

Waikato River Water Quality Monitoring Programme: Data Report 2008

Prepared by:
Stuart Beard

For:
Environment Waikato
PO Box 4010
HAMILTON EAST

June 2009

Document #: 1382075

Peer reviewed by:
Bill Vant

Date 2 July 2009

Approved for release by:
Jim Price

Date 3 July 2009

Disclaimer

This technical report has been prepared for the use of Waikato Regional Council as a reference document and as such does not constitute Council's policy.

Council requests that if excerpts or inferences are drawn from this document for further use by individuals or organisations, due care should be taken to ensure that the appropriate context has been preserved, and is accurately reflected and referenced in any subsequent spoken or written communication.

While Waikato Regional Council has exercised all reasonable skill and care in controlling the contents of this report, Council accepts no liability in contract, tort or otherwise, for any loss, damage, injury or expense (whether direct, indirect or consequential) arising out of the provision of this information or its use by you or any other party.

Acknowledgement

Thanks to Naomi Crawford, Sally Grant, Rebecca Ireland, Claire Kotze, Ralph Ostertag and Chris Service for their commitment and reliability in undertaking field measurements and sample collection; and Ian Buchanan for co-ordinating the laboratory analyses and assisting with co-ordination of the field aspects of sample collection.

Hydrological flow data were provided by Mighty River Power (Hydro Lakes, Waiotapu Stream and Waikato River at Reids Farm), Contact Energy (Ohaaki Bridge) and Genesis Power (Huntly) through agents Opus and NIWA. The Environmental Monitoring Programme, Environment Waikato, Hamilton provided hydrological flow data for the two other sites.

Table of contents

Acknowledgement	i
1 Introduction	1
1.1 Background	1
1.2 Report Content	1
1.3 Water Quality Guidelines and Standards	2
2 The Waikato River Monitoring Programme Design	2
2.1 Sampling collection	2
2.2 Sample locations	3
2.3 Water quality parameters	4
2.4 Quality control, data storage and analysis	5
2.5 Reports	5
3 Results	5
3.1 Waikato River monitoring programme	6
Routine water quality monitoring	6
Summary statistics	6
Key parameter graphs	6
Comparison with water quality standards	6
Raw data	6
3.2 Waikato River Monitoring Programme	26
Bathing Season Microbiological Survey	26
Summary Statistics	26
Comparison with Water Quality Standards	26
Parameter Graph	26
Raw Data	26
3.3 Waikato River Monitoring Programme	30
5-yearly Pesticides Results	30
References	33
Appendix I: Flow Information	34
Appendix II	35
Datasonde Deployments	35
Diurnal variation of Some Water Quality Parameters	35
Appendix III:	50
Water Quality Parameters	50
Guidelines and Standards	50
Analytical Methods	50

Tables

Table 1:	Guidelines and Standards for Physicochemical Water Quality for Ecological Health and for Human Uses of Water	2
Table 2:	Routine Sampling and Bathing Water Monitoring Locations	3
Table 3:	Samples (Year 2008) complying with the 'Satisfactory' Water Quality Guidelines and Standards. n = 12 (except *, where n = 11).	19
Table 4:	Samples (Year 2008) complying with the 'Excellent' Water Quality Guidelines and Standards. n = 12 (except *, where n = 11).	19
Table 5:	Bathing Season Statistics of E. coli Bacteria.	27
Table 6:	Year 2008/2009 Bathing Season E. coli survey results complying with the "Satisfactory" and "Excellent" Water Quality Guidelines. n = 12.	27
Table 7:	Samples for the 3 pesticides which were detected (values shown in bold). The remaining 116 pesticides analysed were not detected.	31
Table 8:	Pesticide parameters analysed for, with respective detection limits and method of analysis (n=24).	32

Figures

Figure 1:	Waikato River Water Quality Monitoring Locations	4
Figure 2:	E. coli – 5 Bathing Season Data	28

1 Introduction

1.1 Background

The year 2008 report follows the format of the previous data report (Beard, 2007).

To effectively manage water quality, the Waikato River monitoring programme addresses the following questions:

1. What is the quality of the water now?
2. Why is the water of the observed level of quality?
3. Is water quality getting better or worse? If so - what makes it change?
4. How can we improve the quality, ecological health and integrity of the Waikato River?

The monitoring information allows Environment Waikato to:

- determine compliance with classification standards
- define the suitability of the resource for various beneficial uses and values of the water
- monitor the impact of major discrete point source discharges on water quality
- monitor the impacts of diffuse discharges on water quality
- provide a basis for evaluating the effectiveness of resource management measures.

This dataset is invaluable for the evaluation of the Waikato River: its state, the pressures on it and its response to these pressures. We need to continue to gather comprehensive, reliable and good quality data on the Waikato River to protect and enhance its values into the future.

This report is the 18th since the re-design of the Waikato River Monitoring Programme (WARIMP) implemented in 1989. Copies of reports can be obtained via the Environment Waikato Internet site <http://www.ew.govt.nz/publications/index.htm> or by contacting Environment Waikato (the Library) on 0800 800 401, e-mail: inforeq@ew.govt.nz.

1.2 Report Content

The report provides information on:

1. Routine monthly monitoring of water quality at 10 sites:
 - Year 2008 summary data, tabulated by parameter for each location and reported with the median of the previous 5 years.
 - Key parameter graphs showing the average water quality for 2008 at each location, compared to results of the previous 5 years.
 - Summary tables identifying the number of samples meeting 'satisfactory' and 'excellent' water quality standards and guidelines.
 - Raw data for 2008.
 - Pesticide monitoring data and parameters for 2008.
2. Additional information is provided in the appendices on:
 - Flow (*Appendix I*).
 - The effect of flow is important to assessing water quality and making comparisons between years. Appendix I provides information on annual average flow at some locations for the previous 10 years.
 - Datasonde Deployments
 - Plots of deployments undertaken during 2008 showing the level of diurnal and seasonal variation at five Waikato River sites (*Appendix II*).

1.3 Water Quality Guidelines and Standards

Table 1 lists the physical and chemical water quality standards and guidelines used to assess the condition of the Waikato River in 2008. The standards mainly relate to either the protection of the ecological health of rivers and streams or to whether they are suitable for water-based recreation, especially swimming.

Some water quality Guidelines and Standards are relevant to the use of the Waikato River for both general water supply (industrial/cooling water, irrigation, stock water etc.) and as a source of municipal drinking water. In most cases two criteria are shown. The less stringent criteria define water that is “satisfactory” for the desired use; these are mostly based on existing national and other Guidelines and Standards (Appendix IV). The more stringent criteria identify “excellent” water, and reflect expert opinion. Samples gathered in 2008 whose results do not comply with the “satisfactory” criteria (Table 1) are underlined in raw data summaries.

Table 1: Guidelines and Standards for Physicochemical Water Quality for Ecological Health and for Human Uses of Water

Water Quality Measure	Relevance ¹	Satisfactory	Excellent
Ecological Health			
Dissolved oxygen (% saturation)	aquatic life (breathing)	>80	>90
pH	aquatic life (acidity)	6.5–9	7–8
Turbidity (NTU)	plant growth (clarity)	<5	<2
Ammoniacal-N (g/m ³)	aquatic life (toxicity)	<0.88	<0.1
Temperature (°C)	fish (spawning)	<12	<10
(May-Sep)		<20	<16
(Oct-Apr)			
Total phosphorus (g/m ³)	Nuisance plant growth	<0.04	<0.01
Total nitrogen (g/m ³)	Nuisance plant growth	<0.5	<0.1
Human Uses—recreation			
Baseflow water clarity (m)	Visibility	>1.6	>4
Escherichia coli (no./100 mL)	human health	<550	<55
Median Escherichia coli (no./100 mL)	human health	<126	<23
Human Uses—water supply			
Phytoplankton chlorophyll a (g/m ³)	filter blockage	<0.02	<0.005
Human Uses—drinking water			
Arsenic (g/m ³)	human health (toxicity)	<0.01	–
Boron (g/m ³)	human health (toxicity)	<1.4	–

¹ Refer to Appendix IV for description of Guideline and Standards values used. These guidelines and standards are also defined on the Environment Waikato Internet site; www.ew.govt.nz

2 The Waikato River Monitoring Programme Design

2.1 Sampling collection

Sample collection occurs monthly, as two sampling runs. Locations in the upper catchment from Taupo to Waipapa are visited as part of the first run, and locations in the middle and lower catchments from Hamilton (at the Narrows) to Tuakau are visited on the next. Each location is sampled at a similar time on each occasion (coefficient of

variation ~2–6%) to minimise the effect of diurnal variation on the measurement of water quality parameters. Sample times are recorded in New Zealand Standard Time (NZST). Because of the controlled nature of the river, our daytime samples are generally collected at higher than median flows.

2.2 Sample locations

Routine water quality monitoring locations of the Waikato River Monitoring Programme and additional locations used during the summer microbiological surveys are summarised in *Table 2* and illustrated in *Figure 1*.

Table 2: Routine Sampling and Bathing Water Monitoring Locations

Location Number	Distance ¹ (km)	Location Name	Map Ref.	Field ^r Measurements
1131.127	0.1	Taupo Gates	U18:772-757	–
1131.119 ^{*d}	1.2	Taupo – Reids Farm	U18:778:763	true left bank
1131.70 ^b	6.0	Huka Falls	U18:789-792	–
1131.244 ^d	7.8	Downstream Huka Falls	U18:797-809	river boat jetty ²
1131.105 ^d	36.5	Ohaaki Bridge	U17:981-914	at bridge, true left bank
1131.107	75.8	Ohakuri Tailrace Bridge	U17:796-061	boat ramp ³
1131.147	105.0	Whakamaru Tailrace	T17:552-056	boat ramp ⁴
1131.143	126.1	Waipapa Tailrace	T16:448-200	boat ramp ⁵
1131.81 ^b	166.7	Lake Karapiro Boat Ramp	T15:436-570	Horahora domain
1131.328	202.2	Hamilton – Narrows	S14:168-710	boat ramp ⁶
1131.145 ^{*b}	210.8	Hamilton – Wellington St Bch	S14:117-757	at jetty, true right bank
1131.64 ^d	211.5	Hamilton – Traffic Bridge	S14:118-764	true right bank
1131.121 ^b	219.8	Hamilton – Sewer Bridge	S14:082-823	true left bank
1131.69	225.6	Horotiu Bridge	S14:048-871	d/s of bridge
1131.102 ^b	232.3	Ngaruawahia Bridge	S14:997-912	u/s of confluence ⁷
1131.77	246.5	Huntly – Tainui Bridge	S13:003-018	true left bank
1131.117 ^{*d}	262.3	Rangiriri Bridge	S13:989-167	true right bank
1131.91	286.3	Mercer Bridge	S12:919-336	–
1131.133	296.8	Tuakau Bridge	R12:828-320	boat ramp ⁸
1131.131 ^d	306.5	Tuakau – Elbows Landing	R12:745-352	NZ Steel Ltd pumping station

¹ approximate distance (in kilometres) from Lake Taupo's outlet.

² river boat jetty and boat ramp, true left bank, about 1.8km downstream of Huka Falls

³ boat ramp in recreation reserve immediately upstream from dam (true left bank).

⁴ boat ramp at Whakamaru Power Station.

⁵ river access d/s of Lake Waipapa, about 500 m off S.H. 32 along a gravel road (true left bank).

⁶ boat ramp accessed via Narrows Lane (true right bank)

⁷ road bridge upstream of Waipa River confluence.

⁸ immediately d/s of bridge, at Reserve (true right bank).

^b bathing season intensive microbiological survey locations only – survey conducted over the 2008/09 summer.

^{*} Locations at **Taupo (Reids Farm)**, 1.1 km d/s from Taupo Gates), at **Hamilton** (Wellington Street jetty) and at **Rangiriri** (Rangiriri Bridge) are sampled and reported as part of the National River Water Quality Network undertaken by NIWA. Contact person: Graham Bryers, NIWA, Hamilton.

^r Logistic considerations mean field measurements are often made at slightly different locations from sample collection (e.g. sampling from bridges).

^d Datasonde deployment sites.

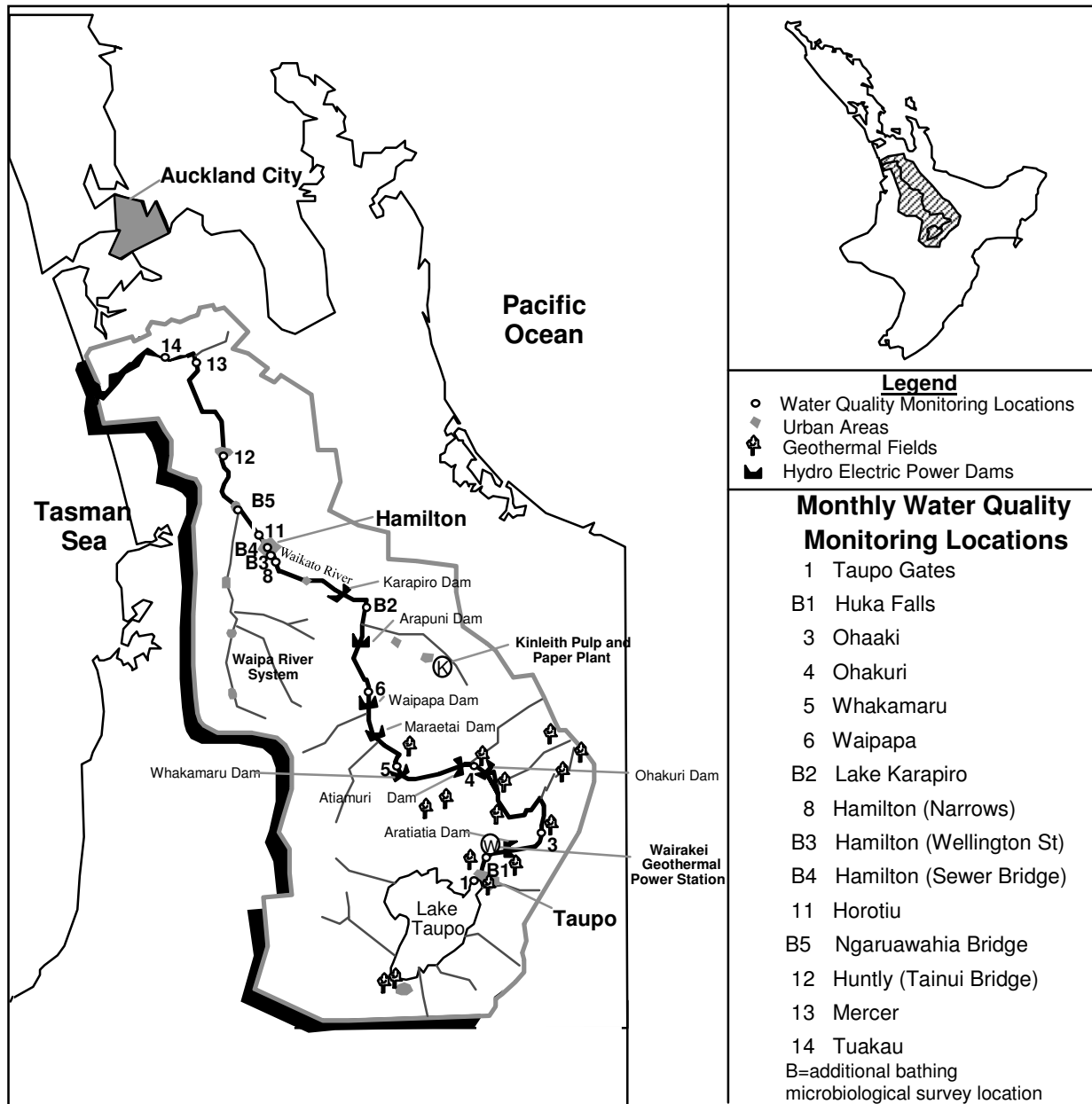


Figure 1: Waikato River Water Quality Monitoring Locations

Ten locations along the river are visited monthly (Taupo, Ohaaki, Ohakuri, Whakamaru, Waipapa, Hamilton-Narrows, Hamilton-Horotiu, Huntly, Mercer and Tuakau), and an additional four locations are included for the summer intensive microbiological survey (see Table 2, Figure 1). The major tributaries that enter the Waikato River are also monitored monthly as part of the Regional River Monitoring Programme (RERIMP) initiated in 1993 (Huser and Wilson, 1996b). Three locations (Taupo at Reids Farm, Hamilton at Wellington Street, and Rangiriri) are sampled by NIWA as part of the 'National River Water Quality Network' (Table 2).

2.3 Water quality parameters

Water quality of the Waikato River is assessed by measuring up to 40 parameters (27 routinely). Some parameters are measured in the field, but the majority of parameters are analysed in a laboratory using standard analytical methods. Details of field measurements and analytical methods used are appended (Appendix IV).

2.4 Quality control, data storage and analysis

Quality control measures are undertaken in accordance with Environment Waikato's ISO 9001:2000 standards including procedures for the collection, transport, storage, of samples, and methods for data verification and quality assurance to ensure the consistency of data across the programme. Samples are sent to IANZ registered laboratories for analysis. Back-up samples are held for two months until results have been verified by routine quality assurance procedures. All data from field measurements and laboratory analyses are stored in Environment Waikato's water quality archiving database (TimeStudio).

Data analysis was performed using Statistica (version 6.0) and DataDesk (version 6.0.1). For the purpose of data analysis, non-detect results (i.e. results with "less than" values) were assumed to be equal to half the corresponding limit of detection (i.e. $<x = x/2$), and results greater than the value reported were taken as equal to the value reported (i.e. $>x = x$).

2.5 Reports

Environment Waikato's State of the Environment Report summarises the state of the Waikato River, other rivers in the region, and common pressures (Environment Waikato, 1999).

Environment Waikato Technical Report 2008/33, Trends in River Water Quality in the Waikato Region, 1987–2007 (Vant, 2008) outlines the trends in the Waikato River and other rivers in the region. Copies are available in electronic format from the publications page of the Environment Waikato website:

<http://www.ew.govt.nz/Publications/Inland-Waters/>

The data contained in these Waikato River reports is updated to the Environment Waikato "Waikato River" Internet page:

<http://www.ew.govt.nz/Environmental-information/Rivers-lakes-and-wetlands/>

The "How healthy are our rivers?" link provides details of the Guidelines and Standards used to assess the condition of the Waikato River and other rivers in the region. A link to water quality at other Regional River monitoring sites is also available from this page.

3 Results

The results are divided up into 2 sections. Section 3.1 contains the results and statistical summaries of the routine analysis monitoring of the Waikato River. Section 3.2 reports the results and statistical summaries of the summer intensive microbiological survey. The raw data is included with each section, placed last.

3.1 Waikato River monitoring programme

Routine water quality monitoring

Summary statistics

Key parameter graphs

Comparison with water quality standards

Raw data

Absorbance of filtered sample at 340 nm (units: cm ⁻¹)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.001	0.001	0.001	0.001	0.000	-1.00	0.001
Ohaaki Bridge	12	0.004	0.003	0.001	0.009	0.003	0.82	0.003
Ohakuri Tailrace Bridge	12	0.005	0.005	0.003	0.008	0.003	0.14	0.006
Whakamaru Tailrace	12	0.008	0.007	0.004	0.013	0.004	0.82	0.007
Waipapa Tailrace	12	0.010	0.009	0.007	0.017	0.003	0.98	0.010
Narrows	12	0.014	0.013	0.008	0.026	0.006	0.96	0.013
Horotiu Bridge	12	0.016	0.013	0.007	0.034	0.009	1.01	0.014
Huntly-Tainui Bridge	12	0.022	0.020	0.011	0.036	0.014	0.50	0.020
Mercer Bridge	12	0.026	0.026	0.008	0.045	0.023	0.10	0.023
Tuakau Bridge	12	0.028	0.026	0.010	0.051	0.027	0.40	0.028

Absorbance of filtered sample at 440 nm (units: cm ⁻¹)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.001	0.001	0.001	0.001	0.000	-1.00	0.001
Ohaaki Bridge	12	0.001	0.001	0.001	0.001	0.000	-1.00	0.001
Ohakuri Tailrace Bridge	12	0.001	0.001	0.001	0.001	0.000	-1.00	0.001
Whakamaru Tailrace	12	0.001	0.001	0.001	0.003	0.001	1.56	0.001
Waipapa Tailrace	12	0.002	0.001	0.001	0.004	0.001	1.29	0.002
Narrows	12	0.002	0.002	0.001	0.006	0.003	0.60	0.003
Horotiu Bridge	12	0.003	0.003	0.001	0.007	0.004	0.50	0.003
Huntly-Tainui Bridge	12	0.004	0.003	0.001	0.007	0.003	0.09	0.004
Mercer Bridge	12	0.004	0.005	0.001	0.008	0.004	-0.11	0.005
Tuakau Bridge	12	0.005	0.005	0.001	0.010	0.004	0.10	0.005

Arsenic - Total (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.011	0.011	0.010	0.012	0.001	0.05	0.011
Ohaaki Bridge	12	0.031	0.028	0.020	0.051	0.016	0.78	0.026
Ohakuri Tailrace Bridge	12	0.035	0.034	0.023	0.044	0.011	-0.11	0.034
Whakamaru Tailrace	12	0.034	0.034	0.023	0.048	0.009	0.35	0.033
Waipapa Tailrace	12	0.028	0.027	0.020	0.038	0.008	0.23	0.028
Narrows	12	0.025	0.025	0.013	0.034	0.011	-0.18	0.024
Horotiu Bridge	12	0.024	0.025	0.014	0.033	0.010	-0.25	0.024
Huntly-Tainui Bridge	12	0.017	0.016	0.005	0.033	0.014	0.37	0.017
Mercer Bridge	12	0.017	0.016	0.005	0.030	0.014	0.07	0.017
Tuakau Bridge	12	0.017	0.016	0.005	0.029	0.015	0.12	0.015

Boron (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.16	0.17	0.14	0.18	0.02	-0.51	0.17
Ohaaki Bridge	12	0.32	0.31	0.22	0.49	0.11	0.66	0.28
Ohakuri Tailrace Bridge	12	0.33	0.33	0.24	0.41	0.10	0.04	0.33
Whakamaru Tailrace	12	0.32	0.31	0.25	0.39	0.11	0.20	0.32
Waipapa Tailrace	12	0.28	0.29	0.19	0.33	0.07	-0.63	0.29
Narrows	12	0.25	0.25	0.16	0.35	0.08	0.15	0.25
Horotiu Bridge	12	0.25	0.25	0.17	0.37	0.08	0.53	0.25
Huntly-Tainui Bridge	12	0.18	0.17	0.07	0.30	0.12	0.12	0.20
Mercer Bridge	12	0.20	0.19	0.08	0.33	0.14	0.10	0.20
Tuakau Bridge	12	0.20	0.19	0.08	0.34	0.13	0.19	0.20

Skew = skewness. Underlined values = non-normal distribution. IQR = Inter Quartile Range

Black Disk (m)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	-	-	-	-	-	-	-	-
Ohaaki Bridge	12	3.5	3.9	1.9	5.1	1.2	-0.31	5.1
Ohakuri Tailrace Bridge	12	2.1	1.9	0.7	3.9	1.0	0.60	2.7
Whakamaru Tailrace	12	2.0	2.1	0.7	3.6	0.8	0.21	2.2
Waipapa Tailrace	12	1.9	1.8	0.8	3.2	0.7	0.39	2.0
Narrows	12	1.4	1.5	0.5	2.1	0.6	-0.54	1.5
Horotiu Bridge	12	1.2	1.2	0.5	2.0	0.6	0.14	1.2
Huntly-Tainui Bridge	12	0.8	0.9	0.2	1.7	0.6	0.18	0.8
Mercer Bridge	-	-	-	-	-	-	-	-
Tuakau Bridge	12	0.6	0.6	0.3	1.0	0.3	0.33	0.6

Biochemical Oxygen Demand - 5 day (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.5	0.3	0.2	1.2	0.3	1.17	0.4
Ohaaki Bridge	12	0.6	0.6	0.2	1.1	0.6	0.29	0.3
Ohakuri Tailrace Bridge	12	0.8	0.7	0.2	1.3	0.3	0.12	0.6
Whakamaru Tailrace	12	1.1	0.9	0.2	4.0	0.8	<u>2.22</u>	0.7
Waipapa Tailrace	12	0.8	0.7	0.4	1.5	0.3	1.14	0.6
Narrows	12	0.6	0.6	0.2	0.9	0.4	-0.22	0.8
Horotiu Bridge	12	0.7	0.7	0.2	1.1	0.4	-0.20	0.8
Huntly-Tainui Bridge	12	1.1	1.0	0.4	2.4	0.4	1.42	0.9
Mercer Bridge	12	1.2	1.2	0.7	2.5	0.5	1.62	1.1
Tuakau Bridge	12	1.3	1.2	0.6	1.8	0.7	-0.20	1.2

Carbon - Dissolved Organic (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.76	0.70	0.44	1.20	0.42	0.39	0.80
Ohaaki Bridge	12	0.82	0.75	0.40	1.20	0.32	0.20	0.79
Ohakuri Tailrace Bridge	12	1.05	1.10	0.67	1.40	0.61	-0.06	0.83
Whakamaru Tailrace	12	1.11	1.10	0.79	1.40	0.26	-0.07	1.05
Waipapa Tailrace	12	1.33	1.30	0.86	1.90	0.30	0.50	1.10
Narrows	12	1.49	1.40	0.96	2.30	0.50	0.63	1.30
Horotiu Bridge	12	1.88	1.70	1.20	3.10	1.10	0.59	1.30
Huntly-Tainui Bridge	12	2.28	1.90	1.40	4.10	1.35	0.91	1.60
Mercer Bridge	12	2.45	2.35	1.40	3.90	1.35	0.36	1.85
Tuakau Bridge	12	2.61	2.35	1.10	5.90	1.50	1.21	1.95

Carbon - Total Organic (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.99	0.93	0.73	1.40	0.36	0.74	1.00
Ohaaki Bridge	12	1.11	1.05	0.78	1.70	0.29	0.84	1.10
Ohakuri Tailrace Bridge	12	1.36	1.30	1.00	1.90	0.45	0.37	1.25
Whakamaru Tailrace	12	1.49	1.55	1.10	1.90	0.25	-0.01	1.40
Waipapa Tailrace	12	1.66	1.70	1.10	2.20	0.25	0.03	1.60
Narrows	12	2.18	2.10	1.50	3.60	0.80	0.98	1.80
Horotiu Bridge	12	2.38	2.20	1.50	4.40	0.75	1.29	2.00
Huntly-Tainui Bridge	12	3.41	2.85	1.70	6.00	2.00	0.69	2.50
Mercer Bridge	12	3.72	3.70	1.70	5.90	1.95	0.35	3.05
Tuakau Bridge	12	3.74	3.70	2.00	7.80	1.70	1.38	3.20

Skew = skewness. Underlined values = non-normal distribution. IQR = Inter Quartile Range

Chloride (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	9	9	8	9	0	0.89	9
Ohaaki Bridge	12	19	17	13	31	10	0.77	16
Ohakuri Tailrace Bridge	12	21	21	15	27	5	-0.07	21
Whakamaru Tailrace	12	21	21	15	25	5	-0.21	20
Waipapa Tailrace	12	19	19	14	23	5	-0.24	19
Narrows	12	18	19	14	24	5	0.26	18
Horotiu Bridge	12	18	19	14	24	5	0.21	18
Huntly-Tainui Bridge	12	17	16	12	23	6	0.26	16
Mercer Bridge	12	18	18	13	23	5	0.22	17
Tuakau Bridge	12	18	18	13	23	5	0.15	17

Chlorophyll a (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.002	0.002	0.002	0.002	0.000	1.00	0.002
Ohaaki Bridge	12	0.002	0.002	0.002	0.002	0.000	1.00	0.002
Ohakuri Tailrace Bridge	12	0.003	0.002	0.002	0.010	0.003	1.17	0.004
Whakamaru Tailrace	12	0.013	0.004	0.002	0.100	0.007	<u>2.82</u>	0.006
Waipapa Tailrace	12	0.004	0.004	0.002	0.008	0.005	0.27	0.005
Narrows	12	0.007	0.006	0.002	0.015	0.006	0.55	0.009
Horotiu Bridge	12	0.009	0.007	0.002	0.019	0.007	0.78	0.009
Huntly-Tainui Bridge	12	0.009	0.007	0.002	0.031	0.007	1.46	0.009
Mercer Bridge	12	0.015	0.013	0.002	0.038	0.010	1.03	0.014
Tuakau Bridge	12	0.018	0.014	0.002	0.046	0.017	0.86	0.016

Colour (Munsell Colour Units)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	-	-	-	-	-	-	-	-
Ohaaki Bridge	11	49.1	50.0	40.0	57.5	6.9	-0.17	47.5
Ohakuri Tailrace Bridge	11	38.0	37.5	30.0	47.5	4.4	0.59	40.0
Whakamaru Tailrace	11	36.8	37.5	32.5	42.5	2.5	0.56	37.5
Waipapa Tailrace	11	36.4	35.0	32.5	42.5	2.5	0.88	35.0
Narrows	12	34.0	33.8	30.0	37.5	2.5	0.13	35.0
Horotiu Bridge	12	32.5	32.5	25.0	35.0	3.8	-1.30	32.5
Huntly-Tainui Bridge	12	30.4	30.0	25.0	35.0	5.0	-0.04	30.0
Mercer Bridge	-	-	-	-	-	-	-	-
Tuakau Bridge	12	29.8	30.0	25.0	35.0	5.0	0.16	30.0

Conductivity at 25 °C (ms m ⁻¹)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	12.0	12.0	11.6	12.4	0.0	0.16	12.0
Ohaaki Bridge	12	16.1	15.4	13.9	21.0	3.3	0.91	15.1
Ohakuri Tailrace Bridge	12	17.7	18.0	14.8	20.0	2.5	-0.46	17.2
Whakamaru Tailrace	12	17.1	17.0	14.6	20.0	1.8	0.22	17.0
Waipapa Tailrace	12	16.4	16.5	14.0	18.0	2.7	-0.28	16.3
Narrows	12	15.9	16.0	13.8	18.0	2.7	-0.03	15.6
Horotiu Bridge	12	16.1	16.0	13.9	19.0	2.5	0.27	15.8
Huntly-Tainui Bridge	12	15.2	15.5	11.6	18.0	3.3	-0.32	14.8
Mercer Bridge	12	16.0	16.5	12.6	19.0	2.7	-0.29	15.2
Tuakau Bridge	12	16.0	16.5	12.8	18.0	2.9	-0.35	15.3

Skew = skewness. Underlined values = non-normal distribution. IQR = Inter Quartile Range

Dissolved Oxygen (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	9.6	9.6	8.7	10.8	0.7	0.45	9.8
Ohaaki Bridge	12	9.5	9.4	8.0	11.0	2.1	0.12	9.9
Ohakuri Tailrace Bridge	12	9.3	9.3	8.1	10.4	0.7	-0.23	9.6
Whakamaru Tailrace	12	9.6	9.8	8.5	10.7	1.0	-0.33	9.9
Waipapa Tailrace	12	9.5	9.9	8.1	10.7	1.5	-0.34	9.9
Narrows	12	9.4	9.8	8.0	10.9	1.7	-0.25	9.8
Horotiu Bridge	12	9.3	9.6	7.9	10.7	1.8	-0.19	9.8
Huntly-Tainui Bridge	12	9.2	9.2	8.1	10.3	0.3	0.36	9.3
Mercer Bridge	12	9.0	9.0	8.3	9.8	0.5	0.18	9.2
Tuakau Bridge	12	9.2	9.3	8.2	10.2	0.8	-0.03	9.5

Dissolved Oxygen (% Saturation)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	100.3	100.4	95.1	105.6	4.1	-0.02	101.0
Ohaaki Bridge	12	100.6	99.4	92.8	109.6	8.1	0.55	102.6
Ohakuri Tailrace Bridge	12	99.4	100.3	88.1	108.6	13.4	-0.22	102.9
Whakamaru Tailrace	12	102.1	100.4	93.3	112.9	13.7	0.34	102.9
Waipapa Tailrace	12	99.0	97.6	93.8	109.1	8.1	0.78	99.6
Narrows	12	95.6	93.9	88.3	105.5	6.2	0.65	98.3
Horotiu Bridge	12	94.2	93.5	88.5	102.6	6.2	0.50	97.0
Huntly-Tainui Bridge	12	94.2	95.2	82.3	106.9	8.9	-0.04	96.5
Mercer Bridge	12	94.2	93.7	78.8	108.4	14.3	-0.07	95.3
Tuakau Bridge	12	97.4	96.3	76.4	123.7	21.1	0.28	96.7

Enterococci (n/100 mL)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	4	1	1	30	3	<u>2.85</u>	1
Ohaaki Bridge	12	45	13	2	310	23	<u>2.53</u>	9
Ohakuri Tailrace Bridge	12	5	3	1	13	7	0.80	2
Whakamaru Tailrace	12	26	16	1	110	22	1.64	6
Waipapa Tailrace	12	17	4	1	100	21	<u>2.35</u>	5
Narrows	12	175	26	6	1700	35	<u>2.98</u>	25
Horotiu Bridge	12	245	39	11	2200	80	<u>2.93</u>	47
Huntly-Tainui Bridge	12	366	37	11	2500	124	<u>2.11</u>	50
Mercer Bridge	12	206	33	3	1500	88	<u>2.42</u>	18
Tuakau Bridge	11	267	27	1	1800	103	<u>2.18</u>	23

Escherichia coli (n/100 mL)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	5	3	1	20	4	<u>1.83</u>	1
Ohaaki Bridge	12	25	16	3	110	20	<u>2.25</u>	12
Ohakuri Tailrace Bridge	12	7	5	1	24	8	1.34	4
Whakamaru Tailrace	12	39	17	4	270	23	<u>2.84</u>	6
Waipapa Tailrace	12	21	12	3	80	25	1.56	8
Narrows	12	424	45	8	4400	65	<u>3.00</u>	38
Horotiu Bridge	12	448	120	50	3600	210	<u>2.92</u>	105
Huntly-Tainui Bridge	12	808	115	40	6000	440	<u>2.55</u>	130
Mercer Bridge	12	557	125	29	4200	290	<u>2.70</u>	105
Tuakau Bridge	12	491	120	30	3600	80	<u>2.54</u>	70

Skew = skewness. Underlined values = non-normal distribution. IQR = Inter Quartile Range

Faecal Coliforms (n/100 mL)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	5	3	1	30	4	<u>2.37</u>	1
Ohaaki Bridge	12	29	18	5	140	21	<u>2.50</u>	17
Ohakuri Tailrace Bridge	12	8	5	1	28	10	1.34	4
Whakamaru Tailrace	12	45	18	4	300	23	<u>2.79</u>	7
Waipapa Tailrace	12	28	14	3	110	28	1.52	9
Narrows	12	432	45	10	4400	78	<u>3.00</u>	44
Horotiu Bridge	12	463	120	50	3600	255	<u>2.91</u>	170
Huntly-Tainui Bridge	12	815	115	55	6000	420	<u>2.56</u>	150
Mercer Bridge	12	607	170	29	4200	280	<u>2.52</u>	160
Tuakau Bridge	12	531	120	60	3600	95	<u>2.30</u>	105

Lithium (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.039	0.039	0.036	0.044	0.005	0.36	0.039
Ohaaki Bridge	12	0.100	0.088	0.065	0.170	0.047	0.85	0.087
Ohakuri Tailrace Bridge	12	0.119	0.115	0.081	0.160	0.050	0.11	0.117
Whakamaru Tailrace	12	0.117	0.115	0.083	0.150	0.047	0.01	0.117
Waipapa Tailrace	12	0.102	0.102	0.070	0.140	0.037	0.23	0.100
Narrows	12	0.090	0.094	0.059	0.130	0.036	0.10	0.088
Horotiu Bridge	12	0.089	0.093	0.060	0.130	0.032	0.26	0.088
Huntly-Tainui Bridge	12	0.066	0.057	0.021	0.120	0.046	0.31	0.064
Mercer Bridge	12	0.066	0.058	0.023	0.110	0.051	0.19	0.065
Tuakau Bridge	12	0.067	0.060	0.022	0.110	0.051	0.14	0.064

Nitrate/Nitrite Nitrogen (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.003	0.002	0.001	0.008	0.004	0.86	0.001
Ohaaki Bridge	12	0.036	0.034	0.001	0.083	0.024	0.56	0.033
Ohakuri Tailrace Bridge	12	0.100	0.093	0.001	0.270	0.125	0.60	0.078
Whakamaru Tailrace	12	0.130	0.121	0.005	0.380	0.177	0.71	0.092
Waipapa Tailrace	12	0.190	0.160	0.085	0.440	0.150	1.08	0.155
Narrows	12	0.308	0.265	0.100	0.770	0.280	0.99	0.216
Horotiu Bridge	12	0.359	0.310	0.130	0.890	0.320	1.03	0.239
Huntly-Tainui Bridge	12	0.641	0.425	0.130	1.700	0.780	0.92	0.397
Mercer Bridge	12	0.611	0.420	0.094	1.500	0.895	0.78	0.400
Tuakau Bridge	12	0.579	0.410	0.040	1.700	0.790	0.93	0.390

Nitrogen - Ammoniacal (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.01	0.01	0.01	0.01	0.00	<u>3.02</u>	0.005
Ohaaki Bridge	12	0.01	0.01	0.01	0.03	0.01	0.97	0.005
Ohakuri Tailrace Bridge	12	0.01	0.01	0.01	0.05	0.01	1.56	0.005
Whakamaru Tailrace	12	0.01	0.01	0.01	0.02	0.01	1.44	0.005
Waipapa Tailrace	12	0.02	0.02	0.01	0.04	0.03	0.19	0.010
Narrows	12	0.02	0.02	0.01	0.06	0.03	0.43	0.020
Horotiu Bridge	12	0.01	0.01	0.01	0.05	0.01	1.45	0.012
Huntly-Tainui Bridge	12	0.02	0.01	0.01	0.05	0.02	1.04	0.010
Mercer Bridge	12	0.02	0.01	0.01	0.10	0.01	<u>2.43</u>	0.005
Tuakau Bridge	12	0.01	0.01	0.01	0.06	0.00	<u>1.99</u>	0.005

Skew = skewness. Underlined values = non-normal distribution. IQR = Inter Quartile Range

Nitrogen - Total Kjeldahl (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.05	0.06	0.03	0.08	0.05	-0.41	0.07
Ohaaki Bridge	12	0.08	0.09	0.06	0.13	0.04	0.43	0.10
Ohakuri Tailrace Bridge	12	0.11	0.12	0.03	0.14	0.02	<u>-1.81</u>	0.13
Whakamaru Tailrace	12	0.18	0.16	0.09	0.56	0.04	<u>2.69</u>	0.16
Waipapa Tailrace	12	0.16	0.16	0.11	0.25	0.07	0.65	0.16
Narrows	12	0.20	0.19	0.15	0.28	0.05	0.88	0.21
Horotiu Bridge	12	0.21	0.19	0.16	0.32	0.05	1.32	0.22
Huntly-Tainui Bridge	12	0.32	0.28	0.20	0.56	0.19	0.76	0.28
Mercer Bridge	12	0.35	0.36	0.16	0.56	0.20	0.10	0.34
Tuakau Bridge	12	0.33	0.32	0.15	0.57	0.15	0.53	0.34

Nitrogen - Total (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.06	0.06	0.03	0.09	0.04	-0.31	0.07
Ohaaki Bridge	12	0.12	0.11	0.08	0.18	0.03	0.78	0.12
Ohakuri Tailrace Bridge	12	0.21	0.20	0.07	0.38	0.12	0.46	0.21
Whakamaru Tailrace	12	0.31	0.29	0.18	0.57	0.14	0.95	0.26
Waipapa Tailrace	12	0.35	0.33	0.24	0.64	0.10	<u>1.78</u>	0.31
Narrows	12	0.50	0.46	0.27	0.98	0.30	0.88	0.43
Horotiu Bridge	12	0.57	0.50	0.31	1.12	0.34	0.89	0.47
Huntly-Tainui Bridge	12	0.96	0.68	0.39	2.26	0.91	0.96	0.68
Mercer Bridge	12	0.96	0.77	0.35	1.98	1.05	0.78	0.72
Tuakau Bridge	12	0.91	0.70	0.29	2.27	0.97	0.97	0.70

pH (pH Units)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	7.7	7.7	7.3	8.0	0.4	-0.22	7.6
Ohaaki Bridge	12	7.3	7.3	7.1	7.6	0.3	0.68	7.3
Ohakuri Tailrace Bridge	12	7.3	7.3	7.1	7.5	0.2	0.27	7.4
Whakamaru Tailrace	12	7.4	7.4	7.3	7.6	0.1	0.12	7.5
Waipapa Tailrace	12	7.4	7.3	7.2	7.5	0.1	0.38	7.4
Narrows	12	7.4	7.3	7.0	7.8	0.3	0.21	7.5
Horotiu Bridge	12	7.4	7.5	7.1	7.7	0.3	-0.59	7.5
Huntly-Tainui Bridge	12	7.4	7.5	6.9	7.7	0.3	-0.52	7.5
Mercer Bridge	12	7.4	7.5	6.9	8.0	0.5	0.01	7.5
Tuakau Bridge	12	7.5	7.4	6.8	8.3	0.5	0.43	7.4

Phosphorus - Dissolved Reactive (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.002	0.002	0.002	0.002	0.000	-1.00	0.002
Ohaaki Bridge	12	0.005	0.005	0.002	0.012	0.005	0.71	0.007
Ohakuri Tailrace Bridge	12	0.008	0.006	0.002	0.021	0.010	0.93	0.010
Whakamaru Tailrace	12	0.008	0.006	0.002	0.015	0.007	0.21	0.010
Waipapa Tailrace	12	0.015	0.016	0.002	0.023	0.011	-0.35	0.016
Narrows	12	0.021	0.022	0.009	0.034	0.014	0.01	0.016
Horotiu Bridge	12	0.029	0.029	0.015	0.046	0.015	0.27	0.025
Huntly-Tainui Bridge	12	0.024	0.023	0.011	0.045	0.012	0.68	0.023
Mercer Bridge	12	0.019	0.019	0.008	0.039	0.009	1.00	0.020
Tuakau Bridge	12	0.018	0.015	0.006	0.038	0.013	0.69	0.016

Skew = skewness. Underlined values = non-normal distribution. IQR = Inter Quartile Range

Phosphorus - Total (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.004	0.005	0.002	0.006	0.002	-0.57	0.005
Ohaaki Bridge	12	0.017	0.017	0.007	0.028	0.007	-0.11	0.016
Ohakuri Tailrace Bridge	12	0.027	0.027	0.017	0.037	0.005	0.07	0.026
Whakamaru Tailrace	12	0.034	0.030	0.019	0.074	0.009	<u>2.21</u>	0.028
Waipapa Tailrace	12	0.034	0.036	0.018	0.047	0.012	-0.44	0.034
Narrows	12	0.046	0.045	0.026	0.074	0.010	0.80	0.042
Horotiu Bridge	12	0.059	0.056	0.036	0.100	0.023	0.81	0.052
Huntly-Tainui Bridge	12	0.076	0.069	0.048	0.110	0.031	0.79	0.066
Mercer Bridge	12	0.076	0.071	0.058	0.110	0.019	1.06	0.070
Tuakau Bridge	12	0.073	0.071	0.057	0.090	0.021	0.17	0.069

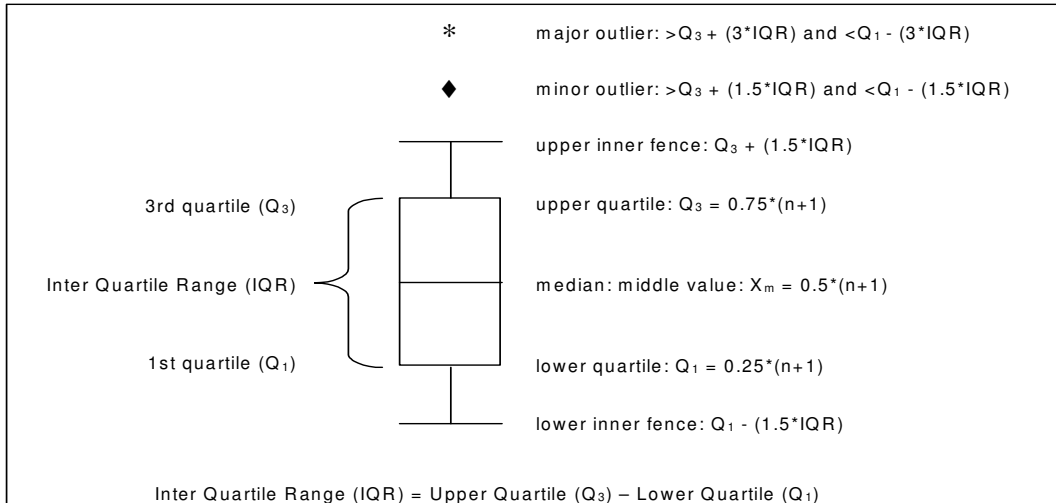
Temperature (°C)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	15.4	14.2	11.5	19.9	6.1	0.28	14.8
Ohaaki Bridge	12	16.7	15.4	13.0	21.3	7.0	0.29	16.4
Ohakuri Tailrace Bridge	11	17.1	16.5	12.9	22.1	6.7	0.11	16.4
Whakamaru Tailrace	11	17.2	15.6	12.2	22.9	7.8	0.11	16.4
Waipapa Tailrace	11	16.8	15.6	11.9	22.2	7.4	0.04	16.1
Narrows	12	16.5	15.5	11.7	22.9	7.3	0.22	16.2
Horotiu Bridge	12	16.4	15.3	11.6	22.9	7.5	0.23	16.3
Huntly-Tainui Bridge	12	16.7	15.6	11.5	24.0	7.5	0.31	16.2
Mercer Bridge	12	17.5	15.7	12.8	24.3	7.3	0.37	16.6
Tuakau Bridge	12	17.9	16.3	12.3	25.1	8.1	0.26	17.1

Dissolved Solids - Total (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	85	85	73	92	6	-0.86	86
Ohaaki Bridge	12	112	110	94	130	27	0.08	109
Ohakuri Tailrace Bridge	12	128	130	110	140	15	-0.45	126
Whakamaru Tailrace	12	126	125	100	150	15	-0.07	125
Waipapa Tailrace	12	114	120	5	160	20	<u>-2.22</u>	124
Narrows	12	123	120	99	150	20	0.28	120
Horotiu Bridge	12	126	120	110	160	15	1.15	120
Huntly-Tainui Bridge	12	118	120	89	140	10	-0.78	115
Mercer Bridge	12	122	125	99	140	15	-0.49	117
Tuakau Bridge	12	120	120	75	140	25	-0.95	118

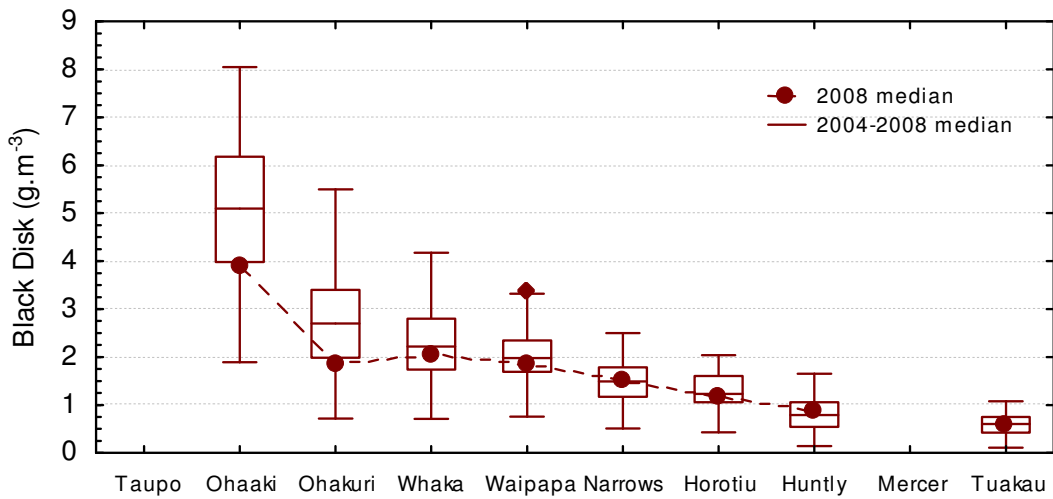
Turbidity (NTU)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.4	0.3	0.2	0.7	0.2	0.90	0.3
Ohaaki Bridge	12	0.8	0.6	0.5	1.3	0.5	0.91	0.6
Ohakuri Tailrace Bridge	12	1.1	1.0	0.6	2.0	0.4	0.86	1.0
Whakamaru Tailrace	12	1.6	1.4	0.8	5.0	0.6	<u>2.53</u>	1.2
Waipapa Tailrace	12	1.4	1.4	0.9	2.6	0.3	1.54	1.4
Narrows	12	2.8	1.9	1.2	9.5	0.9	<u>2.26</u>	2.1
Horotiu Bridge	12	3.4	2.5	1.4	11.0	1.3	<u>2.31</u>	2.6
Huntly-Tainui Bridge	12	11.7	6.3	2.7	34	14.7	1.11	5.7
Mercer Bridge	12	12.1	9.1	3.4	33	12.1	1.14	8.5
Tuakau Bridge	12	10.6	9.9	3.2	24.0	10.0	0.62	9.0

Skew = skewness. Underlined values = non-normal distribution. IQR = Inter Quartile Range

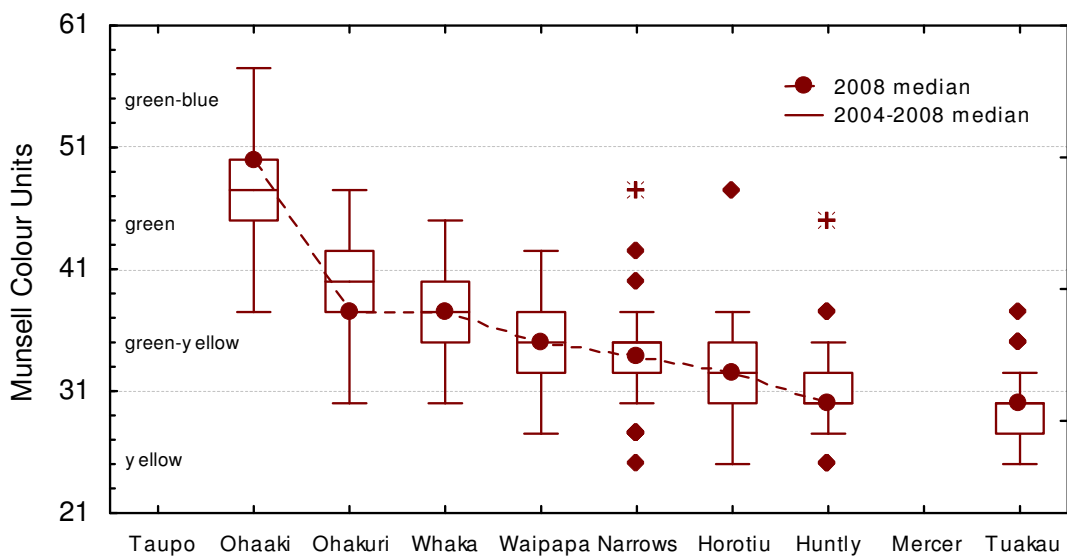
Boxplots are used to present data



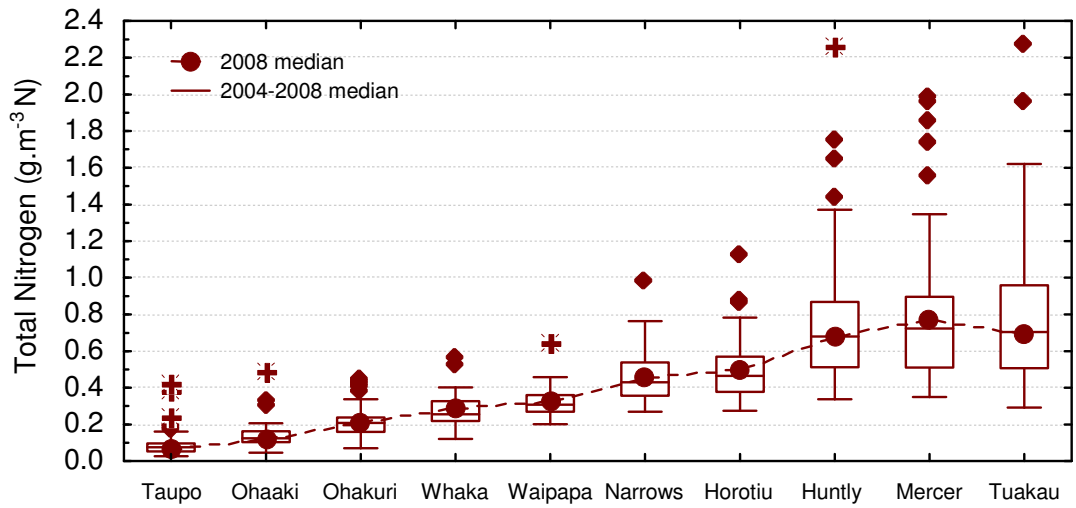
Black Disk, 2004-2008 Data



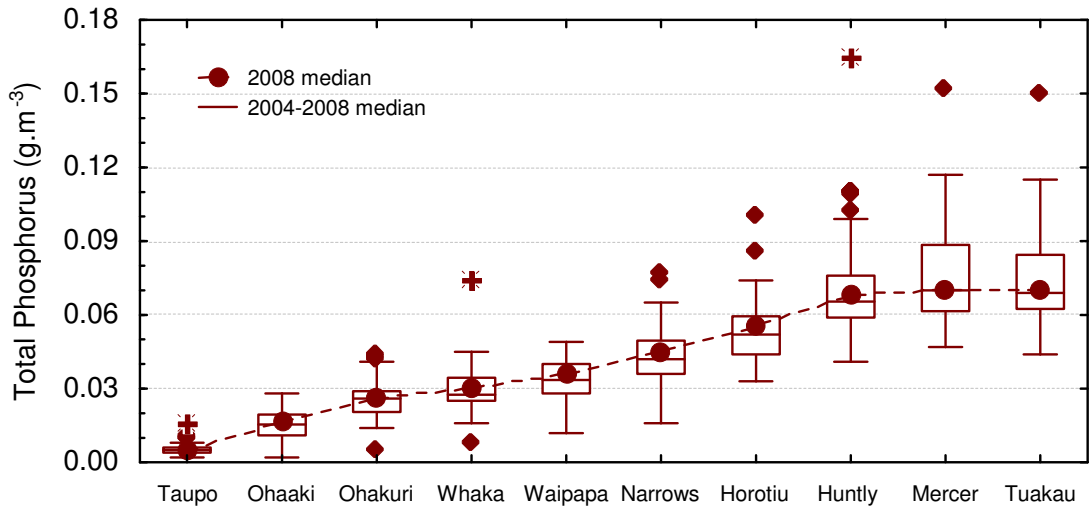
Colour, 2004-2008 Data



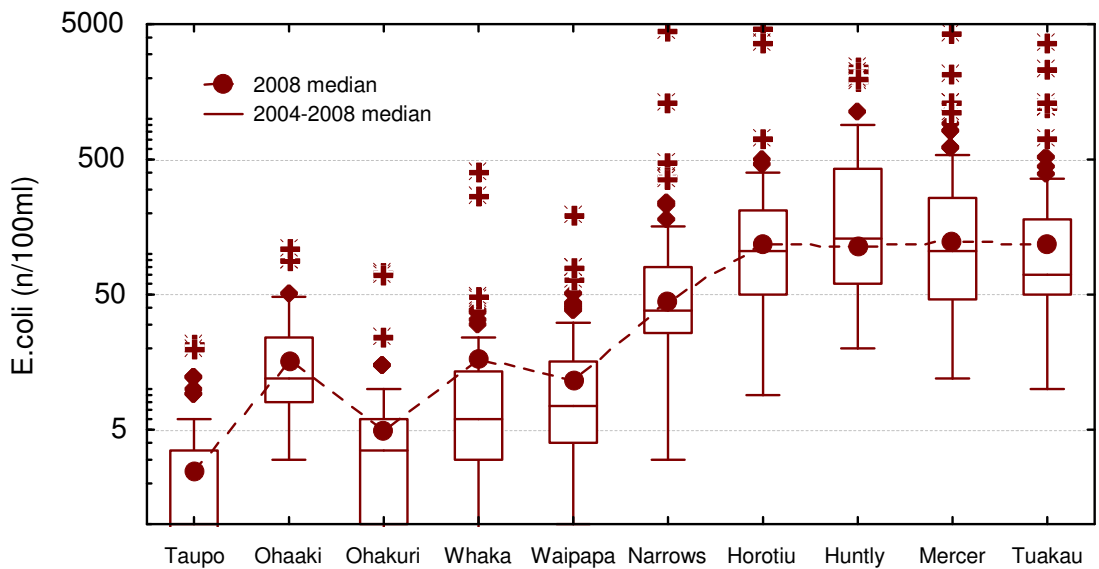
Total Nitrogen, 2004-2008 Data



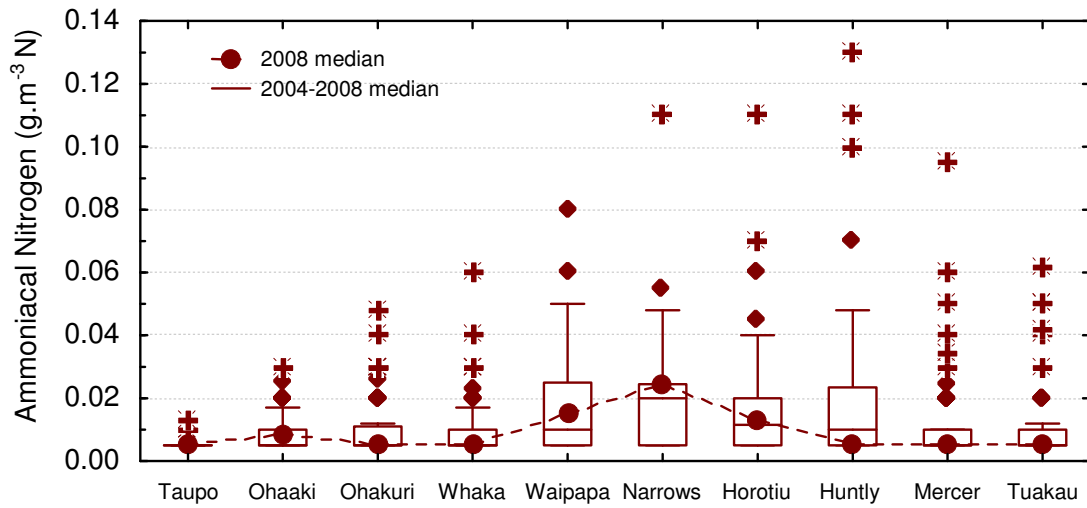
Total Phosphorus, 2004-2008 Data



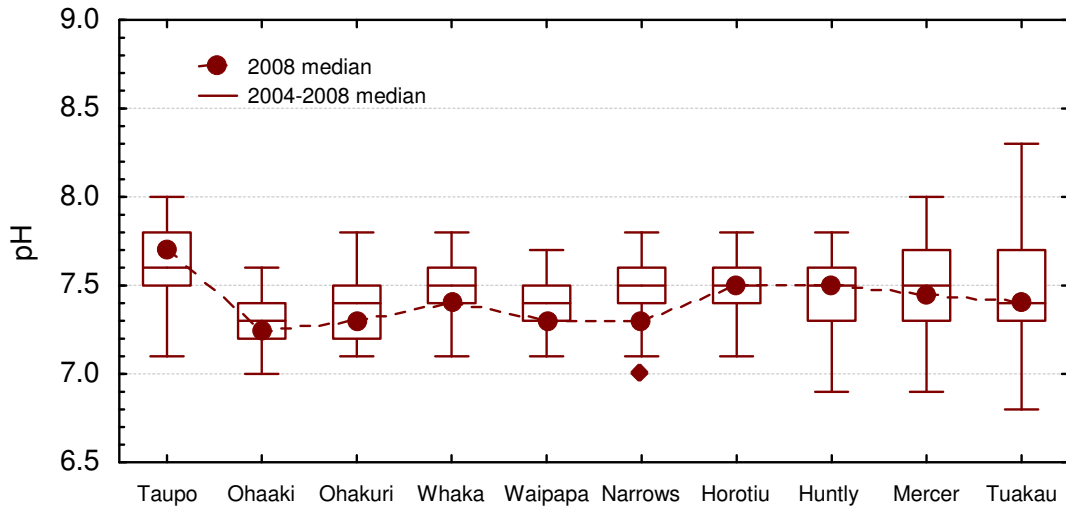
E.coli, 2004-2008 Data



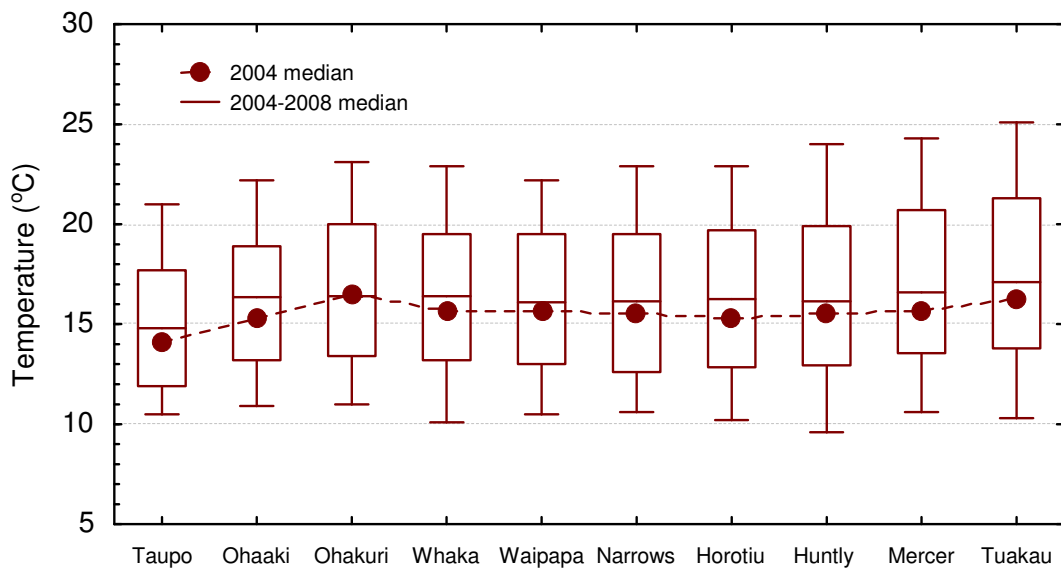
Ammoniacal Nitrogen, 2004-2008 Data



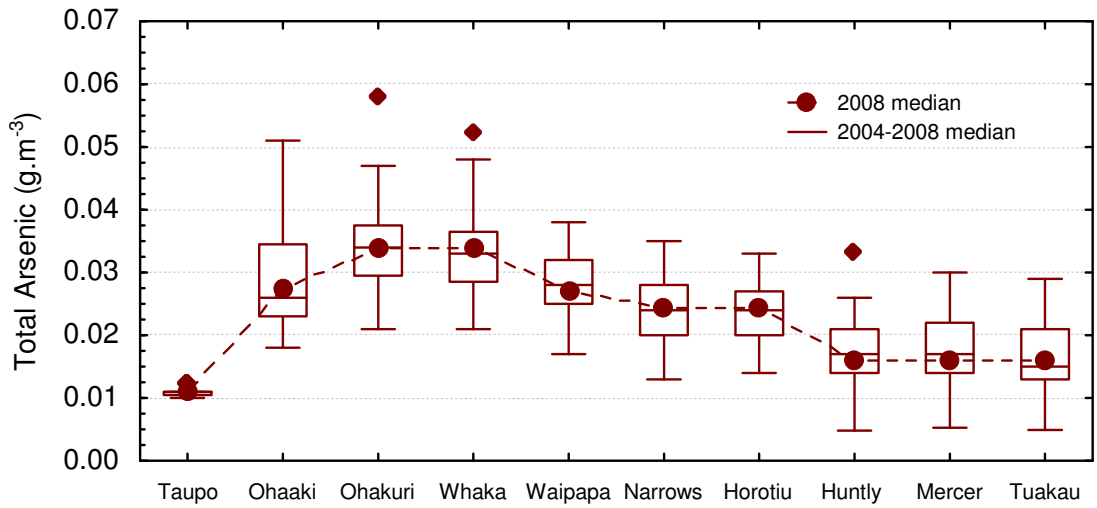
pH, 2004-2008 Data



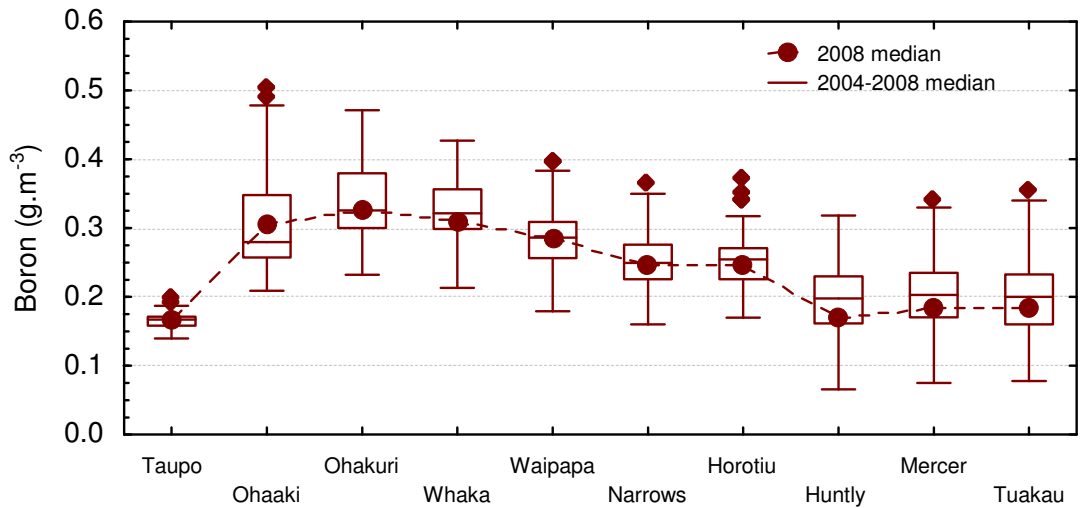
Temperature, 2004-2008 Data



Total Arsenic, 2004-2008 Data



Boron, 2004-2008 Data



Dissolved Oxygen, 2004-2008 Data

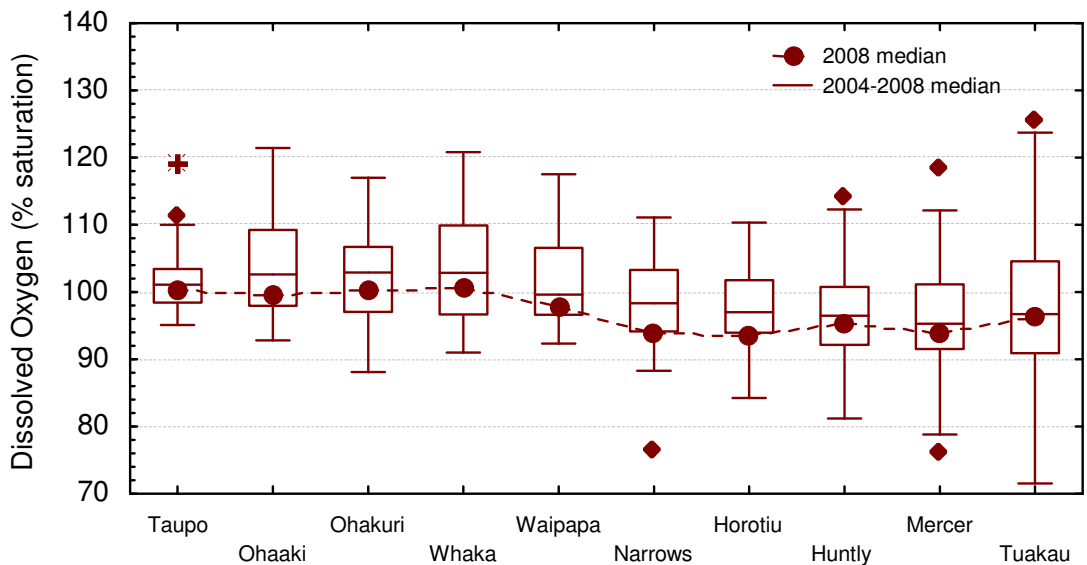


Table 3: Samples (Year 2008) complying with the ‘Satisfactory’ Water Quality Guidelines and Standards. n = 12 (except *, where n = 11).

Location	ECOLOGICAL HEALTH							HUMAN USES					
								Recreation			water supply	drinking water	
	DO	pH	Turb	NH ₄ N	Temp	TP	TN	Bk ¹ Disk	E coli	Median E coli	CHLa	As	B
Taupo Gates	12	12	12	12	9	12	12	-	12	Y	12	0	12
Ohaaki Bridge	12	12	12	12	4	12	12	10/10	12	Y	12	0	12
Ohakuri Tailrace Br	12	12	12	12	3*	12	12	7/9	12	Y	12	0	12
Whakamaru Tailrace	12	12	11	12	3*	11	10	5/7	12	Y	11	0	12
Waipapa Tailrace	12	12	12	12	4*	8	11	8/11	12	Y	12	0	12
Hamilton – Narrows	12	12	11	12	6	3	7	4/8	11	Y	12	0	12
Horotiu Bridge	12	12	10	12	6	2	6	3/9	10	Y	12	0	12
Huntly – Tainui Br	12	12	4	12	4	0	3	1/9	9	Y	10	3	12
Mercer Bridge	12	12	3	12	2	0	3	-	10	Y	10	3	12
Tuakau Bridge	10	12	2	12	2	0	4	-	10	Y	8	2	12

¹ samples complying with the baseflow water clarity guideline from the number of samples measured when flow was below the upper decile of all flows

Table 4: Samples (Year 2008) complying with the ‘Excellent’ Water Quality Guidelines and Standards. n = 12 (except *, where n = 11).

Location	ECOLOGICAL HEALTH							HUMAN USES					
								Recreation			water supply	Drinking water	
	DO	pH	Turb	NH ₄ N	Temp	TP	TN	Bk ¹ Disk	E coli	Median E coli	CHLa	As	B
Taupo Gates	12	12	12	12	2	12	12	-	12	Y	12	n/a	n/a
Ohaaki Bridge	12	12	12	12	2	1	1	3/10	11	Y	12	n/a	n/a
Ohakuri Tailrace Br	11	12	12	12	2*	0	1	0/9	12	Y	9	n/a	n/a
Whakamaru Tailrace	12	12	10	12	2*	0	0	0/7	11	Y	7	n/a	n/a
Waipapa Tailrace	12	12	11	12	2*	0	0	0/11	11	Y	7	n/a	n/a
Hamilton – Narrows	11	12	6	12	1	0	0	0/8	9	N	5	n/a	n/a
Horotiu Bridge	10	12	2	12	2	0	0	0/3	1	N	4	n/a	n/a
Huntly – Tainui Br	9	11	0	12	1	0	0	0/9	2	N	3	n/a	n/a
Mercer Bridge	8	11	0	12	1	0	0	-	3	N	1	n/a	n/a
Tuakau Bridge	8	9	0	12	1	0	0	-	1	N	2	n/a	n/a

¹ samples complying with the baseflow water clarity guideline from the number of samples measured when flow was below the upper decile of all flows

DATE	TIME*	FLOW	BDISK	COLOR	COND	PH	TEMP	DO	PCDO	BOD5	TURB	TDS	NNN	NO3-N	NH4-N
dd/mm/yy	hh:mm	m ³ /s	m	units	mS/m	units	'C	g/m ³	%Sat	g/m ³	NTU	g/m ³	g/m ³	g/m ³	g/m ³
Satisfactory Water Quality Guideline/Standard			>1.6	-	-	6.5-9	<12 (May-Sep)	>80	-	<5	-	-	-	-	<0.88
							<20 (Oct-Apr)								

1131-127 UD = 262 m³/m (Flows from "Reids Farm")

Waikato River at Taupo Control Gates

08/01/08	8:35 a.m.	152	-	-	12.0	7.3	19.7	8.7	100.1	< 0.4	0.29	83	0.006	0.003	< 0.01
05/02/08	8:50 a.m.	251	-	-	12.0	7.8	19.9	9.3	105.6	< 0.4	0.34	92	0.003	0.002	< 0.01
03/03/08	9:30 a.m.	151	-	-	12.0	7.9	19.6	8.8	100.8	0.5	0.21	87	< 0.002	< 0.002	< 0.01
02/04/08	8:00 a.m.	127	-	-	12.0	7.7	18.0	9.2	100.6	1.0	0.30	89	0.002	0.002	< 0.01
06/05/08	9:35 a.m.	116	-	-	12.0	7.6	<u>15.0</u>	9.5	99.4	< 0.4	0.35	73	0.008	0.008	< 0.01
03/06/08	9:10 a.m.	208	-	-	12.0	8.0	<u>13.0</u>	9.6	95.1	< 0.4	0.23	89	0.004	0.004	< 0.01
03/07/08	9:25 a.m.	149	-	-	12.0	7.5	11.8	9.9	96.6	0.5	0.20	86	< 0.002	< 0.002	< 0.01
08/08/08	9:30 a.m.	296	-	-	12.4	7.7	<u>13.3</u>	9.6	97.5	1.2	0.52	88	0.003	0.003	< 0.01
03/09/08	9:00 a.m.	295	-	-	12.0	7.5	11.5	10.8	101.8	< 0.4	0.46	84	0.006	0.006	0.01
07/10/08	8:40 a.m.	284	-	-	11.8	7.6	12.9	9.9	99.4	0.5	0.36	84	< 0.002	< 0.002	< 0.01
06/11/08	7:20 a.m.	191	-	-	11.6	8.0	12.6	10.4	103.3	0.6	0.50	76	< 0.002	< 0.002	< 0.01
02/12/08	8:45 a.m.	182	-	-	12.0	7.9	17.5	9.4	103.5	< 0.4	0.72	83	< 0.002	< 0.002	< 0.01

1131-105 UD = 274 m³/s (Flows from Ohaaki Bridge Recorder, +/- 20%)

Waikato River at Ohaaki Br

08/01/08	9:20 a.m.	128	5.1	50.0	15.0	7.1	<u>21.3</u>	8.0	93.9	0.7	0.60	110	0.033	0.032	0.02
05/02/08	9:45 a.m.	217	2.0	47.5	14.0	7.1	<u>21.2</u>	8.6	99.8	0.5	0.62	110	< 0.002	< 0.002	< 0.01
03/03/08	11:00 a.m.	92	3.9	52.5	18.0	7.3	<u>21.3</u>	8.3	97.8	0.8	0.50	130	0.034	0.032	< 0.01
02/04/08	9:15 a.m.	99	4.1	57.5	17.0	7.1	19.7	8.2	92.8	1.0	0.55	120	0.052	0.049	< 0.01
06/05/08	10:25 a.m.	71	3.9	42.5	21.0	7.1	<u>16.5</u>	9.3	98.1	< 0.4	0.48	130	0.083	0.081	0.01
03/06/08	10:00 a.m.	112	3.9	55.0	17.0	7.4	<u>14.2</u>	9.9	99.0	0.4	0.51	120	0.044	0.044	0.01
03/07/08	10:15 a.m.	124	3.9	-	18.0	7.2	<u>14.2</u>	9.5	96.4	0.6	1.20	130	0.043	0.043	< 0.01
08/08/08	10:10 a.m.	313	(2.5)	40.0	14.4	7.6	<u>13.0</u>	11.0	109.6	1.1	1.30	97	0.015	0.015	< 0.01
03/09/08	10:00 a.m.	312	(1.9)	45.0	13.9	7.3	<u>13.2</u>	10.3	100.2	< 0.4	0.85	97	0.015	0.015	0.01
07/10/08	9:20 a.m.	219	3.2	47.5	15.0	7.2	13.7	10.8	109.2	< 0.4	0.60	100	0.033	0.033	0.01
06/11/08	8:00 a.m.	267	3.2	52.5	14.0	7.5	13.2	11.0	109.3	0.8	1.20	94	0.027	0.025	< 0.01
02/12/08	9:50 a.m.	135	4.4	50.0	15.7	7.3	18.7	9.0	101.1	< 0.4	0.60	110	0.046	0.045	0.03

1131-107 UD = 315 m³/s (Flows from Ohakuri Dam - Total)

Waikato River at Ohakuri Tailrace Br

08/01/08	10:15 a.m.	172	1.6	37.5	19.0	7.1	<u>20.1</u>	9.1	99.7	1.2	1.20	140	0.009	0.007	0.05
05/02/08	10:40 a.m.	313	<u>0.72</u>	30.0	17.0	7.3	<u>22.1</u>	9.1	107.1	0.7	0.96	130	< 0.002	< 0.002	< 0.01
03/03/08	12:20 p.m.	172	1.8	47.5	18.0	7.5	<u>21.4</u>	9.3	108.6	0.9	2.00	130	0.014	0.012	< 0.01
02/04/08	10:30 a.m.	120	2.0	40.0	19.0	7.2	<u>20.6</u>	8.1	93.0	0.8	0.60	130	0.047	0.044	< 0.01
06/05/08	11:20 a.m.	142	2.3	35.0	20.0	7.2	<u>16.5</u>	8.3	88.1	0.6	0.83	140	0.190	0.180	0.01
03/06/08	10:50 a.m.	288	3.5	37.5	18.0	7.4	<u>13.7</u>	9.3	91.8	< 0.4	0.70	130	0.120	0.120	< 0.01
03/07/08	11:00 a.m.	198	3.9	-	19.0	7.2	<u>13.0</u>	9.2	91.1	0.8	0.94	140	0.180	0.180	0.03
08/08/08	11:00 a.m.	287	<u>1.4</u>	37.5	18.0	7.5	<u>12.9</u>	9.8	96.9	1.3	1.70	120	0.270	0.270	0.03
03/09/08	11:20 a.m.	337	(2.6)	37.5	14.8	7.3	-	9.7	100.9	0.5	1.00	110	0.130	0.130	0.01
07/10/08	11:10 a.m.	342	(2.6)	35.0	16.0	7.4	14.2	10.2	103.8	0.6	1.00	120	0.097	0.094	< 0.01
06/11/08	9:00 a.m.	350	<u>(1.4)</u>	45.0	15.5	7.3	14.8	10.4	106.6	0.9	1.40	110	0.088	0.085	< 0.01
02/12/08	10:45 a.m.	246	1.7	35.0	17.7	7.2	19.2	9.3	104.9	0.7	1.20	130	0.056	0.054	< 0.01

1131-147 UD = 305 m³/s (Flows from Whakamaru Dam - Total)

Waikato River at Whakamaru Tailrace

08/01/08	11:00 a.m.	190	2.0	35.0	19.0	7.3	<u>21.6</u>	8.6	100.6	1.0	1.50	140	0.029	0.029	0.02
05/02/08	12:05 p.m.	250	<u>1.0</u>	37.5	17.0	7.4	<u>22.9</u>	9.2	108.2	0.9	1.60	130	0.011	0.010	< 0.01
03/03/08	2:50 p.m.	194	<u>0.7</u>	37.5	17.0	7.6	<u>21.5</u>	9.6	111.3	4.0	5.00	130	0.005	0.005	0.02
02/04/08	11:20 a.m.	233	2.0	35.0	18.0	7.4	<u>20.6</u>	8.5	96.6	1.3	0.98	150	0.054	0.052	< 0.01
06/05/08	12:00 p.m.	258	2.2	35.0	20.0	7.3	<u>15.6</u>	9.0	93.3	0.6	1.20	120	0.220	0.220	< 0.01
03/06/08	11:25 a.m.	306	(3.0)	35.0	18.0	7.5	<u>13.2</u>	9.7	94.3	< 0.4	0.82	130	0.180	0.180	< 0.01
03/07/08	10:40 a.m.	274	3.6	-	17.0	7.4	<u>12.2</u>	9.9	94.9	1.1	1.30	140	0.210	0.210	< 0.01
08/08/08	12:00 p.m.	388	<u>(1.5)</u>	37.5	17.1	7.5	<u>12.2</u>	10.3	99.6	1.3	2.00	120	0.380	0.370	< 0.01
03/09/08	12:15 p.m.	321	(2.4)	40.0	14.6	7.4	-	9.9	100.2	0.4	1.10	100	0.200	0.200	< 0.01
07/10/08	11:50 a.m.	401	(2.3)	37.5	15.8	7.4	14.4	10.0	102.2	0.5	1.00	120	0.160	0.160	< 0.01
06/11/08	10:00 a.m.	324	(2.1)	42.5	15.4	7.5	15.5	10.7	110.6	1.4	1.60	110	0.081	0.077	< 0.01
02/12/08	11:25 a.m.	295	1.6	32.5	16.6	7.5	19.1	10.1	112.9	0.8	1.60	120	0.028	0.028	0.02

Note: < = less than value stated
UD = upper decile flow (period 1989-2008 inclusive)

Underlined values don't comply with the "satisfactory" water quality Guidelines and Standards – Table 1

* New Zealand Standard Time

() black disk measurements taken in flows above upper decile value – don't assess for compliance

TKN g/m ³	TN g/m ³	DRP g/m ³	TP g/m ³	CL g/m ³	AS g/m ³	B g/m ³	LI g/m ³	A340F /cm	A440F /cm	ENT cfu/100ml	FC cfu/100ml	E coli cfu/100ml	CHLA g/m ³	DOC g/m ³	TOC g/m ³
-	<0.5	-	<0.04	-	<0.01	<0.3	-	-	-	<77	-	<273	<0.02		

0.08	0.09	< 0.004	0.005	8.4	<u>0.011</u>	0.16	0.037	< 0.002	< 0.002	5	1	1	< 0.003	0.72	0.8
0.07	0.07	< 0.004	0.006	8.7	<u>0.011</u>	0.17	0.043	< 0.002	< 0.002	30	30	20	< 0.003	1.2	1
0.07	0.07	< 0.004	0.005	8.6	<u>0.011</u>	0.16	0.036	< 0.002	< 0.002	< 1	2	2	< 0.003	0.46	0.84
0.06	0.06	< 0.004	0.004	8.4	<u>0.012</u>	0.17	0.041	< 0.002	< 0.002	< 1	12	12	< 0.003	0.58	0.75
0.07	0.07	< 0.004	0.006	8.5	<u>0.011</u>	0.18	0.042	< 0.002	< 0.002	4	6	6	< 0.003	0.56	0.73
< 0.05	0.03	< 0.004	< 0.004	8.5	<u>0.011</u>	0.17	0.044	< 0.002	< 0.002	< 1	< 1	< 1	< 0.003	1	1.4
< 0.05	0.03	< 0.004	0.005	8.5	<u>0.011</u>	0.17	0.040	< 0.002	< 0.002	1	4	4	< 0.003	0.54	1
< 0.05	0.03	< 0.004	0.005	8.4	<u>0.011</u>	0.15	0.037	< 0.002	< 0.002	1	1	1	< 0.003	0.44	1
< 0.05	0.03	< 0.004	< 0.004	8.6	<u>0.012</u>	0.16	0.040	< 0.002	< 0.002	< 1	2	2	< 0.003	0.68	0.79
0.06	0.06	< 0.004	< 0.004	8.9	<u>0.012</u>	0.17	0.037	< 0.002	< 0.002	< 1	3	3	< 0.003	0.93	1.4
0.06	0.06	< 0.004	0.005	8.4	<u>0.011</u>	0.15	0.038	< 0.002	< 0.002	1	1	< 1	< 0.003	0.85	0.86
0.07	0.07	< 0.004	0.006	8.7	0.010	0.14	0.036	< 0.002	< 0.002	2	3	3	< 0.003	1.1	1.3
0.10	0.13	< 0.004	0.021	17.0	<u>0.029</u>	0.26	0.089	0.003	< 0.002	<u>110</u>	140	110	< 0.003	0.77	1
0.10	0.10	< 0.004	0.021	14.0	<u>0.023</u>	0.25	0.073	0.004	< 0.002	<u>310</u>	26	26	< 0.003	1.2	1.1
0.10	0.13	0.006	0.021	25.0	<u>0.044</u>	<u>0.36</u>	0.120	0.003	< 0.002	12	16	11	< 0.003	0.56	0.79
0.06	0.12	0.005	0.017	20.0	<u>0.035</u>	<u>0.36</u>	0.110	0.002	< 0.002	29	16	16	< 0.003	0.87	1
0.10	0.18	0.012	0.028	31.0	<u>0.051</u>	<u>0.49</u>	0.170	0.009	< 0.002	23	34	32	< 0.003	0.73	0.78
0.06	0.11	0.006	0.017	22.0	<u>0.032</u>	<u>0.35</u>	0.120	0.005	< 0.002	4	11	11	< 0.003	1.1	1.2
0.06	0.10	0.005	0.016	25.0	<u>0.041</u>	<u>0.45</u>	0.140	0.005	< 0.002	18	27	19	< 0.003	0.7	1.2
0.06	0.08	< 0.004	0.007	13.0	<u>0.022</u>	0.22	0.065	< 0.002	< 0.002	3	8	8	< 0.003	0.4	0.98
0.13	0.15	< 0.004	0.010	13.0	<u>0.022</u>	0.25	0.074	< 0.002	< 0.002	2	5	3	< 0.003	0.69	0.94
0.09	0.12	0.009	0.015	16.0	<u>0.023</u>	<u>0.33</u>	0.077	0.003	< 0.002	10	19	16	< 0.003	0.7	1.3
0.09	0.11	< 0.004	0.013	14.0	<u>0.020</u>	0.22	0.069	< 0.002	< 0.002	2	7	7	< 0.003	1.2	1.7
0.07	0.11	0.007	0.024	17.0	<u>0.026</u>	0.28	0.087	0.006	< 0.002	14	44	44	< 0.003	0.93	1.3
0.12	0.13	< 0.004	0.032	26.0	<u>0.044</u>	<u>0.41</u>	0.150	0.005	< 0.002	3	17	15	0.007	0.76	1
0.13	0.13	< 0.004	0.031	21.0	<u>0.038</u>	<u>0.33</u>	0.120	0.003	< 0.002	3	10	10	0.006	1.3	1.3
0.14	0.15	< 0.004	0.028	22.0	<u>0.039</u>	<u>0.33</u>	0.110	0.003	< 0.002	2	< 1	< 1	0.010	0.67	1
< 0.05	0.07	0.006	0.025	23.0	<u>0.043</u>	<u>0.41</u>	0.150	0.003	< 0.002	4	2	2	< 0.003	0.72	1.1
0.14	0.33	0.021	0.037	27.0	<u>0.043</u>	<u>0.40</u>	0.160	0.008	< 0.002	10	28	24	< 0.003	0.73	1.2
0.09	0.21	0.012	0.027	21.0	<u>0.030</u>	<u>0.32</u>	0.130	0.004	< 0.002	< 1	1	1	< 0.003	1.4	1.6
0.12	0.30	0.012	0.026	24.0	<u>0.034</u>	<u>0.39</u>	0.140	0.007	< 0.002	12	8	8	< 0.003	1.1	1.9
0.11	0.38	0.012	0.026	20.0	<u>0.034</u>	0.30	0.100	0.007	< 0.002	13	13	8	< 0.003	1.4	1.3
0.10	0.23	0.006	0.017	15.0	<u>0.023</u>	0.24	0.081	0.004	< 0.002	7	1	< 1	< 0.003	0.85	1.2
0.12	0.22	0.008	0.020	18.0	<u>0.030</u>	0.30	0.091	0.004	< 0.002	2	5	5	0.004	1.1	1.6
0.11	0.20	< 0.004	0.024	17.0	<u>0.026</u>	0.26	0.089	0.007	< 0.002	1	3	3	< 0.003	1.2	1.6
0.11	0.17	0.007	0.027	21.0	<u>0.032</u>	<u>0.31</u>	0.110	0.007	< 0.002	< 1	5	5	0.004	1.4	1.5
0.15	0.18	0.006	0.035	25.0	<u>0.040</u>	<u>0.39</u>	0.140	0.007	< 0.002	4	7	7	0.004	1.2	1.3
0.20	0.21	< 0.004	0.035	21.0	<u>0.037</u>	<u>0.32</u>	0.120	0.005	< 0.002	20	22	22	0.007	1.3	1.3
0.56	<u>0.57</u>	0.004	<u>0.074</u>	21.0	<u>0.048</u>	0.30	0.110	0.007	< 0.002	< 1	11	11	<u>0.100</u>	0.79	1.6
0.17	0.22	0.006	0.030	23.0	<u>0.040</u>	<u>0.38</u>	0.140	0.004	< 0.002	<u>110</u>	37	37	< 0.003	0.88	1.6
0.13	0.35	0.015	0.036	25.0	<u>0.036</u>	<u>0.39</u>	0.150	0.009	< 0.002	34	66	49	0.004	1.1	1.4
0.09	0.27	0.011	0.030	22.0	<u>0.031</u>	<u>0.33</u>	0.140	0.006	< 0.002	<u>80</u>	300	270	< 0.003	1	1.4
0.16	0.37	0.011	0.038	23.0	<u>0.034</u>	<u>0.37</u>	0.140	0.013	0.003	20	28	21	0.009	1.2	1.6
0.14	<u>0.52</u>	0.013	0.030	19.0	<u>0.029</u>	0.26	0.092	0.012	0.002	17	27	23	< 0.003	1.4	1.9
0.10	0.30	0.006	0.019	15.0	<u>0.023</u>	0.25	0.083	0.005	< 0.002	15	10	8	< 0.003	1	1.1
0.17	0.33	0.012	0.025	18.0	<u>0.034</u>	0.29	0.094	0.005	< 0.002	6	9	7	0.005	0.99	1.6
0.15	0.23	< 0.004	0.027	17.0	<u>0.027</u>	0.26	0.093	0.008	< 0.002	8	13	13	<u>0.021</u>	1.1	1.6
0.17	0.20	0.005	0.027	19.0	<u>0.031</u>	0.27	0.100	0.009	0.002	2	4	4	0.004	1.3	1.5

Note: < = less than value stated

Underlined values don't comply with the "satisfactory" water quality Guidelines and Standards – Table 1

DATE	TIME*	FLOW	BDISK	COLOR	COND	PH	TEMP	DO	PCDO	BOD5	TURB	TDS	NNN	NO3-N	NH4-N
dd/mm/yy	hh:mm	m ³ /s	m	units	mS/m	units	'C	g/m ³	%Sat	g/m ³	NTU	g/m ³	g/m ³	g/m ³	g/m ³
Satisfactory Water Quality Guideline/Standard			>1.6	-	-	6.5-9	<12 (May-Sep)	>80	-	<5	-	-	-	-	<0.88
							<20 (Oct-Apr)								

1131-143 UD = 356 m³/s (Flows from Waipapa Dam - Total)

Waikato River at Waipapa Tailrace

08/01/08 11:55 a.m.	190	<u>1.5</u>	35.0	17.0	7.2	<u>20.7</u>	8.7	98.9	1.5	1.90	130	0.100	0.098	0.04
05/02/08 12:30 p.m.	250	<u>0.8</u>	35.0	18.0	7.3	<u>22.2</u>	8.1	93.8	0.5	1.40	130	0.085	0.081	0.04
07/03/08 11:05 a.m.	155	1.6	37.5	18.0	7.3	<u>20.9</u>	8.7	97.8	0.4	1.20	<10	0.100	0.100	0.03
02/04/08 12:30 p.m.	215	1.8	32.5	18.0	7.4	<u>20.6</u>	8.5	95.9	1.3	1.00	160	0.140	0.130	0.03
06/05/08 12:40 p.m.	258	1.8	32.5	17.0	7.3	<u>15.6</u>	9.2	93.8	0.9	1.20	120	0.240	0.240	0.02
03/06/08 11:55 a.m.	306	2.4	35.0	18.0	7.3	<u>12.9</u>	10.0	95.3	0.5	0.88	130	0.230	0.220	<0.01
03/07/08 12:00 p.m.	227	3.2	-	16.0	7.3	<u>12.0</u>	9.9	93.8	0.7	1.10	120	0.260	0.260	<0.01
08/08/08 12:45 p.m.	388	<u>(1.3)</u>	35.0	14.4	7.5	11.9	10.2	97.4	0.8	2.60	110	0.440	0.440	0.01
03/09/08 12:55 p.m.	321	2.1	42.5	14.0	7.3		10.2	100.5	0.6	1.30	110	0.270	0.270	<0.01
07/10/08 12:20 p.m.	105	2.3	35.0	15.2	7.4	14.4	10.4	104.7	0.6	1.40	120	0.180	0.170	<0.01
06/11/08 11:00 a.m.	109	<u>1.5</u>	42.5	15.4	7.5	15.3	10.7	109.1	0.8	1.50	110	0.140	0.140	<0.01
02/12/08 12:05 p.m.	107	2.1	37.5	16.0	7.4	18.7	9.8	106.9	0.7	1.40	120	0.091	0.089	0.04

1131-328 UD = 360 m³/s (Flows from Karapiro Dam - Total)

Waikato River at Narrows Boat Ramp

09/01/08 8:00 a.m.	152	1.8	37.5	16.0	7.1	<u>21.3</u>	8.1	92.5	0.4	1.20	120	0.140	0.140	0.06
04/02/08 8:20 a.m.	154	<u>1.5</u>	32.5	18.0	7.5	<u>22.9</u>	8.0	93.7	0.5	1.70	99	0.130	0.120	0.05
06/03/08 7:55 a.m.	153	1.7	32.5	17.0	7.5	19.9	8.6	94.1	0.5	2.00	140	0.100	0.100	0.02
02/04/08 8:20 a.m.	152	2.1	32.5	17.0	7.3	19.7	8.1	88.3	0.8	1.60	130	0.140	0.140	0.04
07/05/08 9:10 a.m.	157	<u>1.1</u>	37.5	17.0	7.0	<u>14.8</u>	9.7	95.8	<0.4	2.90	150	0.410	0.410	<0.01
04/06/08 9:10 a.m.	196	<u>1.2</u>	35.0	18.0	7.3	<u>12.8</u>	9.9	93.7	0.6	1.60	150	0.350	0.350	<0.01
03/07/08 9:15 a.m.	333	<u>1.3</u>	35.0	16.0	7.3	11.7	10.0	92.7	0.9	2.00	120	0.430	0.430	<0.01
06/08/08 9:05 a.m.	401	<u>(1.0)</u>	32.5	13.9	7.1	<u>12.1</u>	9.9	91.6	0.5	5.00	100	0.770	0.770	0.02
01/09/08 9:50 a.m.	405	<u>(1.5)</u>	35.0	13.8	7.6	<u>12.3</u>	10.9	99.4	0.5	2.10	120	0.510	0.510	<0.01
08/10/08 8:00 a.m.	403	<u>(0.5)</u>	30.0	14.1	7.5	14.7	10.2	101.7	0.9	<u>9.50</u>	110	0.320	0.320	0.02
05/11/08 8:05 a.m.	405	<u>(1.6)</u>	32.5	14.6	7.8	16.2	10.1	105.5	0.9	1.70	120	0.210	0.210	0.03
03/12/08 8:05 a.m.	152	1.9	35.0	15.1	7.3	19.3	9.1	98.1	0.7	1.70	120	0.180	0.180	0.03

1131-69 UD = 385 m³/s (Flows from Hamilton - Bridge Street Bridge)

Waikato River at Horotiu Br

09/01/08 9:20 a.m.	160	1.8	35.0	16.0	7.1	<u>21.2</u>	7.9	89.1	0.5	1.40	120	0.180	0.180	0.05
04/02/08 9:10 a.m.	169	<u>1.1</u>	32.5	18.0	7.6	<u>22.9</u>	8.1	94.7	0.6	2.30	140	0.140	0.140	0.01
06/03/08 8:40 a.m.	162	<u>1.0</u>	35.0	17.0	7.6	<u>20.7</u>	8.2	91.3	0.5	2.40	120	0.130	0.130	<0.01
02/04/08 8:50 a.m.	163	2.0	32.5	17.0	7.5	19.5	8.2	88.5	0.9	2.10	120	0.180	0.170	0.03
07/05/08 10:00 a.m.	198	<u>0.9</u>	25.0	17.0	7.1	<u>14.7</u>	9.3	91.6	<0.4	3.80	160	0.560	0.550	<0.01
04/06/08 10:20 a.m.	167	<u>1.0</u>	35.0	19.0	7.4	<u>12.9</u>	10.0	94.8	1.1	1.80	140	0.390	0.390	<0.01
03/07/08 10:15 a.m.	306	<u>1.2</u>	35.0	16.0	7.4	11.6	10.0	92.3	0.9	2.60	130	0.490	0.490	0.02
06/08/08 10:00 a.m.	499	<u>(0.8)</u>	32.5	14.3	7.2	11.6	9.9	91.1	0.4	<u>5.30</u>	110	0.890	0.880	0.02
01/09/08 10:40 a.m.	406	<u>(1.5)</u>	35.0	13.9	7.5	<u>12.5</u>	10.7	98.3	0.7	2.60	120	0.510	0.500	<0.01
08/10/08 8:45 a.m.	443	<u>(0.5)</u>	32.5	14.2	7.5	14.2	10.2	100.0	0.9	<u>11.00</u>	110	0.380	0.380	0.02
05/11/08 8:45 a.m.	384	<u>1.4</u>	30.0	14.8	7.7	15.8	9.9	102.6	0.8	3.00	120	0.240	0.240	<0.01
03/12/08 9:15 a.m.	167	1.6	30.0	15.4	7.5	19.7	8.9	96.5	0.7	2.20	120	0.220	0.220	0.01

1131-77 UD = 586 m³/s (Flows from Huntly Power Station Recorder)

Waikato River at Huntly-Tainui Br

09/01/08 10:10 a.m.	181	1.7	32.5	16.0	7.2	<u>22.1</u>	8.1	93.1	0.4	2.70	120	0.260	0.250	0.04
04/02/08 10:10 a.m.	182	<u>1.1</u>	27.5	18.0	7.7	<u>24.0</u>	9.0	106.9	2.4	<u>6.80</u>	140	0.130	0.120	<0.01
06/03/08 9:25 a.m.	176	<u>0.9</u>	35.0	17.0	7.7	<u>20.4</u>	9.0	99.0	1.2	3.20	130	0.180	0.180	<0.01
02/04/08 9:40 a.m.	177	<u>1.3</u>	32.5	17.0	7.5	19.6	9.2	100.1	1.1	3.40	120	0.240	0.230	0.01
07/05/08 10:45 a.m.	423	<u>0.4</u>	25.0	16.0	7.0	<u>13.7</u>	9.1	87.9	0.7	<u>26.00</u>	120	1.700	1.700	<0.01
04/06/08 11:05 a.m.	195	<u>0.9</u>	35.0	18.0	7.5	<u>12.7</u>	10.3	96.9	1.2	3.0	130	0.460	0.450	<0.01
03/07/08 11:05 a.m.	460	<u>0.7</u>	32.5	15.0	7.2	11.5	9.3	86.1	1.5	<u>10.00</u>	120	1.200	1.200	0.04
06/08/08 11:00 a.m.	1086	<u>(0.2)</u>	30.0	11.8	6.9	<u>12.1</u>	8.9	82.3	0.8	<u>32.00</u>	91	1.400	1.400	0.05
01/09/08 11:10 a.m.	625	<u>(0.8)</u>	27.5	13.4	7.5	<u>13.1</u>	10.0	93.5	0.7	<u>5.70</u>	120	0.860	0.850	<0.01
08/10/08 9:20 a.m.	743	<u>(0.3)</u>	30.0	11.6	7.3	14.5	9.2	90.7	1.1	<u>34</u>	89	0.530	0.520	0.02
05/11/08 9:20 a.m.	477	<u>0.9</u>	30.0	14.1	7.5	16.6	9.2	96.9	0.9	<u>8.20</u>	120	0.390	0.390	<0.01
03/12/08 10:10 a.m.	284	<u>1.0</u>	27.5	14.4	7.5	<u>20.4</u>	8.8	97.3	0.8	<u>5.80</u>	110	0.340	0.330	<0.01

Note: < = less than value stated
UD = upper decile flow (period 1989-2008 inclusive)

Underlined values don't comply with the "satisfactory" water quality Guidelines and Standards – Table 1

* New Zealand Standard Time

() black disk measurements taken in flows above upper decile value – don't assess for compliance

TKN g/m ³	TN g/m ³	DRP g/m ³	TP g/m ³	CL g/m ³	AS g/m ³	B g/m ³	LI g/m ³	A340F /cm	A440F /cm	ENT cfu/100ml	FC cfu/100ml	E coli cfu/100ml	CHLA g/m ³	DOC g/m ³	TOC g/m ³
-	<0.5	-	<0.04	-	<0.01	<0.3	-	-	-	<77	-	<273	<0.02		
0.25	0.35	0.012	<u>0.047</u>	21.0	<u>0.033</u>	<u>0.31</u>	0.110	0.010	< 0.002	<u>100</u>	8	3	0.007	1.3	1.6
0.20	0.29	0.020	<u>0.042</u>	22.0	<u>0.038</u>	<u>0.32</u>	0.130	0.010	0.002	3	7	7	0.005	1.3	1.7
0.14	0.24	0.022	<u>0.041</u>	21.0	<u>0.032</u>	0.28	0.094	0.009	< 0.002	4	3	3	0.006	1.1	1.3
0.15	0.29	0.023	0.039	23.0	<u>0.034</u>	<u>0.33</u>	0.130	0.009	< 0.002	24	80	80	< 0.003	1.1	1.4
0.17	0.41	0.023	0.038	20.0	<u>0.026</u>	0.29	0.110	0.017	0.002	20	50	43	< 0.003	1.4	1.8
0.11	0.34	0.015	0.040	18.0	<u>0.027</u>	<u>0.32</u>	0.140	0.008	< 0.002	10	8	4	< 0.003	1.7	2.1
0.13	0.39	0.017	0.034	21.0	<u>0.027</u>	<u>0.31</u>	0.110	0.013	0.004	2	20	20	0.003	1.2	1.6
0.20	<u>0.64</u>	0.016	0.032	15.0	<u>0.020</u>	0.19	0.070	0.015	0.002	32	110	40	< 0.003	1.9	2.2
0.13	0.40	0.008	0.018	14.0	<u>0.020</u>	0.24	0.075	0.007	< 0.002	3	13	8	< 0.003	0.86	1.1
0.13	0.31	0.011	0.025	16.0	<u>0.025</u>	0.26	0.081	0.007	< 0.002	< 1	15	15	0.007	1.3	1.7
0.16	0.30	< 0.004	0.029	17.0	<u>0.025</u>	0.25	0.086	0.009	< 0.002	1	19	19	0.008	1.3	1.7
0.20	0.29	0.009	0.028	18.0	<u>0.028</u>	0.25	0.090	0.010	< 0.002	1	6	6	0.004	1.5	1.7
0.19	0.33	0.014	<u>0.042</u>	18.0	<u>0.032</u>	0.28	0.110	0.010	< 0.002	17	34	22	0.005	0.96	1.5
0.22	0.35	0.019	<u>0.044</u>	23.0	<u>0.034</u>	<u>0.32</u>	0.120	0.013	0.003	40	30	30	0.011	1.4	1.7
0.17	0.27	0.034	0.039	20.0	<u>0.031</u>	0.27	0.099	0.008	< 0.002	26	40	40	0.014	1.1	1.7
0.16	0.30	0.023	<u>0.049</u>	20.0	<u>0.030</u>	0.26	0.099	0.008	< 0.002	12	10	8	0.006	1.3	1.6
0.27	<u>0.68</u>	0.021	<u>0.047</u>	20.0	<u>0.025</u>	0.27	0.099	0.015	0.002	<u>160</u>	280	230	0.010	1.8	2.2
0.15	0.50	0.024	<u>0.046</u>	24.0	<u>0.027</u>	<u>0.35</u>	0.130	0.012	< 0.002	11	30	30	0.006	1.4	2.2
0.18	<u>0.61</u>	0.024	<u>0.042</u>	19.0	<u>0.021</u>	0.23	0.089	0.015	0.003	27	52	52	0.003	1.6	2.4
0.21	<u>0.98</u>	0.030	<u>0.054</u>	15.0	<u>0.013</u>	0.16	0.061	0.023	0.004	59	130	120	0.003	1.9	3.1
0.15	<u>0.66</u>	0.010	<u>0.052</u>	14.0	<u>0.018</u>	0.18	0.060	0.011	< 0.002	6	49	49	< 0.003	1.6	2.5
0.28	<u>0.60</u>	0.031	<u>0.074</u>	14.0	<u>0.017</u>	0.17	0.059	0.026	0.005	<u>1700</u>	4400	<u>4400</u>	0.015	2.3	3.6
0.20	0.41	0.013	0.026	16.0	<u>0.022</u>	0.22	0.079	0.010	< 0.002	18	36	36	0.005	1.4	1.6
0.17	0.35	0.009	0.034	16.0	<u>0.024</u>	0.23	0.077	0.017	0.006	26	90	70	0.008	1.1	2
0.19	0.37	0.025	<u>0.057</u>	18.0	<u>0.030</u>	0.30	0.100	0.010	< 0.002	38	70	60	0.006	1.4	1.5
0.22	0.36	0.022	<u>0.054</u>	23.0	<u>0.033</u>	<u>0.31</u>	0.120	0.012	0.004	<u>140</u>	500	<u>500</u>	0.016	1.7	2.1
0.18	0.31	0.028	<u>0.048</u>	20.0	<u>0.030</u>	0.27	0.100	0.007	< 0.002	54	230	210	0.017	1.2	2.3
0.18	0.36	0.035	<u>0.071</u>	20.0	<u>0.028</u>	0.27	0.100	0.008	< 0.002	30	70	50	0.007	1.3	1.6
0.30	<u>0.86</u>	0.032	<u>0.069</u>	21.0	<u>0.025</u>	0.27	0.099	0.019	0.003	<u>290</u>	350	<u>300</u>	0.009	2.3	2.7
0.19	<u>0.58</u>	0.037	<u>0.067</u>	24.0	<u>0.028</u>	<u>0.37</u>	0.130	0.013	0.002	19	70	70	0.007	2.6	2.5
0.17	<u>0.66</u>	0.029	<u>0.052</u>	19.0	<u>0.022</u>	0.22	0.087	0.018	0.005	20	70	70	0.004	2	2.5
0.23	<u>1.12</u>	0.043	<u>0.071</u>	15.0	<u>0.014</u>	0.17	0.062	0.029	0.005	70	300	240	< 0.003	2.6	3.4
0.19	<u>0.70</u>	0.015	0.036	14.0	<u>0.016</u>	0.20	0.063	0.012	< 0.002	11	50	50	0.006	1.2	1.9
0.32	<u>0.70</u>	0.046	<u>0.100</u>	14.0	<u>0.017</u>	0.19	0.060	0.034	0.006	<u>2200</u>	3600	<u>3600</u>	0.019	3.1	4.4
0.18	0.42	0.020	0.038	16.0	<u>0.021</u>	0.21	0.074	0.011	< 0.002	40	170	170	0.005	1.5	1.9
0.16	0.38	0.018	<u>0.046</u>	16.0	<u>0.024</u>	0.22	0.075	0.020	0.007	31	70	60	0.007	1.7	1.8
0.22	0.48	0.023	<u>0.070</u>	18.0	<u>0.024</u>	0.25	0.087	0.016	0.003	14	100	100	0.006	1.4	1.7
0.37	0.50	0.011	<u>0.074</u>	23.0	<u>0.033</u>	0.30	0.120	0.015	0.003	60	90	50	<u>0.031</u>	1.9	3
0.21	0.39	0.037	<u>0.063</u>	20.0	<u>0.026</u>	0.24	0.090	0.011	< 0.002	39	160	150	0.020	1.6	2.6
0.20	0.44	0.045	<u>0.072</u>	20.0	<u>0.024</u>	0.23	0.087	0.013	< 0.002	13	55	40	0.011	1.5	2
0.56	<u>2.26</u>	0.021	<u>0.110</u>	16.0	0.010	0.12	0.043	0.032	0.006	<u>1400</u>	2000	<u>2000</u>	0.006	4.1	5.4
0.25	<u>0.71</u>	0.032	<u>0.067</u>	22.0	<u>0.019</u>	0.29	0.110	0.018	0.003	11	60	50	0.006	1.9	2.6
0.44	<u>1.64</u>	0.016	<u>0.066</u>	16.0	<u>0.012</u>	0.13	0.046	0.026	0.005	70	130	130	< 0.003	2.8	4.5
0.35	<u>1.75</u>	0.023	<u>0.110</u>	12.0	0.005	0.07	0.021	0.032	0.006	<u>210</u>	700	<u>700</u>	< 0.003	3.2	4.7
0.29	<u>1.15</u>	0.013	<u>0.048</u>	14.0	<u>0.011</u>	0.14	0.043	0.020	0.003	21	80	80	0.007	1.8	2.9
0.47	<u>1.00</u>	0.028	<u>0.110</u>	12.0	0.008	0.10	0.029	0.036	0.007	<u>2500</u>	6000	<u>6000</u>	0.010	3.5	6
0.26	<u>0.65</u>	0.021	<u>0.059</u>	15.0	<u>0.016</u>	0.16	0.058	0.019	0.003	19	310	<u>310</u>	< 0.003	2	2.7
0.21	<u>0.55</u>	0.022	<u>0.058</u>	15.0	<u>0.016</u>	0.18	0.055	0.022	0.004	35	90	90	0.011	1.7	2.8

Note: < = less than value stated

Underlined values don't comply with the "satisfactory" water quality Guidelines and Standards – Table 1

DATE	TIME*	FLOW	BDISK	COLOR	COND	PH	TEMP	DO	PCDO	BOD5	TURB	TDS	NNN	NO3-N	NH4-N
dd/mm/yy	hh:mm	m ³ /s	m	units	mS/m	units	'C	g/m ³	%Sat	g/m ³	NTU	g/m ³	g/m ³	g/m ³	g/m ³
Satisfactory Water Quality			>1.6	-	-	6.5-9	<12 (May-Sep)	>80	-	<5	-	-	-	-	<0.88
Guideline/Standard							<20 (Oct-Apr)								

1131-91 UD = 637 m³/s (Flows from Mercer Bridge Recorder)

Waikato River at Mercer Br

09/01/08 11:00 a.m.	184	-	-	16.0	7.4	<u>22.6</u>	8.8	102.8	1.1	3.40	120	0.180	0.180	0.01
04/02/08 11:10 a.m.	201	-	-	18.0	8.0	<u>24.3</u>	9.0	108.4	1.5	<u>7.4</u>	140	0.094	0.088	< 0.01
06/03/08 10:10 a.m.	188	-	-	17.0	7.8	<u>20.8</u>	9.2	101.6	0.9	5.00	130	0.120	0.120	< 0.01
02/04/08 10:25 a.m.	208	-	-	17.0	7.6	<u>20.5</u>	8.5	93.8	1.2	4.50	120	0.240	0.240	< 0.01
07/05/08 11:45 a.m.	454	-	-	17.0	7.0	<u>14.5</u>	8.8	86.1	0.7	<u>19.00</u>	130	1.400	1.400	< 0.01
04/06/08 11:50 a.m.	261	-	-	19.0	7.5	<u>13.9</u>	9.8	95.1	1.3	4.8	140	0.500	0.490	< 0.01
03/07/08 12:30 p.m.	596	-	-	18.0	7.2	<u>12.8</u>	8.9	84.8	2.5	<u>14.00</u>	130	1.500	1.500	0.10
06/08/08 12:10 p.m.	1272	-	-	13.2	6.9	<u>13.4</u>	8.3	<u>78.8</u>	0.8	<u>33.00</u>	100	1.400	1.400	0.03
01/09/08 12:00 p.m.	832	-	-	14.9	7.3	<u>14.1</u>	9.4	89.5	1.0	<u>9.40</u>	130	0.810	0.800	< 0.01
08/10/08 10:20 a.m.	628	-	-	12.6	7.3	15.0	9.3	92.8	1.0	<u>21</u>	99	0.440	0.430	0.02
05/11/08 10:05 a.m.	473	-	-	14.9	7.5	16.4	8.9	93.5	1.3	<u>15.00</u>	120	0.400	0.390	< 0.01
03/12/08 11:00 a.m.	317	-	-	14.8	7.8	<u>21.8</u>	9.1	102.6	1.5	<u>8.80</u>	110	0.250	0.250	< 0.01

1131-133

Waikato River at Tuakau Br

09/01/08 11:35 a.m.	-	<u>0.9</u>	32.5	16.0	7.5	<u>23.3</u>	9.6	113.7	1.5	3.20	120	0.110	0.110	< 0.01
04/02/08 11:40 a.m.	-	<u>0.7</u>	30.0	18.0	8.3	<u>25.1</u>	10.2	123.7	1.7	5.0	140	0.040	0.036	< 0.01
06/03/08 10:50 a.m.	-	<u>0.6</u>	30.0	17.0	8.1	<u>22.3</u>	9.5	109.6	1.5	3.70	120	0.043	0.040	< 0.01
02/04/08 10:50 a.m.	-	<u>1.0</u>	32.5	17.0	7.4	<u>20.6</u>	8.9	98.5	1.0	<u>5.20</u>	120	0.220	0.210	< 0.01
07/05/08 12:40 p.m.	-	<u>0.6</u>	25.0	17.0	7.0	<u>15.3</u>	8.7	86.6	0.6	<u>13.00</u>	130	1.100	1.100	< 0.01
04/06/08 12:45 p.m.	-	<u>1.0</u>	35.0	18.0	7.6	<u>14.1</u>	10.0	97.3	1.8	4.0	140	0.450	0.440	< 0.01
03/07/08 1:20 p.m.	-	<u>0.6</u>	32.5	18.0	7.1	<u>12.3</u>	8.4	<u>79.5</u>	1.2	<u>13.0</u>	140	1.700	1.700	0.06
06/08/08 12:40 p.m.	-	<u>0.3</u>	30.0	14.0	6.8	<u>12.6</u>	8.2	<u>76.4</u>	0.9	<u>24.00</u>	100	1.500	1.500	0.04
01/09/08 12:25 p.m.	-	<u>0.6</u>	27.5	14.5	7.3	<u>14.3</u>	9.2	88.0	1.2	<u>11.0</u>	130	0.780	0.770	< 0.01
08/10/08 10:50 a.m.	-	<u>0.4</u>	27.5	12.8	7.4	15.4	9.3	92.9	0.9	<u>20.0</u>	75	0.440	0.440	< 0.01
05/11/08 10:30 a.m.	-	<u>0.4</u>	27.5	14.9	7.4	17.2	9.0	95.2	1.2	<u>16.0</u>	110	0.380	0.380	< 0.01
03/12/08 11:30 a.m.	-	<u>0.7</u>	27.5	14.8	7.8	<u>22.3</u>	9.4	107.1	1.7	<u>8.80</u>	110	0.190	0.180	< 0.01

Note: < = less than value stated
UD = upper decile flow (period 1989-2008 inclusive)

Underlined values don't comply with the "satisfactory" water quality Guidelines and Standards – Table 1

* New Zealand Standard Time

() black disk measurements taken in flows above upper decile value – don't assess for compliance

TKN g/m ³	TN g/m ³	DRP g/m ³	TP g/m ³	CL g/m ³	AS g/m ³	B g/m ³	LI g/m ³	A340F /cm	A440F /cm	ENT cfu/100ml	FC cfu/100ml	E coli cfu/100ml	CHLA g/m ³	DOC g/m ³	TOC g/m ³
-	<0.5	-	<0.04	-	<0.01	<0.3	-	-	-	<77	-	<273	<0.02		

0.24	0.42	0.017	<u>0.058</u>	18.0	<u>0.024</u>	0.27	0.092	0.013	0.002	3	70	50	0.019	1.6	1.7
0.42	<u>0.51</u>	0.013	<u>0.068</u>	23.0	<u>0.030</u>	0.30	0.110	0.014	0.003	<u>< 100</u>	80	40	<u>0.038</u>	1.9	2.8
0.23	0.35	0.020	<u>0.066</u>	21.0	<u>0.027</u>	0.26	0.090	0.008	< 0.002	16	80	80	<u>0.028</u>	1.6	2.6
0.16	0.40	0.039	<u>0.073</u>	20.0	<u>0.025</u>	0.26	0.089	0.012	< 0.002	11	170	120	0.013	1.4	2.2
0.56	<u>1.96</u>	0.023	<u>0.110</u>	18.0	<u>0.014</u>	0.17	0.059	0.034	0.006	<u>600</u>	1500	<u>1100</u>	0.008	3.4	5.8
0.24	<u>0.74</u>	0.020	<u>0.074</u>	23.0	<u>0.022</u>	<u>0.33</u>	0.110	0.018	0.003	11	29	29	0.009	2.1	3.1
0.48	<u>1.98</u>	0.010	<u>0.066</u>	18.0	0.008	0.11	0.035	0.042	0.008	70	200	200	0.005	3.9	5.9
0.45	<u>1.85</u>	0.023	<u>0.110</u>	14.0	0.005	0.08	0.023	0.045	0.008	<u>130</u>	500	<u>500</u>	< 0.003	3.4	5.3
0.37	<u>1.18</u>	0.008	<u>0.059</u>	15.0	0.009	0.12	0.038	0.038	0.006	13	70	70	0.011	2.8	3.8
0.35	<u>0.79</u>	0.025	<u>0.089</u>	13.0	<u>0.011</u>	0.13	0.042	0.030	0.005	<u>1500</u>	4200	<u>4200</u>	0.012	2.6	4
0.40	<u>0.80</u>	0.016	<u>0.075</u>	16.0	<u>0.014</u>	0.16	0.050	0.033	0.006	14	210	160	0.016	2.8	3.8
0.29	<u>0.54</u>	0.015	<u>0.060</u>	16.0	<u>0.018</u>	0.20	0.057	0.021	0.005	50	170	130	0.017	1.9	3.6

0.22	0.33	0.009	<u>0.058</u>	18.0	<u>0.025</u>	0.26	0.090	0.013	0.002		100	100	<u>0.027</u>	1.4	2
0.31	0.35	0.006	<u>0.061</u>	23.0	<u>0.029</u>	0.29	0.110	0.016	0.004	<u>130</u>	70	70	<u>0.046</u>	1.7	2.6
0.25	0.29	0.014	<u>0.057</u>	20.0	<u>0.025</u>	0.25	0.089	0.010	< 0.002	28	130	120	<u>0.045</u>	1.5	2.5
0.15	0.37	0.038	<u>0.069</u>	20.0	<u>0.026</u>	0.26	0.091	0.011	< 0.002	1	60	60	0.016	1.1	2.2
0.38	<u>1.48</u>	0.025	<u>0.084</u>	18.0	<u>0.013</u>	0.16	0.057	0.032	0.005	<u>1800</u>	1700	<u>1300</u>	0.007	3.1	4.7
0.23	<u>0.68</u>	0.021	<u>0.067</u>	23.0	<u>0.017</u>	<u>0.34</u>	0.110	0.019	0.004	20	70	30	0.010	2.1	3.1
0.57	<u>2.27</u>	0.013	<u>0.076</u>	20.0	0.009	0.12	0.040	0.051	0.010	< 10	130	130	< 0.003	5.9	7.8
0.46	<u>1.96</u>	0.031	<u>0.089</u>	15.0	0.005	0.08	0.022	0.049	0.009	<u>90</u>	200	170	< 0.003	4.1	4.3
0.40	<u>1.18</u>	0.009	<u>0.066</u>	15.0	0.010	0.14	0.037	0.049	0.008	17	70	70	0.011	3.1	4.1
0.27	<u>0.71</u>	0.023	<u>0.090</u>	13.0	<u>0.011</u>	0.13	0.040	0.030	0.005	<u>800</u>	3600	<u>3600</u>	0.009	2.8	4.2
0.37	<u>0.75</u>	0.016	<u>0.085</u>	16.0	<u>0.015</u>	0.16	0.052	0.033	0.006	27	120	120	0.018	2.6	4
0.32	<u>0.51</u>	0.013	<u>0.072</u>	16.0	<u>0.019</u>	0.21	0.063	0.021	0.005	18	120	120	<u>0.024</u>	1.9	3.4

Note: < = less than value stated

Underlined values don't comply with the "satisfactory" water quality Guidelines and Standards – Table 1

3.2 Waikato River Monitoring Programme

Bathing Season Microbiological Survey

Summary Statistics

Comparison with Water Quality Standards

Parameter Graph

Raw Data

Table 5: Bathing Season Statistics of E. coli Bacteria.

Location Name	BATHING SEASON MEDIAN					5 Season
	00/01	02/03	04/05	06/07	08/09	Median
Taupo Gates	1	1	1	2	3	2
Huka Falls	9	5	4	8	13	7
Ohaaki Bridge	28	18	22	16	41	23
Ohakuri Tailrace Br	1	2	4	2	3	2
Whakamaru Tailrace	5	6	7	6	10	6
Waipapa Tailrace	8	6	9	6	6	7
Lake Karapiro Boatramp	19	25	27	8	25	20
Narrows Br	100	26	28	55	83	41
Wellington Street Beach	100	39	43	84	80	54
Sewer Br Alandale	100	44	75	100	120	90
Horotiu Br	160	44	90	150	120	90
Ngaruawahia Br	-	160	80	140	120	-
Huntly-Tainui Br	140	175	135	150	160	140
Mercer Br	80	70	36	85	115	80
Tuakau Br	60	70	44	50	105	66
Waipa River (Ngaruawahia Br)	-	86	95	90	130	-

Table 6: Year 2008/09 Bathing Season E. coli survey results complying with the “Satisfactory” and “Excellent” Water Quality Guidelines. n = 12.

Location Name	HUMAN USES - RECREATION			
	SATISFACTORY		EXCELLENT	
	<i>E. coli</i> Samples < 550	<i>E. coli</i> Median <126	<i>E. coli</i> Samples < 55	<i>E. coli</i> Median <23
Taupo Gates	12	Y	12	Y
Huka Falls	12	Y	12	Y
Ohaaki Bridge	12	Y	7	N
Ohakuri Tailrace Br	12	Y	12	Y
Whakamaru Tailrace	12	Y	10	Y
Waipapa Tailrace	12	Y	12	Y
Lake Karapiro Boatramp	12	Y	10	N
Narrows Br	12	Y	5	N
Wellington Street Beach	12	Y	3	N
Sewer Br Alandale	11	Y	1	N
Horotiu Br	11	Y	1	N
Ngaruawahia Br	11	Y	0	N
Huntly-Tainui Br	12	N	4	N
Mercer Br	12	Y	2	N
Tuakau Br	12	Y	1	N
Waipa River (Ngaruawahia Br)	12	Y	1	N

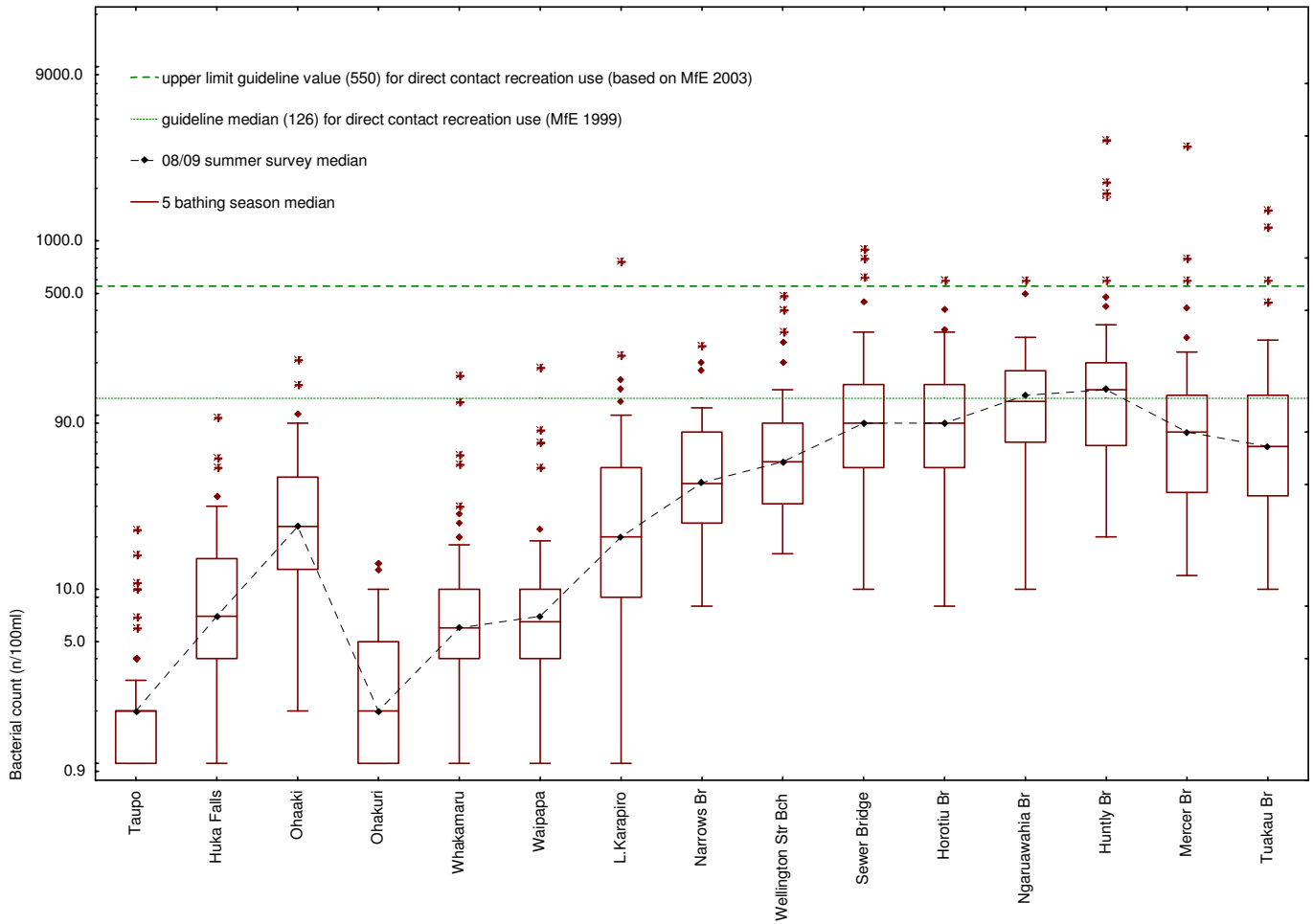


Figure 2: E. coli – 5 Bathing Season Data

DATE	EColi c/100ml	ENT c/100ml	FC c/100ml	DATE	EColi c/100ml	ENT c/100ml	FC c/100ml	DATE	EColi c/100ml	ENT c/100ml	FC c/100ml
Taupo Control Gates				Lake Karapiro Boatramp				Huntly-Tainui Bridge			
2/12/08	3	2	3	2/12/08	21	16	21	3/12/08	90	35	90
9/12/08	4	< 1	4	9/12/08	50	25	60	10/12/08	330	120	330
16/12/08	4	5	4	16/12/08	6	23	6	17/12/08	140	45	140
22/12/08	6	< 1	6	22/12/08	27	19	27	23/12/08	200	70	200
7/01/09	1	1	2	7/01/09	10	4	19	7/01/09	51	4	59
13/01/09	1	< 1	1	13/01/09	220	230	220	14/01/09	220	90	220
20/01/09	< 1	3	1	20/01/09	22	8	22	21/01/09	40	24	40
27/01/09	< 1	1	< 1	27/01/09	25	14	26	28/01/09	40	30	50
3/02/09	2	< 1	2	3/02/09	17	32	17	2/02/09	42	10	49
10/02/09	7	22	13	10/02/09	140	110	140	11/02/09	200	140	500
17/02/09	2	< 1	4	17/02/09	50	90	90	18/02/09	180	100	180
24/02/09	< 1	4	< 1	24/02/09	13	9	24	25/02/09	140	70	240
Median	2	1	3	Median	24	21	25	Median	140	58	160
Huka Falls				Narrows Boat Ramp				Mercer Bridge			
2/12/08	9	13	9	3/12/08	70	26	90	3/12/08	130	50	170
9/12/08	6	8	9	9/12/08	50	80	80	10/12/08	410	150	410
16/12/08	7	8	14	16/12/08	80	26	90	17/12/08	90	25	120
22/12/08	50	31	50	22/12/08	85	40	85	23/12/08	90	21	90
7/01/09	28	14	35	7/01/09	31	23	40	7/01/09	42	6	42
13/01/09	13	12	13	13/01/09	110	48	110	14/01/09	200	22	200
20/01/09	7	8	12	20/01/09	27	24	27	21/01/09	80	9	110
27/01/09	17	17	20	27/01/09	20	14	20	28/01/09	60	5	90
3/02/09	8	4	8	2/02/09	39	24	39	2/02/09	23	5	23
10/02/09	23	26	23	10/02/09	70	54	70	11/02/09	100	20	110
17/02/09	7	4	8	17/02/09	180	100	210	18/02/09	150	27	190
24/02/09	9	9	9	24/02/09	110	53	190	25/02/09	110	26	190
Median	9	11	13	Median	70	33	83	Median	95	22	115
Ohaaki Bridge				Wellington Street Beach				Tuakau Bridge			
2/12/08	44	14	44	3/12/08	80	27	80	3/12/08	120	18	120
9/12/08	26	10	38	10/12/08	120	130	180	10/12/08	270	50	310
16/12/08	80	17	80	17/12/08	79	42	79	17/12/08	130	28	150
22/12/08	11	9	11	23/12/08	90	27	90	23/12/08	60	7	60
7/01/09	15	4	18	7/01/09	37	21	37	7/01/09	70	8	90
13/01/09	80	45	80	14/01/09	85	56	85	14/01/09	200	24	220
20/01/09	90	27	90	21/01/09	45	33	56	21/01/09	80	9	100
27/01/09	210	240	250	28/01/09	32	33	37	28/01/09	60	9	70
3/02/09	34	33	34	2/02/09	70	25	70	2/02/09	17	6	17
10/02/09	62	71	74	11/02/09	260	290	360	11/02/09	80	31	100
17/02/09	13	21	13	18/02/09	60	130	60	18/02/09	130	63	170
24/02/09	27	20	27	25/02/09	80	200	100	25/02/09	110	33	110
Median	39	21	41	Median	80	38	80	Median	95	21	105
Ohakuri Tailrace Bridge				Sewer Bridge Alandale							
2/12/08	5	< 1	5	3/12/08	120	27	120				
9/12/08	2	5	3	10/12/08	120	63	120				
16/12/08	< 1	4	< 1	17/12/08	140	40	140				
22/12/08	1	< 1	1	23/12/08	110	37	110				
7/01/09	4	2	4	7/01/09	80	32	80				
13/01/09	6	3	6	14/01/09	110	80	120				
20/01/09	< 1	4	< 1	21/01/09	50	21	60				
27/01/09	1	4	1	28/01/09	60	41	80				
3/02/09	< 1	2	< 1	2/02/09	60	41	60				
10/02/09	6	5	6	11/02/09	900	270	1100				
17/02/09	9	1	15	18/02/09	100	100	130				
24/02/09	3	2	3	25/02/09	250	90	270				
Median	3	3	3	Median	110	41	120				
Whakamaru Tailrace				Horotiu Bridge				Waipa River @ Ngaruawahia			
2/12/08	4	2	4	3/12/08	60	31	70	3/12/08	100	27	100
9/12/08	8	5	10	10/12/08	120	120	170	10/12/08	250	140	250
16/12/08	7	2	8	17/12/08	90	130	170	17/12/08	60	35	60
22/12/08	5	4	5	23/12/08	90	40	130	23/12/08	80	18	80
7/01/09	12	6	12	7/01/09	110	30	110	7/01/09	170	15	200
13/01/09	9	5	9	14/01/09	120	90	120	14/01/09	120	37	150
20/01/09	1	17	3	21/01/09	60	31	80	21/01/09	110	34	110
27/01/09	170	45	210	28/01/09	73	48	83	28/01/09	140	41	160
3/02/09	3	20	3	2/02/09	50	30	50	2/02/09	38	22	38
10/02/09	60	230	70	11/02/09	600	900	700	11/02/09	160	170	160
17/02/09	16	13	16	18/02/09	120	38	120	18/02/09	90	33	100
24/02/09	27	29	34	25/02/09	200	110	220	25/02/09	170	80	190
Median	9	10	10	Median	100	44	120	Median	115	35	130
Waipapa Tailrace				Ngaruawahia Bridge							
2/12/08	6	1	6	3/12/08	55	45	90				
9/12/08	1	4	1	10/12/08	140	130	140				
16/12/08	6	1	6	17/12/08	110	80	110				
22/12/08	10	3	10	23/12/08	130	59	200				
7/01/09	7	4	7	7/01/09	120	21	120				
13/01/09	3	1	4	14/01/09	100	45	120				
20/01/09	5	5	5	21/01/09	80	17	120				
27/01/09	4	3	4	28/01/09	90	32	110				
3/02/09	< 1	3	< 1	2/02/09	70	27	70				
10/02/09	8	7	8	11/02/09	600	380	600				
17/02/09	17	11	22	18/02/09	120	60	180				
24/02/09	22	27	27	25/02/09	170	110	170				
Median	6	4	6	Median	115	52	120				

3.3 Waikato River Monitoring Programme

5-yearly Pesticides Results

Table 7: Samples for the 3 pesticides which were detected (values shown in bold). The remaining 116 pesticides analysed were not detected.

DATE dd/mm/yy	TIME* hh:mm	Acetochl mg/m3	Atrazine mg/m3	Terbuthy mg/m3
1131-127 Waikato River at Taupo Control Gates				
3/03/2008	09:30	< 0.010	< 0.010	< 0.005
3/06/2008	09:10	< 0.010	< 0.010	< 0.005
3/09/2008	09:00	< 0.010	< 0.010	< 0.005
2/12/2008	08:45	< 0.010	< 0.010	< 0.005
1131-107 Waikato River at Ohakuri Tailrace Br				
3/03/2008	12:20	< 0.010	< 0.010	< 0.005
5/06/2008	12:30	< 0.010	< 0.010	< 0.005
3/09/2008	11:20	< 0.010	< 0.010	< 0.005
2/12/2008	10:45	< 0.010	< 0.010	0.0058
1131-143 Waikato River at Waipapa Tailrace				
7/03/2008	11:05	< 0.010	< 0.010	< 0.005
3/06/2008	11:55	< 0.010	< 0.010	< 0.005
3/09/2008	12:55	< 0.010	< 0.010	< 0.005
2/12/2008	12:05	< 0.010	< 0.010	< 0.005
1131-328 Waikato River at Narrows Boat Ramp				
6/03/2008	07:55	< 0.010	< 0.010	< 0.005
4/06/2008	09:10	< 0.010	< 0.010	< 0.005
8/10/2008	08:00	< 0.010	< 0.010	< 0.005
3/12/2008	08:05	< 0.010	< 0.010	0.023
1131-69 Waikato River at Horotiu Br				
6/03/2008	08:40	< 0.010	< 0.010	< 0.005
4/06/2008	10:20	< 0.010	< 0.010	< 0.005
8/10/2008	08:45	0.052	0.026	<0.0063
3/12/2008	09:15	< 0.010	< 0.010	0.012
1131-133 Waikato River at Tuakau Br				
6/03/2008	10:50	< 0.010	< 0.010	< 0.005
4/06/2008	12:45	< 0.010	< 0.010	< 0.005
8/10/2008	10:50	0.027	0.015	0.014
3/12/2008	11:30	< 0.010	< 0.010	0.020

< = less than the value stated

*Time = New Zealand Standard Time

Table 8: Pesticide parameters analysed for, with respective detection limits (DL) and method of analysis (n=24).

Code	Parameter	#DL	*Method	Code	Parameter	#DL	*Method	Code	Parameter	#DL	*Method	Detection limits (mg/m ³)	
2,4"-DDD	2,4"-DDD	b	GC-ECD	Dicloran	Dicloran	j	GC-MS	Oxadiazol	Oxadiazon	g	GC-MS	a	0.00013
2,4"-DDE	2,4"-DDE	b	GC-ECD	Dieldrin	Dieldrin	b	GC-ECD	Oxyfluof	Oxyfluofen	e	GC-MS	b	0.00063
2,4"-DDT	2,4"-DDT	b	GC-ECD	Difenoco	Difenoconazole	h	GC-MS	Paclobut	Paclobutrazol	g	GC-MS	c	0.00200
4,4"-DDD	4,4"-DDD	b	GC-ECD	Dimethoa	Dimethoate	i	GC-MS	Parathie	Parathion-ethyl	g	GC-MS	d	0.00500
4,4"-DDE	4,4"-DDE	b	GC-ECD	Diphenyl	Diphenylamine	i	GC-MS	Parathim	Parathion-methyl	g	GC-MS	e	0.00630
4,4"-DDT	4,4"-DDT	b	GC-ECD	Diuron	Diuron	g	GC-MS	Pendimet	Pendimethalin	g	GC-MS	f	0.01000
Acetochl	Acetochlor	f	GC-MS	Endosul	Endosulfan I	g	GC-ECD	Permethr	Permethrin	d	GC-MS	g	0.01300
Alachlor	Alachlor	e	GC-MS	Endosull	Endosulfan II	b	GC-ECD	Pirimica	Pirimicarb	g	GC-MS	h	0.02000
Aldrin	Aldrin	b	GC-ECD	Endosulp	Endosulfan sulphate	b	GC-ECD	Pirimiph	Pirimiphos Methyl	g	GC-MS	i	0.02500
Alpha-BH	Alpha-BHC	b	GC-ECD	Endrin	Endrin	b	GC-ECD	Prochlor	Prochloraz	l	GC-MS	j	0.03200
Atrazind	Atrazine-desethyl	a	GC-MS	Endrin a	Endrin aldehyde	b	GC-ECD	Procymid	Procymidone	g	GC-MS	k	0.06000
Atrazine	Atrazine	f	GC-MS	Endrin K	Endrin Ketone	b	GC-ECD	Prometry	Prometryn	e	GC-MS	l	0.06300
Atrazini	Atrazine-deisopropyl	i	GC-MS	Fenpropi	Fenpropimorph	g	GC-MS	Propachl	Propachlor	g	GC-MS		
Azaconaz	Azaconazole	e	GC-MS	Fluazifo	Fluazifop-p-butyl	g	GC-MS	Propanil	Propanil	i	GC-MS		
Azinphos	Azinphos-methyl	i	GC-MS	Fluometu	Fluometuron	g	GC-MS	Propazin	Propazine	e	GC-MS		
Benalaxy	Benalaxyl	e	GC-MS	Flusilaz	Flusilazole	g	GC-MS	Propicon	Propiconazole	f	GC-MS		
Beta-BHC	Beta-BHC	b	GC-ECD	Fluvalin	Fluvalinate	f	GC-MS	Pyriprox	Pyriproxyfen	g	GC-MS		
Bitertan	Bitertanol	i	GC-MS	Furalax	Furalaxyl	e	GC-MS	Quizalet	Quizalofop-ethyl	g	GC-MS		
Bromacil	Bromacil	g	GC-MS	Gamma-BH	Gamma-BHC (Lindane)	b	GC-ECD	Simazine	Simazine	g	GC-MS		
Bromopro	Bromopropylate	g	GC-MS	Haloxypm	Haloxypop-methyl	g	GC-MS	Simetryn	Simetryn	g	GC-MS		
Butachlo	Butachlor	g	GC-MS	Heptachl	Heptachlor	b	GC-ECD	Sulfentr	Sulfentrazone	l	GC-MS		
Captan	Captan	i	GC-MS	Heptaepo	Heptachlor epoxide	b	GC-ECD	TCMTB	TCMTB	i	GC-MS		
Carbaryl	Carbaryl	g	GC-MS	Hexachlo	Hexachlorobenzene	b	GC-ECD	Tebucona	Tebuconazole	g	GC-MS		
Carbofur	Carbofuran	g	GC-MS	Hexacona	Hexaconazole	g	GC-MS	Terbacil	Terbacil	g	GC-MS		
Chlorflu	Chlorfluazuron	g	GC-MS	Hexazino	Hexazinone	e	GC-MS	Terbufos	Terbufos	g	GC-MS		
Chloroth	Chlorothalonil	g	GC-MS	IPBC	IPBC (3-Iodo-2-propynyl -n-butylcarbamate)	l	GC-MS	Terbumet	Terbumeton	g	GC-MS		
Chlorpyf	Chlorpyrifos	g	GC-MS	Iprodion	Iprodione	g	GC-MS	Terbutde	Terbutylazine desethyl	g	GC-MS		
Chlorpym	Chlorpyrifos-methyl	g	GC-MS	Kresoxim	Kresoxim-methyl	e	GC-MS	Terbuty	Terbutylazine	e	GC-MS		
Chlortol	Chlortoluron	i	GC-MS	Linuron	Linuron	g	GC-MS	Terbutry	Terbutryn	f	GC-MS		
cis-Chlo	cis-Chlordane	b	GC-ECD	Malathio	Malathion	g	GC-MS	Thiabend	Thiabendazole	k	GC-MS		
Cyfluthr	Cyfluthrin	g	GC-MS	Metalaxy	Metalaxyl	g	GC-MS	Thiobenc	Thiobencarb	g	GC-MS		
Cyhaloth	Cyhalothrin	g	GC-MS	Methoxyc	Methoxychlor	b	GC-ECD	Tolyflua	Tolyfluanid	e	GC-MS		
Cynanazi	Cynanazine	g	GC-MS	Metolach	Metolachlor	e	GC-MS	Total Ch	Total Chlordane (cis+trans)*100/42	c	GC-ECD		
Cypermeth	Cypermethrin	i	GC-MS	Metribuz	Metribuzin	g	GC-MS	trans-Ch	trans-Chlordane	b	GC-ECD		
Delta-BH	Delta-BHC	b	GC-ECD	Molinate	Molinate	i	GC-MS	Triazoph	Triazophos	g	GC-MS		
Deltamet	Deltamethrin	g	GC-MS	Myclobut	Myclobutanil	g	GC-MS	Triflura	Trifluralin	g	GC-MS		
Diazinon	Diazinon	e	GC-MS	Naled	Naled	l	GC-MS	Vinclozo	Vinclozolin	g	GC-MS		
Dichlofl	Dichlofluanid	g	GC-MS	Norflura	Norflurazon	i	GC-MS						
Dichlorv	Dichlorvos	h	GC-MS										

Method

GC-MS: Solid phase extraction, GPC (if required), GC-MS analysis

GC-ECD: Solid phase extraction, SPE cleanup (if required), dual column GC-ECD analysis

References

Huser, B. and Wilson, B. 1997: *Waikato River Water Quality Monitoring Programme Data Report 1996*. Environment Waikato Technical Report No. 97/5. Waikato Regional Council (Environment Waikato), Hamilton

Smith, P. 2003: *Waikato River Water Quality Monitoring Programme Data Report 2002*. Environment Waikato Technical Report No. 2003/01. Waikato Regional Council (Environment Waikato), Hamilton

Smith, P. 2004: *Waikato River Water Quality Monitoring Programme Data Report 2003*. Environment Waikato Technical Report No. 2004/10. Waikato Regional Council (Environment Waikato), Hamilton

Smith, P. 2005: *Waikato River Water Quality Monitoring Programme Data Report 2004*. Environment Waikato Technical Report No. 2005/2. Waikato Regional Council (Environment Waikato), Hamilton

Smith, P. 2006: *Waikato River Water Quality Monitoring Programme Data Report 2005*. Environment Waikato Technical Report No. 2006/34. Waikato Regional Council (Environment Waikato), Hamilton

Beard, S. 2007: *Waikato River Water Quality Monitoring Programme Data Report 2006*. Environment Waikato Technical Report No. 2007/18. Waikato Regional Council (Environment Waikato), Hamilton.

Beard, S. 2008: *Waikato River Water Quality Monitoring Programme Data Report 2007*. Environment Waikato Technical Report No. 2008/20. Waikato Regional Council (Environment Waikato), Hamilton.

Vant B. 2008: *Trends in River Water Quality in the Waikato Region, 1987-2007*. Environment Waikato Technical Report 2008/33, Waikato Regional Council (Environment Waikato), Hamilton.

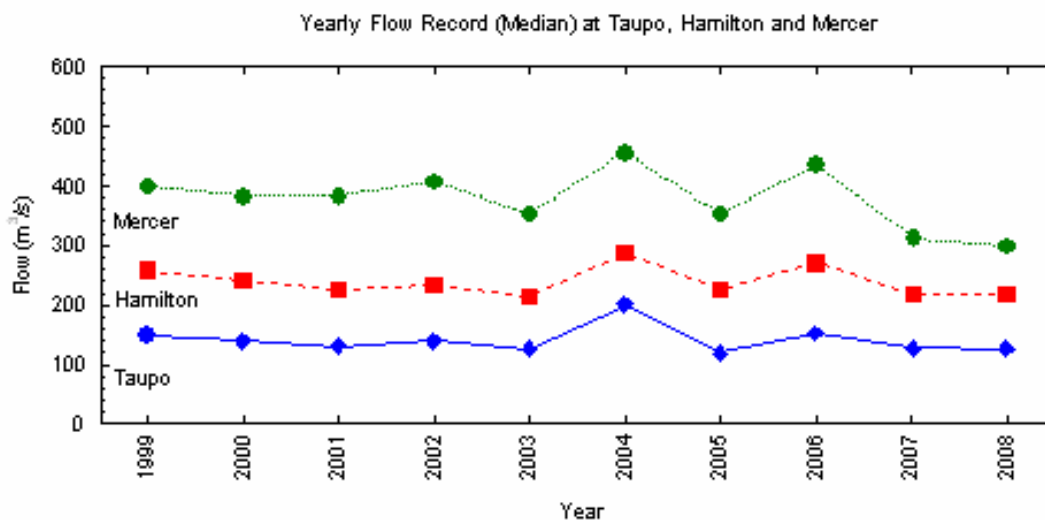
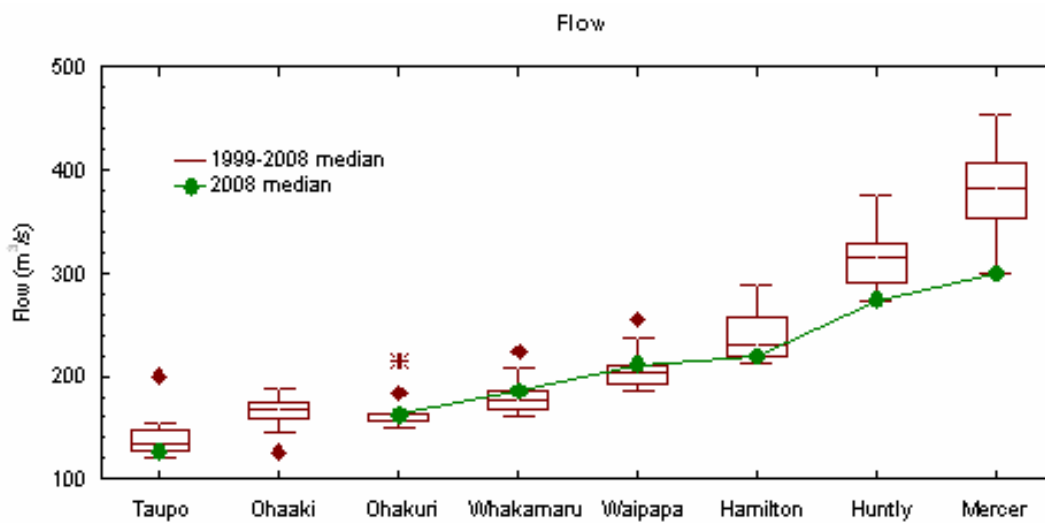
Wilson, B.; Vant, B. and Huser, B. 1998: *Waikato River Water Quality Monitoring Programme Data Report 1997*. Environment Waikato Technical Report No. 98/6. Waikato Regional Council (Environment Waikato), Hamilton

Appendix I: Flow Information

Median Flows of the Waikato River and Main Tributaries

Location	DISTANCE		FLOW RATE [†] (m ³ /s)									10 YEAR	
	km		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Median
Taupo	4.2		148	139	130	141	127	200	121	154	128	127	135
Ohakuri	75.8		157	158	150	164	157	214	152	184	157	163	158
Whakamaru	105.0		174	168	161	183	168	224	175	208	178	186	177
Waipapa	126.1		205	196	186	211	192	256	200	237	190	211	203
Hamilton	211.5		257	241	225	234	213	288	226	273	220	220	230
Huntly	246.5		327	314	299	328	315	376	290	343	282	274	315
Mercer	286.3		400	381	383	408	353	455	355	437	312	299	382
Waiotapu Stm	46.6		3.4	2.8	3.2	2.8	2.6	3.7	3.6	3.8	2.9	3.0	3.1
Waipa River	232.7		55	52	62	73	61	87	56	61	39	43	59

[†]Rating curve errors mean estimates of flow are $\pm 8\%$

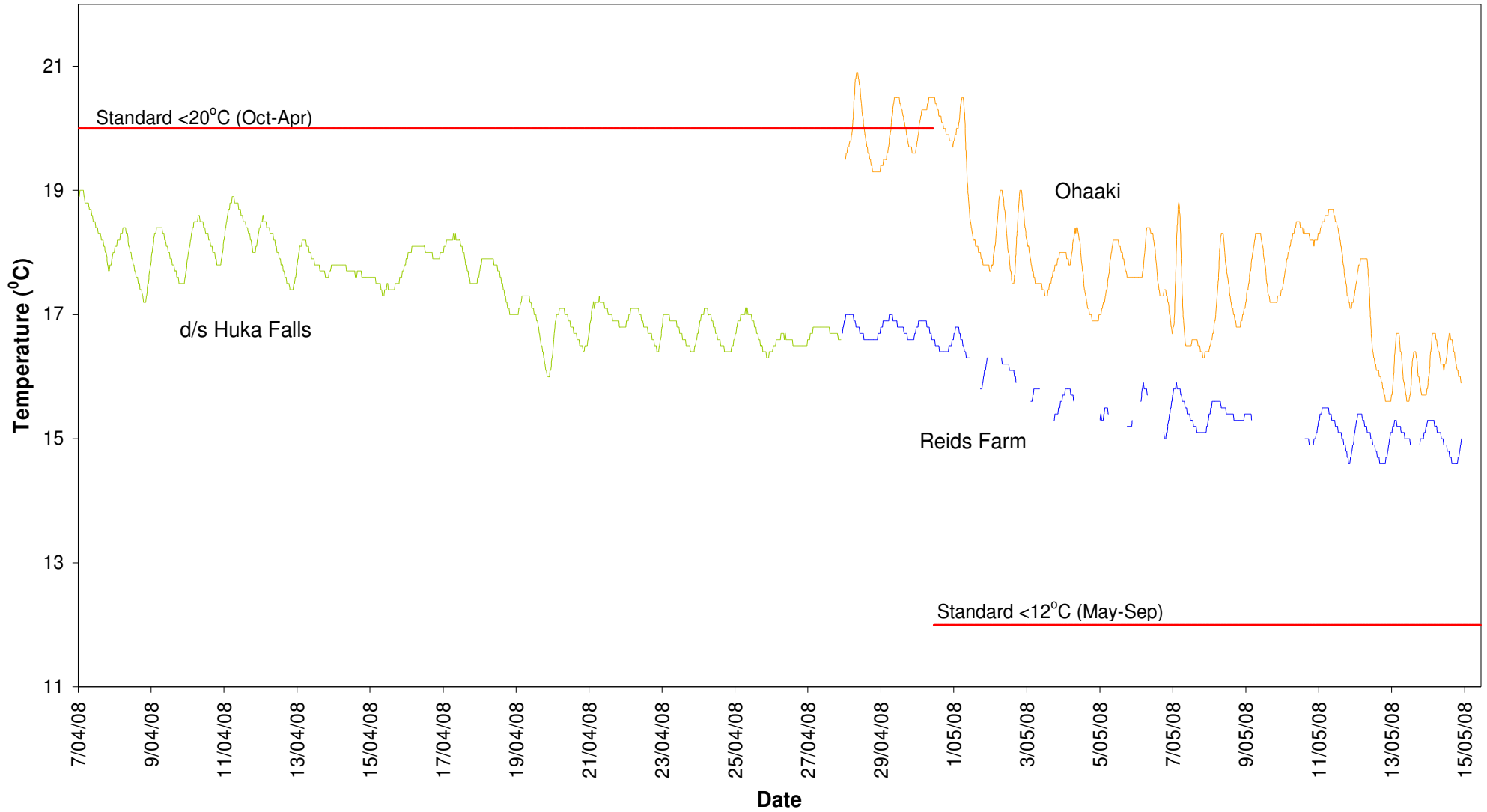


Appendix II

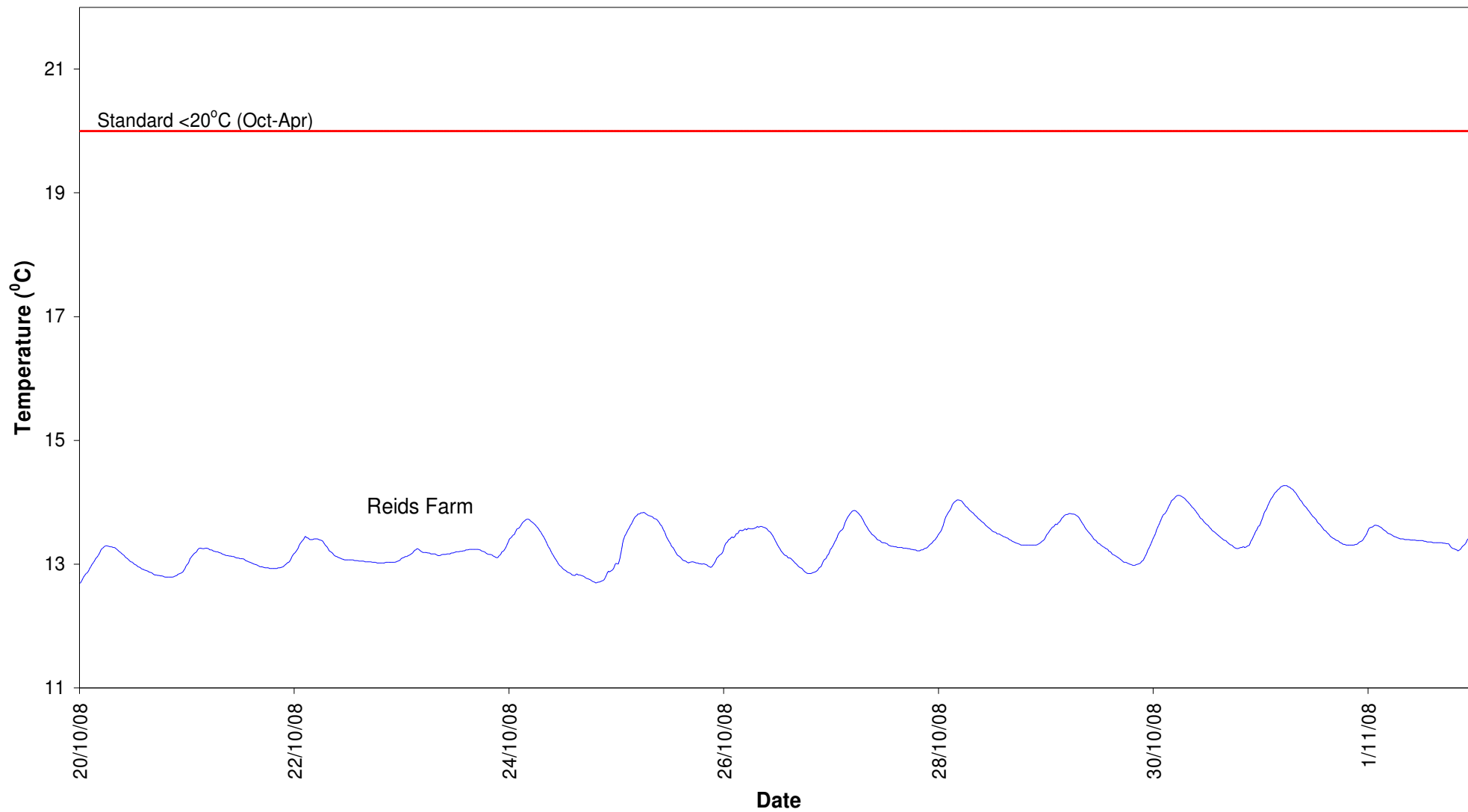
Datasonde Deployments

Diurnal variation of Some Water Quality Parameters

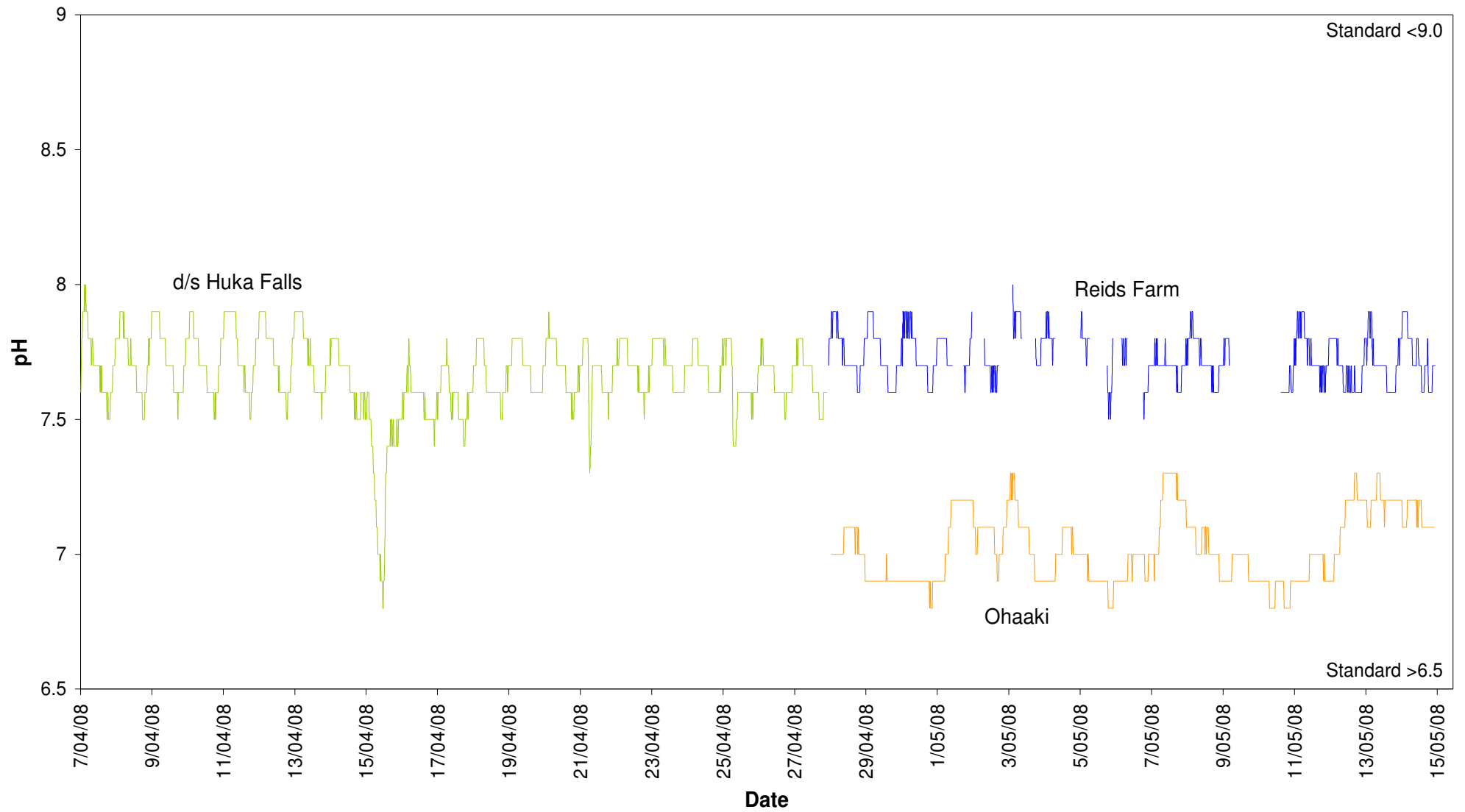
Temperature: Upper Waikato (April - May)



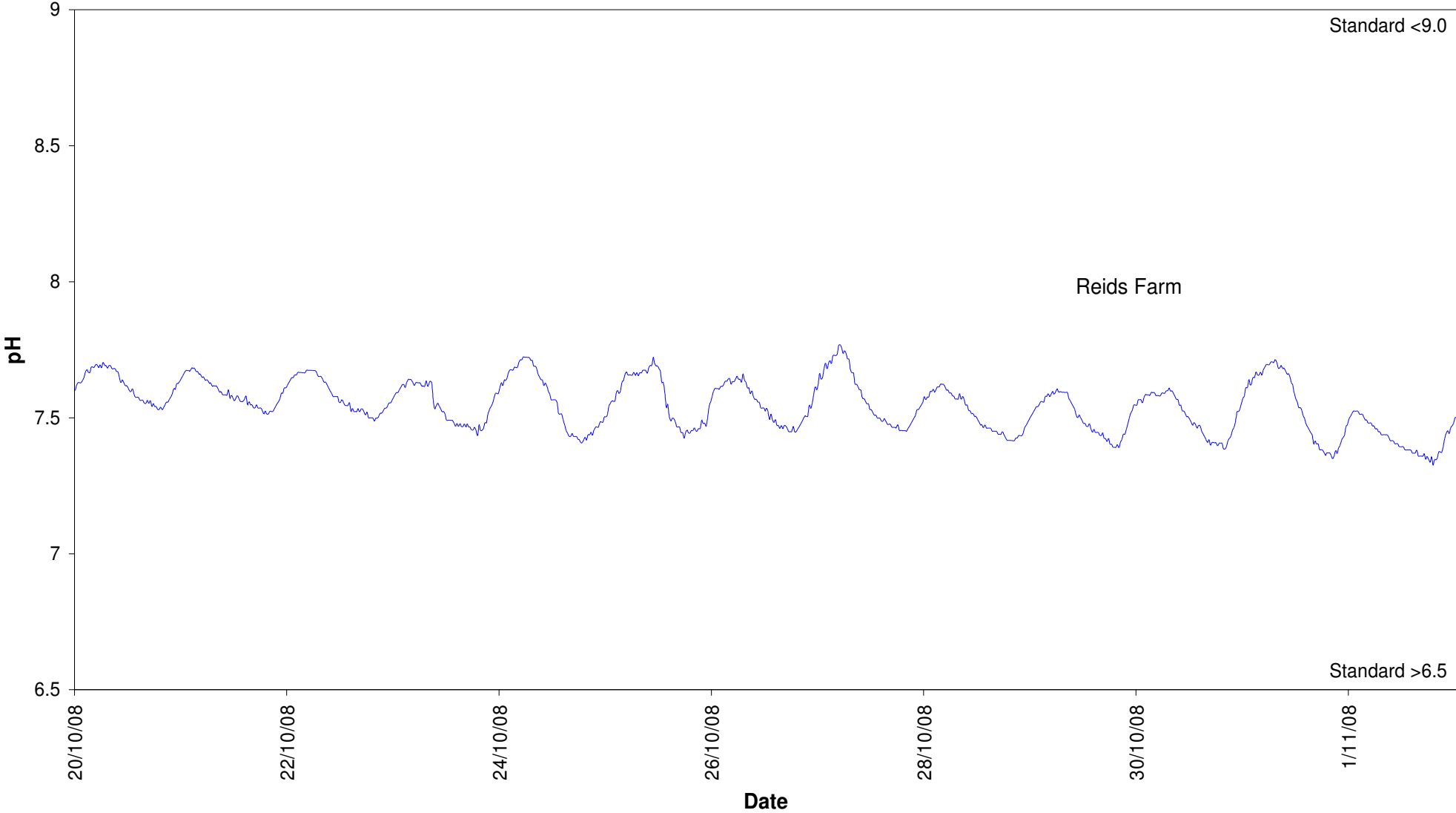
Temperature: Upper Waikato (October)



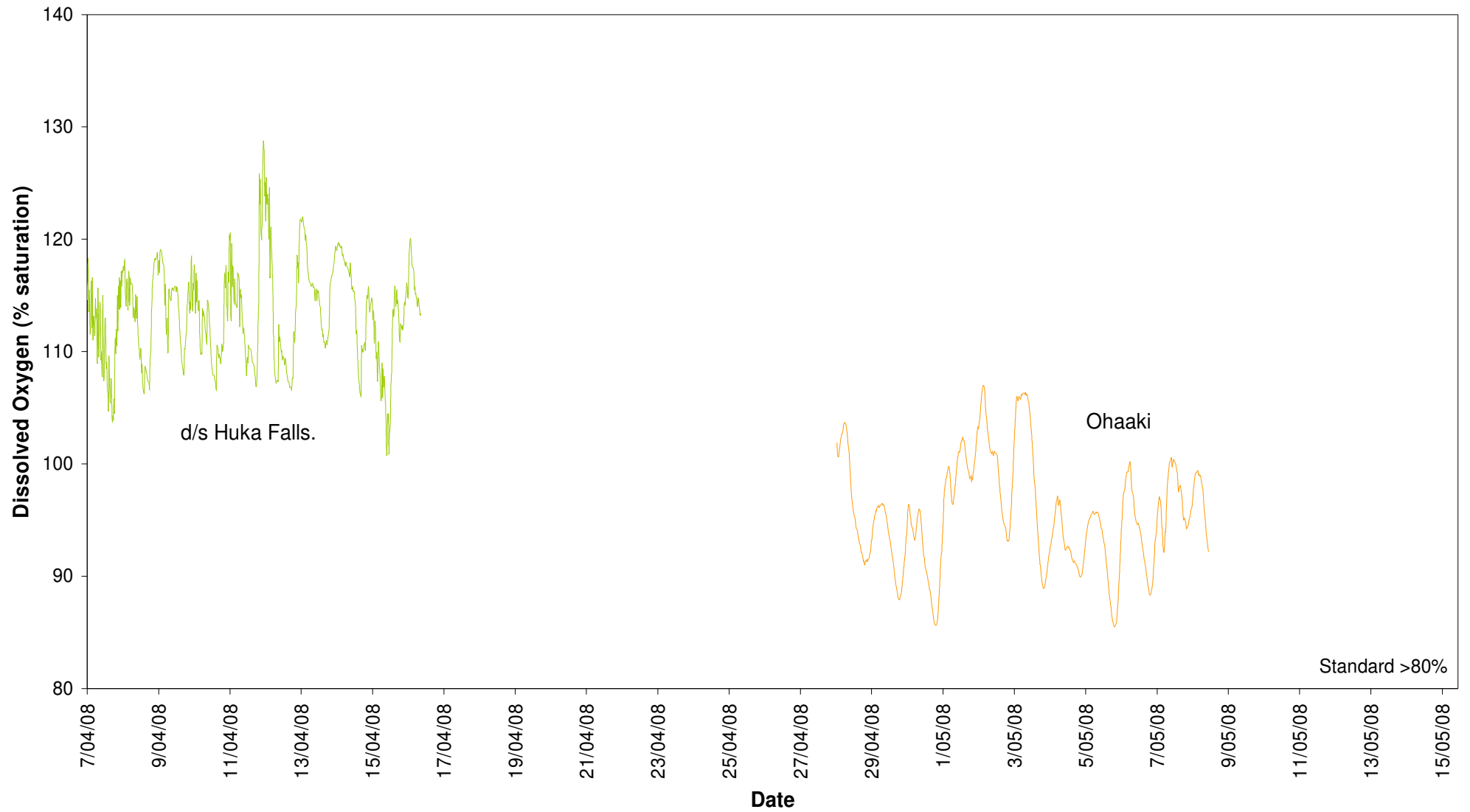
pH: Upper Waikato (April-May)



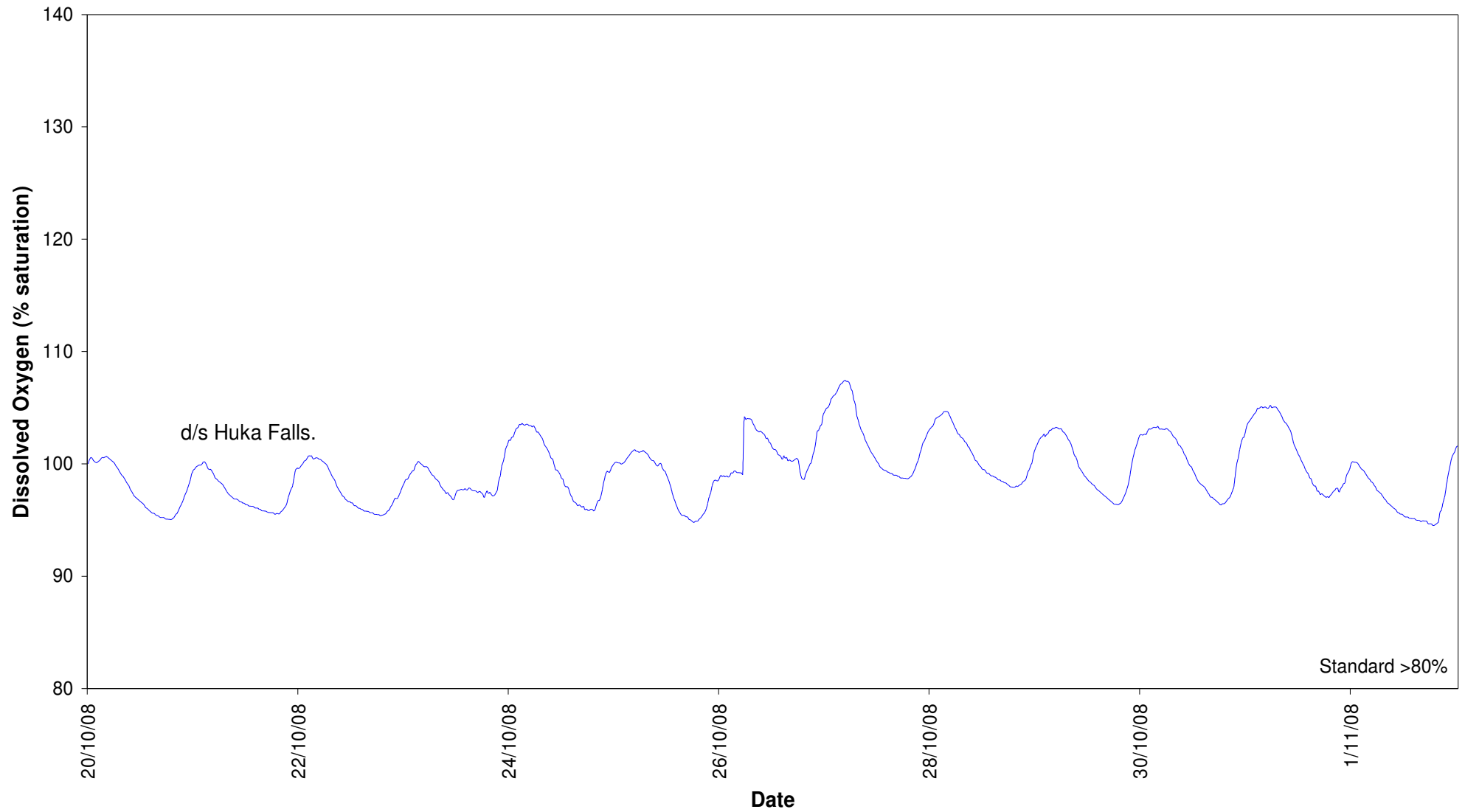
pH: Upper Waikato (October-November)



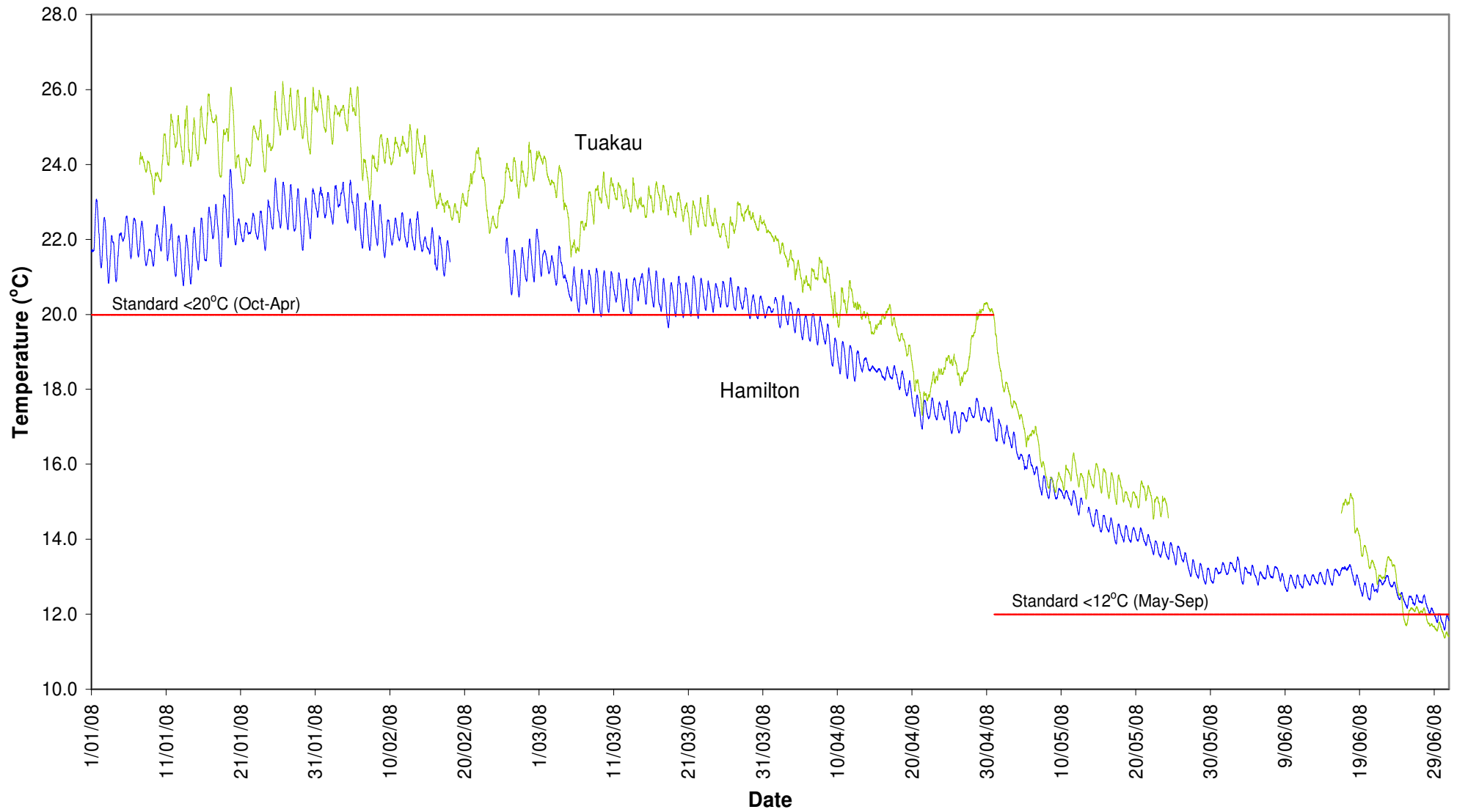
Dissolved Oxygen, % saturation: Upper Waikato (April - May)



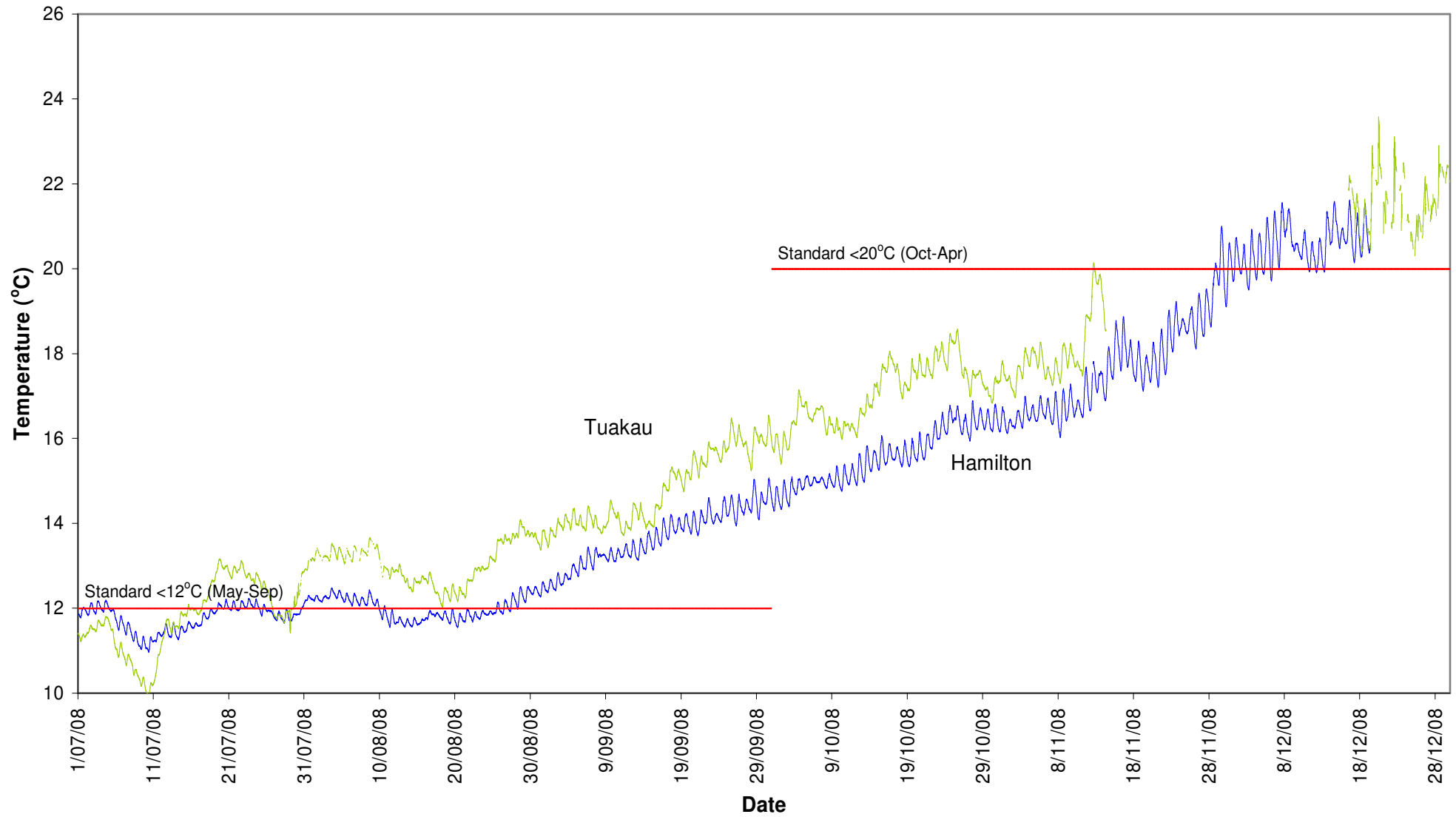
Dissolved Oxygen, % saturation: Upper Waikato (October-November)



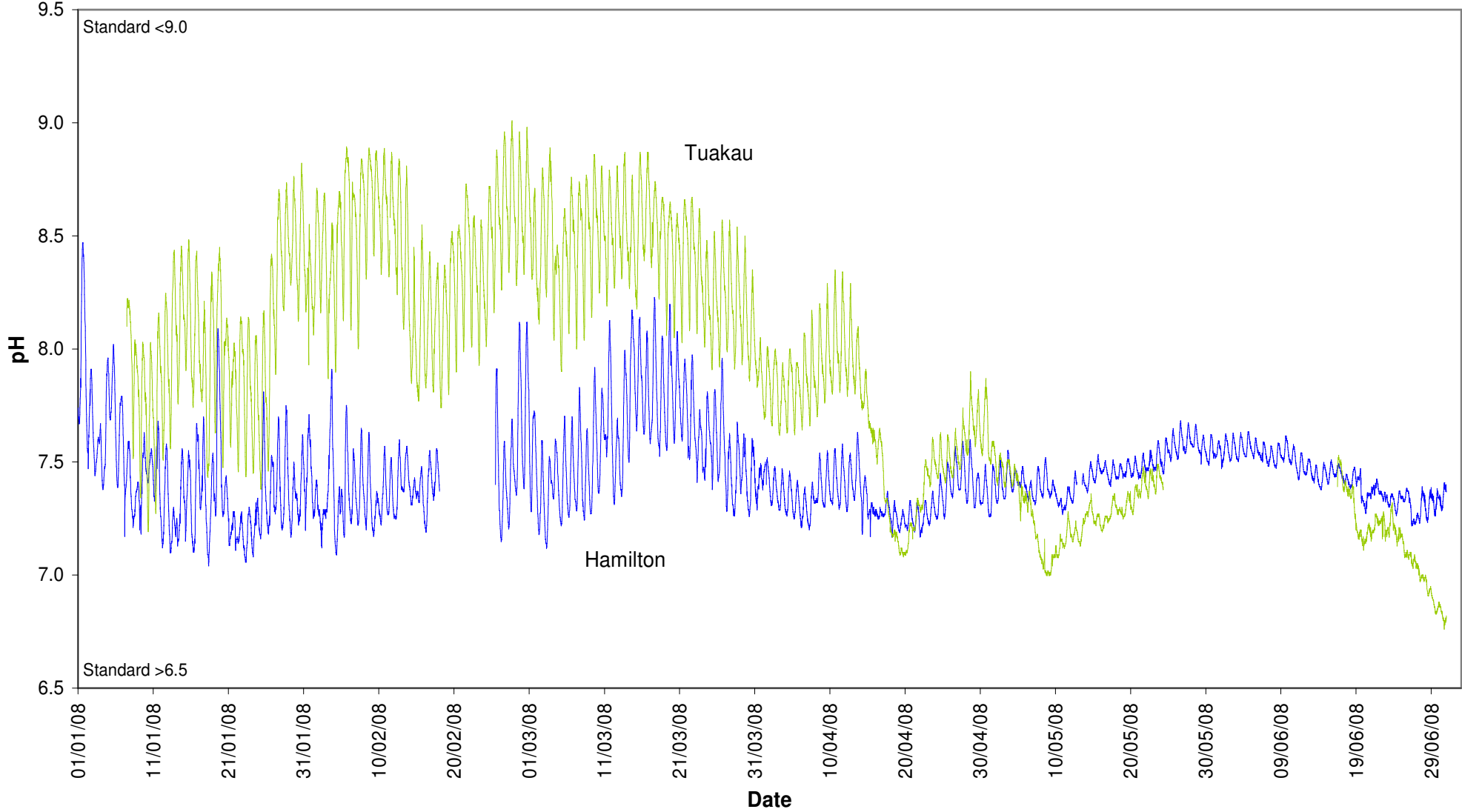
Temperature: Lower Waikato (January-June)



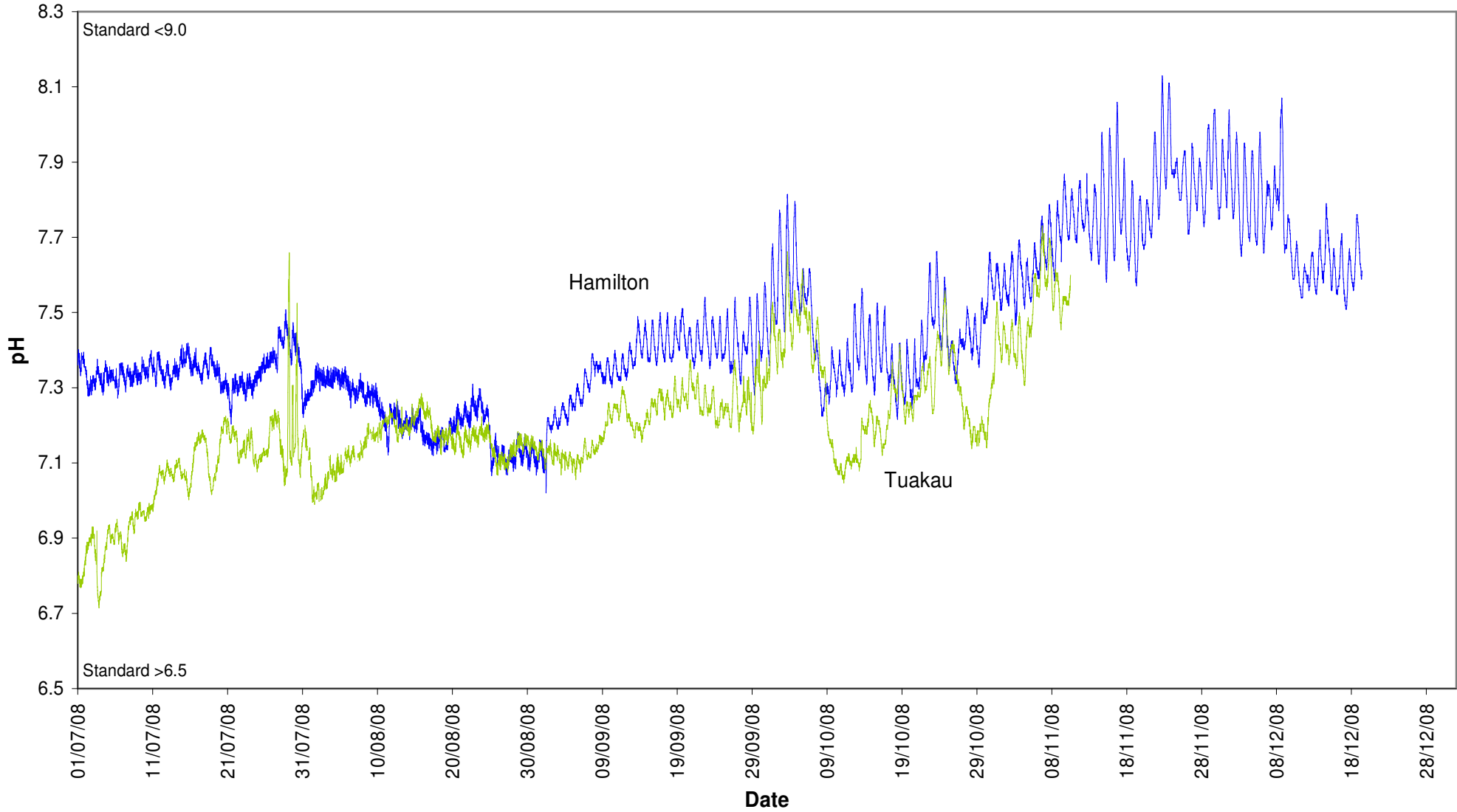
Temperature: Lower Waikato (July-December)



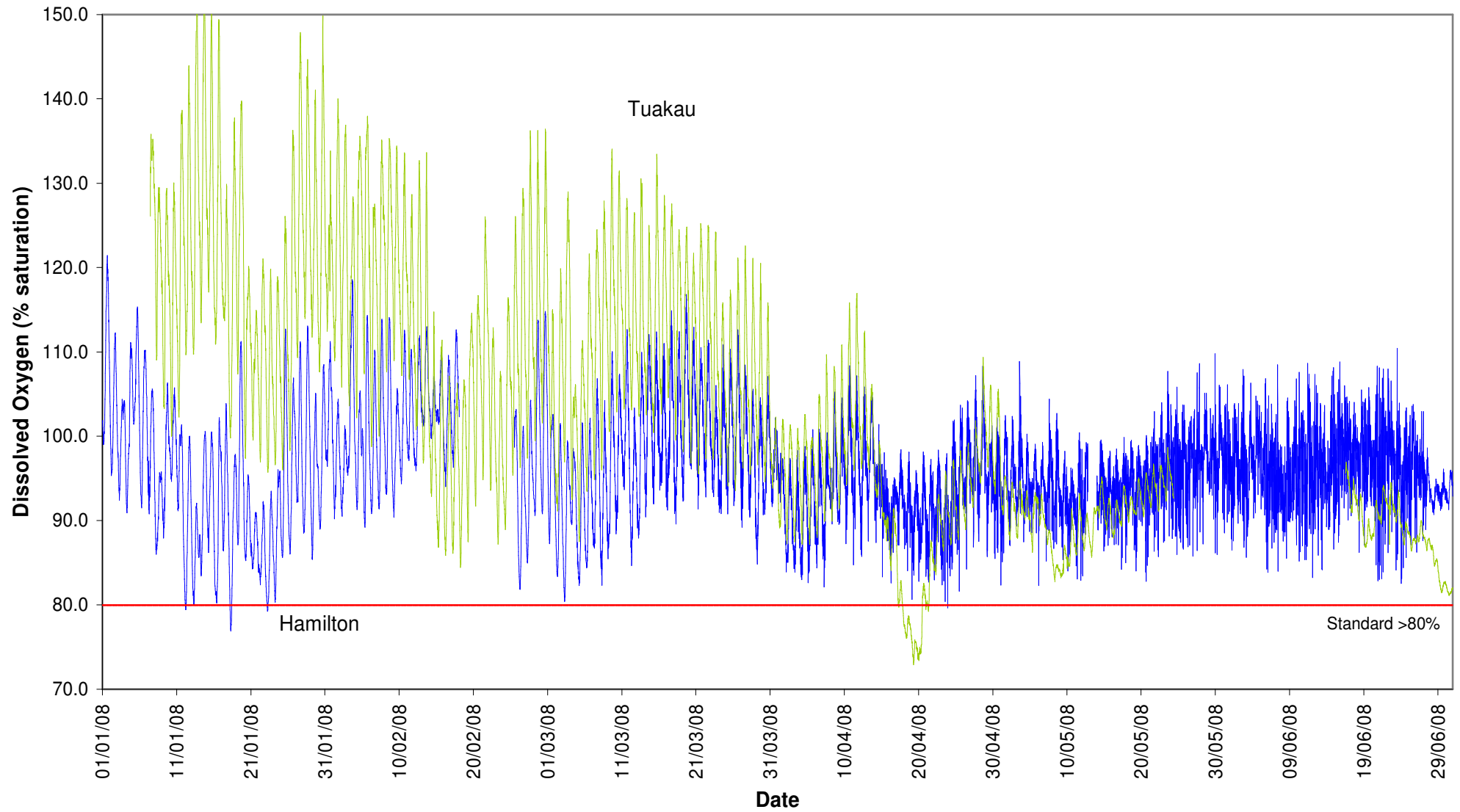
pH: Lower Waikato (July - December)



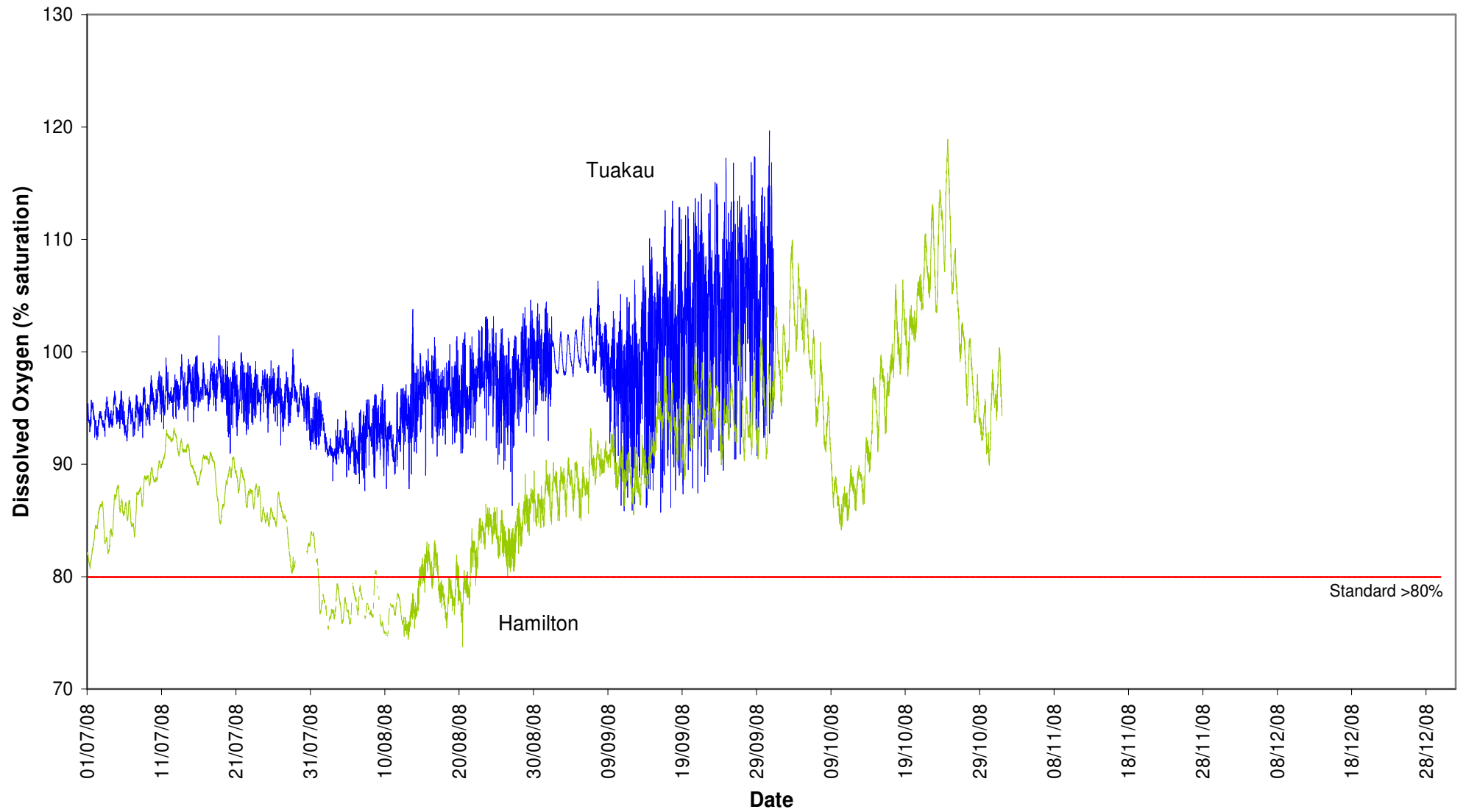
pH: Lower Waikato (July - December)



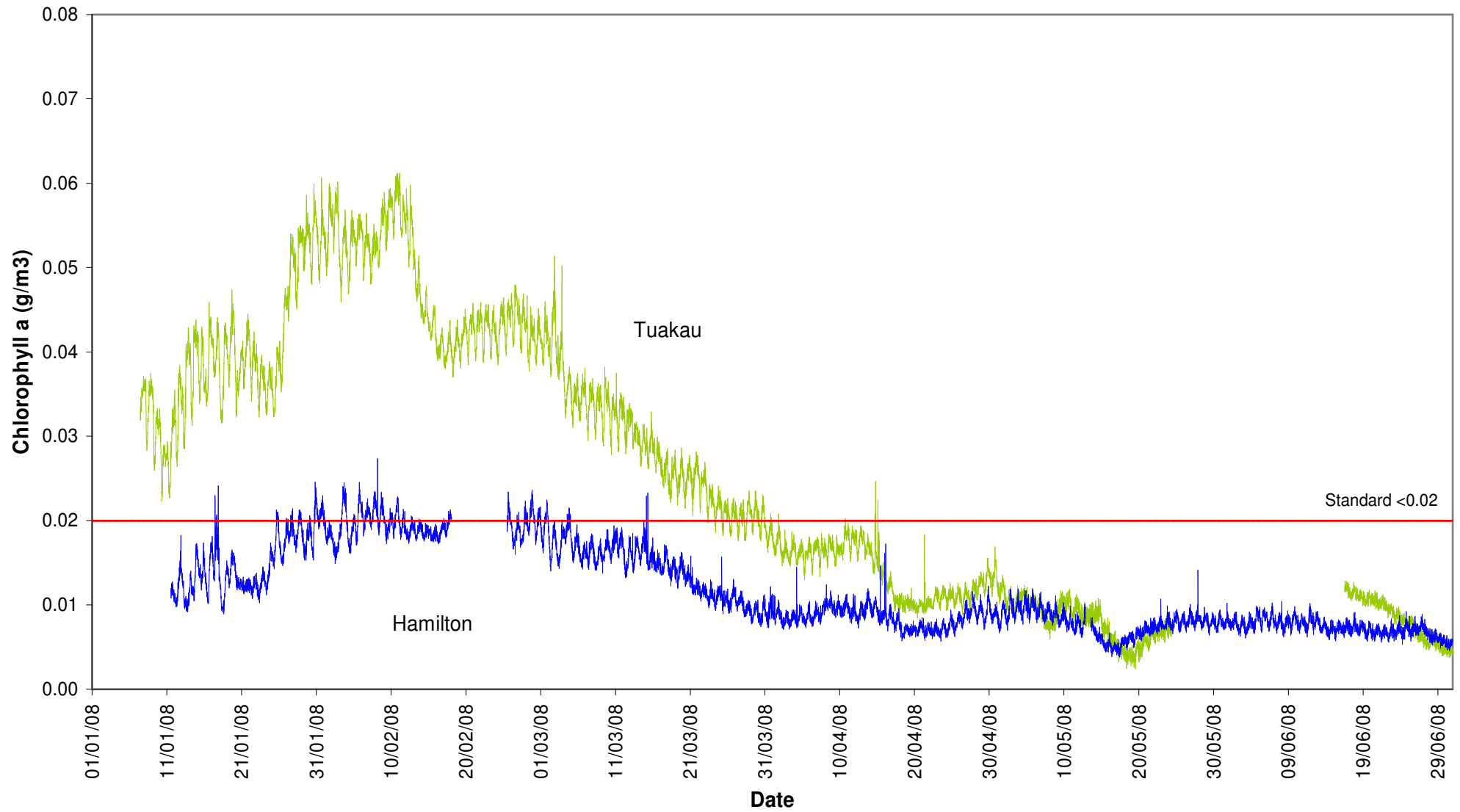
Dissolved Oxygen (% saturation): Lower Waikato (January - June)



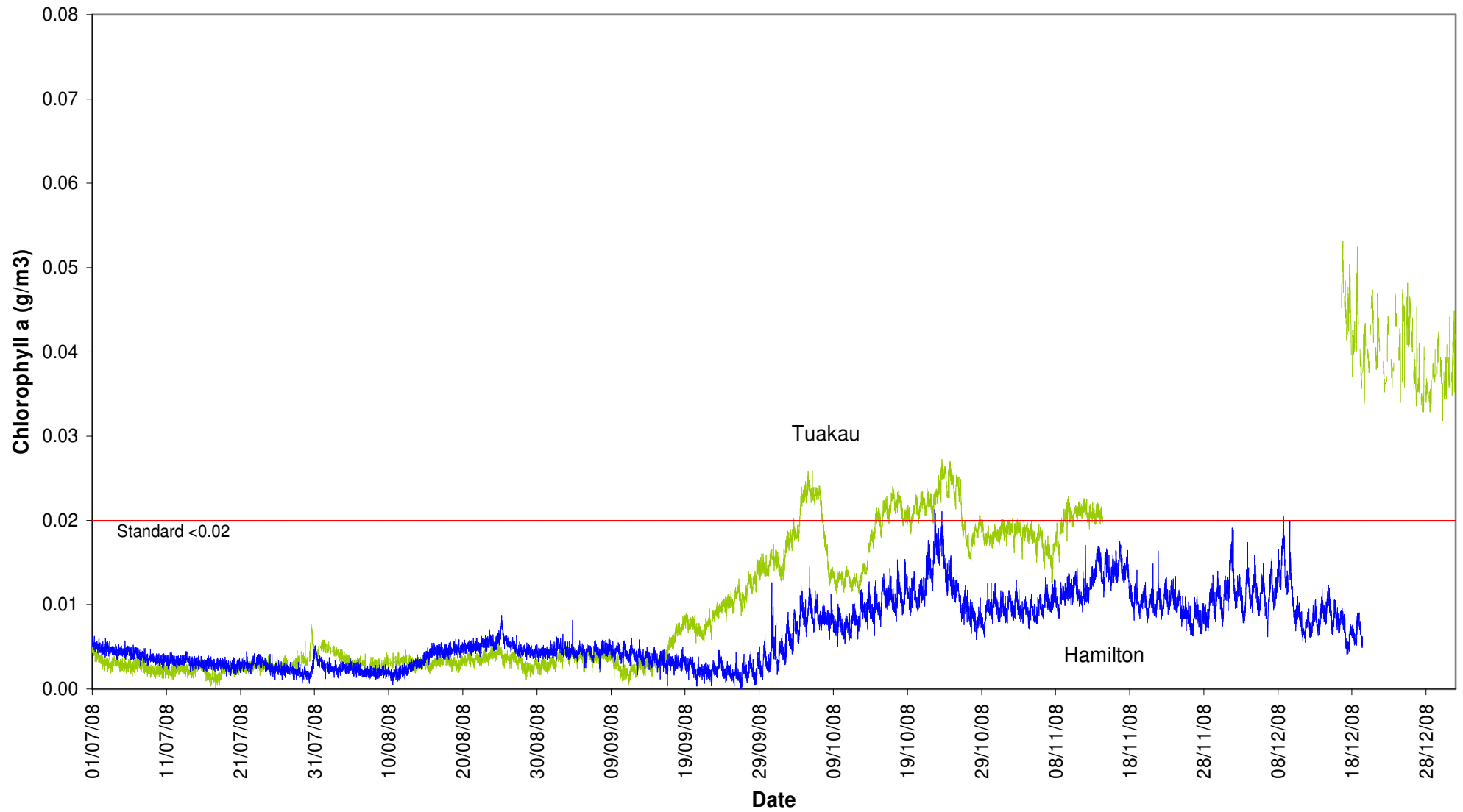
Dissolved Oxygen (% saturation): Lower Waikato (July - December)



Chlorophyll a: Lower Waikato (Jan - June)



Chlorophyll a: Lower Waikato (July - December)



Appendix III:
Water Quality Parameters
Guidelines and Standards
Analytical Methods

Waikato River Water Quality Monitoring Programme Parameters

Water Quality Parameter	Reason For Monitoring	Parameter Monitored ¹	Comments ²
Dissolved Oxygen	- requirement for aquatic life	DO (conc.)	routine (field)
	- indicator of organic pollution	DO (%sat.)	routine (field)
	- indicator of photosynthesis (plant growth)		
Temperature	- indicator of biological activity	Temperature	routine (field)
	- requirement for aquatic life		
	- mixing processes		
	- modelling studies (e.g. nutrient uptake)		
Conductivity	- indicator of total salts dissolved in water	Conductivity	routine
	- indicator for geothermal input	TDS	routine
pH	- aquatic life protection	pH	routine
	- indicator of industrial discharges, mining		
Clarity - turbidity - black disk (visual clarity)	- aesthetic appearance	Turbidity	routine
	- light availability for excessive plant growth	Black disk	routine (field)
	- aquatic life protection		
	- indicator of catchment condition, land use		
Colour - light absorption	- aesthetic appearance	Munsell colour	routine (field)
	- light availability for excessive plant growth	Absorbance at: 340,440,780nm	routine
	- indicator of presence of organic matter		
Nutrients (N and P) Chlorophyll a	- enrichment, excessive plant growth	NO ₃ -N+NO ₂ -N	routine
	- nutrient limitation for plant/algal growth	NH ₄ -N,TKN	
		DRP, TP, Chl a	
Geothermal Contaminants	- indicators of geothermal inflows	Cl, Li, B, As	routine
	- aquatic life protection (ecotoxicity)		
	- drinking water (human health aspects)		
Organic Carbon	- indicator of organic pollution	BOD ₅	routine
	- catchment characteristics	TOC/DOC	routine
Faecal Bacteria - E. coli - enterococci - faecal coliforms	- indicator of pollution with faecal matter	E. Coli	routine
	- disease risk for swimming etc.	ENT	routine
		FC	routine

¹ see the page 54 for the meaning of the abbreviations.

² routine means sampled monthly.

Details of Water Quality Standards and Guidelines for “Satisfactory” Water Quality

Parameter	Critical Value(s)	Source
Dissolved oxygen	>80% of saturation concentration	RMA Third Schedule, Classes AE, F, and FS.
pH	6.5–9	ANZECC (1992) and Canadian guidelines for freshwater aquatic life (1987).
Turbidity	<5 NTU	Studies of adverse effects on underwater light—and thus on plant and invertebrate production—in certain South Island streams (Davies-Colley 1991).
Ammoniacal-nitrogen	<0.88 g/m ³	USEPA (1998) value for 1-hour exposure at pH 9.
Temperature	<12°C (May – Sep) <20°C (Oct – Apr)	Environment Waikato Proposed Regional Plan standards for trout fisheries and trout spawning (1998).
Total phosphorus	<0.04 g/m ³	From upper quartile values for 77 New Zealand rivers in NIWA’s National Water Quality Network (after Smith & Maasdam 1994)—note that the guidelines for “excellent” conditions are the lower quartile concentrations for these rivers.
Total nitrogen	<0.5 g/m ³	From upper quartile values for 77 New Zealand rivers in NIWA’s National Water Quality Network (after Smith & Maasdam 1994)—note that the guidelines for “excellent” conditions are the lower quartile concentrations for these rivers.
Water clarity at baseflow	>1.6 m	“Baseflow” defined as flows less than the upper decile flow. Guideline from Ministry for the Environment (1994).
Escherichia coli	<550/100 mL	Ministry for the Environment (2003) guidelines for the management of recreational and marine shellfish-gathering waters.
Median Escherichia coli	<126/100 mL	Ministry for the Environment (1999) guidelines for the management of recreational and marine shellfish-gathering waters.
Enterococci	<77/100 mL	Department of Health (1992) guidelines for “moderate” level of recreational use.
Chlorophyll <i>a</i>	<0.02 g/m ³	Ministry for the Environment (1992).
Arsenic	<0.01 g/m ³	Ministry of Health (2001).
Boron	<1.4 g/m ³	Ministry of Health (2001).

Waikato River Monitoring Programme - Water Quality Parameters & Analytical Methods

Id ¹	Parameter	Method
A340F	Absorbance @ 340 nm Filtered	Spectrophotometer, 1 cm path length, APHA method 5910B
A440F	Absorbance @ 440 nm Filtered	Spectrophotometer, 1 cm path length, APHA method 5910B
A780F [†]	Absorbance @ 780 nm Filtered	Spectrophotometer, 1 cm path length, APHA method 5910B
As	Arsenic Total	Nitric acid digestion, ICP-MS, APHA method 3125B
B	Boron	ICP-MS, APHA method 3125B
BDISK	Black Disk	Field measurement, horizontal water transparency (20mm, 60mm, 100mm, 200mm disk) in river or trough (20mm only)
BOD ₅	Biochemical Oxygen Demand (5 day)	Incubation 5 days at 20°C, DO-meter, No nitrification inhibitor added, unseeded, APHA method 5210B
CHLA	Chlorophyll a	Acetone extraction. Spectroscopy. APHA method 10200H
CI	Chloride	Filtered sample. Ion Chromatography APHA method 4110B
COLOUR	Colour	Field measurement, Munsell Colour Patches
COND	Conductivity	Lab Meter @ 25°C. APHA method 2510B
DO	Dissolved Oxygen	Field measurement (WTW DO meter, model 340A)
DO (% Sat)	Dissolved Oxygen (percent saturation)	Field measurement (WTW DO meter, model 340A)
DOC	Dissolved Organic Carbon	Filtration, acidification, purging to remove inorganic C, catalytic oxidation, IR detection. APHA method 5310B (modified)
DRP	Dissolved Reactive Phosphorus	Molybdenum Blue Colorimetry. Flow injection analyser. APHA 4500 PG (proposed)
E. coli	Escherichia coli	Membrane Filtration (mFC Agar) confirmation by NA-MUG Agar. APHA method 9222G
ENT	Enterococci bacteria	Membrane Filtration (mE Agar) confirmation by EIA Agar. APHA method 9230C
FC	Faecal Coliforms	Membrane Filtration with resuscitation(mFC Agar). APHA method 9222D
Flow	Flow – Instantaneous	Calculated from rating curve ± 8%
Li	Lithium	ICP-MS, method APHA 3125B
NH ₄ -N	Ammoniacal Nitrogen (Total)	Phenol/Hypochlorite Colorimetry. Flow injection analyser. APHA method 4500-NH ₃ H
NNN	Nitrite/Nitrate Nitrogen	Automated Cadmium reduction. Flow injection analyser. APHA method 4500 – NO ₃ I (proposed).
NO ₃ -N	Nitrate Nitrogen	Calculation: (Nitrate-N + Nitrite -N) – Nitrite - N
pH	pH	Lab Meter @ 25°C. APHA method 4500-H ⁺ B
TDS	Total Dissolved Solids	Filtration, gravimetric. APHA 2540C (modified)
TEMP	Temperature	Field measurement (WTW DO meter, model 340A)
TKN	Total Kjeldahl-Nitrogen	Acid digestion. Phenol/Hypochlorite colorimetry. Flow injection analyser. APHA method 4500-N _{org} D (modified)
TOC	Total Organic Carbon	Acidification, purging to remove inorganic C, catalytic oxidation, IR detection. APHA method 5310B (modified)
TN	Total Nitrogen	Calculated from NNN + TKN (Nitrite/Nitrate Nitrogen + Total Kjeldahl-Nitrogen)
TP	Total Phosphorus	Acid persulphate digestion, Colorimetry. Discrete Analyser. APHA method 4500-PE (modified)
TURB	Turbidity	Turbidity Meter Hach 2100N. APHA method 2130B

¹ Water quality parameter identification code refers to Environment Waikato's water quality database (TimeStudio) parameter short name.

APHA = Standards Methods for the Examination of Water and Wastewater, 20th Edition, 1998, APHA, AWWA, WEF

ICP-MS = Inductively Coupled Plasma – Mass Spectroscopy