Otago Regional Council

# Water Quality - Schedule 15 Otago 2023





## Our regional monitoring network

Water quality and ecosystem health are an integral component of environmental health and influence many uses and values of our waterways. Otago Regional Council (ORC) operates a State of Environment (SoE) water quality monitoring network in lakes and rivers throughout the region. The information gathered through this programme is used to report on the state and trends of water quality and ecosystem health over time to inform environmental management and policy effectiveness.

The ORC currently monitors 106 river sites and 8 lakes. The sites are chosen to represent river types in the Otago region, based on the <u>River Environment Classification</u> (REC). Rivers are divided into 3 reporting groups, See page 6 for a list of site names. Rivers are categorised as Group 1 (more flushing flows) or Group 2 (fewer flushing flows), with Upper Clutha/Mata-Au sites in Group 3 based on the exceptional water quality in this area. Groups 4 and 5 represent small and large lakes, respectively.

This report presents the current state of river and lake water quality within the Otago Region based on the water quality parameters defined by <u>Schedule 15</u> of the <u>Regional</u> <u>plan</u>.

Results presented here are are based on the 80<sup>th</sup> percentile for 5 consecutive years of monthly monitoring data. A percentile indicates the value below which a percentage of observations fall. The 5-year 80th percentile is the value below which 80 % of all samples taken over the 5 years will lie (and 20 % of samples will exceed).

Otago Monitoring Sites Biomonitoring and river/lake State of the Environment (SoE) sites





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### Ngā karere mātua Key findings

- A total 65% of sites show Excellent or good compliance with the overall Schedule 15 targets. This is similar to previous years.
- 105 of 106 sites pass the targets for NH<sub>4</sub> and 62 of the 106 sites pass the targets for NNN.
- 81 out of 106 sites pass the targets for DRP.
- *E. coli* targets are passed at 61 of 106 sites.
- 89 sites pass the targets for turbidity.



# Rivers

### Group 1

8   Blackcleugh Burn at Rongahere Road     12   Catlins at Houipapa     16   Crookston Burn at Kelso Road     24   Heriot Burn at Park Hill Road     28   Kaikorai Stream at Brighton Road     35   Leith at Dundas Street Bridge     38   Lindsays Creek at North Road Bridge     39   Lovells Creek at Station Road     54   Owaka at Katea Road     57   Pomahaka at Burkes Ford     71   Tahakopa at Tahakopa     84   Tokomairiro at West Branch Bridge     86   Tuapeka River     96   Waipahi at Waipahi     98   Waitahuna at Tweeds Bridge     100   Waitahuna at Maws Farm     101   Waiwera at Maws Farm     103   Clutha at Balclutha	#	Site Name	
12 Catlins at Houipapa   16 Crookston Burn at Kelso Road   24 Heriot Burn at Park Hill Road   28 Kaikorai Stream at Brighton Road   35 Leith at Dundas Street Bridge   38 Lindsays Creek at North Road Bridge   39 Lovells Creek at North Road   54 Owaka at Katea Road   57 Pomahaka at Burkes Ford   71 Tahakopa at Tahakopa   84 Tokomairiro at West Branch Bridge   86 Tuapeka River   96 Waipahi at Waipahi   98 Waitahuna at Tweeds Bridge   100 Waitahuna at Maws Farm   103 Clutha at Balclutha	8	Blackcleugh Burn at Rongahere Road	
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	103	Clutha at Balclutha	

3	Akatore Creek at Akatore Creek Road	59	Poolbu
4	Arrow at Morven Ferry Road	62	Quartz
5	Awamoko at SH83	64	Roar
6	Bannock Burn at Lake Dunstan	66	Sha
7	Benger Burn at SH8	67	Shag at
0	Bullock Creek at Dunmore Street Footbridge	68	Silver Str
1	Cardrona at Mt Barker	69	Silverstream
.3	Clutha at Millers Flat	70	Suttor
4	Contour Channel	72	Taieria
8	Deep Stream at SH87	73	Taieri at I
0	Dunstan Creek at Beattie Road	74	Tai
1	Fraser at Old Man Range	75	Taier
5	Hills Creek at SH85	76	Та
9	Kakaho Creek at SH1	77	Та
0	Kakanui at Clifton Falls Bridge	78	Taie
1	Kakanui at McCones	79	Teviota
2	Kauru at Ewings	81	Thoms
6	Lindis at Ardgour Road	85	Trotters
7	Lindis at Lindis Peak	88	Upper Cardro
0	Luggate Creek at SH6 Bridge	89	Upper Pomaha
3	Manuherikia at Blackstone	90	Upper Sh
4	Manuherikia at Galloway	91	Waian
5	Manuherikia at Ophir	92	Waianakaru
6	Manuherikia downstream of Fork	93	Waiareka
8	Meggat Burn at Berwick Road	94	Waikou
9	Mill Creek at Fish Trap	97	Waiporiat
1	Nenthorn at Mt Stoker Road	102	Whare Cree
2	Nevis at Wentworth Station	104	Shotov
3	Oamaru Creek at SH1	105	Clu
6	Pleasant at Patterson Road Ford	106	Kawara
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#### Group 2

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#### Group 3

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12 Mile Creek at Glenorchy Queenstown Road 25 Mile Creek at Glenorchy Queenstown Road Buckler Burn at Glenorchy Queenstown Road Craig Burn at SH6 Dart at The Hillocks Dundas Creekat Mill Flat Greenstone at Greenstone Station Road Hawea at Camphill Bridge Horn Creek at Queenstown Bay Invincible Creek at Rees Valley Road Leaping Burn at Wanaka Mt Aspiring Road Makarora at Makarora Matukituki at West Wanaka Motatapu at Wanaka Mt Aspiring Road Ox Burn at Rees Valley Road Precipice Creek at Glenorchy Paradise Road Quartz Creek at Maungawera Valley Road Rees at Glenorchy Paradise Road Bridge Scott Creek at Routeburn Road The Neck Creek at Meads Road Timaru at Peter Muir Bridge Turner Creek at Kinloch Road

Name

#### Schedule 15 compliance



### Schedule 15 – Water Quality

Schedule 15 (Regional plan: Water) sets out the numerical limits for acceptable water quality for all catchments in the Otago region. The receiving water limits for 5 different parameters per site are applied as five-year, 80th percentiles, when flows are at or below median flow. The median flow is the value in the 'middle' of the flow record. For our analysis, samples taken at higher flows (above median) are removed from the data set to exclude the effects of flood events on water quality when contaminant levels often peak. The results are more reflective of 'normal' conditions, and of water quality at flows when recreational use is most popular.

Excellent	35%	35%	38%	37%
Good	30%	32%	30%	32%
Fair	17%	18%	16%	15%
Poor	18%	15%	16%	16%
	2019	2020 Y	2021 ear	2023



### NH<sub>4</sub>-N and NNN toxicity (Rivers)

High levels of nitrate-nitrite-nitrogen (NNN) or ammoniacal nitrogen ( $NH_4$ -N) in water can create conditions that make it difficult for aquatic insects or fish to <u>survive</u>. In Otago rivers, concentrations are generally < 0.03 mg/L for NNN and <2.4 mg/L for NH<sub>4</sub>-N. At these concentrations, NNN and NH<sub>4</sub>-N are not expected to be harmful to most freshwater species and do not pose a risk for <u>humans</u>.

For ammoniacal nitrogen one site, Horn Creek at Queenstown Bay, fails the Schedule 15 limits and targets. Conversely, 43 sites fail the limits and targets for Nitrite-Nitrate-Nitrogen.

<u>Sources</u> of nitrate include farming and wastewater discharge and it is often a combination of several anthropogenic activities that contribute to high concentrations of nitrate in freshwater.

and the second	Schedule 15 limits	Nitrite-Nitrate- Nitrogen (NNN, mg/L)	Ammoniacal Nitrogen (NH <sub>4</sub> -N, mg/L)
	Group 1	0.444	0.10
	Group 2	0.075	0.10
	Group 3	0.075	0.01

### DRP (Rivers)

<u>Dissolved reactive phosphorus</u> is a form of P that is readily available for uptake by algal cells, allowing for fast algal growth if supply is sufficient. Most rivers in New Zealand are <u>P limited</u> therefore algal blooms are more likely to be triggered by excess concentrations of P rather than N.

Of our 106 monitoring sites, 81 pass the criteria set for DRP. Reasons why sites are failing the criteria can be manifold as sources of DRP can be natural (weathering of rocks or plant decomposition) or from human activities including fertilizer application and waste inputs.

Schedule 15 limits	Dissolved Reactive Phosphorus (DRP, mg/L)
Group 1	0.026
Group 2	0.010
Group 3	0.005

#### **Otago - Dissolved Reactive Phosporus**

pass fail



### Escherichia coli (Rivers)

The bacterium <u>Escherichia Coli</u> (E. coli) is naturally present in animal faeces and freshwater and can reach high concentrations by the addition of wastewater or runoff from agricultural pastures to streams. High densities of *E. coli* indicate the presence of other bacteria and the risk of infection with several diseases, such as gastroenteritis, if the waterbody is used for recreational activities and lowers the Mana of the waterway.

A total 57 sites pass the *E. coli* criteria, these sites are mainly located in the Upper-Clutha and Dunstan areas. Sampling sites with highest *E. coli* numbers are clustered around areas with urban (Dunedin) or agricultural land uses (Pomahaka, Lower Clutha, Taieri, Manuherekia and North Otago). In addition to anthropogenic sources, natural <u>sources</u> of *E. coli*, such as bird colonies, can also significantly impact water quality.

Schedule 15 limits	<i>Escherichia coli</i> (cfu/100 ml)
Group 1	260
Group 2	260
Group 3	50

### Turbidity (Rivers)

Elevated concentrations of suspended fine sediment (SFS) negatively influence benthic environments, fish community composition, and carry nutrients and toxins that can <u>lower the</u> <u>mana</u> of a waterway. Suspended fine sediment is naturally present in all rivers due to the presence of organic substances and the weathering of rocks.

A total 89 sites pass the criteria for turbidity. The two major rivers in Otago, the Clutha and <u>Taieri</u>, alongside some other rivers in the region, are influenced by natural sources of suspended fine sediment. High loads of glacial flour are present in the Clutha, providing for its unique turquoise colour while natural tannin staining is responsible for the brown colour of the Taieri and some rivers in the Catlins FMU. Human activities that increase the amount of suspended fine sediment include farming or construction.

Schedule 15 limits	Turbidity (NTU)	de.
Group 1	5	
Group 2	5	
Group 3	3	







### Group 4

Name
Lake Hayes
Lake Onslow
Lake Tuakitoto
Lake Waihola

## Group 5

1-3

10-13

	Name	1
	Lake Dunstan	
Ser.	Lake Hawea	
1	Lake Wakatipu	
	LakeWanaka	



### Ammonia (Lakes)

High levels of ammoniacal nitrogen (NH4-N) in water can create conditions that make it difficult for aquatic insects or fish to survive. In Otago Lakes, concentrations are generally <0.1 mg/L for NH<sub>4</sub>-N. At these concentrations, NNN and NH4-N are not expected to be harmful to most freshwater species and do not pose a risk for humans.

	Schedule 15 limits	Ammoniacal Nitrogen (NH <sub>4</sub> -N, mg/L)
	Group 4	0.10
200	Group 5	0.01

### Escherichia coli (Lakes)

The bacterium *Escherichia Coli* (*E. coli*) is naturally present in animal faeces and freshwater and can reach high concentrations by the addition of wastewater or runoff from agricultural pastures to streams. High densities of E. coli pose the risk of infection with several diseases, such as gastroenteritis (campylobacter), if the waterbody is used for recreational activities and lowers the Mana of the waterway.

*E. coli* concentrations are overall low in the monitored lakes. The only lake that fails the Schedule 15 compliance is Lake Tuakitoto, where a combination of natural and anthropogenic sources leads to elvated *E. coli* concentrations.

Schedule 15 limits	Escherichia coli (cfu/100ml)	
Group 4	126	
Group 5	10	





### Turbidity (Lakes)

Elevated concentrations of suspended fine sediment (SFS) negatively influence benthic environments, fish community composition, and carry nutrients and toxins that can <u>lower the</u> <u>mana</u> of a waterway.

Suspended fine sediment is naturally present in all lakes due to the presence of organic substances and the weathering of rocks. High loads of <u>glacial flour</u> are present in Otago's alpine lakes, providing for their unique turquoise colour while natural <u>tannin</u> <u>staining</u> is responsible for the brown colour of Lake Waihola and Lake Tuakitoto. Human activities that increase turbidity include farming or urban development.

Schedule 15 limits	Turbidity (NTU)
Group 4	5
Group 5	3

### Total Nitrogen (Lakes)

The growth of algae, forming the basis of food-webs in lakes, is controlled by the amount and availability of nutrients. <u>The major</u> <u>nutrients</u> algae need for growth are nitrogen (N) and phosphorous (P) and the concentrations of these nutrients in freshwater often give an indication for the possible magnitude of <u>algal growth</u>.

The water quality of lakes is assessed by a range of parameters and lakes are <u>classified</u> accordingly. If nutrients and algal growth is low, lakes are classified as 'oligotrophic'. Conversely, if nutrient concentrations and algal growth are high, to the extent of large surface blooms, the lake is classified as 'eutrophic' or 'hypertrophic/supertrophic'. Lakes with intermediate nutrient levels and algal growth are classified as 'mesotrophic'.

Our large alpine lakes, <u>Wakatipu</u>, <u>Wanaka</u> and <u>Hawea</u> are all classified as oligotrophic, while <u>Lake Waihola</u> and <u>Lake Tuakitoto</u> are classified as supertrophic.

Schedule 15 limits	Total Nitrogen (mg/L)
Group 4	0.55
Group 5	0.10





### Total Phosphorus (Lakes)

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Lake Hayes, Lake Waihola and Lake Tuakitoto fail the Schedule 15 compliance thresholds due to the large amount of sediment that enters these lakes and is retained within them, releasing the nutrients bound to sediment over time.

Schedule 15 limits	Total Phosphorus (mg/L)
Group 4	0.033
Group 5	0.005

