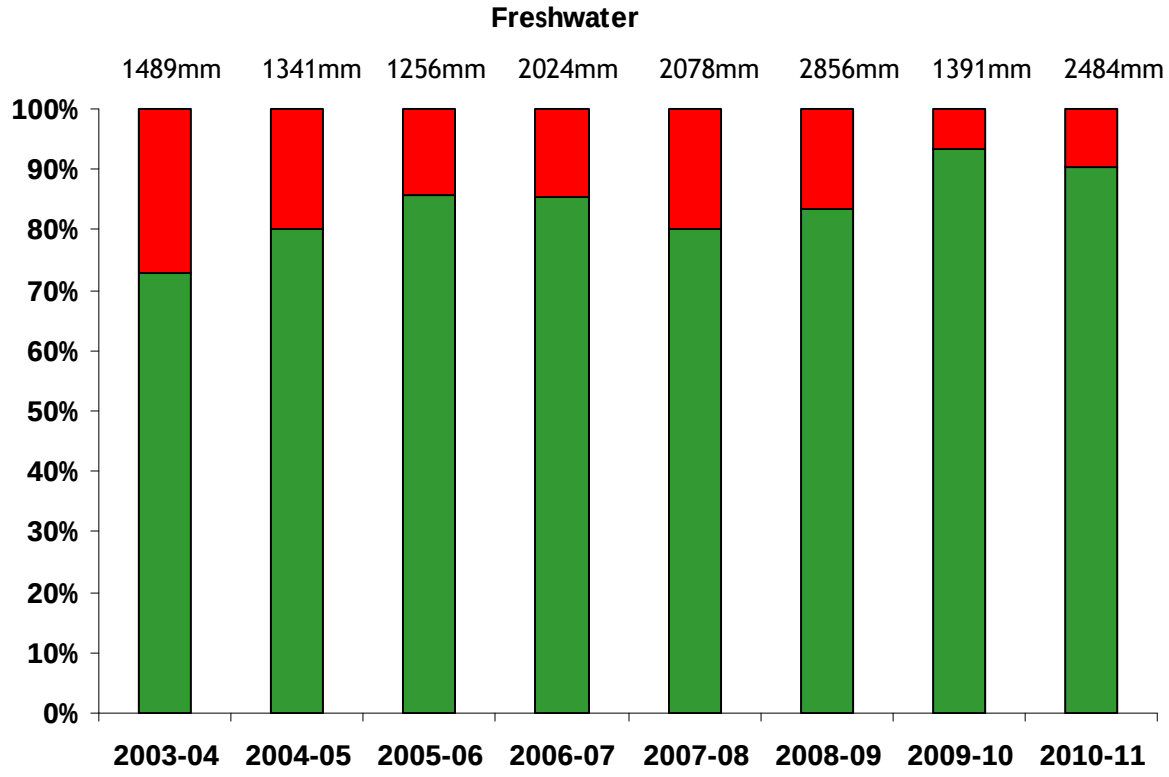


Figure 15: Percentage compliance with the bathing water guidelines from 2003 to 2011 at freshwater sites. Compliance is denoted by the green bars and non-compliance with the red bars. Total summer rainfall from four key sites in Marlborough is shown above each bar for each summer.

Trends in water quality for each site are shown in Table 7. The table shows both the median and 95%ile for the last 8 years. Water quality has improved at the Opawa River sites, Rai River sites, Pelorus Bridge, the Waihopai and at the Wairau rowing club. No discernable change is noted for the Taylor at Hutcheson, the Wairau Diversion or Blenheim Rowing Club. A gradual deterioration in water quality is observed for the Taylor at Riverside.

Table 7: The median and 95%ile for each freshwater site for each summer season from 2003 to 2011.

Median	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
Opawa River @ Elizabeth St Footbridge	111	111.5	178	124	178	99	10.5	53
Opawa River @ Malthouse Reserve	150.5	215	53	87	87	105	28.5	38
Pelorus River @ Bridge	20	30	30	20	20	20	16.5	35
Pelorus River @ Totara Flat	87	111	20	40	75	47.5	20	40

Rai River @ Brown River Reserve	316	207	172	87	271	99	40	87
Rai River @ Falls	207	192	69.5	53	99	83	46.5	93
Taylor River @ Hutcheson Street	124	171	207	192	137	178.5	27	64
Taylor River @ Riverside Park		137	192	178	164	150	22.5	65
Waihopai River @ Craiglochart	75	46.5	30	20	75	47.5	12	21
Wairau Diversion @ Bridge	178	81	75	64	40	105	33	86.5
Wairau River @ Blenheim Rowing Club	75	25	40	30	30	35.5	7.5	9.5
Wairau River @ Ferry Bridge	40	64	75	40	75	36.5	13.5	13.5
Wairau River @ Wairau Rowing Club	99	58.5	30	40	40	31	1.5	17.5
95%ile	**2003/04**	**2004/05**	**2005/06**	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**
Opawa River @ Elizabeth St Footbridge	1498.8	314	988.3	877	312.85	526	318.4	591.2
Opawa River @ Malthouse Reserve	2001	2001	150	1306	706.2	742	358.6	756
Pelorus River @ Bridge	666.65	740.1	955.05	778	789.15	438	232.2	145.8
Pelorus River @ Totara Flat	682.1	1267.1	1266	720	1145	2001	572	572.55
Rai River @ Brown River Reserve	2001	1300	2001	1452	1425	2240	648	1364
Rai River @ Falls	1520	1510.3	1367.4	1731	1670.45	2001	1148	1080
Taylor River @ Hutcheson Street	2001	617.5	1835.45	427	965.2	1331	1556	1260
Taylor River @ Riverside Park		520.5	1330.55	344	2001	1640	1504	2044
Waihopai River @ Craiglochart	257.8	644	1738.95	586	2001	194	245.2	692
Wairau Diversion @ Bridge	511.85	1239.5	245.2	432	524.85	1007	496	1944
Wairau River @ Blenheim Rowing Club	392.5	271	465.75	143	528.85	630	80	383.4
Wairau River @ Ferry Bridge	265.5	316	176	301	449.1	773	85.2	704
Wairau River @ Wairau Rowing Club	1430	431	393.15	162	416.35	582	118.2	608

Over this eight year period the worst sites are located on the Rai and the Taylor rivers (figures 15 and 16). The Rai at Rai Falls has shown a decrease in the median *E. coli* number in recent years (table 7), showing that despite frequent exceedances of the guidelines improvements in water quality are being made. The best recreational water quality is from the Pelorus Bridge and the Wairau.

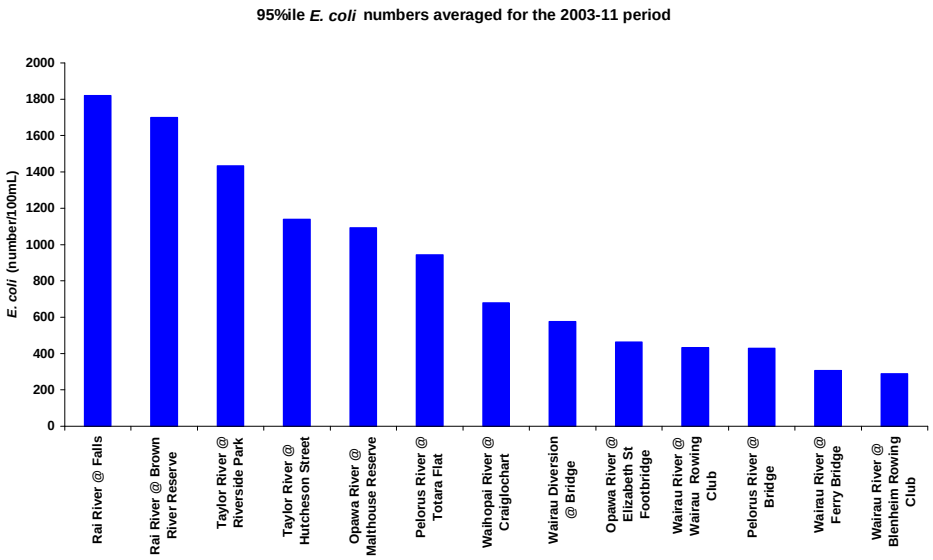


Figure 16: Freshwater sites ranked according to the 95%ile numbers over 8 years

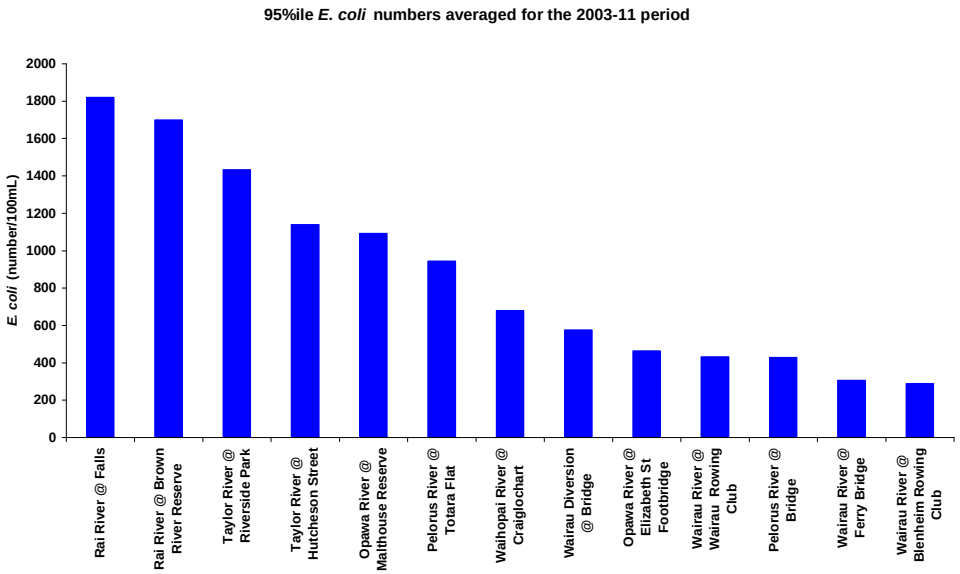


Figure 17: Freshwater sites ranked according to the median numbers over 8 years

5.2.3. Suitability for Recreation Grades (SFRGs) 2010-11

The Suitability for Recreation Grades have been calculated using the latest five years of microbiological data and the SIC classes which were reassessed in 2009; complete results are shown in Appendix 5. Long term data exists for all sites sampled and thus it is possible to calculate the SFRG grade for all sites. SFRG's are complete for all sites. The results are shown in Table 8.

Table 8: Suitability for Recreation Grades for Marlborough's Freshwater recreation sites

Site	MAC Grade* Summer season 2010-11	MAC Grade** long term (5 years)	MAC ** dataset	Trend	SFRG	Status of SFRG grade
Opawa at Elizabeth St Footbridge	D	C	Complete	↓	Fair	Complete
Opawa at Malthouse Reserve	D	D	Complete	↔	Poor	Complete
Pelorus Bridge	B	C	Complete	↑	Fair	Complete
Pelorus at Totara Flat	D	D	Complete	↔	Very Poor	Complete
Rai at Brown River Reserve	D	D	Complete	↔	Very Poor	Complete
Rai at Rai Falls	D	D	Complete	↔	Very Poor	Complete
Taylor at Hutcheson	D	D	Complete	↔	Very Poor	Complete
Taylor at Riverside	D	D	Complete	↔	Very Poor	Complete
Waihopai at Craiglochart	D	D	Complete	↔	Poor	Complete
Wairau at Blenheim Rowing Club	C	B	Complete	↓	Good	Complete
Wairau at Ferry Bridge	D	C	Complete	↓	Fair	Complete
Wairau at Wairau Rowing Club	D	C	Complete	↓	Fair	Complete
Wairau Diversion at Neals Road	D	D	Complete	↔	Poor	Complete

* Based on the 95th percentile (Hazen) for the 2009-10 Bathing Water season.

** Calculated using MfEs' Bathewatch programme, includes the latest 5 years of microbiological data

Most sites showed either a deterioration or no change in the MAC grade for the 2010-11 over the long term. Only one site (Pelorus Bridge) showed an improvement in the MAC grade over the long term. The beach grade (SFRG) for the Wairau at the Blenheim Rowing Club improved from Fair to Good.

Figure 17 shows the percentage of sites that fall within each SFRG grade. The first 'Good' grade for the freshwater sites was achieved this year at The Blenheim Rowing Club. Last year the grade at Pelorus Bridge improved from Poor to Fair. Just over 60% are graded as Poor or Very Poor compared with 69% of sites two years ago.

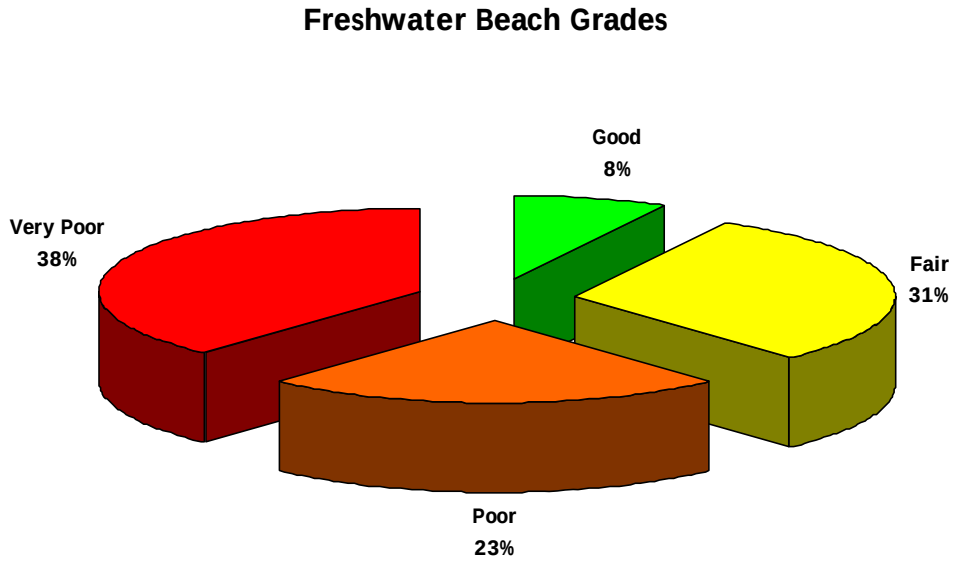


Figure 18: Pie-chart of SFRG's for the freshwater bathing water sites for the summer 2010-11.

5.2.4. Marlborough's River Sites in a National Context

Results from the recreational monitoring programme are reported to the Ministry for the Environment (MfE) annually. MfE publish annual report cards which comment on the overall quality of freshwater across the country (www.mfe.govt.nz/environmental-reporting/report-cards/water-quality/2011/index.html). Recreational water quality in 2010-11, at a national level, was marginally better than typical conditions (Figure 19). Under typical conditions, 13 per cent of sites are often high risk; 48 per cent of sites are generally low risk but occasionally high risk; and 40 per cent of sites are almost always low risk. For the 2010–2011 summer, 13 per cent of sites were high risk; 43 per cent of sites were low risk but occasionally high risk; and 44 per cent of sites were low risk. Risk is defined by how often a site exceeds the action level guideline (550 *E. coli* /100mL) as follows:

- more than 95 per cent of samples below the threshold are almost always low risk
- between 75 and 95 per cent of samples below the threshold are generally low risk but occasionally high risk
- less than 75 per cent of samples below the threshold are often high risk. This means that more than five samples over a 20 week summer period, or more than 25 samples over a five-year period, had shown high risk bacteria levels.

River water quality in Marlborough compares favourably with river water quality nationally, with most sites suitable for swimming nearly all of the time (figure 19). Approximately 8% of sites in Marlborough are high risk compared with 13% nationally. However there are more sites nationally which are almost

always low risk compared with those in Marlborough (40% Vs 23%) where most sites (69%) showed occasional high risk.

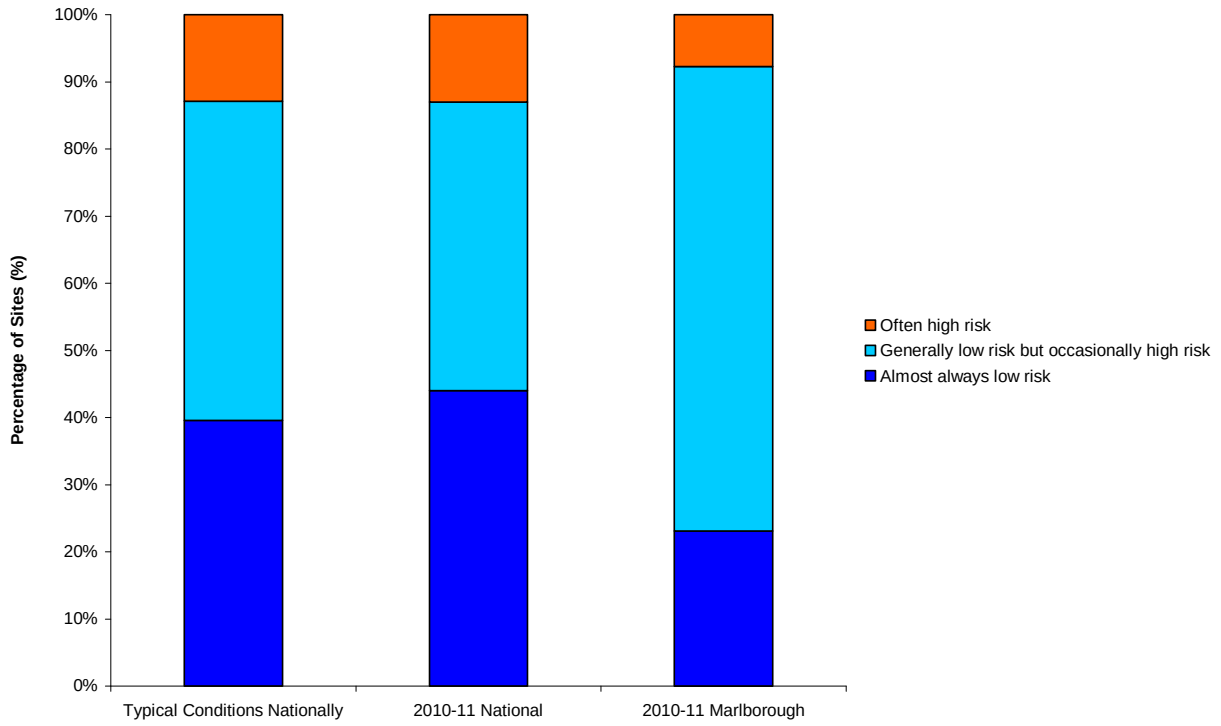


Figure 19: National comparison of compliance with river bathing water action level guidelines (from: www.mfe.govt.nz/environmental-reporting/report-cards/water-quality/2011/index.html)

Scarsbrook and McBride (2004) showed that from 410 river sites in New Zealand 69% were rated as Poor or Very Poor according to MfE's methodology for grading sites. River water quality is primarily impacted by diffuse pollution, either from urban runoff or from areas of intensive agriculture. Mitigation measures such as stock exclusion from waterways and riparian planting can reduce the faecal contaminant load reaching rivers.

5.3. Microbial Source Tracking (MST) Investigations

The use of chemical and microbial methods has been used for a number of years to help identify sources of faecal contamination; the use of fluorescent whitening agents and faecal sterols are among those widely used. Faecal source tracking is the term used for these methods. In recent years the use of DNA methods has been researched in more depth. Microbial source tracking (MST) is the term used when microbial identification techniques based on PCR markers and other DNA methods are used to discern the source of faecal contamination.

Cawthron and ESR, funded through the Ministry for Science and Innovation's Envirolink scheme undertook research into the use of Quantitative PCR (qPCR) based MST markers for identifying the presence and relative contributions of human and ruminant sources of faecal pollution in New Zealand. Nine regional councils, including Marlborough District Council, assisted in the field trials. The field trials consisted of 1) collecting faecal matter from a range of sources from seagulls to deer 2) collecting water samples from marine and river environments with a history of faecal contamination.

Four sites in Marlborough were sampled 4 times during February and March 2011. The sites chosen were: the Brown River at SH6 (BRN-2), The Rai at Rai Falls (RAR-1), Moenui Beach (MOE-1) and Momorangi Beach (MOM-001) (figure 19). Each of these sites has a history of high levels of faecal contamination. All except the Brown River are contact recreation sites.

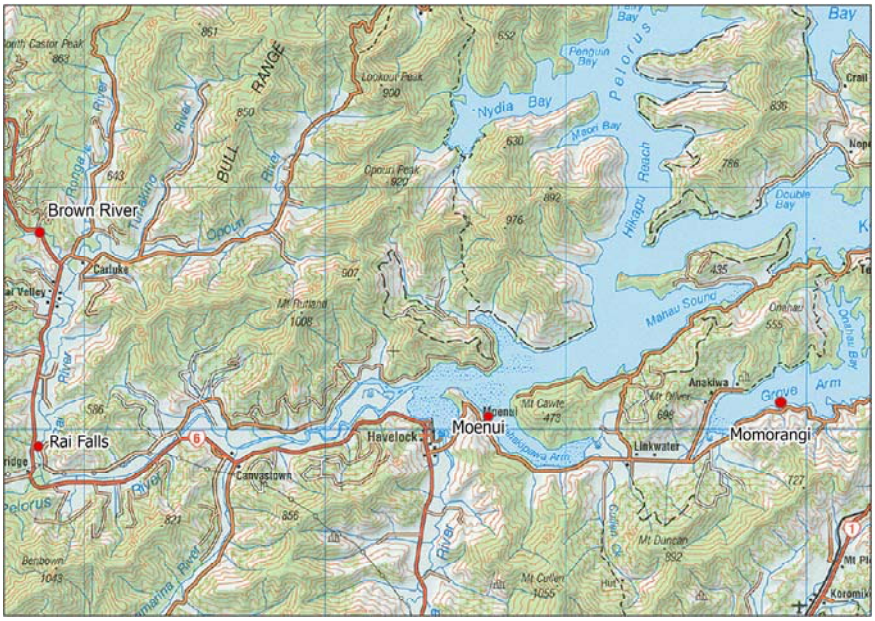


Figure 20: MST sites sampled in 2011.

The results (Appendix 6) show that faecal contamination at the Brown River, the Rai Falls and at Moenui is dominated by a ruminant source (Cornelisen *et al*., 2012). High faecal contamination at Moenui Beach was previously considered to be possibly from one or more of: 1. poorly performing septic tanks 2. the Havelock oxidation ponds or 3. dairying/livestock in the Pelorus/Kaituna and Cullens catchments. These results show that poor water quality at Moenui is most likely a result of dairying/livestock in the surrounding catchments (Appendix 6). It is likely that water quality in other areas of the inner Pelorus Sound is adversely affected by bovine and ruminant sources in the draining catchments.

Results for Momorangi show that neither ruminants nor humans were a source of the faecal contamination. This supports the investigations into the source of faecal contamination carried out in 2008 (MDC, 2008) which showed that wildfowl were the most likely source of the faecal contamination. Further work should be done at this site to determine the exact source.

Nationally, ruminants were found to be the dominant source of faecal contamination (Figure 21). Human sources were found for Auckland, Wellington and Christchurch. A number of sites (including Momorangi) had no discernable source identified:

> *The source-specific markers used in the trial were unable to identify the contamination source at 17% of the sites. At some of these sites, faecal contamination levels were simply too low during sampling to detect source-specific markers that are in lower abundance than the general indicators (Table 3). In cases where faecal contamination was clearly present (e.g. French Bay in Auckland), it is likely that sources other than ruminant and human were the major contributors to contamination. For example, wildfowl, seagulls and dogs in residential areas and along beaches can represent significant sources of faecal contamination (Wright et al. 2009). At some sites, such as Laingholm Beach in Manukau Harbour, enterococci concentrations were elevated despite very low UBac concentrations and an absence of source-specific markers. In this case, it is possible that FIB is associated with persistent populations of FIB in the environment (i.e. aged contamination) or possibly treated sources in which FIB are still present, but bacteria targeted by MST markers have died off. In all these cases, further sampling under a range of conditions and possibly using additional markers is needed to confirm sources leading to elevated FIB levels.* (Cornelisen *et al*., 2012)

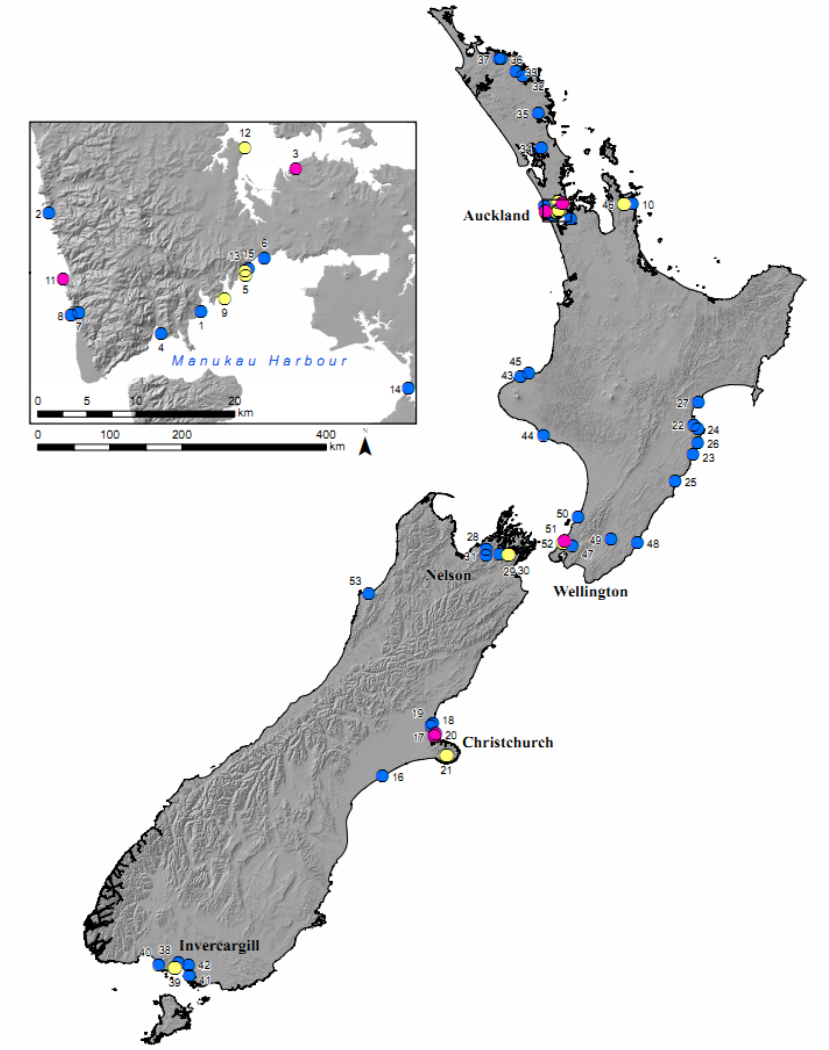


Figure 21: Sampling sites where water samples for the trial were collected by Councils. Numbers correspond with sites listed in Table 3. Colours correspond to sources (● = ruminant, ● = human) contributing to contamination at these sites based on the presence of source-specific markers. In some cases (sites marked ●), faecal indicators (*e.g.* enterococci and UBac marker) were present, but source specific markers were not detected (from: Cornelisen *et al*., 2012).

6. Recommendations for Summer Sampling 2010-11

- Carry out a survey to determine the most popular bathing water sites in the region. The results should be used to reassess which sites are included in the Recreational Water Quality Monitoring Programme.

- Maintain routine monitoring of all sites to allow for the assessment of beach grades, the assessment of trends over time and for a comparison of Marlborough's recreational water quality with sites across the country.

- Investigate the use of microbial source tracking to identify sources of faecal contamination at poorly performing sites. These include the Wairau Diversion at Neals Road, The Taylor River at Riverside, Hakahaka Bay, Trimoana and Picton Foreshore.

7. References

Cornelisen, C.D., Kirs, M., Gilpin, B. and Scholes, P. (2012) Microbial Source Tracking (MST) tools for water quality monitoring. Prepared for the Regional Councils and Coastal Special Interest Group. Cawthron Report No. 2047. 28 p. plus appendices.

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MDC (2009a) *Marlborough's Coastal Recreational Water Quality 2008-09.* Marlborough District Council.

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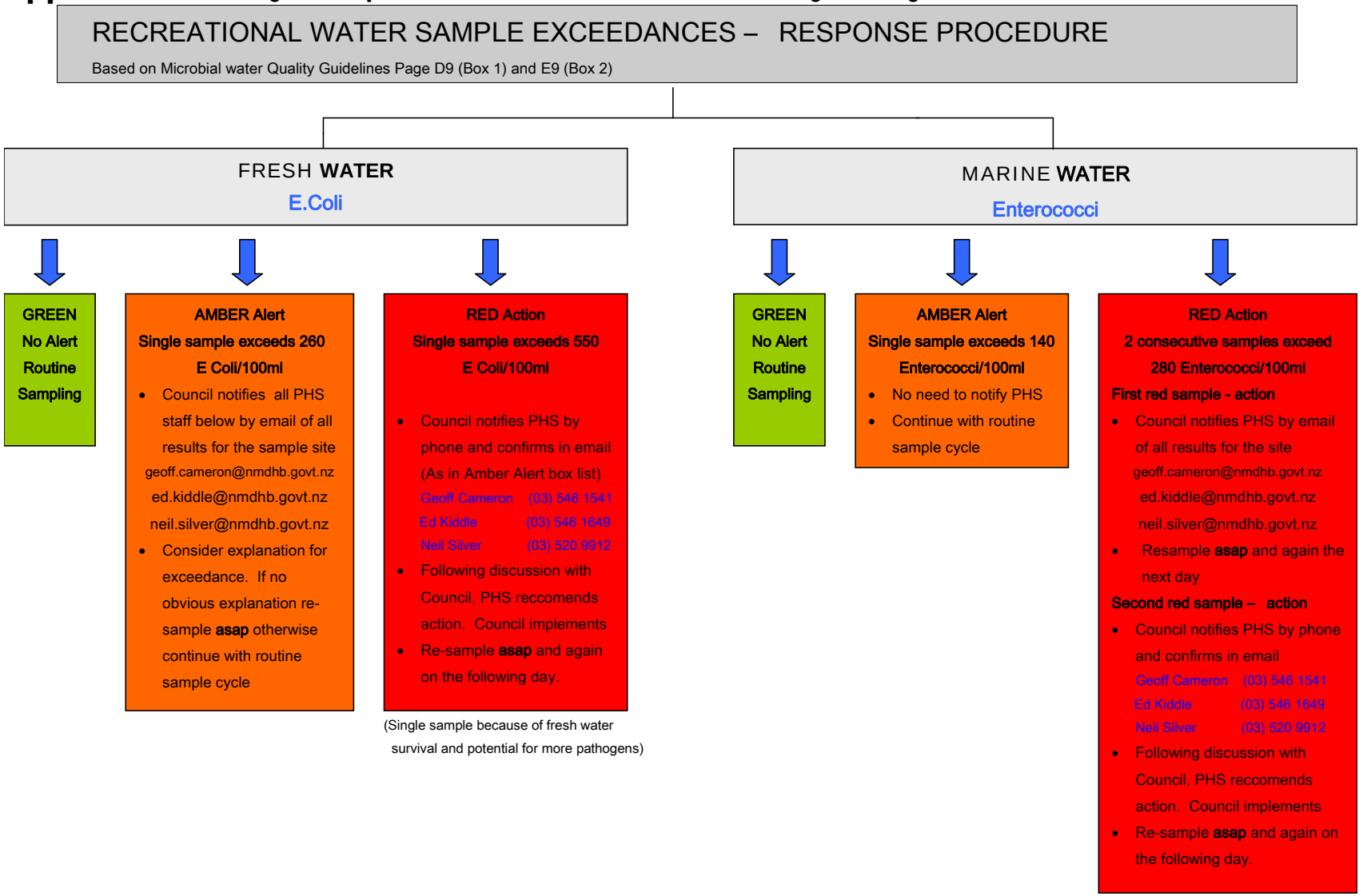
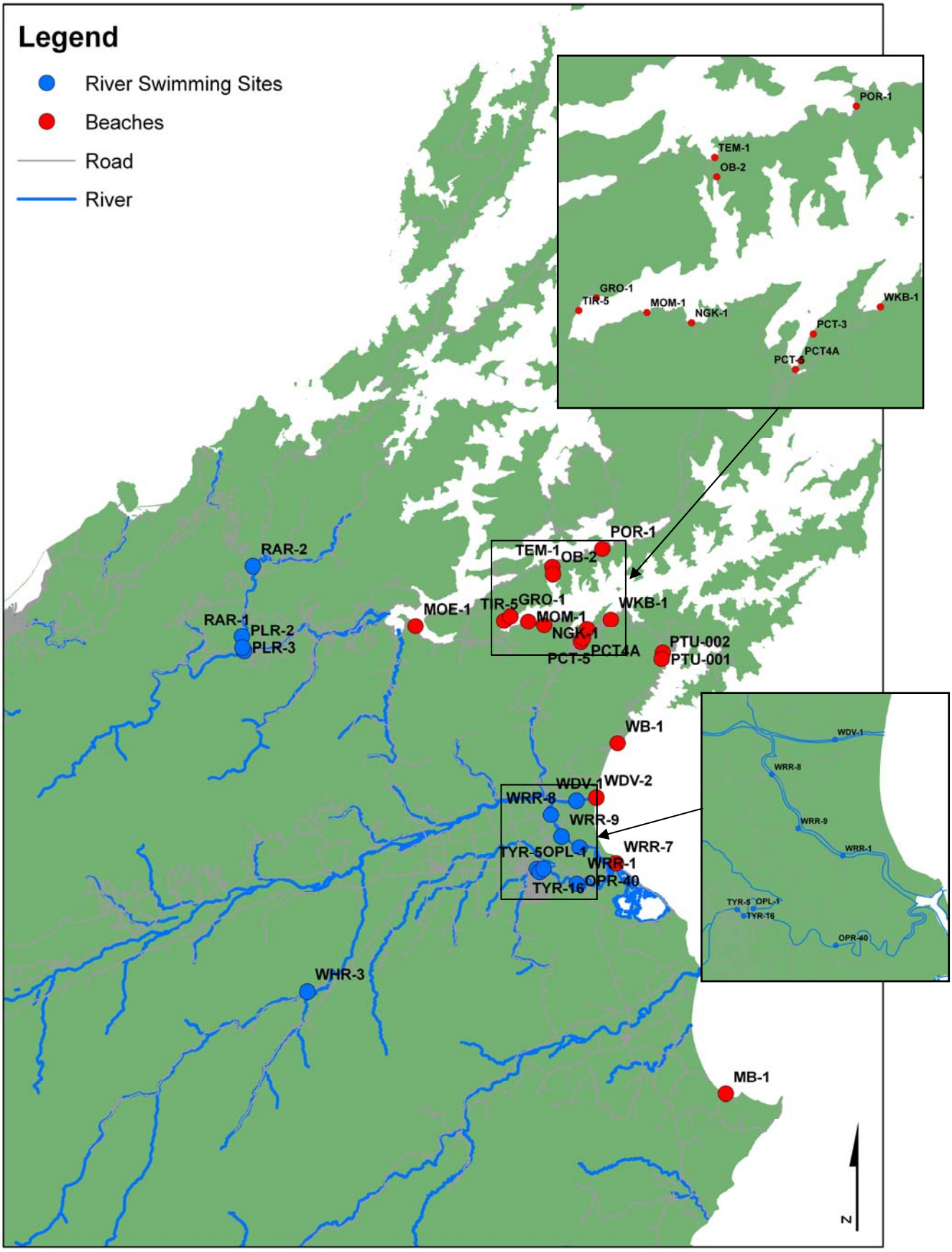
Scarsbrook, M. and McBride, G. (2004) *Levels of E. coli in New Zealands rivers*. NIWA Client Report: HAM2004-157. December 2004.

Appendix 1: Management procedure for exceedances of bathing water guidelines.



Appendix 2: Locations of Recreational Water Quality Sites



Appendix 3: Recreational water quality results 2010-11.

COASTAL SITES			RIVER SITES		
Site ID	**Time**	**Enterococci (cfu/100mL)**	**Site ID**	**Time**	***E. coli* (cfu/100mL)**
GRO-001	2/11/2010 15:10	20	OPL-1	3/11/2010 7:45	47
GRO-001	8/11/2010 12:23	4	OPL-1	9/11/2010 13:39	19
GRO-001	15/11/2010 12:30	4	OPL-1	16/11/2010 13:48	3
GRO-001	22/11/2010 12:24	4	OPL-1	23/11/2010 13:20	5
GRO-001	29/11/2010 12:34	4	OPL-1	30/11/2010 13:36	13
GRO-001	6/12/2010 13:12	4	OPL-1	7/12/2010 13:32	126
GRO-001	13/12/2010 12:59	4	OPL-1	14/12/2010 13:47	13
GRO-001	20/12/2010 12:22	27	OPL-1	21/12/2010 13:53	292
GRO-001	30/12/2010 11:04	100	OPL-1	29/12/2010 14:39	1040
GRO-001	5/01/2011 13:21	4	OPL-1	6/01/2011 13:32	89
GRO-001	10/01/2011 12:41	4	OPL-1	11/01/2011 13:38	101
GRO-001	17/01/2011 12:27	4	OPL-1	18/01/2011 13:19	231
GRO-001	24/01/2011 12:59	160	OPL-1	25/01/2011 13:09	17
GRO-001	31/01/2011 12:50	8	OPL-1	1/02/2011 14:06	7
GRO-001	8/02/2011 12:53	4	OPL-1	9/02/2011 13:07	49
GRO-001	14/02/2011 12:16	4	OPL-1	15/02/2011 13:58	63
GRO-001	21/02/2011 12:57	4	OPL-1	22/02/2011 13:40	91
GRO-001	3/03/2011 12:59	68	OPL-1	1/03/2011 13:43	91
GRO-001	8/03/2011 12:46	76	OPL-1	9/03/2011 13:50	250
GRO-001	14/03/2011 12:53	2	OPL-1	15/03/2011 13:40	48
GRO-001	21/03/2011 12:47	12	OPL-1	22/03/2011 14:05	57
GRO-001	28/03/2011 12:43	16	OPL-1	29/03/2011 13:57	31
MB-1	2/11/2010 10:30	4	OPR-40	3/11/2010 14:10	9
MB-1	8/11/2010 10:20	8	OPR-40	9/11/2010 14:22	30
MB-1	15/11/2010 10:40	4	OPR-40	16/11/2010 14:28	10
MB-1	22/11/2010 10:25	4	OPR-40	23/11/2010 14:05	54
MB-1	29/11/2010 11:40	16	OPR-40	30/11/2010 14:15	45
MB-1	6/12/2010 11:20	4	OPR-40	7/12/2010 14:09	173
MB-1	13/12/2010 11:30	4	OPR-40	14/12/2010 14:24	17

MB-1	20/12/2010 10:10	8	OPR-40	21/12/2010 14:40	740
MB-1	29/12/2010 10:20	4	OPR-40	29/12/2010 15:07	780
MB-1	5/01/2011 10:20	4	OPR-40	6/01/2011 14:07	114
MB-1	10/01/2011 10:40	8	OPR-40	11/01/2011 14:14	27
MB-1	17/01/2011 7:30	4	OPR-40	18/01/2011 14:03	185
MB-1	24/01/2011 10:20	12	OPR-40	25/01/2011 13:47	78
MB-1	31/01/2011 9:55	84	OPR-40	1/02/2011 14:39	40
MB-1	8/02/2011 9:35	4	OPR-40	9/02/2011 13:54	29
MB-1	14/02/2011 11:30	4	OPR-40	15/02/2011 14:37	27
MB-1	21/02/2011 10:00	28	OPR-40	22/02/2011 14:27	106
MB-1	28/02/2011 10:25	4	OPR-40	1/03/2011 14:21	17
MB-1	8/03/2011 9:45	4	OPR-40	9/03/2011 14:27	36
MB-1	14/03/2011 11:40	15	OPR-40	15/03/2011 14:19	34
MB-1	21/03/2011 10:00	4	OPR-40	22/03/2011 14:35	51
MB-1	28/03/2011 10:10	2	OPR-40	29/03/2011 14:44	18
MOE-1	2/11/2010 12:00	4	PLR-2	2/11/2010 11:15	5
MOE-1	8/11/2010 9:53	4	PLR-2	8/11/2010 9:06	49
MOE-1	15/11/2010 9:34	4	PLR-2	15/11/2010 8:46	38
MOE-1	22/11/2010 9:33	4	PLR-2	22/11/2010 8:46	189
MOE-1	29/11/2010 9:18	4	PLR-2	29/11/2010 8:36	94
MOE-1	6/12/2010 10:02	140	PLR-2	6/12/2010 9:03	38
MOE-1	13/12/2010 9:40	44	PLR-2	13/12/2010 8:59	14
MOE-1	20/12/2010 9:16	3900	PLR-2	20/12/2010 8:35	70
MOE-1	30/12/2010 14:05	2500	PLR-2	30/12/2010 15:11	35
MOE-1	5/01/2011 9:27	660	PLR-2	5/01/2011 8:41	29
MOE-1	7/01/2011 10:20	270	PLR-2	10/01/2011 8:36	11
MOE-1	10/01/2011 9:21	16	PLR-2	17/01/2011 8:40	20
MOE-1	17/01/2011 9:25	100	PLR-2	24/01/2011 8:44	65
MOE-1	24/01/2011 9:37	130	PLR-2	31/01/2011 8:28	24
MOE-1	31/01/2011 9:23	170	PLR-2	8/02/2011 8:33	38
MOE-1	8/02/2011 9:44	460	PLR-2	14/02/2011 8:25	10
MOE-1	14/02/2011 9:04	4	PLR-2	21/02/2011 8:28	5

MOE-1	21/02/2011 9:11	8	PLR-2	3/03/2011 8:35	117
MOE-1	23/02/2011 9:53	16	PLR-2	8/03/2011 8:46	49
MOE-1	3/03/2011 9:14	910	PLR-2	14/03/2011 8:35	35
MOE-1	8/03/2011 9:28	36	PLR-2	21/03/2011 8:29	11
MOE-1	14/03/2011 9:29	2	PLR-2	28/03/2011 8:34	28
MOE-1	21/03/2011 9:11	20	PLR-3	2/11/2010 11:30	10
MOE-1	28/03/2011 9:51	4	PLR-3	8/11/2010 9:17	63
MOM-001	2/11/2010 15:30	4	PLR-3	15/11/2010 8:53	38
MOM-001	8/11/2010 12:49	4	PLR-3	22/11/2010 8:57	102
MOM-001	15/11/2010 12:58	8	PLR-3	29/11/2010 8:49	5
MOM-001	22/11/2010 12:48	16	PLR-3	6/12/2010 9:16	9
MOM-001	29/11/2010 12:59	16	PLR-3	13/12/2010 9:09	19
MOM-001	6/12/2010 13:36	4	PLR-3	20/12/2010 8:47	1100
MOM-001	13/12/2010 13:24	12	PLR-3	5/01/2011 8:54	79
MOM-001	20/12/2010 12:47	62	PLR-3	10/01/2011 8:48	40
MOM-001	30/12/2010 10:24	46	PLR-3	17/01/2011 8:54	25
MOM-001	5/01/2011 13:52	12	PLR-3	24/01/2011 8:55	97
MOM-001	10/01/2011 13:18	24	PLR-3	31/01/2011 8:40	26
MOM-001	17/01/2011 12:59	20	PLR-3	8/02/2011 8:44	67
MOM-001	24/01/2011 13:27	210	PLR-3	14/02/2011 8:34	6
MOM-001	31/01/2011 13:17	4	PLR-3	21/02/2011 8:41	7
MOM-001	8/02/2011 13:19	32	PLR-3	3/03/2011 8:44	141
MOM-001	14/02/2011 12:53	4	PLR-3	8/03/2011 8:56	75
MOM-001	21/02/2011 13:25	52	PLR-3	14/03/2011 8:47	37
MOM-001	23/02/2011 11:12	2100	PLR-3	21/03/2011 8:40	47
MOM-001	3/03/2011 13:44	64	PLR-3	28/03/2011 8:44	51
MOM-001	8/03/2011 13:14	4	RAR-1	2/11/2010 11:00	15
MOM-001	14/03/2011 13:18	4	RAR-1	8/11/2010 8:45	113
MOM-001	21/03/2011 13:13	8	RAR-1	15/11/2010 8:31	91
MOM-001	28/03/2011 13:08	2	RAR-1	22/11/2010 8:30	140
NGK-001	2/11/2010 15:40	4	RAR-1	29/11/2010 8:24	47
NGK-001	8/11/2010 13:02	28	RAR-1	6/12/2010 8:49	47

NGK-001	15/11/2010 13:18	20	RAR-1	13/12/2010 8:45	47
NGK-001	22/11/2010 13:04	4	RAR-1	20/12/2010 8:25	1800
NGK-001	29/11/2010 13:14	4	RAR-1	30/12/2010 14:59	115
NGK-001	6/12/2010 13:48	4	RAR-1	5/01/2011 8:28	178
NGK-001	13/12/2010 13:37	40	RAR-1	10/01/2011 8:25	95
NGK-001	20/12/2010 13:00	410	RAR-1	17/01/2011 8:29	77
NGK-001	30/12/2010 10:09	120	RAR-1	24/01/2011 8:28	153
NGK-001	5/01/2011 14:07	16	RAR-1	31/01/2011 8:15	191
NGK-001	10/01/2011 13:32	20	RAR-1	8/02/2011 8:20	125
NGK-001	17/01/2011 13:15	8	RAR-1	14/02/2011 8:10	76
NGK-001	24/01/2011 13:41	1600	RAR-1	21/02/2011 8:12	49
NGK-001	26/01/2011 10:45	80	RAR-1	23/02/2011 9:12	122
NGK-001	31/01/2011 13:45	8	RAR-1	3/03/2011 8:15	600
NGK-001	8/02/2011 13:33	12	RAR-1	8/03/2011 8:36	90
NGK-001	14/02/2011 13:14	4	RAR-1	14/03/2011 8:19	105
NGK-001	21/02/2011 13:40	180	RAR-1	21/03/2011 8:16	74
NGK-001	3/03/2011 13:57	140	RAR-1	28/03/2011 8:21	82
NGK-001	8/03/2011 13:23	4	RAR-2	2/11/2010 10:40	37
NGK-001	14/03/2011 13:34	4	RAR-2	8/11/2010 8:28	66
NGK-001	21/03/2011 13:27	2	RAR-2	15/11/2010 8:12	177
NGK-001	28/03/2011 13:20	12	RAR-2	22/11/2010 8:13	71
OB-2	2/11/2010 14:00	4	RAR-2	29/11/2010 8:10	21
OB-2	8/11/2010 11:26	4	RAR-2	6/12/2010 8:35	5
OB-2	15/11/2010 11:10	4	RAR-2	13/12/2010 8:29	14
OB-2	22/11/2010 11:11	12	RAR-2	20/12/2010 8:10	2200
OB-2	29/11/2010 11:15	4	RAR-2	5/01/2011 8:12	214
OB-2	6/12/2010 11:35	4	RAR-2	10/01/2011 8:11	150
OB-2	13/12/2010 11:33	4	RAR-2	17/01/2011 8:15	88
OB-2	20/12/2010 11:07	50	RAR-2	24/01/2011 8:12	135
OB-2	30/12/2010 12:03	32	RAR-2	31/01/2011 7:59	128
OB-2	5/01/2011 11:44	28	RAR-2	8/02/2011 8:05	73
OB-2	10/01/2011 11:10	4	RAR-2	14/02/2011 7:54	65

OB-2	17/01/2011 11:14	4	RAR-2	21/02/2011 7:58	85
OB-2	24/01/2011 11:18	16	RAR-2	3/03/2011 7:59	680
OB-2	31/01/2011 11:14	8	RAR-2	8/03/2011 8:18	116
OB-2	8/02/2011 11:30	8	RAR-2	14/03/2011 7:59	123
OB-2	14/02/2011 10:54	4	RAR-2	21/03/2011 8:03	87
OB-2	21/02/2011 11:22	4	RAR-2	28/03/2011 8:04	84
OB-2	3/03/2011 11:23	24	TYR-16	3/11/2010 7:30	122
OB-2	8/03/2011 11:23	110	TYR-16	9/11/2010 14:07	31
OB-2	14/03/2011 11:16	4	TYR-16	16/11/2010 14:08	25
OB-2	21/03/2011 11:02	35	TYR-16	23/11/2010 13:48	38
OB-2	28/03/2011 11:24	2	TYR-16	30/11/2010 13:59	10
PCT-3	3/11/2010 9:15	4	TYR-16	7/12/2010 13:54	151
PCT-3	9/11/2010 10:17	4	TYR-16	14/12/2010 14:07	39
PCT-3	16/11/2010 10:20	4	TYR-16	21/12/2010 14:23	1620
PCT-3	23/11/2010 9:32	4	TYR-16	29/12/2010 14:55	280
PCT-3	30/11/2010 9:40	4	TYR-16	6/01/2011 13:53	71
PCT-3	7/12/2010 9:42	4	TYR-16	11/01/2011 13:58	91
PCT-3	14/12/2010 10:04	4	TYR-16	18/01/2011 13:46	2680
PCT-3	21/12/2010 9:51	120	TYR-16	25/01/2011 13:30	51
PCT-3	23/12/2010 7:15	53	TYR-16	1/02/2011 14:25	28
PCT-3	29/12/2010 10:05	16	TYR-16	9/02/2011 13:38	94
PCT-3	30/12/2010 8:48	4	TYR-16	15/02/2011 14:21	27
PCT-3	6/01/2011 9:40	120	TYR-16	22/02/2011 14:14	148
PCT-3	11/01/2011 10:03	4	TYR-16	1/03/2011 14:05	59
PCT-3	18/01/2011 9:49	12	TYR-16	9/03/2011 14:12	15
PCT-3	25/01/2011 9:22	12	TYR-16	15/03/2011 14:03	400
PCT-3	1/02/2011 10:17	4	TYR-16	17/03/2011 10:15	110
PCT-3	9/02/2011 9:34	8	TYR-16	22/03/2011 14:24	115
PCT-3	15/02/2011 9:33	4	TYR-16	29/03/2011 14:31	40
PCT-3	22/02/2011 9:42	28	TYR-5	3/11/2010 8:00	93
PCT-3	1/03/2011 10:14	4	TYR-5	9/11/2010 13:57	31
PCT-3	9/03/2011 10:12	24	TYR-5	16/11/2010 13:59	46

PCT-3	15/03/2011 9:55	2	TYR-5	23/11/2010 13:34	55
PCT-3	22/03/2011 10:42	210	TYR-5	30/11/2010 13:49	22
PCT-3	29/03/2011 10:24	4	TYR-5	7/12/2010 13:43	160
PCT-4A	2/11/2010 16:30	4	TYR-5	14/12/2010 13:57	39
PCT-4A	8/11/2010 13:39	12	TYR-5	21/12/2010 14:12	1020
PCT-4A	15/11/2010 14:00	4	TYR-5	29/12/2010 14:47	440
PCT-4A	22/11/2010 13:48	4	TYR-5	6/01/2011 13:44	92
PCT-4A	29/11/2010 14:02	4	TYR-5	11/01/2011 13:49	100
PCT-4A	6/12/2010 14:27	4	TYR-5	18/01/2011 13:31	1620
PCT-4A	13/12/2010 14:14	8	TYR-5	25/01/2011 13:20	66
PCT-4A	20/12/2010 13:41	810	TYR-5	1/02/2011 14:15	31
PCT-4A	23/12/2010 8:05	75	TYR-5	9/02/2011 13:25	90
PCT-4A	30/12/2010 9:19	44	TYR-5	15/02/2011 14:09	38
PCT-4A	5/01/2011 14:47	4	TYR-5	22/02/2011 13:50	148
PCT-4A	10/01/2011 14:07	16	TYR-5	1/03/2011 13:55	68
PCT-4A	17/01/2011 13:55	12	TYR-5	9/03/2011 14:00	20
PCT-4A	24/01/2011 14:20	280	TYR-5	15/03/2011 13:54	39
PCT-4A	26/01/2011 10:00	60	TYR-5	22/03/2011 14:14	62
PCT-4A	31/01/2011 14:23	4	TYR-5	29/03/2011 14:21	60
PCT-4A	8/02/2011 14:10	8	WDV-1	3/11/2010 12:20	3
PCT-4A	14/02/2011 13:56	2	WDV-1	9/11/2010 12:15	27
PCT-4A	21/02/2011 14:18	24	WDV-1	16/11/2010 12:21	48
PCT-4A	3/03/2011 14:28	96	WDV-1	23/11/2010 11:49	8
PCT-4A	8/03/2011 14:03	28	WDV-1	30/11/2010 12:15	33
PCT-4A	14/03/2011 14:12	4	WDV-1	7/12/2010 12:08	89
PCT-4A	21/03/2011 13:59	4	WDV-1	14/12/2010 12:15	186
PCT-4A	28/03/2011 13:55	4	WDV-1	21/12/2010 12:16	1320
PCT-5	2/11/2010 16:25	4	WDV-1	29/12/2010 12:41	2880
PCT-5	8/11/2010 13:28	12	WDV-1	6/01/2011 12:10	84
PCT-5	15/11/2010 13:48	4	WDV-1	11/01/2011 12:17	44
PCT-5	22/11/2010 13:34	4	WDV-1	18/01/2011 11:56	90
PCT-5	29/11/2010 13:45	32	WDV-1	25/01/2011 11:50	420

PCT-5	6/12/2010 14:15	12	WDV-1	1/02/2011 12:28	11
PCT-5	13/12/2010 14:03	4	WDV-1	9/02/2011 11:43	111
PCT-5	20/12/2010 13:29	840	WDV-1	15/02/2011 11:52	108
PCT-5	23/12/2010 8:15	207	WDV-1	22/02/2011 12:13	420
PCT-5	30/12/2010 9:31	84	WDV-1	1/03/2011 12:24	400
PCT-5	5/01/2011 14:36	44	WDV-1	9/03/2011 12:30	32
PCT-5	10/01/2011 13:55	4	WDV-1	15/03/2011 12:19	79
PCT-5	17/01/2011 13:43	12	WDV-1	22/03/2011 12:38	181
PCT-5	24/01/2011 14:07	410	WDV-1	29/03/2011 13:45	65
PCT-5	26/01/2011 10:10	62	WHR-3	2/11/2010 9:00	2
PCT-5	31/01/2011 14:12	2	WHR-3	8/11/2010 9:05	16
PCT-5	8/02/2011 13:59	32	WHR-3	15/11/2010 9:10	10
PCT-5	14/02/2011 13:43	4	WHR-3	22/11/2010 9:15	76
PCT-5	21/02/2011 14:05	12	WHR-3	29/11/2010 9:00	7
PCT-5	3/03/2011 14:18	340	WHR-3	6/12/2010 12:45	22
PCT-5	8/03/2011 13:51	12	WHR-3	13/12/2010 9:10	10
PCT-5	14/03/2011 14:00	4	WHR-3	20/12/2010 8:40	239
PCT-5	21/03/2011 13:49	4	WHR-3	29/12/2010 9:00	920
PCT-5	28/03/2011 13:45	72	WHR-3	5/01/2011 8:45	115
POR-1	2/11/2010 13:20	4	WHR-3	10/01/2011 8:10	20
POR-1	8/11/2010 10:59	4	WHR-3	17/01/2011 8:40	22
POR-1	15/11/2010 10:44	4	WHR-3	24/01/2011 8:30	55
POR-1	22/11/2010 10:45	100	WHR-3	31/01/2011 8:45	1
POR-1	29/11/2010 10:49	4	WHR-3	8/02/2011 8:15	540
POR-1	6/12/2010 11:10	4	WHR-3	14/02/2011 9:35	13
POR-1	13/12/2010 11:08	8	WHR-3	21/02/2011 8:40	16
POR-1	20/12/2010 10:41	120	WHR-3	28/02/2011 9:00	56
POR-1	30/12/2010 12:35	36	WHR-3	8/03/2011 8:30	41
POR-1	5/01/2011 11:10	1100	WHR-3	14/03/2011 9:20	23
POR-1	7/01/2011 11:30	360	WHR-3	21/03/2011 8:30	15
POR-1	10/01/2011 10:42	4	WHR-3	28/03/2011 8:50	20
POR-1	17/01/2011 10:44	24	WRR-1	3/11/2010 13:50	1

POR-1	24/01/2011 10:49	8	WRR-1	9/11/2010 13:07	1
POR-1	31/01/2011 10:43	4	WRR-1	16/11/2010 13:33	1
POR-1	8/02/2011 11:03	16	WRR-1	23/11/2010 12:57	1
POR-1	14/02/2011 10:27	4	WRR-1	30/11/2010 13:24	1
POR-1	21/02/2011 10:57	12	WRR-1	7/12/2010 13:17	37
POR-1	3/03/2011 10:53	16	WRR-1	14/12/2010 13:31	2
POR-1	8/03/2011 10:56	4	WRR-1	21/12/2010 13:37	119
POR-1	14/03/2011 10:49	4	WRR-1	29/12/2010 14:23	780
POR-1	21/03/2011 10:34	100	WRR-1	6/01/2011 13:18	21
POR-1	28/03/2011 10:59	2	WRR-1	11/01/2011 13:22	34
PTU-001	3/11/2010 10:40	4	WRR-1	18/01/2011 13:03	19
PTU-001	9/11/2010 8:10	36	WRR-1	25/01/2011 12:53	13
PTU-001	16/11/2010 8:48	4	WRR-1	1/02/2011 13:39	1
PTU-001	23/11/2010 8:10	4	WRR-1	9/02/2011 12:50	24
PTU-001	30/11/2010 8:07	4	WRR-1	15/02/2011 13:07	1
PTU-001	7/12/2010 8:14	330	WRR-1	22/02/2011 13:23	23
PTU-001	14/12/2010 8:47	24	WRR-1	1/03/2011 13:27	10
PTU-001	21/12/2010 8:27	6400	WRR-1	9/03/2011 13:37	9
PTU-001	23/12/2010 12:00	4	WRR-1	15/03/2011 13:26	6
PTU-001	29/12/2010 8:58	96	WRR-1	22/03/2011 13:51	10
PTU-001	30/12/2010 10:00	73	WRR-1	29/03/2011 13:43	1
PTU-001	6/01/2011 8:11	550	WRR-8	3/11/2010 12:50	1
PTU-001	11/01/2011 8:44	28	WRR-8	9/11/2010 12:49	6
PTU-001	18/01/2011 8:13	4	WRR-8	16/11/2010 13:00	60
PTU-001	25/01/2011 8:03	32	WRR-8	23/11/2010 12:28	10
PTU-001	1/02/2011 8:53	2	WRR-8	30/11/2010 12:52	4
PTU-001	9/02/2011 8:08	12	WRR-8	7/12/2010 12:46	83
PTU-001	15/02/2011 8:00	76	WRR-8	14/12/2010 13:03	10
PTU-001	22/02/2011 8:04	80	WRR-8	21/12/2010 12:59	740
PTU-001	1/03/2011 8:27	12	WRR-8	29/12/2010 13:27	680
PTU-001	9/03/2011 8:02	4	WRR-8	6/01/2011 12:51	24
PTU-001	15/03/2011 8:00	16	WRR-8	11/01/2011 12:55	13

PTU-001	22/03/2011 8:56	260	WRR-8	18/01/2011 12:34	14
PTU-001	29/03/2011 8:56	4	WRR-8	25/01/2011 12:24	29
PTU-002	3/11/2010 10:55	4	WRR-8	1/02/2011 13:07	1
PTU-002	9/11/2010 8:17	20	WRR-8	9/02/2011 12:22	23
PTU-002	16/11/2010 8:57	4	WRR-8	15/02/2011 12:35	20
PTU-002	23/11/2010 8:20	44	WRR-8	22/02/2011 12:49	53
PTU-002	30/11/2010 8:21	4	WRR-8	1/03/2011 12:59	7
PTU-002	7/12/2010 8:24	1000	WRR-8	9/03/2011 13:06	12
PTU-002	14/12/2010 8:59	20	WRR-8	15/03/2011 12:59	5
PTU-002	21/12/2010 8:41	5200	WRR-8	22/03/2011 13:23	28
PTU-002	23/12/2010 12:15	4	WRR-8	29/03/2011 13:15	7
PTU-002	29/12/2010 9:06	27	WRR-9	3/11/2010 13:40	2
PTU-002	30/12/2010 10:20	4	WRR-9	9/11/2010 13:25	1
PTU-002	6/01/2011 8:22	200	WRR-9	16/11/2010 13:14	1
PTU-002	11/01/2011 8:53	96	WRR-9	23/11/2010 12:44	5
PTU-002	18/01/2011 8:22	4	WRR-9	30/11/2010 13:07	1
PTU-002	25/01/2011 8:15	24	WRR-9	7/12/2010 13:03	28
PTU-002	1/02/2011 9:02	16	WRR-9	14/12/2010 13:17	114
PTU-002	9/02/2011 8:20	24	WRR-9	21/12/2010 13:14	440
PTU-002	15/02/2011 8:14	24	WRR-9	29/12/2010 13:47	860
PTU-002	22/02/2011 8:15	56	WRR-9	6/01/2011 13:06	32
PTU-002	1/03/2011 8:36	4	WRR-9	11/01/2011 13:09	31
PTU-002	9/03/2011 8:13	4	WRR-9	18/01/2011 12:47	26
PTU-002	15/03/2011 8:15	2	WRR-9	25/01/2011 12:39	14
PTU-002	22/03/2011 9:04	120	WRR-9	1/02/2011 13:20	10
PTU-002	29/03/2011 9:06	16	WRR-9	9/02/2011 12:36	21
TEM-1	2/11/2010 14:15	4	WRR-9	15/02/2011 12:51	2
TEM-1	8/11/2010 10:36	4	WRR-9	22/02/2011 13:07	29
TEM-1	15/11/2010 10:19	4	WRR-9	1/03/2011 13:12	5
TEM-1	22/11/2010 10:20	4	WRR-9	9/03/2011 13:22	25
TEM-1	29/11/2010 10:21	8	WRR-9	15/03/2011 13:12	1
TEM-1	6/12/2010 10:46	4	WRR-9	22/03/2011 13:36	25

TEM-1	13/12/2010 10:43	12	WRR-9	29/03/2011 13:30	1
TEM-1	20/12/2010 9:58	77			
TEM-1	30/12/2010 13:08	19			
TEM-1	5/01/2011 10:39	24			
TEM-1	10/01/2011 10:12	4			
TEM-1	17/01/2011 10:20	4			
TEM-1	24/01/2011 10:24	20			
TEM-1	31/01/2011 10:14	4			
TEM-1	8/02/2011 10:40	8			
TEM-1	14/02/2011 10:03	4			
TEM-1	21/02/2011 10:30	4			
TEM-1	3/03/2011 10:15	24			
TEM-1	8/03/2011 10:29	16			
TEM-1	14/03/2011 10:29	4			
TEM-1	21/03/2011 10:09	4			
TEM-1	28/03/2011 10:36	2			
TIR-5	2/11/2010 15:00	4			
TIR-5	8/11/2010 12:33	4			
TIR-5	15/11/2010 12:42	4			
TIR-5	22/11/2010 12:34	16			
TIR-5	29/11/2010 12:43	24			
TIR-5	6/12/2010 13:22	4			
TIR-5	13/12/2010 13:07	4			
TIR-5	20/12/2010 12:31	490			
TIR-5	30/12/2010 10:54	100			
TIR-5	5/01/2011 13:32	300			
TIR-5	7/01/2011 13:00	240			
TIR-5	10/01/2011 12:52	84			
TIR-5	17/01/2011 12:39	4			
TIR-5	24/01/2011 13:09	120			
TIR-5	31/01/2011 13:00	16			
TIR-5	8/02/2011 13:03	4			

TIR-5	14/02/2011 12:33	4
TIR-5	21/02/2011 13:09	4
TIR-5	3/03/2011 13:28	370
TIR-5	8/03/2011 12:57	28
TIR-5	14/03/2011 13:03	2
TIR-5	21/03/2011 12:59	20
TIR-5	28/03/2011 12:53	80
WB-1	3/11/2010 11:45	4
WB-1	9/11/2010 11:18	4
WB-1	16/11/2010 11:40	4
WB-1	23/11/2010 10:38	4
WB-1	30/11/2010 10:52	4
WB-1	7/12/2010 10:44	4
WB-1	14/12/2010 11:01	4
WB-1	21/12/2010 11:02	480
WB-1	23/12/2010 13:10	4
WB-1	29/12/2010 11:25	84
WB-1	30/12/2010 9:00	92
WB-1	6/01/2011 10:43	36
WB-1	11/01/2011 11:29	16
WB-1	18/01/2011 10:49	12
WB-1	25/01/2011 10:24	20
WB-1	1/02/2011 11:15	4
WB-1	9/02/2011 10:30	4
WB-1	15/02/2011 10:34	4
WB-1	22/02/2011 10:44	12
WB-1	1/03/2011 11:07	20
WB-1	9/03/2011 11:09	2
WB-1	15/03/2011 10:52	4
WB-1	22/03/2011 11:43	4
WB-1	29/03/2011 11:23	4
WDV-2	3/11/2010 12:30	4

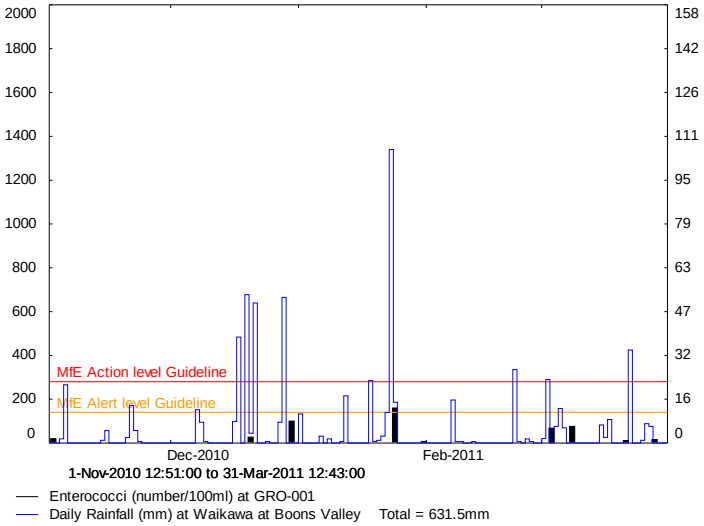
WDV-2	9/11/2010 12:05	4
WDV-2	16/11/2010 12:07	4
WDV-2	23/11/2010 11:34	4
WDV-2	30/11/2010 12:02	8
WDV-2	7/12/2010 11:53	240
WDV-2	14/12/2010 12:02	4
WDV-2	21/12/2010 12:00	400
WDV-2	29/12/2010 12:32	4200
WDV-2	6/01/2011 11:55	60
WDV-2	11/01/2011 11:59	16
WDV-2	18/01/2011 11:46	28
WDV-2	25/01/2011 11:38	360
WDV-2	1/02/2011 12:16	36
WDV-2	9/02/2011 11:01	4
WDV-2	15/02/2011 11:37	8
WDV-2	22/02/2011 11:59	260
WDV-2	1/03/2011 12:13	48
WDV-2	9/03/2011 12:19	44
WDV-2	15/03/2011 12:07	8
WDV-2	22/03/2011 12:28	110
WDV-2	29/03/2011 13:26	2
WKB-1	3/11/2010 10:00	4
WKB-1	9/11/2010 9:47	16
WKB-1	16/11/2010 9:30	4
WKB-1	23/11/2010 8:49	240
WKB-1	30/11/2010 8:53	4
WKB-1	7/12/2010 8:55	8
WKB-1	14/12/2010 9:27	24
WKB-1	21/12/2010 9:15	4000
WKB-1	23/12/2010 7:50	10
WKB-1	29/12/2010 9:38	96
WKB-1	30/12/2010 8:18	54

WKB-1	6/01/2011 8:57	56
WKB-1	11/01/2011 9:24	44
WKB-1	18/01/2011 8:53	48
WKB-1	25/01/2011 8:48	56
WKB-1	1/02/2011 9:39	16
WKB-1	9/02/2011 8:49	2
WKB-1	15/02/2011 8:48	8
WKB-1	22/02/2011 8:52	4
WKB-1	1/03/2011 9:03	4
WKB-1	9/03/2011 8:44	4
WKB-1	15/03/2011 8:51	150
WKB-1	22/03/2011 9:36	8
WKB-1	29/03/2011 9:48	8
WRR-7	3/11/2010 13:10	4
WRR-7	9/11/2010 12:33	4

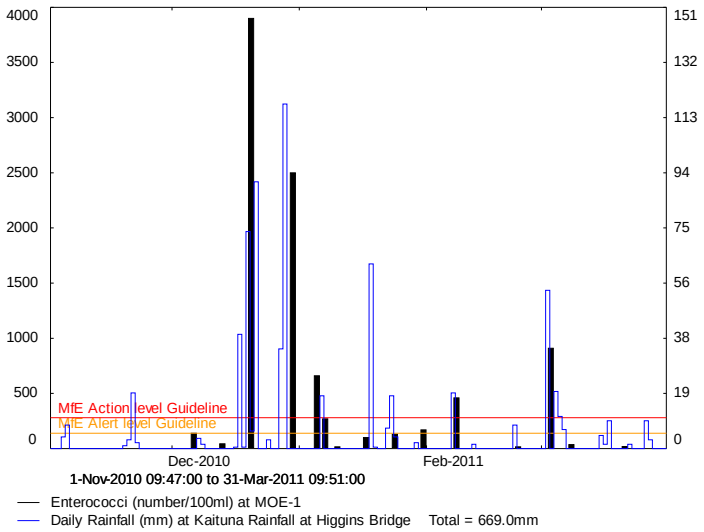
Appendix 4: Graphed results showing daily rainfall for the summer period 2010-2011

COASTAL SITES

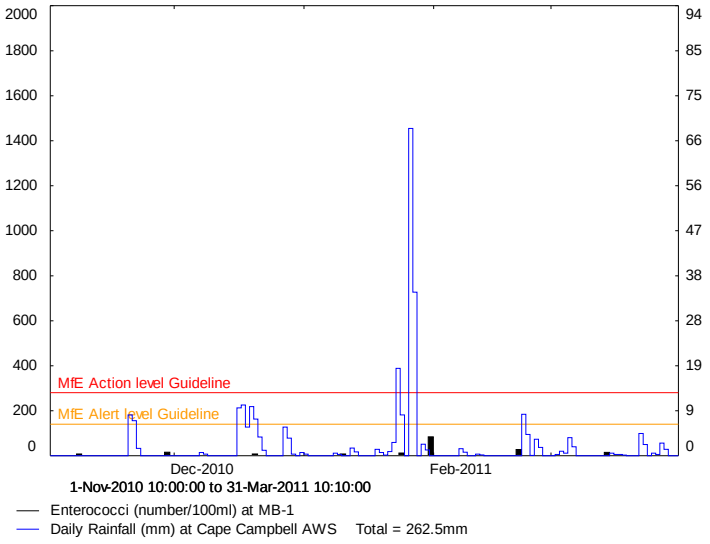
Anakiwa



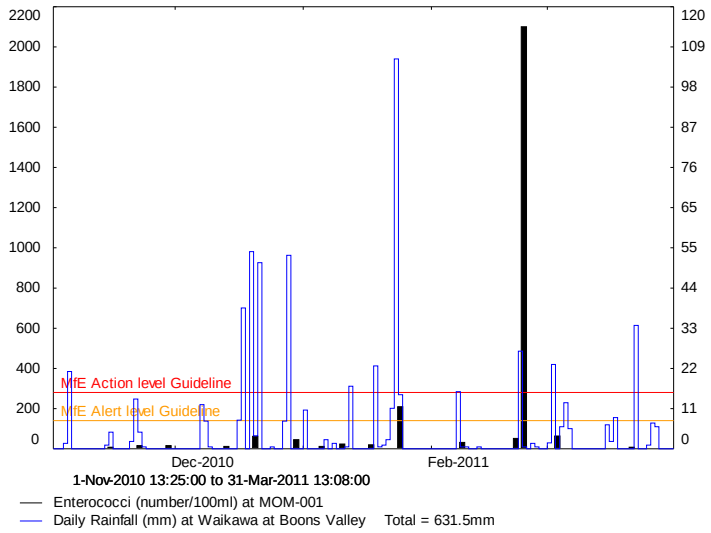
Moenui



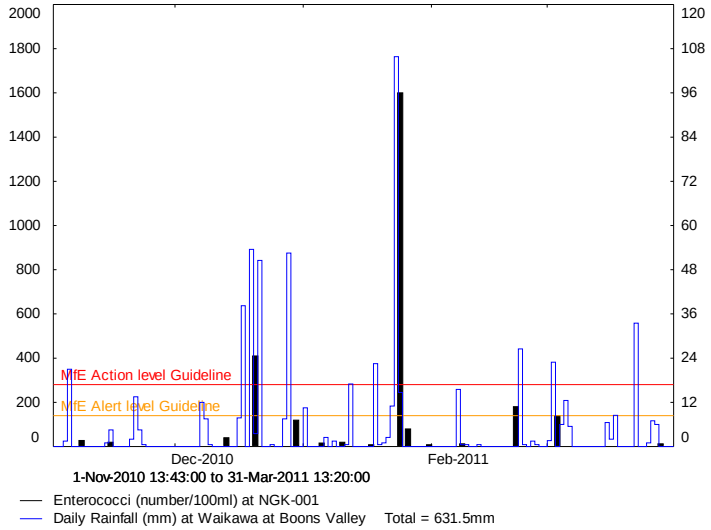
Marfells Beach



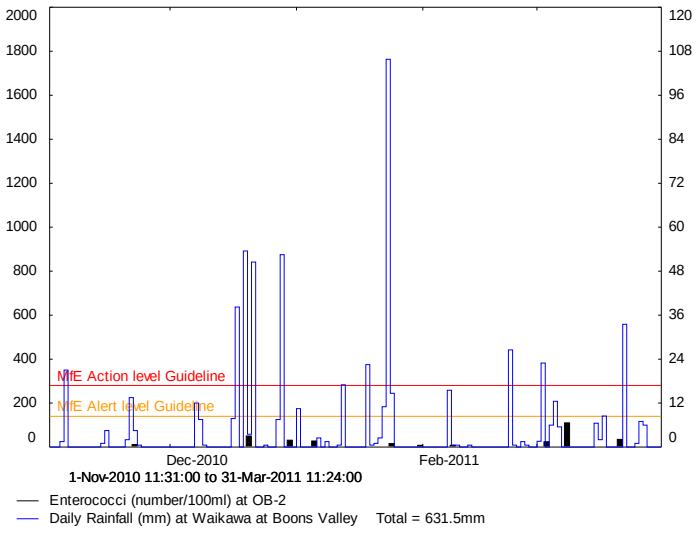
Momorangi Bay



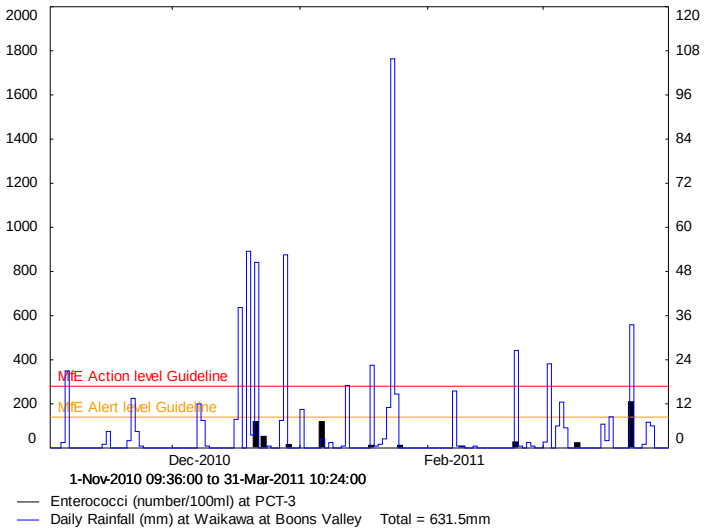
Ngakuta Bay



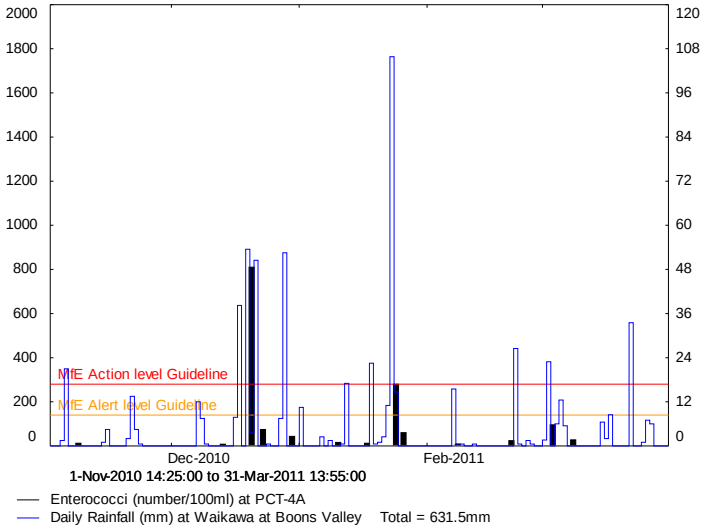
Mistletoe Bay



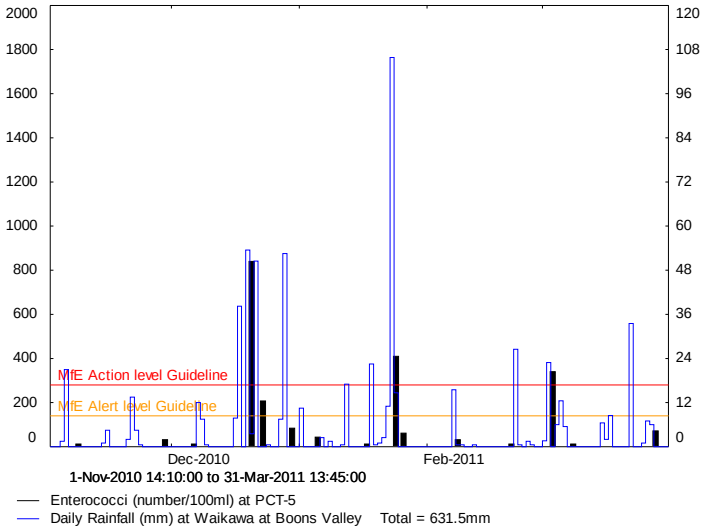
Bobs Bay



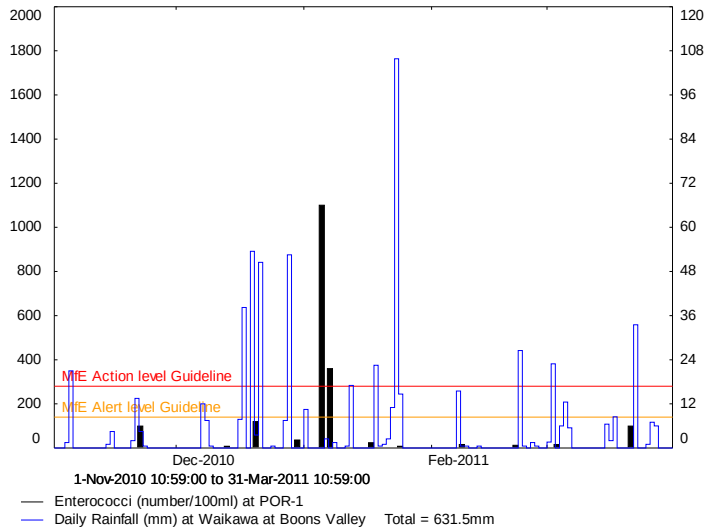
Shelly Beach



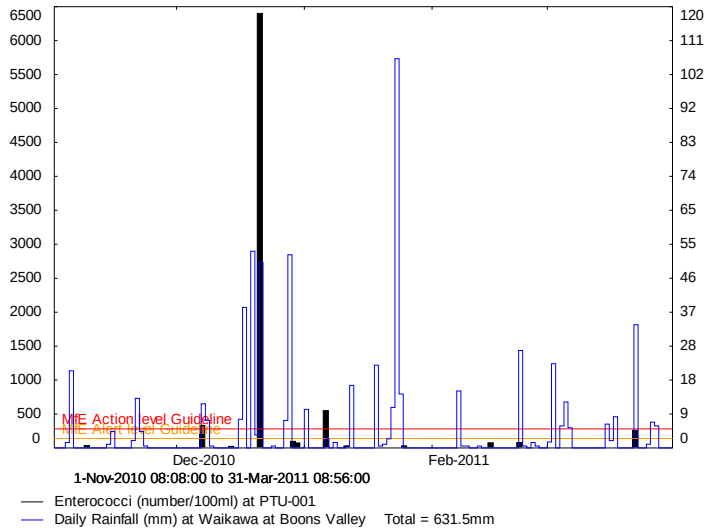
Picton Foreshore



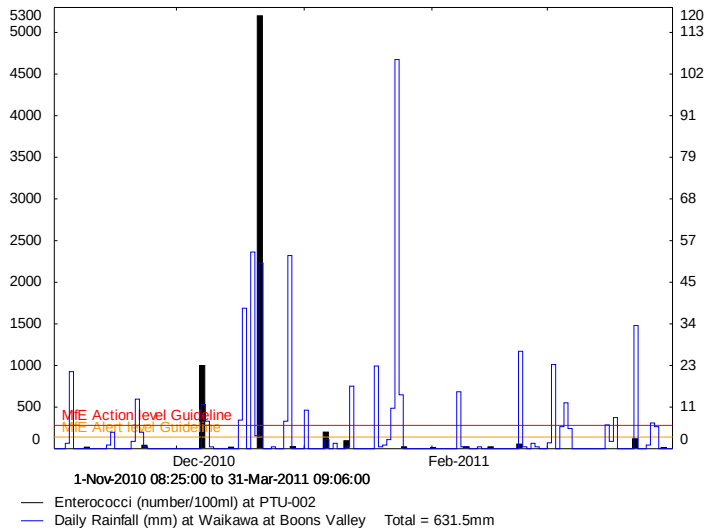
Portage Bay



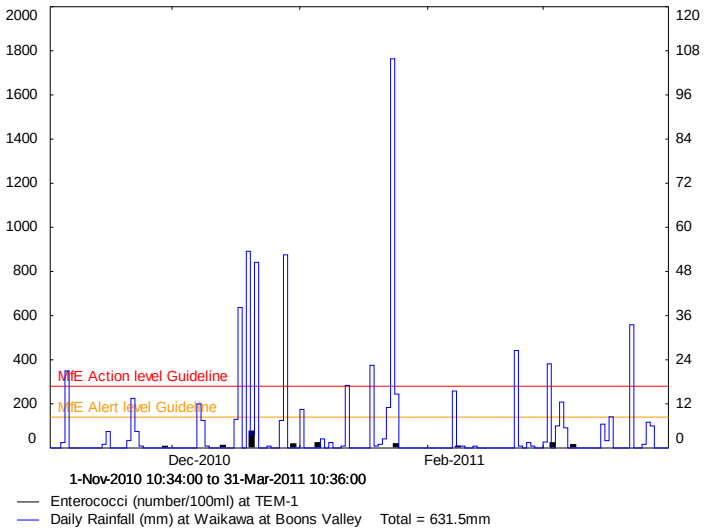
Hakahaka Bay



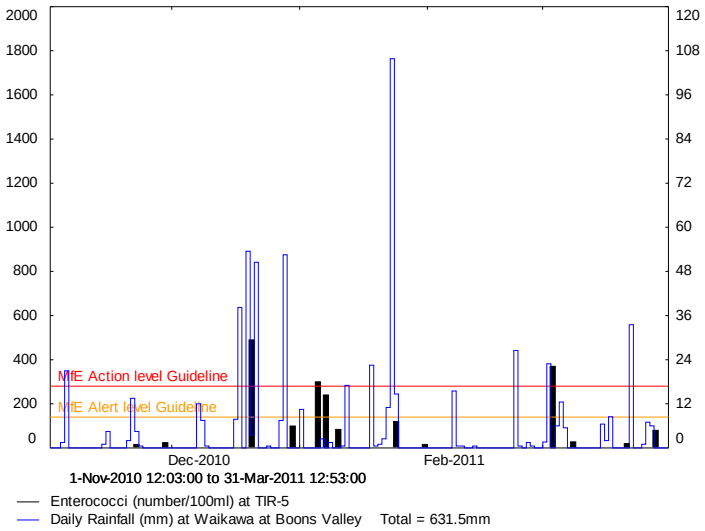
Oyster Bay



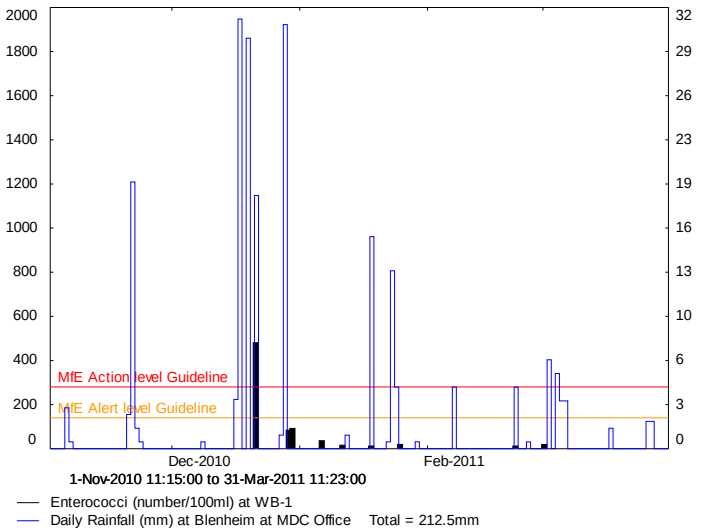
Te Mahia



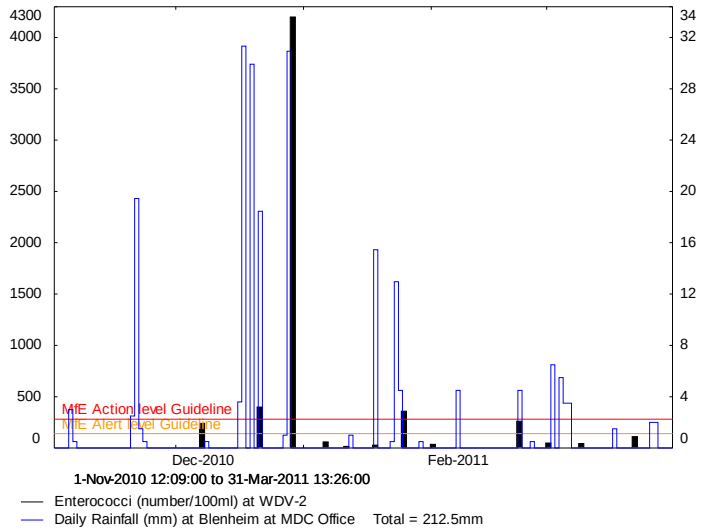
Tirimoana



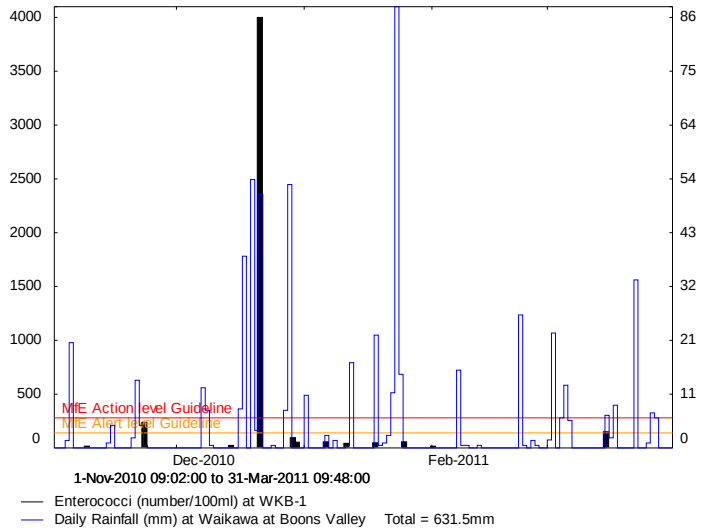
Whites Bay



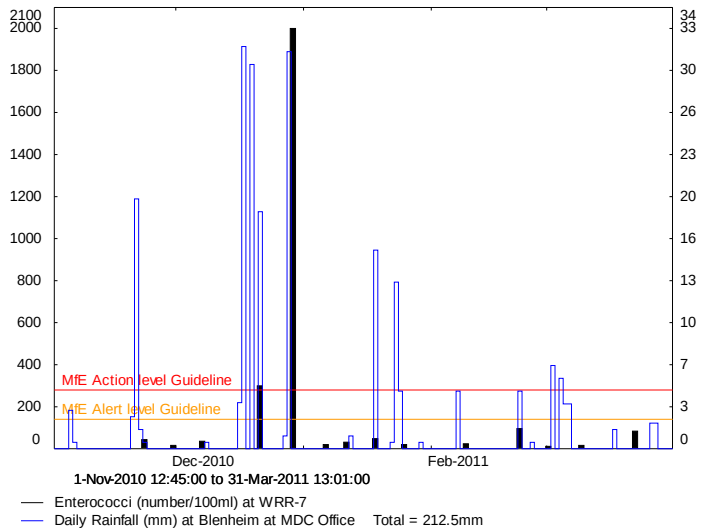
Wairau Diversion



Waikawa Bay

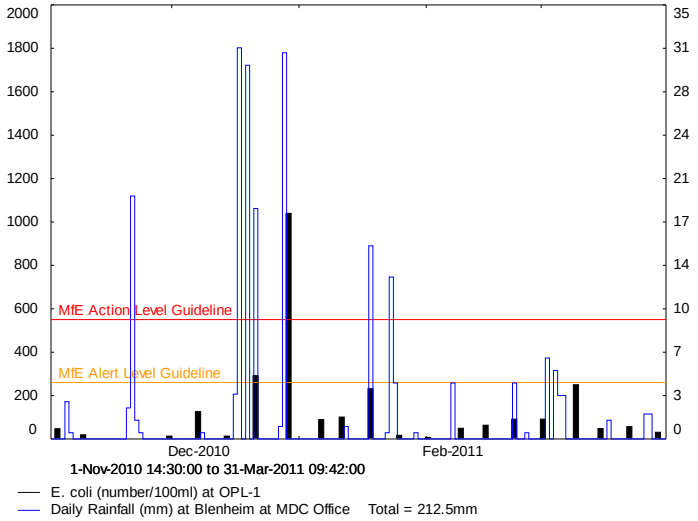


Wairau Bar

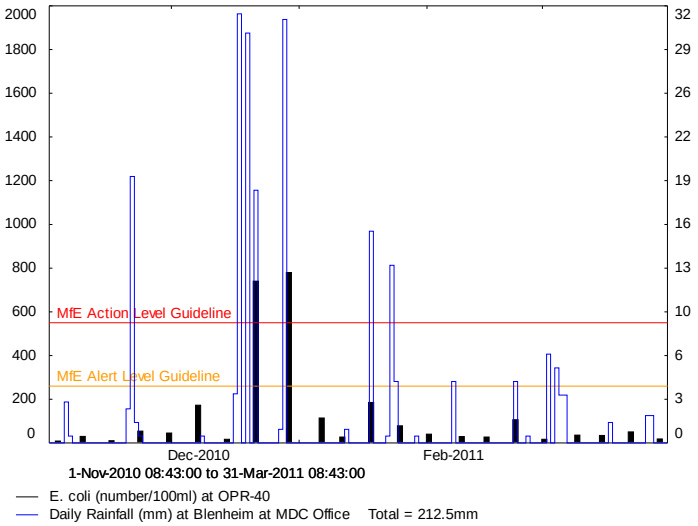


FRESHWATER SITES

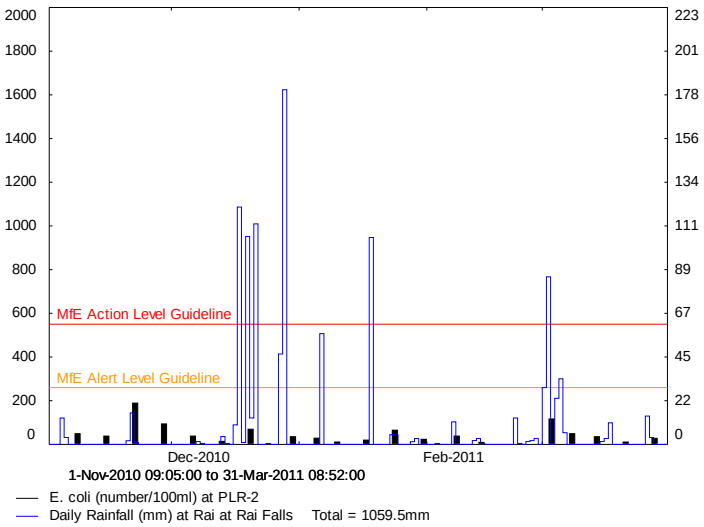
Opawa at Elizabeth Street Footbridge



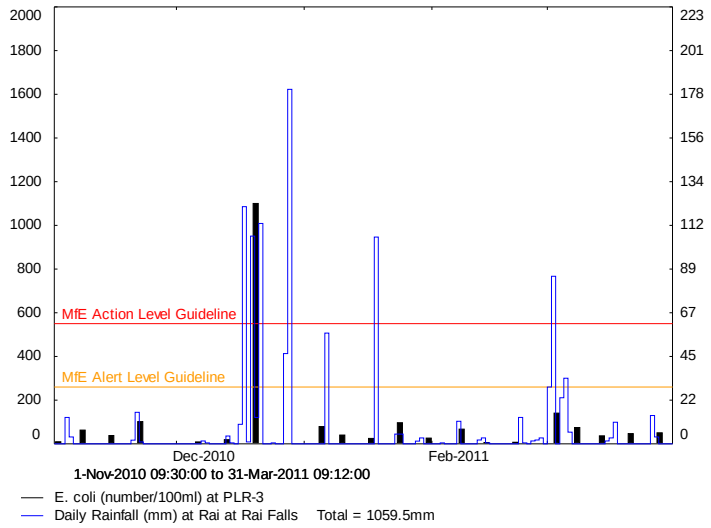
Opawa at Malthouse Reserve



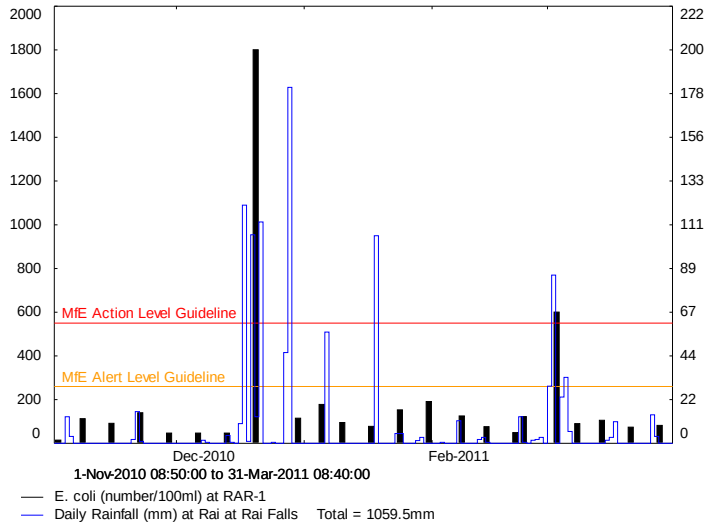
Pelorus at Pelorus Bridge



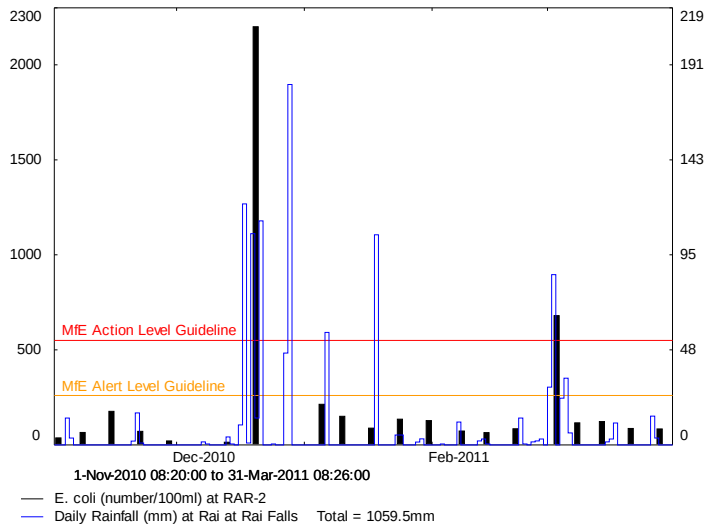
Pelorus at Totara Flat



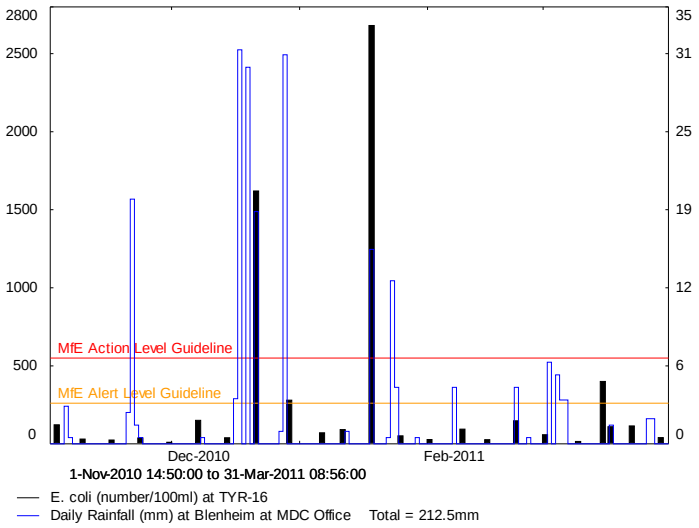
Rai at Rai Falls



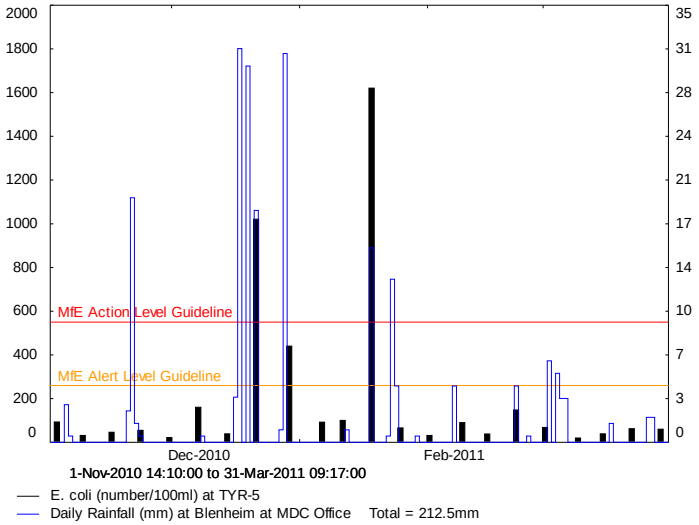
Rai at Brown River Reserve



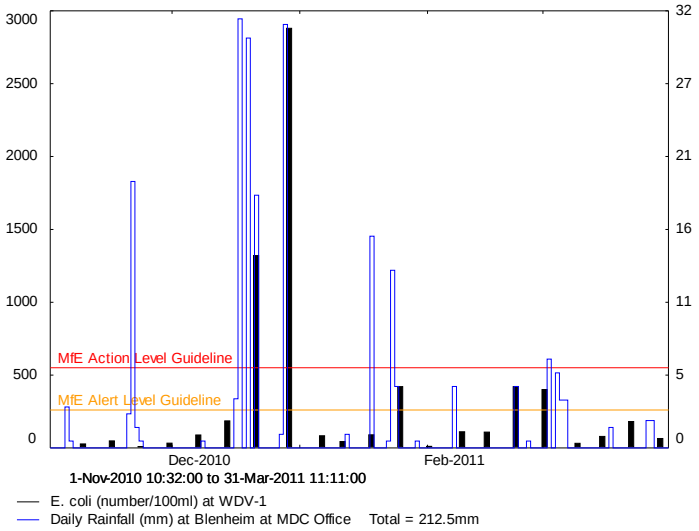
Taylor at Riverside



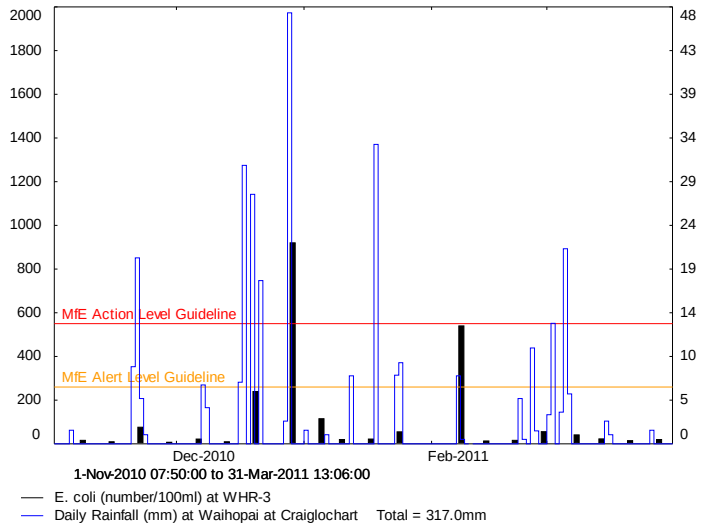
Taylor at Hutcheson



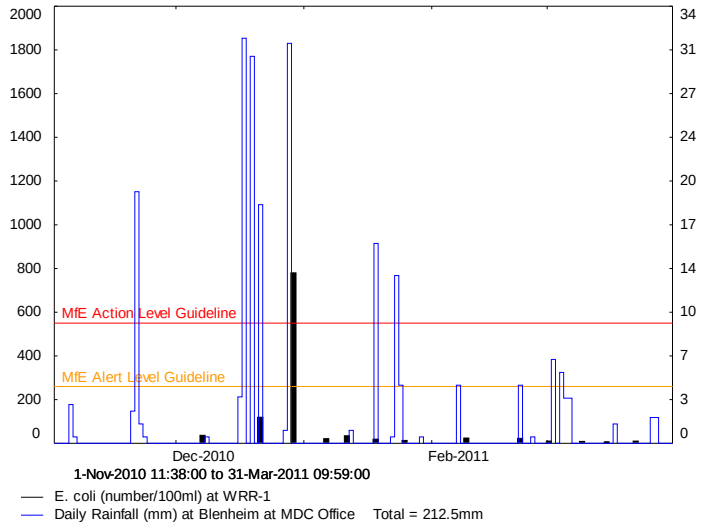
Wairau Diversion at Neals Road Bridge



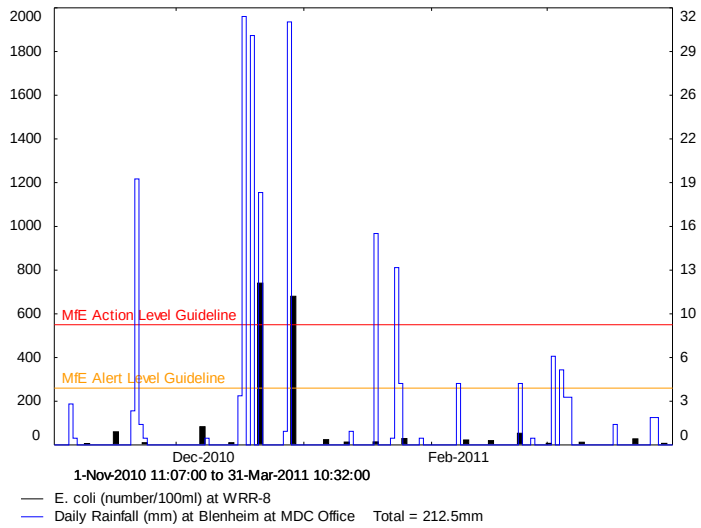
Waihopai at Craiglochart at Bridge no. 2



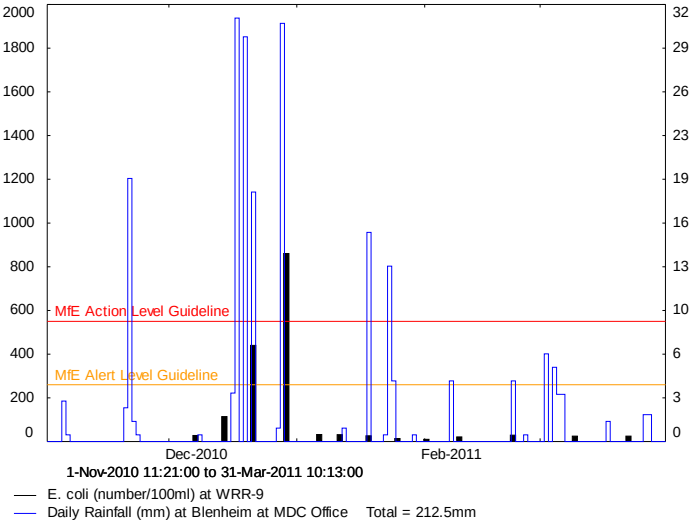
Wairau at Blenheim Rowing Club



Wairau at Ferry Road Bridge



Wairau at Wairau Rowing Club



Appendix 5: 2010-11 Suitability for Recreation Grade (SFRGs) Results

Coastal

ANAKIWA

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 140 to 280	exceed >280	%days <280
Year	2011	22	1	0	100
Year	2010	22	1	0	100
Year	2009	22	0	0	100
Year	2008	23	3	2	91
Year	2007	20	0	1	95
Total	0	109	5	3	97

Assessment Results

Microbiological Assessment Grade - B

Hazen Percentile Result - 190.1

Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Grade **********

Suitability Assessment Results

SFRG Assessment Grade - Good

Primary Impact - 13: River - agricultural activites/birds/feral animals

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - Moderate

Primary Impact:

13: River - agricultural activites/birds/feral animals

BOBS BAY

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 140 to 280	exceed >280	%days <280
Year	2011	22	1	0	100
Year	2010	22	1	0	100
Year	2009	22	0	0	100
Year	2008	20	1	1	95
Year	2007	16	0	0	100
Total	0	102	3	1	99

Assessment Results

Microbiological Assessment Grade - B

Hazen Percentile Result - 123.2

Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Grade **********

Suitability Assessment Results
SFRG Assessment Grade - Very Good
Primary Impact - 0: No significant source indicated.
Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********
Catchment Assessment Checklist Results
SIC Assessment Grade - Very Low
Primary Impact:
0: No significant source indicated.

HAKAHAKA BAY

********** Microbiological Assessment Category **********
Annual exceedance information

	sample season	sample size	exceed 140 to 280	exceed >280	%days <280
Year	2011	25	1	3	88
Year	2010	24	0	1	95
Year	2009	21	1	1	95
Year	2008	18	0	1	94
Year	2007	0	0	0	0
Total	0	88	2	6	93

Assessment Results
Microbiological Assessment Grade - C
Hazen Percentile Result - 352
Interim Data Set (< 5 years or < 100 samples used)

********** Suitability for Recreation Grade **********
Suitability Assessment Results
SFRG Assessment Grade - Very Poor
Primary Impact - 4: Private sewage disposal systems
Interim Data Set (< 5 years or < 100 samples used)

********** Sanitary Inspection Category **********
Catchment Assessment Checklist Results
SIC Assessment Grade - Very High
Primary Impact:
4: Private sewage disposal systems

MARFELLS BEACH

********** Microbiological Assessment Category **********
Annual exceedance information

	sample season	sample size	exceed 140 to 280	exceed >280	%days <280
Year	2011	22	0	0	100
Year	2010	22	0	0	100
Year	2009	22	0	1	95
Year	2008	21	0	0	100
Year	2007	7	0	0	100
Total	0	94	0	1	98

Assessment Results
Microbiological Assessment Grade - B

Hazen Percentile Result - 48
Interim Data Set (< 5 years or < 100 samples used)

********** Suitability for Recreation Grade **********
Suitability Assessment Results
SFRG Assessment Grade - Very Good
Primary Impact - 0: No significant source indicated.
Interim Data Set (< 5 years or < 100 samples used)

********** Sanitary Inspection Category **********
Catchment Assessment Checklist Results
SIC Assessment Grade - Very Low
Primary Impact:
0: No significant source indicated.

MISTLETOE BAY

********** Microbiological Assessment Category **********
Annual exceedance information

	sample season	sample size	exceed 140 to 280	exceed >280	%days <280
Year	2011	22	0	0	100
Year	2010	22	0	1	95
Year	2009	22	0	1	95
Year	2008	0	0	0	0
Year	2007	0	0	0	0
Total	0	66	0	2	96

Assessment Results
Microbiological Assessment Grade - B
Hazen Percentile Result - 112
Interim Data Set (< 5 years or < 100 samples used)

********** Suitability for Recreation Grade **********
Suitability Assessment Results
SFRG Assessment Grade - Very Good
Primary Impact - 0: No significant source indicated.
Interim Data Set (< 5 years or < 100 samples used)

********** Sanitary Inspection Category **********
Catchment Assessment Checklist Results
SIC Assessment Grade - Very Low
Primary Impact:
0: No significant source indicated.

MOENUI

********** Microbiological Assessment Category **********
Annual exceedance information

	sample season	sample size	exceed 140 to 280	exceed >280	%days <280
Year	2011	22	1	5	77
Year	2010	22	2	2	90
Year	2009	21	1	2	90
Year	2008	24	3	6	75
Year	2007	20	0	0	100

Total	0	109	7	15	86

Assessment Results
Microbiological Assessment Grade - D
Hazen Percentile Result - 1715
Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Grade **********
Suitability Assessment Results
SFRG Assessment Grade - Very Poor
Primary Impact - 7: Intensive agricultural use
Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********
Catchment Assessment Checklist Results
SIC Assessment Grade - High
Primary Impact:
7: Intensive agricultural use

MOMORANGI

********** Microbiological Assessment Category **********
Annual exceedance information

	sample season	sample size	exceed 140 to 280	exceed >280	%days <280
Year	2011	22	1	0	100
Year	2010	22	3	1	95
Year	2009	22	1	0	100
Year	2008	36	4	6	83
Year	2007	26	1	5	80
Total	0	128	10	12	90

Assessment Results
Microbiological Assessment Grade - D
Hazen Percentile Result - 687.6
Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Grade **********
Suitability Assessment Results
SFRG Assessment Grade - Poor
Primary Impact - 13: River - agricultural activites/birds/feral animals
Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********
Catchment Assessment Checklist Results
SIC Assessment Grade - Moderate
Primary Impact:
13: River - agricultural activites/birds/feral animals

OYSTER BAY

********** Microbiological Assessment Category **********
Annual exceedance information

	sample season	sample size	exceed 140 to 280	exceed >280	%days <280
Year	2011	25	1	2	92

Year	2010	22	2	1	95
Year	2009	21	0	1	95
Year	2008	19	0	1	94
Year	2007	0	0	0	0
Total	0	87	3	5	94

Assessment Results

Microbiological Assessment Grade - D

Hazen Percentile Result - 544.95

Interim Data Set (< 5 years or < 100 samples used)

********** Suitability for Recreation Grade **********

Suitability Assessment Results

SFRG Assessment Grade - Very Poor

Primary Impact - 16: Tidal/onshore winds carry untreated wastewater

Interim Data Set (< 5 years or < 100 samples used)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - Very High

Primary Impact:

16: Tidal/onshore winds carry untreated wastewater

PICTON FORESHORE

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 140 to 280	exceed >280	%days <280
Year	2011	22	0	3	86
Year	2010	22	0	0	100
Year	2009	22	0	2	90
Year	2008	23	0	3	86
Year	2007	21	0	1	95
Total	0	110	0	9	91

Assessment Results

Microbiological Assessment Grade - D

Hazen Percentile Result - 560

Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Grade **********

Suitability Assessment Results

SFRG Assessment Grade - Very Poor

Primary Impact - 2: Stormwater outlets

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - High

Primary Impact:

2: Stormwater outlets

PORTAGE

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 140 to 280	exceed >280	%days <280
Year	2011	22	0	1	95
Year	2010	22	0	1	95
Year	2009	21	3	2	90
Year	2008	19	0	0	100
Year	2007	18	1	1	94
Total	0	102	4	5	95

Assessment Results

Microbiological Assessment Grade - C

Hazen Percentile Result - 282

Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Grade **********

Suitability Assessment Results

SFRG Assessment Grade - Very Poor

Primary Impact - 5: Primary or secondary treatment facilities

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - Very High

Primary Impact:

5: Primary or secondary treatment facilities

SHELLEY BEACH

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 140 to 280	exceed >280	%days <280
Year	2011	22	1	1	95
Year	2010	22	0	0	100
Year	2009	22	0	0	100
Year	2008	23	2	0	100
Year	2007	21	1	1	95
Total	0	110	4	2	98

Assessment Results

Microbiological Assessment Grade - B

Hazen Percentile Result - 150

Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Grade **********

Suitability Assessment Results

SFRG Assessment Grade - Good

Primary Impact - 3: Urban stormwater

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - Moderate

Primary Impact:

3: Urban stormwater

TE MAHIA

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 140 to 280	exceed >280	%days <280
Year	2011	22	0	0	100
Year	2010	22	1	1	95
Year	2009	21	0	1	95
Year	2008	18	0	0	100
Year	2007	17	0	0	100
Total	0	100	1	2	98

Assessment Results

Microbiological Assessment Grade - B

Hazen Percentile Result - 88

Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Grade **********

Suitability Assessment Results

SFRG Assessment Grade - Very Good

Primary Impact - 0: No significant source indicated.

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - Very Low

Primary Impact:

0: No significant source indicated.

TIRIMOANA

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 140 to 280	exceed >280	%days <280
Year	2011	22	0	3	86
Year	2010	22	0	0	100
Year	2009	22	0	1	95
Year	2008	21	0	4	80
Year	2007	20	0	1	95
Total	0	107	0	9	91

Assessment Results

Microbiological Assessment Grade - C

Hazen Percentile Result - 399.9

Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Grade **********

Suitability Assessment Results

SFRG Assessment Grade - Fair

Primary Impact - 13: River - agricultural activites/birds/feral animals

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - Moderate

Primary Impact:

13: River - agricultural activites/birds/feral animals

WAIKAWA BAY

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 140 to 280	exceed >280	%days <280
Year	2011	22	2	1	95
Year	2010	22	0	0	100
Year	2009	22	0	1	95
Year	2008	21	0	1	95
Year	2007	20	0	0	100
Total	0	107	2	3	97

Assessment Results

Microbiological Assessment Grade - B

Hazen Percentile Result - 127.9

Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Grade **********

Suitability Assessment Results

SFRG Assessment Grade - Good

Primary Impact - 14: River - focal points of drainage

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - Low

Primary Impact:

14: River - focal points of drainage

WAIRAU BAR

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 140 to 280	exceed >280	%days <280
Year	2011	22	0	2	90
Year	2010	22	0	1	95
Year	2009	22	0	1	95
Year	2008	22	0	2	90
Year	2007	20	0	1	95
Total	0	108	0	7	93

Assessment Results

Microbiological Assessment Grade - C

Hazen Percentile Result - 328

Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Grade **********

Suitability Assessment Results

SFRG Assessment Grade - Fair
Primary Impact - 13: River - agricultural activites/birds/feral animals
Complete Data Set (5 years with at least 100 samples)

******** Sanitary Inspection Category ********
Catchment Assessment Checklist Results
SIC Assessment Grade - Moderate
Primary Impact:
13: River - agricultural activites/birds/feral animals

WAIRAU DIVERSION

******** Microbiological Assessment Category ********
Annual exceedance information

	sample season	sample size	exceed 140 to 280	exceed >280	%days <280
Year	2011	22	2	3	86
Year	2010	22	1	0	100
Year	2009	22	0	1	95
Year	2008	20	0	1	95
Year	2007	18	0	0	100
Total	0	104	3	5	95

Assessment Results
Microbiological Assessment Grade - C
Hazen Percentile Result - 290
Complete Data Set (5 years with at least 100 samples)

******** Suitability for Recreation Grade ********
Suitability Assessment Results
SFRG Assessment Grade - Fair
Primary Impact - 13: River - agricultural activites/birds/feral animals
Complete Data Set (5 years with at least 100 samples)

******** Sanitary Inspection Category ********
Catchment Assessment Checklist Results
SIC Assessment Grade - Moderate
Primary Impact:
13: River - agricultural activites/birds/feral animals

WHITES BAY

******** Microbiological Assessment Category ********
Annual exceedance information

	sample season	sample size	exceed 140 to 280	exceed >280	%days <280
Year	2011	22	0	1	95
Year	2010	22	0	0	100
Year	2009	22	0	1	95
Year	2008	20	0	0	100
Year	2007	20	0	0	100
Total	0	106	0	2	98

Assessment Results
Microbiological Assessment Grade - A
Hazen Percentile Result - 32

Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Grade **********

Suitability Assessment Results

SFRG Assessment Grade - Very Good

Primary Impact - 0: No significant source indicated.

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - Very Low

Primary Impact:

0: No significant source indicated.

Freshwater

OPAWA AT ELIZABETH STREET FOOTBRIDGE

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 260 to 550	exceed >550	%days <550
Year	2011	22	1	1	95
Year	2010	22	1	0	100
Year	2009	22	2	1	95
Year	2008	21	2	0	100
Year	2007	18	0	1	94
Total	0	105	6	3	97

Assessment Results

Microbiological Assessment Grade - C

Hazen Percentile Result - 399
Data Set Extent - Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Class **********

Suitability Assessment Results

SFRC Assessment Grade - Fair

Primary Impact - 5: Primary or secondary treatment facilities

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - Moderate

Primary Impact:

3: Urban stormwater

OPAWA AT MALTHOUSE RESERVE

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 260 to 550	exceed >550	%days <550

Year	2011	22	0	2	90
Year	2010	22	0	1	95
Year	2009	22	2	1	95
Year	2008	21	2	1	95
Year	2007	20	1	2	90
Total	0	107	5	7	93

Assessment Results

Microbiological Assessment Grade - D

Hazen Percentile Result - 743
Data Set Extent - Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Class **********

Suitability Assessment Results

SFRC Assessment Grade - Poor

Primary Impact - 5: Primary or secondary treatment facilities

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - Moderate

Primary Impact:

8: Run-off from low intensity agriculture

PELORUS BRIDGE

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 260 to 550	exceed >550	%days <550
Year	2011	22	0	0	100
Year	2010	22	1	0	100
Year	2009	22	0	1	95
Year	2008	21	1	1	95
Year	2007	19	2	1	94
Total	0	106	4	3	97

Assessment Results

Microbiological Assessment Grade - C

Hazen Percentile Result - 391.2
Data Set Extent - Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Class **********

Suitability Assessment Results

SFRC Assessment Grade - Fair

Primary Impact - 5: Primary or secondary treatment facilities

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - Moderate

Primary Impact:

8: Run-off from low intensity agriculture

PELORUS AT TOTARA FLAT

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 260 to 550	exceed >550	%days <550
Year	2011	21	0	1	95
Year	2010	22	1	1	95
Year	2009	22	1	4	81
Year	2008	21	3	2	90
Year	2007	19	1	2	89
Total	0	105	6	10	90

Assessment Results

Microbiological Assessment Grade - D

Hazen Percentile Result - 1100
Data Set Extent - Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Class **********

Suitability Assessment Results

SFRC Assessment Grade - Very Poor

Primary Impact - 5: Primary or secondary treatment facilities

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - High

Primary Impact:

7: Intensive agricultural use

RAI AT BROWN RIVER RESERVE

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 260 to 550	exceed >550	%days <550
Year	2011	21	0	2	90
Year	2010	22	1	1	95
Year	2009	22	2	3	86
Year	2008	21	8	3	85
Year	2007	19	3	2	89
Total	0	105	14	11	89

Assessment Results

Microbiological Assessment Grade - D

Hazen Percentile Result - 1200
Data Set Extent - Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Class **********

Suitability Assessment Results

SFRC Assessment Grade - Very Poor

Primary Impact - 5: Primary or secondary treatment facilities

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - High

Primary Impact:

7: Intensive agricultural use

RAI AT RAI FALLS

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 260 to 550	exceed >550	%days <550
Year	2011	22	0	2	90
Year	2010	22	1	3	86
Year	2009	22	1	4	81
Year	2008	21	3	3	85
Year	2007	19	1	4	78
Total	0	106	6	16	84

Assessment Results

Microbiological Assessment Grade - D

Hazen Percentile Result - 1920
Data Set Extent - Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Class **********

Suitability Assessment Results

SFRC Assessment Grade - Very Poor

Primary Impact - 5: Primary or secondary treatment facilities

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - High

Primary Impact:

7: Intensive agricultural use

TAYLOR AT HUTCHESON STREET BRIDGE

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 260 to 550	exceed >550	%days <550
Year	2011	22	1	2	90
Year	2010	22	1	1	95
Year	2009	22	5	2	90
Year	2008	21	2	1	95
Year	2007	19	5	0	100
Total	0	106	14	6	94

Assessment Results

Microbiological Assessment Grade - D

Hazen Percentile Result - 912
Data Set Extent - Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Class **********

Suitability Assessment Results

SFRC Assessment Grade - Very Poor

Primary Impact - 5: Primary or secondary treatment facilities

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - High

Primary Impact:

2: Stormwater outlets

TAYLOR AT RIVERSIDE

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 260 to 550	exceed >550	%days <550
Year	2011	22	2	2	90
Year	2010	22	0	2	90
Year	2009	22	3	3	86
Year	2008	21	6	2	90
Year	2007	19	6	0	100
Total	0	106	17	9	91

Assessment Results

Microbiological Assessment Grade - D

Hazen Percentile Result - 1696
Data Set Extent - Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Class **********

Suitability Assessment Results

SFRC Assessment Grade - Very Poor

Primary Impact - 5: Primary or secondary treatment facilities

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - High

Primary Impact:

2: Stormwater outlets

WAIHOPAI AT CRAIGLOCHART

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 260 to 550	exceed >550	%days <550
Year	2011	22	1	1	95
Year	2010	22	1	0	100
Year	2009	22	0	0	100
Year	2008	21	0	4	80
Year	2007	19	0	1	94
Total	0	106	2	6	94

Assessment Results

Microbiological Assessment Grade - D

Hazen Percentile Result - 756.6
Data Set Extent - Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Class **********

Suitability Assessment Results

SFRC Assessment Grade - Poor

Primary Impact - 5: Primary or secondary treatment facilities

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - Moderate

Primary Impact:

8: Run-off from low intensity agriculture

WAIRAU AT BLENHEIM ROWING CLUB

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 260 to 550	exceed >550	%days <550
Year	2011	22	0	1	95
Year	2010	22	0	0	100
Year	2009	22	1	1	95
Year	2008	21	1	1	95
Year	2007	18	0	0	100
Total	0	105	2	3	97

Assessment Results

Microbiological Assessment Grade - B

Hazen Percentile Result - 240
Data Set Extent - Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Class **********

Suitability Assessment Results

SFRC Assessment Grade - Good

Primary Impact - 5: Primary or secondary treatment facilities

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - Moderate

Primary Impact:

8: Run-off from low intensity agriculture

WAIRAU AT FERRY BRIDGE

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 260 to 550	exceed >550	%days <550
Year	2011	22	0	2	90
Year	2010	22	0	0	100
Year	2009	22	1	2	90
Year	2008	21	2	1	95

Year	2007	20	1	0	100
Total	0	107	4	5	95

Assessment Results

Microbiological Assessment Grade - C

Hazen Percentile Result - 403
Data Set Extent - Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Class **********

Suitability Assessment Results

SFRC Assessment Grade - Fair

Primary Impact - 5: Primary or secondary treatment facilities

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - Moderate

Primary Impact:

8: Run-off from low intensity agriculture

WAIRAU AT WAIRAU ROWING CLUB

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 260 to 550	exceed >550	%days <550
Year	2011	22	1	1	95
Year	2010	22	0	0	100
Year	2009	22	1	1	95
Year	2008	21	3	0	100
Year	2007	17	0	0	100
Total	0	104	5	2	98

Assessment Results

Microbiological Assessment Grade - C

Hazen Percentile Result - 412.9
Data Set Extent - Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Class **********

Suitability Assessment Results

SFRC Assessment Grade - Fair

Primary Impact - 5: Primary or secondary treatment facilities

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - Moderate

Primary Impact:

8: Run-off from low intensity agriculture

WAIRAU DIVERSION AT NEALS ROAD BRIDGE

********** Microbiological Assessment Category **********

Annual exceedance information

	sample season	sample size	exceed 260 to 550	exceed >550	%days <550
Year	2011	22	3	2	90
Year	2010	23	3	0	100
Year	2009	22	1	4	81
Year	2008	21	1	1	95
Year	2007	19	2	0	100
Total	0	107	10	7	93

Assessment Results

Microbiological Assessment Grade - D

Hazen Percentile Result - 703.15
Data Set Extent - Complete Data Set (5 years with at least 100 samples)

********** Suitability for Recreation Class **********

Suitability Assessment Results

SFRC Assessment Grade - Poor

Primary Impact - 5: Primary or secondary treatment facilities

Complete Data Set (5 years with at least 100 samples)

********** Sanitary Inspection Category **********

Catchment Assessment Checklist Results

SIC Assessment Grade - Moderate

Primary Impact:
16: Indirect influences - High intensity agriculture or feral animals/birds

Appendix 6: Results from the MST investigations

MDC Ref	Site ID	Location	Sample Date	Sample Time (NZST)	E. coli [cfu/100mL]	Enterococci [cfu/100mL]	Water Temp. [°C]	Cond.@ 25 °C [uS/cm]	Salinity [ppt]	Tide/river level	Weather	Rainfall (daily totals mm)	Rainfall Recorder	Comments
20110384	**BRN-2**	Brown River. @ SH6 Bridge	14/02/2011	7:37	740		17.3	195.3	0.1	n/a	7/8 cloud cover, warm & calm	2mm 12 Feb; 3mm 13 Feb; 0.5mm 14 Feb	At Rai Falls	water reasonably clear; brown sediments released when bed is disturbed
20110385	**BRN-2**	Brown River. @ SH6 Bridge	21/02/2011	7.45	197		14	220.9 uS/cm	n/a	low flow	sunny, cool, no wind	0mm 19 Feb; 0mm 20 Feb; 0mm 21 Feb	At Rai Falls	Very clear water
20112645	**BRN-2**	Brown River. @ SH6 Bridge	23/02/2011	8.48	720		15.6	145 uS/cm	0.1	Mid level flow.	Overcast; rained previous day; no wind	0mm 21 Feb; 13.5mm 22 Feb; 1mm 23 Feb	At Rai Falls	3 ducks at site. Water reasonably clear
20110417	**BRN-2**	Brown River. @ SH6 Bridge	3/03/2011	7.47	760		12.3	111 uS/cm	n/a	Mid flow	6/8 cloud, cool, no wind	29mm 1 Mar; 85.5mm 2 Mar; 0mm 3 Mar	At Rai Falls	Brown but clear waters, 3 ducks in adjacent field.
20110357	**MOE-1**	Moenui Beach	3/03/2011	9:04		<4	20.9	44.17	28.6	mid tide	6/8 cloud cover, warm & calm	1.5mm 12 Feb; 0mm 13 Feb; 0mm 14 Feb	At Kaituna	water reasonably clear for this site, but still murky brown (0.4m vis.), 1/2 tide, beach clean, no wildlife or people
20110390	**MOE-1**	Moenui Beach	21/02/2011	9.11		8	20.2	47.64 mS/cm	31	nearly high tide	sunny, a light breeze	0mm 19 Feb; 0mm 20 Feb; 0mm 21 Feb	At Kaituna	Water quite turbid
20112647	**MOE-1**	Moenui Beach	23/02/2011	9.53		16	19.2	45.28 mS/cm	29.4	Nearly high, incoming tide	Overcast; rained previous day; no wind	0mm 21 Feb; 8mm 22 Feb; 0mm 23 Feb	At Kaituna	Water flat calm, slightly turbid.
20110422	**MOE-1**	Moenui Beach	3/03/2011	9.14		910	17	20.42 mS/cm	12.1	High tide	1/8 cloud, warm, light breeze	0mm 1 Mar; 54mm 2 Mar; 0mm 3 Mar	At Kaituna	Turbid brown colour. Lots of wood and leaf detritus, evidence from heavy rain the preceding day.
20110363	**MOM-001**	Momorangi Bay	3/03/2011	12:53		<4	21.8	50.4	33.3	nearly low tide	3/8 cloud cover, 12-18 knots NE	0.5mm 12 Feb; 0mm 13 Feb; 0mm 14 Feb	At Waikawa	water slighly murky, brown/green up to 20m out (0.8m vis.), 1/3 tide, 3 oystercatcher & 1 gull on the beach
20110396	**MOM-001**	Momorangi Bay	21/02/2011	13.25		52	21.5	51.2 mS/cm	33.7	high tide	sunny, sligh tbreeze	0mm 19 Feb; 0mm 20 Feb; 0mm 21 Feb	At Waikawa	Water relatively turbid, detritus/leaves on water surface. 4 gulls on water
20112648	**MOM-001**	Momorangi Bay	23/02/2011	11.12		2100	20.2	45.5 mS/cm	29.6	High, incoming tide	Overcast; slight onshore breeze, rain previous night	0mm 21 Feb; 26.5mm 22 Feb; 0.5mm 23 Feb	At Waikawa	Coastal site but during high tide 2 streams either side of beach create a lagoon of with a low sand bar separating the beach from the main coast. Water slightly turbid, small waves. Approx 20 ducks on beach. 6 campervans at campground
20110428	**MOM-001**	Momorangi Bay	3/03/2011	13.44		64	19	46.78 mS/cm	30.7	low tide	1/8 cloud, warm, light breeze	1.5mm 1 Mar; 23mm 2 Mar; 0mm 3 Mar	At Waikawa	7 campers at campground. Good flow in both small streams entering the bay.
20110354	**RAR-1**	Rai River at Rai Falls	3/03/2011	8:10	76		18.1	77.2	0	n/a	7/8 cloud cover, warm & calm	2mm 12 Feb; 3mm 13 Feb; 0.5mm 14 Feb	At Rai Falls	Dark green waters, >2m visibility, bed varies - clean to smothered in algae,
20110387	**RAR-1**	Rai River at Rai Falls	21/02/2011	8.12	49		17.8	78.6 uS/cm	n/a	low flow	sunny, cool, no wind	0mm 19 Feb; 0mm 20 Feb; 0mm 21 Feb	At Rai Falls	Clear dark green water.
20112646	**RAR-1**	Rai River at Rai Falls	23/02/2011	9.12	122		16.8	76.9 uS/cm	0	Mid level flow.	sunny; 3/8 cloud; no wind	0mm 21 Feb; 13.5mm 22 Feb; 1mm 23 Feb	At Rai Falls	Minimal periphyton growth, water clear.
20110419	**RAR-1**	Rai River at Rai Falls	3/03/2011	8.15	600		13.9	56.1 uS/cm	n/a	receding fresh	4/8 cloud, cool, no wind	29mm 1 Mar; 85.5mm 2 Mar; 0mm 3 Mar	At Rai Falls	Heavy rain the previous day but river receding from the rain. Waters still turbid and brown looking.

Marlborough District Council

Date Sampled	Sampling site	Enterococci MPN / 100 ml	Result				Report comment
			universal	ruminant	bovine	human	
14/02/2011	Brown River @SH6 Bridge (BRN-2)	150	weak +ve	ruminant present, up to 100% of source	ND[1]	ND[1]	Low to moderate levels of contamination at this site. Contamination levels (based on Enterococci) corresponded with rainfall. Ruminant sources are dominant at this site.
21/02/2011	Brown River @SH6 Bridge (BRN-2)	20	very strong +ve	ND[2]	ND[3]	ND[4]	
23/02/2011	Brown River @SH6 Bridge (BRN-2)	137	strong +ve	ruminant present, 50 to 100% of source	ND[1]	ND[4]	
3/03/2011	Brown River @SH6 Bridge (BRN-2)	87	+ve	ruminant present, up to 100% of source	ND[1]	ND[1]	
14/02/2011	Moenui Beach (MOE-1)	10	weak +ve	ND[1]	ND[1]	ND[1]	Low to high levels of contamination at this site. Highest contamination corresponded with the lowest salinity reading (highest freshwater input). Contamination on this occasion was likely driven by ruminant sources.
21/02/2011	Moenui Beach (MOE-1)	31	ND	ND[1]	ND[1]	ND[1]	
23/02/2011	Moenui Beach (MOE-1)	<10	weak +ve	ruminant present, 10 to 50% of source	ND[1]	ND[1]	
3/03/2011	Moenui Beach (MOE-1)	>2000	very strong +ve	ruminant present, up to 100% of source	ND[3]	ND[4]	
14/02/2011	Momorangi Bay (MOM-001)	10	weak +ve	ND[1]	ND[1]	ND[1]	Low to high levels of contamination at this site. Highest contamination corresponded with the lowest salinity reading and rainfall. Source of contamination cannot be confirmed.
21/02/2011	Momorangi Bay (MOM-001)	31	strong +ve	ND[2]	ND[1]	ND[1]	
23/02/2011	Momorangi Bay (MOM-001)	>2000	very strong +ve	ND[2]	ND[3]	ND[4]	
3/03/2011	Momorangi Bay (MOM-001)	10	very strong +ve	ruminant present, up to 1% of source	ND[3]	ND[4]	
14/02/2011	Rai River at Rai Falls (RAR-1)	124	strong +ve	ruminant present, 50 to 100% of source	ND[3]	ND[4]	Low to high levels of contamination at this site. Contamination corresponded with rainfall. Ruminants a dominant source of contamination at this site and the detection of the bovine marker indicates cows may be the main ruminant source.
21/02/2011	Rai River at Rai Falls (RAR-1)	42	strong +ve	ruminant present, ~ 50% of source	ND[1]	ND[4]	
23/02/2011	Rai River at Rai Falls (RAR-1)	453	strong +ve	ruminant present, 50 to 100% of source	ND[1]	ND[4]	
3/03/2011	Rai River at Rai Falls (RAR-1)	659	strong +ve	ruminant present, up to 100% of source	Present	ND[4]	

ND[1] Not detected: Contamination (as measured by UBac marker) was likely too low.
ND[2] Not detected: Would detect if ruminants a major source
ND[3] Not detected: Would detect if bovine a major source
ND[4] Not detected: Would detect if human a major source

From: Cornelisen *et al*. 2012