

Waikato River Water Quality Monitoring Programme: Data Report 2007

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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.

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1 Introduction

1.1 Background

The year 2007 report follows the format of the previous data report (Beard, 2006).

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 17th 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 2007 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 2007 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 Year 2007.
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 2007 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 2007. 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 2007 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
		(Oct-Apr)	<16
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
1131.101	202.0	Hamilton – Narrows Bridge	S14:168-708	at jetty ⁶
1131.328	202.2	Hamilton – Narrows	S14:168-710	boat ramp ⁷
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 ⁸
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 ⁹
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 jetty at Hamilton Gardens

⁷ boat ramp accessed via Narrows Lane (true right bank)

⁸ road bridge upstream of Waipa River confluence.

⁹ immediately d/s of bridge, at Reserve (true right bank).

^b bathing season intensive microbiological survey locations only – survey conducted over the 2006/2007 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.

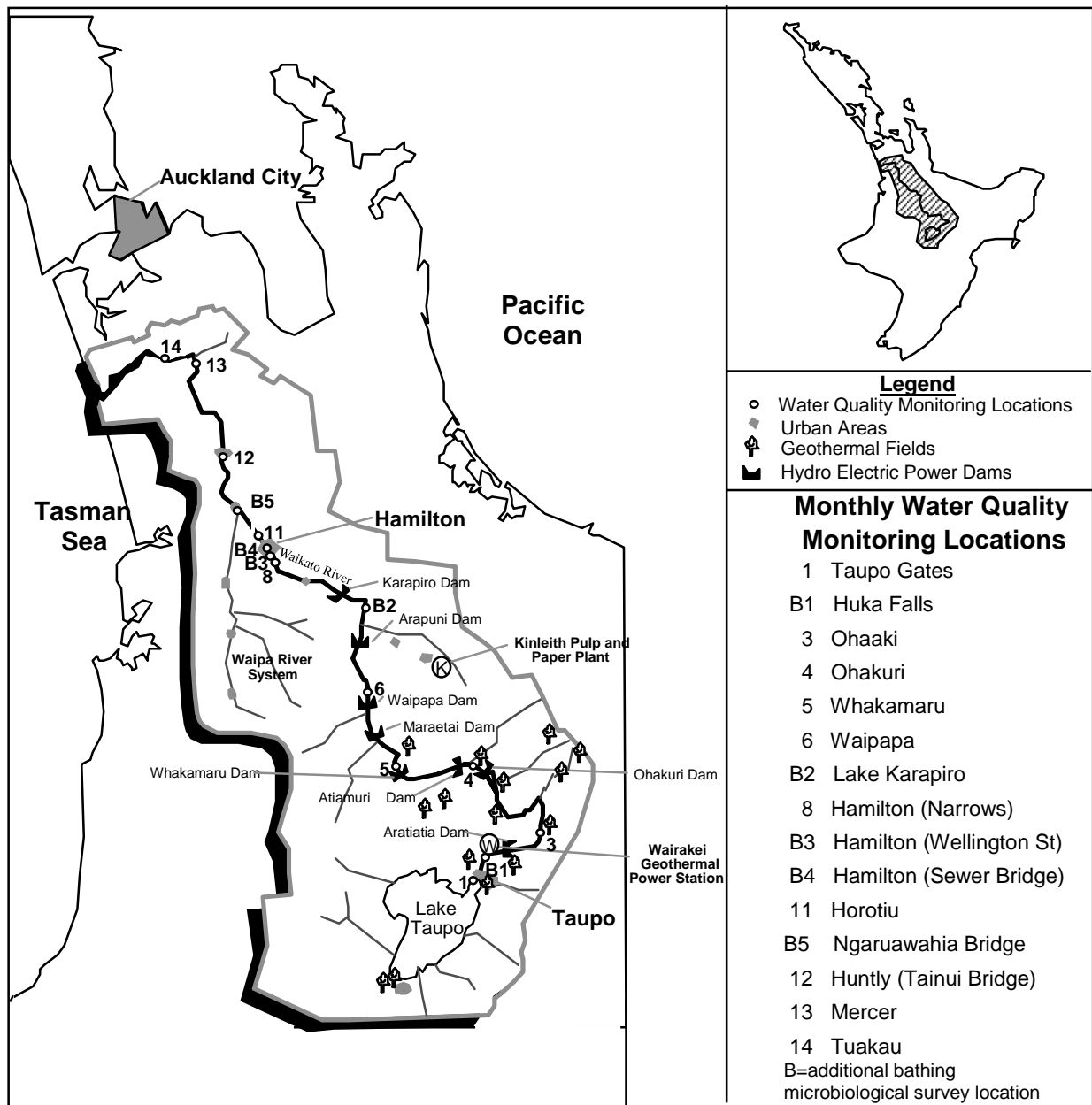


Figure 1: Waikato River Water Quality Monitoring Locations

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).

During 2007 it was necessary, for operational reasons, to relocate the 'Hamilton – Narrows Bridge' site 200m downstream to a newly created 'Hamilton – Narrows' site, with reporting of data from the new site beginning in July. For the purposes of this report, the data from these two sites are presented as one.

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 2004/02 Trends in river water quality in the Waikato Region, 1987-2002 (Vant & Smith, 2004) 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/index.htm>

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

<http://www.ew.govt.nz/enviroinfo/water/healthyivers/waikato/index.htm>

upon completion of the report. The "Healthy Rivers" page provides a link to 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	0.002	0.001	0.001	0.007	0.001	<u>2.14</u>	0.001
Ohaaki Bridge	12	0.003	0.003	0.001	0.007	0.003	0.76	0.003
Ohakuri Tailrace Bridge	12	0.005	0.005	0.002	0.008	0.002	0.20	0.006
Whakamaru Tailrace	12	0.006	0.006	0.004	0.014	0.002	<u>1.92</u>	0.007
Waipapa Tailrace	12	0.010	0.010	0.006	0.014	0.004	0.39	0.010
Narrows	12	0.011	0.011	0.008	0.019	0.004	1.10	0.013
Horotiu Bridge	12	0.012	0.012	0.008	0.021	0.005	1.04	0.013
Huntly-Tainui Bridge	12	0.021	0.019	0.011	0.034	0.008	0.61	0.020
Mercer Bridge	12	0.026	0.023	0.012	0.046	0.013	0.66	0.023
Tuakau Bridge	12	0.028	0.028	0.010	0.051	0.015	0.42	0.027

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	0.002	0.000	<u>3.02</u>	0.001
Waipapa Tailrace	12	0.002	0.001	0.001	0.004	0.001	1.30	0.002
Narrows	12	0.002	0.002	0.001	0.004	0.002	0.86	0.002
Horotiu Bridge	12	0.002	0.001	0.001	0.004	0.002	0.54	0.003
Huntly-Tainui Bridge	12	0.004	0.004	0.002	0.006	0.002	0.16	0.004
Mercer Bridge	12	0.005	0.005	0.002	0.008	0.003	0.21	0.005
Tuakau Bridge	12	0.005	0.006	0.001	0.010	0.003	0.22	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	-0.08	0.011
Ohaaki Bridge	12	0.031	0.028	0.020	0.047	0.013	0.63	0.028
Ohakuri Tailrace Bridge	12	0.035	0.036	0.025	0.046	0.007	0.13	0.035
Whakamaru Tailrace	12	0.033	0.034	0.025	0.040	0.007	-0.43	0.033
Waipapa Tailrace	12	0.029	0.030	0.023	0.036	0.008	-0.19	0.029
Narrows	12	0.025	0.025	0.018	0.030	0.007	-0.47	0.025
Horotiu Bridge	12	0.025	0.025	0.017	0.030	0.006	-0.49	0.024
Huntly-Tainui Bridge	12	0.018	0.020	0.008	0.023	0.007	-0.87	0.018
Mercer Bridge	12	0.017	0.018	0.009	0.023	0.005	-0.78	0.017
Tuakau Bridge	12	0.017	0.017	0.009	0.026	0.007	0.02	0.016

Boron (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.17	0.17	0.15	0.20	0.01	0.69	0.16
Ohaaki Bridge	12	0.33	0.29	0.22	0.48	0.16	0.64	0.29
Ohakuri Tailrace Bridge	12	0.34	0.34	0.26	0.46	0.06	0.69	0.33
Whakamaru Tailrace	12	0.33	0.33	0.27	0.38	0.05	-0.11	0.32
Waipapa Tailrace	12	0.28	0.28	0.23	0.38	0.04	1.17	0.29
Narrows	12	0.26	0.26	0.21	0.33	0.04	0.39	0.25
Horotiu Bridge	12	0.26	0.26	0.20	0.34	0.04	0.52	0.26
Huntly-Tainui Bridge	12	0.20	0.22	0.11	0.25	0.07	-0.68	0.20
Mercer Bridge	12	0.20	0.21	0.12	0.26	0.06	-0.63	0.21
Tuakau Bridge	12	0.20	0.21	0.12	0.26	0.07	-0.46	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	5.3	5.1	1.9	8.1	2.6	-0.08	5.3
Ohakuri Tailrace Bridge	12	2.7	2.7	1.3	5.2	0.8	1.02	2.8
Whakamaru Tailrace	12	2.1	1.8	0.9	3.5	0.9	0.43	2.3
Waipapa Tailrace	12	2.0	2.0	1.2	3.1	0.4	0.47	2.0
Narrows	12	1.4	1.2	0.7	2.3	0.7	0.67	1.5
Horotiu Bridge	12	1.2	1.1	0.4	2.0	0.7	0.23	1.2
Huntly-Tainui Bridge	12	0.7	0.5	0.2	1.6	0.5	1.14	0.8
Mercer Bridge	-	-	-	-	-	-	-	-
Tuakau Bridge	12	0.5	0.4	0.2	1.1	0.3	0.87	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	0.5	1.05	0.4
Ohaaki Bridge	12	0.3	0.2	0.2	1.0	0.2	1.60	0.3
Ohakuri Tailrace Bridge	12	0.5	0.5	0.2	1.2	0.6	0.56	0.6
Whakamaru Tailrace	12	0.7	0.8	0.2	1.4	0.7	-0.02	0.7
Waipapa Tailrace	12	0.5	0.5	0.2	1.0	0.5	0.04	0.6
Narrows	12	0.8	0.9	0.5	1.3	0.5	0.29	0.9
Horotiu Bridge	12	0.8	0.7	0.4	1.6	0.7	0.73	0.9
Huntly-Tainui Bridge	12	1.0	1.0	0.4	1.8	0.7	0.30	0.9
Mercer Bridge	12	1.3	1.2	0.7	2.3	0.7	0.64	1.1
Tuakau Bridge	12	1.3	1.2	0.6	2.1	0.6	0.63	1.2

Carbon - Dissolved Organic (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.81	0.80	0.15	1.30	0.33	-0.68	0.78
Ohaaki Bridge	12	0.99	0.90	0.52	1.50	0.20	0.38	0.70
Ohakuri Tailrace Bridge	12	1.03	1.00	0.58	1.70	0.35	0.46	0.80
Whakamaru Tailrace	12	1.16	1.15	0.77	1.50	0.25	-0.08	0.90
Waipapa Tailrace	12	1.41	1.45	1.00	1.70	0.25	-0.49	1.00
Narrows	12	1.38	1.30	0.70	1.80	0.55	-0.28	1.15
Horotiu Bridge	12	1.61	1.65	1.30	2.00	0.40	0.10	1.20
Huntly-Tainui Bridge	12	2.01	1.95	1.40	2.80	0.70	0.29	1.30
Mercer Bridge	12	2.36	2.20	1.40	3.50	0.90	0.47	1.70
Tuakau Bridge	12	2.56	2.45	1.20	3.80	1.20	0.06	1.75

Carbon - Total Organic (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	1.06	1.05	0.70	1.40	0.37	0.01	1.00
Ohaaki Bridge	12	1.30	1.20	0.90	1.80	0.50	0.46	1.05
Ohakuri Tailrace Bridge	12	1.29	1.30	0.90	1.50	0.20	-0.93	1.20
Whakamaru Tailrace	12	1.55	1.50	1.10	2.10	0.30	0.42	1.40
Waipapa Tailrace	12	1.71	1.60	1.50	2.00	0.20	0.71	1.60
Narrows	12	2.04	1.95	1.40	2.70	0.60	0.23	1.80
Horotiu Bridge	12	2.26	2.10	1.60	2.90	0.65	0.01	2.00
Huntly-Tainui Bridge	12	2.98	2.80	1.60	4.20	1.25	0.13	2.40
Mercer Bridge	12	3.75	3.65	1.80	5.40	1.15	-0.06	2.80
Tuakau Bridge	12	3.90	3.75	1.90	5.80	1.30	0.21	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	-1.21	9
Ohaaki Bridge	12	19	17	13	30	8	0.71	17
Ohakuri Tailrace Bridge	12	21	21	17	27	5	0.51	21
Whakamaru Tailrace	12	21	21	18	25	4	0.46	21
Waipapa Tailrace	12	20	20	16	25	4	0.32	20
Narrows	12	18	18	16	22	3	0.47	18
Horotiu Bridge	12	18	18	16	22	3	0.43	18
Huntly-Tainui Bridge	12	17	17	14	20	4	0.06	17
Mercer Bridge	12	17	17	14	21	3	0.17	17
Tuakau Bridge	12	18	17	14	21	3	0.06	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	0.005	0.004	0.002	0.009	0.005	0.45	0.004
Whakamaru Tailrace	12	0.008	0.007	0.002	0.017	0.009	0.39	0.007
Waipapa Tailrace	12	0.006	0.005	0.002	0.014	0.004	0.91	0.006
Narrows	12	0.012	0.010	0.003	0.025	0.008	0.83	0.011
Horotiu Bridge	12	0.012	0.010	0.003	0.026	0.010	0.64	0.011
Huntly-Tainui Bridge	12	0.011	0.010	0.002	0.022	0.007	0.25	0.009
Mercer Bridge	12	0.018	0.017	0.003	0.031	0.020	0.01	0.015
Tuakau Bridge	12	0.019	0.021	0.003	0.029	0.014	-0.42	0.017

Colour (Munsell Colour Units)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	-	-	-	-	-	-	-	-
Ohaaki Bridge	11	47.7	47.5	42.5	57.5	5.0	0.88	47.5
Ohakuri Tailrace Bridge	11	40.2	40.0	32.5	45.0	4.4	-0.89	40.0
Whakamaru Tailrace	11	35.9	35.0	30.0	42.5	6.3	0.27	37.5
Waipapa Tailrace	11	34.3	35.0	30.0	40.0	2.5	0.56	35.0
Narrows	12	32.9	33.8	27.5	37.5	5.0	-0.31	35.0
Horotiu Bridge	12	32.9	32.5	27.5	37.5	5.0	-0.10	32.5
Huntly-Tainui Bridge	12	30.6	30.0	25.0	37.5	5.0	0.33	30.0
Mercer Bridge	-	-	-	-	-	-	-	-
Tuakau Bridge	12	28.8	28.8	25.0	32.5	2.5	0.00	30.0

Conductivity at 25 °C (ms m ⁻¹)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	11.9	12.0	11.7	12.0	0.1	-1.30	12.0
Ohaaki Bridge	12	16.2	15.4	14.0	20.5	3.3	0.79	15.2
Ohakuri Tailrace Bridge	12	17.4	17.2	15.5	20.0	2.1	0.52	17.1
Whakamaru Tailrace	12	17.0	16.9	15.7	18.8	1.8	0.46	16.9
Waipapa Tailrace	12	16.6	16.6	14.4	18.9	2.4	0.11	16.4
Narrows	12	15.9	16.0	14.0	17.8	1.3	0.09	15.7
Horotiu Bridge	12	16.1	16.0	14.2	17.9	1.3	0.26	15.9
Huntly-Tainui Bridge	12	15.1	15.2	12.6	17.1	1.9	-0.28	14.8
Mercer Bridge	12	15.5	15.2	14.0	17.4	1.5	0.31	15.3
Tuakau Bridge	12	15.5	15.4	13.0	17.4	1.5	-0.34	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	9.8	9.8	9.0	10.7	1.2	0.03	9.9
Ohaaki Bridge	12	9.8	9.7	8.4	11.7	1.2	0.68	9.9
Ohakuri Tailrace Bridge	12	9.7	9.7	8.4	11.7	1.1	0.76	9.8
Whakamaru Tailrace	12	10.1	9.9	8.8	12.5	1.0	1.12	9.9
Waipapa Tailrace	12	9.9	10.0	8.6	12.1	1.4	0.67	9.9
Narrows	12	9.5	9.7	8.3	10.8	0.9	-0.16	9.8
Horotiu Bridge	12	9.4	9.5	8.4	10.8	1.0	0.22	9.8
Huntly-Tainui Bridge	12	9.3	9.2	8.6	10.3	0.9	0.56	9.4
Mercer Bridge	12	9.0	8.7	7.8	10.5	0.9	0.51	9.5
Tuakau Bridge	12	9.2	9.1	8.1	11.2	1.4	0.69	9.6

Dissolved Oxygen (% Saturation)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	100.8	99.3	95.1	111.1	7.8	0.82	101.3
Ohaaki Bridge	12	102.6	100.0	94.9	112.0	13.4	0.27	102.6
Ohakuri Tailrace Bridge	12	102.1	100.3	89.8	115.0	12.5	0.04	103.3
Whakamaru Tailrace	12	105.9	108.3	94.5	120.0	17.8	0.01	104.6
Waipapa Tailrace	12	102.4	101.2	93.5	113.6	11.0	0.20	100.7
Narrows	12	96.4	95.1	88.2	108.0	7.6	0.61	99.5
Horotiu Bridge	12	96.5	96.5	87.9	106.3	6.6	0.37	98.5
Huntly-Tainui Bridge	12	95.3	95.4	85.0	112.3	12.1	0.53	97.1
Mercer Bridge	12	93.6	93.1	80.5	112.0	11.3	0.42	96.1
Tuakau Bridge	12	96.7	95.5	78.3	125.4	18.2	0.60	97.7

Enterococci (n/100 mL)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	2	1	1	7	2	1.47	1
Ohaaki Bridge	12	26	7	1	200	18	<u>2.80</u>	8
Ohakuri Tailrace Bridge	12	1	1	1	3	2	1.03	1
Whakamaru Tailrace	12	10	8	1	31	15	0.94	5
Waipapa Tailrace	12	6	7	1	12	4	-0.13	6
Narrows	12	39	21	1	150	49	1.33	23
Horotiu Bridge	12	95	90	4	250	106	0.63	44
Huntly-Tainui Bridge	12	87	65	5	220	111	0.68	38
Mercer Bridge	12	111	24	1	430	180	1.13	17
Tuakau Bridge	12	128	42	1	500	167	1.33	22

Escherichia coli (n/100 mL)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	2	1	1	10	2	<u>2.56</u>	1
Ohaaki Bridge	12	24	11	5	90	25	1.64	12
Ohakuri Tailrace Bridge	12	3	1	1	15	2	<u>2.08</u>	3
Whakamaru Tailrace	12	6	4	1	24	4	<u>1.88</u>	5
Waipapa Tailrace	12	10	11	3	19	10	0.03	8
Narrows	12	80	45	12	360	58	<u>2.27</u>	33
Horotiu Bridge	12	173	155	30	460	145	0.96	91
Huntly-Tainui Bridge	12	435	235	34	1900	490	<u>1.86</u>	160
Mercer Bridge	12	388	180	12	1300	655	0.91	100
Tuakau Bridge	12	351	195	21	1200	360	1.32	60

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	2	2	1	10	2	<u>2.48</u>	1
Ohaaki Bridge	12	27	15	10	90	28	1.51	18
Ohakuri Tailrace Bridge	12	4	3	1	19	4	<u>2.10</u>	4
Whakamaru Tailrace	12	8	5	1	35	3	<u>2.22</u>	6
Waipapa Tailrace	12	12	12	6	19	8	0.22	9
Narrows	12	92	62	12	360	56	<u>1.77</u>	44
Horotiu Bridge	12	251	260	40	460	200	-0.06	135
Huntly-Tainui Bridge	12	543	380	50	2300	610	<u>1.80</u>	195
Mercer Bridge	12	467	235	12	1400	645	0.82	130
Tuakau Bridge	12	439	280	25	1600	465	1.34	92

Lithium (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.040	0.040	0.036	0.046	0.004	0.33	0.039
Ohaaki Bridge	12	0.105	0.095	0.065	0.169	0.053	0.62	0.092
Ohakuri Tailrace Bridge	12	0.122	0.119	0.094	0.166	0.034	0.58	0.121
Whakamaru Tailrace	12	0.122	0.121	0.100	0.147	0.024	0.36	0.118
Waipapa Tailrace	12	0.105	0.101	0.084	0.147	0.023	0.95	0.101
Narrows	12	0.094	0.093	0.070	0.130	0.018	0.73	0.089
Horotiu Bridge	12	0.095	0.093	0.070	0.128	0.014	0.78	0.088
Huntly-Tainui Bridge	12	0.070	0.073	0.036	0.094	0.031	-0.42	0.067
Mercer Bridge	12	0.068	0.069	0.039	0.094	0.026	-0.30	0.066
Tuakau Bridge	12	0.067	0.070	0.038	0.092	0.025	-0.28	0.065

Nitrate/Nitrite Nitrogen (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.002	0.001	0.001	0.005	0.001	<u>2.04</u>	0.001
Ohaaki Bridge	12	0.033	0.030	0.017	0.066	0.026	0.66	0.032
Ohakuri Tailrace Bridge	12	0.058	0.051	0.004	0.162	0.084	0.67	0.069
Whakamaru Tailrace	12	0.079	0.040	0.001	0.231	0.142	0.60	0.086
Waipapa Tailrace	12	0.143	0.145	0.062	0.245	0.129	0.18	0.148
Narrows	12	0.214	0.193	0.066	0.425	0.157	0.50	0.197
Horotiu Bridge	12	0.232	0.213	0.082	0.473	0.170	0.58	0.224
Huntly-Tainui Bridge	12	0.423	0.365	0.170	1.000	0.264	1.21	0.356
Mercer Bridge	12	0.410	0.331	0.090	1.130	0.225	1.28	0.362
Tuakau Bridge	12	0.405	0.352	0.064	1.110	0.250	1.17	0.324

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	1.00	0.005
Ohaaki Bridge	12	0.01	0.01	0.01	0.03	0.01	<u>2.44</u>	0.005
Ohakuri Tailrace Bridge	12	0.01	0.01	0.01	0.03	0.01	<u>2.37</u>	0.005
Whakamaru Tailrace	12	0.01	0.01	0.01	0.04	0.00	<u>2.30</u>	0.005
Waipapa Tailrace	12	0.02	0.02	0.01	0.04	0.02	0.59	0.010
Narrows	12	0.02	0.02	0.01	0.04	0.01	0.72	0.020
Horotiu Bridge	12	0.02	0.01	0.01	0.07	0.02	<u>1.94</u>	0.010
Huntly-Tainui Bridge	12	0.03	0.02	0.01	0.13	0.03	<u>2.37</u>	0.010
Mercer Bridge	12	0.01	0.01	0.01	0.04	0.00	<u>3.02</u>	0.005
Tuakau Bridge	12	0.01	0.01	0.01	0.03	0.00	<u>2.53</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	0.10	0.09	0.07	0.17	0.04	1.22	0.08
Ohaaki Bridge	12	0.11	0.11	0.08	0.15	0.02	0.82	0.10
Ohakuri Tailrace Bridge	12	0.13	0.13	0.09	0.20	0.04	0.79	0.13
Whakamaru Tailrace	12	0.19	0.19	0.12	0.24	0.07	-0.10	0.16
Waipapa Tailrace	12	0.15	0.16	0.03	0.22	0.03	-1.63	0.16
Narrows	12	0.23	0.23	0.19	0.26	0.05	-0.12	0.22
Horotiu Bridge	12	0.24	0.23	0.20	0.31	0.06	0.57	0.23
Huntly-Tainui Bridge	12	0.34	0.34	0.23	0.49	0.13	0.49	0.28
Mercer Bridge	12	0.39	0.38	0.25	0.61	0.10	1.06	0.34
Tuakau Bridge	12	0.39	0.37	0.29	0.55	0.12	0.82	0.35

Nitrogen - Total (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.10	0.09	0.07	0.17	0.03	1.27	0.08
Ohaaki Bridge	12	0.14	0.13	0.10	0.19	0.06	0.43	0.12
Ohakuri Tailrace Bridge	12	0.19	0.19	0.11	0.29	0.05	0.37	0.20
Whakamaru Tailrace	12	0.27	0.27	0.16	0.38	0.10	0.05	0.25
Waipapa Tailrace	12	0.29	0.30	0.20	0.40	0.10	0.10	0.30
Narrows	12	0.44	0.44	0.31	0.64	0.13	0.40	0.42
Horotiu Bridge	12	0.48	0.44	0.31	0.78	0.15	1.14	0.46
Huntly-Tainui Bridge	12	0.76	0.72	0.40	1.43	0.33	1.01	0.61
Mercer Bridge	12	0.80	0.72	0.40	1.74	0.27	1.36	0.69
Tuakau Bridge	12	0.80	0.71	0.41	1.62	0.22	1.31	0.64

pH (pH Units)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	7.7	7.8	7.1	8.0	0.5	-0.62	7.6
Ohaaki Bridge	12	7.3	7.4	7.0	7.6	0.3	-0.45	7.3
Ohakuri Tailrace Bridge	12	7.4	7.5	7.1	7.6	0.2	-0.79	7.4
Whakamaru Tailrace	12	7.5	7.6	7.1	7.8	0.4	-0.43	7.5
Waipapa Tailrace	12	7.4	7.4	7.2	7.7	0.3	0.24	7.4
Narrows	12	7.6	7.7	7.5	7.8	0.2	-0.03	7.6
Horotiu Bridge	12	7.6	7.7	7.4	7.8	0.2	-0.63	7.6
Huntly-Tainui Bridge	12	7.6	7.6	7.2	7.8	0.2	-0.60	7.5
Mercer Bridge	12	7.6	7.7	7.1	7.8	0.2	-1.13	7.6
Tuakau Bridge	12	7.6	7.7	7.0	7.9	0.3	-0.86	7.5

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	0.004	0.002	0.011	0.007	0.46	0.009
Ohakuri Tailrace Bridge	12	0.007	0.006	0.002	0.017	0.007	0.77	0.011
Whakamaru Tailrace	12	0.008	0.006	0.002	0.019	0.010	0.73	0.011
Waipapa Tailrace	12	0.015	0.015	0.005	0.026	0.012	0.07	0.016
Narrows	12	0.015	0.013	0.002	0.031	0.019	0.46	0.014
Horotiu Bridge	12	0.026	0.025	0.012	0.043	0.020	0.20	0.024
Huntly-Tainui Bridge	12	0.028	0.026	0.015	0.045	0.013	0.63	0.024
Mercer Bridge	12	0.021	0.021	0.005	0.044	0.013	0.52	0.019
Tuakau Bridge	12	0.019	0.019	0.005	0.039	0.013	0.58	0.017

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	0.005	0.005	0.002	0.011	0.002	0.63	0.005
Ohaaki Bridge	12	0.018	0.018	0.013	0.027	0.006	0.73	0.015
Ohakuri Tailrace Bridge	12	0.028	0.027	0.023	0.044	0.005	<u>1.93</u>	0.024
Whakamaru Tailrace	12	0.030	0.028	0.025	0.038	0.006	0.82	0.027
Waipapa Tailrace	12	0.036	0.038	0.025	0.044	0.012	-0.43	0.032
Narrows	12	0.049	0.047	0.036	0.065	0.016	0.09	0.039
Horotiu Bridge	12	0.058	0.056	0.046	0.074	0.016	0.39	0.051
Huntly-Tainui Bridge	12	0.073	0.072	0.058	0.099	0.023	0.51	0.066
Mercer Bridge	12	0.082	0.075	0.062	0.112	0.033	0.53	0.073
Tuakau Bridge	12	0.084	0.084	0.057	0.110	0.033	-0.04	0.071

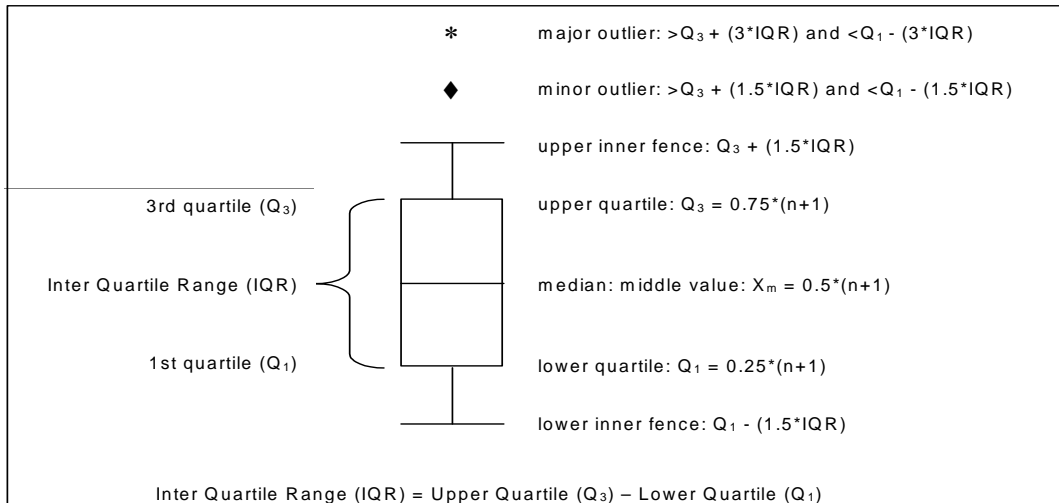
Temperature (°C)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	14.9	14.5	10.5	20.4	5.6	0.29	14.8
Ohaaki Bridge	12	16.3	15.8	10.9	21.4	6.2	0.13	16.4
Ohakuri Tailrace Bridge	12	16.7	16.7	11.0	23.1	6.8	0.10	16.3
Whakamaru Tailrace	12	16.4	16.5	10.1	21.9	6.2	-0.16	16.4
Waipapa Tailrace	12	16.3	16.6	10.5	21.9	6.1	-0.13	16.2
Narrows	12	16.3	16.3	11.9	21.4	6.1	0.08	16.2
Horotiu Bridge	12	16.5	16.4	11.9	21.8	6.9	0.09	16.3
Huntly-Tainui Bridge	12	16.6	16.1	11.6	22.5	7.0	0.13	16.0
Mercer Bridge	12	17.2	17.2	12.1	23.2	7.6	0.11	16.8
Tuakau Bridge	12	17.7	17.8	12.4	23.5	7.8	0.01	17.4

Dissolved Solids - Total (g m ⁻³)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	90	89	78	117	8	1.63	88
Ohaaki Bridge	12	115	110	96	149	23	0.68	109
Ohakuri Tailrace Bridge	12	133	132	116	157	23	0.43	126
Whakamaru Tailrace	12	130	130	120	144	10	0.56	126
Waipapa Tailrace	12	130	129	115	151	20	0.35	125
Narrows	12	124	123	108	140	9	0.31	121
Horotiu Bridge	12	122	122	95	143	7	-0.54	121
Huntly-Tainui Bridge	12	115	115	97	141	18	0.38	114
Mercer Bridge	12	119	120	99	139	11	-0.04	117
Tuakau Bridge	12	118	119	100	135	11	-0.12	118

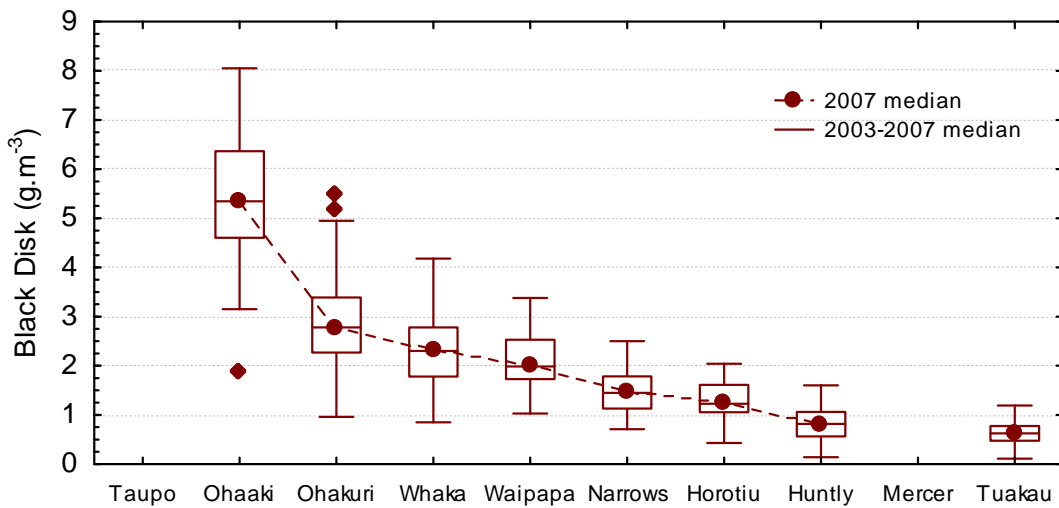
Turbidity (NTU)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.7	0.5	0.3	2.8	0.3	<u>2.44</u>	0.3
Ohaaki Bridge	12	0.6	0.6	0.4	0.8	0.2	0.35	0.6
Ohakuri Tailrace Bridge	12	1.0	1.0	0.5	1.4	0.4	-0.23	1.0
Whakamaru Tailrace	12	1.3	1.3	0.6	2.1	0.6	-0.02	1.2
Waipapa Tailrace	12	1.4	1.4	0.8	1.9	0.4	-0.49	1.4
Narrows	12	2.5	2.5	1.3	4.8	1.0	1.02	2.4
Horotiu Bridge	12	2.9	2.7	1.7	6.3	0.9	<u>1.70</u>	2.7
Huntly-Tainui Bridge	12	10.8	6.0	2.7	33	13.6	1.17	5.6
Mercer Bridge	12	13.6	8.9	3.1	30	15.9	0.78	8.5
Tuakau Bridge	12	14.8	12.2	4.7	38.0	13.9	1.03	9.0

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

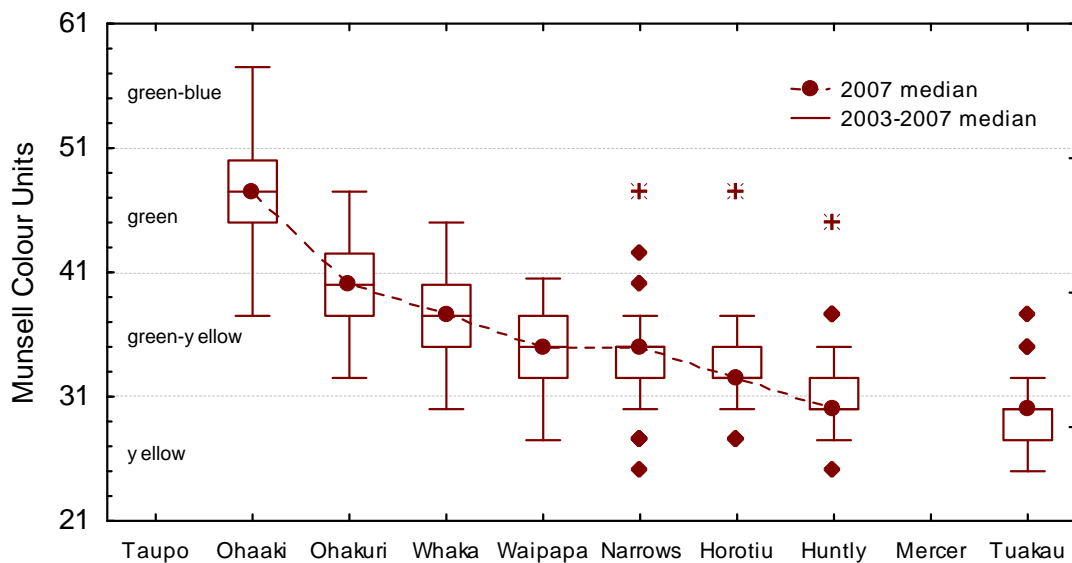
Boxplots are used to present data



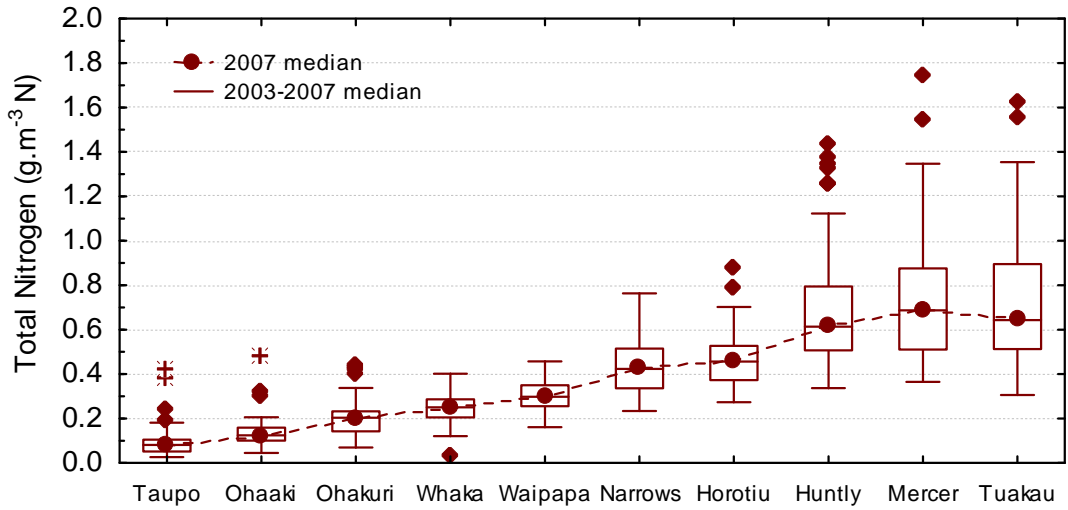
Black Disk, 2003-2007 Data



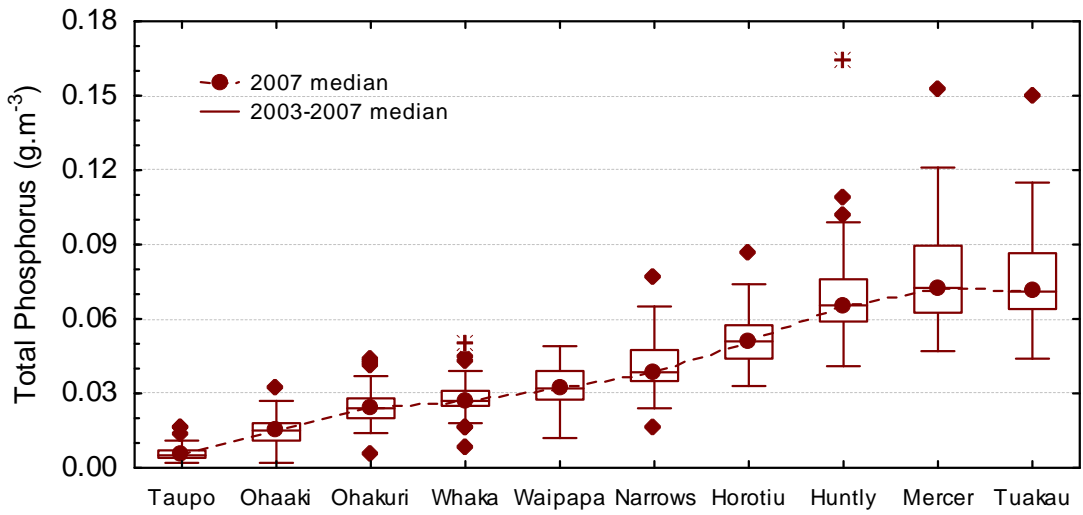
Colour, 2003-2007 Data



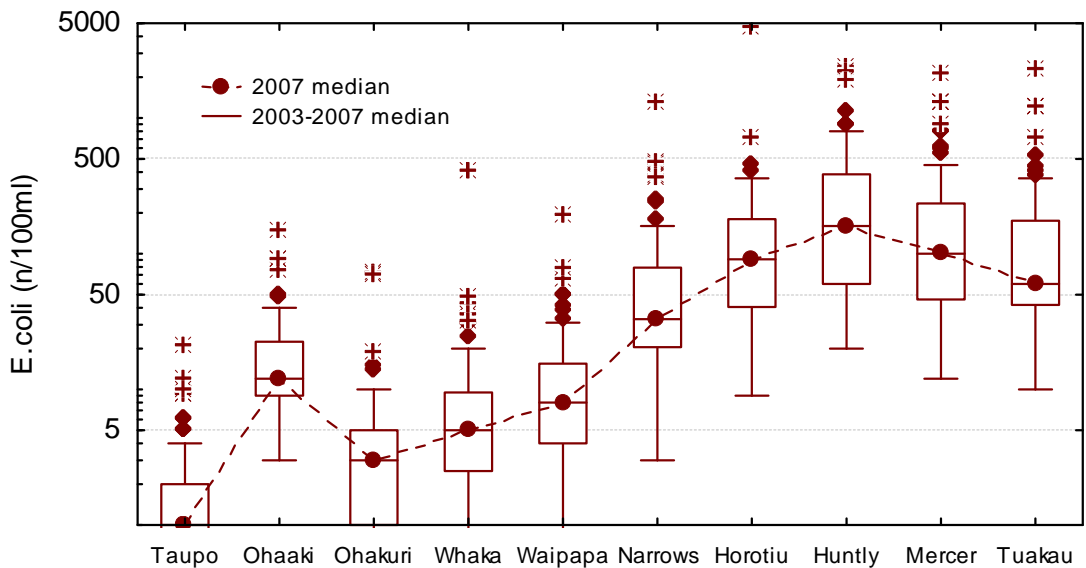
Total Nitrogen, 2003-2007 Data



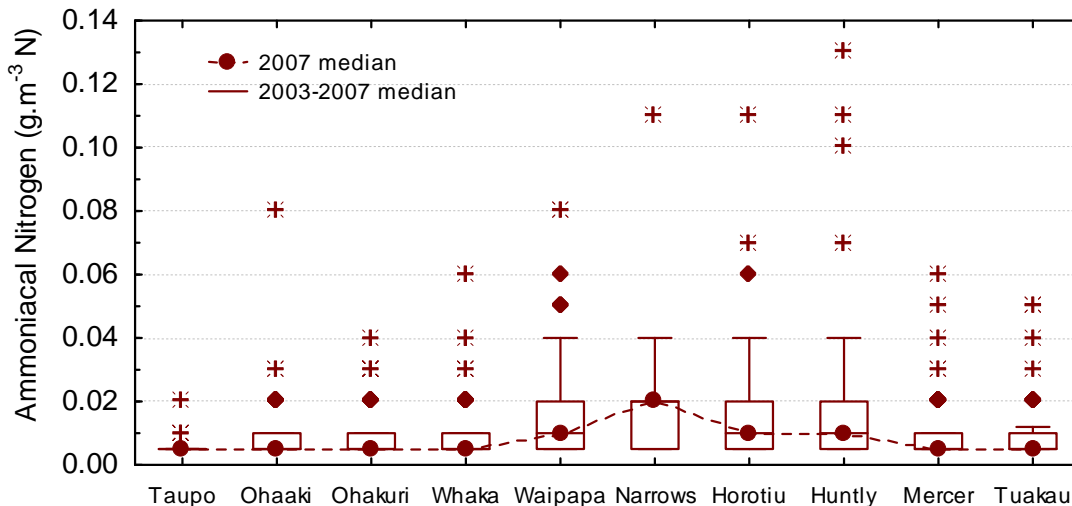
Total Phosphorus, 2003-2007 Data



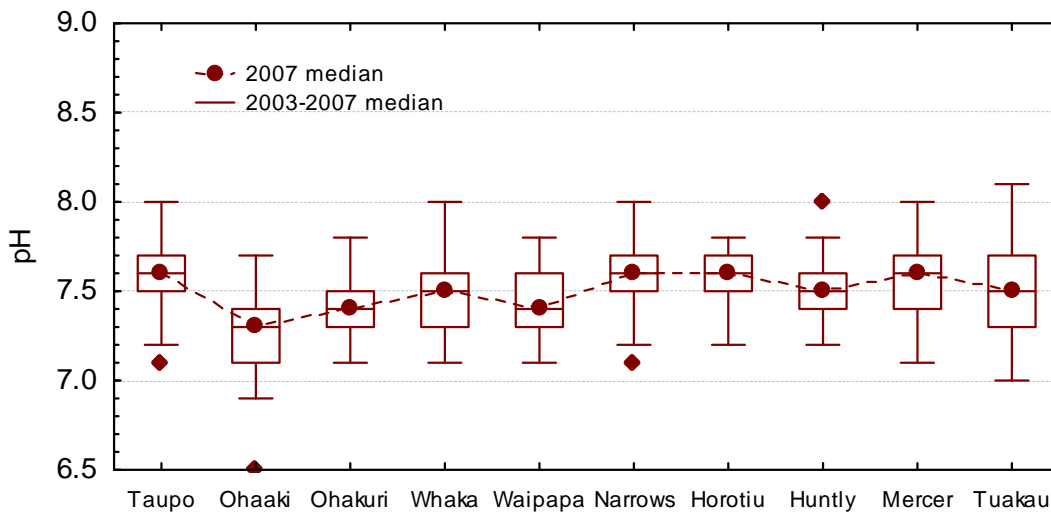
E.coli, 2003-2007 Data



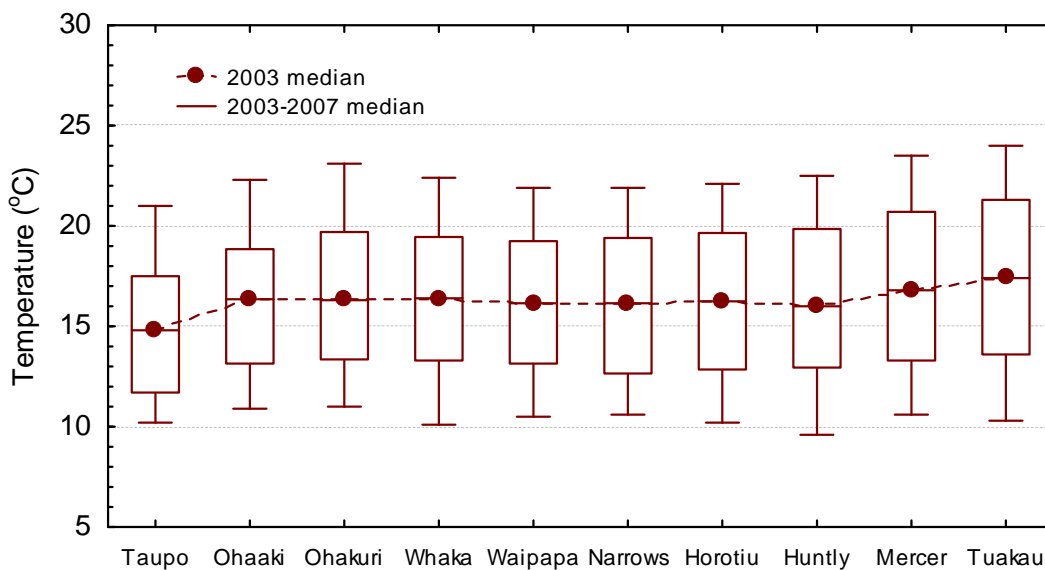
Ammoniacal Nitrogen, 2003-2007 Data



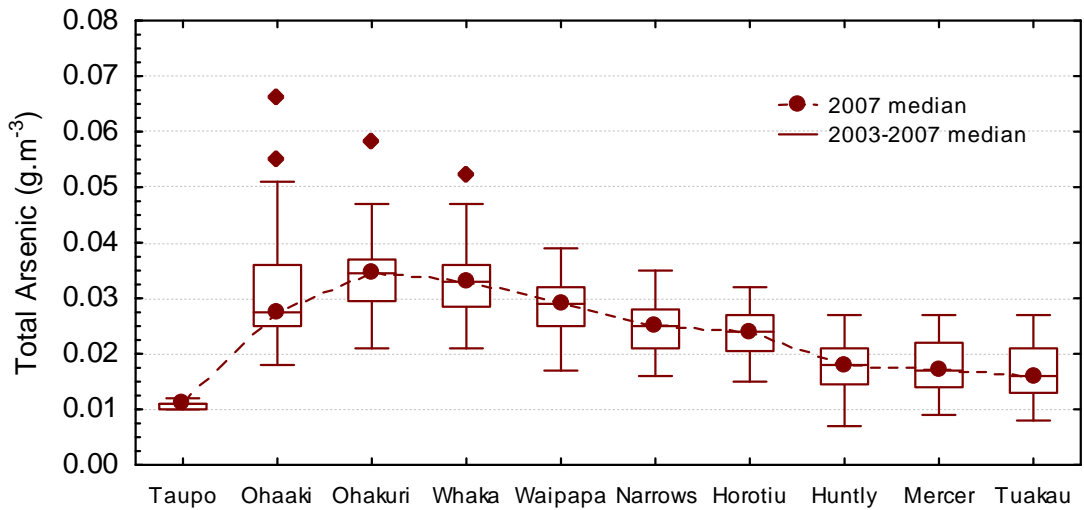
pH, 2003-2007 Data



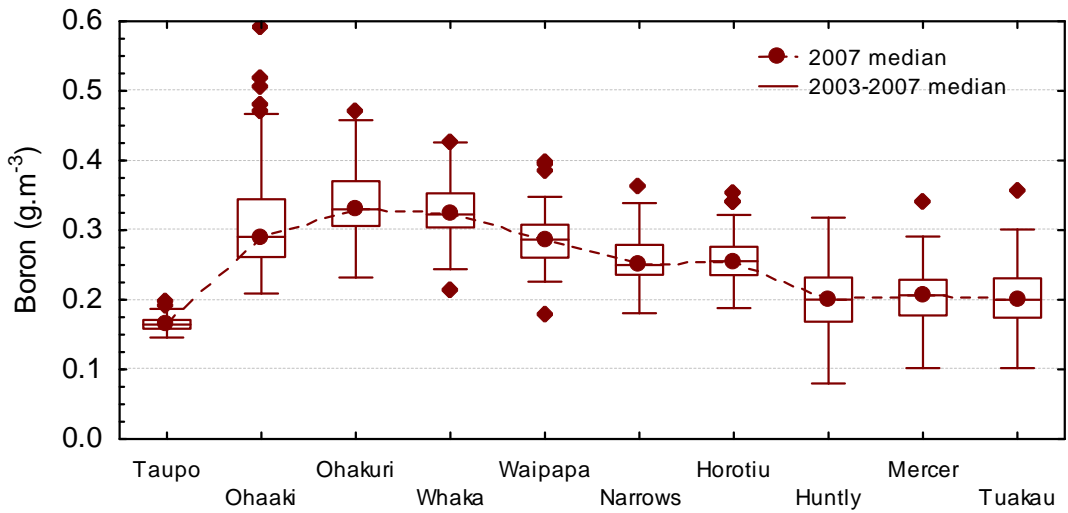
Temperature, 2003-2007 Data



Total Arsenic, 2003-2007 Data



Boron, 2003-2007 Data



Dissolved Oxygen, 2003-2007 Data

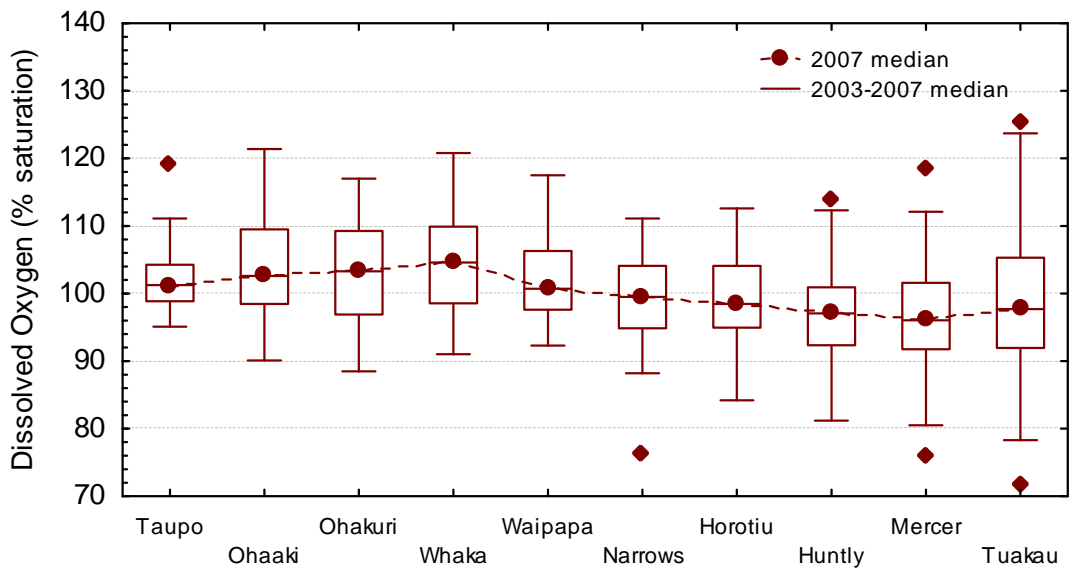


Table 3: Samples (Year 2007) complying with the 'Satisfactory' Water Quality Guidelines and Standards. n = 12

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	8	12	12	-	12	Y	12	2	12
Ohaaki Bridge	12	12	12	12	5	12	12	12/12	12	Y	12	0	7
Ohakuri Tailrace Br	12	12	12	12	6	11	12	11/12	12	Y	12	0	3
Whakamaru Tailrace	12	12	12	12	7	12	12	10/12	12	Y	12	0	3
Waipapa Tailrace	12	12	12	12	7	9	12	11/12	12	Y	12	0	9
Hamilton – Narrows	12	12	12	12	7	2	9	3/12	11	Y	10	0	10
Horotiu Bridge	12	12	11	12	7	0	8	3/12	10	N	10	0	10
Huntly – Tainui Br	12	12	4	12	4	0	2	0/12	7	N	11	1	12
Mercer Bridge	12	12	1	12	3	0	3	-	7	N	7	2	12
Tuakau Bridge	12	12	2	12	2	0	2	-	6	N	6	1	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 2007) complying with the 'Excellent' Water Quality Guidelines and Standards. n = 12.

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	11	12	11	11	8	-	12	Y	12	n/a	n/a
Ohaaki Bridge	12	12	12	12	12	0	0	10/12	11	Y	12	n/a	n/a
Ohakuri Tailrace Br	12	11	12	12	12	0	0	2/12	12	Y	7	n/a	n/a
Whakamaru Tailrace	12	12	11	12	11	0	0	0/12	12	Y	5	n/a	n/a
Waipapa Tailrace	12	12	12	12	12	0	0	0/12	12	Y	5	n/a	n/a
Hamilton – Narrows	12	11	4	12	4	0	0	0/12	6	N	2	n/a	n/a
Horotiu Bridge	12	11	3	12	3	0	0	0/12	3	N	1	n/a	n/a
Huntly – Tainui Br	12	8	0	12	0	0	0	0/12	2	N	1	n/a	n/a
Mercer Bridge	12	7	0	12	0	0	0	-	3	N	1	n/a	n/a
Tuakau Bridge	12	9	0	12	0	0	0	-	4	N	0	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			>1.6	-	-	6.5-9	<12 (May-Sep)	>80	-	<5	-	-	-	-	<0.88
Guideline/Standard							<20 (Oct-Apr)								

1131-127 UD = 263 m³/m (Flows from "Reids Farm")

Waikato River @ Taupo Control Gates

04/01/07	8:50 a.m.	104	-	-	12.0	8.0	16.4	10.2	110.0	< 0.4	0.29	83	< 0.002	< 0.002	< 0.01
08/02/07	10:55 a.m.	243	-	-	11.9	7.8	<u>20.3</u>	9.1	103.0	0.6	0.45	78	< 0.002	< 0.002	< 0.01
06/03/07	9:10 a.m.	222	-	-	11.7	7.9	<u>20.4</u>	9.1	104.4	0.5	2.79	85	< 0.002	< 0.002	< 0.01
04/04/07	9:15 a.m.	76	-	-	11.9	7.9	18.0	9.1	101.0	< 0.4	0.32	90	0.002	< 0.002	< 0.01
11/05/07	9:15 a.m.	151	-	-	12.0	7.9	<u>16.5</u>	9.0	95.1	1.2	1.17	91	0.003	0.003	< 0.01
05/06/07	8:50 a.m.	221	-	-	11.8	7.9	<u>14.0</u>	9.4	95.7	0.8	0.28	81	< 0.002	< 0.002	< 0.01
03/07/07	9:25 a.m.	73	-	-	12.0	7.4	10.6	10.4	98.3	< 0.4	0.53	97	< 0.002	< 0.002	< 0.01
08/08/07	9:05 a.m.	264	-	-	12.0	7.1	10.5	10.2	96.2	< 0.4	0.50	117	< 0.002	< 0.002	< 0.01
04/09/07	9:30 a.m.	267	-	-	12.0	7.4	11.4	10.5	100.1	< 0.4	0.53	93	0.005	0.005	< 0.01
01/10/07	9:05 a.m.	202	-	-	11.9	7.4	12.0	9.8	95.7	< 0.4	0.28	88	< 0.002	< 0.002	< 0.01
07/11/07	9:39 a.m.	269	-	-	12.0	7.6	13.5	9.8	98.5	0.7	0.69	86	< 0.002	< 0.002	< 0.01
06/12/07	8:40 a.m.	243	-	-	12.0	7.7	15.0	10.7	111.1	0.4	0.33	90	< 0.002	< 0.002	< 0.01

1131-105 UD = 270 m³/s (Flows from Ohaaki Bridge Recorder, +/- 20%)

Waikato River @ Ohaaki Br

04/01/07	10:00 a.m.	68	6.7	42.5	19.6	7.2	18.8	8.8	97.0	< 0.4	0.64	133	0.057	0.056	0.01
08/02/07	11:40 a.m.	214	4.5		14.7	7.5	<u>21.4</u>	9.6	112.0	1.0	0.82	96	0.017	0.017	< 0.01
06/03/07	9:55 a.m.	211	4.8	45.0	14.6	7.6	<u>21.3</u>	9.2	106.3	0.7	0.42	105	0.017	0.016	< 0.01
04/04/07	10:20 a.m.	61	8.1	45.0	20.5	7.4	<u>20.2</u>	8.4	96.3	< 0.4	0.50	149	0.033	0.030	0.01
11/05/07	10:15 a.m.	101	8.0	47.5	17.0	7.4	<u>17.1</u>	8.9	94.9	< 0.4	0.48	123	0.045	0.043	0.01
05/06/07	9:35 a.m.	117	5.1	47.5	16.4	7.5	<u>15.1</u>	9.4	96.7	< 0.4	0.53	108	0.043	0.042	< 0.01
03/07/07	10:05 a.m.	90	5.1	50.0	18.3	7.0	<u>13.1</u>	9.8	97.0	< 0.4	0.73	124	0.066	0.066	0.03
08/08/07	9:53 a.m.	239	4.0	42.5	14.0	7.1	10.9	11.7	109.8	< 0.4	0.83	125	0.019	0.018	< 0.01
04/09/07	10:20 a.m.	226	3.4	57.5	14.1	7.3	<u>12.2</u>	11.5	111.2	< 0.4	0.52	109	0.022	0.017	< 0.01
01/10/07	9:50 a.m.	118	5.5	50.0	15.8	7.0	13.6	9.8	97.2	< 0.4	0.66	97	0.038	0.037	0.01
07/11/07	10:28 a.m.	212	1.9	47.5	15.0	7.4	15.0	10.1	102.7	0.6	0.68	110	0.017	0.016	< 0.01
06/12/07	9:40 a.m.	173	7.0	50.0	14.0	7.4	16.5	10.4	110.6	< 0.4	0.48	99	0.027	0.027	< 0.01

1131-107 UD = 312 m³/s (Flows from Ohakuri Dam - Total)

Waikato River @ Ohakuri Tailrace Br

04/01/07	10:45 a.m.	210	1.9	32.5	20.0	7.6	<u>20.4</u>	10.1	115.0	0.6	1.33	147	0.009	0.007	< 0.01
08/02/07	12:45 p.m.	262	<u>1.26</u>		17.4	7.5	<u>23.1</u>	9.2	109.6	1.2	1.22	119	0.004	0.003	< 0.01
06/03/07	10:50 a.m.	281	2.2	40.0	16.6	7.6	<u>22.3</u>	9.0	105.4	1.0	1.11	126	0.010	0.010	< 0.01
04/04/07	11:30 a.m.	197	2.7	40.0	18.8	7.5	19.5	8.8	98.4	0.5	0.98	135	0.039	0.033	0.01
11/05/07	11:15 a.m.	141	2.7	42.5	19.2	7.5	<u>17.1</u>	8.4	89.8	< 0.4	0.53	139	0.110	0.107	0.01
05/06/07	10:50 a.m.	210	5.2	45.0	17.7	7.4	<u>14.5</u>	9.0	91.1	< 0.4	0.63	134	0.108	0.107	0.01
03/07/07	10:55 a.m.	223	4.1	42.5	16.0	7.2	11.6	10.5	100.2	< 0.4	0.76	121	0.083	0.082	0.01
08/08/07	10:55 a.m.	292	2.7	37.5	17.7	7.1	<u>12.4</u>	9.8	95.1	< 0.4	1.44	157	0.162	0.160	0.03
04/09/07	11:10 a.m.	269	2.4	42.5	15.5	7.4	11.0	11.7	108.9	0.5	1.04	120	0.068	0.067	< 0.01
01/10/07	11:00 a.m.	276	1.67	37.5	16.3	7.2	13.9	9.9	99.5	< 0.4	1.03	116	0.063	0.062	0.01
07/11/07	11:25 a.m.	286	2.7	40.0	16.0	7.5	16.2	9.6	100.4	0.7	1.20	150	0.014	0.013	< 0.01
06/12/07	10:45 a.m.	250	3.0	42.5	17.0	7.5	18.6	10.1	111.6	0.9	0.82	130	0.021	0.021	< 0.01

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

Waikato River @ Whakamaru Tailrace

04/01/07	11:40 a.m.	197	1.8	30.0	16.8	7.8	19.4	10.8	117.8	1.0	1.47	125	0.016	0.015	< 0.01
08/02/07	2:00 a.m.	234	<u>1.2</u>		17.1	7.6	<u>21.3</u>	9.8	120.0	1.1	1.49	121	0.009	0.008	0.04
06/03/07	11:35 a.m.	216	2.1	32.5	16.8	7.7	<u>21.9</u>	9.5	110.4	1.4	1.25	129	0.007	0.007	< 0.01
04/04/07	12:25 p.m.	212	2.5	35.0	18.4	7.6	19.5	8.8	98.1	0.6	1.18	137	0.052	0.050	0.01
11/05/07	12:05 p.m.	202	3.5	42.5	18.8	7.3	<u>16.4</u>	9.1	94.5	0.6	0.57	142	0.152	0.150	< 0.01
05/06/07	11:40 a.m.	228	1.8	40.0	18.3	7.5	<u>14.5</u>	9.5	95.5	< 0.4	0.65	132	0.172	0.171	< 0.01
03/07/07	11:40 a.m.	202	3.4	37.5	17.2	7.2	11.5	10.1	95.7	< 0.4	0.93	126	0.156	0.155	< 0.01
08/08/07	11:45 a.m.	289	1.9	35.0	16.0	7.1	<u>12.1</u>	9.9	94.8	< 0.4	1.67	144	0.231	0.228	0.02
04/09/07	12:00 p.m.	265	1.8	35.0	16.0	7.6	10.1	12.5	113.3	0.8	1.40	125	0.112	0.111	< 0.01
01/10/07	11:55 a.m.	263	<u>0.9</u>	35.0	15.7	7.3	14.5	11.2	113.4	0.8	2.07	120	0.018	0.017	< 0.01
07/11/07	12:08 p.m.	230	1.7	32.5	16.0	7.8	16.5	10.1	106.2	1.2	1.80	130	< 0.002	< 0.002	< 0.01
06/12/07	11:30 a.m.	297	2.8	40.0	17.0	7.6	19.4	9.9	110.8	0.7	0.96	130	0.027	0.027	< 0.01

Note: < = less than value stated
UD = upper decile flow (period 1988-2007 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		

0.11	0.11	<0.004	0.004	8.8	<u>0.011</u>	0.17	0.041	<0.002	<0.002	<1	2	2	<0.003	0.8	1.1
0.07	0.07	<0.004	0.006	8.9	<u>0.011</u>	0.16	0.038	<0.002	<0.002	1	<1	<1	<0.003	1	1
0.09	0.09	<0.004	0.005	8.3	<u>0.011</u>	0.18	0.040	0.007	<0.002	3	10	10	<0.003	0.8	1
0.09	0.09	<0.004	0.005	8.9	0.010	0.15	0.039	<0.002	<0.002	<1	2	1	<0.003	0.8	0.8
0.17	0.17	<0.004	0.011	9.0	0.010	0.15	0.039	<0.002	<0.002	7	1	1	<0.003	1.3	1.4
0.08	0.08	<0.004	<0.004	8.7	<u>0.011</u>	0.20	0.046	0.004	<0.002	2	3	3	<0.003	0.9	1.3
0.11	0.11	<0.004	0.005	9.0	<u>0.011</u>	0.17	0.042	0.002	<0.002	1	<1	<1	<0.003	1	1.1
0.09	0.09	<0.004	0.005	8.7	<u>0.012</u>	0.17	0.040	<0.002	<0.002	1	<1	<1	<0.003	0.6	0.9
0.07	0.08	<0.004	0.008	8.9	<u>0.011</u>	0.17	0.043	<0.002	<0.002	<1	2	2	<0.003	1	1.2
0.15	0.15	<0.004	<0.004	8.9	<u>0.011</u>	0.17	0.043	<0.002	<0.002	<1	<1	<1	<0.003	0.6	0.7
0.08	0.08	<0.004	0.007	8.7	<u>0.012</u>	0.16	0.036	<0.002	<0.002	<1	<1	<1	<0.003	<0.3	0.87
0.07	0.07	<0.004	0.006	9.1	<u>0.012</u>	0.16	0.037	<0.002	<0.002	7	2	<1	<0.003	0.75	1.3

0.11	0.17	0.009	0.019	26.6	<u>0.047</u>	<u>0.47</u>	0.155	0.003	<0.002	<1	12	8	<0.003	1.5	1.8
0.10	0.12	<0.004	0.014	16.2	<u>0.025</u>	0.25	0.081	<0.002	<0.002	16	56	48	<0.003	0.9	1.1
0.11	0.13	<0.004	0.013	15.7	<u>0.027</u>	0.28	0.091	0.004	<0.002	200	50	50	<0.003	0.9	1
0.11	0.14	0.011	0.027	29.7	<u>0.047</u>	<u>0.48</u>	0.169	0.005	<0.002	39	13	11	<0.003	0.9	1
0.09	0.14	0.007	0.018	21.8	<u>0.034</u>	<u>0.35</u>	0.118	<0.002	<0.002	23	10	9	<0.003	1.3	1.5
0.13	0.17	0.008	0.024	20.4	<u>0.037</u>	<u>0.35</u>	0.116	<0.002	<0.002	6	28	18	<0.003	1.1	1.8
0.12	0.19	0.011	0.022	24.8	<u>0.038</u>	<u>0.47</u>	0.142	0.003	<0.002	4	10	10	<0.003	1	1.4
0.09	0.11	<0.004	0.013	14.6	<u>0.026</u>	0.26	0.076	0.007	<0.002	1	12	7	<0.003	0.8	0.9
0.08	0.10	0.005	0.015	14.5	<u>0.020</u>	0.28	0.078	<0.002	<0.002	1	18	18	<0.003	1.1	1.2
0.15	0.19	<0.004	0.016	17.6	<u>0.028</u>	0.30	0.099	<0.002	<0.002	3	16	5	<0.003	0.9	1.6
0.10	0.11	<0.004	0.017	16.0	<u>0.025</u>	0.23	0.072	0.003	<0.002	8	10	10	<0.003	0.52	1.1
0.10	0.12	<0.004	0.018	13.0	<u>0.022</u>	0.22	0.065	0.004	<0.002	15	90	90	<0.003	0.9	1.2

0.20	0.21	<0.004	0.028	27.2	<u>0.046</u>	<u>0.46</u>	0.166	0.007	<0.002	<1	4	3	0.009	1.2	1.5
0.15	0.15	<0.004	0.029	21.4	<u>0.037</u>	<u>0.34</u>	0.120	0.005	<0.002	3	1	1	0.009	1	1.5
0.19	0.20	0.004	0.024	19.3	<u>0.036</u>	<u>0.33</u>	0.118	0.006	<0.002	3	5	1	0.004	1	1.3
0.13	0.17	0.007	0.028	25.0	<u>0.038</u>	<u>0.38</u>	0.143	0.006	<0.002	<1	3	1	0.006	1.1	1.2
0.13	0.24	0.014	0.025	25.7	<u>0.036</u>	<u>0.36</u>	0.142	0.002	<0.002	1	<1	<1	<0.003	1.2	1.2
0.11	0.22	0.012	0.032	22.3	<u>0.036</u>	<u>0.36</u>	0.132	0.004	<0.002	<1	1	1	<0.003	1	1.4
0.09	0.17	0.010	0.023	18.6	<u>0.029</u>	<u>0.31</u>	0.109	0.003	<0.002	<1	<1	<1	<0.003	0.8	1.4
0.13	0.29	0.017	0.023	22.0	<u>0.036</u>	<u>0.37</u>	0.128	0.008	<0.002	1	19	15	0.003	1.3	1.3
0.11	0.18	0.006	0.027	17.0	<u>0.025</u>	0.30	0.100	0.005	<0.002	<1	2	1	0.005	1.7	1.2
0.15	0.21	0.005	0.023	18.6	<u>0.030</u>	0.29	0.107	0.004	<0.002	3	5	3	0.004	0.6	0.9
0.10	0.11	0.004	<u>0.044</u>	18.0	<u>0.031</u>	0.26	0.094	0.004	<0.002	<1	3	2	0.009	0.58	1.3
0.11	0.13	0.004	0.026	20.0	<u>0.037</u>	<u>0.31</u>	0.100	0.005	<0.002	1	8	8	0.003	0.9	1.3

0.24	0.26	0.005	0.027	20.3	<u>0.037</u>	<u>0.32</u>	0.116	0.006	<0.002	3	<1	<1	0.007	1.5	1.7
0.20	0.21	0.004	0.033	21.2	<u>0.037</u>	<u>0.32</u>	0.121	0.007	<0.002	16	3	3	0.012	1.1	2.1
0.23	0.24	<0.004	0.026	20.0	<u>0.037</u>	<u>0.33</u>	0.122	0.007	<0.002	31	6	6	0.012	1.1	1.4
0.22	0.27	0.006	0.028	24.3	<u>0.034</u>	<u>0.35</u>	0.138	0.006	<0.002	2	6	6	0.006	1	1.1
0.12	0.27	0.014	0.026	25.1	<u>0.035</u>	<u>0.37</u>	0.143	0.004	<0.002	9	1	1	0.003	1.2	1.4
0.16	0.33	0.013	0.037	23.9	<u>0.034</u>	<u>0.38</u>	0.147	0.005	<0.002	7	5	4	0.004	1.4	1.6
0.18	0.34	0.013	0.031	21.6	<u>0.032</u>	<u>0.35</u>	0.128	0.005	<0.002	9	4	4	<0.003	1.2	1.4
0.15	0.38	0.019	0.025	19.1	<u>0.029</u>	<u>0.30</u>	0.109	0.014	0.002	16	35	24	0.003	1.2	1.7
0.20	0.31	0.007	0.031	18.6	<u>0.025</u>	0.30	0.110	0.008	<0.002	<1	5	5	0.011	1.4	1.7
0.24	0.26	<0.004	0.028	18.1	<u>0.029</u>	0.28	0.106	0.004	<0.002	<1	4	2	0.013	1.1	1.4
0.16	0.16	<0.004	0.038	18.0	<u>0.032</u>	0.27	0.100	0.004	<0.002	<1	4	2	0.017	0.77	1.4
0.16	0.19	0.005	0.026	21.0	<u>0.040</u>	<u>0.34</u>	0.120	0.006	<0.002	30	17	14	0.003	1	1.7

Note: < = less than value stated

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

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

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)								

1131-143 UD = 354 m³/s (Flows from Waipapa Dam - Total)

Waikato River @ Waipapa Tailrace

04/01/07	12:20 p.m.	197	1.9	35.0	14.8	7.6	19.0	9.9	107.2	0.5	1.28	115	0.125	0.123	0.02
08/02/07	3:15 a.m.	297	<u>1.2</u>		17.0	7.5	<u>21.3</u>	9.2	108.0	0.8	1.74	117	0.072	0.069	0.03
06/03/07	12:35 p.m.	345	2.6	32.5	16.1	7.5	<u>21.9</u>	8.6	98.4	0.7	1.39	128	0.079	0.075	0.04
04/04/07	1:20 a.m.	240	2.4	35.0	17.7	7.4	18.8	8.9	97.4	0.4	1.10	138	0.164	0.159	0.03
11/05/07	1:05 a.m.	218	2.0	37.5	18.9	7.3	<u>16.7</u>	9.0	93.5	0.5	0.75	151	0.201	0.197	0.02
05/06/07	12:20 p.m.	268	3.1	40.0	18.4	7.4	<u>14.3</u>	9.6	94.5	< 0.4	1.01	131	0.232	0.229	0.01
03/07/07	12:20 p.m.	260	2.0	35.0	15.6	7.2	10.5	10.8	98.7	< 0.4	1.64	127	0.207	0.204	< 0.01
08/08/07	12:25 p.m.	340	1.9	32.5	14.4	7.2	<u>12.0</u>	10.1	95.9	< 0.4	1.49	146	0.245	0.242	0.02
04/09/07	12:40 p.m.	384	1.8	32.5	15.6	7.7	11.0	12.1	110.7	0.8	1.54	122	0.168	0.165	< 0.01
01/10/07	12:25 p.m.	230	1.7	32.5	15.3	7.3	14.3	10.8	107.1	0.5	1.54	117	0.083	0.082	0.01
07/11/07	12:55 p.m.	326	2.0	30.0	17.0	7.7	16.5	10.0	103.7	1.0	1.90	130	0.072	0.069	< 0.01
06/12/07	12:15 p.m.	240	2.03	35.0	18.0	7.4	19.5	10.2	113.6	0.8	1.40	140	0.062	0.060	< 0.01

1131-101/328 UD = 358 m³/s (Flows from Karapiro Dam - Total)

Waikato River @ Narrows Br/Boat Ramp

03/01/07	8:00 a.m.	147	<u>1.0</u>	30.0	15.2	7.6	18.1	9.5	100.4	1.3	2.76	135	0.129	0.125	0.02
08/02/07	7:55 a.m.	241	<u>1.5</u>	35.0	16.6	7.6	<u>21.2</u>	9.6	108.0	0.9	1.79	123	0.112	0.109	< 0.01
08/03/07	8:15 a.m.	158	1.9	35.0	16.0	7.7	<u>21.4</u>	8.3	94.7	1.0	1.31	123	0.127	0.123	0.04
04/04/07	8:25 a.m.	150	2.1	37.5	16.1	7.7	19.0	8.6	93.6	0.5	1.51	123	0.225	0.221	0.03
08/05/07	9:00 a.m.	151	2.3	35.0	17.8	7.5	<u>16.5</u>	8.7	88.2	0.6	1.71	140	0.285	0.282	0.02
07/06/07	8:50 a.m.	155	<u>1.0</u>	32.5	17.3	7.7	<u>14.5</u>	9.8	97.0	0.5	2.56	135	0.256	0.255	0.01
05/07/07	8:50 a.m.	162	<u>0.9</u>	37.5	15.9	7.5	11.9	9.8	92.3	0.5	3.94	121	0.344	0.341	< 0.01
09/08/07	9:25 a.m.	328	<u>1.0</u>	32.5	14.0	7.5	11.9	9.9	91.0	0.9	4.77	108	0.425	0.421	0.01
04/09/07	9:00 a.m.	266	<u>1.1</u>	30.0	15.0	7.8	<u>12.4</u>	10.8	100.6	1.0	2.65	114	0.284	0.278	0.01
03/10/07	8:45 a.m.	152	<u>1.3</u>	35.0	14.9	7.7	13.7	9.9	95.5	0.8	2.31	122	0.153	0.151	0.02
08/11/07	8:50 a.m.	194	<u>1.5</u>	27.5	16.0	7.7	16.1	9.3	94.1	0.6	2.40	120	0.160	0.160	0.02
03/12/07	7:32 a.m.	220	<u>0.7</u>	27.5	16.0	7.5	19.3	9.8	101.1	1.0	2.50	120	0.066	0.064	< 0.01

1131-69 UD = 381 m³/s (Flows from Hamilton - Bridge Street Bridge)

Waikato River @ Horotiu Br

03/01/07	9:10 a.m.	154	<u>0.9</u>	32.5	15.4	7.7	19.4	9.7	105.5	1.6	2.67	95	0.120	0.115	0.03
08/02/07	9:40 a.m.	279	<u>1.4</u>	32.5	16.7	7.5	<u>21.7</u>	9.2	106.3	1.1	2.35	122	0.114	0.111	< 0.01
08/03/07	9:10 a.m.	171	1.8	37.5	16.3	7.7	<u>21.8</u>	8.4	96.0	0.8	1.67	124	0.156	0.151	0.07
04/04/07	9:25 a.m.	160	2.0	35.0	16.2	7.7	18.9	8.7	94.1	0.5	1.75	122	0.245	0.243	0.01
08/05/07	10:50 a.m.	164	1.8	32.5	17.9	7.6	<u>17.0</u>	8.6	87.9	0.5	1.83	143	0.323	0.321	0.01
07/06/07	10:45 a.m.	191	<u>1.0</u>	37.5	17.8	7.8	<u>14.1</u>	9.9	97.0	0.5	2.75	132	0.273	0.272	< 0.01
05/07/07	9:40 a.m.	265	<u>1.0</u>	37.5	16.0	7.4	11.9	9.8	91.8	0.6	4.09	128	0.358	0.355	< 0.01
09/08/07	10:10 a.m.	369	<u>0.8</u>	30.0	14.2	7.4	11.9	9.8	90.3	0.8	<u>6.27</u>	122	0.473	0.469	0.02
04/09/07	10:00 a.m.	222	<u>1.1</u>	32.5	15.1	7.6	<u>12.3</u>	10.8	100.1	1.3	2.93	118	0.293	0.291	< 0.01
03/10/07	9:45 a.m.	225	<u>1.2</u>	32.5	15.1	7.7	13.2	10.1	97.0	0.6	3.13	113	0.171	0.166	0.02
08/11/07	9:40 a.m.	254	<u>1.5</u>	27.5	16.0	7.8	15.8	9.3	93.8	0.4	2.50	120	0.180	0.180	0.03
03/12/07	8:21 a.m.	207	<u>0.4</u>	27.5	16.0	7.7	19.9	9.0	98.7	1.2	2.80	120	0.082	0.079	< 0.01

1131-77 UD = 582 m³/s (Flows from Huntly Power Station Recorder)

Waikato River @ Huntly-Tainui Br

03/01/07	10:00 a.m.	198	<u>0.6</u>	30.0	14.8	7.6	<u>20.1</u>	10.2	112.3	1.4	4.82	101	0.205	0.201	< 0.01
08/02/07	11:00 a.m.	336	<u>0.2</u>	30.0	15.9	7.4	<u>21.4</u>	8.6	96.0	1.3	<u>32.50</u>	122	0.214	0.210	0.01
08/03/07	9:45 a.m.	217	<u>1.4</u>	37.5	16.0	7.8	<u>22.5</u>	8.7	100.9	0.9	2.74	125	0.189	0.182	0.04
04/04/07	10:20 a.m.	196	<u>1.6</u>	32.5	15.6	7.6	19.9	9.5	104.3	0.5	3.00	121	0.300	0.294	< 0.01
08/05/07	11:25 a.m.	212	<u>0.9</u>	32.5	17.1	7.5	<u>16.7</u>	8.8	89.4	1.8	4.63	141	0.424	0.421	0.13
07/06/07	11:25 a.m.	306	<u>0.8</u>	32.5	16.3	7.7	<u>13.5</u>	9.8	94.8	0.4	<u>5.5</u>	124	0.445	0.441	0.01
05/07/07	10:25 a.m.	572	<u>0.3</u>	25.0	13.8	7.2	<u>12.0</u>	9.1	85.5	0.6	<u>20.50</u>	101	0.895	0.888	0.02
09/08/07	10:45 a.m.	693	<u>0.5</u>	27.5	12.6	7.4	11.6	9.3	85.0	1.0	<u>19.60</u>	97	1.000	0.996	0.04
04/09/07	11:00 a.m.	419	<u>0.5</u>	30.0	14.3	7.5	<u>12.7</u>	10.3	97.0	1.2	<u>6.03</u>	117	0.501	0.497	0.01
03/10/07	10:30 a.m.	393	<u>0.5</u>	35.0	14.4	7.6	13.5	9.4	90.7	0.8	<u>8</u>	112	0.380	0.375	0.02
08/11/07	10:20 a.m.	446	<u>0.3</u>	27.5	14.0	7.6	15.4	8.8	87.6	0.8	<u>17.00</u>	110	0.350	0.350	0.03
03/12/07	8:58 a.m.	209	<u>0.4</u>	27.5	16.0	7.7	<u>20.1</u>	9.1	100.3	1.7	<u>6.00</u>	110	0.170	0.170	< 0.01

Note: < = less than value stated
UD = upper decile flow (period 1988-2007 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		

0.17	0.30	0.009	0.029	16.2	<u>0.029</u>	0.23	0.084	0.007	<0.002	1	11	10	0.004	1.5	1.6
0.17	0.24	0.013	0.039	20.4	<u>0.033</u>	0.28	0.105	0.010	<0.002	5	7	7	0.007	1.6	2
0.18	0.26	0.016	<u>0.041</u>	18.1	<u>0.031</u>	0.28	0.098	0.010	0.002	6	10	3	0.003	1.6	1.5
0.16	0.32	0.026	<u>0.044</u>	22.6	<u>0.030</u>	<u>0.31</u>	0.120	0.013	0.003	7	19	19	0.004	1.4	1.6
0.17	0.37	0.021	0.036	24.7	<u>0.030</u>	<u>0.32</u>	0.129	0.008	<0.002	8	6	3	0.004	1.5	1.6
0.12	0.35	0.023	<u>0.043</u>	24.2	<u>0.033</u>	<u>0.38</u>	0.147	0.009	<0.002	6	9	5	0.005	1.2	1.8
<0.05	0.23	0.020	0.037	19.0	<u>0.025</u>	0.26	0.101	0.014	0.004	7	12	12	<0.003	1.3	1.8
0.15	0.40	0.020	0.025	16.6	<u>0.023</u>	0.25	0.085	0.013	0.002	7	18	17	0.005	1.3	1.6
0.16	0.33	0.011	0.040	18.6	<u>0.023</u>	0.26	0.095	0.010	0.002	8	13	13	0.012	1.7	1.6
0.22	0.30	0.005	0.026	16.9	<u>0.025</u>	0.24	0.090	0.006	<0.002	<1	14	14	0.007	1.3	1.6
0.16	0.23	0.007	0.029	21.0	<u>0.032</u>	0.28	0.110	0.008	<0.002	12	17	14	0.014	1	1.8
0.14	0.20	0.008	0.038	21.0	<u>0.036</u>	0.29	0.100	0.009	<0.002	2	6	3	0.009	1.5	2
0.21	0.34	0.005	<u>0.043</u>	17.0	<u>0.030</u>	0.26	0.087	0.009	<0.002	6	12	12	0.014	1.7	2.6
0.20	0.31	0.008	<u>0.045</u>	20.5	<u>0.029</u>	0.29	0.103	0.011	<0.002	32	80	80	0.008	1.8	2
0.26	0.39	0.012	<u>0.042</u>	18.4	<u>0.025</u>	0.28	0.097	0.008	<0.002	<u>150</u>	30	30	0.008	1.1	1.4
0.25	0.48	0.023	<u>0.057</u>	19.2	<u>0.025</u>	0.27	0.096	0.012	0.002	8	44	30	0.009	0.7	1.7
0.19	0.48	0.028	<u>0.049</u>	22.1	<u>0.025</u>	<u>0.31</u>	0.130	0.014	0.002	24	26	20	0.003	1.3	1.8
0.22	0.48	0.014	<u>0.059</u>	22.3	<u>0.028</u>	<u>0.33</u>	0.124	0.009	<0.002	10	80	60	<u>0.025</u>	1.4	2.2
0.26	<u>0.60</u>	0.029	<u>0.058</u>	18.9	<u>0.023</u>	0.26	0.094	0.015	0.003	<u>110</u>	240	140	0.011	1.8	2.3
0.21	<u>0.64</u>	0.031	<u>0.059</u>	15.6	<u>0.018</u>	0.22	0.075	0.019	0.004	<u>80</u>	360	<u>360</u>	0.007	1.8	2.7
0.23	<u>0.51</u>	0.013	<u>0.044</u>	16.9	<u>0.018</u>	0.21	0.070	0.012	0.003	<1	31	25	<u>0.023</u>	1.3	2.4
0.26	0.41	0.006	0.036	15.6	<u>0.022</u>	0.23	0.078	0.010	0.002	30	90	90	0.010	1.3	1.7
0.23	0.39	0.009	<u>0.065</u>	18.0	<u>0.030</u>	0.25	0.092	0.010	<0.002	4	29	29	0.008	1.3	1.9
0.24	0.31	<0.004	0.036	17.0	<u>0.030</u>	0.25	0.087	0.009	<0.002	17	80	80	0.018	1.1	1.8
0.28	0.40	0.012	<u>0.054</u>	16.8	<u>0.028</u>	0.26	0.084	0.010	<0.002	4	190	30	<u>0.021</u>	2	2.9
0.20	0.31	0.023	<u>0.058</u>	20.6	<u>0.030</u>	0.28	0.101	0.012	<0.002	55	250	220	0.011	1.7	2.6
0.27	0.43	0.023	<u>0.052</u>	18.5	<u>0.024</u>	0.27	0.096	0.008	<0.002	47	390	180	0.008	1.3	1.6
0.21	0.46	0.031	<u>0.047</u>	19.3	<u>0.024</u>	0.25	0.093	0.013	0.003	<u>180</u>	270	180	0.009	1.8	1.7
0.22	<u>0.54</u>	0.043	<u>0.069</u>	22.2	<u>0.026</u>	<u>0.32</u>	0.128	0.014	0.003	<u>110</u>	140	110	0.003	1.4	2.1
0.22	0.49	0.032	<u>0.068</u>	22.0	<u>0.027</u>	<u>0.34</u>	0.124	0.009	<0.002	21	170	100	<u>0.026</u>	1.3	2.1
0.23	<u>0.59</u>	0.039	<u>0.065</u>	19.0	<u>0.024</u>	0.25	0.093	0.018	0.004	<u>250</u>	320	220	0.008	1.7	2.7
0.31	<u>0.78</u>	0.042	<u>0.074</u>	15.6	<u>0.017</u>	0.20	0.070	0.021	0.004	<u>120</u>	460	<u>460</u>	0.005	1.9	2.7
0.25	<u>0.54</u>	0.016	<u>0.050</u>	16.9	<u>0.019</u>	0.29	0.096	0.013	0.003	<u>110</u>	300	130	0.016	1.8	2.6
0.23	0.40	0.015	<u>0.046</u>	15.8	<u>0.021</u>	0.23	0.078	0.009	<0.002	<u>160</u>	430	<u>360</u>	0.012	1.6	2
0.21	0.39	0.026	<u>0.059</u>	18.0	<u>0.030</u>	0.24	0.091	0.011	<0.002	70	40	40	0.009	1.4	2.1
0.29	0.37	0.012	<u>0.051</u>	17.0	<u>0.029</u>	0.24	0.085	0.009	<0.002	16	50	50	0.019	1.4	2
0.33	<u>0.54</u>	0.015	<u>0.062</u>	16.4	<u>0.021</u>	0.20	0.066	0.016	0.002	5	52	34	0.017	1.9	2.9
0.29	<u>0.50</u>	0.025	<u>0.087</u>	19.5	<u>0.023</u>	0.25	0.085	0.019	0.003	<u>220</u>	2300	<u>1900</u>	0.011	2.4	4.2
0.24	0.43	0.026	<u>0.060</u>	18.3	<u>0.022</u>	0.25	0.089	0.011	0.002	50	410	260	0.014	1.4	1.6
0.26	<u>0.56</u>	0.045	<u>0.061</u>	18.5	<u>0.020</u>	0.22	0.076	0.022	0.005	26	110	90	0.009	1.7	2.2
0.49	<u>0.91</u>	0.042	<u>0.077</u>	20.3	<u>0.019</u>	0.23	0.094	0.021	0.004	33	110	90	0.003	2	2.7
0.34	<u>0.79</u>	0.030	<u>0.075</u>	19.8	<u>0.020</u>	0.24	0.088	0.018	0.003	15	350	210	<u>0.022</u>	2.3	2.9
0.45	<u>1.35</u>	0.028	<u>0.089</u>	15.0	<u>0.012</u>	0.13	0.045	0.030	0.006	<u>80</u>	540	<u>390</u>	0.007	2.8	3.8
0.43	<u>1.43</u>	0.038	<u>0.099</u>	13.5	0.008	0.11	0.036	0.034	0.006	<u>120</u>	460	<u>460</u>	<0.003	2.5	4.1
0.27	<u>0.77</u>	0.021	<u>0.058</u>	15.9	<u>0.014</u>	0.23	0.076	0.019	0.004	<u>90</u>	130	130	0.012	1.9	2.7
0.34	<u>0.72</u>	0.022	<u>0.062</u>	15.2	<u>0.016</u>	0.16	0.053	0.019	0.004	<u>200</u>	1100	<u>900</u>	0.009	1.6	2.5
0.36	<u>0.71</u>	0.022	<u>0.081</u>	15.0	<u>0.018</u>	0.16	0.057	0.027	0.005	<u>160</u>	900	<u>700</u>	0.008	2.1	3.7
0.23	0.40	0.018	<u>0.068</u>	17.0	<u>0.023</u>	0.21	0.071	0.014	0.002	50	50	50	0.015	1.5	2.5

Note: < = less than value stated

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

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

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 = 681 m³/s (Flows from Mercer Bridge Recorder)

Waikato River @ Mercer Br

03/01/07	10:45 a.m.	229	-	-	15.3	7.6	<u>20.5</u>	10.1	112.0	2.3	<u>6.45</u>	99	0.090	0.087	< 0.01
08/02/07	11:50 a.m.	338	-	-	14.8	7.4	<u>22.1</u>	7.8	89.5	1.5	<u>29.5</u>	117	0.301	0.297	< 0.01
08/03/07	10:30 a.m.	252	-	-	16.3	7.8	<u>23.2</u>	8.6	100.6	1.1	3.14	131	0.154	0.152	< 0.01
04/04/07	11:15 a.m.	233	-	-	16.2	7.8	<u>20.9</u>	8.6	96.4	1.2	<u>6.48</u>	121	0.265	0.261	< 0.01
08/05/07	12:15 p.m.	223	-	-	17.4	7.5	<u>17.8</u>	8.6	88.7	0.9	<u>6.98</u>	139	0.413	0.411	< 0.01
07/06/07	12:30 p.m.	321	-	-	17.2	7.7	<u>14.5</u>	9.6	94.8	0.7	<u>9.2</u>	128	0.455	0.451	< 0.01
05/07/07	11:30 a.m.	614	-	-	15.1	7.1	<u>12.7</u>	8.6	82.3	1.0	<u>25.30</u>	108	0.947	0.940	< 0.01
09/08/07	11:43 a.m.	823	-	-	14.0	7.5	<u>12.1</u>	8.7	80.5	0.7	<u>19.90</u>	112	1.130	1.120	0.04
04/09/07	12:00 p.m.	429	-	-	14.8	7.7	<u>13.0</u>	10.5	99.1	1.4	<u>7.80</u>	121	0.410	0.406	< 0.01
03/10/07	11:20 a.m.	404	-	-	15.1	7.7	13.3	9.5	91.3	1.0	<u>10</u>	116	0.298	0.291	< 0.01
08/11/07	11:15 a.m.	473	-	-	14.0	7.5	16.5	8.6	87.7	2.0	<u>30.00</u>	120	0.360	0.350	< 0.01
03/12/07	10:06 a.m.	224	-	-	16.0	7.7	19.3	9.2	99.8	1.8	<u>8.60</u>	120	0.091	0.089	< 0.01

1131-133

Waikato River @ Tuakau Br

03/01/07	11:40 a.m.	-	<u>0.5</u>	27.5	15.4	7.9	<u>21.3</u>	11.2	125.4	2.1	4.97	100	0.068	0.065	< 0.01
08/02/07	12:25 p.m.	-	<u>0.3</u>	30.0	14.6	7.4	<u>22.8</u>	8.3	96.3	1.3	<u>21.5</u>	114	0.303	0.301	< 0.01
08/03/07	11:00 a.m.	-	<u>1.1</u>	32.5	16.3	7.9	<u>23.5</u>	9.5	111.2	1.3	4.69	120	0.120	0.118	< 0.01
04/04/07	11:40 a.m.	-	<u>0.7</u>	30.0	16.4	7.7	<u>21.2</u>	8.8	99.3	1.5	<u>6.23</u>	126	0.253	0.247	< 0.01
08/05/07	12:45 p.m.	-	<u>0.9</u>	25.0	17.4	7.6	<u>18.5</u>	8.6	90.7	0.9	<u>7.38</u>	135	0.403	0.401	< 0.01
07/06/07	1:00 p.m.	-	<u>0.4</u>	30.0	17.1	7.7	<u>14.5</u>	9.8	96.8	0.6	<u>9.5</u>	127	0.440	0.437	0.01
05/07/07	12:00 p.m.	-	<u>0.3</u>	27.5	15.3	7.0	<u>12.5</u>	8.4	80.2	1.1	<u>24.4</u>	118	0.998	0.989	< 0.01
09/08/07	12:09 p.m.	-	<u>0.4</u>	27.5	14.0	7.2	<u>12.4</u>	8.4	<u>78.3</u>	0.8	<u>20.00</u>	107	1.110	1.100	0.03
04/09/07	12:35 p.m.	-	<u>0.4</u>	30.0	15.2	7.6	<u>13.3</u>	10.0	94.6	1.5	<u>13.2</u>	119	0.433	0.429	< 0.01
03/10/07	12:00 p.m.	-	<u>0.6</u>	30.0	15.2	7.7	13.9	9.5	92.3	1.0	<u>11.2</u>	118	0.267	0.259	< 0.01
08/11/07	11:55 a.m.	-	<u>0.2</u>	27.5	13.0	7.5	17.0	8.1	83.4	0.9	<u>38.0</u>	110	0.400	0.390	0.01
03/12/07	10:38 a.m.	-	<u>0.4</u>	27.5	16.0	7.8	<u>21.5</u>	9.8	111.3	2.1	<u>17.00</u>	120	0.064	0.061	< 0.01

Note: < = less than value stated
UD = upper decile flow (period 1988-2007 inclusive)

* New Zealand Standard Time

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

() 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		

0.37	0.46	0.005	<u>0.066</u>	16.9	<u>0.023</u>	0.21	0.071	0.015	0.002	2	12	12	<u>0.030</u>	2.1	3.7
0.40	<u>0.70</u>	0.026	<u>0.105</u>	18.1	<u>0.019</u>	0.19	0.066	0.034	0.006	<u>430</u>	800	<u>800</u>	0.014	3.1	4.8
0.25	0.40	0.017	<u>0.062</u>	18.6	<u>0.021</u>	0.25	0.090	0.012	0.002	31	170	60	0.019	1.4	1.8
0.32	<u>0.59</u>	0.009	<u>0.065</u>	19.1	<u>0.018</u>	0.21	0.070	0.023	0.004	17	170	100	<u>0.024</u>	2.2	3
0.34	<u>0.75</u>	0.026	<u>0.075</u>	20.7	<u>0.017</u>	0.22	0.085	0.028	0.006	<u>120</u>	220	110	0.005	2.3	3.5
0.38	<u>0.84</u>	0.030	<u>0.084</u>	20.7	<u>0.021</u>	0.25	0.094	0.022	0.003	9	250	250	<u>0.025</u>	2.6	4
0.60	<u>1.55</u>	0.019	<u>0.098</u>	16.2	0.009	0.12	0.039	0.041	0.007	< 10	620	<u>450</u>	0.008	3.5	5
0.61	<u>1.74</u>	0.044	<u>0.112</u>	14.9	0.009	0.12	0.039	0.046	0.008	<u>130</u>	700	<u>610</u>	0.003	3.3	5.4
0.31	<u>0.72</u>	0.022	<u>0.074</u>	16.8	<u>0.015</u>	0.26	0.081	0.020	0.004	< 10	40	40	<u>0.031</u>	2.2	3.6
0.43	<u>0.73</u>	0.017	<u>0.071</u>	16.0	<u>0.017</u>	0.20	0.060	0.022	0.005	<u>240</u>	1200	<u>900</u>	0.014	1.8	3.1
0.38	<u>0.74</u>	0.024	<u>0.100</u>	14.0	<u>0.017</u>	0.16	0.054	0.029	0.005	<u>340</u>	1400	<u>1300</u>	0.008	2.1	3.7
0.32	0.41	0.009	<u>0.067</u>	17.0	<u>0.022</u>	0.21	0.069	0.018	0.003	< 1	20	20	<u>0.031</u>	1.7	3.4
0.34	0.41	0.005	<u>0.057</u>	17.2	<u>0.021</u>	0.22	0.070	0.017	0.003	62	25	21	<u>0.029</u>	2.2	3.7
0.35	<u>0.65</u>	0.026	<u>0.084</u>	17.4	<u>0.017</u>	0.18	0.066	0.032	0.006	<u>440</u>	1200	<u>1200</u>	0.014	3.3	4.3
0.29	0.41	0.014	<u>0.063</u>	18.9	<u>0.023</u>	0.26	0.092	0.010	< 0.002	11	110	80	<u>0.024</u>	1.2	1.9
0.36	<u>0.61</u>	0.008	<u>0.062</u>	19.2	<u>0.018</u>	0.20	0.070	0.027	0.005	< 1	90	50	<u>0.026</u>	2.4	2.8
0.37	<u>0.77</u>	0.022	<u>0.081</u>	20.7	<u>0.017</u>	0.22	0.084	0.028	0.006	8	180	50	0.011	2.2	3.5
0.33	<u>0.77</u>	0.027	<u>0.083</u>	20.4	<u>0.021</u>	0.24	0.088	0.024	0.004	21	380	<u>310</u>	<u>0.026</u>	3.1	3.8
0.55	<u>1.55</u>	0.021	<u>0.100</u>	17.0	<u>0.011</u>	0.14	0.044	0.044	0.008	<u>500</u>	620	<u>440</u>	0.013	3.8	5.8
0.51	<u>1.62</u>	0.039	<u>0.104</u>	15.2	0.009	0.12	0.038	0.051	0.010	<u>130</u>	470	<u>360</u>	0.003	3.7	5.7
0.40	<u>0.83</u>	0.016	<u>0.086</u>	17.1	<u>0.014</u>	0.24	0.074	0.029	0.006	15	50	50	<u>0.024</u>	2.8	4.8
0.32	<u>0.59</u>	0.013	<u>0.072</u>	16.0	<u>0.017</u>	0.20	0.062	0.023	0.004	<u>100</u>	470	<u>380</u>	0.017	1.8	3
0.38	<u>0.78</u>	0.021	<u>0.110</u>	14.0	<u>0.014</u>	0.13	0.047	0.037	0.007	<u>230</u>	1600	<u>1200</u>	0.011	2.5	4
0.52	<u>0.58</u>	0.010	<u>0.100</u>	17.0	<u>0.026</u>	0.21	0.070	0.016	0.003	20	70	70	<u>0.026</u>	1.7	3.5

Note: < = less than value stated

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

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

References

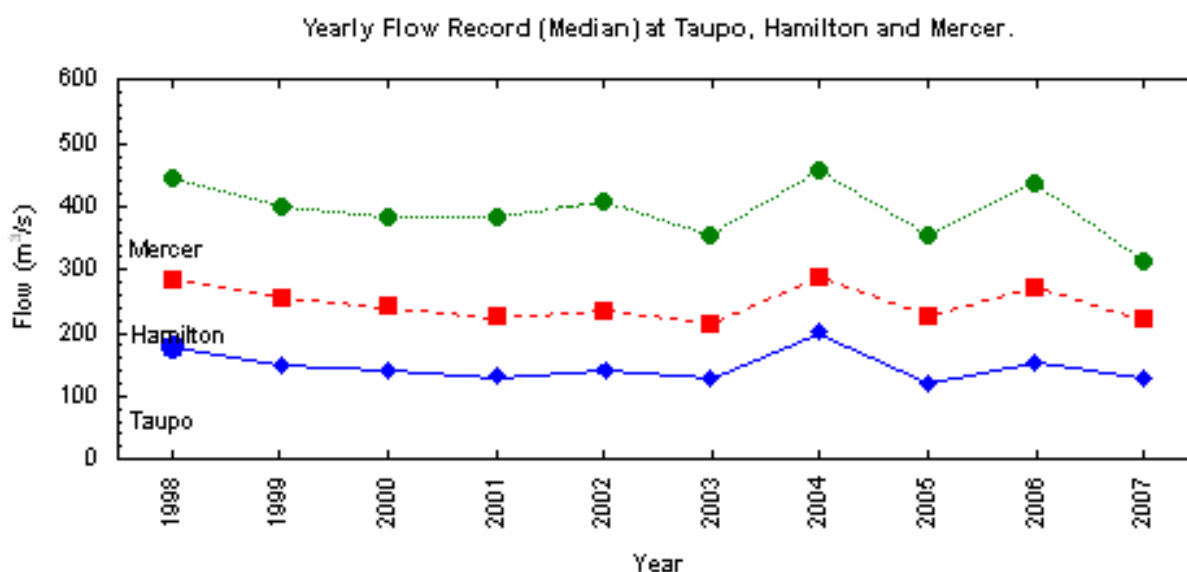
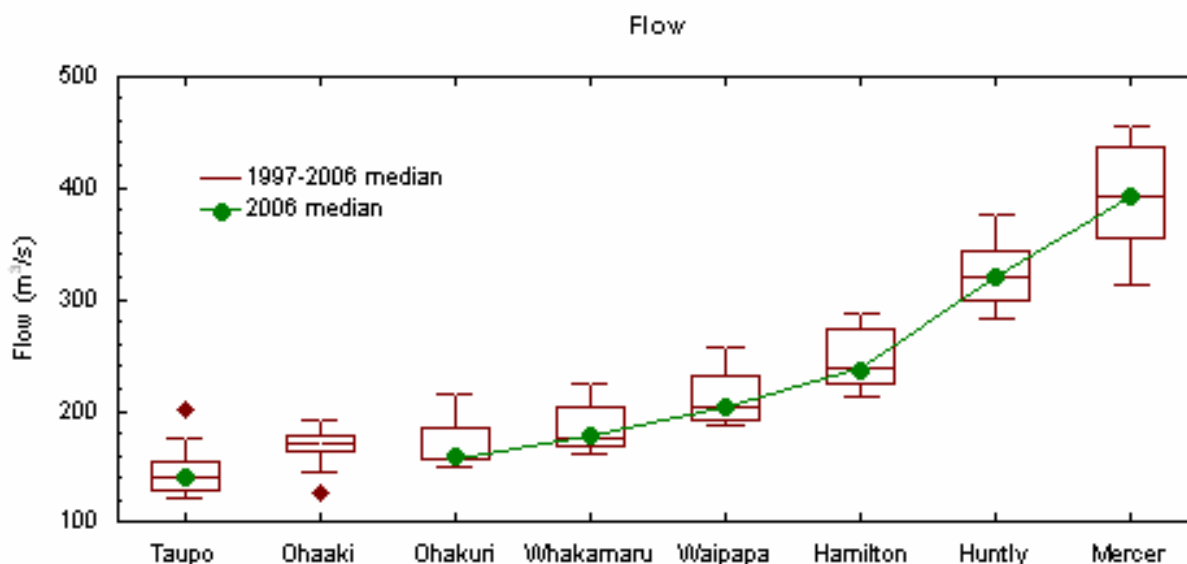
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Appendix I: Flow Information

Median Flows of the Waikato River and Main Tributaries

Location	DISTANCE km	FLOW RATE* (m ³ /s)										10 YEAR Median
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	
Taupo	4.2	177	148	139	130	141	127	200	121	154	128	140
Ohakuri	75.8	187	157	158	150	164	157	214	152	184	157	158
Whakamaru	105.0	204	174	168	161	183	168	224	175	208	178	177
Waipapa	126.1	232	205	196	186	211	192	256	200	237	190	203
Hamilton	211.5	283	257	241	225	234	213	288	226	273	220	238
Huntly	246.5	364	327	314	299	328	315	376	290	343	282	321
Mercer	286.3	442	400	381	383	408	353	455	355	437	312	392
Waiotapu Stm	46.6	3.5	3.4	2.8	3.2	2.8	2.6	3.7	3.6	3.8	2.9	3.3
Waipa River	232.7	66	55	52	62	73	61	87	56	61	39	61

*Rating curve errors mean estimates of flow are $\pm 8\%$

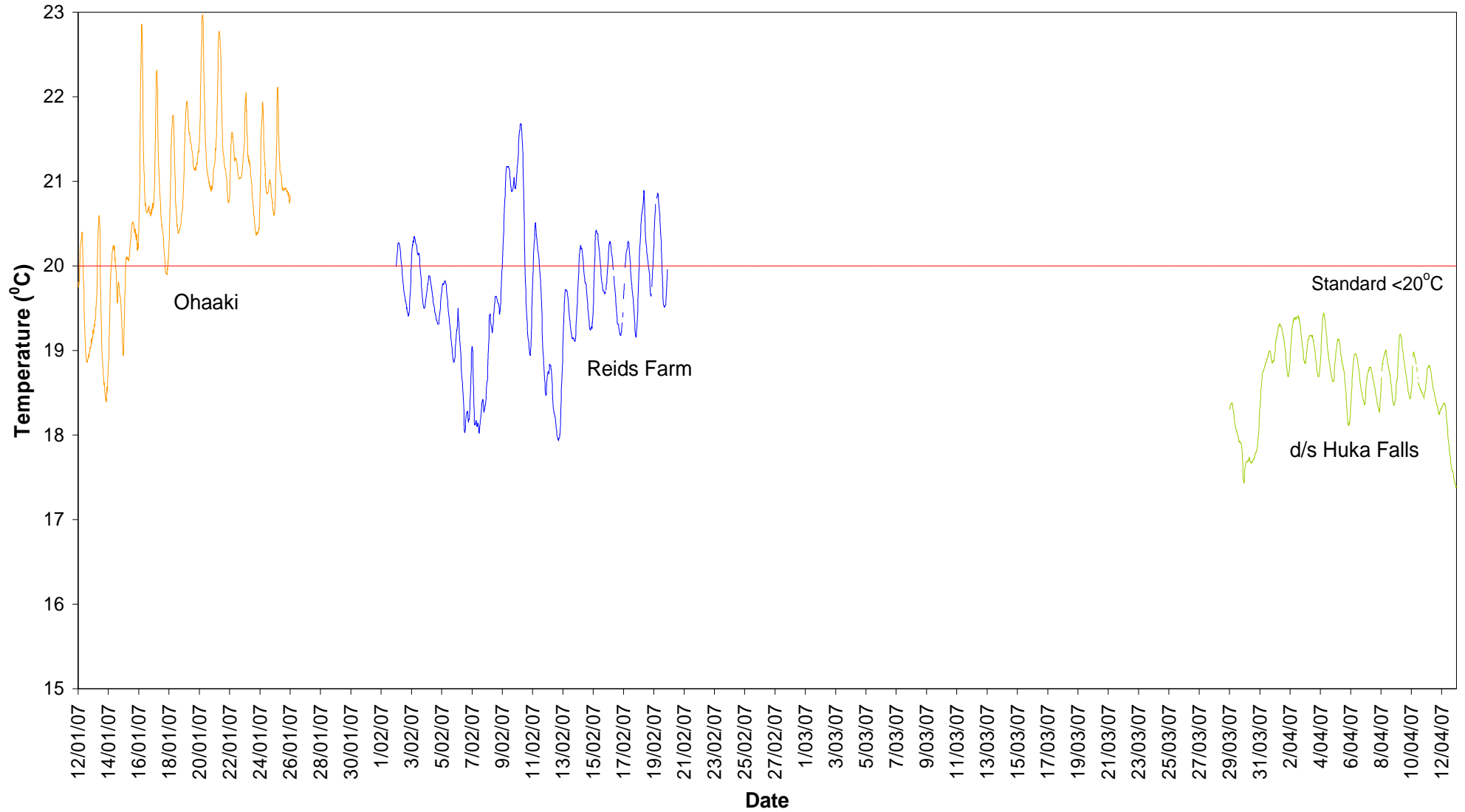


Appendix II

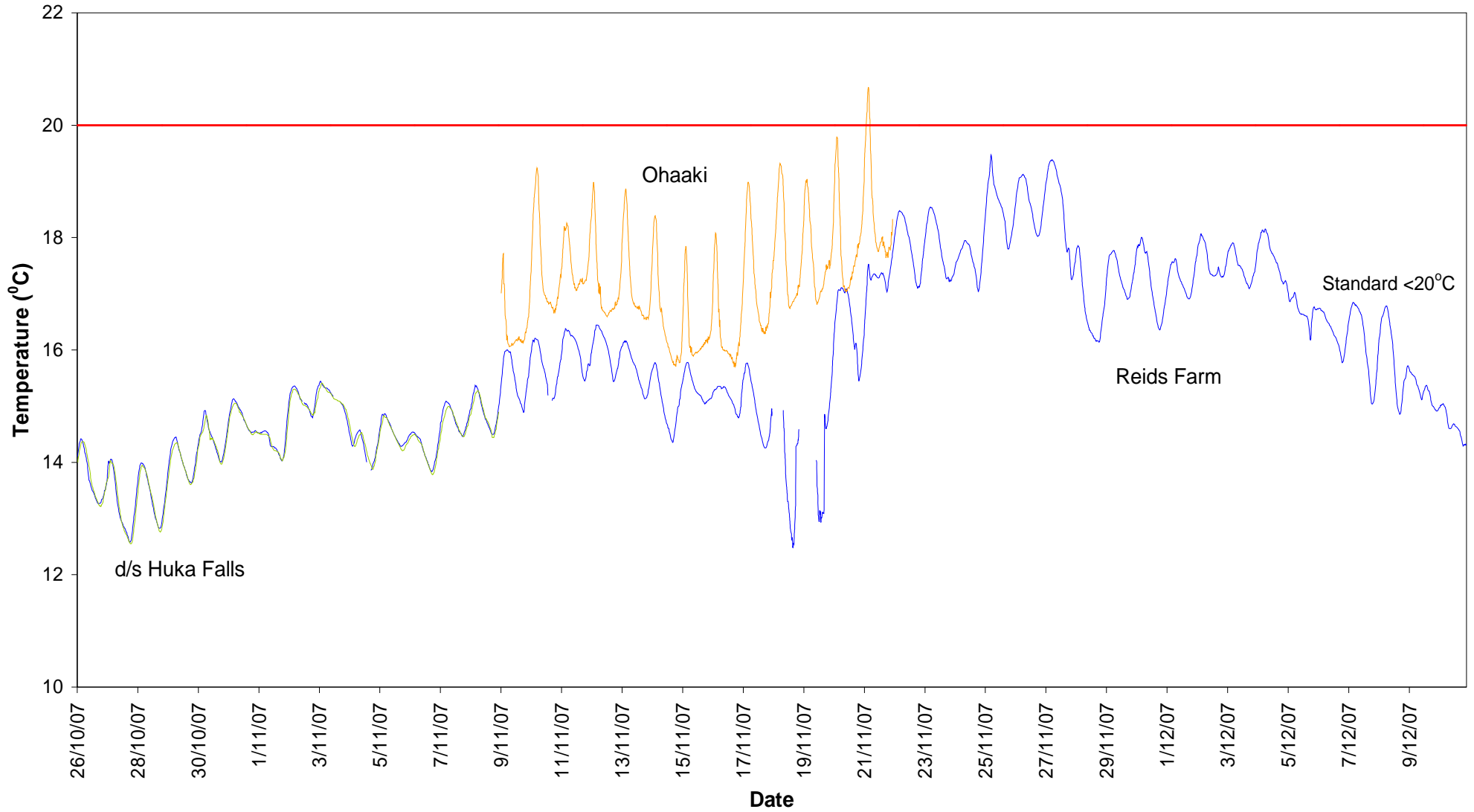
Datasonde Deployments

Diurnal variation of Some Water Quality Parameters

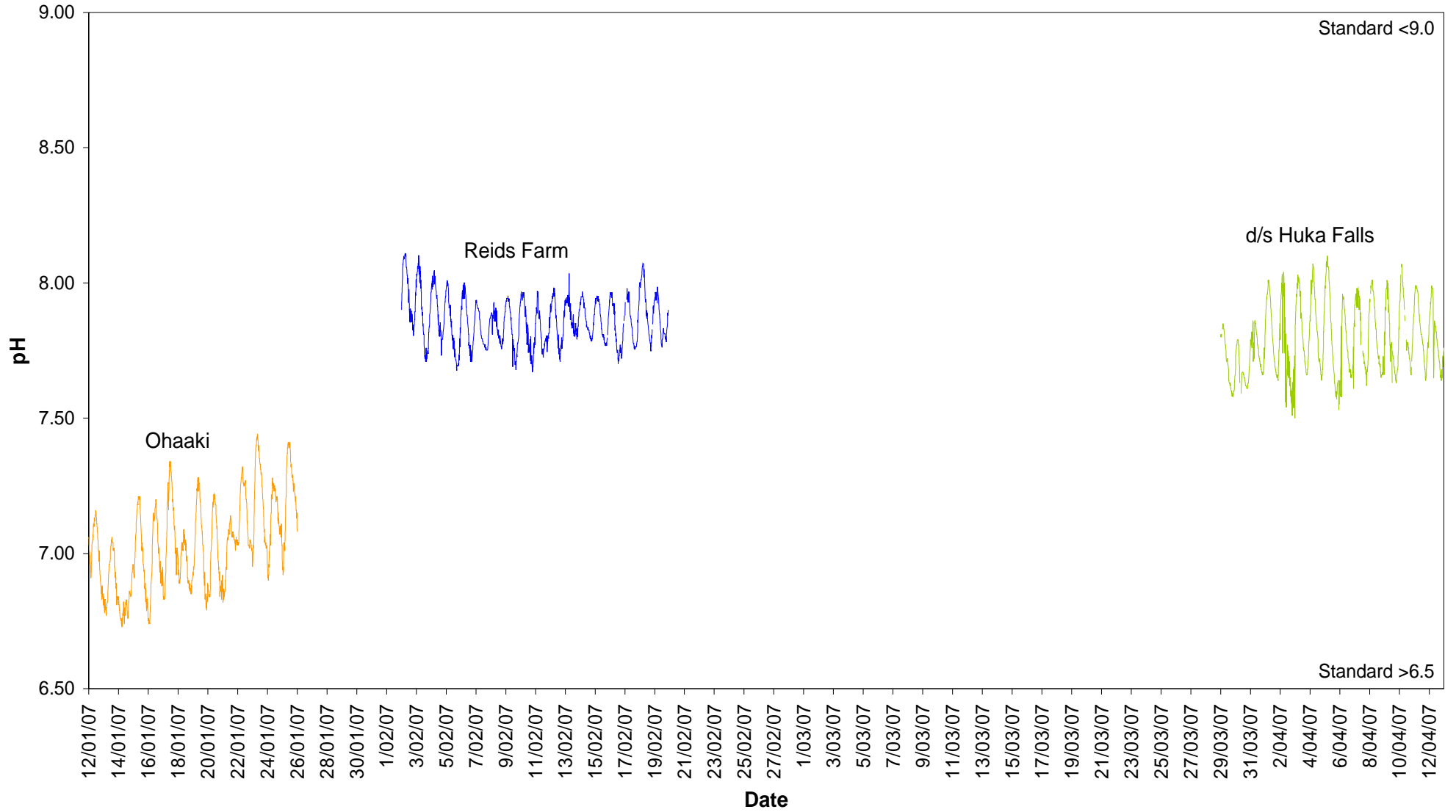
Temperature: Upper Waikato (Jan - April)



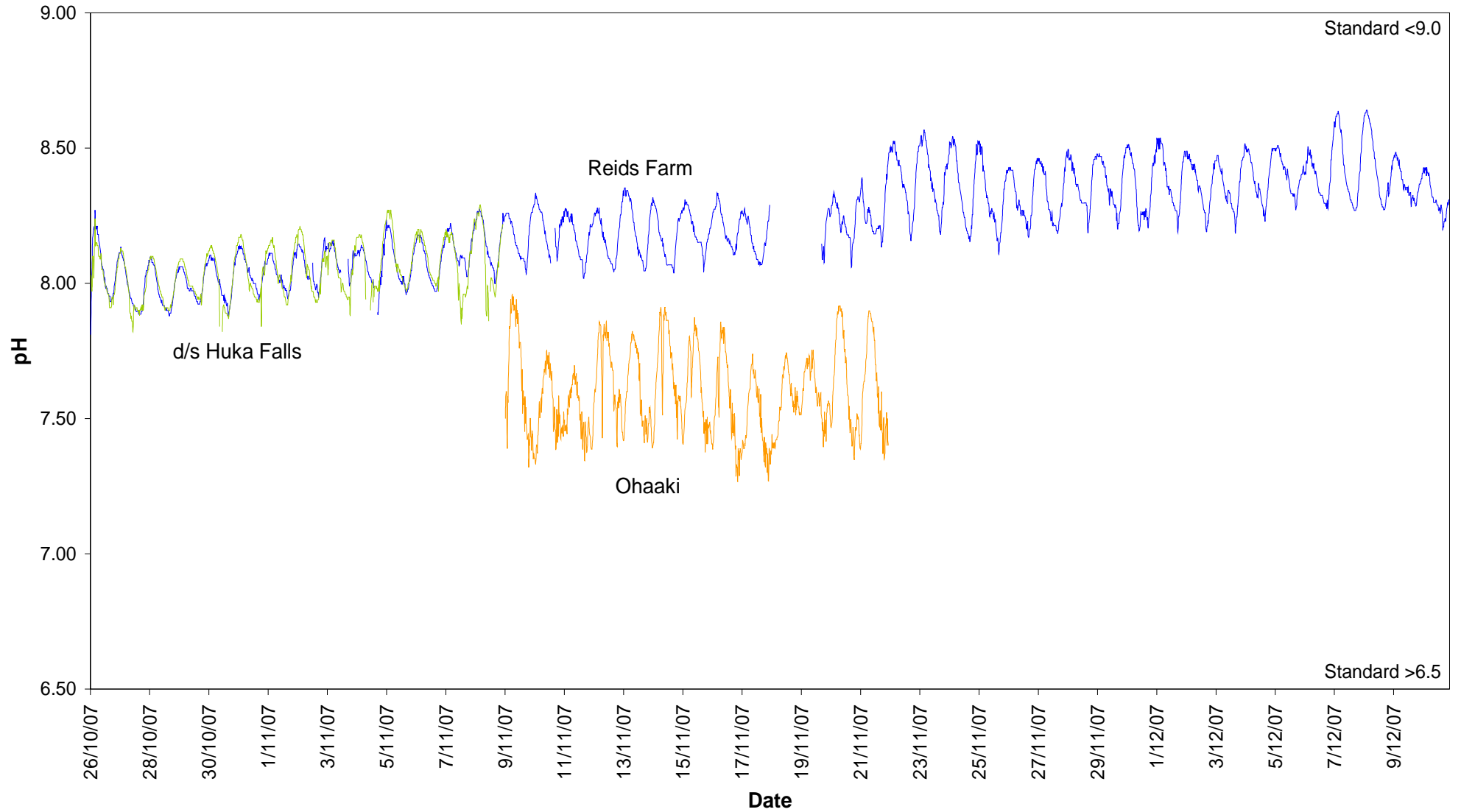
Temperature: Upper Waikato (Oct - Dec)



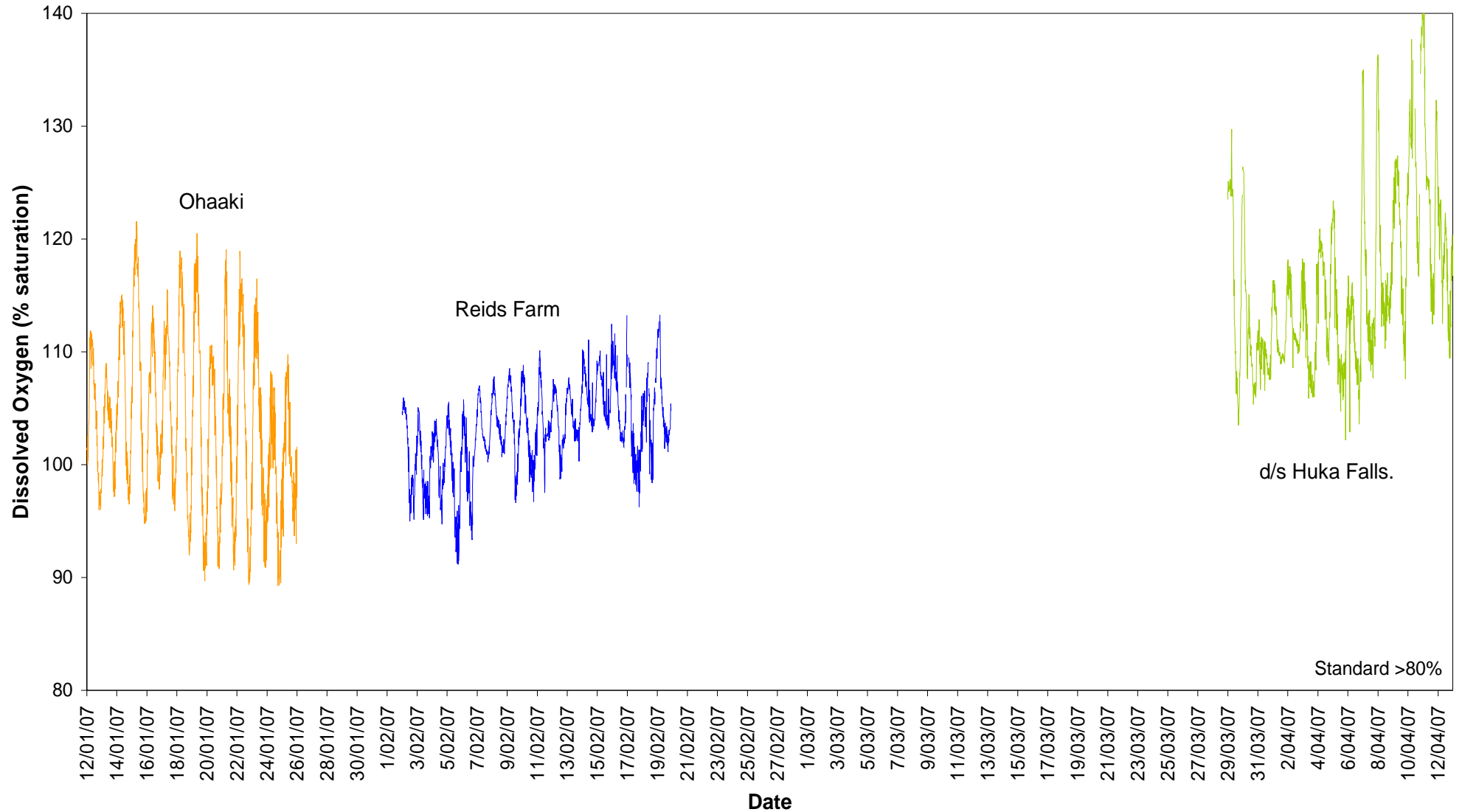
pH: Upper Waikato (March - April)



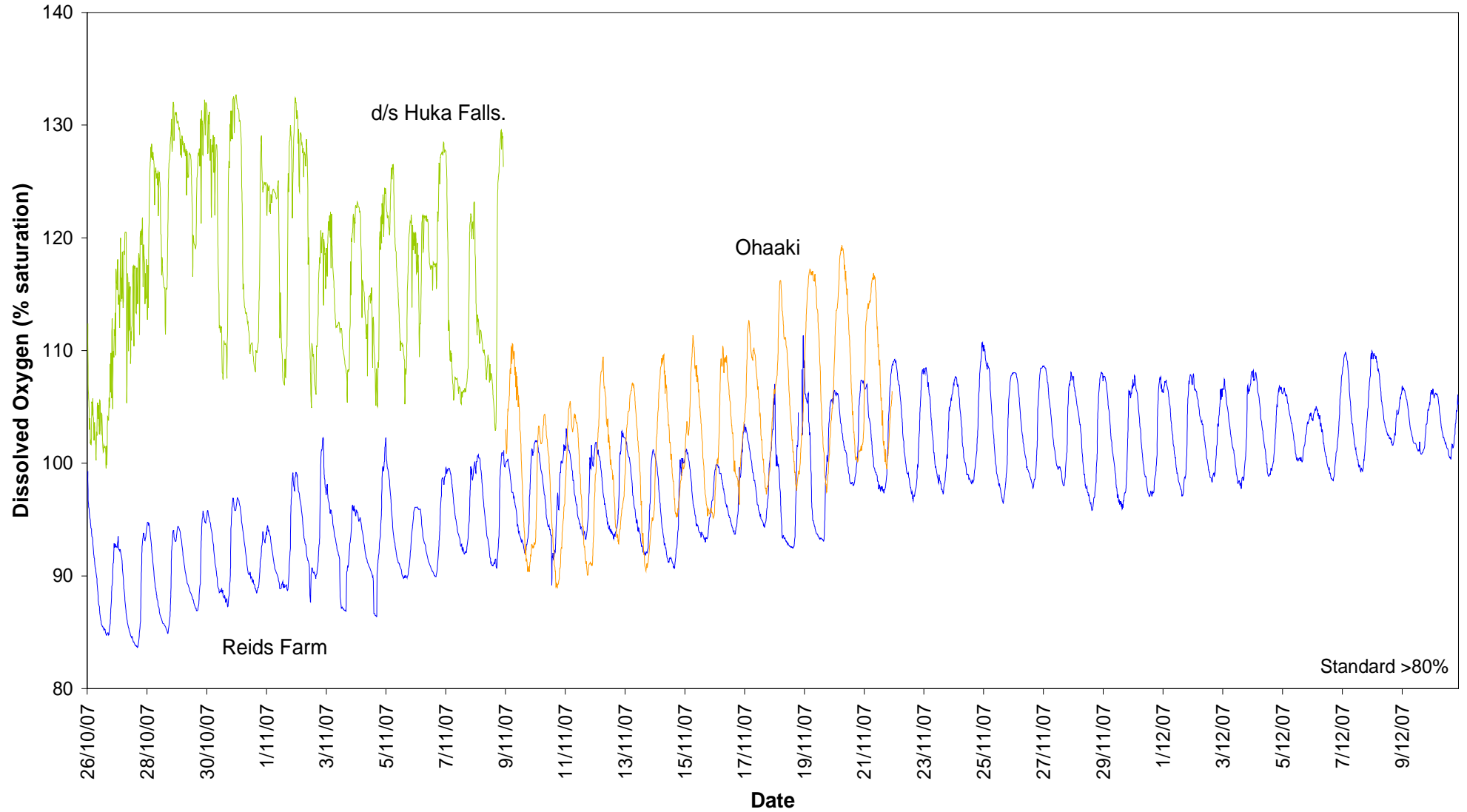
pH: Upper Waikato (Oct - Dec)



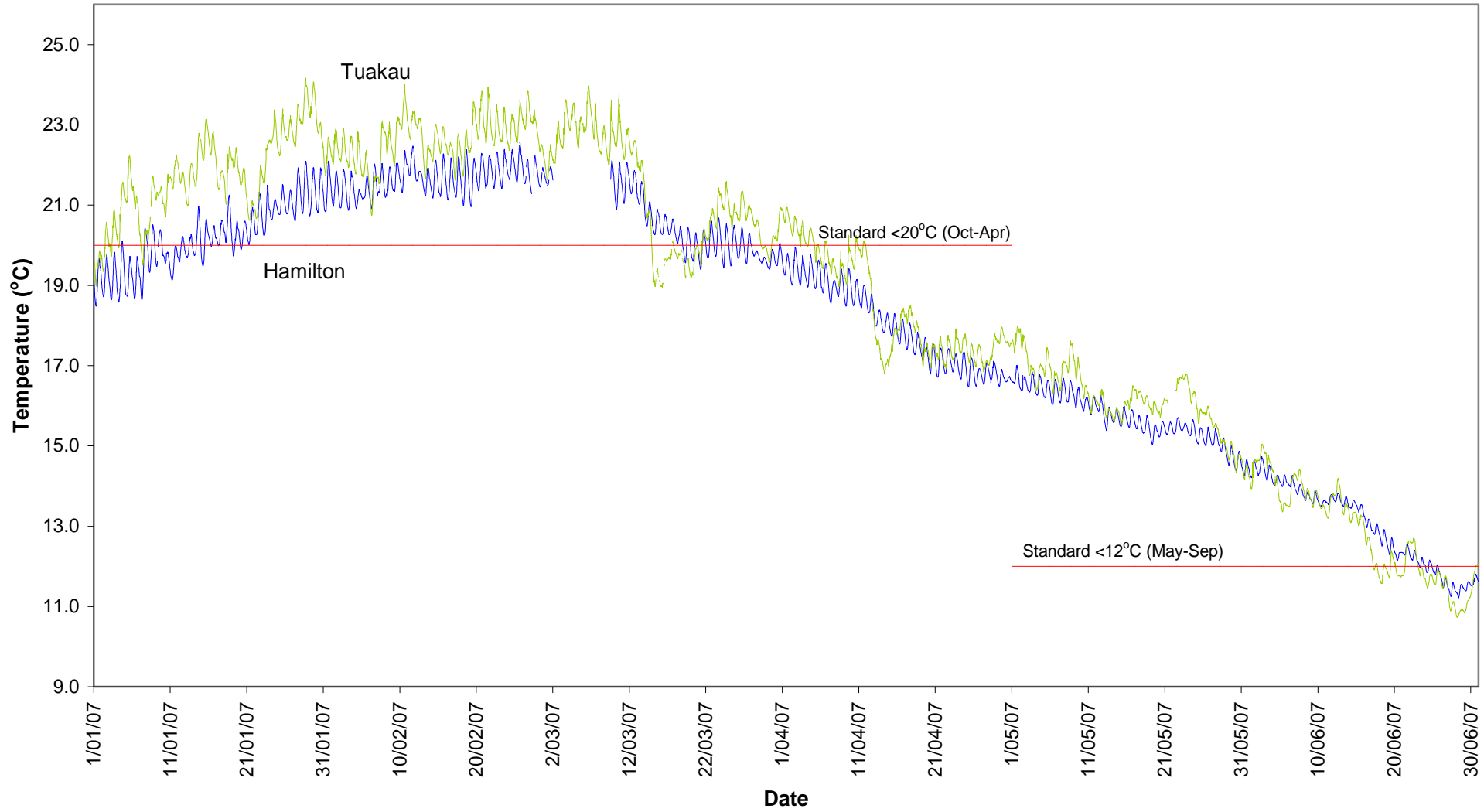
Dissolved Oxygen, % saturation: Upper Waikato (March - April)



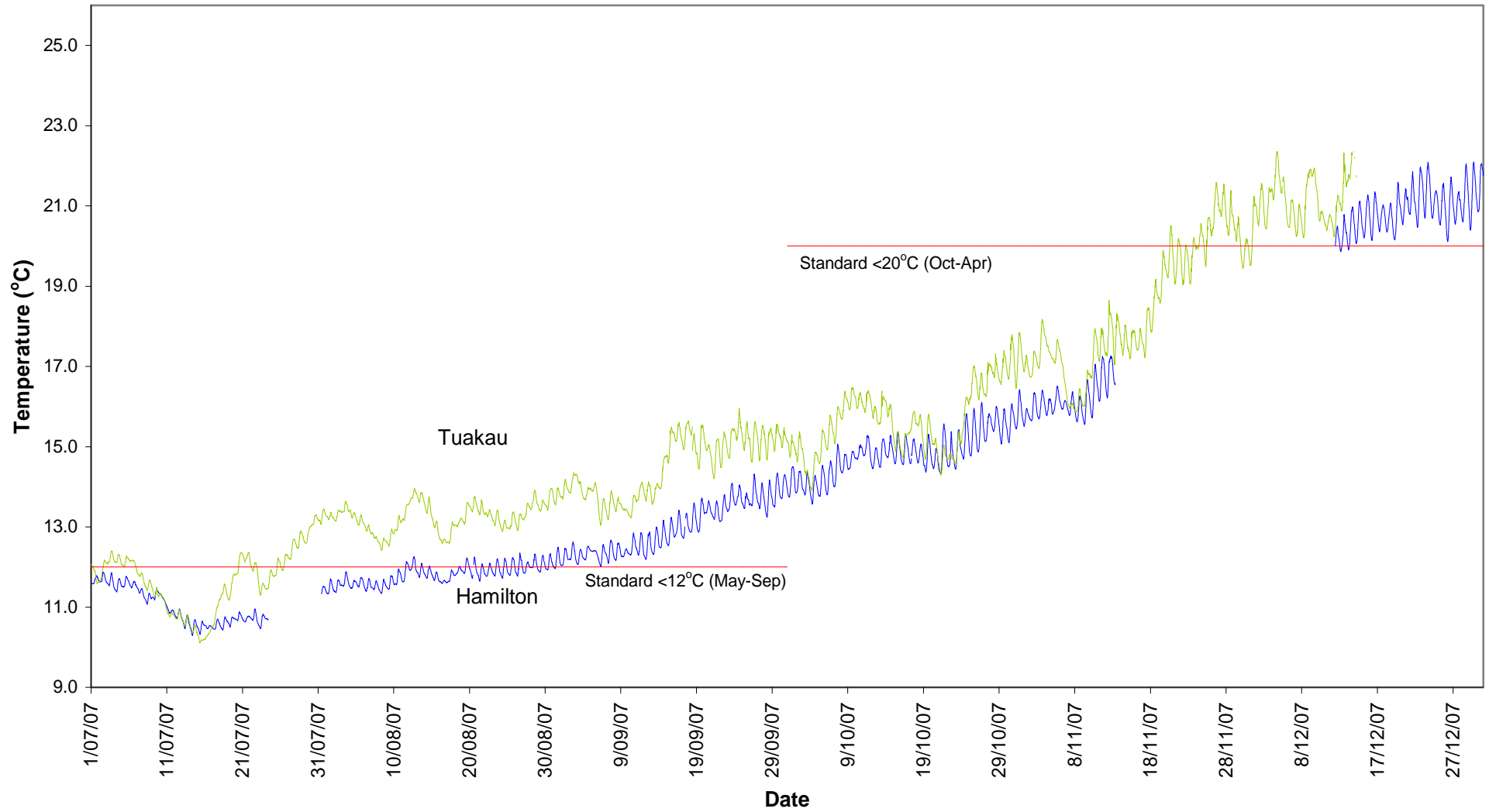
Dissolved Oxygen, % saturation: Upper Waikato (Oct-Dec)



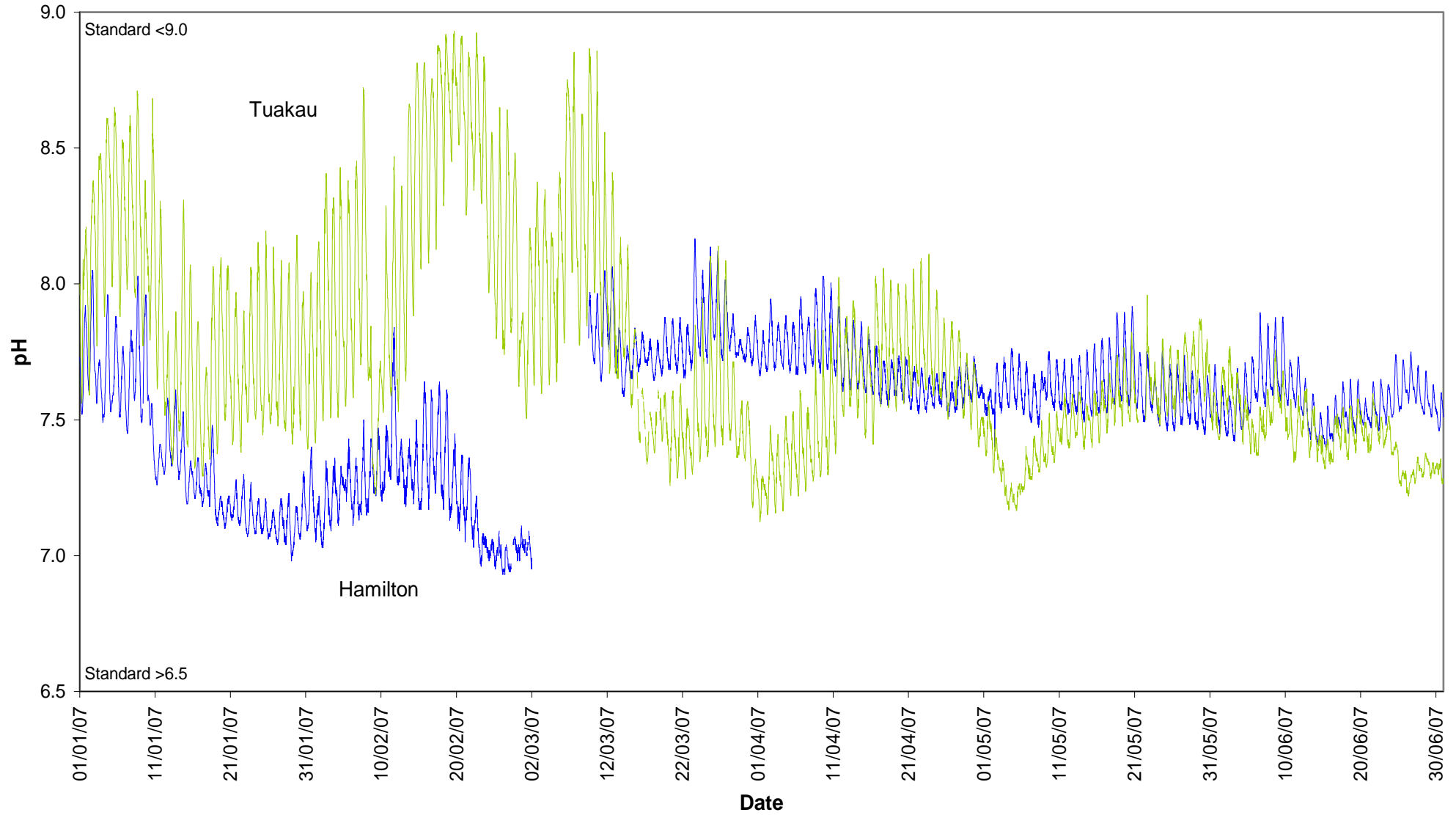
Temperature: Lower Waikato (January-June)



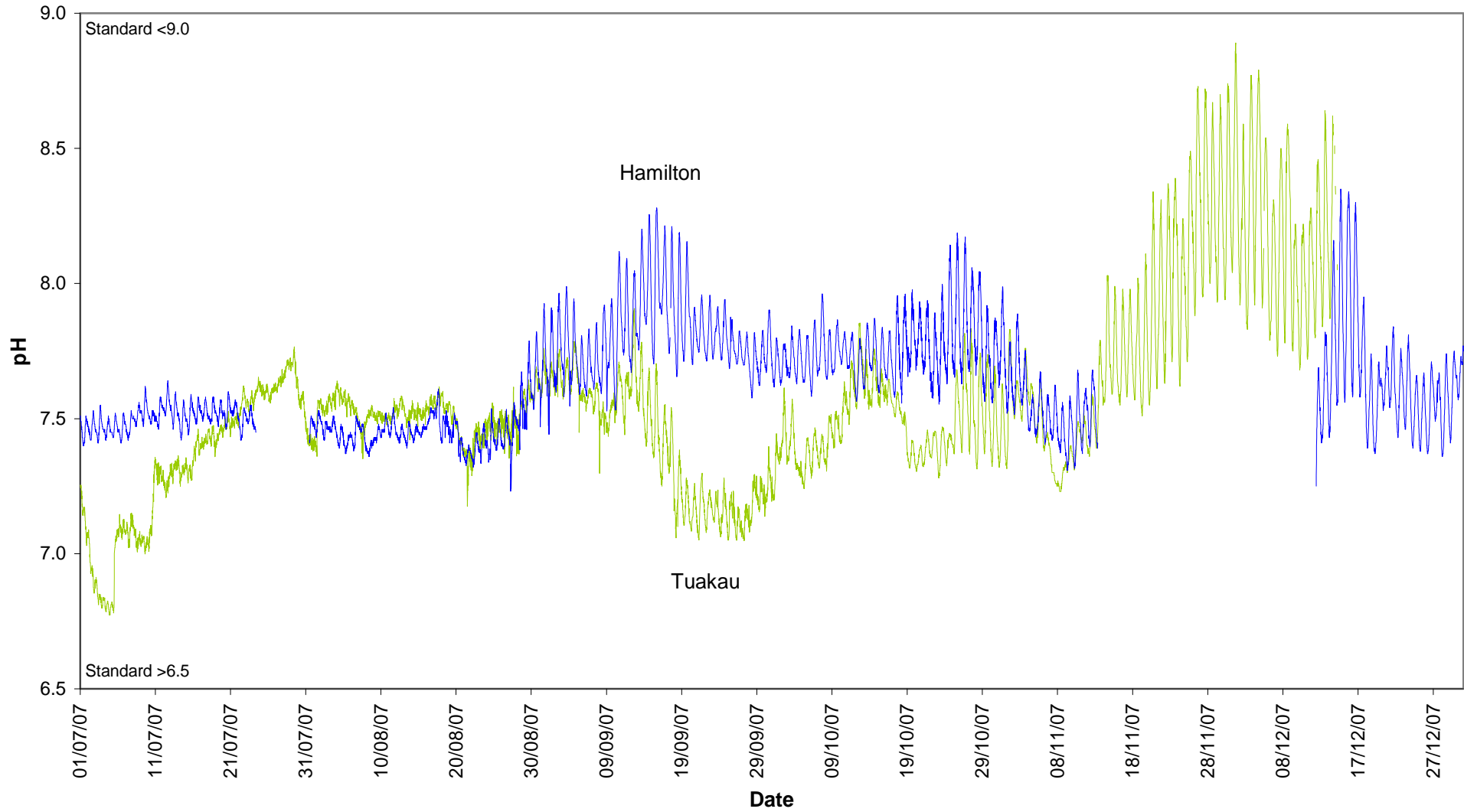
Temperature: Lower Waikato (July-December)



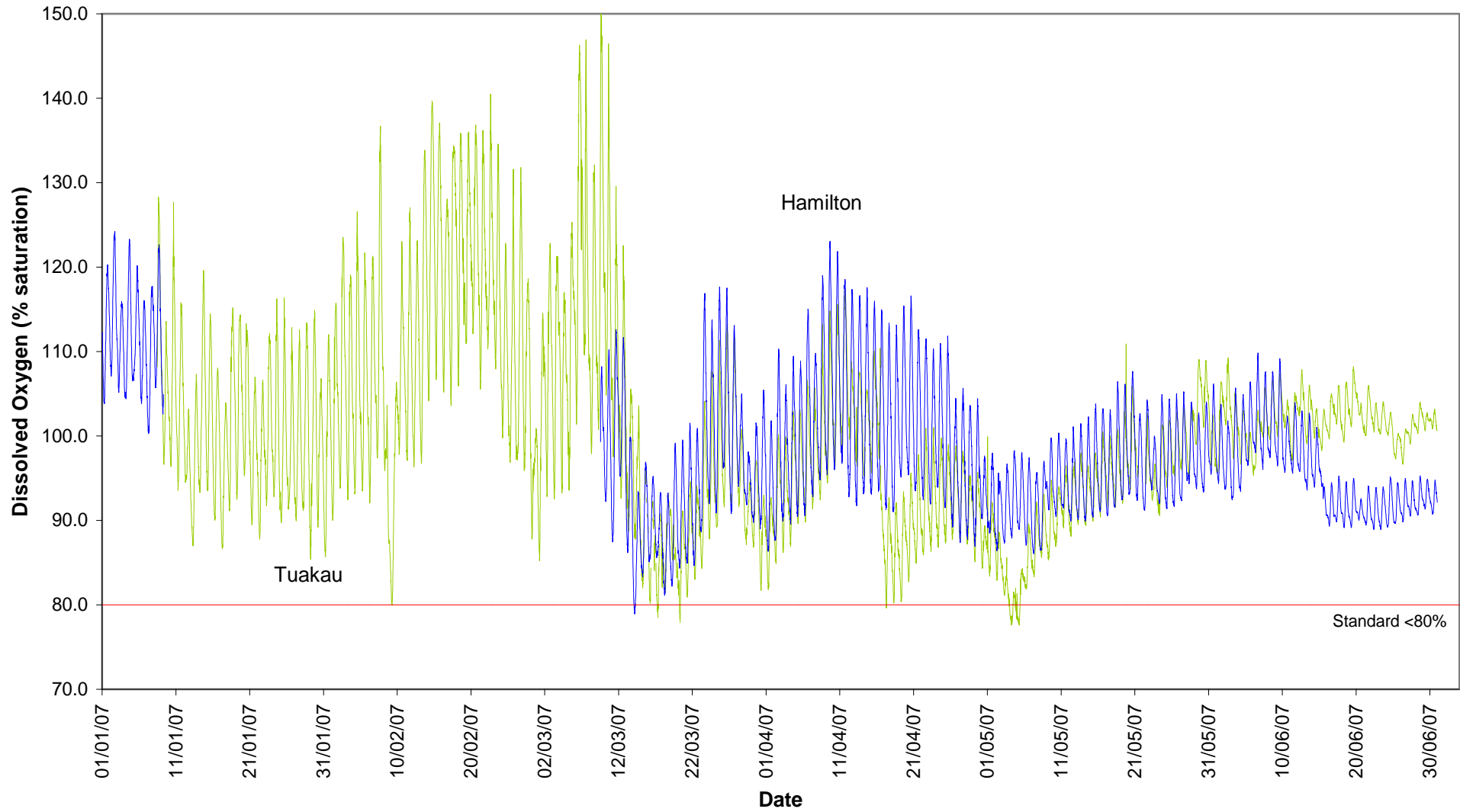
pH: Lower Waikato (January - June)



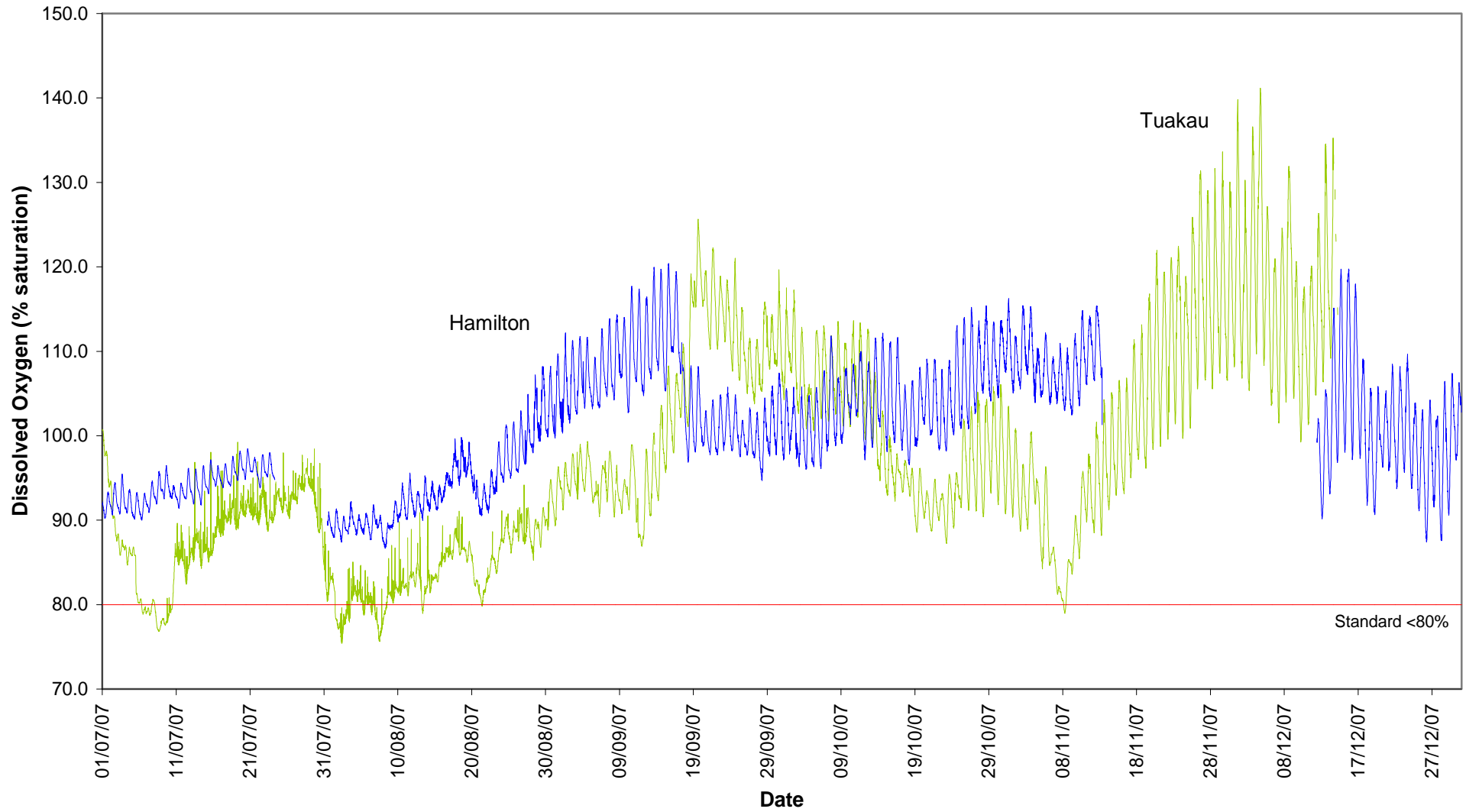
pH: Lower Waikato (July - December)



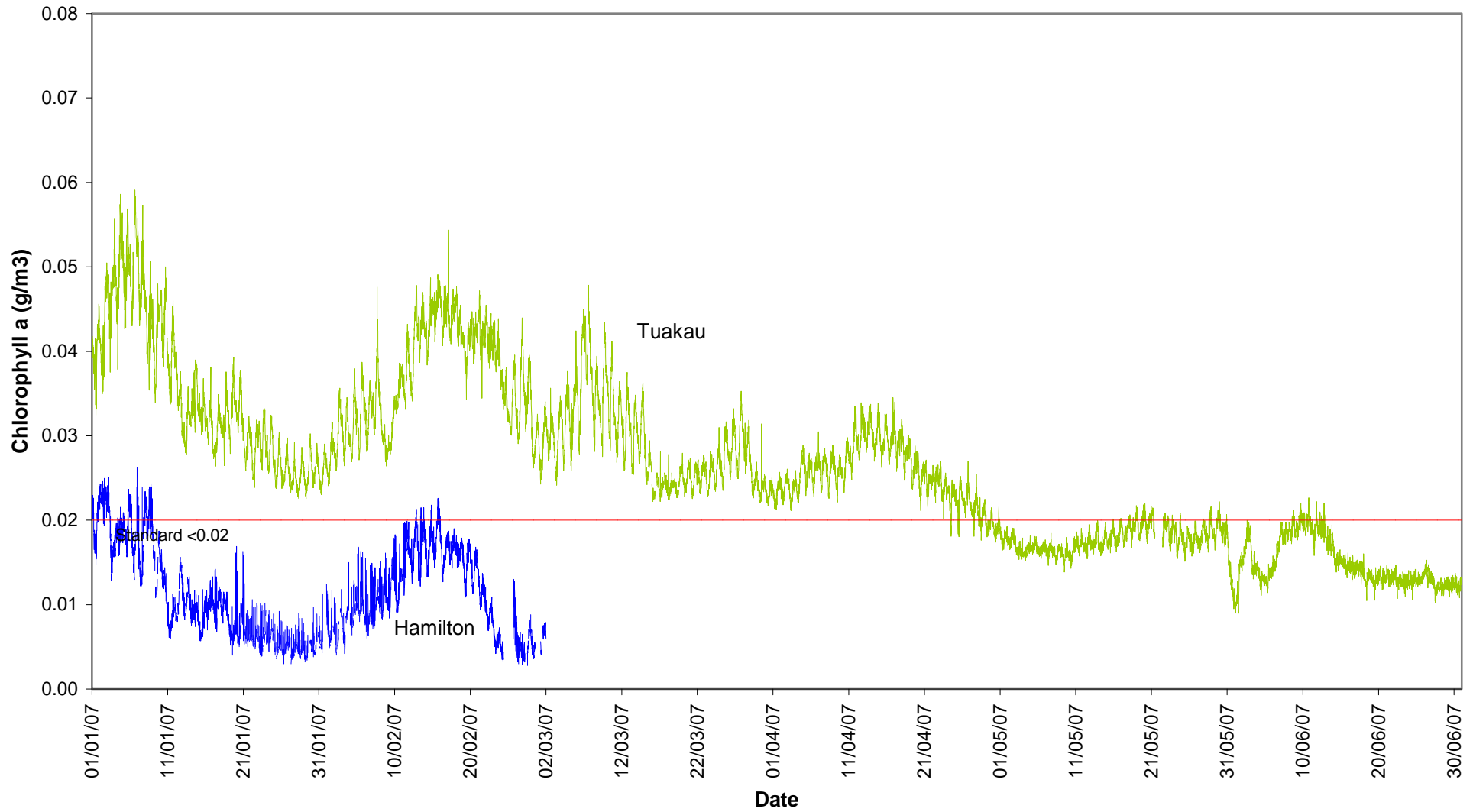
Dissolved Oxygen (% saturation): Lower Waikato (January - December)



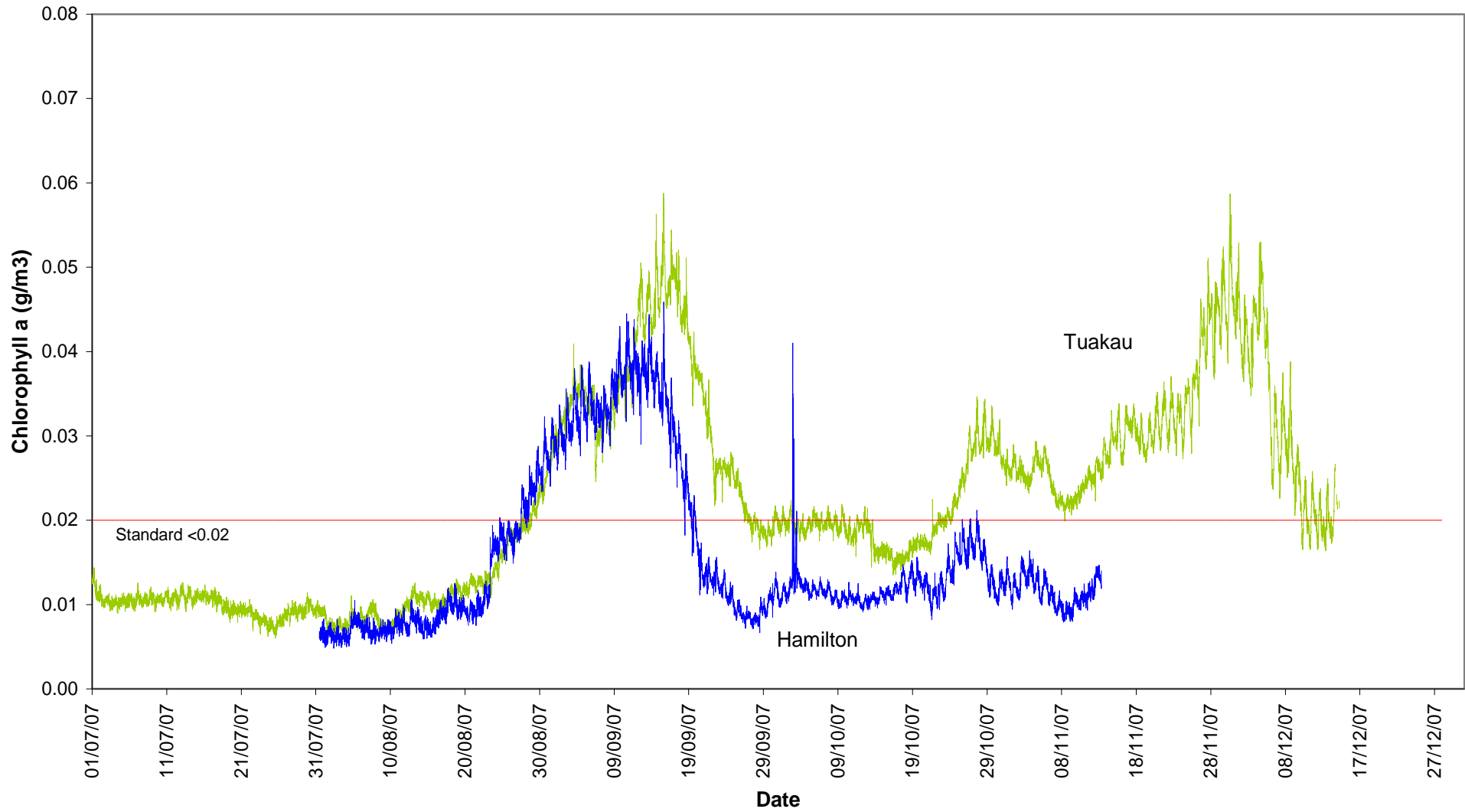
Dissolved Oxygen (% saturation): Lower Waikato (July - December)



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 a	<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).

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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