



River and Stream Health

North and Coastal Otago Annual Monitoring Summary

2005

Key points

- The Dunedin urban streams generally had high concentrations of *Escherichia coli*.
- There is a reasonably good correlation between water quality and biological health.
- Waiareka Creek and the Owaka River generally had poorer water quality than the other sites.
- The Report 'Waiareka Creek and Island Stream' 2004 has more details.

Water quality monitoring

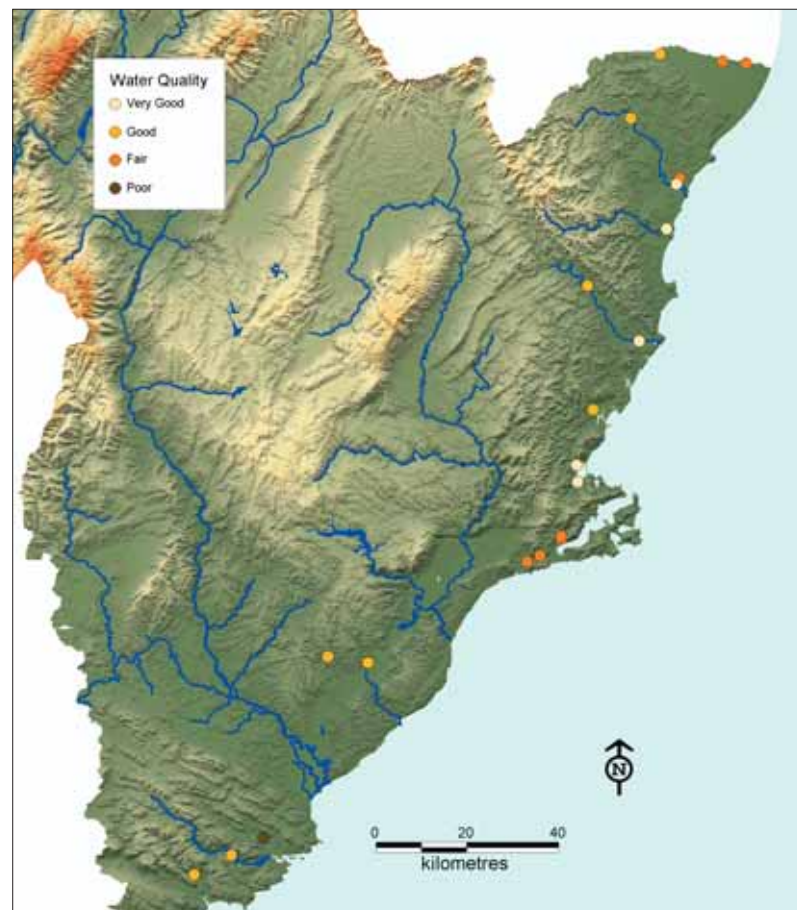
In 2005 Otago Regional Council monitored 21 stream and river sites in the coastal and northern areas of Otago in order to assess the current state of water quality.

There are few significant point source discharges to freshwater in these areas. Land use has the most effect on water quality. The sites with poorer water quality are generally in urban environments, or in intensively farmed areas such as in South Otago.

The classification of sites was achieved by using a water quality index derived from the median values for six variables: turbidity, dissolved oxygen (% saturation), ammoniacal nitrogen, nitrite-nitrate nitrogen, dissolved reactive phosphorus and *Escherichia coli* bacteria.

The median values of each variable were compared to national guidelines, which enabled water quality at each site to be classified into one of the four groups below.

Very Good	All six median values comply with guideline values
Good	Five of six median values comply with guideline values
Fair	Three or four of the median values comply with guideline values
Poor	Two or less of the median values comply with guideline values





Water quality results

The water quality sites are also depicted in the graphs below. The graphs show how water quality is generally good or very good, but there is a deterioration in the Dunedin urban streams, and naturally high levels of nutrients in the Waitaki plain.

Note: the red lines on the graphs below show the ANZECC trigger value or DoH guideline level.

Guidelines and standards

- The ANZECC (2000) guidelines outline trigger values for water quality aspects that put stress on river and stream health (e.g. nutrients, dissolved oxygen and pH). This specifies a level below which the risk of adverse biological effect is low.

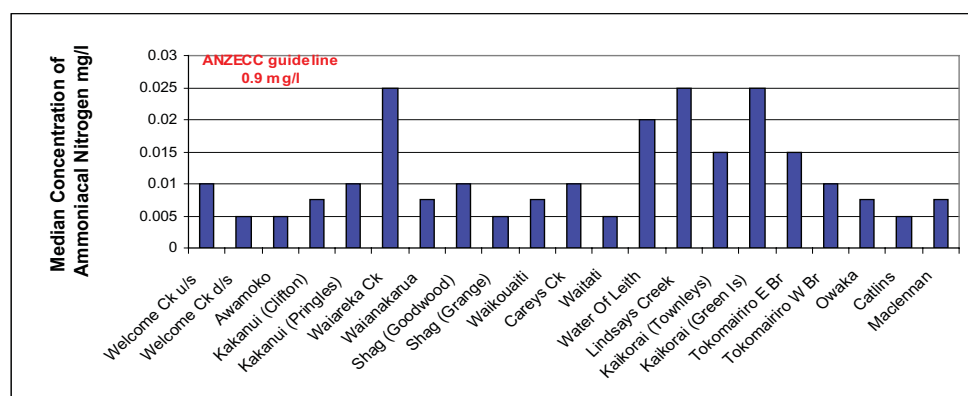
Note: the ANZECC default trigger values depicted in the graphs are for lowland rivers (<150m)

- Otago's water quality standards are outlined in the Regional Plan: Water which sets targets to maintain and improve water quality within the region.
- The DoH (1992) guidelines for contact recreation waters recommend a season median of 126 *Escherichia coli*/100ml.

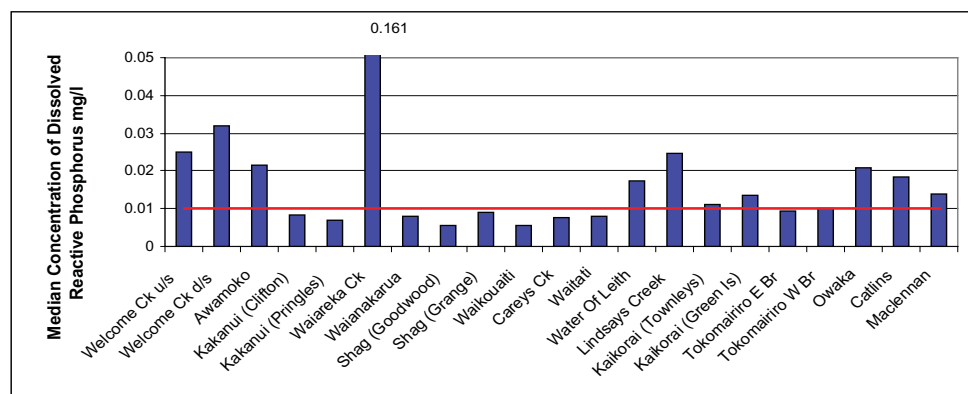
Nutrients

Ammoniacal nitrogen is the combination of ammonium ions and ammonia (NH₃), the ANZECC 2000 high reliability (95%) trigger value for freshwater is 0.9 mg/l. NH₃ is the main toxic component for aquatic organisms, the prevalence of which is dependent on the pH, temperature and salinity of the water. The ANZECC 2000 guideline for NH₃ is 0.021 mg/l.

At all sites the ammoniacal nitrogen levels were well below 0.9 mg/l and the ammonia component (after considering temperature and pH) was less than the guideline value of 0.021 mg/l.

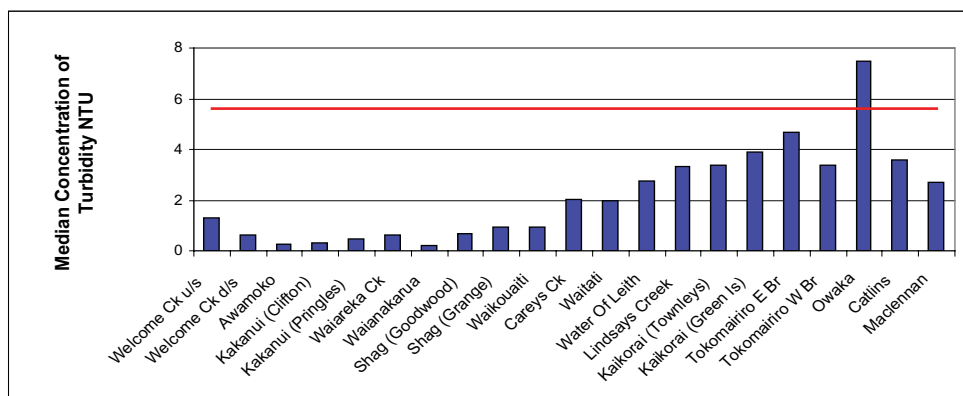


Median dissolved reactive phosphorus concentrations were above the ANZECC default trigger value in three main groups; the springfed streams of the Waitaki plain, the Dunedin urban streams and the South Otago rivers. Waiareka Creek also had a median well above the trigger level, which is probably due to its low flow coupled with its intensive agricultural catchment. The rest of the sites had medians below the default trigger value



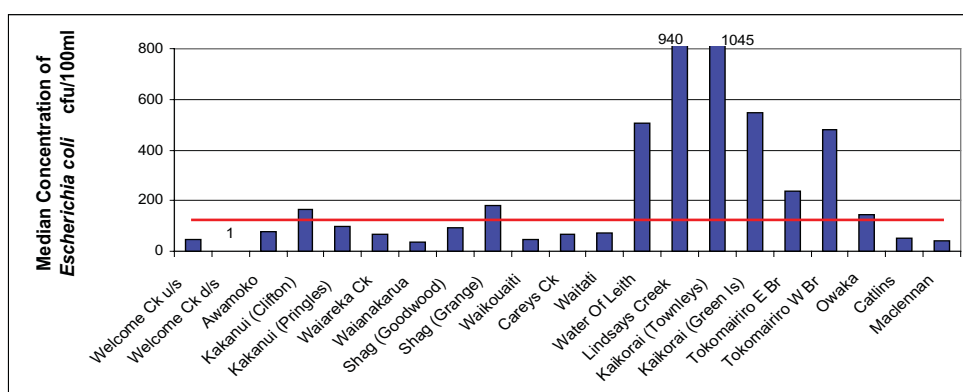
Turbidity

Turbidity was only elevated above trigger values in the Owaka river, however there is a noticeable increase in turbidity south of Waikouaiti, with higher levels in the Dunedin urban streams and the watercourses in coastal south Otago.



Bacteria

Median bacteria levels were above the DoH guideline (126 cfu/100ml) at nine of the 21 sites. The most elevated levels were found in the urban streams, with particularly high concentrations recorded in Lindsay's Creek and the Kaikorai stream. Even if the sites had median concentrations below 126 cfu/100ml (indicating overall minimal health risk) it is likely that the bacteria levels would be higher following rainfall.



Other analytes

- The median result for dissolved oxygen was below 80% in Waiareka Creek (39.5%), Welcome Creek upper springfed site (65%) and Waikouaiti (75.8%)
- pH levels were generally within guideline values for all groups.
- Six sites had elevated concentrations of total nitrogen: Welcome Creek upper (1.49mg/l), Welcome Creek lower (1.11 mg/l), Waiareka Creek (0.805 mg/l), Water of Leith (0.725 mg/l), Lindsay's Creek (1.15 mg/l) and Owaka River (1.65 mg/l)
- Eight sites had elevated concentrations of total phosphorus: Waiareka Creek (0.192 mg/l), Water of Leith (0.04 mg/l), Lindsay's Creek (0.05 mg/l), Kaikorai at Townleys (0.041 mg/l), Kaikorai at Green Island (0.042 mg/l), Tokomairiro E. (0.047 mg/l), Tokomairiro W. (0.04 mg/l) and Owaka River (0.055 mg/l).



Other documents

- The North and Coastal Otago River Catchment Monitoring Report. November 2000.

Recent ORC reports

- Monitoring the effects of irrigation runoff on water quality (Welcome Creek). May 2006.
- A review of the sites chosen for the river and stream health monitoring programme, based on best information needs, best practice and Otago Regional Council's management objectives. March 2006.
- Water Quality of Waiareka Creek and Island Stream. May 2005.

Each of these documents will be available in late 2006 on the ORC website under Environmental Monitoring.

Ecosystem health results

Ecosystem health takes into account a wide range of inter-linked factors, such as water quality, habitat and instream biota. It is generally assessed using two communities that are important to the food chain in rivers and streams: streambed macroinvertebrates (eg insects, crustaceans, snails, worms) and periphyton (eg algae).

These biological indices put a large amount of information into a compact form. Therefore they are inherently coarse tools that give a broad view of general patterns. They are useful, however, as the presence or absence, abundance and distribution of species can tell us much about the quality and condition of the site in which they live.

A key component of the MCI index is the availability of suitable habitat. The MCI index is designed specifically for stony riffle substrates in flowing water, MCI values can vary due to the availability of suitable habitat and not necessarily due to water quality. As substrate type can vary greatly between riffles it is often more appropriate to compare changes in MCI values at the same site over a period of time rather than between sites throughout the catchment. However, by understanding the limitation of the MCI index it still can be useful for picking up improvements or deterioration in water quality at individual sites over time.

Note: In 2005, due to high river flows during the critical monitoring period, ecosystem health was not monitored. The results below are from 2004.

Criteria for Macroinvertebrate Health

Macroinvertebrate Index	Poor	Average	Good	Excellent
MCI	< 80	80 – 99	110 – 119	> 120
SQMCI	< 4	4 – 4.99	5 – 5.99	> 6
Total species	< 10	15 – 20	20 – 30	> 30
Total EPT species	< 5	9 – 15	15 – 20	> 20

Taieri River Macroinvertebrate Health 2004

Sample location	MCI	SQMCI	Total species	Total EPT
Waiareka Creek at Teschmakers	81	4.0	16	1
Kakanui River at Clifton Falls, Dunrobin Rd	99	4.3	22	11
Kakanui River at Pringles (below Maheno)	85	4.3	21	8
Kakanui River at Pringles (Drought)	95	4.4	22	9
Waianakarua River (North Branch) at SH1	127	5.2	14	8
Shag River at McDonald Road (Drought)	101	4.9	26	13
Shag River at SH85, the Grange	101	3.6	25	11
Shag River at SH85, the Grange (Drought)	88	4.1	21	8
Shag River at Goodwood Water Intake	84	2.6	18	6
Waikouaiti River at Orbells Crossing	82	4.0	9	3
Water of Leith at Dundas Street	89	2.9	17	8
Lindsays Creek u/s of Water of Leith	82	2.7	12	4
Kaikorai Stream at Townleys Rd	49	1.6	7	0
Kaikorai Stream at Brighton Rd (u/s landfill)	54	1.5	7	0
Akatore Stream at Taieri Beach Rd	117	5.6	25	10
Tokomairiro River at Coal Gully Road	86	3.6	20	8
Tokomairiro River West Branch at Mt Stuart	106	5.1	25	12
Catlins River at Houipapa	118	5.1	19	12



Biological Indices

- **EPT species** – this index is a sum of the total number of Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) species collected.
- **MCI** – the Macroinvertebrate Community Index is an index based on adding the “pollution tolerance” scores of all species found at a site. Species that are very sensitive to pollution score highly whereas more pollution tolerant species receive a low score.
- **SQMCI** – the Semi-quantitative Macroinvertebrate Community Index is a variation of the MCI that accounts for the abundance of pollution sensitive and tolerant species.

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