



Review of State of the Environment Surface Water Quality Monitoring Sites



March 2006

Executive Summary

The existing State of Environment surface water quality monitoring sites were reviewed, with the aim of creating a core set of sites which relate to policy requirements of the Regional Plan: Water and, where possible, are located at ORC or NIWA hydrological monitoring stations.

The main river sites have been split into two categories, those with a mean annual low flow (MALF) of less than 1000 litres a second, at which water quality and biological monitoring will be carried out, and those with a MALF of greater than 1000 litres second at which only water quality monitoring will be carried out, sites suitable for biological monitoring during drought conditions have also been identified. Lake monitoring, estuary monitoring, biological monitoring and seasonal contact recreation monitoring sites have also been identified.

For each site the River Environment Classification system (REC) has been used to classify the river according to several environmental factors that strongly influence or cause the rivers' physical and ecological characteristics.

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1. Introduction

The Otago Regional Council undertakes State of the Environment surface water quality monitoring throughout the Otago region to fulfil its responsibilities under the Resource Management Act (1991), the Regional Policy Statement and the Regional Plan: Water (2004).

State of the Environment (SOE) monitoring is undertaken to assess the condition (state) of a site and/or to detect trends over a period of time. The SOE surface water quality monitoring programme began in 1994-1995 and initially focused on physical-chemical water quality. A freshwater biological monitoring programme was introduced in late 1996. This report builds on a review undertaken in 2001 (ORC 2002), with the specific aim of assessing the suitability of existing water quality sampling sites.

1.1 Aim of Site Review

The aim of the Council's SOE monitoring programme is to be able to collect reliable information on water quality and aquatic biological data to enable effective resource management. The need for a review of sites was required specifically to:

- Identify or establish long term sites to enable spatial and temporal trends in water quality and aquatic ecology to be identified.
- To address the policies set out in the Regional Policy Statement and the Regional Plan: Water (specifically Policies 7.6.1-7.6.3) through inclusion of sites specific to these policies
- To classify sites using the New Zealand River Environment Classification system.
- To coordinate monitoring at one site (in practice, the hydrological monitoring station).
- To identify sites no longer required.

1.2 Legislative and Policy Framework

The Resource Management Act 1991 (RMA) provides the framework for the management of Otago's natural and physical resources. The Regional Policy Statement (RPS) for Otago provides an overview of the resource management issues of Otago and the policies and methods for achieving integrated management of the region's natural and physical resources and the Regional Plan: Water, prepared under Section 65 of the RMA focuses on the sustainable management of water and waterbodies.

Several policies are relevant to the SOE surface water quality monitoring programme:

7.6.1 To enhance the water quality in the following water bodies so that they become suitable to support primary contact recreation:

- Mill Creek and Lake Hayes
- Kaikorai Stream
- Water of Leith
- Lower Taieri River (below Allanton)
- Lower Silver Stream (below Riccarton Rd)

- Koau Branch of the Clutha River/Mata-Au
- Tokomairiro River
- Lower Waiwera River (below SH1)
- Heriot Burn
- Crookston Burn

7.6.2 To enhance the water quality in the following rivers so that the Macroinvertebrate Community Index score is increased:

- Hayes Creek
- Lower Horne Creek (below gardens walkway)
- Lower Kaikorai Stream (below Townleys Rd)
- Lower Taieri River (below Allanton)
- Lower Waipori River (below Lake Waipori)
- Lower Tokomairiro River (below Tokoiti)
- Lower Owaka River (below SH 92)
- Lower Waiareka River (below Elderslie Road, Round Hill)
- Lower Kaihiku Stream (below Clifton Road)
- Lower Wairuna Stream (below Waipahi-Clydevale Road)

7.6.3 To enhance the water quality in the following lakes so that the aquatic ecosystem is enhanced:

- Lake Hayes
- Lake Johnson
- Lake Tuakitoto
- Lake Waipori
- Lake Waihola

As well as these policies Schedule 2A of the Regional Plan: Water lists specific minimum flows for primary allocation takes in accordance with Policy 6.4.3, and primary allocation limits in accordance with Policy 6.4.2(a)(i). These are shown in Table 1.1.

Table 1.1 Schedule 2A: Specific minimum flows

Catchment See Maps B1-B5	Monitoring Site (with MS number) See Maps B1-B5	Minimum flow (litres per second)	Primary Allocation Limits in accord with Policy 6.4.2(a)(i)
Shag catchment (both minimum flows apply)	Goodwood Pump (MS 1) Craig Road (MS 2)	28 150	280 litres/sec <i>Shag catchment from mouth to headwaters</i>
Kakanui catchment (a) October to April inclusive	Mill Dam (MS 3) and McCones (MS 3b)	250 (300 for secondary permits) If 250 breached, flow must return to 400 before taking can recommence.	750 litres/sec <i>Kakanui catchment from mouth to headwaters excluding the Waiareka Creek and Island Stream catchments.</i>
(b) May to September inclusive	Clifton Falls (MS 3a) Mill Dam (MS 3) and McCones (MS 3b)	400 for primary and secondary permits	
Water of Leith catchment	Water of Leith at University Footbridge (MS 4)	94	140 litres/sec <i>Water of Leith catchment from mouth to headwaters</i>
Taieri River upstream of Paerau	Paerau Dam (MS 5a)	850	4860 litres/sec <i>Taieri River catchment from mouth to headwaters.</i>
Taieri River catchment between Paerau and Waipiata	Taieri River at Waipiata (MS 5)	1000	
Taieri River catchment between Waipiata and Sutton	Taieri River at Sutton (MS 6)	1250	
Taieri River catchment between Sutton and Outram	Taieri River at Outram (MS 6a)	2500	
Lake Hayes catchment area	Mill Creek at Fish Trap (MS 7)	180	260 litres/sec <i>Lake Hayes catchment from lake outlet to headwaters</i>
Manuherikia River catchment upstream of Ophir	Manuherikia River at Ophir (MS 8)	820	3200 litres/sec <i>Manuherikia catchment from mouth to headwaters</i>
Waitahuna River catchment	Waitahuna River at Tweeds Bridge (MS 9)	450	650 litres/sec <i>Waitahuna catchment from mouth to headwaters</i>
Lake Tuakitoto catchment	Lovells Creek at SH1 (MS 10)	5	30 litres/sec <i>Lake Tuakitoto catchment from mouth to headwaters</i>

There are also nine proposed minimum flow sites:

- Waiwera 100m us Clutha conference
- Waianakarua at Browns Pump
- Manuherikia at Galloway
- Luggate at Luggate Ck Bridge
- Trotters Creek at Mathesons
- Waiareka Creek at Taipo Road
- Pomahaka at Glenken
- Pomahaka at Burkes Ford
- Taieri at Tiroiti

2. Freshwater Rivers and Streams

The existing SOE surface water quality monitoring sites were reviewed, with the aim of creating a core set of sites. At these key sites it is proposed that water quality monitoring, biological monitoring, periphyton monitoring and fish sampling will be carried out, where possible these sites have been located at ORC or NIWA hydrological monitoring stations and also tie in with policy requirements of the Regional Plan: Water.

For each site the River Environment Classification system (REC) was also used to group the river into a class according to several environmental factors that strongly influence or cause the rivers' physical and ecological characteristics (climate, topography, geology and land cover). The REC classification comprises a hierarchy of six levels, the first four levels group parts of rivers according to similarities in the climate, topography, geology and land cover of their catchment, the fifth and sixth levels, group parts of rivers according to similarities in attributes of each of the local section of the river network: Network-Position and Valley-Landform.

The purpose of REC is that the various classes or 'groups' of rivers can then be treated as if they share similar characteristics and could be used as a basis for reporting environmental data. The characteristics of each class can be used to make management decisions for the class as a whole (without having to monitor every watercourse).

- *Climate* Warm Extremely Wet (WX), Warm Wet (WW), Warm Dry (WD), Cool Extremely Wet (CX), Cool Wet (CW), Cool Dry (CD).
- *Source of Flow:* Glacial Mountain (GM), Mountain (M), Hill (H), Low Elevation (L), Lake (Lk), Spring (Sp), Regulated (R), Wetland (W).
- *Geology:* Alluvium (AI), Hard Sedimentary (HS), Soft Sedimentary (SS), Volcanic Basic (VS), Volcanic Acidic (VA), Plutonic (P), Miscellaneous(MI).
- *Land Cover:* Bare (B), Indigenous Forest (IF), Pastoral (P), Tussock (T), Scrub (S), Exotic Forest (EF), Wetland (W), Urban (U)
- *Network Position:* Low Order (LO), Middle Order (MO), High Order (HO)
- *Valley Landform:* High Gradient (HG), Medium Gradient (MG), Low Gradient (LG)

2.1 Historical Water Quality Monitoring

2.1.1 NIWA Water Quality Monitoring

NIWA has monitored water quality at eight sites in the Otago region on a monthly basis since commencement of the programme in January 1989. Details of sites monitored are given in Table 2.1. Two of these sites (Balclutha and Outram) double up on ORC SOE monitoring sites and the Taieri at Tiroiti is a proposed ORC minimum flow site. A map showing these sites is given in Figure 2.1.

Table 2.1 NIWA Hamilton – National Rivers Water Quality Network Data

Code	River	Description
AX1	Clutha @ Luggate Br.	Baseline. Takes L. Wanaka and L. Hawea waters. Some catchment devpt. Starting point of the country's major river upstream of hydro electric development. Major tourist attraction.
AX2	Kawarau @ Chards	Pseudo baseline. Little catchment development. Major tourist vlues (and pressures) being downstream of Queenstown and L. Wakatipu. The major tributary of the Clutha River.
AX3	Shotover @ Bowens Peak	Pseudo baseline. Little catchment development. Major tributary of Kawarau R. Subject to tourist pressure, past and current alluvial gold mining.
AX4	Clutha @ Millers Flat	Impact Site. Midway between AX1 and DN4 sites downstream of three towns and major hydro electric lake developments. Upstream of intensive pasture and horticulture.
DN1	Taieri @ Tiroiti	Impact Site. River site at exit to Maniototo Plains (extensive pasture irrigation in an otherwise dry area). Fishing values or regional importance.
DN2	Sutton @ SH87	Baseline. Tussock catchment typical of region. Largely undeveloped. Typical input to Taieri.
DN3	Taieri @ Outram	Impact Site. Downstream of major catchment developments (pasture). Major recreational river (bathing, fishing, rafting).
DN4	Taieri @ Balclutha	Impact Site. Downstream of major hydro electric, horticultural, pasture developments. Major recreational values.

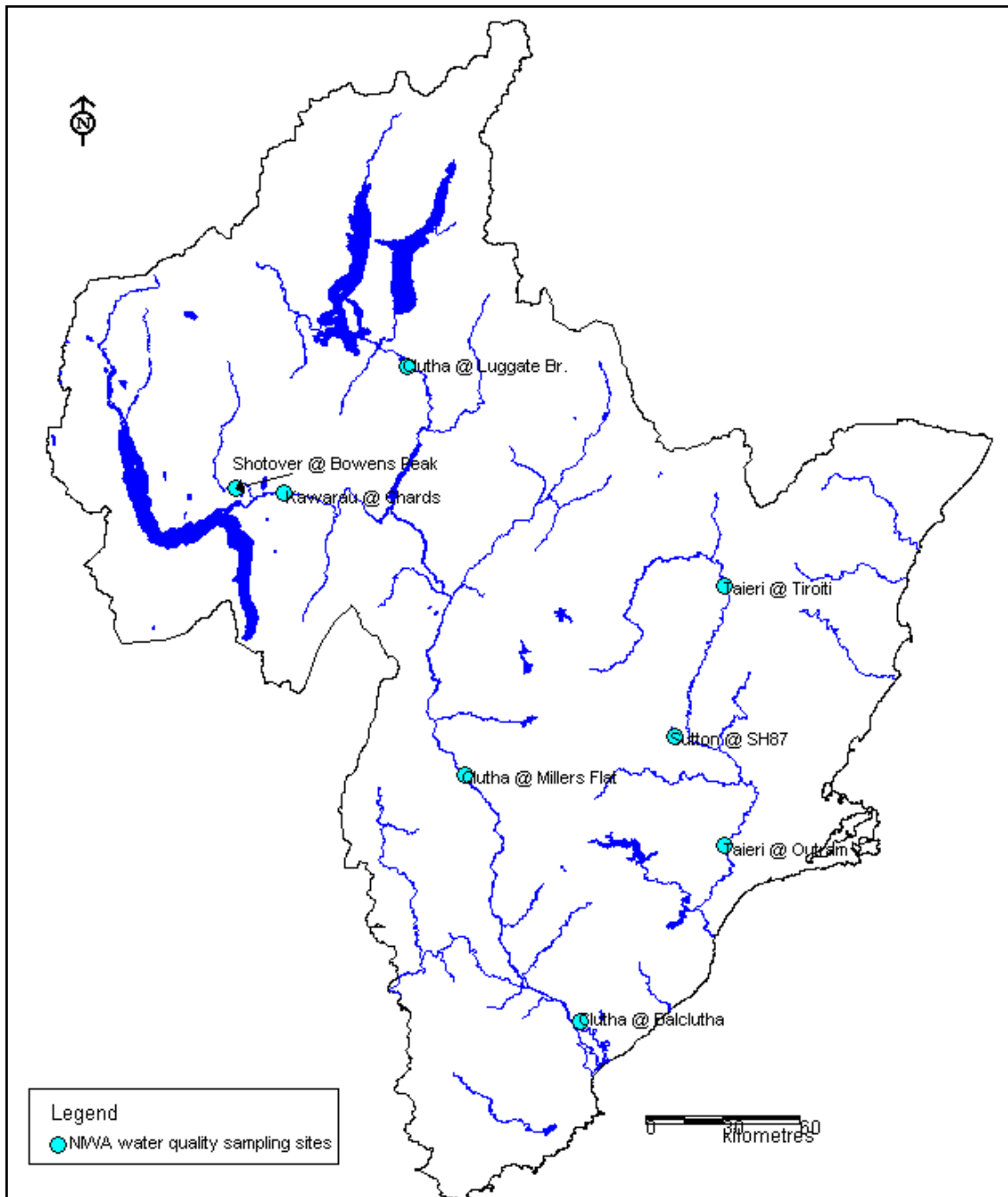


Figure 2.1 NIWA water quality monitoring sites.

2.1.2 *ORC Water Quality Monitoring*

Table 2.2 details water quality monitoring undertaken by ORC over the last ten years. Sites which have been sampled six or more times per annum for four years or more have been listed. Long term data sets are of value as trends of declining or improving water quality can generally only be established after a number of years, however in some instances the sites with long term water quality data are not in appropriate locations and should be discontinued.

The last column in Table 2.2 shows whether it is proposed to retain the site and Table 2.3 indicates the reason if the site is to be discontinued.

Table 2.2 Sites with four or more years of ORC Water Quality Monitoring Data

River	Site	Years	95	96	97	98	99	0	01	02	03	04	Tot.	Retain
		>6 pa												
Kakanui	Pringles	10	8	6	6	6	8	8	9	8	6	7	72	No
Main Drain	Waipori P.S.	10	6	6	9	11	15	9	9	12	12	11	100	Yes
Mill Creek	Fish Trap	10	15	14	13	11	9	9	6	6	6	6	95	Yes
Taieri	Henley Ferry	10	6	6	6	6	7	7	7	11	6	6	68	No
Tokomairiro	Tokoiti	10	12	7	6	6	7	6	6	10	6	6	72	No
Waikouaiti	Orbells	10	11	9	6	6	7	7	6	6	6	7	71	Yes
L. Wakatipu	Outlet	9	6	6	5	6	11	7	6	6	6	6	65	Yes
Taieri	Stonehenge	9	5	6	6	6	8	6	8	14	6	6	71	No
Cardrona	Mt Barker	8		5	7	6	7	7	6	6	6	6	56	Yes
Clutha	Balclutha	8	6	7	5	5	8	6	6	6	6	6	61	No
Hayes Creek	SH6	8		1	10	7	7	7	6	6	6	6	56	Yes
L. Waiholo	Jetty	8		5	6	6	6	6	13	13	6	7	68	Yes
L. Waipori	SE Corner	8	4	6	6	6	6	6	6	5	6	6	57	Yes
L. Wanaka	Outlet	8	7	7	5	6	5	6	6	6	6	6	60	Yes
Taieri	Outram	8	6	6	5	6	6	6	16	18	6	5	80	No
Taieri	Halls Bridge	8		6	6	6	7	5	8	14	7	8	67	No
Crookston B	Kelso	7		4	6	7	5	6	9	8	6	6	57	Yes
Heriot Burn	Parkh/K Rd	7		6	6	1	4	8	8	8	8	7	56	Yes
Kaikorai	Brighton Rd	7			3	7	8	8	6	7	6	6	51	Yes
Lake Hawea	Outlet	7	6	6	5	6	4	6	5	6	6	6	56	Yes
Pomahaka	Burkes Ford	7			3	6	7	7	6	6	6	6	47	Yes
Pomahaka	Glenken	7			5	8	6	6	8	8	7	6	54	Yes
Shag	Goodwood	7	7	7	8	5	5	7	5	6	6	7	63	Yes
Waiareka	Teschmakers	7			3	8	8	8	6	8	6	8	55	Yes
Water Leith	Dundas St	7	5	6	5	7	8	8	7	5	6	6	63	Yes
Careys Ck	SH1	6			3	5	6	6	6	6	6	6	44	Yes
Kaihiku	Clifton Rd	6			3	7	8	7	5	9	12	7	58	Yes
Kakanui	Clifton Falls	6	6	6	3	2	4	4	7	7	6	7	52	Yes
L. Dunstan	Deadmans Pt	6			3	6	5	6	6	6	6	7	45	Yes
Lake Hayes	Surface	6	2	2	10	8	6	6	5	1	6	7	53	Yes
L. Tuakitoto	Outlet	6	5	5	6	6	6	5	5	6	6	6	56	Yes
Lovells	Station Rd	6	5	4	5	6	6	5	9	6	6	6	58	No
Manuherikia	Galloway	6			3	6	6	5	6	7	7	9	49	Yes
Taieri	Middlemarch	6			3	6	8	6	5	6	6	7	47	No
Tuapeka	Mouth	6			3	6	6	7	5	6	6	6	45	Yes
Waipahi	Waipahi	6			3	6	7	7	5	9	12	6	55	Yes
Waitahuna	Tweeds Br	6			3	6	6	6	5	6	6	6	44	Yes
Waitati	Mt. Cargill	6			3	5	6	6	6	6	6	6	44	Yes
Welcome Ck	Lower	6			4	6	6	6	5	6	6	7	46	Yes
Welcome Ck	Upper	6			4	6	6	6	6	5	6	7	46	No
Catlins	Houipapa	5						7	8	8	8	8	39	Yes
Frasers	Station Rd	5	5	4	5	6	6	5	4	6	6	6	53	No
L.Johnson	Surface	5			3	7	5	6	5	6	6	6	44	Yes

River	Site	Years	95	96	97	98	99	0	01	02	03	04	Tot.	Retain
Taieri	Allanton Br	5	11	7	4	1	2	2	3	11	6	6	53	Yes
Tokomairiro	Lisnatunny	5	12	7	3				1	7	6	6	42	Yes
Lindsay Ck	u/s Leith	4				4	5	7	6	5	6	20	53	No
Manuhirikia	Blackst. Hill	4			3	6	6	5	3	3	6	6	38	Yes
Mill Creek	Hunter Rd	4		2	10	7	8	6	3				36	No
Shag	Grange	4	5	6	5	1	1	1	3	6	6	7	41	Yes
Silver Stream	Riccarton Rd	4	6	6	3	1	2	2		2	6	7	35	Yes
Tokomairiro	West Bh Br	4	12	7	2					3	6	6	36	Yes
Wairuna	Cl-Waip Rd	4			3	6	3	5	5	8	6	6	42	Yes

Table 2.3 Sites that have more than four years ORC water quality sampling (six or more samples per annum) to be removed from Sampling Programme

Site Name	Comment
Clutha River Balclutha	NIWA water quality site sampled 12 times pa.
Frasers Ck at Station Rd	Catchment Programme not SOE
Kakanui at Pringles	McCones to replace Pringles, run the two in conjunction for 1 year
Lindsays Ck us Leith	North Road Bridge (Hydro site) to replace u/s Leith
Lovells Ck at Station Rd	Catchment Programme not SOE
Mill Creek at Hunter Rd	Mill Creek monitored at Fish Trap
Taieri at Halls Bridge	Waipiata (MinFl) site to replace
Taieri at Henley Ferry	Tidal site. Estuary monitoring to replace.
Taieri at Middlemarch	Sutton (MinFl) site to replace
Taieri at Outram	NIWA water quality site sampled 12 times pa. Retain as contact recreation site.
Tokomairiro at Tokoiti	Milton STW resource consent requires downstream water quality monitoring. Estuary monitoring to replace.
Welcome Creek upstream	Lower site only to be sampled on a 3 yr rolling programme.

2.2 Mean Annual Low Flow (MALF)

The core river sites have been split into two major categories:

- Those with a MALF of less than 1000 Ls
- Those with a MALF of more than 1000Ls.

A MALF of more than 1000Ls limits the possibilities for macroinvertebrate, fish and periphyton monitoring, however in times of drought, flow at some sites (with a MALF>1000Ls) may fall to a point which will enable fish, algal and macroinvertebrate monitoring to be undertaken. These sites are referred to as 'drought sites'.

2.2.1 Core Sites with a MALF of <1000 litres/second

Table 2.4 lists core sites with a MALF of less than 1000 litres/second. The majority of sites are linked to established hydrological sites, or proposed hydrological sites (P) associated with minimum flow sites. The sites are shown in Figure 2.2.

Table 2.4 Core Sites: MALF<1000Ls (water quality, fish, macroinvertebrates, algae)

				Sched.	Policy	Policy		NIWA
			Stream	2A	7.6.1	7.6.2	Hydro	WQ
CSOFGL	River	Site	Order	MinFl	CR	MCI	Site	Site
CD/H/HS/T	Cardrona	Mt Barker	5				///	
CW/L/SS/P	Catlins	Houipapa	4				///	
CD/M/HS/P	Fraser River	Marshall Rd	5					
CD/L/HS/P	Heriot Burn	Parkhill K Rd	5		///			
CD/L/SS/U	Kaikorai	Brighton Rd	3		///	///		
CD/H/SS/P	Kakanui	Clifton Falls	6	///			///	
CD/L/AI/P	Kakanui	McCones	6	///			///	
CD/L/AI/P	Kakanui	Pringles*	6	///			///	
CD/H/HS/P	Kauru	Ewings	5				///	
CD/H/HS/P	Lindis	Ardgour Rd	6	/// P			///	
CD/L/VB/U	Lindsays Ck	North Rd Br	3	///			///	
CW/M/HS/T	Luggate Ck	Luggate Ck Br	5	/// P				
CD/H/HS/P	Mill Creek	Fish Trap	4	///	///	///	///	
CD/L/AI/P	Owhiro	Burns St	4				/// ***	
CD/H/HS/P	Shag	Craig Rd	5	///			///	
CD/L/AI/P	Shag	Goodwood	2	///			G	
CD/H/HS/P	Shag	Grange*	5				///	
CD/L/HS/P	Silver Strm	Riccarton Rd	4				///	
CD/H/HS/P	Sutton Strm	SH87	4					DN2
CD/L/HS/P	Tokomairiro	West Br Br	4		///	///	///	
CD/L/SS/P	Trotters Ck	Mathesons	3	/// P			G	
CD/H/HS/P	Waianakarua	Browns Pump	5	/// P			///	
CD/L/SS/P	Waiareka	Teschmakers	5	/// P **		///	G	
CD/H/HS/P	Waikouaiti	Orbells	5					
CD/L/SS/P	Waipahi	Waipahi	5				///	
CD/Lk/HS/T	Waipori	Falls Reserve	5				///	
CD/L/HS/P	Waitahuna	Tweeds Br	5	///			///	
CD/L/SS/P	Waiwera	us Clutha	4	/// P	///		G	
CW/L/VB/U	Wof Leith	Dundas Street	4	///	///	///	///	
DRAIN								
CD/L/AI/P	Main Drain	Waipori P.S.±±	4				///	
KEY * =One year only, ** = u/s at Taipo Road, *** us of Taieri , ±± only to be taken when pumping P = Proposed G = Gauging Station								

2.2.2 Secondary Sites with a MALF of < 1000 litres/second

Table 2.5 lists sites at which water quality is to be monitored on a three year rolling programme. The annual split is broadly lower Clutha, Upper Clutha and Taieri and is illustrated in Figure 2.3.

Table 2.5 Secondary Sites: MALF<1000 Ls (water quality at all sites, macroinvertebrates and periphyton at selected sites)

					Sched. 2A	Policy 7.6.1 CR	Policy 7.6.2 MCI	2005 Bio Site	Hydro Site
CSOFGL	River	Site	Order	Year	MinFl				
CW/M/HS/T	Arrow	Morven F Rd	4	2					
CD/H/HS/T	Bannock Bn	u/s L Dunstan	4	1					
CD/M/HS/T	Bannock Bn	Hawksburn	4	1					
CD/H/HS/P	Bengerburn	SH8	5	3					
CD/L/HS/P	Careys Creek	SH1	4	3					
CD/L/HS/P	Contour Ch	Hen-Ber Rd	4	3					
CD/L/AI/P	Crookston B	Kel-Tap Rd	5	1		///			
CD/H/HS/P	Deep Stream	SH87	5	2					///
CD/M/HS/T	Dunstan Ck	Beattie Rd	5	1					///
CD/H/AI/P	Gimmerburn	Wilson Rd	5	3					
CD/Lk/HS/P	Hayes Creek	SH6	4	2					
CD/H/HS/P	Ida Burn	Auripo Rd	6	1					
CD/H/HS/T	Ida Burn	SH85	5	1					
CD/L/SS/P	Kaihiku	Clifton	4	3			///	///	
CD/L/SS/P	Kaihiku	Hillfoot	4	3				///	
CD/L/VB/U	Kaikorai	Townleys Rd	4	3				///	
CD/H/HS/P	Kye Burn	SH 85	3	3				///	
CD/H/HS/P	Lee Stream	SH87	5	2					
CD/H/HS/T	Manuherikia	Blkstn Hill	5	1				///	
CD/H/HS/P	Minzionburn	Mil-Flat Rd	4	2					
CD/H/HS/P	Nenthorn	Mt Stoker Rd	5	3					///
CW/M/HS/T	Nevis	Wentworth	6	2					///
CW/L/SS/P	Owaka	Purekireka	4	2			///		
CD/L/AI/P	Pig Burn	d/s O'Neill Rd	4	3					
CD/H/HS/P	Pool Burn	Auripo Rd	6	1					
CD/H/HS/P	Sheepwash Ck	Mt Stoker Rd	4	3					
CD/L/HS/IF	Silver Stm	3 Mile Hill	4	3				///	
CD/H/HS/P	Sow Burn	u/s Taieri	6	3					
CD/H/HS/P	Teviot	Roxburgh E	6	2					
CD/H/HS/P	3 O'Clock Stm	Hindon	4	3					
CD/H/HS/P	Tima Burn	MF-Rox Rd	4	2					
CW/L/SS/P	Tahokopa	Tahokopa	4	2					
CD/L/HS/P	Tokomairiro	Lisnatunny	4	2		///	///	///	
CD/L/HS/P	Tuapeka	Mouth	5	2					
CD/L/SS/P	Waikoikoi	Bailey Br	4	1					
CW/L/SS/P	Waipahi	Cairns Peak	2	1				///	
CD/L/HS/P	Wairuna	Cly-Wai. Rd	5	3			///	///	
CD/L/VB/P	Waitati	Mt. Cargill Rd	4	3					
CD/L/AI/P	Welcome Ck	Lower	2	3					

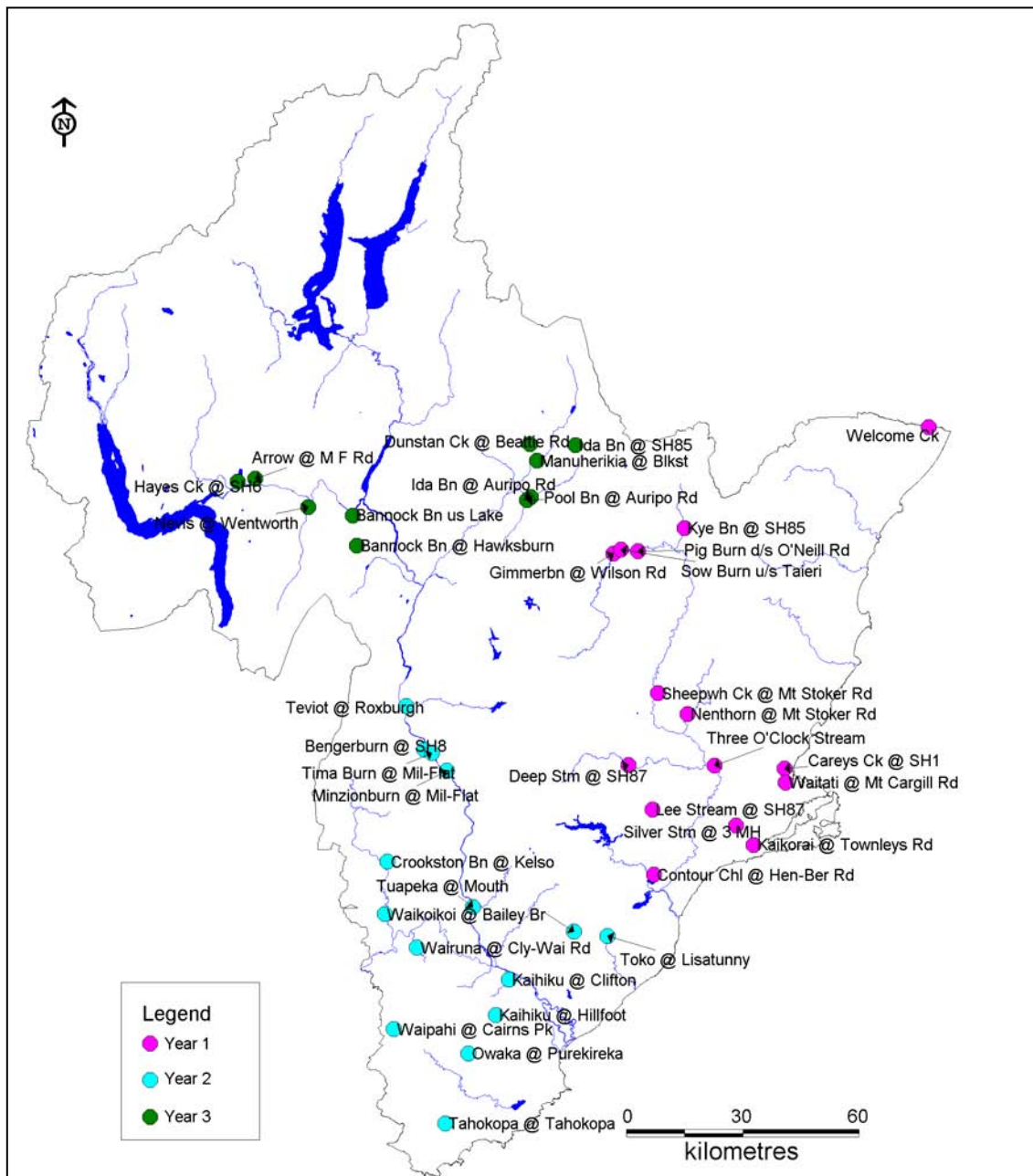


Figure 2.3 Secondary sampling sites. Sites sampled on a three year rolling programme, water quality at all sites, some sites to include biological sampling.

2.3 Core Sites with a MALF of > 1000 litres/second

Table 2.6 lists core sites with a MALF of more than 1000 litres/second at which water quality monitoring will be undertaken. The list includes NIWA water quality sites, water quality data from which will be reported to the Otago Regional Council on an annual basis. Table 2.7 details sites at which, during drought periods, depending on actual flow, biomonitoring may be able to be undertaken. These sites are shown in Figure 2.4.

Table 2.6 Core Sites: MALF>1000Ls (water quality only)

				Sched.	Policy	Policy		NIWA
				2A	7.6.1	7.6.2	Hydro	WQ
CSOFGL	River	Site	Order	MinFl	CR	MCI	Site	Site
CD/L/HS/P	Clutha	Balclutha	8				///	DN4
CD/L/AI/P	Clutha	Luggate Br	7					AX1
CD/L/HS/P	Clutha	Millers Flat	8					AX4
CX/H/HS/P	Dart	Hillocks	6				///	
CX/Lk/HS/T	Hawea	Camphill Br	6				///	
CD/H/AI/P	Kawarau	Chards Rd	7				///	AX2
CD/H/HS/T	Lindis	Lindis Peak	6				///	
CD/H/HS/P	Manuherikia	Galloway	7	/// P			///	
CD/H/HS/P	Manuherikia	Ophir	7	///			///	
CX/GM/HS/T	Matukituki	W Wanaka	6				///	
CD/L/HS/P	Pomahaka	Burkes Fd	6	/// P			///	
CD/H/HS/P	Pomahaka	Glenken	6	/// P			///	
CW/M/HS/T	Shotover	Bowens Pk	6				///	AX3
CD/H/HS/P	Taieri	Allanton Br	6		///	///	///	
CD/H/HS/T	Taieri	Linnburn RR	5					
CD/H/HS/P	Taieri	Outram	6	///			///	DN3
CD/H/HS/T	Taieri	Stonehenge	5	/// *				
CD/H/HS/P	Taieri	Sutton	6	///			///	
CD/H/HS/P	Taieri	Tiroiti	6	/// P			///	DN1
CD/H/HS/P	Taieri	Waipiata	6	///			///	

KEY: P = proposed minimum flow site *at Paerau

Table 2.7 Drought Sites: MALF >1000L/s (fish, macroinvertebrates, algae)

				Sched.	Policy	Policy		NIWA
				2A	7.6.1	7.6.2	Hydro	WQ
				MinFl	CR	MCI	Site	Site
CSOFGL	River	Site	Order					
CD/H/HS/P	Manuherikia	Galloway	7	/// P			///	
CD/H/HS/P	Manuherikia	Ophir	7	///			///	
CD/H/HS/P	Pomahaka	Glenken	6	/// P			///	
CD/H/HS/P	Taieri	Allanton	6	///	///	///	///	
CD/H/HS/P	Taieri	Tiroiti	6	/// P			///	DN1
CD/H/HS/P	Taieri	Waipiata	6	///			///	
CD/H/HS/T	Taieri	Linnburn RR	5					
CD/H/HS/T	Taieri	Paerau	5	///				

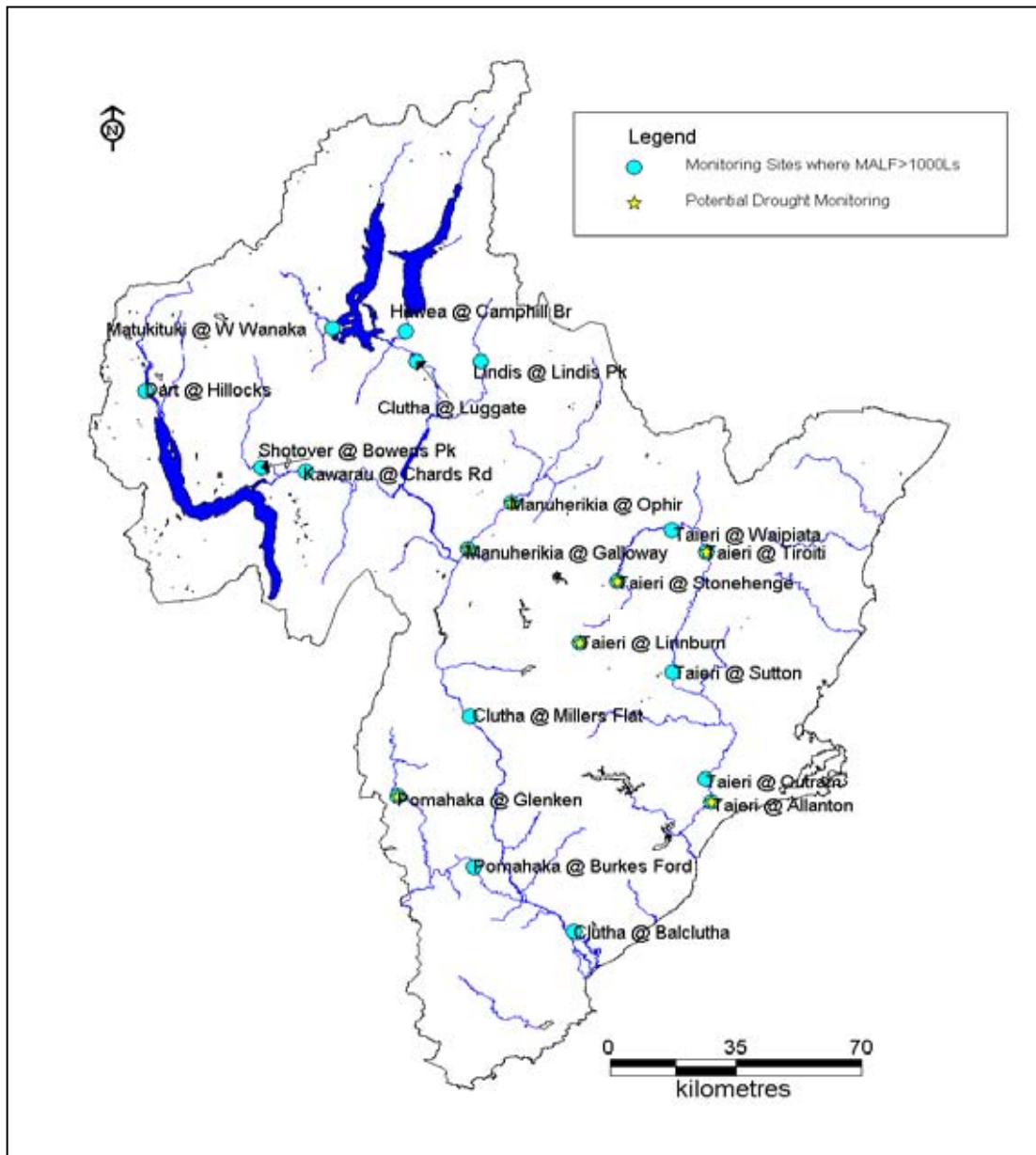


Figure 2.4 Core water quality monitoring sites where MALF > 1000 Ls. In drought years there is the possibility of biological monitoring at sites marked with a star.

3. Core Lake Monitoring Sites

Table 3.1 details lake sites where water quality monitoring is to be undertaken.

A monthly trophic level monitoring programme has already commenced in Lakes Hayes, Onslow, Johnson, Wakatipu and Wanaka. Three additional monitoring stations are located in Lakes Wakatipu and Wanaka for the purpose of trophic lake monitoring.

Table 3.1 Core Lake Sites (water quality only)

				Trophic	Policy	
				Level	7.6.1	Hydro
CSOFGL	River	Site	Order		CR	Site
CD/H/HS/P	Lake Dunstan	Deadmans Point	4			
CX/Lk/HS/T	Lake Hawea	Outlet	6			///
CD/H/HS/P	Lake Hayes	Surface	4	///	///	
CD/Lk/HS/S	Lake Johnson	Surface	2	///		
CD/H/HS/T/HO	Lake Onslow	Boat Ramp	5	///		
CD/L/HS/P	Lake Tuakitoto	Outlet	4			///
CD/Lk/HS/P	Lake Waihola	Jetty	5			
CD/L/AI/P	Lake Waipori	SE Corner	4			
CX/Lk/HS/T	Lake Wakatipu	Outlet at Recorder	7	///		///
CD/L/AI/T	Lake Wanaka	Outlet	7	///		

4. Core Estuary Sites

Table 4.1 details estuaries to be monitored for water quality (over the low tide period).

Table 4.1 Core Estuary Sites. Each estuary sampled twice per annum, over a low tide period (6 hours)

CSOFGL	River	Site	Order	Comment
CW/L/SS/P	Catlins	Hinahina	4	E
CD/L/SS/U	Kaikorai	Estuary	4	E
CD/H/HS/P	Kakanui	Kakanui Bridge	6	E
CD/H/HS/P	Shag	Bushey Park	5	E
CD/H/HS/P	Taieri	Taieri Mouth Br	6	E
CD/L/SS/P	Tokomairio	Tokomairiro Mouth	6	E
CD/H/HS/P	Waikouaiti	Railway Bridge	5	E

5. Seasonal Contact Recreation Sites

Table 5.1 details sites to be monitored for contact recreation purposes over the summer period.

Table 5.1 Seasonal contact recreation monitoring sites, sampled monthly (M) or weekly (W) between the beginning of December and the end of March.

CSOFGL	River	Site	Order	Category
CD/H/SS/P	Kakanui	Clifton Falls (W)	5	ORC CR
CD/H/HS/P	Taieri	Outram (W)	6	ORC CR
	Pacific Ocean	Campells Bay (W)		ORC CR
	Otago Harbour	Macandrews Bay (W)		ORC CR
	Pacific Ocean	Kaka Point (W)		ORC CR
CD/H/HS/P	Manuherikia	Galloway (M)	7	ORC CR
CD/H/HS/P	Taieri	Waipiata (M)	6	ORC CR
CD/H/HS/P	Kakanui	Kakanui Bridge (M)	5	ORC CR
CD/H/HS/P	Waikouaiti	Bucklands (M)	5	ORC CR
CD/Lk/HS/P	Lake Waihola	Jetty (M)	5	ORC CR
CD/H/HS/P	Pomahaka	Glenken (M)	6	ORC CR
CD/H/HS/P	Lake Dunstan	Deadmans Point (M)	4	ORC CR
CD/H/HS/P	Lake Hayes	Surface (M)	4	ORC CR

6. Biomonitoring Sites

Table 6.1 details the 2005 biomonitoring sites and the number of times the sites have been monitored since 2001. The last column shows whether it is proposed to retain the site. Table 6.2 details the proposed sites where biomonitoring is to be undertaken. Figure 6.1 shows the locations of the sites.

Table 6.1 Historical biological monitoring

CSOFGL	River	Site	Order	Times Sampled	Comment
CD/L/HS/EF	Akatore Ck	Taieri Beach Road	5	1	No
CD/H/HS/T	Cardrona	Mt Barker	5	4	Yes
CW/L/SS/P	Catlins	Houipapa	4	4	Yes
CD/M/HS/P	Fraser	Marshall Road	5	2	Yes
CD/L/HS/P	Heriot Burn	Parkhill/K Rd	5	4	Yes
CD/H/HS/P	Heriot Burn	SH90	4	4	No - CP complete
CD/L/HS/P	Kaihiku	Hillfoot	1	4	Yes
CD/L/SS/P	Kaihiku	Clifton	5	4	Yes
CD/L/SS/U	Kaikorai	Brighton Rd	3	2	Yes
CD/L/VB/U	Kaikorai	Townley Rd	3	2	Yes
CD/H/SS/P	Kakanui	Clifton Falls	6	4	Yes
CD/H/HS/P	Kakanui	Pringles	6	6	No - Replace with McCones
CD/H/HS/P	Kye Burn	SH 85	5	2	Yes
CD/H/HS/P	Lee Stream	SH87	5	0	New Site
CD/H/HS/T	Lindis	Lindis Peak	6	2	No - replace with Argdour Rd
CD/L/VB/U	Lindsay Ck	u/s Leith confluence	3	3	No - replace with North Rd Br
CW/M/HS/T	Luggate	Luggate Ck Br	5	0	New Site
CD/H/HS/T	Manuherikia	Blackstone Hill	5	2	Yes
CD/H/HS/P	Manuherikia	Galloway	7	0	No - except drought years
CD/H/HS/P	Mill Creek	Fish Trap	4	4	Yes
CD/L/AI/U	Owhiro	Burns St.	3	2	Yes
CD/L/HS/P	Pomahaka	Burkes Ford	6	4	No - MALF>1000Ls
CD/H/HS/P	Pomahaka	Glenken	6	6	No- except drought years
CD/L/AI/P	Shag	Goodwood Pump	5	3	Yes
CD/H/HS/P	Shag	Grange	5	4	Yes
CD/L/HS/IF	Silver Stm	3 M H Rd	4	2	Yes
CD/L/HS/P	Silver Stm	Riccarton Rd	4	2	Yes
CD/H/HS/P	Sutton	Old Dunstan Rd	4	2	Yes
CD/H/HS/P	Taieri	Allanton Bridge	6	4	No - except drought years
CD/H/HS/P	Taieri	Middlemarch	6	4	No - MALF>1000Ls
CD/H/HS/P	Taieri	Outram	6	4	No - MALF>1000Ls
CD/H/HS/T	Taieri	Stonehenge	6	5	No - MALF>1000Ls
CD/H/HS/P	Taieri	Waipiata	6	3	No - except drought years
CD/L/HS/P	Tokomairiro	Lisnatunny	4	3	Yes
CD/L/HS/P	Tokomairiro	West Branch Bridge	4	3	Yes
CD/L/SS/P	Trotters Ck	Mathesons	3	0	New Site
CD/L/HS/P	Tuapeka	Tuapeka Mouth	5	3	Yes
CD/H/HS/P	Waianakarua	N Br SH1	5	2	No - replace with Browns Pump
CD/L/SS/P	Waiareka	Teschmakers	5	2	Yes

CSOFGL	River	Site	Order	Times Sampled	Comment
CD/H/HS/P	Waikouaiti	Orbells Crossing	5	2	Yes
CW/L/SS/P	Waipahi	Cairns Peak	1	2	Yes
CD/L/SS/P	Waipahi	Waipahi	5	4	Yes
CD/Lk/HS/T	Waipori	Falls Reserve	5	1	Yes
CD/L/HS/P	Wairuna	C-Waip Rd	5	4	Yes
CD/L/SS/P	Waitahuna	Tweeds Bridge	5	0	New Site
CD/L/SS/P	Waiwera	Telford Rd, Clifton	5	2	No - replace with 100m us Clutha
CW/L/VB/U	W of Leith	Dundas Street	4	3	Yes

Table 6.2 Proposed Biological Monitoring Sites

					Sched.	Policy	Policy		NIWA
					2A	7.6.1	7.6.2	Hydro	WQ
CSOFGL	River	Site	Order	Year	MinFl	CR	MCI	Site	Site
CD/H/HS/T	Cardrona	Mt Barker	5	A				///	
CW/L/SS/P	Catlins	Houipapa	4	A				///	
CD/M/HS/P	Fraser River	Marshall Rd	5	A					
CD/L/HS/P	Heriot Burn	Park-Kelso Rd	5	A		///			
CD/L/SS/P	Kaihiku	Clifton	4	2				///	
CD/L/SS/P	Kaihiku	Hillfoot	4	2				///	
CD/L/VB/U	Kaikorai	Townleys Rd	4	1				///	
CD/L/SS/U	Kaikorai	Brighton Rd	3	A		///	///		
CD/H/SS/P	Kakanui	Clifton Falls	6	A	///			///	
CD/L/AI/P	Kakanui	McCones	6	A	///			///	
CD/H/HS/P	Kye Burn	SH 85	3	1				///	
CD/H/HS/P	Lee Stm	SH87	5	1					
CD/H/HS/P	Lindis	Ardgour Rd	6	A	/// P			///	
CD/L/VB/U	Lindsays Ck	North Rd Br	3	A				///	
CW/M/HS/T	Luggate Ck	Luggate Ck Br	5	A	/// P			G	
CD/H/HS/T	Manuherikia	Blackstone	5	2				///	
CD/H/HS/P	Manuherikia	Galloway	7	D	/// P			///	
CD/H/HS/P	Manuherikia	Ophir	7	D	///			///	
CD/H/HS/P	Mill Creek	Fish Trap	4	A	///	///	///	///	
CW/L/SS/P	Owaka	Purekireka	4	2				///	
CD/L/AI/P	Owhiro	Burns St	4	A				///	
CD/H/HS/P	Pomahaka	Glenken	6	D	/// P			///	
CD/H/HS/P	Shag	Craig Rd	5	A	///			///	
CD/L/AI/P	Shag	Goodwood	2	A	///			G	
CD/H/HS/P	Shag	Grange	5	A				///	
CD/L/HS/IF	Silver Stm	3 Mile Hill	4	1				///	
CD/L/HS/P	Silver Stm	Riccarton Rd	4	A				///	
CD/H/HS/P	Sutton Stm	SH87	4	A					DN2
CD/H/HS/P	Taieri	Allanton	6	D	///	///	///	///	
CD/H/HS/T	Taieri	Linnburn RR	5	D					
CD/H/HS/T	Taieri	Paerau	5	D	///				
CD/H/HS/P	Taieri	Tiroiti	6	D	/// P			///	DN1
CD/H/HS/P	Taieri	Waipiata	6	D	///			///	
CD/L/HS/P	Tokomairiro	Lisnatunny	4	2			///	///	

					Sched.	Policy	Policy		NIWA
					2A	7.6.1	7.6.2	Hydro	WQ
CD/L/HS/P	Tokomairiro	W Branch Br	4	2			///	///	
CD/L/SS/P	Trotters Ck	Mathesons	3	A	/// P			G	
CW/L/VB/U	W of Leith	Dundas Street	4	A	///	///	///	///	
CD/H/HS/P	Waianakarua	Browns Pump	5	A	/// P			///	
CD/L/SS/P	Waiaureka	Teschmakers	5	A	/// P		///	///	
CD/H/HS/P	Waikouaiti	Orbells	5	A				///	
CD/L/SS/P	Waipahi	Waipahi	5	A				///	
CW/L/SS/P	Waipahi	Cairns Peak	2	2				///	
CD/Lk/HS/T	Waipori	Falls Reserve	5	A				///	
CD/L/HS/P	Wairuna	Cly-Wai. Rd	5	2				///	
CD/L/HS/P	Waitahuna	Tweeds Bridge	5	A	///			///	
CD/L/SS/P	Waiwera	us Clutha	4	A	/// P	///		G	

Key: D = Drought Year Monitoring, A = Annual Monitoring, 1,2,3 = Year of Rolling Programme Monitoring
P = Proposed Minimum Flow Site, G = Gauging Station

7. Financial Implications

Table 7.1 details the cost of the current SOE monitoring programme compared to the proposed SOE monitoring programme. The table includes the total cost of biological monitoring and the laboratory cost of the water quality component of the SOE programme. There is a substantial difference (approximately 25%) between the two programmes, achieved purely through site rationalisation and the utilisation of sites monitored by NIWA.

Regional Services staff time is not included in the table, as this service is provided on an annual contract basis, and the fishery component of the proposed monitoring has not been included in the table as this is already accounted for in water resource assessments undertaken as a component of minimum flow and surveys.

Table 7.1 Cost of proposed SOE sampling programme. Water quality monitoring details laboratory costs only, biological monitoring details total macroinvertebrate and periphyton costs.

	Cost Per	Annual Cost	Proposed Cost
	Per Site	2005/6	2006/7
<i>SOE Biological Monitoring</i>			
Macroinvertebrate and Periphyton Collection	150	8700	3900
Macroinvertebrate Processing	85	4930	2210
Macroinvertebrate Reporting		1200	1200
Periphyton Processing	65	3770	1690
Periphyton Reporting		800	800
Secondary Sites (Macro./Periphyton - 4 sites pa)			1800
Drought Sites (Macro/Periphyton - 8 sites)			1000
<i>Total Cost of Biological Monitoring</i>		<i>19400</i>	<i>12200</i>
<i>SOE Water Quality Monitoring</i>			
Water Quality Sampling		40692	
Core Sites < 1000 Ls			13020
Core Sites > 1000 Ls			6510
Secondary Sites			6510
Lake			5238
Estuary			1281
Seasonal Contact Recreation		1632	1632
<i>Total Cost of Water Quality Monitoring</i>		<i>42324</i>	<i>34191</i>
Total Cost		61724	46391

8. Conclusions and Recommendations

The review has brought together all the disparate elements of the surface water monitoring programme, specifically:

1. Sites requiring monitoring under the Regional Plan: Water (Schedule 2A minimum flow sites, sites identified under polices 7.6.1 and 7.6.2) have been identified and included in the core ORC SOE monitoring programme.
2. The rationalisation of the SOE programme has met a requirement for more efficient and targeted monitoring.
3. A MALF of 1000 litres second has been determined as the cut off flow for biological monitoring. (Other than at eight sites in drought conditions).
4. Biological, water quality and hydrological monitoring have been coordinated to the same location in a river.
5. Eight sites that NIWA monitors as part of its water quality network data have been included in the ORC SOE programme, and ORC will purchase the data annually.
6. A three year rolling programme for secondary sites has been recommended.
7. Estuarine water quality monitoring has been included in the core SOE monitoring programme.
8. A core set of seasonal contact recreation sites have been formalised, to include the Taieri at Outram (NIWA water quality site).
9. Catchment programme monitoring (land resources, resource science project monitoring) is separated from core SOE monitoring.

Appendix 1

SITE NAME	CORE SITE	BIO SITE	COMMENT
Arrow River @ Morven Ferry Rd			Tributary of the Kawarau River, located in developing residential area. Supports trout and provides habitat for fish spawning and juvenile fish.
Bannockburn Creek @ Hawksdun Station			Reference site for Bannockburn us Lake Dunstan. Provides habitat for fish spawning and juvenile fish. Trout.
Bannockburn Creek u/s Lake Dunstan			Located in developing viticulture/land area. Provides habitat for fish spawning and juvenile fish. Trout.
Benger Burn @ SH8			Located in fruit growing area. Provides habitat for fish spawning and supports rare indigenous fish. Significant habitat for koaro.
Cardrona River @ The Larches/Mt. Barker	✓	✓	Reference/high quality site that is also subject to mining discharges. Provides significant habitat for fish spawning and juvenile fish. Supports rare indigenous fish species – significant habitat for flathead galaxiid. Trout.
Careys Stream @ Jones Road bridge crossing			Tributary of Blueskin Bay, reference/high quality site but may show periodic impact from forestry activity. Provides habitat for fish spawning and juvenile fish, including significant habitat for koaro and banded kokopu. Supports a significant range of indigenous fish species, including some species threatened with extinction.
Catlins River @ Catlins Valley Road, Houipapa		✓	Reference/high quality site with high ecological and scenic values. Provides significant habitat for fish spawning and juvenile fish. Supports a range of indigenous fish and invertebrates, including some rare fish – provides significant habitat for roundhead galaxiid and giant and banded kokopu. Significant presence of trout.
Clutha @ Luggate Bridge	✓		NIWA SITE. Upstream of hydro electric development. Some catchment development.
Clutha River @ Millers Flat	✓		NIWA SITE. Could act as a reference site for the mid reaches of the Clutha River/Mata-Au although water quality is not likely to be any different from the Lake Dunstan site.
Clutha River u/s Balclutha	✓		NIWA SITE. Downstream of major hydro electric, horticultural, pasture developments. Major recreation values. Provides significant habitat for fish spawning and juvenile fish. Supports a range of indigenous fish species. Significant presence of trout and salmon. Flow recorder site.
Contour Channel @ Henley Berwick Rd			Provides information on the quality of water entering the Waipori River from part of the Taieri Plains.
Crookston Burn @ Kelso			Lower catchment site, impacted by dairy farming. Indicates water quality prior to entry to the Pomahaka River.
Dart @ Hillocks			Reference Site. Significant habitat for fish spawning and juveniles. Habitat for eels, trout and salmon.
Deep Stream @ SH87			High quality tributary with little/no development above 900 m asl. Provides habitat for fish spawning and juvenile fish. Supports rare indigenous fish and invertebrates in places - provides significant habitat for Lower Taieri galaxiid. Trout.
Dunstan Creek u/s SH 85 Beatties Rd			Largest tributary of the Manuherikia River, relatively unimpacted and so serves as a reference site for the Manuherikia Valley and surrounds. Provides habitat for fish spawning and juvenile fish. Significant trout presence.
Fraser River @ Marshall Rd	✓		Tributary of the Clutha River/Mata-Au and a summer swimming site, located amongst an area of expanding viticulture. Affected by flow augmentation. Provides habitat for fish spawning and juvenile fish
Gimmerburn @ Wilson Rd			Large tributary of the Taieri River. Receives irrigation bywash water.
Hawea @ Camphill Bridge	✓		Supports fish spawning and juvenile fish. Trout and salmon abundant.
Hayes Creek @ SH6 (u/s Kawarau Gorge Rd)			Provides information on the quality of water leaving Lake Hayes.
Heriot Burn @ Parkhill Kelso Rd		✓	Lower catchment site, impacted by dairy farming. Indicates water quality prior to entry to the Pomahaka River. Policy 7.6.1.
Heriot Burn @ SH90			Upper catchment site, tributary of the Pomahaka River. Policy 7.6.1
Ida Burn @ Auripo Rd			Tributary of the Manuherikia River, impacted by agricultural bywash. Provides habitat for fish spawning and juvenile fish.
Ida Burn @ SH85			Tributary of the Manuherikia River, reference site for Auripo Road. Provides habitat for fish spawning and juvenile fish.

SITE NAME	CORE SITE	BIO SITE	COMMENT
Kaihiku Stream @ Clifton Rd			Lower catchment site impacted by agriculture, particularly dairy farming.
Kaihiku Stream @ Hillfoot Rd			Upper catchment site. Reference site for Clifton.
Kaikorai Stream @ Brighton Rd (u/s landfill)	✓		Lower catchment site, indicating water quality prior to entry to the Kaikorai Estuary. Policy 7.6.1. Policy 7.6.2
Kaikorai Stream @ Townleys Rd			Mid-upper catchment site. Reference Site for Brighton Road. Policies 7.6.1, 7.6.2
Kakanui River @ Clifton Falls	✓	✓	A mid catchment site with little /no development upstream – a reference site for the Kakanui River. Also significant habitat for long-jawed galaxiid and koaro. Policy 7.6.1. Policy 7.6.2
Kakanui River @ McCones A13	✓	✓	Minimum Flow Site. Lower catchment site, valued river.
Kawarau @ Chards Road			NIWA Site. Little catchment development. Major tourist vlues (and pressures) being downstream of Queenstown and L. Wakatipu. The major tributary of the Clutha River/Mata-Au.
Kye Burn @ SH85		✓	Significant habitat for flathead and roundhead galaxiids. Reference stream for the Upper Taieri River.
Lee Stream @ SH87		✓	Provides habitat for fish spawning and juvenile fish. Trout. Supports some rare indigenous fish species – provides significant habitat for the Lower Taieri galaxiid. Supports some rare indigenous invertebrate species in places.
Lindis River @ Ardgour Road	✓	✓	Minimum Flow Site. High water quality.
Lindis River @ Lindis Peak			High water quality/reference site.
Lindsays Creek @ North Rd Bridge	✓	✓	Significant urban tributary of Water of Leith. Significant presence of salmon and trout.
Luggate Creek @ Luggate Ck Br	✓	✓	Minimum Flow Site. Significant habitat for flathead galaxiid.
Main Drain @ Waipori Pumping Station	✓		Provides information on the quality of drainage water discharged into Lake Waipori from the Western Taieri Plains.
Manuherikia @ Blackstone Hill		✓	Upper catchment reference site.
Manuherikia River @ at Galloway	✓	✓	Minimum Flow Site. Lower catchment site indicating water quality prior to confluence with Clutha River/Mata-Au at Alexandra.
Manuherikia River @ Ophir	✓	✓	Minimum Flow Site. Mid catchment site with reasonable water quality. Supports fish spawning and juvenile fish. Trout abundant.
Matukituki @ West Wanaka	✓		Reference Site. Significant habitat for fish spawning and juveniles. Habitat for eels and trout. Policy 7.6.1
Mill Creek @ Fishtrap	✓	✓	Minimum Flow Site. Provides information on the quality of water entering Lake Hayes. Identified in the Proposed Regional Plan: Water as being in need of enhancement to enable contact recreation. Policy 7.6.1. Policy 7.6.2
Minzion Burn u/s Millers Flat Rd			Tributary of Clutha River/Mata-Au. Sheep farming area.
Nenthorn @ Mt Stoker Rd			Provides habitat for fish spawning and juvenile fish. Supports trout and rare indigenous fish. Significant habitat for flathead galaxiid. Flow recorder site.
Nevis River @ Wentworth	✓		Reference Site. Significant habitat for fish spawning and juveniles. Habitat for eels, trout and indigenous invertebrates.
Owaka @ Purekireka		✓	Provides habitat for fish spawning and juvenile fish, indigenous fish and invertebrate species. Policy 7.6.2
Owhiro Stream @ Burns St	✓	✓	Urban tributary of the lower Taieri River with poor water quality. Supports native fish.
Pig Burn @ O'Neill Rd			Tributary of the upper Taieri River impacted by agriculture. Fish spawning and rearing, trout.
Pomahaka River @ Burkes Ford Rd	✓		Minimum Flow site. Lower catchment site, indicating water quality prior to entry to the Clutha River/Mata-Au. Popular river for fishing.
Pomahaka River @ Glenken (Leithen Glen)	✓	✓	Minimum Flow Site. Mid catchment/reference site. Significant fishery, especially trout. Provides habitat for fish spawning and juvenile fish. Supports a significant range of indigenous invertebrates in places, including some rare species.
Pool Burn @ Auripo Road			Tributary of the Manuherikia River, impacted by agricultural bywash. Provides habitat for fish spawning and juvenile fish.
Shag River @ at Craig Road	✓	✓	Minimum Flow Site. Significant habitat for flathead galaxiid, koaro and lamprey. Trout and eels abundant. Supports a significant range of indigenous invertebrates. Provides habitat for trout spawning.

SITE NAME	CORE SITE	BIO SITE	COMMENT
Shag River @ Goodwood Water Supply Intake	✓	✓	Minimum Flow Site. Lower catchment site, provides information on cumulative effects of landuse/water abstraction. Significant habitat for flathead galaxiid, koaro and lamprey. Trout and eels abundant. Provides habitat for trout and, in the lower reaches, inanga spawning.
Shag River @ SH85, the Grange	✓	✓	Significant habitat for flathead galaxiid, koaro and lamprey. Trout and eels abundant. Supports a significant range of indigenous invertebrates. Provides habitat for trout spawning.
Sheepwash Creek @ Mt Stoker Rd			Little information available.
Shotover @ Bowens Peak	✓		NIWA SITE. Little catchment development. Major tributary of Kawarau R. Subject to tourist pressure, past and current alluvial gold mining.
Silver Stream @ Riccarton Rd	✓	✓	Lower reach of significant tributary of the Lower Taieri River that provides significant habitat for koaro and habitat for fish spawning and juvenile fish.
Silver Stream @ Three Mile Hill		✓	Upper reach of significant tributary of the Lower Taieri River that provides significant habitat for koaro and habitat for fish spawning and juvenile fish. Supports some rare indigenous invertebrate and fish species.
Sow Burn @ u/s Taieri			High quality tributary of the upper Taieri River, affected by irrigation bywash. Supports fish spawning and rearing, trout and salmon but affected by water abstraction.
Sutton Stream @ Old Dunstan Rd	✓	✓	NIWA SITE. Tussock catchment typical of region. Largely undeveloped. Typical input to Taieri. Locally important waterway, extensive agriculture in lower reaches. Provides habitat for fish spawning and juvenile fish.
Tahokopa @ Tahokopa			Forested catchments that are largely undisturbed. Significant habitat for fish spawning and juvenile fish, and also support a range of indigenous fish species. Significant habitat for flathead galaxiid. Trout are abundant.
Taieri River @ Sutton	✓		Minimum Flow Site. Mid catchment site. Assists with tracking changes in water quality between the upper and lower Taieri. Supports rare indigenous fish species, including significant habitat for flathead galaxiid. Trout and salmon. Habitat for fish spawning and fish juveniles.
Taieri River @ Allanton	✓	✓	Lower Taieri, below confluence of several agricultural drains, the Silverstream, and Owhiro Stream. Popular recreational fishing spot - supports a significant range of indigenous fish species and significant presence of trout and salmon. Policy 7.6.1. Policy 7.6.2.
Taieri River @ Linnburn Runs Road	✓	✓	Upper reference site for the Taieri River. Important recreational fishing spot. Significant habitat for flathead galaxiid. Supports a significant range of indigenous invertebrates, including some rare species.
Taieri River @ Outram	✓		NIWA SITE. Minimum Flow Site. Downstream of major catchment developments (pasture). Major recreational river (bathing, fishing, rafting). Acts as the reference site for the Lower Taieri. Supports a significant range of indigenous fish species. Significant presence of trout and salmon.
Taieri River @ Stonehenge	✓	✓	Upper reference site for the Taieri River. Important recreational fishing spot. Significant habitat for flathead galaxiid. Supports a significant range of indigenous invertebrates, including some rare species.
Taieri River @ Tiroiti	✓		NIWA SITE. Minimum Flow Site. River site at exit to Maniototo Plains (extensive pasture irrigation in an otherwise dry area). Fishing values or regional importance. Receives irrigation bywash.
Taieri River @ Waipiata	✓	✓	Minimum Flow Site. Tracks changes in water quality as a result of recent agricultural intensification in the upper Taieri.
Teviot River @ Roxburgh East			Significant tributary of the Clutha River/Mata-Au and provides indication of water quality from Lake Onslow. Supports trout and provides habitat for fish spawning and juvenile fish.
Three O'Clock Stream @ Hindon			Supports a significant range of indigenous fish species, including some species threatened with extinction. Significant habitat for flathead galaxiid and koaro, including general fish spawning and juvenile fish. Trout.
Tima Burn @ Millers Flat			Supports rare indigenous fish. Significant habitat for koaro.
Tokomairiro River @ Lisatunny		✓	Mid catchment site providing information on the health of the river above Milton township. Lower reaches provide habitat for fish spawning and juvenile fish. Trout. Policy 7.6.1. Policy 7.6.2
Tokomairiro River @ West Branch Bridge		✓	Mid catchment site providing information on the health of the river above Milton township. Lower reaches provide habitat for fish spawning and juvenile fish. Trout. Policy 7.6.1. Policy 7.6.2
Trotters Creek @ Mathesons	✓	✓	Minimum Flow Site. Significant habitat for giant kokopu and koaro. Significant habitat for lamprey.
Tuapeka River @ Tuapeka Mouth			Lower catchment site, indicating water quality prior to entry to the Clutha River/Mata-Au. Provides habitat for fish spawning and juvenile fish. Trout. Upper reaches supports a significant range of indigenous invertebrates.

SITE NAME	CORE SITE	BIO SITE	COMMENT
Waianakarua River @ Browns Pump	✓	✓	Minimum Flow Site. Lower catchment site positioned to provide water quality information below the confluence of the north and south branches. A relatively clean river that supports a significant range of indigenous fish species, including some rare species.
Waiareka Creek @ Teschmakers	✓	✓	Minimum Flow Site (Taipo Rd). An important agricultural water resource to be supplemented by the Downlands Irrigation Scheme. Policy 7.6.2
Waikoikoi @ Bailey Bridge			Lower catchment site. Provides information on water quality prior to entering the Pomahaka River.
Waikouaiti River @ Orbells Crossing	✓	✓	Lower catchment site (main stem) just above the tidal influence. Provides information on water quality prior to entering the Waikouaiti Estuary. Provides habitat for fish spawning and juvenile fish. Supports indigenous fish species (flathead and hybrid galaxiids, banded kokopu and koaro), including some species threatened with extinction. Significant presence of trout.
Waipahi River @ Cairns Peak		✓	Upper catchment site located in relatively unmodified tussock. Reference site for the lower Waipahi River and other South Otago rivers.
Waipahi River @ Waipahi	✓	✓	Lower catchment site, significant tributary of the Pomahaka River. Provides habitat for fish spawning and juvenile fish. Trout.
Waipori River @ Falls Reserve	✓	✓	Provides information on the quality of water entering Lake Waipori. Popular recreational fishing spot. Provides habitat for fish spawning and juvenile fish. Significant presence of trout. Affected by hydro-influenced flow fluctuations.
Wairuna Stream @ Waipahi-Clydevale Rd		✓	Lower catchment site affected by dairying. Provides information on water quality prior to entry into the Pomahaka River. Policy 7.6.2
Waitahuna River @ Tweeds Bridge	✓	✓	Minimum Flow Site. Tributary of Clutha River/Mata-Au which provides significant habitat for fish spawning and juvenile fish. Supports some rare indigenous fish and invertebrates, including the Waitahuna dusky galaxiid (in the headwaters) and flathead galaxiid. Significant presence of trout.
Waitati River @ Cargill Road bridge crossing			Tributary of Blueksin Bay, impact from sheep farming and dairy farming in the lower reaches as well as water abstraction. Provides habitat for fish spawning (inanga) and juvenile fish. Trout. Supports some rare indigenous fish species.. Provides significant habitat for koaro.
Waiwera River @ 100m us Clutha	✓	✓	Minimum Flow Site. Significant tributary of the Clutha River/Mata-Au located in a catchment that has undergone conversion to dairy farming. Provides habitat for fish spawning and juvenile fish. Supports some rare indigenous fish species (provides significant habitat for roundhead galaxiid) and a significant range of indigenous invertebrate species. Policy 7.6.1.
Water of Leith @ Dundas Street	✓	✓	Minimum Flow Site. Provides information on the quality of water entering Otago Harbour. Significant urban waterway recognised in the Proposed Regional Plan: Water as in need of enhancement for contact recreation. Provides habitat for fish spawning and juvenile fish. Significant presence of salmon and trout. Flow recorder site. Policy 7.6.1. Policy 7.6.2
Welcome Creek			Springfed, the downstream site monitors irrigation bywash water.

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