

**Healthy Estuary and Rivers of the
City:**

***Water quality and ecosystem health
monitoring programme of Ihutai***

Water quality for contact recreation

Summary report on data collected over the
summer of 2007-2008

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Introduction

The Healthy Estuary and Rivers of the City: Water quality and ecosystem health monitoring programme of Ihutai was written in 2006. It includes monitoring programmes for four environmental values. This report presents the data collected over the summer of 2007-2008 from sites in the Avon-Heathcote Estuary/Ihutai and the Avon and Heathcote rivers as part of Value A - Safe for contact recreation.

Over the summer months in particular, people of Christchurch like to partake in recreational activities in nearby waterways including the Avon and Heathcote rivers and the Avon-Heathcote Estuary/Ihutai. These activities include swimming, kayaking, wind surfing, kite surfing and yachting. While swimming tends to result in total immersion in water, such immersion can occur when things don't go according to plan when undertaking the other activities. There can be risks to immersion and ingestion if there is faecal contamination of the water. Such contamination can result in stomach upsets, skin infections, ear infections and respiratory infections. To reduce the risk of becoming sick as a result of immersion in water people need to be informed about the quality of the water for contact recreation so they can then make the choice of whether or not they carry out a recreational activity in or on the water, and where.

Escherichia coli (*E. coli*) is a bacteria that is found in high numbers in the stomachs and intestines of warm-blooded animals (including birds) and people. The presence of high concentrations of *E. coli* in fresh water indicates the likely presence of faecal material and, with it, the possibility that other disease-causing organisms may be present. While *E. coli* is used as an indicator of faecal contamination in fresh water, enterococci are used as the indicator of faecal contamination in sea water. Faecal contamination of water can occur through inadequately treated sewage, stormwater drains, septic tanks, runoff from pastoral farm land, and from wildlife such as waterfowl living in and around waterways.

E. coli concentrations in freshwater and enterococci concentrations in sea water are used to determine if water quality is suitable for contact recreation. As the water within the estuary is a mix of fresh and sea water, the samples collected were analysed for enterococci and *E. coli*.

Sampling

Sampling sites

Samples were collected from one site on each of the rivers and from seven sites in the Avon-Heathcote Estuary/Ihutai. The sites sampled are shown in Figure 1.

The Avon River site at Kerrs Reach is an area used by high numbers of rowers and kayakers. The Heathcote River site at Catherine Street is an area used by kayakers and swimmers, particularly children. Three of the Avon-Heathcote Estuary/Ihutai sites - Pleasant Point Yacht Club, Mount Pleasant Yacht Club and Moncks Bay are at, or near, yacht clubs. Humphreys Drive is a high usage wind surfing and kite surfing area. Penguin Street is an area of the estuary used by local kayakers and shallow hulled yachts. South Spit and Beachville Road jetty are areas that are used for swimming.

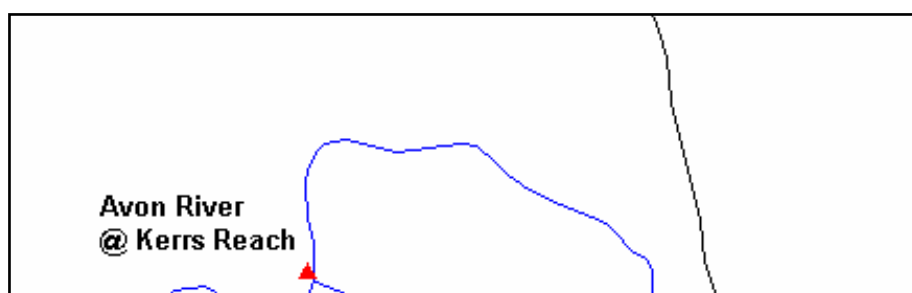


Figure 1 Sampling sites

Sample collection

One water sample was collected from each site, each week, over the period from 21st November 2007 until 27th February 2008. The river samples were collected by an Environment Canterbury staff member while the estuary samples were collected by volunteers from the local community.

At the estuary sites the samples were collected three hours after high tide at Lyttelton and at approximately the same time at all sites. The three hour difference takes into account an hour for daylight saving, the hour difference in the time of high tide between Lyttelton Harbour and the inner region of the estuary, and an hour to ensure sampling was when the tide was beginning to go out. Sampling was undertaken at this state of the tide as it is likely the worst case scenario for recreational water quality as the tertiary treated wastewater discharged into the estuary around high tide flows away from the discharge point. In addition it is around high tide when the extensive mudflats are covered by water that the popular water-based activities such as wind surfing, kite surfing, yachting and kayaking take place within the estuary. Sampling at the river sites was not determined by the state of the tide.

The water samples collected were analysed to determine the concentration of the faecal indicator organisms. The samples collected from the estuary were analysed for enterococci and *E. coli* while the samples from the rivers were only analysed for *E. coli*.

Results

The concentrations of *E. coli* in the samples collected at the river sites are given in Table 1. The concentrations of enterococci and *E. coli* in the samples collected at the estuary sites are given in Table 2. Not only are the results given but values that exceed the Alert trigger level are shaded. The Alert trigger level¹ is where there is potential for faecal contamination of the water and hence potential for human health effects. Where there is no signage warning of poor water quality for contact recreation, exceedence of the alert trigger level results in re-sampling of the site. Where signage is present no re-sampling is undertaken. Around the estuary there is signage warning of poor water quality for contact recreation.

¹ As described in the MfE/MoH Recreational Water Quality Guidelines (2003).

The Alert trigger level for *E. coli* is 260/100mL. The Alert trigger level for enterococci is 140/100mL.

Table 1 *E.coli* concentrations (number/100mL) at sites within the Avon and Heathcote rivers

SHADING OF CELLS: yellow depicts exceedence of the trigger value

Date	Avon River	Heathcote River
21-Nov-07	130	130
28-Nov-07	2000	490
5-Dec-07	270	82
12-Dec-07	2000	1400
19-Dec-07	2000	>2400
27-Dec-07	390	1300
9-Jan-08	120	650
16-Jan-08	310	520
23-Jan-08	>2400	1100
30-Jan-08	170	490
7-Feb-08	210	240
13-Feb-08	2400	1000
20-Feb-08	410	870
27-Feb-08	210	1100
5-Mar-08	310	210

At both river sites the *E.coli* concentrations exceeded the Alert trigger level on the majority of sampling occasions. At both sampling sites there were always numerous water fowl present and these birds are likely to be the main source of the faecal contamination in the water.

In the estuary *E.coli* and enterococci Alert trigger levels were not exceeded at Beachville Road or Moncks Bay and were exceeded infrequently at South Spit, Penguin Street and Mount Pleasant Yacht Club.

At the Pleasant Point Yacht Club the *E.coli* Alert trigger level was exceeded on 7 of the 15 sampling occasions and the enterococci Alert trigger level was exceeded on 3

Table: Enterococci and *E.coli* concentrations (number/100mL) at sites within the Avon-Heathcote Estuary/Ihutai during the 2007-2008 summer

SHADING OF CELLS: Enterococci – orange depicts exceedence of the trigger value
E.coli –yellow depicts exceedence of the trigger value

	South Spit		Penguin Street		Pleasant Point YC		Humphreys Drive		Mt. Pleasant YC		Beachville Road		Moncks Bay	
	Enterococci	<i>E. coli</i>	Enterococci	<i>E. coli</i>	Enterococci	<i>E. coli</i>	Enterococci	<i>E. coli</i>	Enterococci	<i>E. coli</i>	Enterococci	<i>E. coli</i>	Enterococci	<i>E. coli</i>
21-Nov-07	20	200	<2	62	62	500	1200	>24000	8	<10	<2	<10	2	<10
28-Nov-07	4	10	10	52	170	130	56	200	12	31	<2	<10	2	<10
5-Dec-07	14	10	<2	<10	4	52	510	140	2	<10	<2	<10	<2	<10
12-Dec-07	60	41	22	420	100	370	64	20	4	41	<2	<10	4	<10
19-Dec-07	4	31	20	<10	14	240	390	2100	10	20	4	<10	2	20
27-Dec-07	48	63	82	20	78	110	190	360	2	20	<2	10	2	10
3-Jan-08	2	<10	<2	<10	22	410	12	30	4	<10	2	<10	2	<10
9-Jan-08	30	63	4	30	70	840	280	120	4	<10	<2	<10	<2	<10
16-Jan-08	<2	<10	<2	<10	6	120	250	220	4	20	2	10	2	<10
raining → 23-Jan-08	1200	440	180	1100	170	350	190	410	10	41	8	<10	16	20
30-Jan-08	16	20	2	<10	14	98	160	75	16	31	<2	<10	2	<10
7-Feb-08	30	31	20	20	140	400	9000	4100	6	20	<2	<10	2	<10
Moderate rain in the 24 hours prior to sampling → 13-Feb-08	32	110	32	74	2800	3300	900	840	170	610	12	85	4	<10
20-Feb-08	<2	10	<2	20	26	180	1800	1100	170	62	<2	<10	4	<10
27-Feb-08	<2	10	<2	<10	4	83	210	160	16	10	<2	<10	<2	<10

of the 15 sampling occasions. These results suggest that the recreational water quality at the Pleasant Point Yacht Club is affected by the water from the Avon River.

At Humphreys Drive the *E.coli* Alert trigger level was exceeded on 7 of the 15 sampling occasions and the enterococci Alert trigger level was exceeded on 12 of the 15 sampling occasions. These results suggest that there is very frequent faecal contamination of the water at this site. The potential sources of this contamination are the City drain, the abundance of water fowl in proximity to this site, the oxidation pond discharge and the Heathcote River. In addition, decaying seaweed is a known source of enterococci and over the summer there was an abundance of green sea lettuce and the red seaweed *Gracilaria chilensis* present in this part of the estuary. The frequent high enterococci and *E.coli* concentrations at this site are a concern.

Grading of a site for contact recreation

The Ministry for the Environment and Ministry of Health Microbiological Water Quality Guidelines (2003) describe the method to be used to determine the suitability of a site for contact recreation. This guideline integrates two components to give a **Suitability for Recreation Grade (SFRG)**. The two components are:

- microbiological results based ideally on the last 5 years of data (a minimum of 3 years of data were used); this provides a measure of water quality over time. This generates a **Microbiological Assessment Category (MAC)** which is based on the 95th percentile value of all the data.
- a qualitative measure of the susceptibility of the water at the site to faecal contamination – this is known as the **Sanitary Inspection Category (SIC)**.

There are five **SFRG** – **very good, good, fair, poor and very poor**.

In sea water

For sites graded **very good** there are few/low level sources of faecal contamination to the site and the 95th percentile value is less than or equal to 200 enterococci/100mL, consequently the health risk from water contact at the beach is low. For sites graded **very poor** there are significant sources of faecal contamination to the site and the 95th percentile value is more than 500 enterococci/100mL, consequently the health risk from water contact is high.

In fresh water

For sites graded **very good** there are few/low level sources of faecal contamination to the site and the 95th percentile value is less than or equal to 260 *E.coli*/100mL, consequently the health risk from water contact at the beach is low. For sites graded **very poor** there are significant sources of faecal contamination to the site and the 95th percentile value is more than 550 *E.coli*/100mL, consequently the health risk from water contact is high.

The risk of becoming sick from immersion in water increases from sites graded 'very good' to 'very poor'. Sites graded 'very good', 'good' and 'fair' are considered suitable for contact recreation, although 'good' and 'fair' sites may at times not be suitable (for example after heavy rainfall resulting in high bacterial counts). Sites graded 'poor' and 'very poor' are generally considered unsuitable for contact recreation based on both risk and indicator bacteria counts.

The SFRG generated through the combination of the SIC and MAC describes the GENERAL CONDITION of the site with respect to public health risk. The grades are re-evaluated at the end of each summer season and do not change over a summer.

Site gradings

Sanitary Inspection Category (SIC)

The Sanitary Inspection Category identifies susceptibility of the water at a site to faecal contamination. The potential sources of faecal contamination at **all estuary sites** are:

- urban stormwater protected from sewage ingress
- Communal sewage disposal with tertiary treatment facilities
- incidence and density of bird life

At the Pleasant Point Yacht Club and the Mount Pleasant Yacht Club another potential source of faecal contamination is:

- River discharging close to the recreational area with the river potentially affected by:
 - urban stormwater protected from sewage ingress
 - incidence and density of bird life

At all estuary sites the SIC is high because of the discharge of tertiary treated sewage into the estuary.

The potential sources of faecal contamination at the **river sites** are:

- urban stormwater protected from sewage ingress
- incidence and density of bird life

At the river sites the SIC is high because of the incidence and density of bird life.

Microbiological Assessment Category (MAC)

The 2007-2008 enterococci data, in combination with the data from the previous four summers, were used to calculate the MAC at each estuary site. The enterococci MAC at each estuary site is shown in Figure 2.

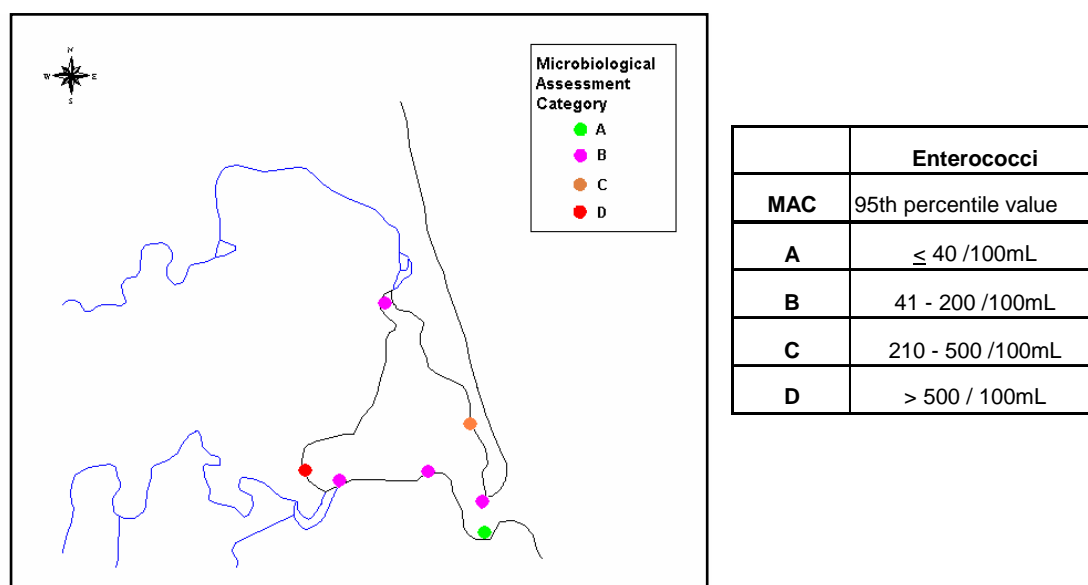


Figure 2 MAC at each site based on enterococci concentrations

The 2007-2008 *E.coli* data, in combination with the data from the previous three summers, were used to calculate the MAC at each estuary site. For the river sites the 2007-2008 *E.coli* data, in combination with the data from the previous two summers were used. The *E.coli* MAC at each site is shown in Figure 3.

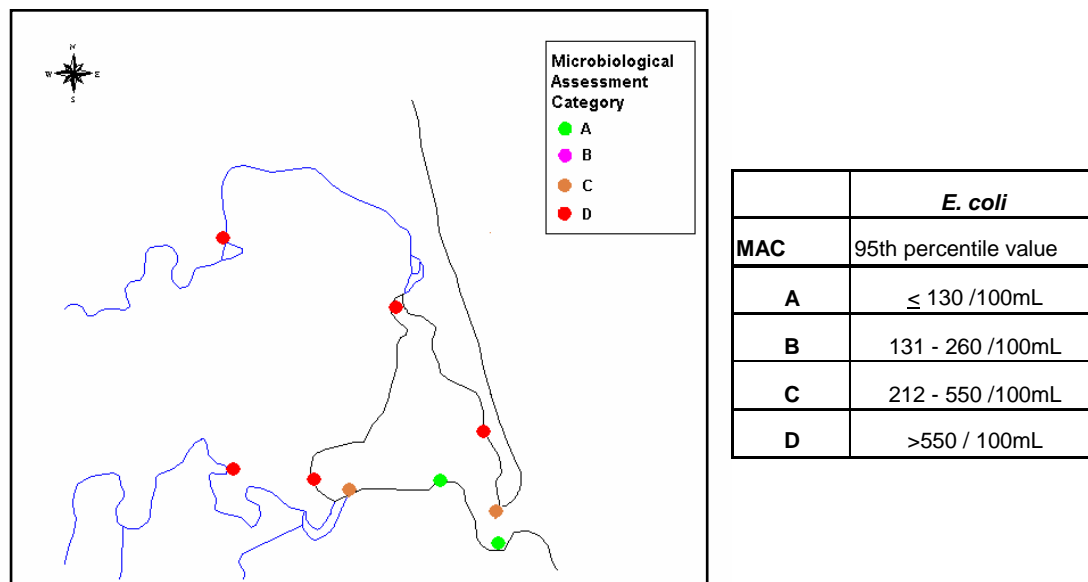


Figure 3 MAC at each site based on *E.coli* concentrations

Suitability for Recreation Grade (SFRG)

The MAC and SIC are used to determine the Suitability For Recreation Grade (SFRG) at a site.

The SFRG at the estuary sites based on the last five years of enterococci concentrations (including 2007-2008 data) are presented below.

	n	95%ile	MAC	SIC	SFRG
South Spit	73	108.5	B	High	Follow-up → Poor
Penguin Street	75	245	C	High	Poor
Pleasant Point YC	73	170	B	High	Follow-up → Poor
Humphreys Drive	73	874.5	D	High	Very Poor
Mount Pleasant Yacht Club	73	164	B	High	Follow-up → Poor
Beachville Road jetty	74	98.8	B	High	Follow-up → Poor
Moncks Bay	74	31	A	High	Follow-up → Poor

The SFRG at the estuary sites based on the last four years of *E.coli* concentrations (including 2007-2008 data) are presented below.

	n	95%ile	MAC	SIC	SFRG
South Spit	58	276	C	High	Poor
Penguin Street	59	590	D	High	Very Poor
Pleasant Point YC	59	723	D	High	Very Poor
Humphreys Drive	57	11970	D	High	Very Poor
Mount Pleasant Yacht Club	59	542	C	High	Poor
Beachville Road jetty	59	46	A	High	Follow-up -> Poor
Moncks Bay	59	36	A	High	Follow-up -> Poor

The SFRG at the river sites based on the last three years of *E.coli* concentrations (including 2007-2008 data) are presented below.

	n	95%ile	MAC	SIC	SFRG
Avon River	45	2400	D	High	Very Poor
Heathcote River	45	2100	D	High	Very Poor

Conclusions

At the sites on the rivers and in the estuary the recreational water quality is poor or very poor. That is, they are generally unsuitable for contact recreation.

At all sites the SIC was high. For sites within the estuary the SIC will change when the tertiary treated wastewater is no longer discharged into the estuary. A change to the SIC may result in a change to the Suitability For Recreation Grade at estuary sites. The Suitability For Recreation Grade at the river sites is unlikely to change in the near future because of the abundance of waterfowl on the rivers.

Recommendations

A detailed investigation of the potential sources of faecal contamination of the Humphreys Drive site should be undertaken over 2008-2009.



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