



**Technical report advising Proposed Plan Change 6A ‘Officer’s
Report of Decisions Requested’**

Schedule 15

Proposed receiving water quality

Five analytes are considered for receiving water quality, as set out in Table 1. Algal growth is in part limited by the frequency of higher flows, which strips the algae from its substrate. Therefore, catchments have been assigned a group depending on whether flushing flows are common. Groups one and two are based on Accrual days (less than or more than 30 days between high flows), however other factors, such as substrate and temperature, can influence algal growth other than just nutrient levels and flow rates.

Changes from notified Plan

Catchments to the south-east of the Clutha River, including the Tokomairiro, Tuapeka and Waitahuna have been moved from Group 2 to Group 1. These catchments were just over the 30 accrual day limit. The decision to move the grouping is based on the similarity that these catchments show in terms of climate to those on the south west of the Clutha River. These catchments generally also have fine sediment substrate which deters prolific algal growth.

Table 1 Schedule 15 –receiving water quality

	Total nitrogen (mg/l)	Nitrate-nitrite nitrogen (mg/l)	Total phosphorus (mg/l)	Dissolved reactive phosphorus (mg/l)	Ammoniacal nitrogen (mg/l)	Escherichia coli (cfu/100ml)	Turbidity NTU
Group 1 (more flushing flows)		0.444		0.026	0.1	126	5
Group 2 (fewer flushing flows)		0.075		0.006	0.1	126	5
Group 3 (Sm. Lakes)	0.725		0.043		0.1	126	5
Group 4 (Lakes Region)		0.03		0.005	0.01	10	3
Group5 (Lg lakes)	0.157		0.009		0.01	10	3

The source of the guideline values are set out in Table 2.

Table 2 Source of guidelines populating the Schedule

	Total nitrogen (mg/l)	Nitrate-nitrite nitrogen (mg/l)	Total phosphorus (mg/l)	Dissolved reactive phosphorus (mg/l)	Ammoniacal nitrogen (mg/l)	Escherichia coli (cfu/100ml)	Turbidity NTU
Group 1 (more flushing flows)		ANZECC 2000		Biggs 2000	ORC	MfE 2002	ORC
Group 2 (fewer flushing flows)		Biggs 2000		Biggs 2000	ORC	MfE 2002	ORC
Group 3 (Sm. Lakes)	Burns 2000		Burns 2000		ORC	MfE 2002	ORC
Group 4 (Lakes Region)		ORC		ORC	ORC	ORC	ORC
Group5 (Lg lakes)	Burns 2000		Burns 2000		ORC	ORC	ORC

A summary of the rationale for Schedule 15 guidelines are given in Table 3.

Table 3 Summary rationale for guidelines

	Guideline value	Group	Reason
NNN	0.03	Area 4	To protect the current very high water quality of the large lakes. Median value of this group is 0.028mg/l
DRP	0.005	Area 4	To protect the current very high water quality of the large lakes. Median value of this group is 0.0045mg/l
NH4	0.1	Areas 1 to 3	Zero tolerance for effluent entering waterways. The median value of all groups meet this proposed guideline For comparison ANZECC guideline in 0.9mg/l
	0.001	Areas 4 -5	To protect the current very high water quality of the large lakes. The median value of both groups meet this proposed guideline For comparison ANZECC guideline in 0.9mg/l
E.coli	10	Areas 4 -5	To protect the current very high water quality of the large lakes. The median value of both groups meet this proposed guideline For comparison MfE, 2002 guideline is 126cfu/100ml
Turbidity	5	Areas 1 to 3	The ANZECC guideline for ecosystem protection is 5.6 NTU. Cawthron Institute ¹ research on trout fisheries indicates that turbidity in excess of the ANZECC guideline may result in a reduction in visual foraging area of drift-feeding trout of about 60 per cent (from clean water conditions), even for small fish (< 10 cm) (MfE, 2009). Young and Hayes (1999) found 5 NTU to be the maximum turbidity value before an effect was had on drift-feeding trout growth potential. The median value of all groups meet this proposed guideline
	3	Areas 4 -5	To protect the current very high water quality of the large lakes. The median value of both groups meet this proposed guideline For comparison the ANZECC guideline is 4.1NTU

References	
Burns 2000	Burns N, Bryers G, Bowman E. 2000. <i>Protocol for Monitoring Trophic Levels of New Zealand Lakes and Reservoirs</i> . Prepared for Ministry of the Environment by Lakes Consulting, March 2000
ANZECC 2000	ANZECC. (2000). Australia and New Zealand guidelines for fresh and marine water quality. Vol.1. The Guidelines.
Biggs 2000	Biggs, B.J.F. (2000). New Zealand periphyton guideline: detecting, monitoring and managing enrichment of streams. Ministry for the Environment, Wellington, 122 p.MfE (Ministry for the Environment). (2002).
MfE 2002 ²	Microbiological water quality guidelines for marine and freshwater recreational areas. Ministry for the Environment, Wellington, New Zealand.

¹ Roger, Y; Hayes, J. 1999. Trout Energetics and Effects of Agricultural land use on the Pomahaka Trout Fishery. Prepared for Fish and Game. February 1999

² These guidelines were based on the Dufour (1984) study, as implemented by the USEPA. That is a median E. coli concentration of 126 per 100 mL, corresponding to a swimming-associated illness risk of 8 per 100 bathers. The alert and action limits were 273 and 410 E. coli per 100 mL. The 'acceptable' illness risks were not chosen a priori but were calculated, once it was decided that risks corresponding to the previous criteria (200 faecal coliforms per 100 mL, as a geometric mean) should be adopted. The 2003 guidelines are based on an explicit choice of acceptable risk, but do not give a recommended median guideline value.

Schedule 15 group statistics

This section presents statistics relating to each 'group'. The statistics are derived from SOE monitoring from June 2006 to July 2011. Statistics for each parameter are given in the tables 4 to 10 below

Table 4 Turbidity statistics

Turbidity	Group 1 (Area 1)	Group 2 (Area 2)	Group 3 (Small Lakes)	Group 4* (Upper Clutha)	Group 5 (Hawea, Wakatipu, Wanaka)
No. samples	413	1288	140	30	89
Schedule 15	5 NTU	5 NTU	5 NTU	3 NTU	3 NTU
Median	3.27	1.57	4.30	2.04	0.40
75%ile	5.71	3.61	8.65	4.50	0.63
80%ile	7.27	4.54	10.26	4.85	0.68
95%ile	27.00	16.07	28.11	58.80	1.16
99%ile	105.76	45.30	74.17	118.30	2.72

Only the Matukituki is in this group (Dart exempt)

Table 5 Total phosphorus statistics

Total phosphorus	Group 1 (Area 1)	Group 2 (Area 2)	Group 3 (Small Lakes)	Group 4* (Upper Clutha)	Group 5 (Hawea, Wakatipu, Wanaka)
No. samples			143		93
Schedule 15	n/a	n/a	0.043	n/a	0.009
Median			0.049		0.005
75%ile			0.082		0.005
80%ile			0.090		0.005
95%ile			0.155		0.011
99%ile			0.222		0.286

Table 6 Dissolved reactive phosphorus statistics

Dissolved reactive phosphorus	Group 1 (Area 1)	Group 2 (Area 2)	Group 3 (Small Lakes)	Group 4* (Upper Clutha)	Group 5 (Hawea, Wakatipu, Wanaka)
No. samples	565	1455		58	
Schedule 15	0.026	0.006	n/a	0.005	n/a
Median	0.016	0.006		0.005	
75%ile	0.023	0.010		0.005	
80%ile	0.026	0.013		0.005	
95%ile	0.041	0.034		0.006	
99%ile	0.078	0.130		0.021	

- Only the Matukituki and Dart are in this group

Table 7 Total nitrogen statistics

	Group 1 (Area 1)	Group 2 (Area 2)	Group 3 (Small Lakes)	Group 4* (Upper Clutha)	Group 5 (Hawea, Wakatipu, Wanaka)
Total nitrogen					
No. samples			143		92
Schedule 15	n/a	n/a	0.725	n/a	0.157
Median			0.510		0.050
75%ile			0.815		0.090
80%ile			0.868		0.090
95%ile			1.420		0.152
99%ile			1.862		0.259

Table 8 Nitrate nitrite nitrogen statistics

	Group 1 (Area 1)	Group 2 (Area 2)	Group 3 (Small Lakes)	Group 4* (Upper Clutha)	Group 5 (Hawea, Wakatipu, Wanaka)
NNN					
No. samples	565	1444		58	
Schedule 15	0.444	0.075	n/a	0.03	n/a
Median	0.396	0.026		0.028	
75%ile	0.922	0.074		0.048	
80%ile	1.062	0.104		0.052	
95%ile	2.010	0.434		0.077	
99%ile	3.003	1.331		0.081	

- Only the Matukituki and Dart are in this group

Table 9 Ammoniacal nitrogen statistics

	Group 1 (Area 1)	Group 2 (Area 2)	Group 3 (Small Lakes)	Group 4* (Upper Clutha)	Group 5 (Hawea, Wakatipu, Wanaka)
Ammoniacal nitrogen					
No. samples	563	1441	143	58	93
Schedule 15	0.1	0.1	0.1	0.01	0.01
Median	0.010	0.009	0.009	0.009	0.009
75%ile	0.020	0.010	0.020	0.009	0.009
80%ile	0.030	0.010	0.026	0.010	0.009
95%ile	0.069	0.030	0.099	0.010	0.009
99%ile	0.138	0.830	0.232	0.029	0.010

- Only the Matukituki and Dart are in this group

Table 10 Escherichia coli statistics

	Group 1 (Area 1)	Group 2 (Area 2)	Group 3 (Small Lakes)	Group 4* (Upper Clutha)	Group 5 (Hawea, Wakatipu, Wanaka)
Escherichia coli					
No. samples	514	1144	145	57	90
Schedule 15	126	126	126	10	10
Median	178	32	6	5	1
75%ile	520	86	44	20	1
80%ile	804	106	69	25	1
95%ile	3135	520	340	115	13
99%ile	7335	1757	1592	1010	22

- Only the Matukituki and Dart are in this group

Statistics were derived from the following sites in each group

Group 1

Site Name	Easting	Northing
Catlins at Houipapa	2244813	5410722
Clutha at Balclutha	2259000	5436200
Crookston Burn at Kelso Road	2217767	5472139
Heriot Burn at Park Hill Road	2215870	5475060
Kaikorai Stream at Brighton Road	2309801	5475014
Leith at Dundas Street Bridge	2317090	5479910
Lindsays Creek at North Road Bridge	2317550	5481090
Pomahaka at Burkes Ford	2231450	5454900
Pomahaka at Glenken	2210249	5475420
Tokomairiro at West Branch Bridge	2266390	5453760
Waipahi at Cairns Peak	2219430	5428700
Waipahi at Waipahi	2220100	5449000
Wairuna at Clydevale-Waipahi Road	2225410	5449770
Waiwera at Maws Farm	1334121	4881633
Waitahuna at Tweeds Bridge	2254150	5459640

Group 2

Site Name	Easting	Northing
Cardrona at Mt Barker	2202600	5599200
Clutha at Luggate Br.	2215441	5602122
Clutha at Millers Flat	2230200	5498700
Dunstan Creek at Beattie Road	2254680	5580380
Fraser at Marshall Road	2223968	5544853
Hawea at Camphill Bridge	2212340	5610730
Kakanui at Clifton Falls Bridge	2332838	5572690
Kakanui at McCones	2343400	5556800
Kauru at Ewings	2331828	5563854
Kawarau at Chards	2184400	5569800
Kye Burn at SH85 Bridge	2294600	5558400
Lake Dunstan at Dead Mans Point	2212160	5567660
Lindis at Ardgour Road	2228800	5589300
Lindis at Lindis Peak	2233300	5601900
Luggate Creek at SH6 Bridge	2214600	5599930
Main Drain at Waipori Pump	2287340	5467170
Manuherikia at Galloway	2229700	5547440
Manuherikia at Ophir	2241800	5560800
Mill Creek at Fish Trap	2179900	5573900
Owhiro Stream at Burns Street	2304180	5476810
Shag at Craig Road	2327060	5528760
Shag at Goodwood Pump	2334360	5523480
Shotover at Bowens Peak	2172200	5571000
Silverstream at Taieri Depot	2301961	5478278
Sutton at SH87	2283200	5508400
Taieri at Allanton Bridge	2297470	5473880
Taieri at Linnburn Runs Road	2260870	5520110
Taieri at Outram	2295800	5481000
Taieri at Stonehenge	2271200	5538000
Taieri at Sutton	2286700	5511600
Taieri at Tiroiti	2295900	5546600

Group 2 continued

Site Name	Easting	Northing
Taieri at Waipiata	2286289	5552928
Trotters Creek at Mathesons	2340690	5532830
Waianakarua at Browns	2340450	5548360
Waikouaiti at Orbells Crossing	2324300	5508400
Waikouaiti at Orbells Crossing	2322439	5507437
Waipori at Waipori Falls Reserve	2282320	5471190

Group 3

Site Name	Easting	Northing
Lake Hayes at Mid Lake - Surface	2180100	5572300
Lake Johnson at Surface	2173600	5569100
Lake Onslow at Boat Ramp	2244240	5511800
Lake Tuakitoto at Outlet	2265335	5436672
Lake Waiholo at End of jetty	2284790	5461220

Group 4

Site Name	Easting	Northing
Matukituki at West Wanaka	2192000	5611400
Dart at The Hillocks	2140086	5593287

Group 5

Site Name	Easting	Northing
Lake Hawea Outflow at Dam	2212500	5615240
Lake Wakatipu at Outflow	2173290	5566820
Lake Wanaka at Outlet	2204700	5608900