

Rivers State of the Environment monitoring programme

Annual data report, 2014/15

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1. Introduction

This report summarises the key results from the Rivers State of Environment (RSoE) monitoring programme for the period 1 July 2014 to 30 June 2015 inclusive. The RSoE programme incorporates monthly monitoring of water quality, periphyton cover and sediment deposition at 53 river and stream sites across the Wellington Region. Macrophyte cover is also assessed monthly at selected RSoE sites. In addition, annual assessments of invertebrate community composition, periphyton biomass and habitat quality are conducted at all 53 RSoE sites in summer/autumn.

Note that the suitability of rivers for contact recreation purposes is reported separately under Greater Wellington Regional Council's (GWRC) recreational water quality monitoring programme; for the 2014/15 results, see Keenan et al. (2015). Information on river and stream flows is reported under GWRC's hydrological monitoring programme (see Harkness 2015).

2. Overview of RSoE monitoring programme

River and stream water quality has been routinely monitored in the western part of the Wellington Region since 1987 and in the Wairarapa since 1991. The monitoring programme has continued to evolve since this time with changes made to the location and number of monitoring sites, the range of variables monitored, and the methods of analysis (see Milne and Perrie (2005) and Perrie et al. (2012) for details). However, since September 2003, the RSoE monitoring programme has remained largely unchanged, with only minor changes to the existing suite of monitoring sites and variables.

2.1 Monitoring objectives

The aims of GWRC's Rivers SoE monitoring programme are to:

1. Assist in the detection of spatial and temporal changes in rivers and streams;
2. Contribute to our understanding of freshwater biodiversity in the Wellington Region;
3. Determine the suitability of rivers and streams for designated uses;
4. Provide information to assist in targeted investigations where remediation or mitigation of poor water quality or ecosystem health is desired; and
5. Provide information required to determine the effectiveness of regional plans and policies.

2.2 Monitoring network

Water quality and ecosystem health are currently monitored at 53 river and stream sites (Figure 2.1, Appendix 1). These sites were chosen to represent the major land uses and human activities, and also the natural diversity of rivers and streams, in the Wellington Region.

2.2.1 Changes to the monitoring network

During 2014/15 monitoring ceased at two sites because regular access was considered no longer safe. These sites were Coles Creek Tributary at Lagoon Hill Road (RS54) and Mataikona Tributary at Sugar Loaf Road (RS35) which were last sampled in June 2014 and August 2014, respectively.

2.3 Monitoring variables

2.3.1 Water quality variables

River and stream water quality is assessed at monthly intervals by measuring a range of physico-chemical and microbiological variables: dissolved oxygen, temperature, pH, conductivity, visual clarity, turbidity, suspended solids, faecal indicator bacteria, total organic carbon, and dissolved and total nutrients. Water samples from ten RSoE sites located in urban catchments with likely exposure to heavy metal inputs, or which discharge into sensitive downstream receiving environments (eg, harbours and estuaries), are also analysed for dissolved concentrations of copper and zinc. The full list of variables monitored, together with details of field and analytical methods, is provided in Appendix 2.

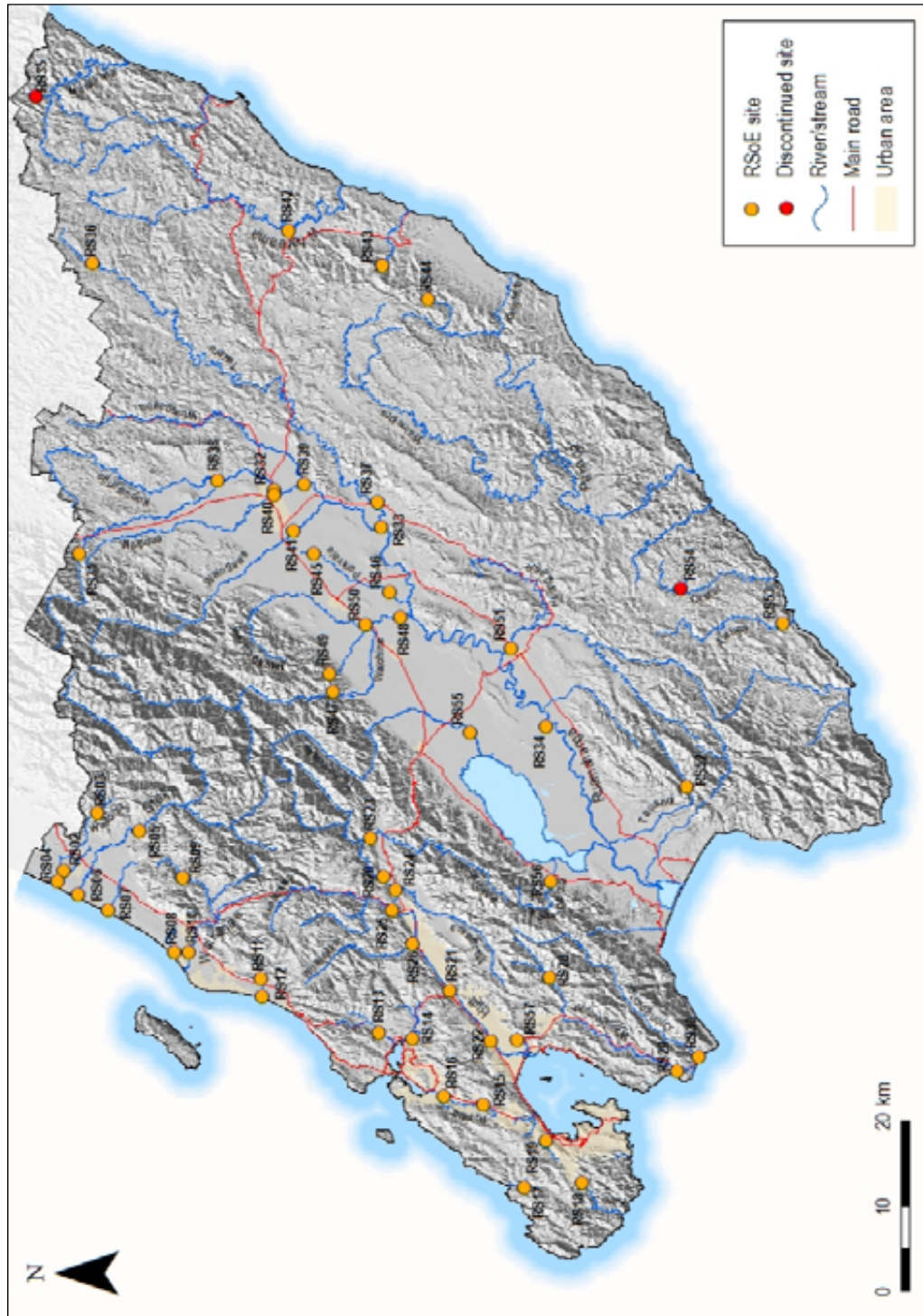


Figure 2.1: RSoE sites monitored over 2014/15

2.3.2 Biological variables

Rivers and streams are also assessed for ecological condition. This involves semi-quantitative assessments of macroinvertebrate communities and periphyton biomass during stable/low flows in summer/autumn. Assessments of periphyton are only undertaken at sites with hard substrates such as cobbles and large gravel (44 in total, see Appendix 1 for RSoE site substrate types). Periphyton cover is also assessed monthly at these sites at the time of water sample collection.

Macrophyte cover is assessed at RSoE sites that are soft-bottomed and hence more likely to support macrophyte communities. Macrophyte cover is also assessed at hard-bottomed sites known to have, at least at times, high macrophyte cover.

Details of current biological monitoring methods are summarised in Appendix 2.

2.3.3 Habitat variables

Habitat assessments are undertaken annually at each RSoE site during summer/early autumn (at the time biological samples are collected). This assessment provides an indication of the condition of the physical habitat and its ability to support stream biota, and incorporates the following variables: fine sediment cover, invertebrate habitat abundance and diversity, fish habitat abundance and diversity, hydraulic heterogeneity, bank stability, channel modification, and riparian buffer width, integrity and shade. Fine sediment cover is also assessed monthly at the time of water sample collection. Details of current habitat assessment methods are summarised in Appendix 2.

2.3.4 Changes to monitoring variables in 2014/15

In 2014/15, there were three changes to the variables monitored:

- Lower analytical detection limits for some nutrients (ammoniacal nitrogen, nitrate nitrogen, nitrite nitrogen and dissolved reactive phosphorus) were implemented from January 2015 onwards (see Table A2.1, Appendix 2) following an initial paired trial of nutrient test methods during 2013/14 (see Heath et al. 2014);
- Periphyton taxonomic identification ceased; and
- Macrophyte channel cloginess was calculated from macrophyte assessments undertaken (see Appendix 2).

2.4 Additional river monitoring during 2014/15

During 2014/15, GWRC (along with several other regional councils) participated in a NIWA-led trial that looked at fostering and supporting community-based monitoring of rivers in New Zealand. This involved community groups and GWRC both sampling water quality (monthly) and macroinvertebrates (biannually) at three sites across the region; two existing RSoE sites (Mangatarere Stream at SH2 and Waikanae River at Greenaway Road) and one new site, Mawaihakona Stream at Hutt Confluence.

A key aim of the project was to compare data collected by community groups and that collected by trained council field staff (GWRC) in order to assess how community group monitoring can be used to increase community engagement and extend the monitoring capacity of regional councils. Additional data collected by GWRC as part of this trial is presented in Appendix 7.

3. Physico-chemical and microbiological water quality

3.1 Approach to analysis

In this section a water quality index is used as a comparative measure to summarise water quality across the Wellington Region, based on physico-chemical and microbiological data collected monthly from July 2014 to June 2015 inclusive (see Appendix 3 for tabulated data). Concentrations of heavy metals (copper and zinc) recorded at selected urban sites are also summarised (Appendix 4). The summary information is typically based on 12 sampling events for all 53 sites. However, sampling at some sites was not always possible due to access issues (eg, during lambing or calving) or safety concerns (eg, high river flows).

During data processing, any water quality variables reported as less than or greater than detection limits were replaced by values one half of the detection limit or the detection limit, respectively (eg, a value of <2 became 1, a value of >400 became 400). The exception is minimum values reported in the tabulated summaries in Appendices 3 and 4 (ie, if a value was reported as <2 the minimum value presented is <2).

3.1.1 Water quality index

A water quality index (WQI), as described by Perrie (2007) and Perrie et al. (2012), is used to facilitate inter-site comparisons of the state of water quality in the region's rivers and streams. The WQI is derived from the *median* values of the following six variables: visual clarity (black disc), dissolved oxygen (% saturation), dissolved reactive phosphorus, ammoniacal nitrogen, nitrite-nitrate nitrogen and *Escherichia coli* (*E. coli*).

The application of the WQI enables water quality at each site to be classified into one of four categories, as follows:

- Excellent: median values for all 6 variables comply with guideline values
- Good: median values for 5 of the 6 variables comply with guideline values, of which dissolved oxygen is one variable that must comply¹
- Fair: median values for 3 or 4 of the 6 variables comply with guideline values, of which dissolved oxygen is one variable that must comply¹
- Poor: median values for <3 of the 6 variables comply with guideline values, or the median dissolved oxygen concentration/value does not comply with the guideline value.

The guidelines used in the WQI assessment are listed in Table 3.1. Refer to Perrie (2007) and Perrie et al. (2012) for further discussion on these guidelines.

¹ If the median dissolved oxygen concentration does not comply with the guideline value, then the WQI grade automatically drops to 'poor'.

Table 3.1: Physico-chemical and microbiological variables and guideline values used in GWRC's WQI

Variable	Guideline value	Reference
Dissolved oxygen (% saturation)	≥80	RMA 1991 Third Schedule
Visual clarity (m)	≥1.6	MfE (1994)
Nitrite-nitrate nitrogen (mg/L)	≤0.444	ANZECC & ARMCANZ (2000)
Ammoniacal nitrogen (mg/L)	≤0.021	ANZECC & ARMCANZ (2000)
Dissolved reactive phosphorus (mg/L)	≤0.010	ANZECC & ARMCANZ (2000)
<i>E. coli</i> (cfu/100mL)	≤100	ANZECC & ARMCANZ (2000)

As outlined in Perrie (2007), the WQI is for comparative purposes rather than an absolute measure of water quality; sites with a grade of 'good', 'fair', or 'poor' are all considered degraded to some degree because the median value of at least one of the six physico-chemical or microbiological variables in the WQI exceeded a guideline value. In addition, as the WQI is based on median values (ie, 50% compliance), sites awarded the same water quality grade may exhibit varying degrees of compliance (from 51 to 100%) with the guideline value. Therefore, to differentiate between 'better' and 'poorer' sites, the sites within each WQI class are ranked based on the number of guideline exceedances for each of the six key variables (eg, a site that exceeded a guideline on 40% of sampling occasions will be ranked lower than a site with the same WQI grade that exceeded the same guideline on 10% of sampling occasions).

3.1.2 Heavy metals

Median heavy metal concentrations are compared against ANZECC (2000) chronic toxicity 'trigger values' (95% level of protection). Because water hardness affects the toxicity of some heavy metals, where a median concentration exceeds the trigger value, site-specific, hardness-modified trigger values are calculated based on recommendations and equations in ANZECC (2000). The median concentrations are then compared against their respective modified trigger value. Because water hardness is not part of the existing suite of variables analysed in the RSoE programme, the median water hardness from monthly monitoring over July 2012 to June 2013 (inclusive) is used as a surrogate of local water hardness conditions (see Morar & Perrie (2013) for hardness information).

3.2 Results

3.2.1 Water quality index

Application of the WQI resulted in the following overall water quality grades for the 53 RSoE sites monitored in the Wellington region over the July 2014 to June 2015 reporting period (Table 3.2; Figure 3.1):

- Excellent: 21 sites (39.6%)
- Good: 6 sites (11.3%)
- Fair: 15 sites (28.3%)
- Poor: 11 sites (20.8%)

Table 3.2: Water Quality Index grades for RSoE sites sampled at monthly intervals over July 2014 to June 2015 inclusive, based on compliance of median dissolved oxygen (DO), visual clarity (clarity), *E. coli*, nitrite-nitrate nitrogen (NNN), ammoniacal nitrogen (Amm. N) and dissolved reactive phosphorus (DRP) values with guideline values

Rank	Site no.	Site name	Guideline compliance (median values)					
			DO	Clarity	<i>E. coli</i>	NNN	Amm. N	DRP
Excellent water quality								
1	RS31	Ruamahanga River at McLays	✓	✓	✓	✓	✓	✓
2	RS20	Hutt River at Te Marua Intake Site	✓	✓	✓	✓	✓	✓
3	RS49	Beef Creek at Headwaters	✓	✓	✓	✓	✓	✓
4	RS05	Otaki River at Pukehinau	✓	✓	✓	✓	✓	✓
5=	RS06	Otaki River at Mouth	✓	✓	✓	✓	✓	✓
	RS25	Akatarawa River at Hutt Confluence	✓	✓	✓	✓	✓	✓
	RS43	Motuwaireka Stream at Headwaters	✓	✓	✓	✓	✓	✓
8	RS52	Tauanui River at Whakatomotomo Rd	✓	✓	✓	✓	✓	✓
9=	RS26	Whakatikei River at Riverstone	✓	✓	✓	✓	✓	✓
	RS47	Waiohine River at Gorge	✓	✓	✓	✓	✓	✓
	RS55	Tauherenikau River at Websters	✓	✓	✓	✓	✓	✓
	RS56	Waiorongomai River at Forest Park	✓	✓	✓	✓	✓	✓
13	RS23	Pakuratahi River 50m Below Farm Creek	✓	✓	✓	✓	✓	✓
14=	RS03	Waitohu Stream at Forest Park	✓	✓	✓	✓	✓	✓
	RS41	Waingawa River at South Rd	✓	✓	✓	✓	✓	✓
16	RS21	Hutt River Opposite Manor Park Golf Club	✓	✓	✓	✓	✓	✓
17	RS10	Waikanae River at Greenaway Rd	✓	✓	✓	✓	✓	✓
18	RS44	Totara Stream at Stronvar	✓	✓	✓	✓	✓	✓
19	RS22	Hutt River at Boulcott	✓	✓	✓	✓	✓	✓
20	RS51	Huangarua River at Ponatahi Bridge	✓	✓	✓	✓	✓	✓
21	RS32	Ruamahanga River at Te Ore Ore	✓	✓	✓	✓	✓	✓
Good water quality								
22	RS28	Wainuiomata River at Manuka Track	✓	✓	✓	✓	✓	x
23	RS30	Orongorongo River at Orongorongo Station	✓	x	✓	✓	✓	✓
24	RS09	Waikanae River at Mangaone Walkway	✓	✓	✓	✓	✓	x
25	RS40	Waipoua River at Colombo Rd Bridge	✓	✓	✓	x	✓	✓
26	RS53	Awhea River at Tora Rd	✓	✓	x	✓	✓	✓
27	RS48	Waiohine River at Bicknells	✓	✓	✓	✓	✓	x
Fair water quality								
28	RS29	Wainuiomata River Upstr of White Bridge	✓	✓	x	✓	✓	x
29=	RS33	Ruamahanga River at Gladstone Bridge	✓	x	✓	✓	✓	x
	RS36	Taueru River at Castlehill	✓	x	x	✓	✓	✓
31	RS42	Whareama River at Gauge	✓	x	x	✓	✓	✓
32	RS14	Pauatahanui Stream at Elmwood Bridge	✓	✓	x	✓	✓	x
33	RS34	Ruamahanga River at Pukio	✓	x	✓	✓	✓	x
34	RS17	Makara Stream at Kennels	✓	✓	x	✓	✓	x
35	RS24	Mangaroa River at Te Marua	✓	x	x	x	✓	✓
36	RS13	Horokiri Stream at Snodgrass	✓	✓	x	x	✓	x
37	RS11	Whareroa Stream at Waterfall Rd	✓	x	x	✓	✓	x
38=	RS19	Kaiwharawhara Stream at Ngaio Gorge	✓	✓	x	x	✓	x
	RS38	Kopuaranga River at Stuarts	✓	✓	x	x	✓	x
40=	RS15	Porirua Stream at Glenside Overhead Cable	✓	✓	x	x	✓	x
	RS18	Karori Stream at Makara Peak	✓	✓	x	x	✓	x
42	RS46	Parkvale Stream at Weir	✓	✓	x	x	✓	x
Poor water quality								
43	RS45	Parkvale tributary at Lowes Reserve	x	✓	✓	x	✓	✓
44	RS37	Taueru River at Gladstone	✓	x	x	x	✓	x
45	RS39	Whangaehu River at 250m from Confluence	✓	x	x	x	✓	x
46	RS16	Porirua Stream at Wall Park	✓	x	x	x	✓	x
47	RS50	Mangatarere Stream at State Highway 2	✓	✓	x	x	x	x
48	RS04	Waitohu Stream at Norfolk Crescent	✓	x	x	✓	x	x
49	RS08	Ngarara Stream at Field Way	x	x	x	✓	✓	x
50	RS57	Waiwhetu Stream at Whites Line East	x	x	x	✓	x	x
51	RS12	Whareroa Stream at QE Park	x	x	x	✓	x	x
52	RS07	Mangaone Stream at Sims Road Bridge	✓	x	x	x	x	x
53	RS02	Mangapouri Stream at Bennetts Rd	✓	x	x	x	x	x

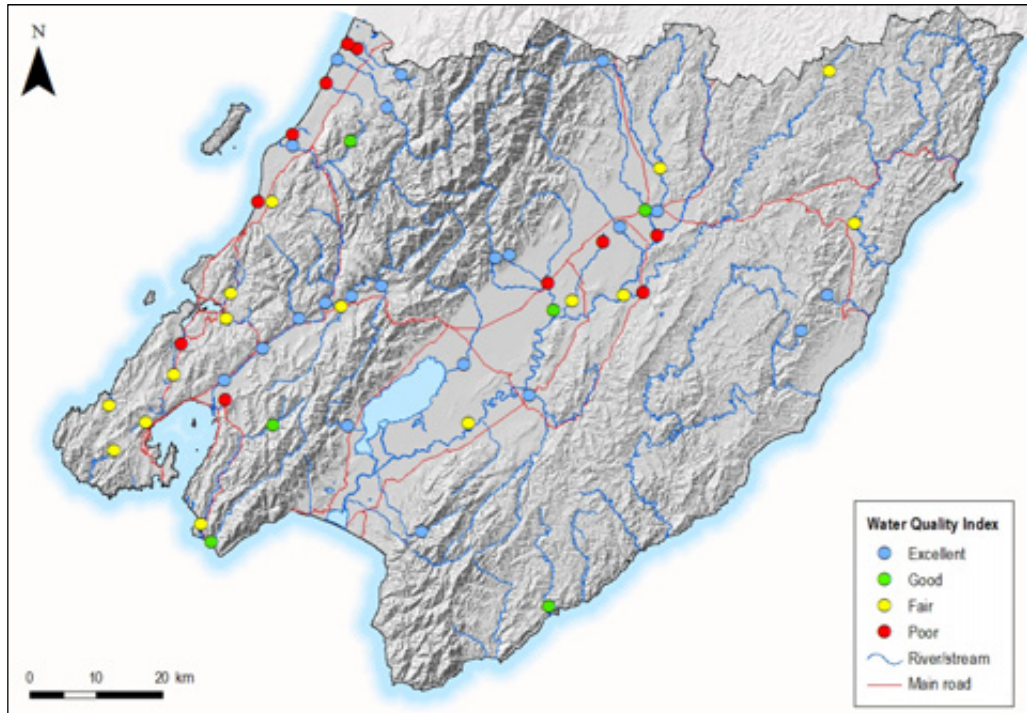


Figure 3.1: Water Quality Index grades for RSoE sites sampled at monthly intervals between July 2014 and June 2015, based on compliance of median dissolved oxygen, visual clarity, nitrite-nitrate nitrogen, ammoniacal nitrogen, dissolved reactive phosphorus and *E. coli* values with guideline values

Seventeen of the 21 RSoE sites graded ‘excellent’ are located on river and stream reaches in catchments with predominantly unmodified indigenous forest cover (refer to Appendix 1 for dominant land cover). These tend to be sites on rivers flowing out of the Aorangi, Tararua and Rimutaka ranges and include the Hutt, Otaki, Tauanui and Waiorongomai rivers, and the upper reaches of the Waitohu Stream and Ruamahanga River. In contrast, RSoE sites graded ‘poor’ are typically located on small rivers or streams draining predominantly pastoral (seven sites) or urban (four sites) catchments. Sites with the poorest water quality during 2014/15 were Mangaone Stream at Sims Road Bridge and Mangapouri Stream at Bennetts Road (Table 3.2).

The water quality variables that most commonly failed to meet guideline values (based on median values) were dissolved reactive phosphorus (25 sites), followed by *E. coli* (24 sites), clarity (16 sites) and nitrite-nitrate nitrogen (15 sites). Guidelines for ammoniacal nitrogen and dissolved oxygen were not met at six and four sites, respectively.

3.2.2 Heavy metals

Median concentrations of dissolved copper exceeded the ANZECC (2000) default trigger value at two sites (Karori Stream at Makara Mountain Bike Park and Kaiwharawhara Stream at Ngaio Gorge), although neither of these sites had median concentrations exceeding their site-specific, hardness-modified trigger value. Based on median values, three sites (Karori Stream at Makara Mountain Bike Park, Porirua Stream at Wall Park and Waiwhetu Stream at

Whites Line East) exceeded both the ANZECC (2000) default trigger value and their site-specific, hardness-modified trigger value for dissolved zinc. Summary statistics for heavy metals can be found in Appendix 4.

4. Periphyton and macrophytes

4.1 Approach to analysis

Assessment of periphyton is limited to RSoE sites with hard substrates (44 of the 53 sites). Monthly observations of percent streambed periphyton cover (filamentous and mat-forming (including cyanobacteria) periphyton) from July 2014 to June 2015 inclusive, and an assessment of periphyton biomass (chlorophyll *a* and Ash Free Dry Mass (AFDM)) undertaken in summer 2014/15 are compared against various MfE (2000) guidelines (Table 4.1). Monthly cover assessments of potentially toxic mat-forming cyanobacteria are compared against the MfE and MoH (2009) guidelines (Table 4.2). Macrophyte cover and macrophyte channel clogging², measured monthly at 16 RSoE sites, is also summarised.

Table 4.1: MfE (2000) guidelines used to assess periphyton streambed cover and biomass

Instream value/variable	Mat periphyton	Filamentous periphyton
<i>Aesthetics/recreation</i>		
Maximum cover of visible streambed	60% >0.3 cm thick	30% >2 cm long
<i>Benthic biodiversity</i>		
Maximum chlorophyll <i>a</i>	50 mg/m ²	50 mg/m ²
<i>Trout habitat and angling</i>		
Maximum AFDM	35 g/m ²	35 g/m ²
Maximum cover of visible streambed	N/A	30% >2 cm long

Table 4.2: MfE/MoH (2009) alert framework for benthic cyanobacteria cover in rivers

Alert level	Guideline
Green	≤20% coverage of potentially toxic cyanobacteria attached to substrate
Amber	20–50% coverage of potentially toxic cyanobacteria attached to substrate
Red	>50% coverage of potentially toxic cyanobacteria attached to substrate

¹ The red alert level is slightly modified from the MfE and MoH (2009) guidelines; detached mats are not recorded.

4.2 Results

The number of observations of streambed periphyton cover made during the reporting period varied among the 44 RSoE sites due to either site access being restricted or because turbid water or high flows prevented periphyton assessments being carried out on some occasions. Observations for some sites in the Ruamahanga River catchment were particularly few in number as a result of sampling often coinciding with high river flows during or following rainfall.

² Essentially how “clogged” up a stream channel is with macrophytes.

Of the 44 RSoE sites with periphyton observations, 13 exceeded the MfE (2000) guideline for filamentous periphyton streambed cover on at least one sampling occasion (Table 4.3). The sites that most often exceeded the guideline were Huangarua River at Ponatahi Bridge, Awhea River at Tora Road and Pauatahanui Stream at Elmwood Bridge. These sites are all located in catchments dominated by pastoral land use.

No sites exceeded the MfE (2000) guideline for mat-forming periphyton cover during the reporting period. However, one site (Waipoua River at Colombo Road Bridge) on one occasion exceeded the MfE/MoH (2009) alert 'Amber' guideline for benthic mat-forming cyanobacteria cover.

Twelve RSoE sites exceeded the MfE (2000) chlorophyll *a* guideline for benthic biodiversity (Table 4.4). The highest chlorophyll *a* biomass recorded was in the Huangarua River at Ponatahi Bridge (342.3 mg/m²). The Huangarua River at Ponatahi Bridge was also the only site that exceeded the MfE (2000) AFDM guideline for trout habitat and angling, with a result of 42.8 g/m².

Overall, 28 of the 44 monitored sites complied with all of the periphyton guidelines. There was a reasonable relationship between periphyton guideline compliance and WQI grades. In general, sites with 'excellent' water quality were more likely to comply with guidelines for periphyton cover and biomass than sites assigned lower WQI grades. However, at some sites variables other than water quality, such as accrual periods and streamside shade, more strongly influence periphyton growth and hence compliance with guidelines.

A summary of total streambed macrophyte cover and macrophyte channel clogginess data is presented in Table 4.5. Sites that recorded the highest median cover were Parkvale tributary at Lowes Reserve (80%), Waiwhetu Stream at Whites Line East (72%) and Mangaone Stream at Sims Road Bridge (60%). Parkvale tributary at Lowes Reserve and Mangaone Stream at Sims Road Bridge also had the highest median macrophyte channel clogginess (80% and 60%, respectively).

Table 4.3: Summary of monthly observations at RSoE sites, over July 2014 to June 2015 inclusive, of visible streambed periphyton cover in relation to exceedances of the MfE (2000) and MfE & MoH (2009) guidelines

Site no.	Site name	n	Streambed cover						
			Filamentous (>2 cm long)		Mats ¹ (>0.3 cm thick)		Cyanobacterial mats ¹ (>0.1 cm thick)		
			Max	n >30%	Max	n >60%	Max	n 20–50%	n >50%
RS03	Waitohu S at Forest Pk	11	0	0	0	0	0	0	0
RS05	Otaki R at Pukehinau	11	3	0	0	0	0	0	0
RS06	Otaki R at Mouth	11	9	0	7	0	2	0	0
RS09	Waikanae R at Mangaone Walkway	12	0	0	0	0	0	0	0
RS10	Waikanae R at Greenaway Rd	9	25	0	8	0	4	0	0
RS11	Whareroa S at Waterfall Rd	10	0	0	0	0	0	0	0
RS13	Horokiri S at Snodgrass	9	53	1	25	0	13	0	0
RS14	Pauatahanui S at Elmwood Br	9	52	5	3	0	0	0	0
RS15	Porirua S at Glenside	10	0	0	0	0	0	0	0
RS16	Porirua S at Wall Park (Milk Depot)	10	91	2	2	0	0	0	0
RS17	Makara S at Kennels	11	1	0	0	0	0	0	0
RS18	Karori S at Makara Peak	10	10	0	0	0	0	0	0
RS19	Kaiwharawhara S at Ngaio Gorge	11	82	1	0	0	0	0	0
RS20	Hutt R at Te Marua Intake Site	10	3	0	0	0	3	0	0
RS21	Hutt R opp. Manor Park G.C.	8	6	0	1	0	15	0	0
RS22	Hutt R at Boulcott	7	2	0	11	0	19	0	0
RS23	Pakuratahi R 50m d/s Farm Ck	11	10	0	2	0	7	0	0
RS24	Mangaroa R at Te Marua	9	47	2	5	0	3	0	0
RS25	Akatarawa R at Hutt confl.	11	3	0	2	0	9	0	0
RS26	Whakatikei R at Riverstone	11	22	0	7	0	11	0	0
RS28	Wainuiomata R at Manuka Track	11	1	0	1	0	1	0	0
RS29	Wainuiomata R d/s of White Br	9	37	1	15	0	9	0	0
RS30	Orongorongo R at Orongorongo Stn	8	61	1	33	0	19	0	0
RS31	Ruamahanga R at McLays	9	0	0	0	0	0	0	0
RS32	Ruamahanga R at Te Ore Ore	9	4	0	35	0	1	0	0
RS33	Ruamahanga R at Gladstone Br	5	8	0	27	0	14	0	0
RS34	Ruamahanga R at Pukio	6	14	0	0	0	0	0	0
RS37	Taueru R at Gladstone	6	39	3	21	0	15	0	0
RS38	Kopuaranga R at Stuarts	10	90	2	30	0	13	0	0
RS40	Waipoua R at Colombo Rd Br	10	14	0	47	0	32	1	0
RS41	Waingawa R at South Rd	9	22	0	0	0	0	0	0
RS43	Motuwaireka S at Headwaters	12	67	2	0	0	0	0	0
RS44	Totara S at Stronvar	10	8	0	12	0	0	0	0
RS45	Parkvale Trib at Lowes Res.	11	0	0	0	0	0	0	0
RS46	Parkvale S at Weir	10	29	0	26	0	13	0	0
RS47	Waiohine R at Gorge	6	0	0	0	0	0	0	0
RS48	Waiohine R at Bicknells	8	5	0	5	0	3	0	0
RS49	Beef Ck at Headwaters	11	0	0	0	0	0	0	0
RS50	Mangatarere S at SH 2	11	62	2	11	0	1	0	0
RS51	Huangarua R at Ponatahi Br	10	92	6	31	0	14	0	0
RS52	Tauanui R at Whakatomotomo Rd	11	4	0	0	0	0	0	0
RS53	Awhea R at Tora Rd	7	88	5	22	0	0	0	0
RS55	Tauherenikau R at Websters	9	10	0	0	0	0	0	0
RS56	Waiorongomai R at Forest Pk	10	0	0	4	0	4	0	0

¹ Mat-forming and cyanobacterial mat-periphyton cover data are not mutually exclusive (eg, cyanobacterial mats >0.3 cm thick would also be counted under mat-forming periphyton).

Table 4.4: Periphyton biomass (AFDM and chlorophyll a) from one-off sampling during summer 2014/15. Non-compliance with MfE (2000) guidelines is highlighted in bold type

Site no.	Site name	AFDM (g/m ²)	Chlorophyll a (mg/m ²)
RS03	Waitohu S at Forest Pk	0.19	0.15
RS05	Otaki R at Pukehinau	0.56	2.02
RS06	Otaki R at Mouth	6.46	12.76
RS09	Waikanae R at Mangaone Walkway	0.52	1.60
RS10	Waikanae R at Greenaway Rd	4.39	33.70
RS11	Whareroa S at Waterfall Rd	1.14	3.90
RS13	Horokiri S at Snodgrass	21.70	146.56
RS14	Pauatahanui S at Elmwood Br	31.20	178.04
RS15	Porirua S at Glenside	6.32	32.96
RS16	Porirua S at Wall Park (Milk Depot)	10.53	61.02
RS17	Makara S at Kennels	1.90	1.82
RS18	Karori S at Makara Peak	5.31	41.37
RS19	Kaiwharawhara S at Ngaio Gorge	7.50	72.68
RS20	Hutt R at Te Marua Intake Site	0.88	2.13
RS21	Hutt R opp. Manor Park G.C.	0.78	5.25
RS22	Hutt R at Boulcott	14.42	132.78
RS23	Pakuratahi R 50m d/s Farm Ck	3.32	15.55
RS24	Mangaroa R at Te Marua	12.68	69.11
RS25	Akatarawa R at Hutt confl.	0.29	0.99
RS26	Whakatikei R at Riverstone	3.60	25.82
RS28	Wainuiomata R at Manuka Track	8.27	37.42
RS29	Wainuiomata R d/s of White Br	10.22	97.02
RS30	Orongorongo R at Orongorongo Stn	4.86	4.62
RS31	Ruamahanga R at McLays	0.28	0.26
RS32	Ruamahanga R at Te Ore Ore	2.33	16.71
RS33	Ruamahanga R at Gladstone Br	8.02	79.46
RS34	Ruamahanga R at Pukio	9.92	43.94
RS37	Taueru R at Gladstone	25.58	141.47
RS38	Kopuaranga R at Stuarts	12.95	115.86
RS40	Waipoua R at Colombo Rd Br	2.31	23.61
RS41	Waingawa R at South Rd	3.37	13.33
RS43	Motuwaireka S at Headwaters	2.00	8.86
RS44	Totara S at Stronvar	2.95	3.49
RS45	Parkvale Trib at Lowes Res.	4.74	5.43
RS46	Parkvale S at Weir	4.06	14.00
RS47	Waiohine R at Gorge	0.38	0.31
RS48	Waiohine R at Bicknells	5.78	28.34
RS49	Beef Ck at Headwaters	1.33	4.70
RS50	Mangatarere S at SH 2	17.63	81.07
RS51	Huangarua R at Ponatahi Br	42.81	342.28
RS52	Tauanui R at Whakatomotomo Rd	1.61	1.80
RS53	Awhea R at Tora Rd	22.18	26.93
RS55	Tauherenikau R at Websters	1.63	1.67
RS56	Waiorongomai R at Forest Pk	0.91	0.76

Table 4.5: Summary of total streambed macrophyte cover and macrophyte channel clogginess at selected RSoE sites, based on monthly observations between July 2014 and June 2015

Site No.	Site name	n	Total streambed macrophyte cover (%)			Macrophyte channel clogginess (%)		
			Median	Min.	Max.	Median	Min.	Max.
RS02	Mangapouri S at Bennetts Rd	11	34	0	62	30	0	56
RS04	Waitohu S at Norfolk Crescent	10	5	0	26	2	0	21
RS07	Mangaone S at Sims Road Br	11	60	6	80	60	6	80
RS08	Ngarara S at Field Way	10	1	0	44	1	0	44
RS12	Whareroa S at QE Park	11	20	0	62	20	0	62
RS14	Pauatahanui S at Elmwood Br	9	10	0	18	2	0	5
RS17	Makara S at Kennels	11	10	0	27	5	0	21
RS29	Wainuiomata R Upstr of White Br	12	11	0	64	10	0	40
RS36	Taueru R at Castlehill	12	0	0	0	0	0	0
RS37	Taueru R at Gladstone	9	32	0	84	14	0	38
RS38	Kopuaranga R at Stuarts	10	16	0	44	13	0	23
RS39	Whangaehu R at 250m from Confl.	9	56	0	100	46	0	69
RS42	Whareama R at Gauge	7	26	0	70	17	0	36
RS45	Parkvale trib at Lowes Reserve	11	80	70	88	80	70	88
RS46	Parkvale S at Weir	11	42	9	72	37	8	64
RS57	Waiwhetu S at Whites Line East	12	72	0	93	9	0	51

5. Macroinvertebrates

5.1 Approach to analysis

Macroinvertebrate sampling was undertaken at each of the 53 RSoE sites during summer 2014/15. The Macroinvertebrate Community Index (MCI), an index of sensitivity to a wide range of environmental variables (Stark & Maxted 2007), is used to summarise macroinvertebrate health. Additional macroinvertebrate indices (QMCI, %EPT taxa, and taxa richness)³ are presented in Appendix 5. Refer to Perrie et al. (2012) for further explanation of these indices.

The quality classifications, as recommended by Stark and Maxted (2007), for interpretation of the MCI scores are outlined in Table 5.1. Soft bottomed MCI scores (MCI-sb) have also been calculated for the nine RSoE sites with soft substrates (see Appendix 1).

Table 5.1: Interpretation of MCI-type scores (from Stark & Maxted 2007)

Quality class	MCI and MCI-sb
Excellent	≥ 120
Good	100–119
Fair	80–99
Poor	<80

5.2 Results

The MCI scores based on one sample collected from each monitoring site are presented in Table 5.2. The 53 RSoE sites fell into the following MCI quality classes (Figure 5.1):

- Excellent: 15 sites (28.3%)
- Good: 17 sites (32.1%)
- Fair: 13 sites (24.5%)
- Poor: 8 sites (15.1%)

All of the RSoE sites in the ‘excellent’ MCI quality class are located in catchments dominated by indigenous forest cover (eg, sites located in the upper reaches of the Otaki, Waikanae, Hutt and Ruamahanga rivers). Seven of the eight RSoE sites in the ‘poor’ quality class have soft-sediment substrate and all eight sites are located in catchments dominated by either pastoral landcover (five sites) or urban landcover (three sites).

There was a reasonable relationship between the MCI quality classes and WQI grades. For example, of the 15 RSoE sites with an ‘excellent’ MCI quality class, 13 had a WQI grade of ‘excellent’ and two a WQI grade of ‘good’. Similarly, of the eight RSoE sites with an MCI quality class of ‘poor’, six had a WQI grade of ‘poor’ and two had a WQI grade of ‘fair’. The relationship between water quality and macroinvertebrate health based on WQI grades and MCI quality grades was less clear in the ‘good’ and ‘fair’ classes.

³ QMCI = Quantitative MCI and %EPT taxa = the percentage of pollution-sensitive Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) taxa. See Perrie et al. (2012) for index calculation details.

Table 5.2: MCI scores for RSoE sites sampled in summer 2014/15

(* denotes MCI-sb scores that were used to apply quality classes at soft-bottomed sites while values in brackets are the MCI-hb scores for these sites)

Site no.	Site name	MCI score	MCI quality class
RS02	Mangapouri S at Bennetts Rd	78.4* (81.6)	Poor
RS03	Waitohu S at Forest Pk	143.2	Excellent
RS04	Waitohu S at Norfolk Cres	84.2* (85)	Fair
RS05	Otaki R at Pukehinau	135.0	Excellent
RS06	Otaki R at Mouth	104.0	Good
RS07	Mangaone S at Sims Rd Br	61.4* (73.7)	Poor
RS08	Ngarara S at Field Way	70.1* (84.8)	Poor
RS09	Waikanae R at Mangaone Walkway	139.3	Excellent
RS10	Waikanae R at Greenaway Rd	109.6	Good
RS11	Whareroa S at Waterfall Rd	115.0	Good
RS12	Whareroa S at QE Park	73.8* (75.5)	Poor
RS13	Horokiri S at Snodgrass	98.3	Fair
RS14	Pauatahanui S at Elmwood Br	92.5	Fair
RS15	Porirua S at Glenside	94.4	Fair
RS16	Porirua S at Wall Park (Milk Depot)	80.9	Fair
RS17	Makara S at Kennels	113.6	Good
RS18	Karori S at Makara Peak	84.8	Fair
RS19	Kaiwharawhara S at Ngaio Gorge	81.9	Fair
RS20	Hutt R at Te Marua Intake Site	138.3	Excellent
RS21	Hutt R opp. Manor Park G.C.	126.0	Excellent
RS22	Hutt R at Boulcott	109.1	Good
RS23	Pakuratahi R 50m d/s Farm Ck	120.7	Excellent
RS24	Mangaroa R at Te Marua	105.9	Good
RS25	Akatarawa R at Hutt confl.	124.4	Excellent
RS26	Whakatikei R at Riverstone	120.0	Excellent
RS28	Wainuiomata R at Manuka Track	137.6	Excellent
RS29	Wainuiomata R d/s of White Br	113.6	Good
RS30	Orongorongo R at Orongorongo Stn	118.8	Good
RS31	Ruamahanga R at McLays	141.9	Excellent
RS32	Ruamahanga R at Te Ore Ore	88.4	Fair
RS33	Ruamahanga R at Gladstone Br	113.3	Good
RS34	Ruamahanga R at Pukio	97.6	Fair
RS36	Taueru R at Castlehill	118.9* (109.7)	Good
RS37	Taueru R at Gladstone	95.0	Fair
RS38	Kopuaranga R at Stuarts	92.0	Fair
RS39	Whangaehu R 250m u/s confl.	58.8* (75)	Poor
RS40	Waipoua R at Colombo Rd Br	101.9	Good
RS41	Waingawa R at South Rd	105.2	Good
RS42	Whareama R at Gauge	65* (74.3)	Poor
RS43	Motuwaireka S at Headwaters	120.0	Excellent
RS44	Totara S at Stronvar	102.5	Good
RS45	Parkvale Trib at Lowes Res.	93.3	Fair
RS46	Parkvale S at Weir	77.0	Poor
RS47	Waiohine R at Gorge	138.6	Excellent
RS48	Waiohine R at Bicknells	113.9	Good
RS49	Beef Ck at Headwaters	131.2	Excellent
RS50	Mangatarere S at SH 2	109.1	Good
RS51	Huangaaru R at Ponatahi Br	103.6	Good
RS52	Tauanui R at Whakatomotomo Rd	131.7	Excellent
RS53	Awhea R at Tora Rd	98.3	Fair
RS55	Tauherenikau R at Websters	115.2	Good
RS56	Waiorongomai R at Forest Pk	126.9	Excellent
RS57	Waiwhetu S at Whites Line East	57.3* (76)	Poor

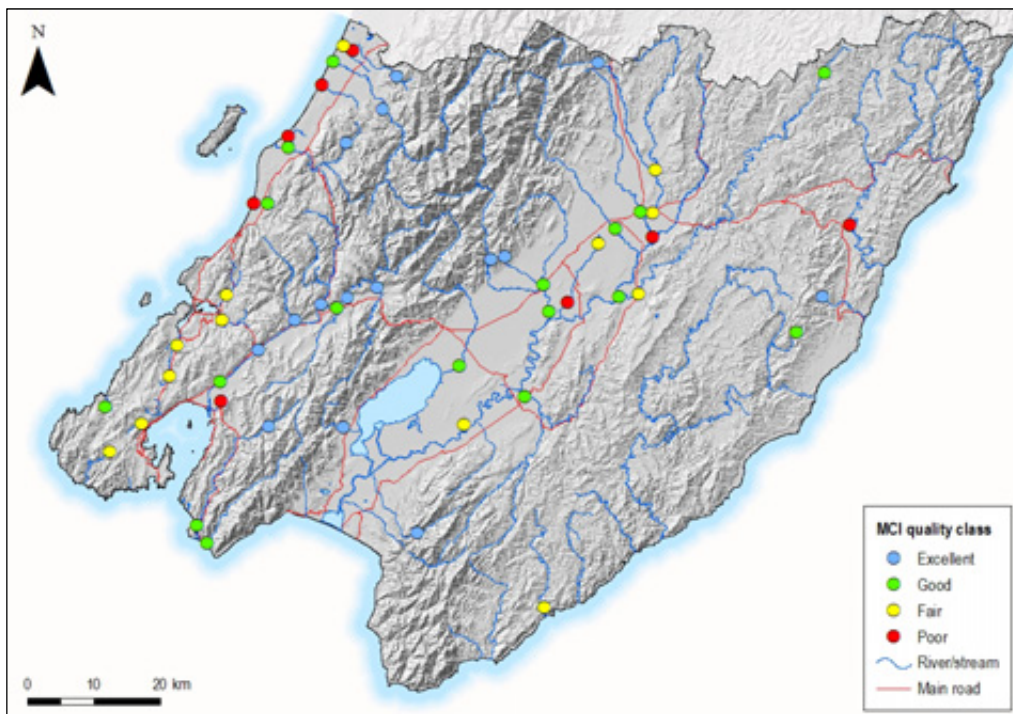


Figure 5.1: MCI quality classes for the 53 RSoE sites, determined from one sampling event over summer 2014/15

Sites that recorded higher MCI scores were also more likely to comply with both periphyton cover and biomass guidelines. Of the 28 sites that complied with all periphyton guidelines, 14 had MCI grades of ‘excellent’ and eight sites had MCI scores of ‘good’.

6. Habitat quality

6.1 Approach to analysis

Habitat assessments were undertaken at each of the 53 RSoE sites at the time annual biological samples were collected in summer 2014/15. A summary of the overall habitat scores for each site is provided (individual scores for each of the nine components that make up the overall habitat score can be found in Appendix 6); these overall scores provide an indication of the physical stream habitat condition and its ability to support stream biota.

Streambed fine sediment cover was assessed monthly at the time of water sample collection. A tabulated summary of these monthly assessments is presented.

6.2 Results

6.2.1 Habitat assessment

Overall habitat scores ranged from 60 (Mangaone Stream at Sims Road Bridge) to 217.5 (Waikanae River at Mangaone Walkway) with a median score across all 53 sites of 147.5 (Table 6.1). The 14 RSoE sites that had the highest habitat scores were all located in catchments with indigenous forest as the dominant landcover and had hard-bottomed substrate (eg, Waikanae River at Mangaone Walkway and Wainuiomata River at Manuka Track). These sites also had 'excellent' MCI classification and 'excellent' or 'good' WQI classifications. In contrast, the RSoE sites that had the lowest habitat scores were all located in catchments dominated by either pastoral or urban landcover and tended to have soft-sediment substrates (eg, Waitohu Stream at Norfolk Crescent and Waiwhetu Stream at Whites Line East). The sites with the lowest habitat scores were more likely to record 'fair' or 'poor' MCI and WQI classes.

6.2.2 Fine sediment cover

The number of observations of fine sediment streambed cover made during the reporting period varied among the 53 sites due to site access being restricted, or turbid water or high flows inhibiting the assessment⁴. Unsurprisingly, most (six) of the nine sites considered 'soft-bottomed' typically had high proportions of fine sediment cover (ie, median values >50% cover) (Table 6.1). Of the 44 RSoE sites considered hard-bottomed, median fine sediment cover values ranged from 0 (at 13 sites, eg, Ruamahanga River at McLays) to >50% at three sites (Makara Stream at Kennels, Awhea River at Tora Road and Pauatahanui Stream at Elmwood Bridge). Sites that had higher median values for fine sediment streambed cover tended to be located on smaller streams, mostly on the Kapiti Coast (eg, Mangapouri Stream at Bennetts Road) or in eastern Wairarapa (eg, Taueru River at Castlehill).

While sites that had low median fine sediment cover scores tended to be located in indigenous forest catchments, obvious relationships between dominant landuse and fine sediment cover were not overly apparent, indicating that factors such as catchment geology and hydrology (flushing flows) are also important.

⁴ Over the reporting period, turbid and/or humic stained water limited the number of monthly fine sediment assessments carried out at the Ngarara Stream at Field Way and Whareroa Stream at QE Park to zero and one, respectively (Table 6.1).

Table 6.1: Overall habitat quality scores based on a one-off assessment and summary of monthly observations of fine sediment (<2 mm) streambed cover at RSoE sites during 2014/15

Site no.	Site name	Overall habitat score	Fine sediment streambed cover			
			n	Median	Minimum	Maximum
RS02	Mangapouri S at Bennetts Rd	86	9	100	100	100
RS03	Waitohu S at Forest Pk	206	11	0	0	10
RS04	Waitohu S at Norfolk Cres	65.5	8	100	100	100
RS05	Otaki R at Pukehinau	183	11	0	0	10
RS06	Otaki R at Mouth	118	11	10	0	30
RS07	Mangaone S at Sims Rd Br	60	1	100	100	100
RS08	Ngarara S at Field Way	75	0	-	-	-
RS09	Waikanae R at Mangaone Walkway	218	12	0	0	10
RS10	Waikanae R at Greenaway Rd	149	9	10	0	30
RS11	Whareroa S at Waterfall Rd	153	10	30	10	90
RS12	Whareroa S at QE Park	99	1	100	100	100
RS13	Horokiri S at Snodgrass	149	9	15	0	30
RS14	Pauatahanui S at Elmwood Br	122	9	50	40	85
RS15	Porirua S at Glenside	157	10	15	5	60
RS16	Porirua S at Wall Park (Milk Depot)	126	10	18	10	90
RS17	Makara S at Kennels	144	11	85	70	90
RS18	Karori S at Makara Peak	150	10	25	10	60
RS19	Kaiwharawhara S at Ngaio Gorge	164	11	20	5	40
RS20	Hutt R at Te Marua Intake Site	175	10	0	0	0
RS21	Hutt R opp. Manor Park G.C.	147	8	13	5	30
RS22	Hutt R at Boulcott	143	7	5	0	15
RS23	Pakuratahi R 50m d/s Farm Ck	196	11	5	0	10
RS24	Mangaroa R at Te Marua	162	9	0	0	5
RS25	Akatarawa R at Hutt confl.	204	11	15	5	30
RS26	Whakatikei R at Riverstone	196	11	20	10	50
RS28	Wainuiomata R at Manuka Track	217	11	0	0	0
RS29	Wainuiomata R d/s of White Br	148	9	10	5	60
RS30	Orongorongo R at Orongorongo Stn	118	6	25	0	40
RS31	Ruamahanga R at McLays	205	11	0	0	10
RS32	Ruamahanga R at Te Ore Ore	131	10	35	10	70
RS33	Ruamahanga R at Gladstone Br	163	9	0	0	10
RS34	Ruamahanga R at Pukio	108	8	30	5	50
RS36	Taueru R at Castlehill	106	11	90	70	100
RS37	Taueru R at Gladstone	126	4	15	10	40
RS38	Kopuaranga R at Stuarts	131	8	18	10	30
RS39	Whangaehu R 250m u/s confl.	132	8	40	30	80
RS40	Waipoua R at Colombo Rd Br	143	10	3	0	10
RS41	Waingawa R at South Rd	147	9	10	0	40
RS42	Whareama R at Gauge	79	6	65	60	100
RS43	Motuwaireka S at Headwaters	195	10	10	0	20
RS44	Totara S at Stronvar	152	11	40	30	80
RS45	Parkvale Trib at Lowes Res.	165	11	0	0	30
RS46	Parkvale S at Weir	104	7	20	10	50
RS47	Waiohine R at Gorge	192	12	0	0	0
RS48	Waiohine R at Bicknells	163	12	0	0	20
RS49	Beef Ck at Headwaters	207	11	0	0	10
RS50	Mangatarere S at SH 2	148	8	10	0	20
RS51	Huangarua R at Ponatahi Br	125	4	20	5	40
RS52	Tauanui R at Whakatomotomo Rd	190	11	10	0	10
RS53	Awhea R at Tora Rd	80	8	55	20	100
RS55	Tauherenikau R at Websters	142	10	10	5	60
RS56	Waiorongomai R at Forest Pk	207	10	0	0	10
RS57	Waiwhetu S at Whites Line East	66	9	20	10	35

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Appendix 1: RSoE monitoring sites

Site no.	Site name	NZTM site coordinates		Substrate (hard or soft bottomed)	REC	Dominant land cover
		Easting	Northing			
RS02	Mangapouri S at Bennetts Rd*	1780903	5487645	Soft	WD/L/AI/U**	Urban
RS03	Waitohu S at Forest Pk	1787593	5483689	Hard	CW/H/HS/IF	Indigenous forest
RS04	Waitohu S at Norfolk Cres	1779537	5488304	Soft	CW/L/HS/P	Pasture
RS05	Otaki R at Pukehinau	1785426	5478749	Hard	CW/H/HS/IF	Indigenous forest
RS06	Otaki R at Mouth	1777983	5485886	Hard	CW/H/HS/IF	Indigenous forest
RS07	Mangaone S at Sims Rd Br	1776242	5482408	Soft	WW/L/AL/P	Pasture
RS08	Ngarara S at Field Way*	1771180	5474620	Soft	WW/L/AL/U**	Urban
RS09	Waikanae R at Mangaone Walkway	1779974	5473638	Hard	CW/L/HS/IF	Indigenous forest
RS10	Waikanae R at Greenaway Rd*	1771223	5472915	Hard	CW/L/HS/IF**	Indigenous forest
RS11	Whareroa S at Waterfall Rd	1768074	5464532	Hard	WW/L/HS/IF**	Indigenous forest
RS12	Whareroa S at QE Park	1765976	5464400	Soft	WW/L/HS/P	Pasture
RS13	Horokiri S at Snodgrass	1761804	5450653	Hard	CW/L/HS/P	Pasture
RS14	Pauatahanui S at Elmwood Br	1761097	5446783	Hard	CW/L/HS/P	Pasture
RS15	Porirua S at Glenside*	1753289	5438364	Hard	CW/L/HS/U	Urban
RS16	Porirua S at Wall Park (Milk Depot)*	1754366	5443031	Hard	WW/L/HS/U	Urban
RS17	Makara S at Kennels	1743530	5433635	Hard	CW/L/HS/P	Pasture
RS18	Karori S at Makara Peak M.P. Park*	1744213	5426874	Hard	CW/L/HS/U	Urban
RS19	Kaiwharawhara S at Ngaio Gorge*	1749069	5431077	Hard	CW/L/HS/U	Urban
RS20	Hutt R at Te Marua Intake Site	1780071	5450158	Hard	CX/H/HS/IF	Indigenous forest
RS21	Hutt R opp. Manor Park G.C.*	1766679	5442285	Hard	CW/H/HS/IF	Indigenous forest
RS22	Hutt R at Boulcott*	1760858	5437486	Hard	CW/L/HS/IF	Indigenous forest
RS23	Pakuratahi R 50m d/s Farm Ck	1784607	5451677	Hard	CX/H/HS/IF	Indigenous forest
RS24	Mangaroa R at Te Marua	1778543	5448643	Hard	CW/L/HS/P	Pasture
RS25	Akatarawa R at Hutt confl.	1776183	5449184	Hard	CW/L/HS/IF	Indigenous forest
RS26	Whakatikei R at Riverstone	1772256	5446748	Hard	CW/L/HS/S	Indigenous forest
RS28	Wainuiomata R at Manuka Track	1768242	5430634	Hard	CW/L/HS/IF	Indigenous forest
RS29	Wainuiomata R d/s of White Br	1757316	5415724	Hard	CW/L/HS/IF	Indigenous forest
RS30	Orongorongo R at Orongorongo Stn	1758930	5413095	Hard	CW/H/HS/IF	Indigenous forest
RS31	Ruamahanga R at McLays	1818149	5485809	Hard	CX/H/HS/S	Indigenous forest
RS32	Ruamahanga R at Te Ore Ore	1825574	5463019	Hard	CW/L/SS/P	Pasture
RS33	Ruamahanga R at Gladstone Br	1821208	5450327	Hard	CW/L/SS/P	Pasture
RS34	Ruamahanga R at Pukio	1797832	5431010	Hard	CW/L/SS/P	Pasture
RS36	Taueru R at Castlehill	1852300	5484198	Soft	CW/L/SS/P	Pasture
RS37	Taueru R at Gladstone	1824148	5450815	Hard	CD/L/SS/P	Pasture
RS38	Kopuaranga R at Stuarts	1826761	5469569	Hard	CW/L/SS/P	Pasture
RS39	Whangaehu R 250m u/s confl.	1826267	5459407	Soft	CD/L/SS/P	Pasture
RS40	Waipoua R at Colombo Rd Br	1825018	5462890	Hard	CW/L/HS/P	Pasture
RS41	Waingawa R at South Rd	1820716	5460649	Hard	CX/H/HS/IF	Indigenous forest
RS42	Whareama R at Gauge	1856090	5461229	Soft	WW/L/SS/P	Pasture
RS43	Motuwaireka S at Headwaters	1852018	5450302	Hard	CW/L/HS/S	Indigenous forest
RS44	Totara S at Stronvar	1848025	5444916	Hard	CW/L/HS/EF	Exotic forest
RS45	Parkvale Trib at Lowes Res.	1818094	5458352	Hard	WD/L/AI/P	Pasture
RS46	Parkvale S at Weir	1813515	5449469	Hard	WD/L/AI/P	Pasture
RS47	Waiohine R at Gorge	1801889	5455995	Hard	CX/H/HS/IF	Indigenous forest
RS48	Waiohine R at Bicknells	1810615	5448099	Hard	CW/H/HS/P	Pasture
RS49	Beef Ck at Headwaters	1803963	5456398	Hard	CW/L/HS/S	Indigenous forest
RS50	Mangatarere S at SH 2	1809768	5452160	Hard	CW/L/HS/P	Pasture
RS51	Huangarua R at Ponatahi Br	1807009	5435213	Hard	CD/L/SS/P	Pasture
RS52	Tauanui R at Whakatomotomo Rd	1790648	5414515	Hard	CW/H/HS/IF	Indigenous forest
RS53	Awhea R at Tora Rd	1809951	5403289	Hard	WW/L/SS/P	Pasture
RS55	Tauherenikau R at Websters	1797082	5439942	Hard	CW/H/HS/P**	Pasture
RS56	Waiorongomai R at Forest Pk	1779604	5430559	Hard	CW/H/HS/IF	Indigenous forest
RS57	Waiwhetu S at Whites Line East	1760977	5434510	Soft	WW/L/HS/U	Urban

*RSoE sites where water samples are also analysed for selected heavy metals.

**REC landcover class changed to reflect more up-to-date catchment scale landcover information from MfE (2010).

Appendix 2: Monitoring variables and methods

Physico-chemical and microbiological water quality

Core water quality variables measured/analysed at each RSoE site are presented in Table A2.1. As far as practicable, individual RSoE monitoring sites are sampled at the same time of the month (and usually at the same time of the day) throughout the year, and where possible all sites on a river or stream are sampled on the same day. Field meters are calibrated on the morning of the day of sampling. Water samples are collected in mid-stream (where possible), typically in run-type habitat from a representative reach of stream. Samples requiring laboratory analysis are placed in chillibins with ice and couriered overnight to RJ Hill Laboratories in Hamilton. Water samples for heavy metal and dissolved nutrient analysis were all laboratory filtered.

Table A2.1: RSoE field and analytical water quality methods and detection limits

Variable	Method	Detection limit
Water temperature	Field meter – generally YSI ProODO	0.01 °C
Dissolved oxygen	Field meter – generally YSI ProODO	0.01 mg/L
Visual clarity	Black disc (20 mm disc if clarity <0.5 m, 60 mm disc for clarity between 0.5 m and 1.5 m, 200 mm disc for clarity >1.5 m)	0.01 m
pH	Field meter – generally YSI Professional Plus	0.01 units
Conductivity	Field meter – generally YSI Professional Plus	0.1 µS/cm
Turbidity	Analysis using a Hach 2100N, Turbidity meter. APHA 2130 B 22nd Ed. 2012	0.05 NTU
Total suspended solids	Filtration using Whatman 934 AH, Advantec GC-50 or 1-2 equivalent filters (nominal pore size 1.2–1.5µm), gravimetric determination. APHA 2540 D 22nd Ed. 2012	2 mg/L
Total organic carbon	Catalytic oxidation, IR detection, for Total C. Acidification, purging for Total Inorganic C. TOC = TC–TIC. APHA5310 B 22nd Ed. 2012	0.5 mg/L
Ammoniacal nitrogen	Filtered sample. Phenol/hyperchlorite colorimetry. Discrete Analyser. (NH ₄ -N = NH ₄ ⁺ -N + NH ₃ -N) APHA 4500-NH ₃ F (modified from manual analysis) 22nd Ed. 2012	0.01 mg/L until Dec. 2014 0.005 mg/L from Jan. 2015
Nitrite nitrogen	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO ₂ ⁻ I (Modified) 22nd Ed. 2012	0.002 mg/L until Dec. 2014 0.001 mg/L from Jan. 2015
Nitrate nitrogen	Calculation: (Nitrate-N + Nitrite-N) – Nitrite-N	0.002 mg/L until Dec. 2014 0.001 mg/L from Jan. 2015
Nitrate + nitrite nitrogen	Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO ₃ ⁻ I (Modified) 22nd Ed. 2012	0.002 mg/L until Dec. 2014 0.001 mg/L from Jan. 2015
Total Kjeldahl nitrogen	Kjeldahl digestion, phenol/hyperchlorite colorimetry (Discrete Analysis). APHA 4500-N Org C. (modified) 4500-NH ₃ F (modified) 22nd Ed. 2012	0.1 mg/L
Total nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N	0.11 mg/L ¹
Total phosphorus	Total Phosphorus digestion, ascorbic acid colorimetry. Discrete Analyser. APHA 4500-P E (modified from manual analysis) 22nd Ed. 2012	0.004 mg/L
Dissolved reactive phosphorus	Filtered sample. Molybdenum blue colorimetry. Discrete Analyser. APHA 4500-P E (modified from manual analysis) 22nd Ed. 2012	0.004 mg/L until Dec. 2014 0.001 mg/L from Jan. 2015
Faecal coliforms	APHA 9222D 22nd Ed. 2012	1 cfu/100mL
<i>E. coli</i>	APHA 9222G 22nd Ed. 2012	1 cfu/100mL
Dissolved copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 22nd Ed. 2012	0.0005 mg/L
Dissolved zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 22nd Ed. 2012	0.0010 mg/L

¹ A detection limit of 0.05 mg/L can be achieved if samples are analysed in duplicate.

Periphyton

Formal periphyton assessments are limited to the 44 RSoE sites with hard substrates.

Monthly assessment of visible streambed cover

Periphyton cover is determined by estimating the percentage of mat (>0.3 cm thick), cyanobacterial mat (>0.1 cm thick) and filamentous (>2 cm long) periphyton present on the stream or river bed. Note that cover of mat and cyanobacterial mat-periphyton are not mutually exclusive (ie, cyanobacterial mat cover >0.3 cm thick will also be counted as mat-periphyton). A total of 20 observations are undertaken at each site from two transects of ten observations or, if the stream or river is not wide enough or too deep/swift to wade across more than half of the river's width, four transects of five observations. Each observation is typically made with an underwater viewer and covers an approximate area of a 30 cm diameter circle.

Visible streambed periphyton cover assessments are carried out equally in both run and riffle-type habitats if these are present at a sampling site/reach.

Annual assessment of biomass and relative abundance

Periphyton samples for quantitative biomass assessments (chlorophyll *a* and Ash Free Dry Matter) are collected during late summer/early autumn at the time of macroinvertebrate sample collection. Sampling protocols follow a modified version of quantitative method 1a (QM-1a), as outlined by Biggs and Kilroy (2000) that involves pooling periphyton samples from 10 rocks into a single composite sample for analysis.

Biomass assessments are carried out on periphyton samples collected in riffle-type habitats in close proximity to macroinvertebrate sampling sites.

Macrophytes

Macrophyte cover is assessed monthly at 16 of the 53 RSoE sites (at the time of water sample collection). These sites were selected because they are either soft-bottomed sites and hence are more likely to support macrophyte communities and/or were known to have, at least at times, moderate to high macrophyte cover.

Macrophyte cover is assessed following the method in Collier et al. (2007) except that information on the native and exotic components of the macrophyte community are not recorded. This method provides a general overview of reach scale rooted macrophyte cover (Collier et al. 2007) and involves estimating the proportion of emergent, surface reaching and submerged rooted macrophyte cover in 1 m strips at 5 evenly spaced transects along a sampling reach (~50–100 m). The proportion of channel cross sectional area (or volume) occupied by the submerged macrophyte cover in each transect is also estimated to feed into the channel cloginess calculation (following Matheson et al. 2012). Macrophyte indices are calculated as follows:

- Total macrophyte cover = \sum (% emergent cover + % surface reaching cover + % submerged cover)/5
- Macrophyte channel cloginess = \sum (% emergent cover + % surface reaching cover + (% submerged cover * % channel cross sectional area occupied by submerged cover))/5

Note: Collier et al. (2007) state that this method is most suitable for wadeable streams. Undertaking this assessment in non-wadeable streams, as well streams that are turbid or experiencing elevated flows, may result in less reliable estimates of reach scale macrophyte cover.

Macroinvertebrates

A single macroinvertebrate sample is collected at or adjacent to each RSoE water sampling site during summer/early autumn. The timing of sampling is determined at random, although macroinvertebrate sampling is, where practicable, avoided within two weeks of any flood event (flood events are defined as flows greater than three times the median river flow).

Samples are collected with the use of a kick-net (0.5 mm mesh size) following Protocol C1 of the national macroinvertebrate sampling protocols (Stark et al. 2001) for the 44 RSoE sites with hard substrate (in riffle habitat) and Protocol C2 for the nine RSoE sites with a soft substrate. All samples are processed in accordance with Protocol P2 (Stark et al. 2001).

Habitat quality assessments

Habitat assessments are undertaken annually at each of the 53 RSoE sites during summer/early autumn (at the time biological samples are collected) following the methods outlined in Clapcott (2013). This assessment provides an indication of the condition of the physical habitat and its ability to support stream biota, and incorporates the following variables: fine sediment cover, invertebrate habitat abundance and diversity, fish habitat abundance and diversity, hydraulic heterogeneity, bank stability, channel modification and riparian buffer width, integrity and shade. Each category is scored between 1 ('poor') and 20 ('excellent') with both invertebrate and habitat categories weighted double that of the other variables. Summation of individual scores provides an overall total habitat quality score for each site (lowest and highest possible scores are 11 and 220, respectively).

Note that the habitat assessment methodology is considered a working draft and is expected to be refined over time. This methodology was also developed with a focus on wadeable hard-bottomed streams (Clapcott 2013) and hence its applicability to other stream/river types has not been explored.

Fine sediment streambed cover

Assessments of fine sediment streambed cover are undertaken monthly and coincide with the collection of water samples at each of the 53 RSoE sites using a modified version of Sediment Assessment Method 1 (Clapcott et al. 2011; bankside visual estimate of % sediment cover). This method involves a relatively quick visual estimate of the proportion fine sediment (<2 mm) cover of the streambed and it is undertaken from the bankside of the river. Visual estimates are typically made in run-type habitat over a representative reach (typically 20–50 m) and information on the length and width or streambed assessed is also recorded. The modification to the method is that, apart from sand, proportions of streambed cover of other substrates (eg, gravels, cobbles, etc.) are not estimated.

Appendix 3: Physico-chemical and microbiological data

Table A3.1: Water temperature (°C)

Site no.	Site name	Median	Minimum	5th percentile	95th percentile	Maximum	n
RS02	Mangapouri S at Bennetts Rd	14.4	8.7	9.4	19.1	19.9	12
RS03	Waitohu S at Forest Pk	11.0	7.1	7.3	16.0	16.1	12
RS04	Waitohu S at Norfolk Cres	13.1	7.9	8.2	18.5	19.5	12
RS05	Otaki R at Pukehinau	10.5	6.4	6.8	16.2	16.6	12
RS06	Otaki R at Mouth	13.0	8.0	8.3	19.8	20.3	12
RS07	Mangaone S at Sims Rd Br	12.4	8.3	8.7	17.1	17.2	12
RS08	Ngarara S at Field Way	15.2	7.1	8.8	21.1	22.6	12
RS09	Waikanae R at Mangaone Walkway	11.7	7.7	8.4	14.6	15.0	12
RS10	Waikanae R at Greenaway Rd	14.9	9.3	9.9	20.7	21.4	12
RS11	Whareroa S at Waterfall Rd	12.2	8.2	8.7	15.4	15.8	12
RS12	Whareroa S at QE Park	14.2	9.1	10.0	18.2	18.9	12
RS13	Horokiri S at Snodgrass	13.4	8.3	9.1	17.2	17.4	12
RS14	Pauatahanui S at Elmwood Br	13.1	8.0	8.7	16.8	17.1	12
RS15	Porirua S at Glenside	13.0	6.4	8.1	16.2	16.5	12
RS16	Porirua S at Wall Park (Milk Depot)	12.3	6.9	8.6	16.6	16.8	12
RS17	Makara S at Kennels	14.2	6.0	8.0	18.7	18.9	12
RS18	Karori S at Makara Peak	12.5	8.5	9.5	16.3	16.8	12
RS19	Kaiwharawhara S at Ngaio Gorge	14.0	7.1	8.8	17.1	17.8	12
RS20	Hutt R at Te Marua Intake Site	10.8	7.2	7.2	15.9	16.8	12
RS21	Hutt R opp. Manor Park G.C.	12.9	8.7	9.0	18.7	19.4	12
RS22	Hutt R at Boulcott	13.1	9.0	9.3	19.7	19.8	12
RS23	Pakuratahi R 50m d/s Farm Ck	11.4	7.7	8.1	15.9	16.3	12
RS24	Mangaroa R at Te Marua	12.3	8.5	8.7	15.9	16.2	12
RS25	Akatarawa R at Hutt confl.	11.6	7.3	7.8	16.1	16.5	12
RS26	Whakatikei R at Riverstone	11.9	7.7	8.0	15.8	16.0	12
RS28	Wainuiomata R at Manuka Track	11.1	7.0	7.0	15.1	15.8	12
RS29	Wainuiomata R d/s of White Br	14.2	7.8	8.3	20.1	20.6	12
RS30	Orongorongo R at Orongorongo Stn	15.4	11.2	11.4	22.8	23.6	12
RS31	Ruamahanga R at McLays	9.3	4.8	4.9	16.5	17.5	12
RS32	Ruamahanga R at Te Ore Ore	13.5	7.2	7.6	21.9	22.2	12
RS33	Ruamahanga R at Gladstone Br	14.0	7.5	8.1	22.5	22.9	12
RS34	Ruamahanga R at Pukio	13.7	7.6	8.0	23.1	23.6	12
RS36	Taueru R at Castlehill	12.3	7.4	7.7	17.7	19.8	12
RS37	Taueru R at Gladstone	12.7	6.5	7.5	15.1	15.4	12
RS38	Kopuaranga R at Stuarts	12.2	6.5	7.0	17.7	18.5	12
RS39	Whangaehu R 250m u/s confl.	13.3	6.5	7.0	19.7	21.1	11
RS40	Waipoua R at Colombo Rd Br	15.9	6.9	8.8	20.8	22.9	12
RS41	Waingawa R at South Rd	14.7	7.0	8.4	21.6	23.0	12
RS42	Whareama R at Gauge	14.3	7.1	7.4	19.7	21.3	12
RS43	Motuwaireka S at Headwaters	11.1	6.6	7.0	15.0	16.3	12
RS44	Totara S at Stronvar	13.3	6.3	6.8	20.3	21.6	12
RS45	Parkvale Trib at Lowes Res.	12.0	10.5	10.7	15.1	15.1	11
RS46	Parkvale S at Weir	15.6	7.8	8.4	22.4	24.9	12
RS47	Waiohine R at Gorge	8.9	5.6	5.7	16.9	18.3	12
RS48	Waiohine R at Bicknells	12.4	8.2	8.5	18.6	19.7	12
RS49	Beef Ck at Headwaters	9.9	5.8	6.2	14.5	15.4	11
RS50	Mangatarere S at SH 2	12.4	8.3	8.5	18.0	18.6	12
RS51	Huangarua R at Ponatahi Br	14.1	6.9	6.9	18.9	19.3	12
RS52	Tauanui R at Whakatomotomo Rd	11.7	6.5	6.8	16.2	16.3	11
RS53	Awhea R at Tora Rd	16.1	8.6	8.7	23.6	25.6	12
RS55	Tauherenikau R at Websters	13.3	6.0	7.3	17.9	20.1	12
RS56	Waiorongomai R at Forest Pk	13.5	6.7	8.0	17.6	19.1	12
RS57	Waiwhetu S at Whites Line East	14.4	9.2	9.3	18.6	18.7	12

Table A3.2: Dissolved oxygen (% saturation)

Site no.	Site name	Median	Minimum	5th percentile	95th percentile	Maximum	n
RS02	Mangapouri S at Bennetts Rd	81.8	45.5	46.3	90.0	92.4	12
RS03	Waitohu S at Forest Pk	100.5	97.6	97.6	102.6	103.4	12
RS04	Waitohu S at Norfolk Cres	91.3	60.1	66.4	98.5	99.9	12
RS05	Otaki R at Pukehinau	101.3	97.9	98.5	103.3	103.4	12
RS06	Otaki R at Mouth	102.4	96.0	97.5	110.5	110.6	12
RS07	Mangaone S at Sims Rd Br	80.7	40.0	48.6	94.9	100.1	12
RS08	Ngarara S at Field Way	47.6	15.9	22.3	59.8	63.3	12
RS09	Waikanae R at Mangaone Walkway	99.1	95.7	96.4	101.2	101.8	12
RS10	Waikanae R at Greenaway Rd	101.8	96.6	98.0	108.9	110.3	12
RS11	Whareroa S at Waterfall Rd	96.9	90.1	90.8	100.7	101.1	12
RS12	Whareroa S at QE Park	68.2	19.6	36.7	77.8	78.0	12
RS13	Horokiri S at Snodgrass	101.7	95.1	96.4	107.1	109.4	12
RS14	Pauatahanui S at Elmwood Br	96.1	82.1	83.3	97.9	98.0	12
RS15	Porirua S at Glenside	99.9	96.3	96.7	113.0	116.0	12
RS16	Porirua S at Wall Park (Milk Depot)	99.8	96.7	97.6	114.6	119.5	12
RS17	Makara S at Kennels	99.0	85.6	88.5	109.6	109.7	12
RS18	Karori S at Makara Peak	98.5	95.1	95.4	103.8	103.9	12
RS19	Kaiwharawhara S at Ngaio Gorge	101.4	96.2	97.0	106.5	107.2	12
RS20	Hutt R at Te Marua Intake Site	100.6	96.1	97.4	103.6	104.4	12
RS21	Hutt R opp. Manor Park G.C.	101.9	98.7	99.4	110.0	110.3	12
RS22	Hutt R at Boulcott	101.5	97.7	98.3	109.1	110.5	12
RS23	Pakuratahi R 50m d/s Farm Ck	95.6	92.4	92.7	99.6	100.6	12
RS24	Mangaroa R at Te Marua	100.8	97.5	97.8	107.7	108.1	12
RS25	Akatarawa R at Hutt confl.	101.7	97.2	98.4	105.3	107.4	12
RS26	Whakatikei R at Riverstone	102.3	99.1	99.4	109.5	112.0	12
RS28	Wainuiomata R at Manuka Track	100.6	94.9	96.1	102.3	102.9	12
RS29	Wainuiomata R d/s of White Br	109.8	94.4	96.1	126.0	127.6	12
RS30	Orongorongo R at Orongorongo Stn	102.4	99.9	100.0	106.4	108.5	12
RS31	Ruamahanga R at McLays	98.0	95.8	96.0	99.5	100.0	12
RS32	Ruamahanga R at Te Ore Ore	100.6	97.6	97.7	131.3	134.9	12
RS33	Ruamahanga R at Gladstone Br	98.9	93.8	94.2	129.3	133.4	12
RS34	Ruamahanga R at Pukio	99.4	96.3	96.8	121.7	129.8	12
RS36	Taueru R at Castlehill	96.8	88.5	89.9	104.2	104.5	12
RS37	Taueru R at Gladstone	90.9	71.0	76.3	106.8	121.2	12
RS38	Kopuaranga R at Stuarts	95.8	93.7	93.8	99.0	100.2	12
RS39	Whangaehu R 250m u/s confl.	107.6	77.0	82.5	140.7	155.8	11
RS40	Waipoua R at Colombo Rd Br	103.4	97.9	98.2	113.7	116.6	12
RS41	Waingawa R at South Rd	99.9	97.4	98.0	115.8	117.8	12
RS42	Whareama R at Gauge	96.7	85.9	85.9	107.2	110.7	12
RS43	Motuwaireka S at Headwaters	100.6	94.3	96.8	109.4	116.1	12
RS44	Totara S at Stronvar	99.4	94.9	95.9	101.0	101.5	12
RS45	Parkvale Trib at Lowes Res.	72.1	61.3	61.6	82.4	86.2	11
RS46	Parkvale S at Weir	101.3	79.3	81.4	120.5	125.1	12
RS47	Waiohine R at Gorge	100.0	96.5	97.5	101.1	101.2	12
RS48	Waiohine R at Bicknells	100.6	95.4	96.4	118.2	121.1	12
RS49	Beef Ck at Headwaters	98.5	94.1	95.2	99.9	100.1	11
RS50	Mangatarere S at SH 2	95.9	89.0	90.2	112.0	124.4	12
RS51	Huangaaru R at Ponatahi Br	97.0	89.3	90.4	115.0	121.9	12
RS52	Tauanui R at Whakatomotomo Rd	99.3	94.1	94.5	103.5	106.5	11
RS53	Awhea R at Tora Rd	108.0	49.7	73.4	156.0	175.1	12
RS55	Tauherenikau R at Websters	98.6	80.2	86.4	102.8	106.0	12
RS56	Waiorongomai R at Forest Pk	99.4	95.7	96.4	101.8	103.0	12
RS57	Waiwhetu S at Whites Line East	79.2	25.2	26.9	103.9	112.0	12

Table A3.3: Dissolved oxygen (mg/L)

Site no.	Site name	Median	Minimum	5th percentile	95th percentile	Maximum	n
RS02	Mangapouri S at Bennetts Rd	8.3	4.3	4.4	10.0	10.2	12
RS03	Waitohu S at Forest Pk	11.1	9.7	9.7	12.0	12.2	12
RS04	Waitohu S at Norfolk Cres	9.7	5.7	6.3	10.9	11.1	12
RS05	Otaki R at Pukehinau	11.2	9.8	9.9	12.3	12.5	12
RS06	Otaki R at Mouth	10.9	9.1	9.3	12.1	12.4	12
RS07	Mangaone S at Sims Rd Br	8.8	3.9	4.7	10.2	10.4	12
RS08	Ngarara S at Field Way	4.9	1.4	2.0	6.9	7.0	12
RS09	Waikanae R at Mangaone Walkway	10.8	9.8	9.8	11.7	11.9	12
RS10	Waikanae R at Greenaway Rd	10.3	8.9	9.1	11.9	12.4	12
RS11	Whareroa S at Waterfall Rd	10.4	9.2	9.3	11.5	11.7	12
RS12	Whareroa S at QE Park	7.0	2.7	3.9	8.8	9.0	12
RS13	Horokiri S at Snodgrass	10.7	9.2	9.5	11.9	12.1	12
RS14	Pauatahanui S at Elmwood Br	10.1	8.0	8.2	11.4	11.6	12
RS15	Porirua S at Glenside	10.9	9.6	9.8	12.8	13.6	12
RS16	Porirua S at Wall Park (Milk Depot)	11.0	9.7	9.8	12.7	13.5	12
RS17	Makara S at Kennels	10.5	8.5	8.5	12.7	13.7	12
RS18	Karori S at Makara Peak	10.5	9.4	9.7	11.3	11.5	12
RS19	Kaiwharawhara S at Ngaio Gorge	10.8	9.2	9.6	11.8	12.0	12
RS20	Hutt R at Te Marua Intake Site	11.0	9.8	9.9	12.2	12.2	12
RS21	Hutt R opp. Manor Park G.C.	10.6	10.1	10.2	11.9	12.3	12
RS22	Hutt R at Boulcott	10.3	9.8	9.8	11.7	12.0	12
RS23	Pakuratahi R 50m d/s Farm Ck	10.4	9.2	9.3	11.6	11.6	12
RS24	Mangaroa R at Te Marua	10.7	10.1	10.3	11.6	11.9	12
RS25	Akatarawa R at Hutt confl.	11.0	10.0	10.3	12.1	12.4	12
RS26	Whakatikei R at Riverstone	11.1	10.4	10.5	12.1	12.4	12
RS28	Wainuiomata R at Manuka Track	11.2	9.6	9.9	12.2	12.3	12
RS29	Wainuiomata R d/s of White Br	11.6	9.2	9.9	12.1	12.1	12
RS30	Orongorongo R at Orongorongo Stn	10.3	8.6	9.1	11.1	11.1	12
RS31	Ruamahanga R at McLays	10.9	9.4	9.5	12.4	12.6	12
RS32	Ruamahanga R at Te Ore Ore	11.2	10.0	10.0	11.8	11.8	12
RS33	Ruamahanga R at Gladstone Br	10.9	9.7	9.8	11.5	11.6	12
RS34	Ruamahanga R at Pukio	10.9	9.7	9.7	11.5	11.5	12
RS36	Taueru R at Castlehill	10.5	8.7	9.2	11.5	11.7	12
RS37	Taueru R at Gladstone	9.6	7.2	8.0	11.1	11.1	12
RS38	Kopuaranga R at Stuarts	10.1	9.3	9.3	11.6	11.7	12
RS39	Whangaehu R 250m u/s confl.	11.4	7.3	8.7	13.0	13.4	11
RS40	Waipoua R at Colombo Rd Br	10.4	10.0	10.0	11.7	12.4	12
RS41	Waingawa R at South Rd	10.5	9.0	9.3	12.0	12.5	12
RS42	Whareama R at Gauge	10.0	8.1	8.3	11.7	11.7	12
RS43	Motuwaireka S at Headwaters	10.8	9.7	9.9	12.3	12.3	12
RS44	Totara S at Stronvar	10.6	8.4	8.8	12.1	12.2	12
RS45	Parkvale Trib at Lowes Res.	7.7	6.2	6.2	8.9	9.1	11
RS46	Parkvale S at Weir	10.9	6.6	7.2	12.2	12.3	12
RS47	Waiohine R at Gorge	11.6	9.5	9.7	12.7	12.7	12
RS48	Waiohine R at Bicknells	11.0	10.0	10.1	11.6	11.8	12
RS49	Beef Ck at Headwaters	11.2	10.0	10.0	12.3	12.5	11
RS50	Mangatarere S at SH 2	10.4	9.2	9.4	11.6	11.9	12
RS51	Huangarua R at Ponatahi Br	11.3	8.3	8.4	12.6	12.8	12
RS52	Tauanui R at Whakatomotomo Rd	10.3	9.7	9.7	12.1	12.1	11
RS53	Awhea R at Tora Rd	11.5	9.3	10.2	14.7	16.4	12
RS55	Tauherenikau R at Websters	10.5	7.2	8.1	11.9	12.4	12
RS56	Waiorongomai R at Forest Pk	10.2	9.5	9.5	11.9	12.4	12
RS57	Waiwhetu S at Whites Line East	8.4	2.4	2.5	10.9	11.3	12

Table A3.4: pH – field meter

Site no.	Site name	Median	Minimum	5th percentile	95th percentile	Maximum	n*
RS02	Mangapouri S at Bennetts Rd	6.9	6.8	6.8	7.1	7.1	12
RS03	Waitohu S at Forest Pk	7.6	6.9	7.2	7.7	7.7	12
RS04	Waitohu S at Norfolk Cres	7.0	6.7	6.8	7.1	7.2	12
RS05	Otaki R at Pukehinau	7.6	7.2	7.3	7.7	7.7	12
RS06	Otaki R at Mouth	7.5	7.2	7.3	7.9	8.1	12
RS07	Mangaone S at Sims Rd Br	6.9	6.5	6.6	7.2	7.3	12
RS08	Ngarara S at Field Way	6.9	6.5	6.6	7.1	7.1	12
RS09	Waikanae R at Mangaone Walkway	7.6	5.9	6.5	7.7	7.7	12
RS10	Waikanae R at Greenaway Rd	7.4	6.7	7.0	7.8	7.9	12
RS11	Whareroa S at Waterfall Rd	7.6	6.8	6.9	7.7	7.8	12
RS12	Whareroa S at QE Park	6.8	6.6	6.6	7.0	7.1	12
RS13	Horokiri S at Snodgrass	7.3	6.8	6.8	7.7	7.9	12
RS14	Pauatahanui S at Elmwood Br	7.1	6.4	6.6	7.3	7.4	12
RS15	Porirua S at Glenside	7.3	6.8	6.8	7.6	7.7	11*
RS16	Porirua S at Wall Park (Milk Depot)	6.8	6.2	6.3	7.4	7.5	11*
RS17	Makara S at Kennels	7.2	6.9	6.9	7.5	7.5	11*
RS18	Karori S at Makara Peak	7.1	6.2	6.5	7.3	7.4	11*
RS19	Kaiwharawhara S at Ngaio Gorge	7.6	7.0	7.0	7.9	8.1	11*
RS20	Hutt R at Te Marua Intake Site	7.1	6.8	6.9	7.5	7.6	12
RS21	Hutt R opp. Manor Park G.C.	7.2	6.9	6.9	7.4	7.5	12
RS22	Hutt R at Boulcott	7.1	6.9	6.9	7.6	7.7	12
RS23	Pakuratahi R 50m d/s Farm Ck	6.9	6.3	6.4	7.3	7.4	12
RS24	Mangaroa R at Te Marua	7.1	6.7	6.8	7.4	7.5	12
RS25	Akatarawa R at Hutt confl.	7.1	6.7	6.7	7.5	7.8	12
RS26	Whakatikei R at Riverstone	7.2	6.5	6.8	7.8	8.2	11*
RS28	Wainuiomata R at Manuka Track	7.4	6.8	6.8	7.5	7.5	12
RS29	Wainuiomata R d/s of White Br	7.6	6.9	6.9	8.9	9.0	12
RS30	Orongorongo R at Orongorongo Stn	7.8	7.4	7.4	8.4	8.7	12
RS31	Ruamahanga R at McLays	7.2	6.1	6.4	7.8	7.8	12
RS32	Ruamahanga R at Te Ore Ore	7.9	7.7	7.7	8.7	8.7	12
RS33	Ruamahanga R at Gladstone Br	7.7	7.4	7.4	8.8	9.0	12
RS34	Ruamahanga R at Pukio	7.7	7.4	7.4	8.4	8.6	12
RS36	Taueru R at Castlehill	7.9	7.6	7.6	8.0	8.0	12
RS37	Taueru R at Gladstone	8.0	7.5	7.6	8.1	8.1	12
RS38	Kopuaranga R at Stuarts	8.0	7.5	7.5	8.1	8.1	12
RS39	Whangaehu R 250m u/s confl.	7.8	7.2	7.3	8.2	8.3	11
RS40	Waipoua R at Colombo Rd Br	7.5	7.3	7.3	7.9	7.9	12
RS41	Waingawa R at South Rd	7.6	7.1	7.2	8.1	8.5	12
RS42	Whareama R at Gauge	8.0	7.9	7.9	8.2	8.3	12
RS43	Motuwaireka S at Headwaters	8.0	7.7	7.8	8.1	8.1	12
RS44	Totara S at Stronvar	7.8	7.4	7.6	8.2	8.2	12
RS45	Parkvale Trib at Lowes Res.	6.7	6.5	6.5	6.9	7.0	11
RS46	Parkvale S at Weir	7.4	7.1	7.2	8.7	8.9	12
RS47	Waiohine R at Gorge	7.5	6.4	6.7	7.9	8.0	12
RS48	Waiohine R at Bicknells	7.2	7.1	7.1	7.3	7.3	12
RS49	Beef Ck at Headwaters	7.7	7.1	7.3	7.8	7.9	11
RS50	Mangatarere S at SH 2	7.0	7.0	7.0	7.1	7.2	12
RS51	Huangaaru R at Ponatahi Br	8.1	7.7	7.8	8.3	8.4	11*
RS52	Tauanui R at Whakatomotomo Rd	7.8	7.6	7.6	7.8	7.8	10*
RS53	Awhea R at Tora Rd	8.4	8.0	8.1	8.8	8.9	11*
RS55	Tauherenikau R at Websters	7.5	6.6	6.9	7.7	7.8	12
RS56	Waiorongomai R at Forest Pk	7.6	6.9	7.0	7.7	7.8	12
RS57	Waiwhetu S at Whites Line East	6.7	6.2	6.4	6.8	6.9	12

*Lower n counts for some sites (when compared to other variables) reflects sampling occasions when the field pH meter had malfunctioned and no measurement could be made. In such instances, the lab was asked to measure pH from a supplied water sample.

Table A3.5: Visual clarity (m)

Site no.	Site name	Median	Minimum	Maximum	n
RS02	Mangapouri S at Bennetts Rd	0.70	0.09	1.21	12
RS03	Waitohu S at Forest Pk	3.01	0.10	4.57	12
RS04	Waitohu S at Norfolk Cres	0.72	0.63	1.09	11
RS05	Otaki R at Pukehinau	4.17	0.67	7.77	12
RS06	Otaki R at Mouth	3.32	0.46	7.71	12
RS07	Mangaone S at Sims Rd Br	0.69	0.29	1.05	12
RS08	Ngarara S at Field Way	0.55	0.41	1.49	12
RS09	Waikanae R at Mangaone Walkway	4.58	1.54	5.23	12
RS10	Waikanae R at Greenaway Rd	5.60	0.82	7.77	12
RS11	Whareroa S at Waterfall Rd	0.59	0.05	2.11	12
RS12	Whareroa S at QE Park	0.64	0.21	1.16	12
RS13	Horokiri S at Snodgrass	2.38	0.16	4.84	12
RS14	Pauatahanui S at Elmwood Br	1.85	0.15	3.15	12
RS15	Porirua S at Glenside	1.73	0.12	2.66	12
RS16	Porirua S at Wall Park (Milk Depot)	1.59	0.21	2.39	12
RS17	Makara S at Kennels	1.65	0.04	2.13	12
RS18	Karori S at Makara Peak	3.10	0.10	4.85	12
RS19	Kaiwharawhara S at Ngaio Gorge	3.87	0.04	4.75	12
RS20	Hutt R at Te Marua Intake Site	5.52	1.17	7.01	12
RS21	Hutt R opp. Manor Park G.C.	3.51	0.05	5.25	12
RS22	Hutt R at Boulcott	3.01	0.04	6.00	12
RS23	Pakuratahi R 50m d/s Farm Ck	5.32	1.00	8.54	12
RS24	Mangaroa R at Te Marua	1.50	0.99	2.78	12
RS25	Akatarawa R at Hutt confl.	5.29	0.07	7.24	12
RS26	Whakatikei R at Riverstone	4.78	0.03	9.48	12
RS28	Wainuiomata R at Manuka Track	2.31	0.66	3.17	11
RS29	Wainuiomata R d/s of White Br	1.90	0.27	2.39	11
RS30	Orongorongo R at Orongorongo Stn	0.75	0.05	5.61	11
RS31	Ruamahanga R at McLays	7.12	0.20	10.75	12
RS32	Ruamahanga R at Te Ore Ore	1.94	0.10	6.46	12
RS33	Ruamahanga R at Gladstone Br	1.37	0.08	5.36	12
RS34	Ruamahanga R at Pukio	0.75	0.05	4.43	12
RS36	Taueru R at Castlehill	1.11	0.30	1.99	12
RS37	Taueru R at Gladstone	0.83	0.18	2.97	12
RS38	Kopuaranga R at Stuarts	1.62	0.13	3.30	12
RS39	Whangaehu R 250m u/s confl.	0.82	0.09	3.02	11
RS40	Waipoua R at Colombo Rd Br	3.69	0.24	5.99	12
RS41	Waingawa R at South Rd	3.44	0.14	7.00	12
RS42	Whareama R at Gauge	0.72	0.08	2.04	12
RS43	Motuwaireka S at Headwaters	2.80	0.91	>3.00	12
RS44	Totara S at Stronvar	2.58	0.10	4.51	12
RS45	Parkvale Trib at Lowes Res.	3.00	2.03	4.01	11
RS46	Parkvale S at Weir	1.75	0.37	3.08	12
RS47	Waiohine R at Gorge	4.06	1.21	10.44	12
RS48	Waiohine R at Bicknells	1.68	0.66	4.61	12
RS49	Beef Ck at Headwaters	3.05	1.11	3.53	11
RS50	Mangatarere S at SH 2	1.75	0.43	4.54	12
RS51	Huangarua R at Ponatahi Br	2.95	0.23	4.65	12
RS52	Tauanui R at Whakatomotomo Rd	4.32	1.06	5.99	11
RS53	Awhea R at Tora Rd	2.06	0.05	3.32	12
RS55	Tauherenikau R at Websters	3.57	0.16	7.22	12
RS56	Waiorongomai R at Forest Pk	4.09	0.15	6.95	12
RS57	Waiwhetu S at Whites Line East	0.85	0.44	2.32	11

Table A3.6: Turbidity (NTU)

Site no.	Site name	Median	Minimum	Maximum	n
RS02	Mangapouri S at Bennetts Rd	6.1	4.3	134	12
RS03	Waitohu S at Forest Pk	0.9	0.6	96	12
RS04	Waitohu S at Norfolk Cres	4.4	2.4	58	12
RS05	Otaki R at Pukehinau	0.9	0.3	8.7	12
RS06	Otaki R at Mouth	1.0	0.3	15.0	12
RS07	Mangaone S at Sims Rd Br	8.2	3.2	26	12
RS08	Ngarara S at Field Way	6.1	2.2	14.3	12
RS09	Waikanae R at Mangaone Walkway	0.7	0.4	2.0	12
RS10	Waikanae R at Greenaway Rd	0.6	0.2	6.9	12
RS11	Whareroa S at Waterfall Rd	8.8	3.1	2,900	12
RS12	Whareroa S at QE Park	7.6	2.9	43	12
RS13	Horokiri S at Snodgrass	1.3	0.7	750	12
RS14	Pauatahanui S at Elmwood Br	2.3	1.4	70	12
RS15	Porirua S at Glenside	2.6	1.2	101	12
RS16	Porirua S at Wall Park (Milk Depot)	3.3	1.2	30	12
RS17	Makara S at Kennels	2.8	1.2	310	12
RS18	Karori S at Makara Peak	1.0	0.7	79	12
RS19	Kaiwharawhara S at Ngaio Gorge	0.8	0.6	140	12
RS20	Hutt R at Te Marua Intake Site	0.5	0.3	4.2	12
RS21	Hutt R opp. Manor Park G.C.	1.0	0.3	220	12
RS22	Hutt R at Boulcott	0.9	0.3	230	12
RS23	Pakuratahi R 50m d/s Farm Ck	0.6	0.3	7.0	12
RS24	Mangaroa R at Te Marua	1.4	0.7	4.3	12
RS25	Akatarawa R at Hutt confl.	0.4	0.2	191	12
RS26	Whakatikei R at Riverstone	0.7	0.3	580	12
RS28	Wainuiomata R at Manuka Track	1.1	0.8	7.8	12
RS29	Wainuiomata R d/s of White Br	1.7	0.7	18.8	12
RS30	Orongorongo R at Orongorongo Stn	4.4	0.6	370	12
RS31	Ruamahanga R at McLays	0.5	0.2	36	12
RS32	Ruamahanga R at Te Ore Ore	2.3	0.3	310	12
RS33	Ruamahanga R at Gladstone Br	4.3	0.3	440	12
RS34	Ruamahanga R at Pukio	7.5	0.7	240	12
RS36	Taueru R at Castlehill	5.2	2.3	18.2	12
RS37	Taueru R at Gladstone	3.8	1.0	33	12
RS38	Kopuaranga R at Stuarts	2.8	0.7	111	12
RS39	Whangaehu R 250m u/s confl.	4.7	1.1	280	11
RS40	Waipoua R at Colombo Rd Br	0.7	0.4	20	12
RS41	Waingawa R at South Rd	1.3	0.4	85	12
RS42	Whareama R at Gauge	7.8	1.2	310	12
RS43	Motuwaireka S at Headwaters	0.9	0.3	8.4	12
RS44	Totara S at Stronvar	1.3	0.4	480	12
RS45	Parkvale Trib at Lowes Res.	0.5	0.2	1.2	11
RS46	Parkvale S at Weir	2.1	0.5	19.1	12
RS47	Waiohine R at Gorge	1.0	0.3	4.7	12
RS48	Waiohine R at Bicknells	2.8	0.9	6.3	12
RS49	Beef Ck at Headwaters	1.3	0.6	5.8	11
RS50	Mangatarere S at SH 2	1.7	0.5	11.7	12
RS51	Huangarua R at Ponatahi Br	1.5	0.4	29	12
RS52	Tauanui R at Whakatomotomo Rd	0.8	0.3	3.9	11
RS53	Awhea R at Tora Rd	3.5	0.8	780	12
RS55	Tauherenikau R at Websters	1.0	0.3	48	12
RS56	Waiorongomai R at Forest Pk	0.5	0.2	54	12
RS57	Waiwhetu S at Whites Line East	6.7	1.1	14.9	12

Table A3.7: Total suspended solids (mg/L)

Site no.	Site name	Median	Minimum	Maximum	n
RS02	Mangapouri S at Bennetts Rd	5	2	230	12
RS03	Waitohu S at Forest Pk	1	<2	169	12
RS04	Waitohu S at Norfolk Cres	6	<2	118	12
RS05	Otaki R at Pukehinau	1	<2	9	12
RS06	Otaki R at Mouth	1	<2	27	12
RS07	Mangaone S at Sims Rd Br	7	2	30	12
RS08	Ngarara S at Field Way	5	<2	25	12
RS09	Waikanae R at Mangaone Walkway	1	<2	2	12
RS10	Waikanae R at Greenaway Rd	1	<2	9	12
RS11	Whareroa S at Waterfall Rd	5	<2	3,700	12
RS12	Whareroa S at QE Park	5	2	68	12
RS13	Horokiri S at Snodgrass	2	<2	1,290	12
RS14	Pauatahanui S at Elmwood Br	3	<2	130	12
RS15	Porirua S at Glenside	3	<2	129	12
RS16	Porirua S at Wall Park (Milk Depot)	2	<2	46	12
RS17	Makara S at Kennels	2	<2	700	12
RS18	Karori S at Makara Peak	1	<2	122	12
RS19	Kaiwharawhara S at Ngaio Gorge	1	<2	240	12
RS20	Hutt R at Te Marua Intake Site	1	<2	5	12
RS21	Hutt R opp. Manor Park G.C.	1	<2	440	12
RS22	Hutt R at Boulcott	2	<2	470	12
RS23	Pakuratahi R 50m d/s Farm Ck	1	<2	7	12
RS24	Mangaroa R at Te Marua	2	<2	4	12
RS25	Akatarawa R at Hutt confl.	1	<2	370	12
RS26	Whakatikei R at Riverstone	1	<2	990	12
RS28	Wainuiomata R at Manuka Track	1	<2	13	12
RS29	Wainuiomata R d/s of White Br	1	<2	14	12
RS30	Orongorongo R at Orongorongo Stn	5	<2	440	12
RS31	Ruamahanga R at McLays	1	<2	58	12
RS32	Ruamahanga R at Te Ore Ore	2	<2	420	12
RS33	Ruamahanga R at Gladstone Br	4	<2	570	12
RS34	Ruamahanga R at Pukio	6	<2	420	12
RS36	Taueru R at Castlehill	6	<2	12	12
RS37	Taueru R at Gladstone	4	<2	50	12
RS38	Kopuaranga R at Stuarts	3	<2	184	12
RS39	Whangaehu R 250m u/s confl.	3	<2	510	11
RS40	Waipoua R at Colombo Rd Br	1	<2	31	12
RS41	Waingawa R at South Rd	1	<2	161	12
RS42	Whareama R at Gauge	8	<2	540	12
RS43	Motuwaireka S at Headwaters	1	<2	5	12
RS44	Totara S at Stronvar	1	<2	290	12
RS45	Parkvale Trib at Lowes Res.	1	<2	6	11
RS46	Parkvale S at Weir	3	<2	17	12
RS47	Waiohine R at Gorge	1	<2	5	12
RS48	Waiohine R at Bicknells	2	<2	7	12
RS49	Beef Ck at Headwaters	1	<2	2	11
RS50	Mangatarere S at SH 2	2	<2	19	12
RS51	Huangarua R at Ponatahi Br	1	<2	26	12
RS52	Tauanui R at Whakatomotomo Rd	1	<2	2	11
RS53	Awhea R at Tora Rd	9	<2	570	12
RS55	Tauherenikau R at Websters	1	<2	76	12
RS56	Waiorongomai R at Forest Pk	1	<2	80	12
RS57	Waiwhetu S at Whites Line East	4	<2	23	12

Table A3.8: Electrical conductivity – field meter ($\mu\text{S}/\text{cm}$)

Site no.	Site name	Median	Minimum	5th percentile	95th percentile	Maximum	<i>n</i> *
RS02	Mangapouri S at Bennetts Rd	209	120	153	230	231	12
RS03	Waitohu S at Forest Pk	91	50	67	98	98	12
RS04	Waitohu S at Norfolk Cres	149	85	98	179	183	12
RS05	Otaki R at Pukehinau	67	57	59	78	80	12
RS06	Otaki R at Mouth	69	59	61	80	81	12
RS07	Mangaone S at Sims Rd Br	197	163	166	226	229	12
RS08	Ngarara S at Field Way	339	244	258	439	487	12
RS09	Waikanae R at Mangaone Walkway	90	75	79	96	97	12
RS10	Waikanae R at Greenaway Rd	106	95	98	116	117	12
RS11	Whareroa S at Waterfall Rd	249	152	176	274	282	12
RS12	Whareroa S at QE Park	268	206	229	296	306	12
RS13	Horokiri S at Snodgrass	198	124	147	214	222	12
RS14	Pauatahanui S at Elmwood Br	186	157	159	213	227	12
RS15	Porirua S at Glenside	248	127	146	260	265	11*
RS16	Porirua S at Wall Park (Milk Depot)	256	138	160	264	265	11*
RS17	Makara S at Kennels	278	253	256	333	341	11*
RS18	Karori S at Makara Peak	222	76	123	234	237	11*
RS19	Kaiwharawhara S at Ngaio Gorge	282	143	189	299	303	11*
RS20	Hutt R at Te Marua Intake Site	76	58	61	85	87	12
RS21	Hutt R opp. Manor Park G.C.	98	73	78	109	112	12
RS22	Hutt R at Boulcott	96	76	78	113	116	12
RS23	Pakuratahi R 50m d/s Farm Ck	87	74	78	94	97	12
RS24	Mangaroa R at Te Marua	109	97	99	122	125	12
RS25	Akatarawa R at Hutt confl.	87	54	63	99	102	12
RS26	Whakatikei R at Riverstone	114	82	93	130	135	11*
RS28	Wainuiomata R at Manuka Track	109	97	98	120	120	12
RS29	Wainuiomata R d/s of White Br	139	122	124	154	157	12
RS30	Orongorongo R at Orongorongo Stn	140	114	118	170	170	12
RS31	Ruamahanga R at McLays	56	31	36	71	72	12
RS32	Ruamahanga R at Te Ore Ore	130	48	67	201	202	12
RS33	Ruamahanga R at Gladstone Br	111	46	64	149	150	12
RS34	Ruamahanga R at Pukio	136	70	72	182	193	12
RS36	Taueru R at Castlehill	275	175	176	337	356	12
RS37	Taueru R at Gladstone	431	316	319	543	568	12
RS38	Kopuaranga R at Stuarts	251	158	160	394	399	12
RS39	Whangaehu R 250m u/s confl.	350	218	252	384	392	11
RS40	Waipoua R at Colombo Rd Br	105	82	87	117	117	12
RS41	Waingawa R at South Rd	62	40	47	74	75	12
RS42	Whareama R at Gauge	557	376	382	751	836	12
RS43	Motuwaireka S at Headwaters	281	196	209	394	403	12
RS44	Totara S at Stronvar	252	206	218	327	339	12
RS45	Parkvale Trib at Lowes Res.	171	145	147	189	191	11
RS46	Parkvale S at Weir	161	128	139	175	176	12
RS47	Waiohine R at Gorge	54	38	44	73	73	12
RS48	Waiohine R at Bicknells	76	46	53	89	91	12
RS49	Beef Ck at Headwaters	89	69	75	124	127	11
RS50	Mangatarere S at SH 2	115	93	93	150	152	12
RS51	Huangarua R at Ponatahi Br	402	305	320	447	453	12
RS52	Tauanui R at Whakatomotomo Rd	150	110	121	185	188	11
RS53	Awhea R at Tora Rd	416	327	353	491	498	12
RS55	Tauherenikau R at Websters	72	53	57	88	89	12
RS56	Waiorongomai R at Forest Pk	121	85	92	144	146	12
RS57	Waiwhetu S at Whites Line East	218	100	101	265	280	12

*Lower *n* counts for some sites (when compared to other variables) reflects sampling occasions when the field conductivity meter had malfunctioned and no measurement could be made. In such instances, the lab was asked to measure conductivity from a supplied water sample.

Table A3.9: Total organic carbon (mg/L)

Site no.	Site name	Median	Minimum	Maximum	n
RS02	Mangapouri S at Bennetts Rd	5.0	3.8	25.0	12
RS03	Waitohu S at Forest Pk	2.0	1.4	17.9	12
RS04	Waitohu S at Norfolk Cres	3.6	2.9	10.1	12
RS05	Otaki R at Pukehinau	1.2	0.6	2.9	12
RS06	Otaki R at Mouth	1.2	0.3	2.2	12
RS07	Mangaone S at Sims Rd Br	4.2	2.9	8.3	12
RS08	Ngarara S at Field Way	11.9	8.9	22.0	12
RS09	Waikanae R at Mangaone Walkway	1.4	1.1	4.0	12
RS10	Waikanae R at Greenaway Rd	1.3	0.9	2.4	12
RS11	Whareroa S at Waterfall Rd	3.9	1.9	30.0	12
RS12	Whareroa S at QE Park	12.8	7.9	18.8	12
RS13	Horokiri S at Snodgrass	2.0	1.6	50.0	12
RS14	Pauatahanui S at Elmwood Br	3.5	2.1	14.0	12
RS15	Porirua S at Glenside	3.6	2.3	14.5	12
RS16	Porirua S at Wall Park (Milk Depot)	3.4	2.2	6.8	12
RS17	Makara S at Kennels	4.7	3.4	58.0	12
RS18	Karori S at Makara Peak	2.2	1.4	15.2	12
RS19	Kaiwharawhara S at Ngaio Gorge	2.7	2.0	29.0	12
RS20	Hutt R at Te Marua Intake Site	1.8	1.3	3.2	12
RS21	Hutt R opp. Manor Park G.C.	1.7	1.2	16.2	12
RS22	Hutt R at Boulcott	1.6	1.5	9.4	12
RS23	Pakuratahi R 50m d/s Farm Ck	1.7	1.2	4.0	12
RS24	Mangaroa R at Te Marua	4.3	1.8	6.3	12
RS25	Akatarawa R at Hutt confl.	1.5	0.8	13.9	12
RS26	Whakatikei R at Riverstone	1.5	1.0	27.0	12
RS28	Wainuiomata R at Manuka Track	2.1	1.5	10.4	12
RS29	Wainuiomata R d/s of White Br	1.9	1.3	9.8	12
RS30	Orongorongo R at Orongorongo Stn	1.7	0.6	8.3	12
RS31	Ruamahanga R at McLays	1.0	0.5	6.2	12
RS32	Ruamahanga R at Te Ore Ore	2.1	0.3	9.8	12
RS33	Ruamahanga R at Gladstone Br	2.1	0.9	12.1	12
RS34	Ruamahanga R at Pukio	2.6	1.6	14.8	12
RS36	Taueru R at Castlehill	5.4	4.0	9.5	12
RS37	Taueru R at Gladstone	3.7	0.3	9.1	12
RS38	Kopuaranga R at Stuarts	2.7	0.7	13.9	12
RS39	Whangaehu R 250m u/s confl.	6.6	2.6	21.0	11
RS40	Waipoua R at Colombo Rd Br	1.8	0.9	5.5	12
RS41	Waingawa R at South Rd	1.0	0.6	3.7	12
RS42	Whareama R at Gauge	5.4	0.3	18.4	12
RS43	Motuwaiereka S at Headwaters	2.1	0.8	3.6	12
RS44	Totara S at Stronvar	2.7	2.0	8.5	12
RS45	Parkvale Trib at Lowes Res.	2.8	1.6	6.0	11
RS46	Parkvale S at Weir	4.9	3.4	10.3	12
RS47	Waiohine R at Gorge	1.3	0.5	3.0	12
RS48	Waiohine R at Bicknells	1.3	0.7	3.0	12
RS49	Beef Ck at Headwaters	1.6	0.9	2.8	11
RS50	Mangatarere S at SH 2	2.0	1.6	4.0	12
RS51	Huangarua R at Ponatahi Br	1.3	0.3	6.0	12
RS52	Tauanui R at Whakatomotomo Rd	1.8	0.9	3.9	11
RS53	Awhea R at Tora Rd	2.3	0.3	9.1	12
RS55	Tauherenikau R at Websters	1.2	0.7	4.2	12
RS56	Waiorongomai R at Forest Pk	2.0	1.0	9.0	12
RS57	Waiwhetu S at Whites Line East	3.8	1.6	7.1	12

Table A3.10: Ammoniacal nitrogen (mg/L)

Site no.	Site name	Median	Minimum	Maximum	n
RS02	Mangapouri S at Bennetts Rd	0.060	0.025	0.230	12
RS03	Waitohu S at Forest Pk	0.005	<0.005	0.008	12
RS04	Waitohu S at Norfolk Cres	0.022	0.006	0.049	12
RS05	Otaki R at Pukehinau	0.004	<0.005	0.005	12
RS06	Otaki R at Mouth	0.005	<0.005	0.006	12
RS07	Mangaone S at Sims Rd Br	0.120	0.047	0.172	12
RS08	Ngarara S at Field Way	0.021	<0.005	0.057	12
RS09	Waikanae R at Mangaone Walkway	0.005	<0.005	0.005	12
RS10	Waikanae R at Greenaway Rd	0.005	<0.005	0.007	12
RS11	Whareroa S at Waterfall Rd	0.005	<0.005	0.045	12
RS12	Whareroa S at QE Park	0.102	<0.005	0.270	12
RS13	Horokiri S at Snodgrass	0.007	<0.005	0.038	12
RS14	Pauatahanui S at Elmwood Br	0.011	<0.005	0.021	12
RS15	Porirua S at Glenside	0.006	<0.005	0.018	12
RS16	Porirua S at Wall Park (Milk Depot)	0.015	<0.005	0.025	12
RS17	Makara S at Kennels	0.012	<0.005	0.036	12
RS18	Karori S at Makara Peak	0.013	<0.005	0.191	12
RS19	Kaiwharawhara S at Ngaio Gorge	0.005	<0.005	0.058	12
RS20	Hutt R at Te Marua Intake Site	0.004	<0.005	0.005	12
RS21	Hutt R opp. Manor Park G.C.	0.005	<0.005	0.013	12
RS22	Hutt R at Boulcott	0.004	<0.005	0.005	12
RS23	Pakuratahi R 50m d/s Farm Ck	0.005	<0.005	0.006	12
RS24	Mangaroa R at Te Marua	0.005	<0.005	0.011	12
RS25	Akatarawa R at Hutt confl.	0.004	<0.005	0.011	12
RS26	Whakatikei R at Riverstone	0.004	<0.005	0.011	12
RS28	Wainuiomata R at Manuka Track	0.005	<0.005	0.006	12
RS29	Wainuiomata R d/s of White Br	0.005	<0.005	0.014	12
RS30	Orongorongo R at Orongorongo Stn	0.004	<0.005	0.005	12
RS31	Ruamahanga R at McLays	0.005	<0.005	0.008	12
RS32	Ruamahanga R at Te Ore Ore	0.005	<0.005	0.037	12
RS33	Ruamahanga R at Gladstone Br	0.006	<0.005	0.068	12
RS34	Ruamahanga R at Pukio	0.013	<0.005	0.068	12
RS36	Taueru R at Castlehill	0.008	<0.010	0.029	12
RS37	Taueru R at Gladstone	0.006	<0.005	0.034	12
RS38	Kopuaranga R at Stuarts	0.005	<0.005	0.045	12
RS39	Whangaehu R 250m u/s confl.	0.005	<0.005	0.072	11
RS40	Waipoua R at Colombo Rd Br	0.005	<0.005	0.013	12
RS41	Waingawa R at South Rd	0.005	<0.005	0.064	12
RS42	Whareama R at Gauge	0.005	<0.005	0.041	12
RS43	Motuwaireka S at Headwaters	0.005	<0.005	0.009	12
RS44	Totara S at Stronvar	0.004	<0.005	0.005	12
RS45	Parkvale Trib at Lowes Res.	0.005	<0.005	0.005	11
RS46	Parkvale S at Weir	0.010	<0.005	0.280	12
RS47	Waiohine R at Gorge	0.005	<0.005	0.006	12
RS48	Waiohine R at Bicknells	0.010	<0.005	0.049	12
RS49	Beef Ck at Headwaters	0.005	<0.005	0.009	11
RS50	Mangatarere S at SH 2	0.130	<0.010	0.630	12
RS51	Huangarua R at Ponatahi Br	0.004	<0.005	0.013	12
RS52	Tauanui R at Whakatomotomo Rd	0.005	<0.005	0.005	11
RS53	Awhea R at Tora Rd	0.004	<0.005	0.059	12
RS55	Tauherenikau R at Websters	0.005	<0.005	0.007	12
RS56	Waiorongomai R at Forest Pk	0.004	<0.005	0.005	12
RS57	Waiwhetu S at Whites Line East	0.048	<0.005	0.146	12

Table A3.11: Nitrite-nitrate nitrogen (mg/L)

Site no.	Site name	Median	Minimum	Maximum	n
RS02	Mangapouri S at Bennetts Rd	1.945	0.660	3.300	12
RS03	Waitohu S at Forest Pk	0.022	0.007	0.046	12
RS04	Waitohu S at Norfolk Cres	0.370	0.092	1.090	12
RS05	Otaki R at Pukehinau	0.044	0.009	0.060	12
RS06	Otaki R at Mouth	0.063	0.007	0.099	12
RS07	Mangaone S at Sims Rd Br	1.760	0.820	2.700	12
RS08	Ngarara S at Field Way	0.099	<0.001	1.050	12
RS09	Waikanae R at Mangaone Walkway	0.141	0.051	0.230	12
RS10	Waikanae R at Greenaway Rd	0.235	0.020	0.430	12
RS11	Whareroa S at Waterfall Rd	0.335	0.151	0.740	12
RS12	Whareroa S at QE Park	0.146	0.007	1.030	12
RS13	Horokiri S at Snodgrass	0.620	0.061	1.050	12
RS14	Pauatahanui S at Elmwood Br	0.250	0.003	0.590	12
RS15	Porirua S at Glenside	0.820	0.480	1.350	12
RS16	Porirua S at Wall Park (Milk Depot)	0.785	0.440	1.390	12
RS17	Makara S at Kennels	0.405	<0.001	0.890	12
RS18	Karori S at Makara Peak	1.215	0.490	1.570	12
RS19	Kaiwharawhara S at Ngaio Gorge	1.075	0.780	1.400	12
RS20	Hutt R at Te Marua Intake Site	0.079	0.037	0.126	12
RS21	Hutt R opp. Manor Park G.C.	0.240	0.086	0.310	12
RS22	Hutt R at Boulcott	0.230	0.076	0.310	12
RS23	Pakuratahi R 50m d/s Farm Ck	0.225	0.121	0.300	12
RS24	Mangaroa R at Te Marua	0.460	0.290	0.590	12
RS25	Akatarawa R at Hutt confl.	0.073	0.012	0.191	12
RS26	Whakatikei R at Riverstone	0.125	0.020	0.270	12
RS28	Wainuiomata R at Manuka Track	0.075	0.018	0.195	12
RS29	Wainuiomata R d/s of White Br	0.188	0.005	0.380	12
RS30	Orongorongo R at Orongorongo Stn	0.047	0.001	0.106	12
RS31	Ruamahanga R at McLays	0.023	0.008	0.042	12
RS32	Ruamahanga R at Te Ore Ore	0.355	0.053	0.940	12
RS33	Ruamahanga R at Gladstone Br	0.290	0.061	1.030	12
RS34	Ruamahanga R at Pukio	0.335	0.002	0.970	12
RS36	Taueru R at Castlehill	0.172	0.009	1.180	12
RS37	Taueru R at Gladstone	0.840	0.340	1.430	12
RS38	Kopuaranga R at Stuarts	0.885	0.720	1.430	12
RS39	Whangaehu R 250m u/s confl.	0.490	0.020	0.960	11
RS40	Waipoua R at Colombo Rd Br	0.660	0.330	1.810	12
RS41	Waingawa R at South Rd	0.056	0.021	0.210	12
RS42	Whareama R at Gauge	0.001	<0.001	0.810	12
RS43	Motuwaireka S at Headwaters	0.050	0.002	0.174	12
RS44	Totara S at Stronvar	0.088	0.002	0.870	12
RS45	Parkvale Trib at Lowes Res.	4.400	2.600	7.100	11
RS46	Parkvale S at Weir	1.515	0.001	4.000	12
RS47	Waiohine R at Gorge	0.025	0.006	0.109	12
RS48	Waiohine R at Bicknells	0.330	0.116	0.990	12
RS49	Beef Ck at Headwaters	0.025	0.003	0.045	11
RS50	Mangatarere S at SH 2	1.055	0.530	2.300	12
RS51	Huangarua R at Ponatahi Br	0.161	0.003	0.500	12
RS52	Tauanui R at Whakatomotomo Rd	0.008	0.003	0.034	11
RS53	Awhea R at Tora Rd	0.014	<0.001	0.300	12
RS55	Tauherenikau R at Websters	0.038	0.015	0.180	12
RS56	Waiorongomai R at Forest Pk	0.025	0.001	0.072	12
RS57	Waiwhetu S at Whites Line East	0.420	0.005	1.010	12

Table A3.12: Total Kjeldahl nitrogen (mg/L)

Site no.	Site name	Median	Minimum	Maximum	n
RS02	Mangapouri S at Bennetts Rd	0.46	0.36	2.60	12
RS03	Waitohu S at Forest Pk	0.05	<0.10	0.91	12
RS04	Waitohu S at Norfolk Cres	0.26	0.15	0.53	12
RS05	Otaki R at Pukehinau	0.05	<0.10	0.05	12
RS06	Otaki R at Mouth	0.05	<0.10	0.05	12
RS07	Mangaone S at Sims Rd Br	0.51	<0.10	0.78	12
RS08	Ngarara S at Field Way	0.54	0.42	1.21	12
RS09	Waikanae R at Mangaone Walkway	0.05	<0.10	0.11	12
RS10	Waikanae R at Greenaway Rd	0.05	<0.10	0.14	12
RS11	Whareroa S at Waterfall Rd	0.16	0.12	6.00	12
RS12	Whareroa S at QE Park	0.59	0.32	1.30	12
RS13	Horokiri S at Snodgrass	0.13	<0.10	5.70	12
RS14	Pauatahanui S at Elmwood Br	0.21	0.14	0.96	12
RS15	Porirua S at Glenside	0.21	0.13	0.78	12
RS16	Porirua S at Wall Park (Milk Depot)	0.21	0.16	0.62	12
RS17	Makara S at Kennels	0.27	0.22	4.90	12
RS18	Karori S at Makara Peak	0.17	0.11	1.55	12
RS19	Kaiwharawhara S at Ngaio Gorge	0.18	0.11	2.30	12
RS20	Hutt R at Te Marua Intake Site	0.05	<0.10	0.13	12
RS21	Hutt R opp. Manor Park G.C.	0.05	<0.10	1.87	12
RS22	Hutt R at Boulcott	0.05	<0.10	1.75	12
RS23	Pakuratahi R 50m d/s Farm Ck	0.05	<0.10	0.13	12
RS24	Mangaroa R at Te Marua	0.15	0.10	0.25	12
RS25	Akatarawa R at Hutt confl.	0.05	<0.10	1.33	12
RS26	Whakatikei R at Riverstone	0.05	<0.10	4.50	12
RS28	Wainuiomata R at Manuka Track	0.05	<0.10	0.41	12
RS29	Wainuiomata R d/s of White Br	0.12	<0.10	0.47	12
RS30	Orongorongo R at Orongorongo Stn	0.05	<0.10	0.47	12
RS31	Ruamahanga R at McLays	0.05	<0.10	0.19	12
RS32	Ruamahanga R at Te Ore Ore	0.12	<0.10	0.92	12
RS33	Ruamahanga R at Gladstone Br	0.15	<0.10	0.85	12
RS34	Ruamahanga R at Pukio	0.18	<0.10	1.22	12
RS36	Taueru R at Castlehill	0.27	0.17	0.48	12
RS37	Taueru R at Gladstone	0.38	0.25	0.69	12
RS38	Kopuaranga R at Stuarts	0.24	0.17	1.07	12
RS39	Whangaehu R 250m u/s confl.	0.48	0.21	2.20	11
RS40	Waipoua R at Colombo Rd Br	0.15	<0.10	0.50	12
RS41	Waingawa R at South Rd	0.05	<0.10	0.15	12
RS42	Whareama R at Gauge	0.39	0.26	1.52	12
RS43	Motuwaireka S at Headwaters	0.05	<0.10	0.10	12
RS44	Totara S at Stronvar	0.15	<0.10	0.88	12
RS45	Parkvale Trib at Lowes Res.	0.27	0.20	0.34	11
RS46	Parkvale S at Weir	0.44	0.29	1.12	12
RS47	Waiohine R at Gorge	0.05	<0.10	0.11	12
RS48	Waiohine R at Bicknells	0.05	<0.10	0.18	12
RS49	Beef Ck at Headwaters	0.05	<0.10	0.11	11
RS50	Mangatarere S at SH 2	0.38	0.11	0.88	12
RS51	Huangarua R at Ponatahi Br	0.16	<0.10	0.32	12
RS52	Tauanui R at Whakatomotomo Rd	0.05	<0.10	0.11	11
RS53	Awhea R at Tora Rd	0.22	0.10	0.80	12
RS55	Tauherenikau R at Websters	0.05	<0.10	0.11	12
RS56	Waiorongomai R at Forest Pk	0.05	<0.10	0.24	12
RS57	Waiwhetu S at Whites Line East	0.34	0.14	0.54	12

Table A3.13: Total nitrogen (mg/L)

Site no.	Site name	Median	Minimum	Maximum	n
RS02	Mangapouri S at Bennetts Rd	2.55	1.14	3.70	12
RS03	Waitohu S at Forest Pk	0.06	<0.11	0.95	12
RS04	Waitohu S at Norfolk Cres	0.59	0.30	1.40	12
RS05	Otaki R at Pukehinau	0.06	<0.11	0.11	12
RS06	Otaki R at Mouth	0.08	<0.11	0.16	12
RS07	Mangaone S at Sims Rd Br	2.25	1.08	3.20	12
RS08	Ngarara S at Field Way	0.77	0.42	2.30	12
RS09	Waikanae R at Mangaone Walkway	0.19	0.12	0.34	12
RS10	Waikanae R at Greenaway Rd	0.31	0.06	0.57	12
RS11	Whareroa S at Waterfall Rd	0.49	0.32	6.80	12
RS12	Whareroa S at QE Park	0.62	0.33	2.30	12
RS13	Horokiri S at Snodgrass	0.81	0.20	6.40	12
RS14	Pauatahanui S at Elmwood Br	0.48	0.17	1.41	12
RS15	Porirua S at Glenside	1.10	0.66	1.61	12
RS16	Porirua S at Wall Park (Milk Depot)	1.17	0.61	1.60	12
RS17	Makara S at Kennels	0.79	0.24	5.50	12
RS18	Karori S at Makara Peak	1.45	0.93	2.00	12
RS19	Kaiwharawhara S at Ngaio Gorge	1.26	0.96	3.40	12
RS20	Hutt R at Te Marua Intake Site	0.14	<0.11	0.20	12
RS21	Hutt R opp. Manor Park G.C.	0.31	0.19	1.96	12
RS22	Hutt R at Boulcott	0.34	0.19	1.83	12
RS23	Pakuratahi R 50m d/s Farm Ck	0.31	0.21	0.37	12
RS24	Mangaroa R at Te Marua	0.62	0.45	0.72	12
RS25	Akatarawa R at Hutt confl.	0.18	<0.11	1.38	12
RS26	Whakatikei R at Riverstone	0.23	<0.11	4.60	12
RS28	Wainuiomata R at Manuka Track	0.15	<0.11	0.61	12
RS29	Wainuiomata R d/s of White Br	0.35	<0.11	0.77	12
RS30	Orongorongo R at Orongorongo Stn	0.10	<0.11	0.55	12
RS31	Ruamahanga R at McLays	0.06	<0.11	0.20	12
RS32	Ruamahanga R at Te Ore Ore	0.52	0.29	1.65	12
RS33	Ruamahanga R at Gladstone Br	0.45	0.30	1.57	12
RS34	Ruamahanga R at Pukio	0.51	0.14	2.00	12
RS36	Taueru R at Castlehill	0.44	0.18	1.66	12
RS37	Taueru R at Gladstone	1.26	0.79	1.86	12
RS38	Kopuaranga R at Stuarts	1.14	0.99	1.84	12
RS39	Whangaehu R 250m u/s confl.	0.91	0.23	2.80	11
RS40	Waipoua R at Colombo Rd Br	0.82	0.46	1.97	12
RS41	Waingawa R at South Rd	0.15	<0.11	0.24	12
RS42	Whareama R at Gauge	0.41	0.26	1.68	12
RS43	Motuwaiereka S at Headwaters	0.13	<0.11	0.27	12
RS44	Totara S at Stronvar	0.24	<0.11	1.08	12
RS45	Parkvale Trib at Lowes Res.	4.70	2.90	7.20	11
RS46	Parkvale S at Weir	1.96	0.29	4.40	12
RS47	Waiohine R at Gorge	0.06	<0.11	0.15	12
RS48	Waiohine R at Bicknells	0.39	0.11	1.08	12
RS49	Beef Ck at Headwaters	0.06	<0.11	0.16	11
RS50	Mangatarere S at SH 2	1.46	0.86	2.70	12
RS51	Huangarua R at Ponatahi Br	0.34	0.11	0.80	12
RS52	Tauanui R at Whakatomotomo Rd	0.06	<0.11	0.11	11
RS53	Awhea R at Tora Rd	0.23	0.11	1.02	12
RS55	Tauherenikau R at Websters	0.08	<0.11	0.20	12
RS56	Waiorongomai R at Forest Pk	0.06	<0.11	0.29	12
RS57	Waiwhetu S at Whites Line East	0.73	0.34	1.37	12

Table A3.14: Dissolved reactive phosphorus (mg/L)

Site no.	Site name	Median	Minimum	Maximum	n
RS02	Mangapouri S at Bennetts Rd	0.035	0.029	0.070	12
RS03	Waitohu S at Forest Pk	0.009	0.007	0.011	12
RS04	Waitohu S at Norfolk Cres	0.017	0.012	0.022	12
RS05	Otaki R at Pukehinau	0.005	0.004	0.008	12
RS06	Otaki R at Mouth	0.005	0.002	0.007	12
RS07	Mangaone S at Sims Rd Br	0.027	0.019	0.056	12
RS08	Ngarara S at Field Way	0.037	0.020	0.090	12
RS09	Waikanae R at Mangaone Walkway	0.013	0.011	0.015	12
RS10	Waikanae R at Greenaway Rd	0.007	0.003	0.010	12
RS11	Whareroa S at Waterfall Rd	0.031	0.012	0.048	12
RS12	Whareroa S at QE Park	0.047	0.040	0.078	12
RS13	Horokiri S at Snodgrass	0.011	0.003	0.026	12
RS14	Pauatahanui S at Elmwood Br	0.015	0.007	0.021	12
RS15	Porirua S at Glenside	0.020	0.015	0.028	12
RS16	Porirua S at Wall Park (Milk Depot)	0.019	0.014	0.029	12
RS17	Makara S at Kennels	0.032	0.014	0.058	12
RS18	Karori S at Makara Peak	0.039	0.018	0.184	12
RS19	Kaiwharawhara S at Ngaio Gorge	0.044	0.032	0.070	12
RS20	Hutt R at Te Marua Intake Site	0.004	0.002	0.005	12
RS21	Hutt R opp. Manor Park G.C.	0.005	<0.001	0.008	12
RS22	Hutt R at Boulcott	0.005	<0.001	0.007	12
RS23	Pakuratahi R 50m d/s Farm Ck	0.005	0.002	0.006	12
RS24	Mangaroa R at Te Marua	0.010	0.004	0.015	12
RS25	Akatarawa R at Hutt confl.	0.004	0.002	0.005	12
RS26	Whakatikei R at Riverstone	0.008	0.005	0.010	12
RS28	Wainuiomata R at Manuka Track	0.012	0.008	0.016	12
RS29	Wainuiomata R d/s of White Br	0.012	0.006	0.023	12
RS30	Orongorongo R at Orongorongo Stn	0.005	0.002	0.010	12
RS31	Ruamahanga R at McLays	0.002	0.002	0.004	12
RS32	Ruamahanga R at Te Ore Ore	0.005	0.002	0.032	12
RS33	Ruamahanga R at Gladstone Br	0.010	0.002	0.062	12
RS34	Ruamahanga R at Pukio	0.015	0.002	0.060	12
RS36	Taueru R at Castlehill	0.009	0.005	0.021	12
RS37	Taueru R at Gladstone	0.016	<0.001	0.034	12
RS38	Kopuaranga R at Stuarts	0.014	0.008	0.040	12
RS39	Whangaehu R 250m u/s confl.	0.029	0.025	0.113	11
RS40	Waipoua R at Colombo Rd Br	0.006	0.002	0.009	12
RS41	Waingawa R at South Rd	0.003	0.002	0.005	12
RS42	Whareama R at Gauge	0.004	<0.001	0.022	12
RS43	Motuwaireka S at Headwaters	0.004	0.002	0.007	12
RS44	Totara S at Stronvar	0.002	0.001	0.006	12
RS45	Parkvale Trib at Lowes Res.	0.010	<0.004	0.025	11
RS46	Parkvale S at Weir	0.031	0.016	0.128	12
RS47	Waiohine R at Gorge	0.003	0.002	0.005	12
RS48	Waiohine R at Bicknells	0.015	0.006	0.032	12
RS49	Beef Ck at Headwaters	0.008	0.006	0.009	11
RS50	Mangatarere S at SH 2	0.093	0.020	0.400	12
RS51	Huangarua R at Ponatahi Br	0.004	0.001	0.019	12
RS52	Tauanui R at Whakatomotomo Rd	0.006	0.004	0.007	11
RS53	Awhea R at Tora Rd	0.005	0.002	0.088	12
RS55	Tauherenikau R at Websters	0.002	0.002	0.004	12
RS56	Waiorongomai R at Forest Pk	0.003	0.002	0.005	12
RS57	Waiwhetu S at Whites Line East	0.022	0.008	0.035	12

Table A3.15: Total phosphorus (mg/L)

Site no.	Site name	Median	Minimum	Maximum	n
RS02	Mangapouri S at Bennetts Rd	0.074	0.056	0.620	12
RS03	Waitohu S at Forest Pk	0.013	0.009	0.169	12
RS04	Waitohu S at Norfolk Cres	0.040	0.025	0.119	12
RS05	Otaki R at Pukehinau	0.006	0.002	0.019	12
RS06	Otaki R at Mouth	0.006	0.002	0.012	12
RS07	Mangaone S at Sims Rd Br	0.070	0.040	0.114	12
RS08	Ngarara S at Field Way	0.091	0.042	0.330	12
RS09	Waikanae R at Mangaone Walkway	0.015	0.013	0.020	12
RS10	Waikanae R at Greenaway Rd	0.009	0.006	0.017	12
RS11	Whareroa S at Waterfall Rd	0.045	0.025	1.700	12
RS12	Whareroa S at QE Park	0.102	0.069	0.260	12
RS13	Horokiri S at Snodgrass	0.015	0.008	1.160	12
RS14	Pauatahanui S at Elmwood Br	0.026	0.013	0.200	12
RS15	Porirua S at Glenside	0.026	0.019	0.155	12
RS16	Porirua S at Wall Park (Milk Depot)	0.030	0.020	0.091	12
RS17	Makara S at Kennels	0.043	0.020	0.580	12
RS18	Karori S at Makara Peak	0.043	0.029	0.390	12
RS19	Kaiwharawhara S at Ngaio Gorge	0.050	0.035	0.470	12
RS20	Hutt R at Te Marua Intake Site	0.006	0.002	0.016	12
RS21	Hutt R opp. Manor Park G.C.	0.008	0.005	0.380	12
RS22	Hutt R at Boulcott	0.009	0.002	0.390	12
RS23	Pakuratahi R 50m d/s Farm Ck	0.008	0.004	0.027	12
RS24	Mangaroa R at Te Marua	0.016	0.012	0.030	12
RS25	Akatarawa R at Hutt confl.	0.007	0.002	0.300	12
RS26	Whakatikei R at Riverstone	0.009	0.007	0.850	12
RS28	Wainuiomata R at Manuka Track	0.017	0.014	0.042	12
RS29	Wainuiomata R d/s of White Br	0.022	0.014	0.062	12
RS30	Orongorongo R at Orongorongo Stn	0.010	0.002	0.184	12
RS31	Ruamahanga R at McLays	0.002	0.002	0.044	12
RS32	Ruamahanga R at Te Ore Ore	0.014	0.002	0.200	12
RS33	Ruamahanga R at Gladstone Br	0.021	0.010	0.290	12
RS34	Ruamahanga R at Pukio	0.030	0.006	0.390	12
RS36	Taueru R at Castlehill	0.028	0.011	0.040	12
RS37	Taueru R at Gladstone	0.037	0.013	0.126	12
RS38	Kopuaranga R at Stuarts	0.026	0.017	0.250	12
RS39	Whangaehu R 250m u/s confl.	0.068	0.046	0.550	11
RS40	Waipoua R at Colombo Rd Br	0.008	0.002	0.070	12
RS41	Waingawa R at South Rd	0.005	0.002	0.062	12
RS42	Whareama R at Gauge	0.026	0.011	0.480	12
RS43	Motuwaireka S at Headwaters	0.005	<0.004	0.013	12
RS44	Totara S at Stronvar	0.006	<0.004	0.460	12
RS45	Parkvale Trib at Lowes Res.	0.017	0.008	0.031	11
RS46	Parkvale S at Weir	0.052	0.031	0.157	12
RS47	Waiohine R at Gorge	0.005	<0.004	0.008	12
RS48	Waiohine R at Bicknells	0.020	0.010	0.045	12
RS49	Beef Ck at Headwaters	0.012	0.006	0.015	11
RS50	Mangatarere S at SH 2	0.120	0.024	0.460	12
RS51	Huangarua R at Ponatahi Br	0.010	<0.004	0.049	12
RS52	Tauanui R at Whakatomotomo Rd	0.008	0.006	0.014	11
RS53	Awhea R at Tora Rd	0.011	0.004	0.380	12
RS55	Tauherenikau R at Websters	0.004	<0.004	0.030	12
RS56	Waiorongomai R at Forest Pk	0.005	<0.004	0.065	12
RS57	Waiwhetu S at Whites Line East	0.050	0.017	0.200	12

Table A3.16: *E. coli* (cfu/100mL)

Site no.	Site name	Median	Minimum	Maximum	<i>n</i>
RS02	Mangapouri S at Bennetts Rd	1,000	350	79,000	12
RS03	Waitohu S at Forest Pk	14	<1	260	12
RS04	Waitohu S at Norfolk Cres	650	180	6,300	12
RS05	Otaki R at Pukehinau	5	<1	130	12
RS06	Otaki R at Mouth	22	2	80	12
RS07	Mangaone S at Sims Rd Br	800	41	4,700	12
RS08	Ngarara S at Field Way	170	40	2,200	12
RS09	Waikanae R at Mangaone Walkway	12	<1	95	12
RS10	Waikanae R at Greenaway Rd	24	6	140	12
RS11	Whareroa S at Waterfall Rd	115	21	24,000	12
RS12	Whareroa S at QE Park	110	50	4,600	12
RS13	Horokiri S at Snodgrass	395	75	33,000	12
RS14	Pauatahanui S at Elmwood Br	345	60	11,000	12
RS15	Porirua S at Glenside	405	120	6,400	12
RS16	Porirua S at Wall Park (Milk Depot)	1,500	320	6,100	12
RS17	Makara S at Kennels	390	90	16,000	12
RS18	Karori S at Makara Peak	900	290	52,000	12
RS19	Kaiwharawhara S at Ngaio Gorge	295	63	24,000	12
RS20	Hutt R at Te Marua Intake Site	14	3	30	12
RS21	Hutt R opp. Manor Park G.C.	40	4	4,000	12
RS22	Hutt R at Boulcott	38	12	3,600	12
RS23	Pakuratahi R 50m d/s Farm Ck	70	12	480	12
RS24	Mangaroa R at Te Marua	140	50	900	12
RS25	Akatarawa R at Hutt confl.	38	12	2,600	12
RS26	Whakatikei R at Riverstone	15	4	2,400	12
RS28	Wainuiomata R at Manuka Track	4	<1	90	12
RS29	Wainuiomata R d/s of White Br	150	9	6,300	12
RS30	Orongorongo R at Orongorongo Stn	21	1	450	12
RS31	Ruamahanga R at McLays	5	<1	40	12
RS32	Ruamahanga R at Te Ore Ore	53	9	2,200	12
RS33	Ruamahanga R at Gladstone Br	24	2	3,900	12
RS34	Ruamahanga R at Pukio	53	9	3,700	12
RS36	Taueru R at Castlehill	155	15	1,500	12
RS37	Taueru R at Gladstone	170	20	950	12
RS38	Kopuaranga R at Stuarts	155	60	4,000	12
RS39	Whangaehu R 250m u/s confl.	160	11	8,000	11
RS40	Waipoua R at Colombo Rd Br	46	14	800	12
RS41	Waingawa R at South Rd	10	<1	61	12
RS42	Whareama R at Gauge	240	12	4,000	12
RS43	Motuwaireka S at Headwaters	8	2	120	12
RS44	Totara S at Stronvar	31	4	17,000	12
RS45	Parkvale Trib at Lowes Res.	19	8	80	11
RS46	Parkvale S at Weir	285	57	1,000	12
RS47	Waiohine R at Gorge	9	2	90	12
RS48	Waiohine R at Bicknells	48	5	150	12
RS49	Beef Ck at Headwaters	23	3	270	11
RS50	Mangatarere S at SH 2	200	30	1,500	12
RS51	Huangarua R at Ponatahi Br	85	39	320	12
RS52	Tauanui R at Whakatomotomo Rd	21	7	340	11
RS53	Awhea R at Tora Rd	145	8	440	12
RS55	Tauherenikau R at Websters	26	5	95	12
RS56	Waiorongomai R at Forest Pk	15	<1	170	12
RS57	Waiwhetu S at Whites Line East	550	13	6,600	12

Table A3.17: Faecal coliforms (cfu/100mL)

Site no.	Site name	Median	Minimum	Maximum	n
RS02	Mangapouri S at Bennetts Rd	1,500	430	99,000	12
RS03	Waitohu S at Forest Pk	18	<1	260	12
RS04	Waitohu S at Norfolk Cres	665	230	9,400	12
RS05	Otaki R at Pukehinau	7	<1	160	12
RS06	Otaki R at Mouth	28	2	100	12
RS07	Mangaone S at Sims Rd Br	850	48	5,000	12
RS08	Ngarara S at Field Way	185	40	2,700	12
RS09	Waikanae R at Mangaone Walkway	13	<1	100	12
RS10	Waikanae R at Greenaway Rd	29	10	160	12
RS11	Whareroa S at Waterfall Rd	125	23	33,000	12
RS12	Whareroa S at QE Park	120	70	6,500	12
RS13	Horokiri S at Snodgrass	460	84	38,000	12
RS14	Pauatahanui S at Elmwood Br	395	60	19,000	12
RS15	Porirua S at Glenside	485	170	8,500	12
RS16	Porirua S at Wall Park (Milk Depot)	2,000	410	8,500	12
RS17	Makara S at Kennels	410	90	17,000	12
RS18	Karori S at Makara Peak	900	350	54,000	12
RS19	Kaiwharawhara S at Ngaio Gorge	435	79	25,000	12
RS20	Hutt R at Te Marua Intake Site	16	3	35	12
RS21	Hutt R opp. Manor Park G.C.	41	8	5,600	12
RS22	Hutt R at Boulcott	48	21	4,500	12
RS23	Pakuratahi R 50m d/s Farm Ck	85	14	550	12
RS24	Mangaroa R at Te Marua	165	55	900	12
RS25	Akatarawa R at Hutt confl.	61	16	3,100	12
RS26	Whakatikei R at Riverstone	23	5	2,400	12
RS28	Wainuiomata R at Manuka Track	4	<1	90	12
RS29	Wainuiomata R d/s of White Br	175	11	8,200	12
RS30	Orongorongo R at Orongorongo Stn	24	1	480	12
RS31	Ruamahanga R at McLays	6	<1	40	12
RS32	Ruamahanga R at Te Ore Ore	60	14	2,200	12
RS33	Ruamahanga R at Gladstone Br	27	3	3,900	12
RS34	Ruamahanga R at Pukio	57	11	3,700	12
RS36	Taueru R at Castlehill	170	20	1,700	12
RS37	Taueru R at Gladstone	170	20	1,100	12
RS38	Kopuaranga R at Stuarts	180	70	4,000	12
RS39	Whangaehu R 250m u/s confl.	180	12	8,000	11
RS40	Waipoua R at Colombo Rd Br	51	15	1,000	12
RS41	Waingawa R at South Rd	11	<1	70	12
RS42	Whareama R at Gauge	280	19	4,000	12
RS43	Motuwaireka S at Headwaters	10	2	120	12
RS44	Totara S at Stronvar	40	7	24,000	12
RS45	Parkvale Trib at Lowes Res.	19	9	80	11
RS46	Parkvale S at Weir	350	65	1,000	12
RS47	Waiohine R at Gorge	10	2	350	12
RS48	Waiohine R at Bicknells	53	5	150	12
RS49	Beef Ck at Headwaters	26	3	270	11
RS50	Mangatarere S at SH 2	230	30	1,900	12
RS51	Huangarua R at Ponatahi Br	90	44	410	12
RS52	Tauanui R at Whakatomotomo Rd	25	9	380	11
RS53	Awhea R at Tora Rd	145	8	440	12
RS55	Tauherenikau R at Websters	28	5	130	12
RS56	Waiorongomai R at Forest Pk	15	<1	190	12
RS57	Waiwhetu S at Whites Line East	645	13	8,700	12

Appendix 4: Tabulated heavy metal data

The default trigger values presented here represent the ANZECC (2000) 95% species protection level for slightly modified freshwater ecosystems.

Table A4.1: Summary of dissolved copper (mg/L) concentrations measured at 10 RSoE sites between July 2014 and June 2015 (D.L.= detection limit). The percentages of samples exceeding the ANZECC (2000) default and hardness-modified trigger values (TVs) are also presented

Site no.	Site name	Median	Minimum	Maximum	n	n <D.L.	% of samples (n) exceeding ANZECC (2000)	
							Default TV (≤ 0.0014)	Hardness modified TV
RS02	Mangapouri S at Bennetts Rd	0.0012	0.0005	0.0028	12	0	16.7	16.7
RS08	Ngarara S at Field Way	0.0003	<0.0005	0.0015	12	8	8.3	0
RS10	Waikanae R at Greenaway Rd	0.0003	<0.0005	0.0007	12	11	0	0
RS15	Porirua S at Glenside	0.0009	<0.0005	0.0022	12	1	8.3	8.3
RS16	Porirua S at Wall Park (Milk Depot)	0.0013	0.0006	0.0031	12	0	33.3	8.3
RS18	Karori S at Makara Peak	0.0015	0.0009	0.0040	12	0	50	41.7
RS19	Kaiwharawhara S at Ngaio Gorge	0.0015	0.0010	0.0060	12	0	50	16.7
RS21	Hutt R opp. Manor Park G.C.	0.0003	<0.0005	0.0005	12	10	0	0
RS22	Hutt R at Boulcott	0.0003	<0.0005	0.0018	12	11	8.3	8.3
RS57	Waiwhetu S at Whites Line East	0.0012	<0.0005	0.0046	12	1	41.7	41.7

Table A4.2: Summary of dissolved zinc (mg/L) concentrations measured at 10 RSoE sites between July 2014 and June 2015 (D.L.= detection limit). The percentages of samples exceeding the ANZECC (2000) default and hardness-modified trigger values (TVs) are also presented

Site no.	Site name	Median	Minimum	Maximum	n	n <D.L.	% of samples (n) exceeding ANZECC (2000)	
							Default TV (≤ 0.008)	Hardness modified TV
RS02	Mangapouri S at Bennetts Rd	0.0031	0.0018	0.0072	12	0	0	0
RS08	Ngarara S at Field Way	0.0014	<0.001	0.0030	12	3	0	0
RS10	Waikanae R at Greenaway Rd	0.0005	<0.001	0.0011	12	11	0	0
RS15	Porirua S at Glenside	0.0058	0.0027	0.0157	12	0	25	8.3
RS16	Porirua S at Wall Park (Milk Depot)	0.0149	0.0031	0.0750	12	0	75	66.7
RS18	Karori S at Makara Peak	0.0270	0.0133	0.0390	12	0	100	100
RS19	Kaiwharawhara S at Ngaio Gorge	0.0067	0.0016	0.0184	12	0	25	8.3
RS21	Hutt R opp. Manor Park G.C.	0.0005	<0.001	0.0026	12	8	0	0
RS22	Hutt R at Boulcott	0.0005	<0.001	0.0068	12	9	0	8.3
RS57	Waiwhetu S at Whites Line East	0.0250	0.0057	0.0660	12	0	91.7	83.3

Appendix 5: Additional macroinvertebrate indices

Table A5.1: QMCI, %EPT* taxa and taxa richness scores for RSoE sites sampled in summer 2014/2015

Site no.	Site name	QMCI	%EPT* taxa	Taxa richness
RS02	Mangapouri S at Bennetts Rd	4.50	12.0	25
RS03	Waitohu S at Forest Pk	8.26	63.2	19
RS04	Waitohu S at Norfolk Cres	4.71	16.7	24
RS05	Otaki R at Pukehinau	7.15	55.0	20
RS06	Otaki R at Mouth	4.91	40.0	20
RS07	Mangaone S at Sims Rd Br	4.09	0.0	19
RS08	Ngarara S at Field Way	4.53	9.5	21
RS09	Waikanae R at Mangaone Walkway	8.13	60.0	30
RS10	Waikanae R at Greenaway Rd	4.83	52.2	23
RS11	Whareroa S at Waterfall Rd	5.23	46.4	28
RS12	Whareroa S at QE Park	4.44	4.5	22
RS13	Horokiri S at Snodgrass	4.88	34.8	23
RS14	Pauatahanui S at Elmwood Br	3.23	37.5	24
RS15	Porirua S at Glenside	6.39	33.3	18
RS16	Porirua S at Wall Park (Milk Depot)	3.10	17.4	23
RS17	Makara S at Kennels	5.14	44.0	25
RS18	Karori S at Makara Peak	3.05	16.0	25
RS19	Kaiwharawhara S at Ngaio Gorge	2.81	19.0	21
RS20	Hutt R at Te Marua Intake Site	7.55	65.2	23
RS21	Hutt R opp. Manor Park G.C.	6.08	56.7	30
RS22	Hutt R at Boulcott	4.91	40.9	22
RS23	Pakuratahi R 50m d/s Farm Ck	5.62	55.6	27
RS24	Mangaroa R at Te Marua	5.22	40.7	27
RS25	Akatarawa R at Hutt confl.	7.87	55.6	27
RS26	Whakatikei R at Riverstone	6.54	53.3	30
RS28	Wainuiomata R at Manuka Track	7.55	66.7	33
RS29	Wainuiomata R d/s of White Br	5.58	44.0	25
RS30	Orongorongo R at Orongorongo Stn	6.67	47.1	17
RS31	Ruamahanga R at McLays	7.32	57.1	21
RS32	Ruamahanga R at Te Ore Ore	4.63	31.6	19
RS33	Ruamahanga R at Gladstone Br	6.03	46.7	15
RS34	Ruamahanga R at Pukio	5.36	41.2	17
RS36	Taueru R at Castlehill	4.16	34.5	29
RS37	Taueru R at Gladstone	4.15	25.0	20
RS38	Kopuaranga R at Stuarts	4.07	33.3	15
RS39	Whangaehu R 250m u/s confl.	3.73	8.3	24
RS40	Waipoua R at Colombo Rd Br	4.77	38.1	21
RS41	Waingawa R at South Rd	5.51	43.5	23
RS42	Whareama R at Gauge	3.98	21.4	14
RS43	Motuwaireka S at Headwaters	6.58	42.9	35
RS44	Totara S at Stronvar	5.24	37.5	24
RS45	Parkvale Trib at Lowes Res.	4.50	28.6	21
RS46	Parkvale S at Weir	4.15	25.0	20
RS47	Waiohine R at Gorge	7.59	71.4	14
RS48	Waiohine R at Bicknells	3.91	43.5	23
RS49	Beef Ck at Headwaters	5.93	52.9	34
RS50	Mangatarere S at SH 2	4.97	40.9	22
RS51	Huangarua R at Ponatahi Br	4.29	36.4	22
RS52	Tauanui R at Whakatomotomo Rd	6.96	58.3	24
RS53	Awhea R at Tora Rd	5.35	29.2	24
RS55	Tauherenikau R at Websters	5.40	42.9	21
RS56	Waiorongomai R at Forest Pk	6.53	57.7	26
RS57	Waiwhetu S at Whites Line East	3.95	6.7	15

*Pollution tolerant EPT taxa (*Oxyethira* and *Paroxythira*) were excluded from this calculation.

Appendix 6: Habitat scores for RSoE sites assessed in summer 2014/15

Site no.	Site name	Substrate (hard or soft bottomed)	Dominant Landcover	Fine sediment	Invertebrate habitat	Fish cover	Hydraulic heterogeneity	Bank stability	Bank vegetation	Riparian buffer	Riparian shade	Channel alteration	Total habitat score	Rank
RS02	Mangapouri S at Bennetts Rd	Soft	Urban	2	10	22	4	8.5	9.5	8	11	11	86	47
RS03	Waitohu S at Forest Pk	Hard	Indigenous forest	20	40	38	18	18.5	18.5	18	15	20	206	5
RS04	Waitohu S at Norfolk Cres	Soft	Pasture	1	2	10	1	10.5	5.5	8.5	11	16	65.5	52
RS05	Otaki R at Pukehinau	Hard	Indigenous forest	20	30	36	18	17	18	19	5	20	183	13
RS06	Otaki R at Mouth	Hard	Indigenous forest	19	28	20	8	16	7.5	10.5	1	8	118	41
RS07	Mangaone S at Sims Rd Br	Soft	Pasture	1	2	12	1	18	7	5	2	12	60	53
RS08	Ngarara S at Field Way	Soft	Urban	1	10	24	1	16	8	9	3	3	75	50
RS09	Waikanae R at Mangaone Walkway	Hard	Indigenous forest	20	40	40	20	17.5	20	20	20	20	217.5	1
RS10	Waikanae R at Greenaway Rd	Hard	Indigenous forest	20	30	30	15	18.5	13	12	5	5	148.5	25
RS11	Whareroa S at Waterfall Rd	Hard	Indigenous forest	2	26	30	15	4	17	19	20	20	153	21
RS12	Whareroa S at QE Park	Soft	Pasture	1	2	30	1	11	12.5	19	2	20	98.5	46
RS13	Horokiri S at Snodgrass	Hard	Pasture	18	30	34	11	15	9	4	13	15	149	24
RS14	Pauatahanui S at Elmwood Br	Hard	Pasture	7	12	32	11	12.5	9	8	11	19	121.5	40
RS15	Porirua S at Glenside	Hard	Urban	16	36	36	10	14.5	15	15	2	12	156.5	20
RS16	Porirua S at Wall Park (Milk Depot)	Hard	Urban	4	38	30	1	16	5	12.5	5	14	125.5	37=
RS17	Makara S at Kennels	Hard	Pasture	5	30	38	11	14.5	16.5	14.5	6	8	143.5	30
RS18	Karori S at Makara Peak	Hard	Urban	20	40	30	6	16	13	12	7	6	150	23
RS19	Kaiwharawhara S at Ngaio Gorge	Hard	Urban	16	30	32	7	15.5	18	18	8	19	163.5	16
RS20	Hutt R at Te Marua Intake Site	Hard	Indigenous forest	20	36	26	19	18	18	18	1	19	175	14
RS21	Hutt R opp. Manor Park G.C.	Hard	Indigenous forest	15	30	36	13	15.5	13	13.5	2	9	147	28=
RS22	Hutt R at Boulcott	Hard	Indigenous forest	13	26	32	9	17.5	12	13	7	13	142.5	31=
RS23	Pakuratahi R 50m d/s Farm Ck	Hard	Indigenous forest	19	40	36	15	20	19	19	8	20	196	8=
RS24	Mangaroa R at Te Marua	Hard	Pasture	19	30	32	19	17	11	12	8	14	162	19
RS25	Akatarawa R at Hutt confl.	Hard	Indigenous forest	18	38	38	20	19	19.5	20	13	18	203.5	7
RS26	Whakatikei R at Riverstone	Hard	Indigenous forest	9	36	38	19	19	20	20	15	20	196	8=
RS28	Wainuiomata R at Manuka Track	Hard	Indigenous forest	20	40	40	18	20	20	20	19	20	217	2
RS29	Wainuiomata R d/s of White Br	Hard	Indigenous forest	19	38	30	18	12.5	6	6	1	17	147.5	26=

Site no.	Site name	Substrate (hard or soft bottomed)	Dominant Landcover	Fine sediment	Invertebrate habitat	Fish cover	Hydraulic heterogeneity	Bank stability	Bank vegetation	Riparian buffer	Riparian shade	Channel alteration	Total habitat score	Rank
RS30	Orongorongo R at Orongorongo Stn	Hard	Indigenous forest	10	32	14	15	15.5	7	5	1	18	117.5	42
RS31	Ruamahanga R at McLays	Hard	Indigenous forest	20	40	40	20	17	17.5	15	15	20	204.5	6
RS32	Ruamahanga R at Te Ore Ore	Hard	Pasture	15	26	28	11	13.5	11	12	9	5	130.5	36
RS33	Ruamahanga R at Gladstone Br	Hard	Pasture	19	32	30	14	18.5	11	15	9	14	162.5	18
RS34	Ruamahanga R at Pukio	Hard	Pasture	19	10	22	6	12	6	6.5	6	20	107.5	43
RS36	Taueru R at Castlehill	Soft	Pasture	1	2	30	6	11	12	12	12	20	106	44
RS37	Taueru R at Gladstone	Hard	Pasture	6	22	26	11	14.5	7	18	6	15	125.5	37=
RS38	Kopuaranga R at Stuarts	Hard	Pasture	8	28	22	16	16.5	7	9.5	6	18	131	35
RS39	Whangaehu R 250m u/s confl.	Soft	Pasture	1	20	36	1	18	11	15.5	11	18	131.5	34
RS40	Waipoua R at Colombo Rd Br	Hard	Pasture	10	40	40	13	7	9	10.5	2	11	142.5	31=
RS41	Waingawa R at South Rd	Hard	Indigenous forest	17	36	36	18	7	10	15	7	1	147	28=
RS42	Whareama R at Gauge	Soft	Pasture	1	4	28	8	9	5	3	6	15	79	49
RS43	Motuwaireka S at Headwaters	Hard	Indigenous forest	5	40	40	15	17.5	20	20	17	20	194.5	10
RS44	Totara S at Stronvar	Hard	Exotic forest	5	32	40	6	15.5	10	9	14	20	151.5	22
RS45	Parkvale Trib at Lowes Res.	Hard	Pasture	1	30	30	5	20	19	20	20	20	165	15
RS46	Parkvale S at Weir	Hard	Pasture	7	26	16	8	14.5	7.5	11	3	11	104	45
RS47	Waiohine R at Gorge	Hard	Indigenous forest	20	40	34	20	20	18	17.5	2	20	191.5	11
RS48	Waiohine R at Bicknells	Hard	Pasture	20	38	36	18	12	11	11	7	10	163	17
RS49	Beef Ck at Headwaters	Hard	Indigenous forest	18	38	40	19	19.5	18	14	20	20	206.5	3=
RS50	Mangatarere S at SH 2	Hard	Pasture	13	24	34	10	15.5	11	18	7	15	147.5	26=
RS51	Huangularua R at Ponatahi Br	Hard	Pasture	10	30	16	6	16	13	15.5	2	16	124.5	39
RS52	Tauanui R at Whakatomotomo Rd	Hard	Indigenous forest	11	36	40	20	15	20	20	8	20	190	12
RS53	Awhea R at Tora Rd	Hard	Pasture	2	12	12	3	13.5	7	8	2	20	79.5	48
RS55	Tauherenikau R at Websters	Hard	Pasture	13	22	22	12	20	11	12	10	20	142	33
RS56	Waiorongomai R at Forest Pk	Hard	Indigenous forest	15	40	40	20	17.5	16	20	18	20	206.5	3=
RS57	Waiwhetu S at Whites Line East	Soft	Urban	8	10	16	1	15	4	5	6	1	66	51

Appendix 7: Additional monitoring data for 2014/15

Table A7.1 summarises water quality, periphyton and fine sediment data collected as part of the community-based river monitoring trial (refer Section 2.4). Macroinvertebrate metrics presented for existing RSoE sites in Table A7.2 are based on samples collected on different occasions to those summarised in Section 5.

Water quality and macroinvertebrate samples were typically collected in accordance with methodology outlined in Appendix 2, except that in some cases macroinvertebrate samples were collected during winter/spring periods.

Table A7.1: Summary of water quality, periphyton and fine sediment data collected in the Mawaihakona Stream at Hutt Confluence, based on 12 sampling occasions between July 2014 and June 2015¹

Variable	Median	Minimum	Maximum	n
Water temperature (°C)	15.7	11.9	19.9	12
Dissolved oxygen (% saturation)	115.9	91.9	138.9	12
Dissolved oxygen (mg/L)	11.5	9.5	12.9	12
pH	7.2	6.7	8.2	11
Water clarity (m)	2.12	0.66	4.54	12
Turbidity (NTU)	1.4	0.3	5.4	12
Total suspended solids (mg/L)	3.5	<2.0	11	12
Conductivity (µS/cm)	133.2	89.9	145.8	12
Total organic carbon (mg/L)	1.7	0.9	3.9	12
Ammoniacal nitrogen (mg/L)	0.005	<0.010	0.031	12
Nitrite-nitrate nitrogen (mg/L)	1.150	0.510	1.590	12
Total Kjeldahl nitrogen (mg/L)	0.150	0.110	0.240	12
Total nitrogen (mg/L)	1.300	0.680	1.770	12
Dissolved reactive phosphorus (mg/L)	0.013	0.006	0.020	12
Total phosphorus (mg/L)	0.021	0.015	0.039	12
<i>E. coli</i> (cfu/100 mL)	145	40	2,400	12
Faecal coliforms (cfu/100 mL)	165	50	2,900	12
Fine sediment (% cover)	50	30	70	11
Filamentous periphyton (% cover)	1	0	4	11
Mat periphyton (% cover)	0	0	9	11
Cyanobacteria mat periphyton (% cover)	1	0	3	11

¹Note that additional water quality data are available for this site (sampling has occurred monthly from March 2014 to August 2015 inclusive).

Table A7.2: Summary of macroinvertebrate metrics based on additional samples/sites collected between July 2014 and June 2015¹ as part of the community based river monitoring trial

Site	Sampling date	MCI	QMCI	%EPT taxa	TAXA richness
Mawaihakona S at Hutt confluence	19/08/2014	75.0	3.24	12.5	16
Mawaihakona S at Hutt confluence	28/01/2015	85.3	3.98	26.3	19
Waikanae R at Greenaway Rd (RS10)	25/08/2014	123.0	6.61	48.1	27
Mangatarere S at SH 2 (RS50)	05/09/2014	116.8	7.04	44.0	25
Mangatarere S at SH 2 (RS50)	04/02/2015	112.2	5.69	39.1	23

¹Additional macroinvertebrate data are available for these sites but was collected outside of the July 2014 to June 2015 reporting period covered here.