



# River and stream health

North and Coastal Otago Annual Monitoring Summary

2005-2006

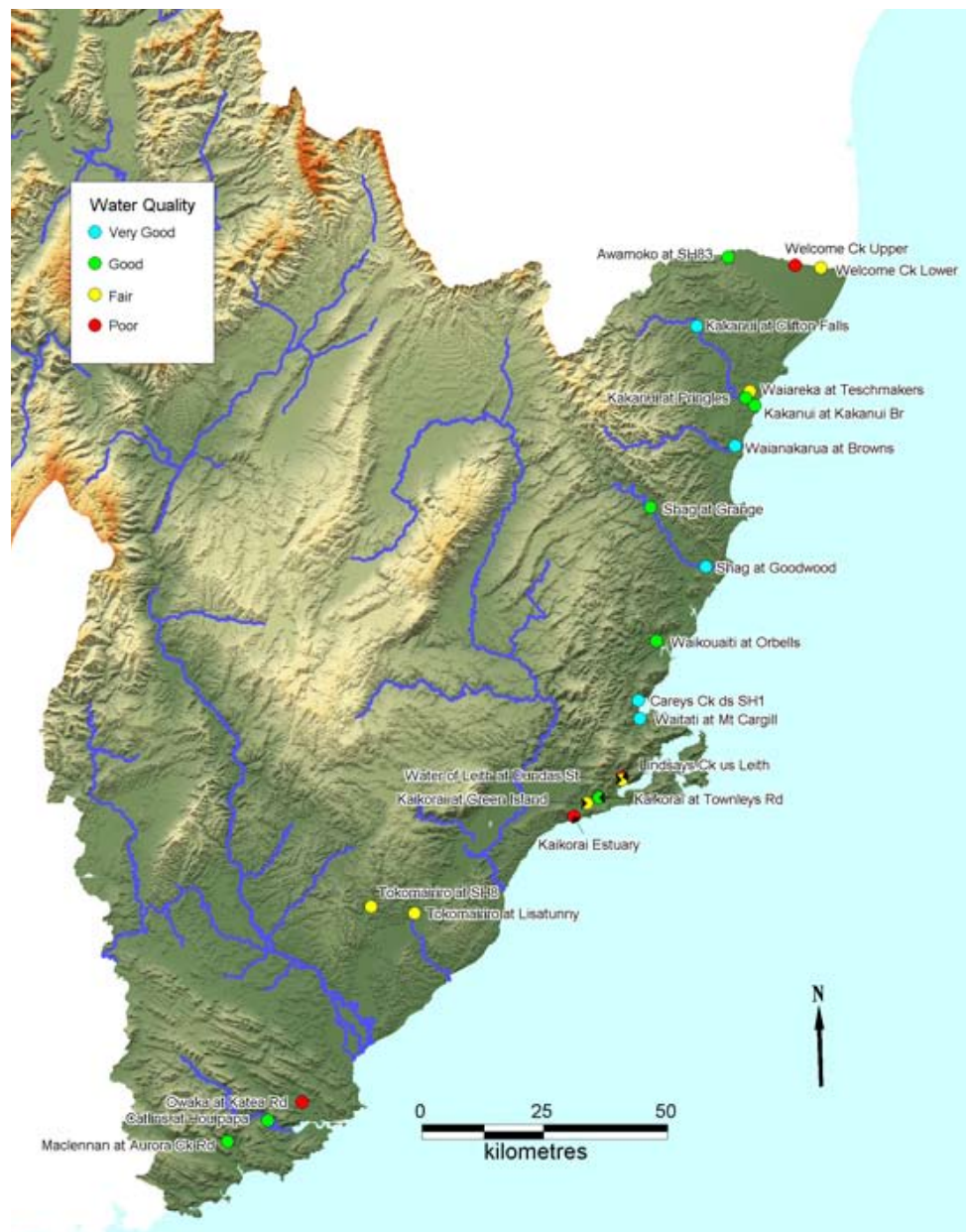
## Key points

- A higher number of water courses are classified as poor in 2006 than in 2005.
- Dunedin's urban streams and the Tokomariro and Owaka Rivers had high concentrations of the bacteria *Escherichia coli*.
- Northern Otago coastal rivers generally showed better water quality than both Dunedin's streams and South Otago's Rivers.
- There is a reasonable correlation between water quality and biological health.

## Water Quality Monitoring

In 2006 the Otago Regional Council monitored 23 river and stream sites in the northern and coastal areas of Otago, in order to assess the current state of water quality.

Sites were classified using a water quality index, derived from median values of seven indicator variables: turbidity, dissolved oxygen (% saturation), total nitrogen, nitrite-nitrate nitrogen, total phosphorus, dissolved reactive phosphorus, and *Escherichia coli* bacteria.



Cover photos courtesy of Stephen Moore





Median values of these variables were compared with ANZECC and DoH guideline levels, enabling classification of water quality into one of the following groups:

Very Good	All seven values comply with guideline values
Good	Five or six median values comply with guideline values
Fair	Three or four median values comply with guideline values
Poor	Two or fewer median values comply with guideline values

## Guidelines & standards

- The ANZECC (2000) guidelines outline trigger values for water quality aspects that put stress on river and stream health. This specifies a level below which the risk of adverse biological effect is low. Note: The ANZECC trigger values used here 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/100 ml.

## Water Quality Results

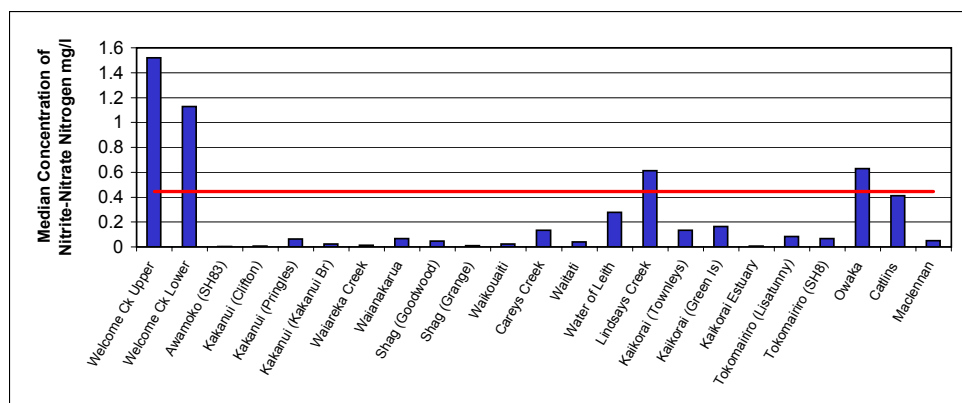
Selected water quality indicators are displayed in the graphs and discussed below. Overall these graphs show that water quality is generally good or very good, with poorer quality in Dunedin's urban streams and some South Otago Rivers, and there are also naturally high levels of nutrients in the Waitaki Plain.

Note: The red lines on these graphs indicate the ANZECC trigger value or the DoH guideline level.

## Nutrients

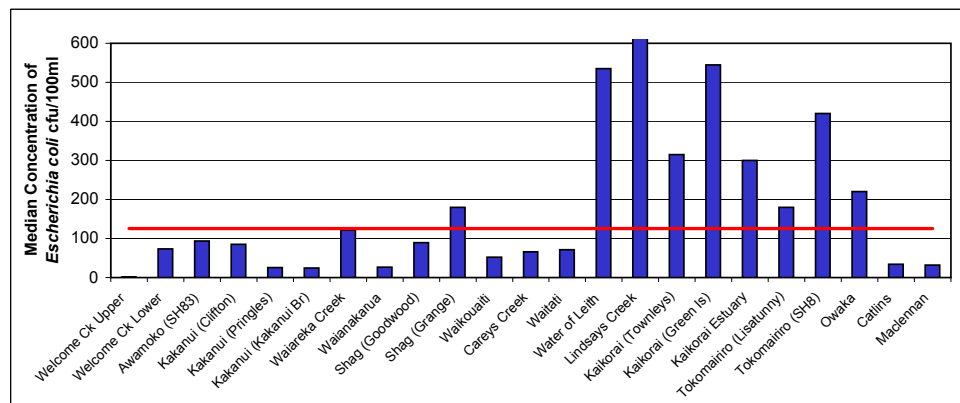
Nitrite-nitrate nitrogen (NNN) is a form of nitrogen primarily derived from land drainage. It is an important nutrient for algae and other plant growth, but can be harmful in higher concentrations. The median concentration of NNN was above the ANZECC trigger value for four sites: both upper and lower Welcome Creek sites, Lindsay's Creek and the Owaka River. While the Catlins River also approached the trigger value, the remainder of sites had median values well below the default trigger.

Median dissolved reactive phosphorus (DRP) concentrations were above the ANZECC trigger value for more than half of all sites analysed. These high-DRP sites were localised in four areas: spring fed streams of the Waitaki plain, the Kakanui estuary, Dunedin's urban streams, and South Otago's rivers. Rivers of the North Otago coast generally showed median DRP concentrations lower than the trigger value.



## Bacteria

Median levels of *Escherichia coli* bacteria were above the DoH guideline level (126 cfu/100ml) at nine of the 23 sites analysed. Levels were highest in Dunedin's urban streams, and at sites in the Tokomariro and Owaka Rivers. The Shag River at the Grange also showed elevated *E. coli* levels.

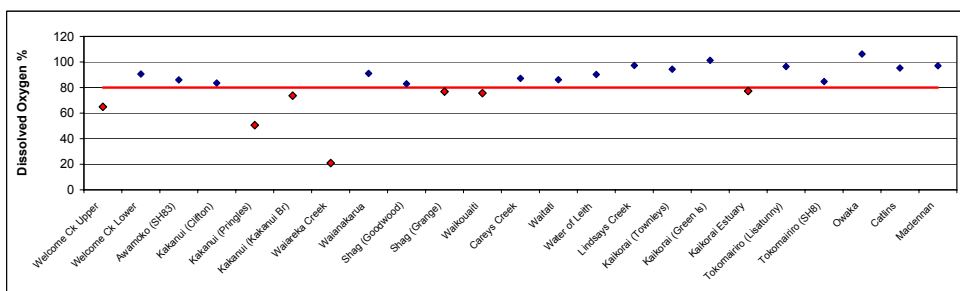


## Recent ORC Reports

- Monitoring the effects of irrigation runoff on water quality (Welcome Creek), May 2006.
- Water Quality of Waiareka Creek and Island Stream, May 2005.

## Dissolved Oxygen

Dissolved oxygen saturations should be above 80%, and below this saturation is considered insufficient for biological health. The median saturation was below the trigger value of 80% at seven sites. This is considerably higher than in 2005, when only three sites (Welcome Creek upper, Waiareka Creek, and the Waikouaiti River) showed decreased O<sub>2</sub> saturation. The extremely low O<sub>2</sub> saturation in Waiareka Creek (20.9%) may be due to excessive plant growth as a result of high nutrient levels.



## Other Analytes

- Ammoniacal nitrogen is the combination of ammonium ions and ammonia (NH<sub>3</sub>). Levels of ammoniacal nitrogen were well below the ANZECC guideline level of 0.9 mg/l in all samples analysed. NH<sub>3</sub> is the main toxic component of ammoniacal nitrogen, the toxicity of which is dependent on pH and temperature. Taking these factors into account, levels of NH<sub>3</sub> were also well below the guideline value (0.021 mg/l) at all sites.
- Water at all sites was neutral with respect to pH, falling within ANZECC guideline levels.
- Turbidity was only elevated above trigger values in the Owaka River, a situation which remains unchanged from 2005 analyses.
- Five sites had median concentrations of total nitrogen elevated above the trigger level (0.614 mg/l): Welcome Creek upper (1.52 mg/l), Welcome Creek lower (1.25 mg/l), Waiareka Creek (0.71 mg/l), Lindsays Creek (0.96 mg/l), and the Owaka River (1.28 mg/l). These results are very similar to those of 2005 analyses.
- Eleven sites had median concentrations of total phosphorus above the trigger level (0.033 mg/l). Six sites showed slight elevations: Welcome Creek upper (0.035 mg/l), Welcome Creek lower (0.037 mg/l), Awamoko Stream (0.037 mg/l), Water of

Leith (0.039 mg/l), Kaikorai Stream at Green Island (0.037 mg/l), and the Tokomariro River at SH8 (0.037 mg/l). Five sites showed more significant elevations: Waiareka Creek (0.199 mg/l), Lindsays Creek (0.058 mg/l), Kaikorai Estuary (0.117 mg/l), Tokomariro River at Lisatunny (0.045 mg/l), and the Owaka River (0.046 mg/l).

## Ecosystem Health

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 (e.g. insects, crustaceans, snails, worms) and periphyton (e.g. algae).

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

A key component of the MCI index is the availability of suitable habitat. As the MCI index is specifically designed 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 a catchment. However, taking this limitation into account, the MCI index is still useful for noting improvement or deterioration in water quality at an individual site over time.

## Criteria for Macroinvertebrate Health

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

## North and Coastal Otago Macroinvertebrate Health 2006

Sample Location	MCI	SQMCI	Total Species	Total EPT
<b>Lindsays Creek u/s Water of Leith</b>	94	2.7	21	9
<b>Lindsays Creek at North Road Br</b>	89	3.2	14	6
<b>Water of Leith at Dundas Street</b>	112	6.7	19	11
<b>Kaikorai Stream at Brighton Rd</b>	62	2.6	9	2
<b>Kaikorai Stream at Townleys Rd</b>	58	1.6	10	0
<b>Akatore Creek at Taieri Beach Rd</b>	135	6.3	19	13
<b>Tokomariro River at Coal Gully</b>	87	4.7	19	7
<b>Tokomariro River at Mt Stuart Br</b>	114	5.1	22	14
<b>Catlins River at Houipapa</b>	108	6.1	24	13



## 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 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.

## Contact

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