

# Waikato River water quality monitoring programme: data report 2011

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11 June 2012

Document #: 2202521

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Date 1 August 2012

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Date 7 August 2012

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**Note:** This report was originally published in August 2012 as Technical Report 2012/22. This updated edition added two new pages containing major ion summary statistics (pg's 15 and 16). These changes make no difference to the main report, but in the interests of data coverage we are re-releasing this publication.

# Acknowledgement

Thanks to Nicola Cowie, Naomi Crawford, Dale Hawe, Claire Littler, Kane Lynn, Paul Stanley and Ian Weir for their commitment and reliability in undertaking field measurements and collecting samples, and to Ian Buchanan for co-ordinating the laboratory analyses and assisting with co-ordination of the field aspects of sample collection. Thanks to Stuart Beard, Cara Graham and Paul Smith for helping out with data analysis.

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, Waikato Regional Council, Hamilton provided hydrological flow data for the two other sites.



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# 1 Introduction

## 1.1 Background

The year 2011 report follows the format of the previous data report (Beard, 2011).

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 the Council 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 21<sup>st</sup> since the re-design of the Waikato River Monitoring Programme (WARIMP) implemented in 1989. Copies of reports can be obtained via the Waikato Regional Council Internet site <http://www.waikatoregion.govt.nz/Publications/> or by contacting Waikato Regional Council (the Library) on 0800 800 401, e-mail: [inforeq@waikatoregion.govt.nz](mailto:inforeq@waikatoregion.govt.nz).

## 1.2 Report content

The report provides information on:

1. Routine monthly monitoring of water quality at 10 sites:
  - Year 2011 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 2011 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 2011.
  - Raw data for the 5-yearly trace metal survey (5 sites, quarterly sampling).
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 provide information on annual median flow at some locations for the previous 10 years.
  - Datasonde deployments
    - Plots of deployments undertaken during 2011 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 2011. 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 III). The more stringent criteria identify “excellent” water, and reflect expert opinion. Samples gathered in 2011 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 <sup>1</sup>	Satisfactory	Excellent
<b>Ecological health</b>			
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 <sup>3</sup> )	aquatic life (toxicity)	<0.88	<0.1
Temperature (°C)	fish (spawning)	<12 <20	<10 <16
Total phosphorus (g/m <sup>3</sup> )	nuisance plant growth	<0.04	<0.01
Total nitrogen (g/m <sup>3</sup> )	nuisance plant growth	<0.5	<0.1
<b>Human uses - recreation</b>			
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
<b>Human uses - water supply</b>			
Phytoplankton chlorophyll a (g/m <sup>3</sup> )	filter blockage	<0.02	<0.005
<b>Human uses - drinking water</b>			
Arsenic (g/m <sup>3</sup> )	human health (toxicity)	<0.01	–
Boron (g/m <sup>3</sup> )	human health (toxicity)	<1.4	–

<sup>1</sup> Refer to Appendix III for description of guideline and standards values used. These guidelines and standards are also defined on the Waikato Regional Council Internet site; [www.waikatoregion.govt.nz](http://www.waikatoregion.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  $\approx 2-6\%$ ) 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 illustrated in *Figure 1* and summarised in *Table 2*.

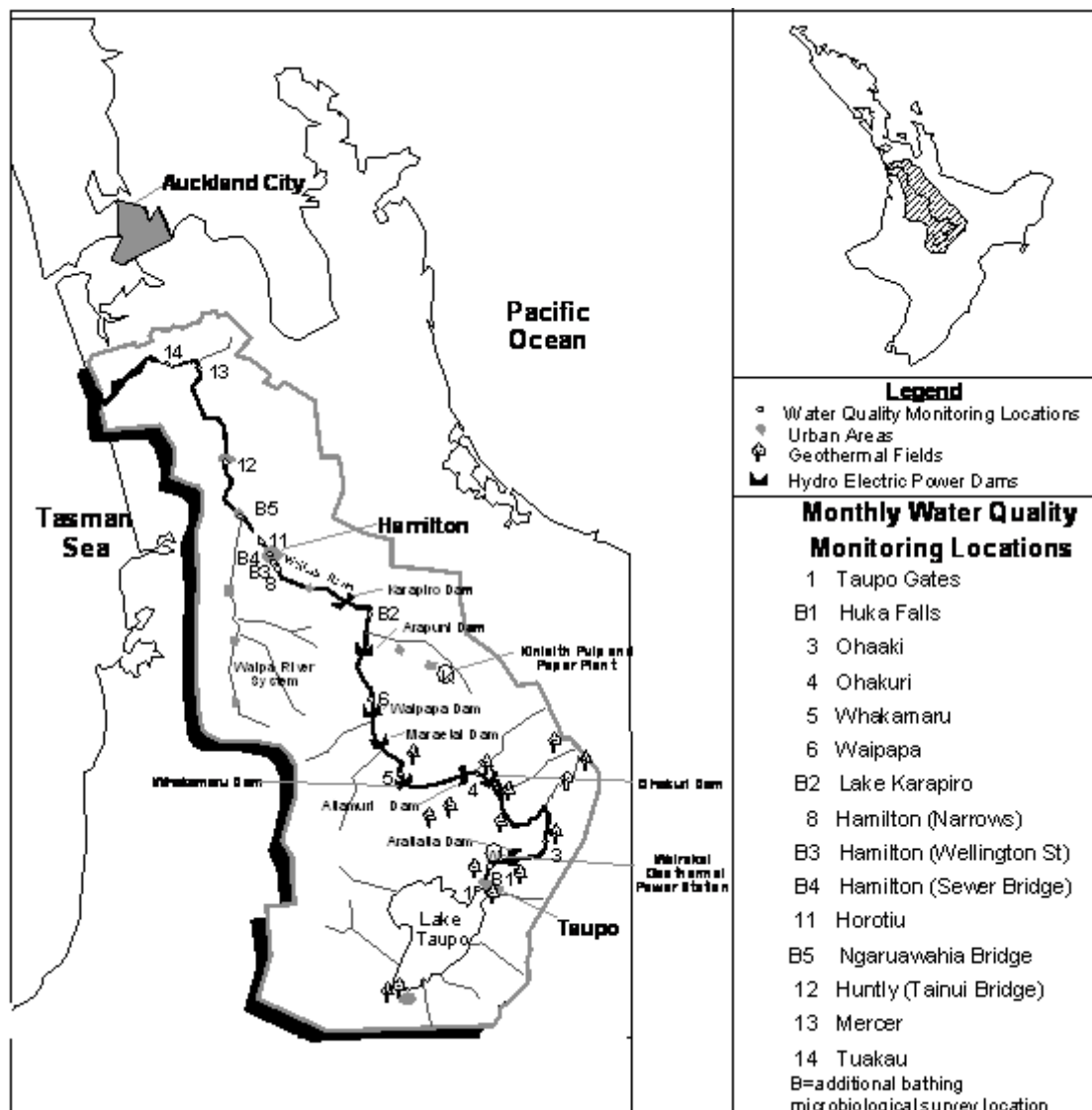


Figure 1: Waikato River water quality monitoring locations

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).

**Table 2: Routine sampling and bathing water monitoring locations**

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

<sup>1</sup> approximate distance (in kilometres) from Lake Taupo's outlet.

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

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

<sup>4</sup> boat ramp at Whakamaru Power Station.

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

<sup>6</sup> boat ramp accessed via Narrows Lane (true right bank)

<sup>7</sup> road bridge upstream of Waipa River confluence.

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

<sup>b</sup> bathing season intensive microbiological survey locations only – survey conducted over the 2010/11 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.

<sup>Y</sup> Logistic considerations mean field measurements are often made at slightly different locations from sample collection (e.g. sampling from bridges).

<sup>d</sup> Datasonde deployment sites.

## 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 III*).

## 2.4 Quality control, data storage and analysis

Quality control measures are undertaken in accordance with Waikato Regional Council's ISO 9001:2008 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 Waikato Regional Council's water quality archiving database (TimeStudio).

Data analysis was performed using Statistica (version 11.0) 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

Waikato Regional Council'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 Waikato Regional Council website:

<http://www.waikatoregion.govt.nz/Publications/Technical-Reports/>

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

<http://www.waikatoregion.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**

Section 3.1 contains the results and statistical summaries of the routine and 5 yearly trace metal monitoring of the Waikato River. The raw data is also included.

### **3.1 Waikato River Monitoring Programme**

#### **Routine Water Quality Monitoring**

##### **Summary Statistics**

##### **Key Parameter Graphs**

##### **Comparison with Water Quality Standards**

##### **Raw Data**

##### **Trace Metal Analysis Raw Data**

Absorbance of filtered sample at 340 nm (units: /cm)								
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	0.003	0.003	0.001	0.004	0.002	0.00	0.003
Ohakuri Tailrace Bridge	12	0.006	0.006	0.003	0.013	0.003	1.11	0.005
Whakamaru Tailrace	11	0.008	0.008	0.004	0.011	0.003	-0.06	0.007
Waipapa Tailrace	12	0.010	0.011	0.007	0.014	0.005	0.06	0.010
Narrow s	12	0.011	0.012	0.006	0.019	0.003	0.66	0.012
Horotiu Bridge	12	0.013	0.012	0.007	0.021	0.003	0.60	0.012
Huntly-Tainui Bridge	12	0.020	0.019	0.012	0.030	0.007	0.54	0.019
Mercer Bridge	12	0.026	0.025	0.009	0.050	0.016	0.68	0.023
Tuakau Bridge	12	0.030	0.027	0.013	0.062	0.022	0.78	0.026

Absorbance of filtered sample at 440 nm (units: /cm)								
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	0.003	0.000	<u>2.22</u>	0.001
Whakamaru Tailrace	11	0.001	0.001	0.001	0.003	0.000	<u>2.08</u>	0.001
Waipapa Tailrace	12	0.002	0.002	0.001	0.003	0.002	0.49	0.001
Narrow s	12	0.002	0.002	0.001	0.004	0.001	1.02	0.002
Horotiu Bridge	12	0.002	0.003	0.001	0.005	0.002	0.55	0.002
Huntly-Tainui Bridge	12	0.004	0.004	0.001	0.006	0.002	-0.11	0.003
Mercer Bridge	12	0.005	0.004	0.001	0.010	0.003	0.82	0.004
Tuakau Bridge	12	0.006	0.006	0.001	0.012	0.004	0.51	0.005

Arsenic - Total (g/m <sup>3</sup> )								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.011	0.011	0.010	0.011	0.001	-0.32	0.011
Ohaaki Bridge	12	0.028	0.028	0.021	0.035	0.005	0.02	0.027
Ohakuri Tailrace Bridge	12	0.032	0.031	0.026	0.042	0.007	0.72	0.034
Whakamaru Tailrace	11	0.032	0.033	0.025	0.037	0.006	-0.43	0.032
Waipapa Tailrace	12	0.027	0.026	0.023	0.032	0.005	0.53	0.027
Narrow s	12	0.024	0.023	0.019	0.030	0.007	0.36	0.025
Horotiu Bridge	12	0.024	0.023	0.019	0.030	0.008	0.29	0.024
Huntly-Tainui Bridge	12	0.017	0.017	0.013	0.025	0.005	0.69	0.018
Mercer Bridge	12	0.018	0.017	0.012	0.026	0.005	0.84	0.017
Tuakau Bridge	12	0.018	0.017	0.013	0.024	0.008	0.45	0.017

Boron (g/m <sup>3</sup> )								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.16	0.16	0.15	0.18	0.02	0.38	0.17
Ohaaki Bridge	12	0.29	0.28	0.23	0.37	0.06	0.63	0.29
Ohakuri Tailrace Bridge	12	0.32	0.31	0.24	0.41	0.06	0.20	0.33
Whakamaru Tailrace	11	0.32	0.32	0.25	0.38	0.06	-0.28	0.33
Waipapa Tailrace	12	0.27	0.27	0.24	0.32	0.06	0.38	0.28
Narrow s	12	0.26	0.26	0.20	0.31	0.04	-0.08	0.26
Horotiu Bridge	12	0.26	0.26	0.20	0.31	0.06	0.08	0.26
Huntly-Tainui Bridge	12	0.20	0.20	0.16	0.23	0.05	-0.20	0.20
Mercer Bridge	12	0.21	0.21	0.17	0.25	0.03	-0.04	0.20
Tuakau Bridge	12	0.21	0.21	0.17	0.25	0.05	0.30	0.21

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	3.2	3.4	1.6	4.2	0.4	-1.22	3.9
Ohakuri Tailrace Bridge	12	2.1	2.0	1.0	3.5	1.0	0.33	2.1
Whakamaru Tailrace	10	1.6	1.6	1.0	2.7	0.9	0.54	1.8
Waipapa Tailrace	12	1.7	1.8	0.6	2.6	0.8	-0.30	1.8
Narrow s	12	1.3	1.3	0.8	1.8	0.5	0.00	1.3
Horotiu Bridge	11	1.1	1.0	0.7	1.7	0.4	0.70	1.1
Huntly-Tainui Bridge	11	0.8	0.9	0.2	1.1	0.3	-1.05	0.8
Mercer Bridge	-	-	-	-	-	-	-	-
Tuakau Bridge	12	0.5	0.6	0.1	0.9	0.3	-0.31	0.6

Biochemical Oxygen Demand - 5 day (g/m <sup>3</sup> )								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.9	0.7	0.2	2.8	0.9	1.43	0.5
Ohaaki Bridge	12	0.9	0.9	0.2	2.4	0.8	1.07	0.6
Ohakuri Tailrace Bridge	12	0.8	0.8	0.2	1.5	0.6	0.21	0.8
Whakamaru Tailrace	11	1.1	1.0	0.4	2.1	0.7	0.51	1.0
Waipapa Tailrace	12	0.9	0.9	0.2	1.6	0.7	0.16	0.8
Narrow s	12	1.0	1.1	0.2	1.7	0.7	-0.35	0.9
Horotiu Bridge	12	0.9	0.8	0.4	1.4	0.6	-0.02	0.8
Huntly-Tainui Bridge	12	0.9	1.0	0.2	1.5	0.6	-0.30	1.0
Mercer Bridge	12	1.2	1.2	0.2	2.0	0.7	-0.26	1.2
Tuakau Bridge	12	1.3	1.4	0.2	1.9	1.0	-0.54	1.2

Carbon - Dissolved Organic (g/m <sup>3</sup> )								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	1.01	0.95	0.50	2.00	0.20	1.55	0.87
Ohaaki Bridge	12	0.87	0.90	0.30	1.10	0.25	-1.20	0.91
Ohakuri Tailrace Bridge	12	1.02	0.95	0.50	1.50	0.40	0.27	1.02
Whakamaru Tailrace	11	1.07	1.00	0.80	1.50	0.28	0.74	1.17
Waipapa Tailrace	12	1.48	1.40	0.90	2.90	0.40	<u>1.88</u>	1.38
Narrow s	12	1.34	1.30	0.80	1.90	0.45	-0.03	1.47
Horotiu Bridge	12	1.46	1.45	0.90	2.10	0.50	0.14	1.67
Huntly-Tainui Bridge	12	1.86	2.00	1.00	2.60	0.95	-0.28	2.17
Mercer Bridge	12	2.29	2.10	1.10	3.90	0.90	0.76	2.47
Tuakau Bridge	12	2.51	2.25	1.10	4.80	1.55	0.79	2.62

Carbon - Total Organic (g/m <sup>3</sup> )								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	1.36	1.30	0.90	2.40	0.40	1.31	1.10
Ohaaki Bridge	12	1.20	1.20	0.90	1.80	0.30	0.95	1.10
Ohakuri Tailrace Bridge	12	1.38	1.30	1.10	1.70	0.35	0.36	1.30
Whakamaru Tailrace	11	1.47	1.40	1.20	1.80	0.33	0.41	1.40
Waipapa Tailrace	12	1.83	1.75	1.30	2.90	0.25	1.40	1.70
Narrow s	12	1.78	1.65	1.30	2.60	0.45	0.97	1.80
Horotiu Bridge	12	2.00	2.00	1.40	2.70	0.60	0.22	2.10
Huntly-Tainui Bridge	12	2.63	2.65	1.80	4.50	0.75	1.36	2.80
Mercer Bridge	12	3.57	3.30	2.30	5.80	1.15	0.94	3.60
Tuakau Bridge	12	4.01	3.45	2.10	6.80	2.20	0.55	3.55

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



Chloride (g/m <sup>3</sup> )								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	8	8	8	9	0	-0.05	9
Ohaaki Bridge	12	17	17	13	22	2	0.19	17
Ohakuri Tailrace Bridge	12	20	20	14	25	5	-0.10	21
Whakamaru Tailrace	11	20	21	17	24	3	-0.39	21
Waipapa Tailrace	12	19	19	16	23	2	0.37	19
Narrow s	12	18	18	15	21	2	0.48	18
Horotiu Bridge	12	18	18	16	20	2	-0.12	18
Huntly-Tainui Bridge	12	17	16	15	19	2	0.65	17
Mercer Bridge	12	17	17	16	19	2	0.25	17
Tuakau Bridge	12	17	17	16	20	2	0.48	17

Chlorophyll a (g/m <sup>3</sup> )								
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	0.004	0.003	0.002	0.011	0.005	0.95	0.004
Whakamaru Tailrace	11	0.009	0.007	0.002	0.019	0.015	0.35	0.007
Waipapa Tailrace	12	0.005	0.003	0.002	0.017	0.005	1.35	0.004
Narrow s	12	0.008	0.007	0.002	0.020	0.010	0.63	0.008
Horotiu Bridge	12	0.008	0.006	0.002	0.018	0.010	0.44	0.009
Huntly-Tainui Bridge	12	0.008	0.007	0.002	0.018	0.010	0.30	0.007
Mercer Bridge	12	0.015	0.017	0.002	0.030	0.012	0.11	0.013
Tuakau Bridge	12	0.016	0.013	0.003	0.036	0.012	0.81	0.014

Colour (Munsell Colour Units)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	-	-	-	-	-	-	-	-
Ohaaki Bridge	11	50.9	52.5	32.5	57.5	9.4	-1.31	50.0
Ohakuri Tailrace Bridge	11	38.9	37.5	30.0	50.0	8.8	0.55	40.0
Whakamaru Tailrace	10	37.5	36.3	30.0	47.5	7.5	0.24	37.5
Waipapa Tailrace	11	38.6	37.5	32.5	50.0	6.9	0.74	35.0
Narrow s	12	36.0	35.0	32.5	40.0	2.5	0.28	35.0
Horotiu Bridge	11	35.5	35.0	30.0	37.5	2.5	-1.29	35.0
Huntly-Tainui Bridge	11	32.3	35.0	20.0	37.5	6.3	-1.20	32.5
Mercer Bridge	-	-	-	-	-	-	-	-
Tuakau Bridge	12	29.2	28.8	22.5	37.5	7.5	0.33	30.0

Conductivity at 25 °C (ms/m)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	11.9	11.9	11.7	12.1	0.2	0.33	12.0
Ohaaki Bridge	12	15.5	15.5	13.8	16.9	0.9	-0.08	15.5
Ohakuri Tailrace Bridge	12	16.9	16.7	14.4	19.9	1.8	0.28	17.7
Whakamaru Tailrace	11	17.1	17.2	15.0	18.7	1.7	-0.43	17.1
Waipapa Tailrace	12	16.2	16.3	14.7	18.0	1.0	0.14	16.2
Narrow s	12	15.6	15.5	14.6	17.1	1.4	0.34	16.0
Horotiu Bridge	12	15.8	15.7	14.6	17.3	1.5	0.23	16.0
Huntly-Tainui Bridge	12	14.9	15.0	14.0	15.9	1.6	0.08	15.0
Mercer Bridge	12	15.7	15.8	14.8	16.6	0.9	-0.05	16.0
Tuakau Bridge	12	15.6	15.7	14.8	16.6	1.1	0.11	15.9

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

Dissolved Oxygen (g/m <sup>3</sup> )								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	9.5	9.6	8.9	10.6	1.0	0.54	9.6
Ohaaki Bridge	12	9.8	9.6	8.3	11.7	1.4	0.41	9.6
Ohakuri Tailrace Bridge	12	9.6	9.4	8.2	11.2	1.9	0.19	9.5
Whakamaru Tailrace	11	10.3	10.8	8.6	11.6	2.4	-0.46	10.0
Waipapa Tailrace	12	9.9	9.7	8.3	11.5	2.0	0.03	9.9
Narrow s	12	9.8	9.7	8.6	11.4	1.3	0.37	9.7
Horotiu Bridge	12	9.6	9.5	8.2	11.2	1.6	0.28	9.7
Huntly-Tainui Bridge	12	9.3	9.4	8.2	10.9	1.0	0.63	9.3
Mercer Bridge	12	9.2	9.3	7.6	10.7	1.3	-0.07	9.2
Tuakau Bridge	12	9.2	9.5	6.9	10.3	1.5	-0.89	9.5

Dissolved Oxygen (% Saturation)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	98.8	99.6	90.6	105.0	7.0	-0.55	99.7
Ohaaki Bridge	12	102.9	104.0	92.9	111.0	11.8	-0.23	101.1
Ohakuri Tailrace Bridge	12	101.2	102.9	86.7	113.5	10.6	-0.37	100.7
Whakamaru Tailrace	11	106.7	104.7	89.1	127.0	20.0	0.17	102.9
Waipapa Tailrace	12	102.1	101.7	87.2	114.2	13.1	-0.27	100.7
Narrow s	12	100.8	101.5	91.9	112.1	12.0	0.04	96.4
Horotiu Bridge	12	98.4	99.2	90.0	108.5	10.7	0.08	96.6
Huntly-Tainui Bridge	12	95.8	97.2	87.8	109.0	9.9	0.36	96.3
Mercer Bridge	12	95.2	97.0	84.6	113.9	11.9	0.68	95.6
Tuakau Bridge	12	95.8	95.9	77.4	118.9	15.3	0.29	96.7

Enterococci (cfu/100 mL)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	11	7	2	1	29	14	1.17	1
Ohaaki Bridge	11	35	8	1	170	26	<u>1.75</u>	8
Ohakuri Tailrace Bridge	11	3	1	1	12	3	<u>2.21</u>	2
Whakamaru Tailrace	10	8	3	1	28	10	1.26	8
Waipapa Tailrace	11	6	2	1	21	9	1.10	5
Narrow s	11	37	30	7	110	29	1.28	26
Horotiu Bridge	11	76	70	13	150	112	0.33	70
Huntly-Tainui Bridge	11	176	66	10	1200	127	<u>2.68</u>	57
Mercer Bridge	11	70	45	3	180	114	0.55	31
Tuakau Bridge	11	56	23	5	270	71	<u>2.00</u>	28

Escherichia coli (cfu/100 mL)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	11	8	1	1	34	15	1.34	1
Ohaaki Bridge	11	24	12	7	90	26	<u>1.71</u>	12
Ohakuri Tailrace Bridge	11	3	2	1	9	3	1.31	3
Whakamaru Tailrace	10	10	7	2	30	8	1.29	6
Waipapa Tailrace	11	30	10	1	250	9	<u>2.82</u>	10
Narrow s	11	58	47	10	190	33	1.65	41
Horotiu Bridge	11	136	90	22	500	133	<u>1.78</u>	140
Huntly-Tainui Bridge	11	1030	140	40	9800	173	<u>2.84</u>	130
Mercer Bridge	11	316	140	20	2100	93	<u>2.74</u>	120
Tuakau Bridge	11	231	80	20	1700	65	<u>2.81</u>	110

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

Faecal Coliforms (cfu/100 mL)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	11	9	1	1	39	15	1.29	2
Ohaaki Bridge	11	29	14	8	100	29	1.48	15
Ohakuri Tailrace Bridge	11	3	2	1	9	3	1.24	3
Whakamaru Tailrace	10	11	7	2	35	10	1.41	6
Waipapa Tailrace	11	38	10	1	330	9	<u>2.83</u>	10
Narrow s	11	69	51	12	260	28	<u>1.94</u>	50
Horotiu Bridge	11	151	90	22	570	157	<u>1.87</u>	170
Huntly-Tainui Bridge	11	1167	170	60	11000	230	<u>2.84</u>	140
Mercer Bridge	11	394	160	30	2600	190	<u>2.72</u>	170
Tuakau Bridge	11	246	100	20	1700	108	<u>2.78</u>	120

Lithium (g/m <sup>3</sup> )								
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	0.32	0.039
Ohaaki Bridge	12	0.092	0.090	0.063	0.116	0.012	0.06	0.090
Ohakuri Tailrace Bridge	12	0.111	0.109	0.072	0.157	0.027	0.29	0.120
Whakamaru Tailrace	11	0.115	0.114	0.089	0.145	0.024	0.17	0.120
Waipapa Tailrace	12	0.098	0.097	0.080	0.117	0.022	0.30	0.100
Narrow s	12	0.090	0.091	0.068	0.111	0.015	0.16	0.092
Horotiu Bridge	12	0.090	0.089	0.073	0.118	0.018	0.59	0.092
Huntly-Tainui Bridge	12	0.067	0.066	0.054	0.080	0.018	0.02	0.068
Mercer Bridge	12	0.069	0.069	0.054	0.082	0.018	0.10	0.067
Tuakau Bridge	12	0.068	0.069	0.053	0.084	0.021	0.07	0.069

Nitrate/Nitrite Nitrogen (g/m <sup>3</sup> )								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.004	0.002	0.001	0.021	0.003	<u>2.39</u>	0.001
Ohaaki Bridge	12	0.039	0.040	0.013	0.051	0.013	-1.11	0.038
Ohakuri Tailrace Bridge	12	0.098	0.080	0.023	0.178	0.067	0.21	0.080
Whakamaru Tailrace	11	0.125	0.101	0.015	0.260	0.119	0.35	0.082
Waipapa Tailrace	12	0.188	0.172	0.047	0.320	0.112	0.22	0.162
Narrow s	12	0.269	0.235	0.114	0.540	0.153	0.91	0.228
Horotiu Bridge	12	0.296	0.260	0.155	0.580	0.115	1.26	0.255
Huntly-Tainui Bridge	12	0.427	0.370	0.192	0.830	0.280	0.65	0.355
Mercer Bridge	12	0.393	0.360	0.094	0.810	0.331	0.40	0.355
Tuakau Bridge	12	0.355	0.310	0.051	0.780	0.330	0.43	0.330

Nitrogen - Ammoniacal (g/m <sup>3</sup> )								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.01	0.01	0.01	0.02	0.00	<u>2.22</u>	0.005
Ohaaki Bridge	12	0.01	0.01	0.01	0.02	0.00	1.33	0.005
Ohakuri Tailrace Bridge	12	0.01	0.01	0.01	0.03	0.00	<u>1.72</u>	0.005
Whakamaru Tailrace	11	0.01	0.01	0.01	0.02	0.01	1.45	0.005
Waipapa Tailrace	12	0.02	0.02	0.01	0.03	0.02	0.14	0.015
Narrow s	12	0.01	0.01	0.01	0.03	0.01	0.37	0.016
Horotiu Bridge	12	0.02	0.02	0.01	0.13	0.01	<u>2.83</u>	0.013
Huntly-Tainui Bridge	12	0.01	0.01	0.01	0.03	0.01	0.99	0.012
Mercer Bridge	12	0.01	0.01	0.01	0.03	0.00	<u>2.27</u>	0.005
Tuakau Bridge	12	0.01	0.01	0.01	0.02	0.00	<u>2.01</u>	0.005

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

Nitrogen - Total Kjeldahl (g/m <sup>3</sup> )								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.14	0.08	0.05	0.50	0.10	<u>2.30</u>	0.08
Ohaaki Bridge	12	0.13	0.11	0.06	0.34	0.08	<u>1.84</u>	0.09
Ohakuri Tailrace Bridge	12	0.15	0.16	0.07	0.24	0.09	0.06	0.13
Whakamaru Tailrace	11	0.18	0.15	0.08	0.38	0.06	1.16	0.16
Waipapa Tailrace	12	0.18	0.20	0.08	0.24	0.07	-0.82	0.16
Narrow s	12	0.19	0.18	0.12	0.29	0.07	0.45	0.20
Horotiu Bridge	12	0.20	0.20	0.14	0.24	0.07	-0.07	0.20
Huntly-Tainui Bridge	12	0.25	0.24	0.15	0.46	0.10	1.25	0.26
Mercer Bridge	12	0.36	0.32	0.21	0.57	0.15	0.67	0.35
Tuakau Bridge	12	0.36	0.33	0.24	0.60	0.16	0.94	0.35

Nitrogen - Total (g/m <sup>3</sup> )								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.14	0.09	0.05	0.50	0.11	<u>2.23</u>	0.08
Ohaaki Bridge	12	0.17	0.16	0.09	0.37	0.07	1.63	0.12
Ohakuri Tailrace Bridge	12	0.25	0.25	0.14	0.33	0.04	-0.26	0.21
Whakamaru Tailrace	11	0.31	0.31	0.21	0.44	0.08	0.48	0.27
Waipapa Tailrace	12	0.37	0.37	0.23	0.43	0.06	-1.10	0.33
Narrow s	12	0.46	0.44	0.33	0.69	0.15	0.89	0.44
Horotiu Bridge	12	0.49	0.46	0.39	0.75	0.11	1.43	0.45
Huntly-Tainui Bridge	12	0.68	0.63	0.39	0.98	0.32	0.23	0.66
Mercer Bridge	12	0.75	0.75	0.46	1.07	0.28	0.07	0.73
Tuakau Bridge	12	0.72	0.76	0.37	1.04	0.46	-0.15	0.70

pH (pH Units)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	7.5	7.5	7.2	7.9	0.3	0.12	7.6
Ohaaki Bridge	12	7.2	7.2	6.5	7.5	0.2	-1.32	7.2
Ohakuri Tailrace Bridge	12	7.3	7.3	7.0	7.5	0.2	-0.33	7.3
Whakamaru Tailrace	11	7.4	7.4	7.0	7.9	0.3	0.09	7.5
Waipapa Tailrace	12	7.4	7.4	7.1	7.6	0.3	0.03	7.4
Narrow s	12	7.5	7.5	7.2	7.8	0.4	-0.26	7.5
Horotiu Bridge	12	7.5	7.5	7.2	7.7	0.3	-0.39	7.5
Huntly-Tainui Bridge	12	7.4	7.4	7.1	7.7	0.3	-0.20	7.4
Mercer Bridge	12	7.4	7.4	7.0	7.7	0.3	-0.35	7.5
Tuakau Bridge	12	7.5	7.5	6.9	7.9	0.5	-0.24	7.5

Phosphorus - Dissolved Reactive (g/m <sup>3</sup> )								
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	0.006	0.006	0.002	0.014	0.005	1.06	0.006
Ohakuri Tailrace Bridge	12	0.008	0.008	0.002	0.013	0.007	-0.15	0.008
Whakamaru Tailrace	11	0.009	0.010	0.002	0.017	0.011	-0.15	0.008
Waipapa Tailrace	12	0.013	0.016	0.002	0.022	0.013	-0.33	0.015
Narrow s	12	0.013	0.015	0.002	0.022	0.015	-0.20	0.017
Horotiu Bridge	12	0.017	0.019	0.006	0.028	0.015	-0.11	0.023
Huntly-Tainui Bridge	12	0.019	0.021	0.009	0.026	0.011	-0.59	0.023
Mercer Bridge	12	0.016	0.016	0.007	0.027	0.009	0.09	0.020
Tuakau Bridge	12	0.013	0.014	0.006	0.019	0.010	-0.21	0.017

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

Phosphorus - Total (g/m <sup>3</sup> )								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.005	0.005	0.002	0.011	0.005	0.51	0.005
Ohaaki Bridge	12	0.014	0.013	0.007	0.022	0.010	0.24	0.016
Ohakuri Tailrace Bridge	12	0.022	0.021	0.015	0.031	0.009	0.65	0.025
Whakamaru Tailrace	11	0.023	0.022	0.020	0.028	0.004	0.65	0.027
Waipapa Tailrace	12	0.029	0.029	0.022	0.035	0.010	-0.07	0.033
Narrow s	12	0.029	0.029	0.018	0.045	0.005	1.02	0.040
Horotiu Bridge	12	0.036	0.034	0.025	0.047	0.010	0.26	0.047
Huntly-Tainui Bridge	12	0.051	0.048	0.036	0.105	0.017	<u>2.05</u>	0.062
Mercer Bridge	12	0.059	0.055	0.040	0.089	0.019	0.61	0.068
Tuakau Bridge	12	0.061	0.059	0.039	0.095	0.023	0.57	0.069

Temperature (°C)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	15.2	14.9	10.6	19.8	6.4	0.11	14.7
Ohaaki Bridge	12	16.5	16.2	11.6	21.7	7.0	0.21	15.7
Ohakuri Tailrace Bridge	12	16.8	16.2	11.1	24.2	6.7	0.37	16.2
Whakamaru Tailrace	11	16.4	16.0	11.1	23.0	5.4	0.39	16.5
Waipapa Tailrace	12	16.4	16.0	11.4	21.6	6.6	0.19	16.0
Narrow s	12	16.6	16.9	10.9	22.1	7.3	0.04	16.2
Horotiu Bridge	12	16.5	16.5	11.0	22.4	6.9	0.14	15.8
Huntly-Tainui Bridge	12	16.8	16.7	10.7	23.2	6.6	0.08	15.9
Mercer Bridge	12	17.4	17.5	11.2	24.0	6.6	0.01	16.6
Tuakau Bridge	12	17.5	17.6	11.5	24.7	6.5	0.16	17.0

Dissolved Solids - Total (g/m <sup>3</sup> )								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	87	86	76	103	13	0.54	87
Ohaaki Bridge	12	109	107	96	127	14	0.52	110
Ohakuri Tailrace Bridge	12	121	122	105	144	24	0.38	130
Whakamaru Tailrace	11	128	127	108	147	16	0.19	130
Waipapa Tailrace	12	123	122	105	147	16	0.49	123
Narrow s	12	116	117	86	130	9	-1.63	120
Horotiu Bridge	12	119	119	108	132	10	0.29	121
Huntly-Tainui Bridge	12	112	113	96	123	9	-0.51	118
Mercer Bridge	12	117	118	107	129	8	0.08	120
Tuakau Bridge	12	117	115	106	128	8	0.42	119

Turbidity (NTU)								
Location	Count	Mean	Median	Min	Max	IQR	Skew	5 Yr Median
Taupo Control Gates	12	0.9	0.6	0.3	3.6	0.4	<u>2.50</u>	0.5
Ohaaki Bridge	12	1.5	1.0	0.5	7.3	0.8	<u>2.79</u>	0.7
Ohakuri Tailrace Bridge	12	1.3	1.2	0.8	2.3	0.4	1.32	1.1
Whakamaru Tailrace	11	1.4	1.4	0.8	2.1	0.6	0.12	1.3
Waipapa Tailrace	12	1.7	1.7	1.0	2.7	0.7	0.59	1.4
Narrow s	12	2.2	2.1	1.7	3.3	0.8	0.67	2.2
Horotiu Bridge	12	2.9	2.5	2.1	6.3	1.1	<u>2.07</u>	2.6
Huntly-Tainui Bridge	12	7.5	6.2	2.1	25	1.7	<u>2.44</u>	6.1
Mercer Bridge	12	11.7	10.7	5.6	19	4.4	0.49	10.0
Tuakau Bridge	12	11.5	12.1	4.6	19.4	8.2	0.03	10.2

Skew = skewness. Underlined values = non-normal distribution. IQR = Inter Quartile Range. TP results under review.

## Major Ion Summary Statistics

Calcium - dissolved (g m <sup>3</sup> )							
Location	Count	Mean	Median	Min	Max	IQR	Skew
Taupo Control Gates	12	6.48	6.45	6.10	7.10	0.15	1.24
Ohaaki Bridge	12	6.73	6.60	6.30	8.00	0.20	2.25
Ohakuri Tailrace Bridge	12	6.60	6.60	6.30	7.20	0.10	1.82
Whakamaru Tailrace	11	6.42	6.40	6.10	7.20	0.10	2.13
Waipapa Tailrace	12	6.27	6.25	6.00	6.70	0.45	0.25
Narrow s	12	6.29	6.30	5.50	7.30	0.75	0.33
Horotiu Bridge	12	6.33	6.50	5.60	6.90	0.75	-0.44
Huntly-Tainui Bridge	12	7.23	7.15	6.70	8.00	0.45	0.81
Mercer Bridge	12	8.22	8.05	6.70	10.40	1.75	0.66
Tuakau Bridge	12	7.81	7.45	6.90	9.40	1.60	0.72

Magnesium - dissolved (g m <sup>3</sup> )							
Location	Count	Mean	Median	Min	Max	IQR	Skew
Taupo Control Gates	12	2.73	2.70	2.60	2.90	0.15	0.22
Ohaaki Bridge	12	2.83	2.80	2.60	3.20	0.20	0.90
Ohakuri Tailrace Bridge	12	2.78	2.80	2.60	2.90	0.15	-0.36
Whakamaru Tailrace	11	2.72	2.70	2.50	2.80	0.10	-1.03
Waipapa Tailrace	12	2.58	2.60	2.40	2.70	0.15	-0.12
Narrow s	12	2.54	2.50	2.20	3.00	0.20	0.51
Horotiu Bridge	12	2.60	2.60	2.30	2.90	0.20	0.00
Huntly-Tainui Bridge	12	2.47	2.45	2.20	2.70	0.25	0.03
Mercer Bridge	12	2.56	2.55	2.20	2.80	0.30	-0.28
Tuakau Bridge	12	2.69	2.70	2.30	3.10	0.35	0.06

Potassium - dissolved (g m <sup>3</sup> )							
Location	Count	Mean	Median	Min	Max	IQR	Skew
Taupo Control Gates	12	1.91	1.88	1.75	2.20	0.14	1.04
Ohaaki Bridge	12	2.73	2.70	2.40	3.40	0.35	1.00
Ohakuri Tailrace Bridge	12	3.11	3.10	2.40	3.70	0.40	-0.22
Whakamaru Tailrace	11	3.23	3.20	2.50	3.90	0.38	-0.14
Waipapa Tailrace	12	3.16	3.15	2.40	4.10	0.35	0.58
Narrow s	12	3.21	3.20	2.70	3.60	0.45	-0.28
Horotiu Bridge	12	3.25	3.30	2.70	3.70	0.40	-0.18
Huntly-Tainui Bridge	12	3.03	3.10	2.40	3.70	0.30	0.11
Mercer Bridge	12	3.04	3.15	2.50	3.40	0.45	-0.58
Tuakau Bridge	12	3.21	3.20	2.60	4.00	0.45	0.44

Sodium - dissolved (g m <sup>3</sup> )							
Location	Count	Mean	Median	Min	Max	IQR	Skew
Taupo Control Gates	12	12.4	12.3	11.5	14.3	0.8	1.23
Ohaaki Bridge	12	18.3	17.7	15.4	23.0	3.0	0.69
Ohakuri Tailrace Bridge	12	20.6	20.0	16.2	25.0	3.8	0.09
Whakamaru Tailrace	11	21.1	20.0	16.1	25.0	3.8	-0.22
Waipapa Tailrace	12	20.0	19.7	15.0	25.0	2.8	0.03
Narrow s	12	18.6	19.4	16.0	21.0	3.3	-0.34
Horotiu Bridge	12	19.0	19.2	16.1	22.0	3.4	-0.04
Huntly-Tainui Bridge	12	16.3	16.0	12.6	19.3	3.4	-0.19
Mercer Bridge	12	16.3	16.1	13.1	19.9	2.2	0.17
Tuakau Bridge	12	16.7	16.4	13.1	21.0	3.5	0.23

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

<b>Alkalinity (units: g.m<sup>-3</sup> CaCO<sub>3</sub>)</b>							
<b>Location</b>	<b>Count</b>	<b>Mean</b>	<b>Median</b>	<b>Min</b>	<b>Max</b>	<b>IQR</b>	<b>Skew</b>
Taupo Control Gates	12	38	38	37	40	1	0.38
Ohaaki Bridge	12	40	39	37	45	1	1.81
Ohakuri Tailrace Bridge	12	40	40	36	43	3	-0.55
Whakamaru Tailrace	11	41	41	38	43	2	-0.27
Waipapa Tailrace	12	39	39	35	43	4	0.06
Narrow s	12	37	37	34	41	4	0.06
Horotiu Bridge	12	37	38	34	42	5	0.11
Huntly-Tainui Bridge	12	35	35	29	42	8	0.15
Mercer Bridge	12	36	35	31	42	7	0.22
Tuakau Bridge	12	34	34	28	42	8	0.16

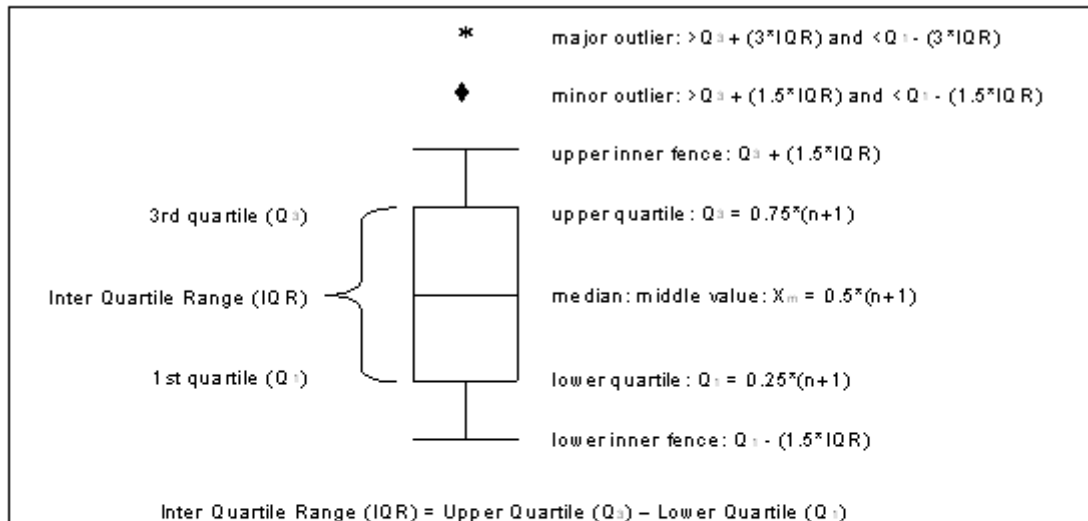
<b>Bicarbonate (units: g.m<sup>-3</sup> HCO<sub>3</sub>)</b>							
<b>Location</b>	<b>Count</b>	<b>Mean</b>	<b>Median</b>	<b>Min</b>	<b>Max</b>	<b>IQR</b>	<b>Skew</b>
Taupo Control Gates	12	46	46	45	48	1	0.12
Ohaaki Bridge	12	48	48	45	54	2	1.29
Ohakuri Tailrace Bridge	12	49	49	44	53	3	-0.49
Whakamaru Tailrace	11	49	50	46	52	3	-0.51
Waipapa Tailrace	12	48	48	43	52	5	-0.06
Narrow s	12	45	46	41	50	6	-0.11
Horotiu Bridge	12	45	46	41	51	6	0.08
Huntly-Tainui Bridge	12	42	42	35	51	9	0.14
Mercer Bridge	12	43	43	38	51	8	0.21
Tuakau Bridge	12	42	41	34	51	10	0.16

<b>Sulphate (g m<sup>-3</sup>)</b>							
<b>Location</b>	<b>Count</b>	<b>Mean</b>	<b>Median</b>	<b>Min</b>	<b>Max</b>	<b>IQR</b>	<b>Skew</b>
Taupo Control Gates	12	7.8	7.8	7.1	8.5	0.4	0.10
Ohaaki Bridge	12	8.8	8.8	7.9	10.4	0.7	0.99
Ohakuri Tailrace Bridge	12	10.3	10.2	9.3	11.6	0.9	0.38
Whakamaru Tailrace	11	9.9	9.6	9.0	12.2	0.7	1.78
Waipapa Tailrace	12	9.6	9.2	8.8	11.9	1.1	1.50
Narrow s	12	9.0	8.8	7.6	10.8	0.8	0.74
Horotiu Bridge	12	9.4	9.2	8.1	11.6	0.9	0.88
Huntly-Tainui Bridge	12	9.0	8.9	7.4	11.4	1.2	0.81
Mercer Bridge	12	10.9	10.3	8.5	16.3	2.7	1.22
Tuakau Bridge	12	11.4	10.6	8.8	17.4	2.8	1.20

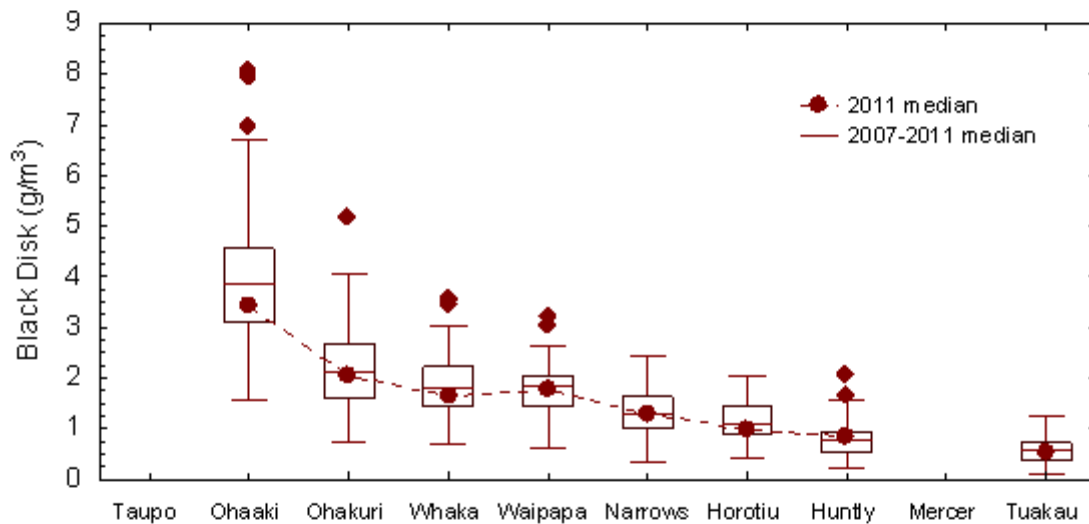
<b>Silica - dissolved reactive (units: g.m<sup>-3</sup> SiO<sub>2</sub>)</b>							
<b>Location</b>	<b>Count</b>	<b>Mean</b>	<b>Median</b>	<b>Min</b>	<b>Max</b>	<b>IQR</b>	<b>Skew</b>
Taupo Control Gates	12	24.1	24.0	23.0	25.0	0.5	-0.08
Ohaaki Bridge	12	28.0	28.0	25.0	30.0	1.5	-0.76
Ohakuri Tailrace Bridge	12	33.3	33.5	28.0	38.0	3.0	-0.30
Whakamaru Tailrace	11	35.9	36.0	31.0	40.0	3.5	-0.39
Waipapa Tailrace	12	35.9	37.0	31.0	39.0	4.0	-0.74
Narrow s	12	35.1	35.5	30.0	40.0	4.0	-0.12
Horotiu Bridge	12	35.3	36.0	31.0	40.0	3.5	0.08
Huntly-Tainui Bridge	12	32.7	33.0	27.0	37.0	3.0	-0.55
Mercer Bridge	12	31.0	32.0	26.0	34.0	3.5	-0.88
Tuakau Bridge	12	30.8	31.5	25.0	34.0	4.0	-0.91

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

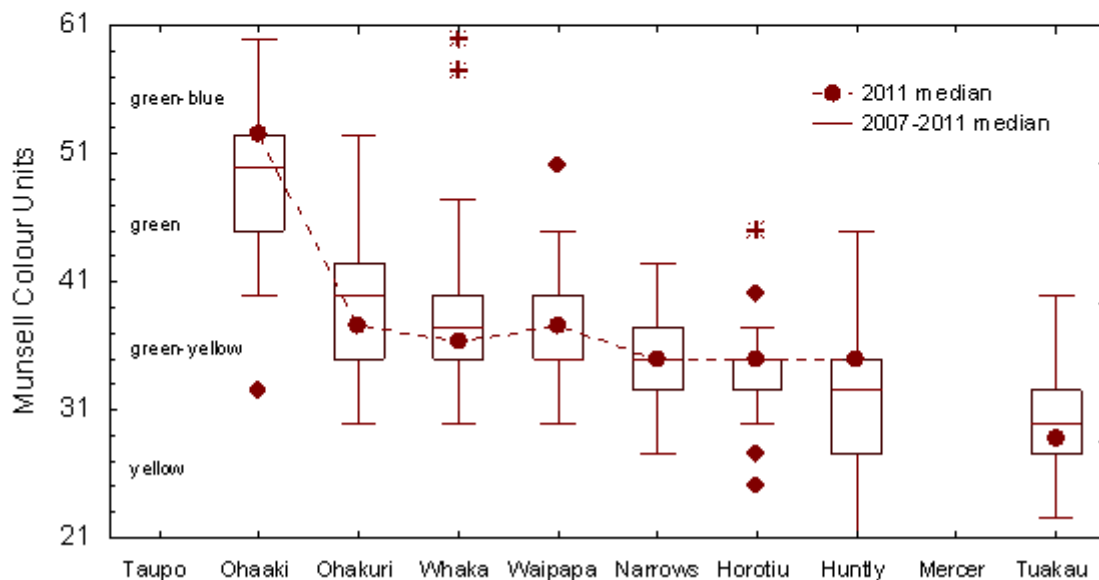
## Boxplots are used to present data



### Black Disk, 2007-2011 Data

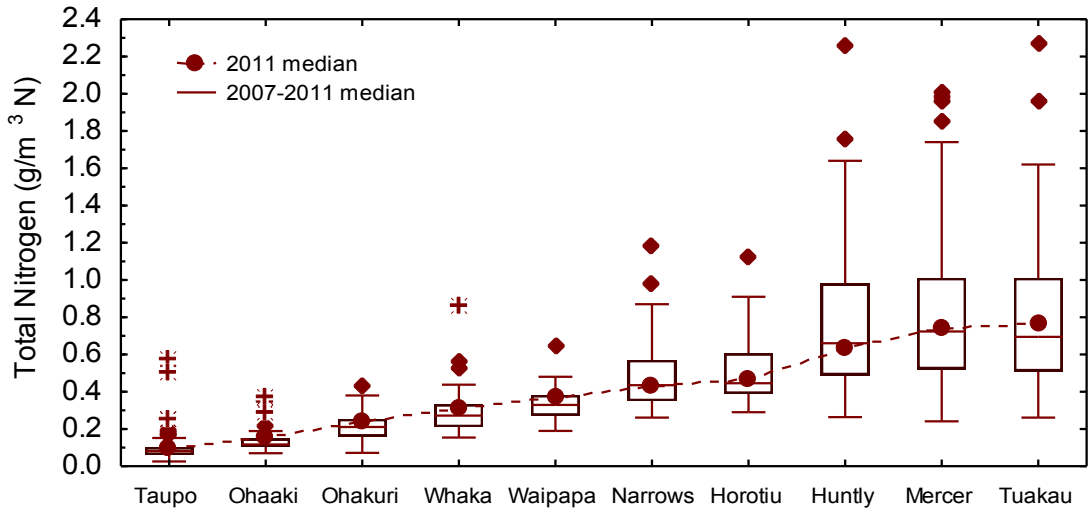


### Colour, 2007-2011 Data

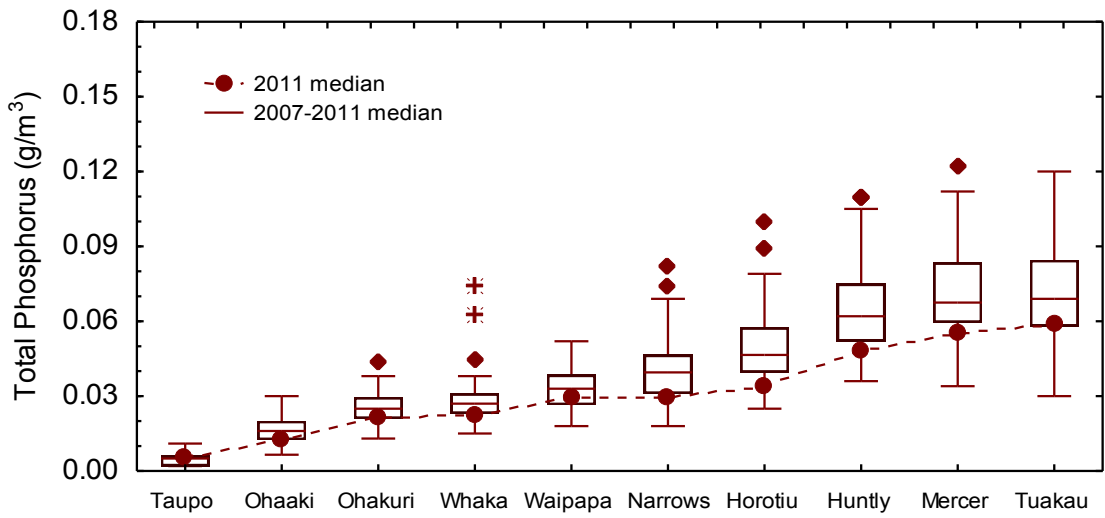




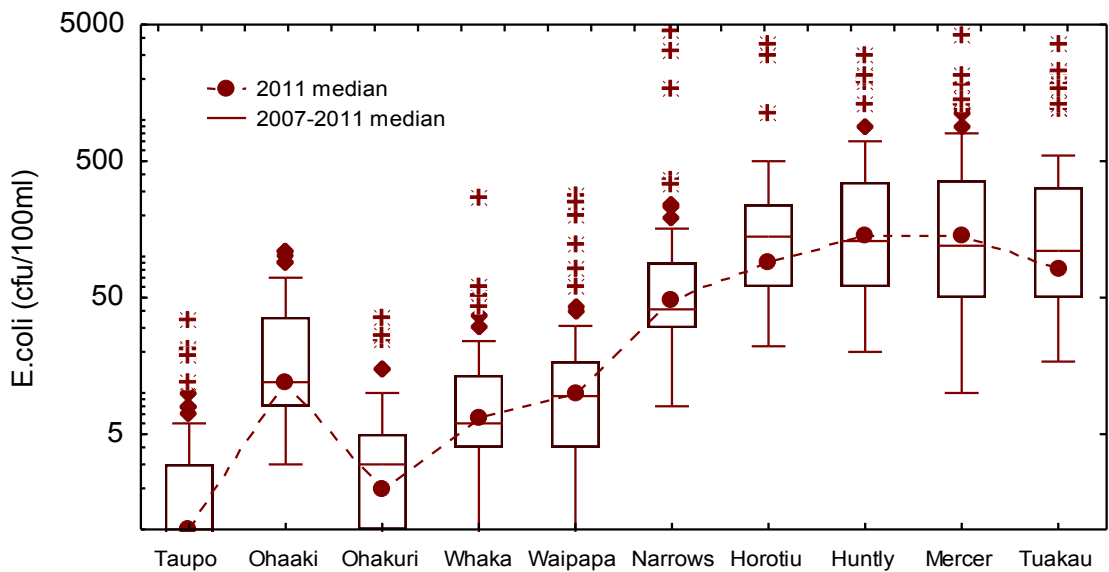
### Total Nitrogen, 2007-2011 Data



### Total Phosphorus, 2007-2011 Data

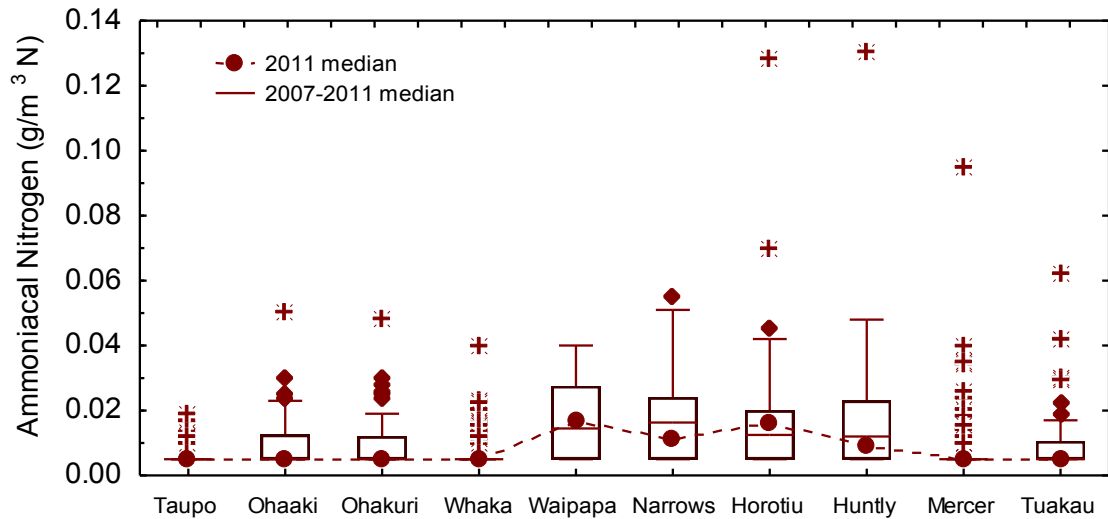


### E.coli, 2007-2011 Data

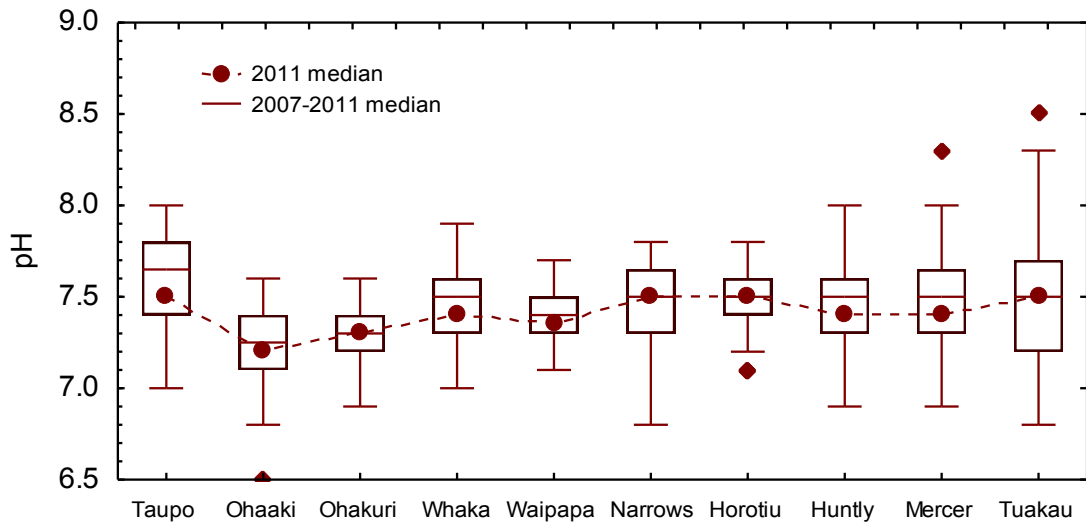


\*TP results under review.

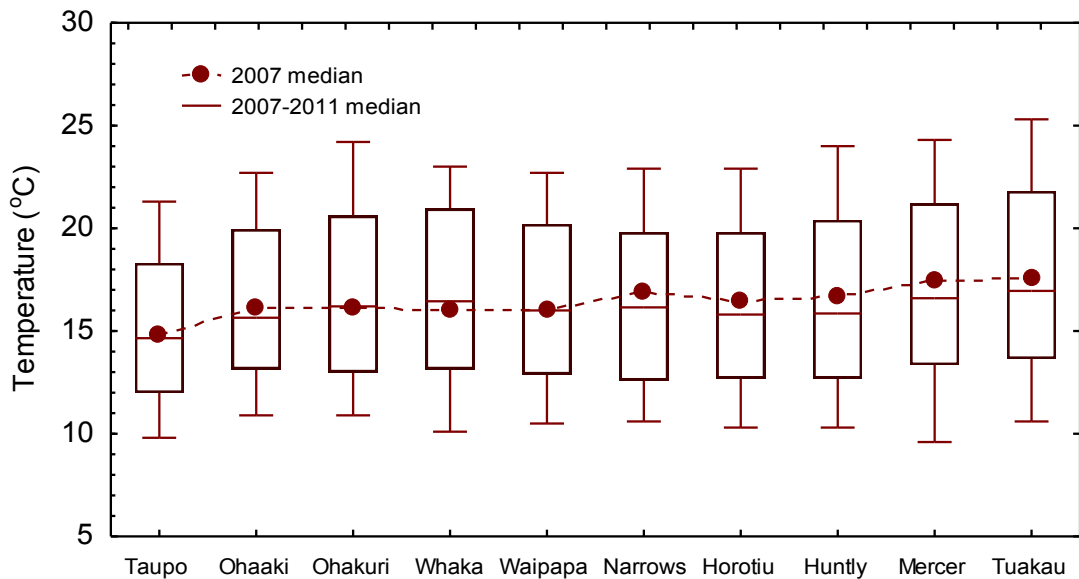
### Ammoniacal Nitrogen, 2007-2011 Data



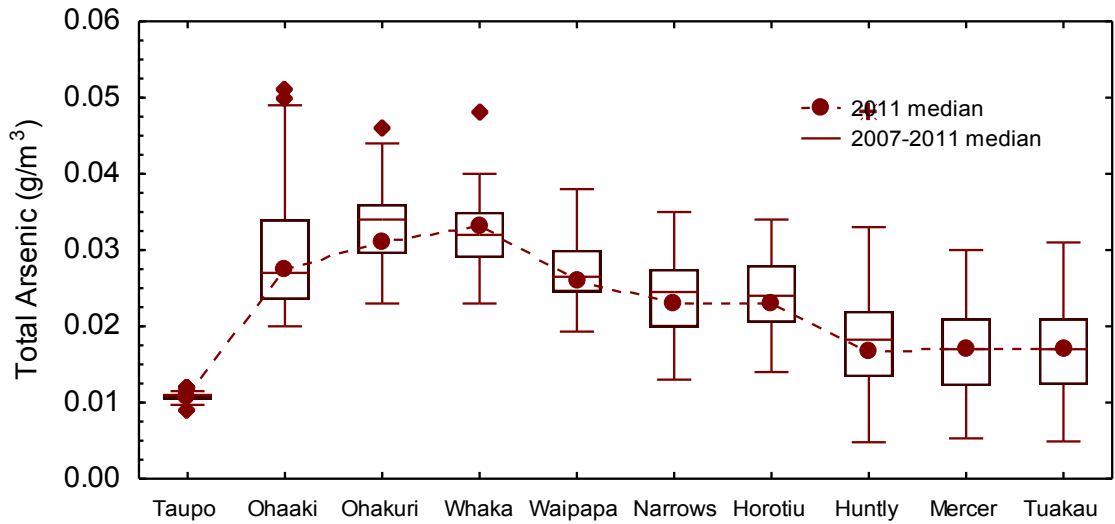
### pH, 2007-2011 Data



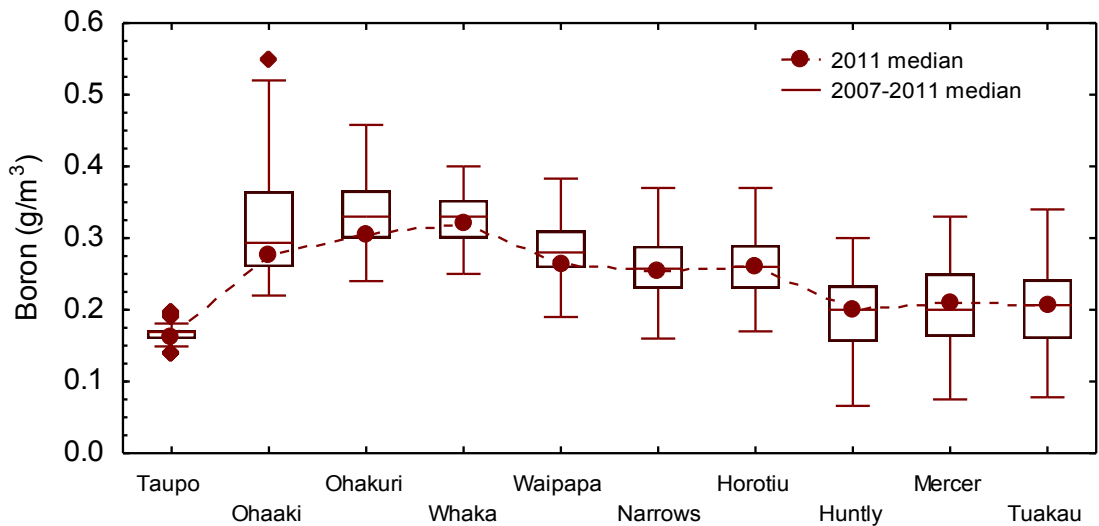
### Temperature, 2007-2011 Data



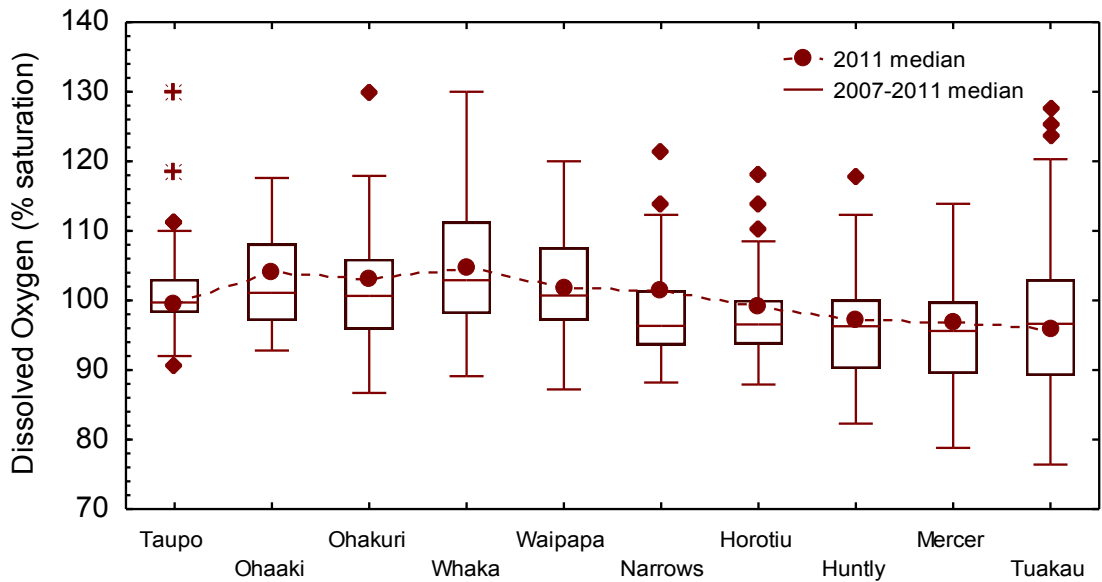
**Total Arsenic, 2007-2011 Data**



**Boron, 2007-2011 Data**



**Dissolved Oxygen, 2007-2011 Data**



**Table 3: Samples (year 2011) 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 <sub>4</sub> N	Temp	TP	TN	Bk <sup>1</sup> Disk	E coli	Median E coli	CHLa	As	B
Taupo Gates	12	12	12	12	9	12	12	-	11*	Y	12	1	12
Ohaaki Bridge	12	12	11	12	5	12	12	10/11	11*	Y	12	0	8
Ohakuri Tailrace Br	12	12	12	12	5	12	12	6/8	11*	Y	12	0	6
Whakamaru Tailrace	11*	11*	11*	11*	5*	11*	11*	4/6 <sup>^</sup>	11*	Y*	11*	0*	4*
Waipapa Tailrace	12	12	12	12	5	12	12	4/7	11*	Y	12	0	9
Hamilton – Narrows	12	12	12	12	6	11	8	4/12	11*	Y	12	0	11
Horotiu Bridge	12	12	11	12	5	8	9	1/11*	11*	Y	12	0	11
Huntly – Tainui Br	12	12	3	12	6	4	2	0/11*	10*	N	12	0	12
Mercer Bridge	12	12	0	12	6	1	1	-	10*	N	11	0	12
Tuakau Bridge	11	12	1	12	5	1	3	0/12	10*	Y	9	0	12

<sup>1</sup> 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 2011) 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 <sub>4</sub> N	Temp	TP	TN	Bk <sup>1</sup> Disk	E coli	Median E coli	CHLa	As	B
Taupo Gates	12	12	12	12	2	11	7	-	11*	Y	12	n/a	n/a
Ohaaki Bridge	12	11	11	12	2	3	2	1/11	10*	Y	12	n/a	n/a
Ohakuri Tailrace Br	12	12	11	12	1	0	0	0/8	11*	Y	8	n/a	n/a
Whakamaru Tailrace	9*	11*	9*	11*	1*	0*	0*	0/6*	11*	Y*	5*	n/a	n/a
Waipapa Tailrace	10	12	9	12	1	0	0	0/7	10*	Y	9	n/a	n/a
Hamilton – Narrows	12	12	6	12	1	0	0	0/12	7*	N	7	n/a	n/a
Horotiu Bridge	12	12	0	11	1	0	0	0/11*	3*	N	6	n/a	n/a
Huntly – Tainui Br	8	12	0	12	1	0	0	0/11*	1*	N	4	n/a	n/a
Mercer Bridge	7	12	0	12	0	0	0	-	2*	N	1	n/a	n/a
Tuakau Bridge	9	11	0	12	1	0	0	0/12	3*	N	1	n/a	n/a

<sup>1</sup> 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/m/m/yy	hh:mm	m <sup>3</sup> /s	m	units	mS/m	units	'C	g/m <sup>3</sup>	%Sat	g/m <sup>3</sup>	NTU	g/m <sup>3</sup>	g/m <sup>3</sup>	g/m <sup>3</sup>	g/m <sup>3</sup>
Satisfactory Water Quality			>1.6	-	-	6.5-9	<12 (May-Sep)	>80	-	<5	-	-	-	-	<0.88
Guideline/Standard							<20 (Oct-Apr)								

1131-127 UD = 267 m<sup>3</sup>/m (Flows from "Reids Farm")

**Waikato River at Taupo Control Gates**

06/01/11	8:15 a.m.	187	-	-	12.0	7.7	19.7	9.0	102.5	1.6	0.43	80	0.021	0.021	<0.01
02/02/11	8:35 a.m.	308	-	-	12.0	7.5	19.8	9.0	102.5	<0.4	0.42	96	<0.002	<0.002	<0.01
03/03/11	8:00 a.m.	102	-	-	11.8	7.8	19.4	9.1	103.2	<0.4	3.60	103	<0.002	<0.002	<0.01
05/04/11	9:25 a.m.	216	-	-	11.8	7.2	17.2	8.9	97.5	0.5	0.43	88	<0.002	<0.002	<0.01
02/05/11	9:25 a.m.	219	-	-	12.1	7.4	<u>15.4</u>	9.5	99.0	<0.4	0.90	99	0.002	<0.002	<0.01
07/06/11	9:01 a.m.	275	-	-	11.8	7.7	<u>14.2</u>	9.0	92.0	<0.4	0.32	86	<0.002	<0.002	<0.01
05/07/11	9:45 a.m.	265	-	-	11.7	7.3	<u>12.0</u>	10.2	100.2	0.7	0.49	79	<0.002	<0.002	<0.01
02/08/11	9:05 a.m.	224	-	-	11.8	7.5	10.6	10.6	98.5	1.2	0.55	91	0.002	<0.002	<0.01
06/09/11	9:15 a.m.	148	-	-	12.0	7.4	11.3	9.7	90.6	0.6	0.74	82	<0.002	<0.002	<0.01
04/10/11	8:00 a.m.	258	-	-	11.9	7.4	11.9	9.6	93.6	1.0	1.45	84	0.008	0.006	0.01
01/11/11	8:23 a.m.	140	-	-	11.9	7.9	14.3	10.3	105.0	2.8	0.65	85	0.003	0.003	0.02
01/12/11	8:38 a.m.	209	-	-	11.8	7.7	16.7	9.6	100.9	1.0	0.63	76	0.005	0.005	<0.01

1131-105 UD = 276 m<sup>3</sup>/s (Flows from Ohaaki Bridge Recorder, +/- 20%)

**Waikato River at Ohaaki Br**

06/01/11	9:30 a.m.	180	3.8	-	15.8	6.5	<u>21.7</u>	9.3	108.8	2.4	1.45	105	0.031	0.031	<0.01
02/02/11	9:35 a.m.	322	(> 3.0)	45.0	13.8	7.2	<u>21.2</u>	9.1	106.0	<0.4	0.72	96	0.013	0.011	<0.01
03/03/11	8:55 a.m.	116	3.6	57.5	16.8	7.2	<u>21.7</u>	8.3	97.5	<0.4	<u>7.30</u>	127	0.051	0.050	<0.01
05/04/11	10:20 a.m.	179	3.3	52.5	15.4	6.9	18.6	9.3	104.5	<0.4	0.57	112	0.044	0.043	<0.01
02/05/11	10:43 a.m.	171	3.4	47.5	15.9	7.1	<u>17.9</u>	8.5	92.9	1.4	0.50	125	0.041	0.041	<0.01
07/06/11	10:00 a.m.	213	3.5	52.5	15.5	7.4	<u>14.6</u>	9.5	96.8	0.9	1.65	108	0.038	0.038	0.01
05/07/11	11:05 a.m.	260	<u>1.6</u>	50.0	14.3	7.2	<u>12.7</u>	11.0	109.1	0.9	0.74	98	0.029	0.027	<0.01
02/08/11	9:40 a.m.	222	3.5	50.0	15.7	7.2	11.6	11.7	111.0	1.1	0.82	115	0.046	0.046	0.01
06/09/11	9:55 a.m.	194	3.5	32.5	15.4	7.1	<u>12.3</u>	10.1	95.5	1.2	0.99	105	0.049	0.049	<0.01
04/10/11	8:40 a.m.	238	3.3	57.5	14.9	7.2	13.1	11.0	109.0	0.6	0.91	103	0.039	0.038	<0.01
01/11/11	9:00 a.m.	159	4.2	57.5	16.9	7.5	15.4	10.0	103.4	0.7	1.63	114	0.051	0.051	0.02
01/12/11	9:19 a.m.	177	2.2	57.5	15.0	7.3	16.9	9.6	100.3	0.8	1.06	98	0.039	0.037	<0.01

1131-107 UD = 327 m<sup>3</sup>/s (Flows from Ohakuri Dam - Total)

**Waikato River at Ohakuri Tailrace Br**

06/01/11	10:15 a.m.	293	<u>1.2</u>	-	19.9	7.1	<u>24.2</u>	8.7	107.5	1.5	2.30	138	0.056	0.055	0.01
02/02/11	10:08 a.m.	324	2.5	35.0	14.4	7.3	<u>21.3</u>	8.8	102.0	<0.4	1.34	105	0.081	0.078	<0.01
03/03/11	9:37 a.m.	404	<u>(1.6)</u>	37.5	17.6	7.2	<u>21.8</u>	8.2	95.9	0.6	0.95	144	0.071	0.070	<0.01
05/04/11	11:15 a.m.	302	2.8	40.0	16.6	7.0	18.9	9.0	101.6	<0.4	0.81	123	0.079	0.077	0.02
02/05/11	11:40 a.m.	292	2.0	37.5	17.7	7.2	<u>16.2</u>	8.3	86.7	<0.4	1.31	138	0.145	0.141	0.03
07/06/11	10:30 a.m.	341	(3.3)	50.0	15.6	7.4	<u>14.4</u>	9.1	92.5	0.6	0.87	107	0.126	0.125	<0.01
05/07/11	11:50 a.m.	369	(3.5)	50.0	15.4	7.3	<u>12.4</u>	10.6	103.8	0.7	0.97	108	0.127	0.126	<0.01
02/08/11	10:20 a.m.	418	(2.3)	32.5	16.2	7.3	11.1	11.2	104.3	1.1	1.23	123	0.178	0.176	<0.01
06/09/11	10:35 a.m.	204	2.1	32.5	18.4	7.2	<u>12.8</u>	9.9	94.6	0.8	1.33	125	0.143	0.142	<0.01
04/10/11	9:30 a.m.	291	1.9	40.0	16.7	7.4	14.1	10.7	107.4	1.4	1.22	112	0.077	0.073	<0.01
01/11/11	9:41 a.m.	293	<u>1.0</u>	30.0	17.7	7.5	16.1	10.8	113.5	0.9	1.71	121	0.066	0.065	<0.01
01/12/11	10:01 a.m.	297	<u>1.6</u>	42.5	16.7	7.4	18.0	9.7	104.0	0.9	1.23	107	0.023	0.022	<0.01

1131-147 UD = 305 m<sup>3</sup>/s (Flows from Whakamaru Dam - Total)

**Waikato River at Whakamaru Tailrace**

06/01/11	10:59 a.m.	217	1.6	-	18.7	7.6	<u>23.0</u>	10.7	127.0	1.5	2.10	134	0.058	0.057	<0.01
02/02/11	10:55 a.m.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03/03/11	10:20 a.m.	259	1.6	42.5	17.2	7.3	<u>21.7</u>	8.7	101.4	0.4	1.36	146	0.056	0.055	0.02
05/04/11	11:55 a.m.	263	1.9	37.5	17.0	7.0	18.9	8.8	98.2	0.6	0.97	127	0.152	0.152	0.01
02/05/11	12:30 p.m.	280	1.9	40.0	17.8	7.3	<u>16.0</u>	8.6	89.1	0.9	1.26	147	0.180	0.178	0.01
07/06/11	11:15 a.m.	391	(1.8)	42.5	16.5	7.4	<u>14.4</u>	8.9	89.6	1.0	1.24	119	0.230	0.230	0.01
05/07/11	12:35 p.m.	353	(2.7)	47.5	15.0	7.4	<u>12.3</u>	10.8	104.7	0.5	0.80	114	0.176	0.173	<0.01
02/08/11	10:55 a.m.	366	-	35.0	15.4	7.2	11.1	11.1	102.5	0.9	1.09	120	0.260	0.260	<0.01
06/09/11	11:10 a.m.	312	(1.7)	30.0	18.0	7.5	<u>13.1</u>	11.1	105.5	1.2	1.69	127	0.101	0.099	<0.01
04/10/11	10:05 a.m.	349	<u>(1.0)</u>	35.0	17.6	7.6	14.3	11.3	113.7	1.4	1.54	126	0.082	0.080	<0.01
01/11/11	10:28 a.m.	251	<u>1.0</u>	30.0	18.2	7.6	16.5	11.6	121.3	1.3	1.78	135	0.065	0.063	<0.01
01/12/11	10:38 a.m.	210	<u>1.0</u>	35.0	16.2	7.9	18.6	11.2	120.7	2.1	1.94	108	0.015	0.014	<0.01

Note: < = less than the value stated

UD = upper decile flow (long-term record 1992-2011 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 values –don't assess for compliance

TKN g/m <sup>3</sup>	TN g/m <sup>3</sup>	DRP g/m <sup>3</sup>	TP g/m <sup>3</sup>	CL g/m <sup>3</sup>	AS g/m <sup>3</sup>	B g/m <sup>3</sup>	LI g/m <sup>3</sup>	A340F /cm	A440F /cm	ENT cfu/100mL	FC cfu/100mL	E coli cfu/100mL	CHLA g/m <sup>3</sup>	DOC g/m <sup>3</sup>	TOC g/m <sup>3</sup>
-	<0.5	-	<0.04	-	<0.01	<0.3	-	-	-	<77	-	<550	<0.02		

0.08	0.10	<0.004	0.011	8.3	<u>0.011</u>	0.16	0.038	<0.002	<0.002	1	5	5	<0.003	1.3	1.2
0.05	0.05	<0.004	<0.004	8.2	<u>0.011</u>	0.16	0.037	<0.002	<0.002	2	<1	<1	<0.003	1	0.9
0.08	0.08	<0.004	0.007	8.3	<u>0.010</u>	0.18	0.044	<0.002	<0.002	16	39	21	<0.003	1.1	1.4
0.08	0.08	<0.004	<0.004	8.6	<u>0.011</u>	0.16	0.036	<0.002	<0.002	12	19	19	<0.003	0.8	1.5
0.17	0.17	<0.004	<0.004	8.6	<u>0.011</u>	0.18	0.039	<0.002	<0.002	-	-	-	<0.003	1	1.2
0.06	0.06	<0.004	0.005	8.3	<u>0.011</u>	0.15	0.036	<0.002	<0.002	1	1	1	<0.003	0.9	1.1
0.12	0.12	<0.004	<0.004	8.5	<u>0.011</u>	0.16	0.041	<0.002	<0.002	3	<1	<1	<0.003	1	1.6
0.08	0.08	<0.004	<0.004	8.0	<u>0.011</u>	0.16	0.037	<0.002	<0.002	<1	1	1	<0.003	0.7	0.9
0.05	0.05	<0.004	0.005	8.4	<u>0.011</u>	0.17	0.042	<0.002	<0.002	<1	1	1	<0.003	0.5	1.1
0.18	0.19	<0.004	0.009	8.5	<u>0.011</u>	0.16	0.038	<0.002	<0.002	29	34	34	<0.003	0.9	1.5
0.50	<u>0.50</u>	<0.004	0.007	8.8	<u>0.011</u>	0.17	0.041	<0.002	<0.002	16	1	1	<0.003	2	2.4
0.17	0.18	<0.004	0.006	8.4	<u>0.011</u>	0.16	0.042	<0.002	<0.002	<1	<1	<1	<0.003	0.9	1.5

0.34	0.37	0.007	0.022	17.4	<u>0.030</u>	0.28	0.098	0.004	<0.002	<u>170</u>	100	90	<0.003	1.1	1.3
0.08	0.09	<0.004	0.008	12.9	<u>0.021</u>	0.23	0.063	0.003	<0.002	25	15	15	<0.003	1	0.9
0.10	0.15	0.009	0.021	21.0	<u>0.031</u>	<u>0.37</u>	0.115	0.003	<0.002	8	14	12	<0.003	0.9	0.9
0.09	0.13	0.006	0.011	18.0	<u>0.027</u>	0.29	0.088	0.004	<0.002	<u>110</u>	67	48	<0.003	0.8	1.3
0.14	0.18	0.005	0.007	17.3	<u>0.029</u>	<u>0.32</u>	0.091	0.003	<0.002	-	-	-	<0.003	1	1
0.18	0.22	<0.004	0.013	18.3	<u>0.033</u>	0.26	0.088	<0.002	<0.002	21	32	25	<0.003	1.1	1.5
0.16	0.19	<0.004	0.008	15.1	<u>0.024</u>	0.26	0.081	0.002	<0.002	3	12	8	<0.003	0.9	1.8
0.12	0.17	0.006	0.011	17.9	<u>0.028</u>	<u>0.32</u>	0.096	0.002	<0.002	<1	11	11	<0.003	1.1	1.2
0.07	0.12	<0.004	0.018	17.0	<u>0.027</u>	0.27	0.094	0.004	<0.002	7	8	8	<0.003	0.3	1
0.06	0.10	0.005	0.016	16.7	<u>0.027</u>	0.26	0.084	<0.002	<0.002	30	41	37	<0.003	0.9	1.2
0.13	0.18	0.014	0.012	22.0	<u>0.035</u>	<u>0.33</u>	0.116	0.002	<0.002	4	10	7	<0.003	0.8	1.2
0.07	0.11	0.006	0.020	15.6	<u>0.023</u>	0.27	0.086	0.002	<0.002	1	8	8	<0.003	0.5	1.1

0.22	0.28	0.006	0.031	25.0	<u>0.042</u>	<u>0.41</u>	0.157	0.008	<0.002	<1	1	1	0.006	0.8	1.6
0.16	0.24	0.013	0.031	13.7	<u>0.026</u>	0.24	0.072	0.013	0.003	4	9	9	<0.003	1.5	1.7
0.16	0.23	0.011	0.023	21.0	<u>0.034</u>	<u>0.33</u>	0.120	0.007	<0.002	2	1	1	0.004	1.1	1.2
0.24	0.32	0.013	0.021	19.6	<u>0.031</u>	0.30	0.104	0.007	<0.002	<1	2	2	<0.003	0.9	1.3
0.18	0.33	0.013	0.021	20.0	<u>0.034</u>	<u>0.36</u>	0.117	0.009	0.002	-	-	-	<0.003	1.5	1.3
0.08	0.21	0.012	0.016	16.8	<u>0.026</u>	0.24	0.084	0.004	<0.002	3	5	5	<0.003	1	1.2
0.10	0.23	0.006	0.015	17.0	<u>0.027</u>	0.29	0.094	0.005	<0.002	3	1	<1	<0.003	0.8	1.5
0.07	0.25	0.009	0.019	18.0	<u>0.028</u>	0.29	0.099	0.005	<0.002	1	6	5	<0.003	1.1	1.3
0.09	0.23	0.006	0.031	23.0	<u>0.033</u>	<u>0.38</u>	0.135	0.006	<0.002	1	2	2	0.006	0.5	1.2
0.18	0.26	<0.004	0.017	19.7	<u>0.031</u>	<u>0.31</u>	0.107	0.003	<0.002	12	3	3	0.007	1.3	1.7
0.18	0.25	0.005	0.021	23.0	<u>0.037</u>	<u>0.34</u>	0.127	0.006	<0.002	<1	2	2	0.011	0.9	1.5
0.12	0.14	<0.004	0.019	19.2	<u>0.030</u>	0.30	0.111	0.004	<0.002	<1	3	3	0.005	0.8	1.1

0.38	0.44	0.005	0.028	23.0	<u>0.036</u>	<u>0.38</u>	0.145	0.011	0.003	19	35	30	0.013	1	1.7
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.15	0.21	0.008	0.025	21.0	<u>0.031</u>	<u>0.32</u>	0.114	0.008	<0.002	28	20	20	0.004	1.1	1.2
0.16	0.31	0.015	0.026	20.0	<u>0.030</u>	<u>0.31</u>	0.105	0.009	<0.002	8	9	8	0.007	1	1.3
0.14	0.32	0.014	0.021	22.0	<u>0.034</u>	<u>0.36</u>	0.116	0.010	0.002	-	-	-	0.004	1.5	1.5
0.09	0.32	0.017	0.024	19.4	<u>0.029</u>	0.29	0.105	0.009	<0.002	11	11	10	<0.003	1.2	1.4
0.08	0.26	0.010	0.020	16.6	<u>0.027</u>	0.28	0.094	0.008	<0.002	2	4	4	<0.003	0.9	1.5
0.14	0.40	0.012	0.020	16.5	<u>0.025</u>	0.25	0.089	0.007	<0.002	2	5	5	<0.003	1.2	1.4
0.17	0.27	<0.004	0.023	22.0	<u>0.034</u>	<u>0.35</u>	0.132	0.006	<0.002	1	2	2	0.019	0.8	1.3
0.15	0.23	0.014	0.022	22.0	<u>0.035</u>	<u>0.35</u>	0.121	0.006	<0.002	<1	14	12	0.019	1.2	1.8
0.21	0.28	<0.004	0.021	24.0	<u>0.037</u>	<u>0.35</u>	0.135	0.006	<0.002	3	4	4	0.019	1	1.7
0.33	0.35	<0.004	0.022	18.7	<u>0.033</u>	<u>0.30</u>	0.113	0.004	<0.002	<1	2	2	0.011	0.9	1.4

Note: < = less than the value stated

UD = upper decile flow (long-term record 1992-2011 inclusive)

\*New Zealand Standard Time

\*TP results under review.

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

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

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

**1131-143** UD = 365 m<sup>3</sup>/s (Flows from Waipapa Dam - Total)

**Waikato River at Waipapa Tailrace**

06/01/11	11:42 a.m.	269	2.2	-	16.9	7.3	<u>21.5</u>	9.7	111.2	1.6	1.92	127	0.134	0.132	0.03
02/02/11	11:30 a.m.	426	(2.0)	32.5	14.7	7.3	<u>21.2</u>	9.6	109.6	<0.4	1.80	105	0.124	0.121	0.02
03/03/11	11:00 a.m.	290	<u>1.6</u>	42.5	16.4	7.2	<u>21.6</u>	8.3	94.9	0.4	1.37	141	0.200	0.195	0.03
05/04/11	12:55 p.m.	308	1.8	45.0	16.0	7.1	18.5	9.3	101.3	0.5	1.05	123	0.184	0.180	0.02
02/05/11	13:05 p.m.	263	1.8	40.0	16.8	7.3	<u>16.0</u>	8.6	88.2	0.9	1.29	147	0.220	0.210	0.02
07/06/11	11:45 a.m.	378	(1.8)	40.0	16.1	7.4	<u>14.2</u>	8.8	87.2	0.7	1.81	120	0.310	0.300	0.02
05/07/11	12:55 p.m.	415	(2.6)	50.0	15.4	7.2	<u>12.2</u>	10.4	100.2	0.5	1.03	114	0.270	0.270	<0.01
02/08/11	11:25 a.m.	437	(2.1)	35.0	15.2	7.4	11.4	11.1	102.0	0.8	1.15	114	0.320	0.320	<0.01
06/09/11	11:40 a.m.	276	<u>1.4</u>	32.5	16.2	7.5	<u>12.5</u>	11.1	103.3	1.2	1.66	114	0.155	0.154	<0.01
04/10/11	10:40 a.m.	425	(0.6)	35.0	18.0	7.6	14.0	11.5	114.2	1.0	2.70	133	0.133	0.130	0.01
01/11/11	11:13 a.m.	242	<u>1.1</u>	37.5	16.6	7.5	16.0	10.9	113.0	1.3	1.85	127	0.159	0.156	0.02
01/12/11	11:15 a.m.	289	<u>1.1</u>	35.0	16.4	7.6	18.0	9.6	99.7	1.1	2.60	109	0.047	0.046	0.03

**1131-328** UD = 377 m<sup>3</sup>/s (Flows from Karapiro Dam - Total)

**Waikato River at Narrows Boat Ramp**

06/01/11	7:44 a.m.	218	1.8	32.5	16.4	7.7	<u>22.1</u>	9.5	107.3	1.0	2.70	120	0.114	0.112	0.02
02/02/11	8:00 a.m.	362	<u>1.3</u>	35.0	15.0	7.3	<u>21.5</u>	9.9	112.1	1.6	2.80	112	0.240	0.240	0.02
03/03/11	7:54 a.m.	157	<u>1.0</u>	37.5	14.8	7.5	<u>21.7</u>	8.6	97.9	0.8	1.84	114	0.165	0.148	0.03
05/04/11	8:50 a.m.	221	<u>1.1</u>	35.0	16.2	7.4	18.4	9.0	96.1	<0.4	1.91	122	0.240	0.240	0.02
02/05/11	9:15 a.m.	301	1.7	37.5	16.7	7.5	<u>16.9</u>	8.9	91.9	1.7	1.66	121	0.290	0.280	<0.01
07/06/11	8:47 a.m.	320	1.6	37.5	14.6	7.5	<u>13.8</u>	9.5	92.0	0.6	1.98	115	0.400	0.400	0.01
05/07/11	9:00 a.m.	331	<u>1.3</u>	35.0	14.7	7.2	11.9	9.7	92.2	<0.4	2.20	113	0.410	0.400	0.01
02/08/11	9:30 a.m.	346	1.6	40.0	15.6	7.2	10.9	11.4	103.6	0.8	1.74	125	0.540	0.530	<0.01
06/09/11	9:06 a.m.	179	<u>1.4</u>	35.0	15.3	7.6	<u>12.6</u>	10.8	100.8	1.2	1.67	112	0.230	0.230	<0.01
04/10/11	8:05 a.m.	287	<u>1.1</u>	35.0	17.1	7.7	13.6	10.9	104.9	1.2	2.40	119	0.230	0.230	0.01
01/11/11	7:45 a.m.	236	<u>0.8</u>	37.5	15.1	7.8	16.9	10.3	108.1	1.4	3.30	86	0.220	0.210	<0.01
01/12/11	8:40 a.m.	160	<u>1.3</u>	35.0	16.1	7.7	19.2	9.6	102.1	1.4	2.50	130	0.144	0.141	0.02

**1131-69** UD = 387 m<sup>3</sup>/s (Flows from Hamilton - Bridge Street Bridge)

**Waikato River at Horotiu Br**

06/01/11	8:55 a.m.	196	1.7	37.5	16.6	7.6	<u>22.4</u>	8.9	102.0	0.7	3.20	128	0.155	0.152	0.02
02/02/11	9:20 a.m.	383	<u>0.9</u>	30.0	15.2	7.3	<u>21.2</u>	9.7	108.5	1.4	3.20	112	0.270	0.270	0.02
03/03/11	8:53 a.m.	146	<u>1.3</u>	35.0	15.1	7.5	<u>21.8</u>	8.2	93.6	0.8	2.20	116	0.200	0.183	0.01
05/04/11	9:25 a.m.	255	<u>0.8</u>	35.0	16.3	7.4	18.5	8.8	93.8	0.4	2.40	121	0.260	0.260	0.02
02/05/11	10:00 a.m.	275	<u>1.5</u>	37.5	17.0	7.5	<u>16.4</u>	8.8	90.0	0.7	2.10	124	0.280	0.280	0.03
07/06/11	9:22 a.m.	274	<u>1.2</u>	37.5	14.7	7.5	<u>13.9</u>	9.4	91.4	0.8	2.10	115	0.410	0.410	0.01
05/07/11	9:48 a.m.	238	<u>0.8</u>	35.0	14.6	7.2	<u>12.0</u>	9.6	91.5	0.4	<u>6.30</u>	118	0.430	0.430	0.02
02/08/11	10:03 a.m.	334	-	-	15.8	7.4	11.0	11.2	101.8	0.8	2.20	119	0.580	0.580	<0.01
06/09/11	9:46 a.m.	177	<u>1.0</u>	35.0	15.6	7.7	<u>12.2</u>	10.8	99.6	1.3	2.10	113	0.260	0.260	<0.01
04/10/11	8:40 a.m.	234	<u>0.9</u>	35.0	17.3	7.7	13.7	10.8	104.5	1.2	2.60	123	0.250	0.240	0.01
01/11/11	8:20 a.m.	185	<u>0.7</u>	37.5	15.0	7.7	16.5	10.1	104.7	1.4	3.80	108	0.230	0.220	0.02
01/12/11	9:15 a.m.	164	<u>1.1</u>	35.0	16.4	7.7	18.4	9.4	98.8	1.2	2.50	132	0.230	0.210	0.13

**1131-77** UD = 582 m<sup>3</sup>/s (Flows from Huntly Power Station Recorder)

**Waikato River at Huntly-Tainui Br**

06/01/11	9:50 a.m.	252	<u>1.1</u>	32.5	15.7	7.6	<u>23.2</u>	9.3	109.0	0.9	<u>6.70</u>	121	0.192	0.190	<0.01
02/02/11	10:00 a.m.	525	<u>0.9</u>	32.5	14.5	7.1	<u>21.0</u>	8.2	98.0	1.2	<u>6.30</u>	111	0.330	0.330	0.02
03/03/11	9:40 a.m.	218	<u>0.9</u>	35.0	15.0	7.5	<u>21.9</u>	8.6	98.4	0.8	<u>6.60</u>	109	0.220	0.220	<0.01
05/04/11	9:55 a.m.	341	<u>0.6</u>	37.5	15.9	7.4	18.1	8.5	90.3	0.5	5.00	119	0.340	0.340	0.02
02/05/11	10:30 a.m.	385	<u>0.9</u>	35.0	15.9	7.3	<u>16.2</u>	8.6	87.8	1.3	<u>6.10</u>	115	0.470	0.470	<0.01
07/06/11	9:52 a.m.	443	<u>0.9</u>	27.5	14.0	7.4	<u>14.3</u>	9.0	88.2	0.6	2.10	112	0.630	0.620	0.01
05/07/11	10:17 a.m.	409	<u>0.9</u>	35.0	14.1	7.2	11.7	9.4	88.4	<0.4	<u>6.60</u>	113	0.700	0.690	0.02
02/08/11	10:32 a.m.	443	-	-	15.0	7.3	10.7	10.9	98.2	0.6	<u>5.80</u>	114	0.830	0.830	0.01
06/09/11	10:14 a.m.	311	<u>0.8</u>	35.0	15.0	7.6	<u>12.6</u>	10.4	96.4	1.2	4.90	107	0.390	0.390	<0.01
04/10/11	9:37 a.m.	450	<u>0.2</u>	20.0	14.0	7.4	15.2	9.4	93.9	1.5	<u>25.00</u>	103	0.480	0.470	0.03
01/11/11	8:50 a.m.	341	<u>0.6</u>	37.5	14.2	7.6	17.1	9.7	101.4	1.2	<u>10.70</u>	96	0.350	0.350	<0.01
01/12/11	9:44 a.m.	286	<u>1.0</u>	27.5	15.7	7.7	19.0	9.4	100.1	1.0	4.60	123	0.197	0.196	<0.01

Note: < = less than the value stated  
UD = upper decile flow (long-term record 1992-2011 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 values –don't assess for compliance

TKN g/m <sup>3</sup>	TN g/m <sup>3</sup>	DRP g/m <sup>3</sup>	TP g/m <sup>3</sup>	CL g/m <sup>3</sup>	AS g/m <sup>3</sup>	B g/m <sup>3</sup>	LI g/m <sup>3</sup>	A340F /cm	A440F /cm	ENT cfu/100mL	FC cfu/100mL	E coli cfu/100mL	CHLA g/m <sup>3</sup>	DOC g/m <sup>3</sup>	TOC g/m <sup>3</sup>
-	<0.5	-	<0.04	-	<0.01	<0.3	-	-	-	<77	-	<550	<0.02		
0.22	0.35	0.022	0.034	19.6	<u>0.030</u>	<u>0.31</u>	0.115	0.011	0.002	13	9	9	<0.003	1.3	1.7
0.20	0.32	0.013	0.031	15.5	<u>0.026</u>	0.24	0.080	0.014	0.003	7	10	10	0.004	1.7	1.8
0.21	0.41	0.020	0.033	18.6	<u>0.025</u>	0.24	0.092	0.012	0.003	<1	12	12	<0.003	1.6	1.7
0.23	0.41	0.016	0.024	18.5	<u>0.026</u>	0.26	0.089	0.011	0.002	8	10	10	0.005	1.2	1.8
0.18	0.40	0.016	0.022	19.5	<u>0.027</u>	<u>0.31</u>	0.100	0.011	0.002	-	-	-	<0.003	1.5	1.5
0.12	0.43	0.022	0.032	18.6	<u>0.026</u>	0.25	0.093	0.014	0.003	10	12	11	<0.003	1.6	1.7
0.08	0.35	0.017	0.027	16.8	<u>0.023</u>	0.25	0.085	0.011	<0.002	<1	1	1	<0.003	1.2	1.8
0.11	0.43	0.015	0.023	16.1	<u>0.024</u>	0.25	0.085	0.007	<0.002	<1	1	1	<0.003	1.3	1.5
0.19	0.35	<0.004	0.035	18.6	<u>0.025</u>	0.28	0.100	0.007	<0.002	2	1	1	0.017	2.9	2.9
0.24	0.37	0.006	0.035	23.0	<u>0.032</u>	<u>0.32</u>	0.117	0.007	<0.002	21	330	250	0.017	1.5	2.4
0.20	0.36	0.004	0.022	21.0	<u>0.032</u>	0.30	0.115	0.009	<0.002	1	16	16	0.005	1.1	1.9
0.18	0.23	0.005	0.026	18.8	<u>0.029</u>	0.27	0.103	0.007	<0.002	2	11	11	0.008	0.9	1.3
0.25	0.36	0.011	0.031	18.9	<u>0.030</u>	0.28	0.096	0.012	0.002	<u>80</u>	51	47	0.009	1.4	1.8
0.17	0.41	0.020	<u>0.045</u>	17.1	<u>0.025</u>	0.25	0.083	0.019	0.004	<u>110</u>	40	40	0.004	1.5	2.1
0.22	0.39	0.008	0.027	15.2	<u>0.022</u>	0.20	0.068	0.011	0.002	30	60	60	0.012	1.9	2.4
0.29	<u>0.53</u>	0.018	0.028	18.6	<u>0.023</u>	0.26	0.091	0.012	0.003	42	60	60	0.004	1.2	1.7
0.15	0.44	0.021	0.030	21.0	<u>0.023</u>	<u>0.31</u>	0.110	0.012	0.002	-	-	-	0.003	1.8	1.5
0.12	<u>0.52</u>	0.022	0.031	16.5	<u>0.021</u>	0.26	0.086	0.013	<0.002	23	54	52	<0.003	1.7	1.8
0.15	<u>0.56</u>	0.021	0.027	15.8	<u>0.019</u>	0.22	0.079	0.013	0.002	17	39	36	<0.003	1.2	1.6
0.15	<u>0.69</u>	0.020	0.026	17.6	<u>0.020</u>	0.25	0.090	0.009	<0.002	8	12	10	<0.003	0.8	1.3
0.12	0.35	<0.004	0.018	16.9	<u>0.020</u>	0.23	0.077	0.006	<0.002	11	18	13	0.014	0.8	1.5
0.22	0.45	0.006	0.031	21.0	<u>0.030</u>	0.29	0.111	0.010	<0.002	34	260	190	0.012	1.2	1.6
0.21	0.43	<0.004	0.026	17.8	<u>0.027</u>	0.25	0.095	0.012	0.002	40	140	110	0.020	1.5	2.6
0.19	0.33	0.006	0.030	18.1	<u>0.028</u>	0.27	0.093	0.008	<0.002	7	30	24	0.009	1.1	1.5
0.23	0.39	0.017	<u>0.041</u>	18.9	<u>0.030</u>	0.29	0.100	0.012	0.002	<u>100</u>	190	160	0.007	1.4	1.9
0.23	0.50	0.023	<u>0.047</u>	16.9	<u>0.025</u>	0.26	0.085	0.021	0.005	<u>150</u>	70	60	0.004	1.7	2
0.24	0.44	0.011	0.030	15.6	<u>0.022</u>	0.22	0.073	0.012	0.002	70	90	90	0.013	2.1	2.5
0.19	0.45	0.020	0.031	18.9	<u>0.023</u>	0.27	0.092	0.012	0.003	<u>150</u>	200	170	0.005	1.3	1.7
0.14	0.42	0.026	0.038	19.8	<u>0.023</u>	<u>0.31</u>	0.108	0.012	0.003	-	-	-	0.005	1.7	1.7
0.16	<u>0.57</u>	0.024	0.034	16.7	<u>0.021</u>	0.24	0.082	0.015	0.003	50	88	66	<0.003	1.6	2
0.17	<u>0.60</u>	0.028	<u>0.045</u>	15.7	<u>0.019</u>	0.20	0.074	0.016	0.003	<u>150</u>	170	170	<0.003	1.8	2.7
0.17	<u>0.75</u>	0.024	0.032	17.7	<u>0.021</u>	0.22	0.087	0.011	<0.002	13	31	29	<0.003	1.1	1.4
0.16	0.42	0.008	0.025	17.2	<u>0.019</u>	0.23	0.078	0.007	<0.002	36	30	30	0.013	0.9	2
0.24	0.49	0.011	<u>0.042</u>	20.0	<u>0.030</u>	<u>0.30</u>	0.118	0.013	<0.002	15	570	500	0.018	1.5	2.2
0.24	0.47	0.006	0.033	18.0	<u>0.028</u>	0.26	0.096	0.014	0.003	<u>80</u>	200	200	0.015	1.3	2.4
0.20	0.43	0.008	0.032	19.3	<u>0.030</u>	0.26	0.091	0.008	<0.002	22	22	22	0.009	1.1	1.5
0.32	<u>0.51</u>	0.020	<u>0.052</u>	17.4	<u>0.023</u>	0.23	0.080	0.018	0.003	57	190	160	0.014	2	2.2
0.25	<u>0.58</u>	0.023	<u>0.062</u>	15.8	<u>0.019</u>	0.21	0.067	0.029	0.006	<u>200</u>	150	130	0.006	2.3	2.9
0.26	0.48	0.015	<u>0.047</u>	15.9	<u>0.018</u>	0.20	0.062	0.016	0.003	<u>90</u>	140	120	0.018	2.3	2.8
0.23	<u>0.57</u>	0.024	0.037	18.0	<u>0.019</u>	0.22	0.077	0.019	0.004	<u>150</u>	250	180	0.006	1.7	2.2
0.26	<u>0.73</u>	0.024	<u>0.049</u>	19.1	<u>0.016</u>	0.23	0.077	0.022	0.004	-	-	-	0.003	2.6	2.6
0.19	<u>0.82</u>	0.026	<u>0.049</u>	15.4	<u>0.014</u>	0.17	0.057	0.024	0.004	66	170	140	<0.003	2.1	2.9
0.20	<u>0.90</u>	0.021	0.039	15.2	<u>0.013</u>	0.16	0.054	0.021	0.004	23	70	70	<0.003	2	3
0.15	<u>0.98</u>	0.023	<u>0.043</u>	16.6	<u>0.014</u>	0.18	0.064	0.017	0.002	13	340	280	<0.003	1.2	1.9
0.20	<u>0.59</u>	0.009	0.036	16.3	<u>0.014</u>	0.19	0.063	0.014	<0.002	10	60	60	0.011	1	2.1
0.46	<u>0.94</u>	0.019	<u>0.105</u>	16.2	<u>0.014</u>	0.16	0.057	0.030	0.005	<u>1200</u>	11000	<u>9800</u>	0.008	2.4	4.5
0.32	<u>0.67</u>	0.011	<u>0.059</u>	16.6	<u>0.020</u>	0.20	0.073	0.018	0.004	<u>120</u>	410	350	0.015	1.4	2.7
0.19	0.39	0.009	0.039	17.9	<u>0.025</u>	0.23	0.078	0.012	0.002	11	60	40	0.011	1.3	1.8

Note: < = less than the value stated

UD = upper decile flow (long-term record 1992-2011 inclusive)

\*New Zealand Standard Time

\*TP results under review.

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

() black disk measurements taken in flows above upper decile values –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 <sup>3</sup> /s	m	units	mS/m	units	'C	g/m <sup>3</sup>	%Sat	g/m <sup>3</sup>	NTU	g/m <sup>3</sup>	g/m <sup>3</sup>	g/m <sup>3</sup>	g/m <sup>3</sup>
Satisfactory Water Quality Guideline/Standard			>1.6	-	-	6.5-9	<12 (May-Sep)	>80	-	<5	-	-	-	-	<0.88
							<20 (Oct-Apr)								

**1131-91** UD = 645 m<sup>3</sup>/s (Flows from Mercer Bridge Recorder)

**Waikato River at Mercer Br**

06/01/11	10:30 a.m.	210	-	-	16.0	7.7	<u>24.0</u>	9.6	113.9	1.5	<u>11.50</u>	119	0.094	0.094	<0.01
02/02/11	10:50 a.m.	637	-	-	15.6	7.0	<u>21.7</u>	7.6	84.6	2.0	<u>16.10</u>	112	0.300	0.290	0.03
03/03/11	10:15 a.m.	202	-	-	15.2	7.6	<u>22.2</u>	8.5	97.6	1.2	<u>7.50</u>	114	0.144	0.144	<0.01
05/04/11	10:35 a.m.	295	-	-	16.5	7.4	18.4	8.2	87.0	0.7	<u>10.70</u>	117	0.340	0.330	<0.01
02/05/11	11:30 a.m.	369	-	-	16.6	7.3	<u>16.9</u>	8.4	87.5	1.6	<u>16.30</u>	122	0.520	0.510	<0.01
07/06/11	10:30 a.m.	445	-	-	14.8	7.4	<u>14.6</u>	8.9	87.7	0.7	<u>10.40</u>	120	0.600	0.600	<0.01
05/07/11	11:15 a.m.	443	-	-	15.1	7.3	11.9	9.4	89.8	<0.4	<u>10.60</u>	119	0.650	0.650	0.02
02/08/11	11:13 a.m.	469	-	-	16.0	7.3	11.2	10.7	97.2	1.0	<u>10.00</u>	123	0.810	0.800	<0.01
06/09/11	11:00 a.m.	305	-	-	15.5	7.3	<u>13.7</u>	10.1	96.7	1.1	<u>5.60</u>	107	0.320	0.310	<0.01
04/10/11	10:22 a.m.	393	-	-	16.0	7.6	16.6	9.8	100.9	1.2	<u>12.50</u>	114	0.400	0.400	<0.01
01/11/11	9:30 a.m.	278	-	-	14.9	7.5	18.0	9.2	98.1	1.2	<u>19.20</u>	108	0.380	0.380	<0.01
01/12/11	11:10 a.m.	246	-	-	16.1	7.7	19.8	9.5	101.9	1.7	<u>9.80</u>	129	0.159	0.158	<0.01

**1131-133** UD = 645 m<sup>3</sup>/s (Flows from Mercer Bridge Recorder)

**Waikato River at Tuakau Br**

06/01/11	10:55 a.m.	210	<u>0.9</u>	35.0	16.0	7.8	<u>24.7</u>	9.9	118.9	1.7	<u>8.10</u>	115	0.051	0.051	<0.01
02/02/11	11:10 a.m.	636	<u>0.4</u>	25.0	15.0	6.9	<u>21.6</u>	6.9	<u>77.4</u>	1.9	<u>15.50</u>	113	0.290	0.290	0.02
03/03/11	10:35 a.m.	208	<u>0.7</u>	32.5	15.1	7.8	<u>22.5</u>	8.9	103.1	1.2	4.60	114	0.102	0.100	<0.01
05/04/11	10:55 a.m.	296	<u>0.6</u>	37.5	16.6	7.4	18.5	8.4	90.2	0.7	<u>7.30</u>	123	0.280	0.280	<0.01
02/05/11	11:55 a.m.	372	<u>0.4</u>	30.0	16.5	7.2	<u>16.9</u>	8.2	84.6	1.5	<u>15.00</u>	117	0.480	0.480	<0.01
07/06/11	10:51 a.m.	445	<u>0.5</u>	27.5	14.8	7.3	<u>14.5</u>	8.6	84.2	0.8	<u>12.70</u>	113	0.570	0.560	<0.01
05/07/11	11:54 a.m.	441	<u>0.5</u>	25.0	14.9	7.3	<u>12.0</u>	9.6	91.5	<0.4	<u>15.70</u>	119	0.620	0.610	0.01
02/08/11	12:00 p.m.	467	<u>0.6</u>	30.0	15.8	7.2	11.5	10.1	93.2	0.7	<u>11.50</u>	127	0.780	0.770	<0.01
06/09/11	11:35 a.m.	306	<u>0.7</u>	32.5	15.6	7.6	<u>13.9</u>	10.3	98.6	1.6	<u>7.00</u>	110	0.270	0.270	<0.01
04/10/11	11:04 a.m.	393	<u>0.4</u>	27.5	16.0	7.6	15.9	10.1	102.2	1.2	<u>15.20</u>	114	0.360	0.360	<0.01
01/11/11	9:50 a.m.	279	<u>0.1</u>	22.5	14.8	7.6	18.3	9.3	100.2	1.7	<u>19.40</u>	106	0.330	0.330	<0.01
01/12/11	11:30 a.m.	247	<u>0.7</u>	25.0	16.0	7.9	19.7	9.8	105.9	1.8	<u>6.10</u>	128	0.121	0.119	<0.01

Note: < = less than the value stated  
UD = upper decile flow (long-term record 1992-2011 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 values –don't assess for compliance

TKN g/m <sup>3</sup>	TN g/m <sup>3</sup>	DRP g/m <sup>3</sup>	TP g/m <sup>3</sup>	CL g/m <sup>3</sup>	AS g/m <sup>3</sup>	B g/m <sup>3</sup>	LI g/m <sup>3</sup>	A340F /cm	A440F /cm	ENT cfu/100mL	FC cfu/100mL	E coli cfu/100mL	CHLA g/m <sup>3</sup>	DOC g/m <sup>3</sup>	TOC g/m <sup>3</sup>
-	<0.5	-	<0.04	-	<0.01	<0.3	-	-	-	<77	-	<550	<0.02		

0.57	<u>0.66</u>	0.014	<u>0.061</u>	17.6	<u>0.024</u>	0.25	0.081	0.016	0.003	26	160	160	0.018	1.5	3
0.55	<u>0.85</u>	0.009	<u>0.089</u>	16.3	<u>0.015</u>	0.20	0.059	0.050	0.010	<u>130</u>	430	360	0.019	3.9	5.8
0.32	0.46	0.016	0.040	15.9	<u>0.018</u>	0.20	0.062	0.018	0.003	<u>150</u>	160	160	<u>0.030</u>	2.3	3.4
0.30	<u>0.64</u>	0.020	<u>0.050</u>	19.0	<u>0.019</u>	0.23	0.076	0.023	0.004	<u>130</u>	290	120	0.008	2	3
0.41	<u>0.93</u>	0.027	<u>0.067</u>	19.4	<u>0.014</u>	0.22	0.071	0.033	0.006	-	-	-	0.011	3.8	4.5
0.26	<u>0.86</u>	0.020	<u>0.054</u>	16.1	<u>0.015</u>	0.19	0.060	0.026	0.004	10	140	140	0.007	2.6	3.7
0.30	<u>0.95</u>	0.019	<u>0.050</u>	15.9	<u>0.012</u>	0.17	0.054	0.034	0.006	45	30	20	0.006	2.7	4
0.26	<u>1.07</u>	0.021	<u>0.053</u>	17.4	<u>0.013</u>	0.19	0.062	0.028	0.004	27	70	60	< 0.003	1.9	3
0.21	<u>0.53</u>	0.007	<u>0.041</u>	17.4	<u>0.017</u>	0.22	0.070	0.009	< 0.002	3	50	50	0.017	1.1	2.3
0.32	<u>0.72</u>	0.016	<u>0.071</u>	18.2	<u>0.020</u>	0.22	0.082	0.021	0.004	<u>180</u>	2600	<u>2100</u>	0.020	1.9	3.2
0.39	<u>0.77</u>	0.009	<u>0.081</u>	17.0	<u>0.017</u>	0.19	0.067	0.032	0.008	13	240	170	0.017	2.2	4.3
0.44	<u>0.60</u>	0.014	<u>0.056</u>	18.2	<u>0.026</u>	0.24	0.081	0.016	0.003	53	160	140	0.020	1.6	2.6

0.32	0.37	0.014	<u>0.057</u>	17.7	<u>0.023</u>	0.25	0.080	0.016	0.003	9	100	80	0.013	1.5	2.9
0.52	<u>0.81</u>	0.016	<u>0.095</u>	16.0	<u>0.015</u>	0.18	0.054	0.062	0.012	<u>80</u>	70	70	0.012	4.8	6.8
0.35	0.45	0.007	0.039	15.7	<u>0.017</u>	0.19	0.060	0.018	0.004	<u>75</u>	120	120	<u>0.031</u>	2.1	3.1
0.24	<u>0.52</u>	0.018	<u>0.045</u>	19.6	<u>0.018</u>	0.25	0.078	0.024	0.005	97	200	120	0.009	2.3	3.4
0.50	<u>0.98</u>	0.011	<u>0.068</u>	19.6	<u>0.014</u>	0.22	0.069	0.040	0.007	-	-	-	0.009	4.3	5.4
0.32	<u>0.89</u>	0.018	<u>0.060</u>	16.5	<u>0.014</u>	0.19	0.058	0.037	0.008	31	140	120	0.006	3.2	4.5
0.34	<u>0.96</u>	0.017	<u>0.068</u>	16.1	<u>0.013</u>	0.17	0.053	0.043	0.007	9	80	80	0.008	3.1	5
0.26	<u>1.04</u>	0.019	<u>0.058</u>	17.5	<u>0.013</u>	0.17	0.059	0.036	0.007	5	60	50	0.003	2.4	3.5
0.26	<u>0.53</u>	0.006	<u>0.043</u>	17.0	<u>0.017</u>	0.21	0.068	0.015	< 0.002	6	33	33	0.019	1.1	2.6
0.35	<u>0.71</u>	0.013	<u>0.069</u>	18.1	<u>0.020</u>	0.22	0.081	0.021	0.004	<u>270</u>	1700	<u>1700</u>	<u>0.022</u>	1.7	3.1
0.60	<u>0.93</u>	0.008	<u>0.087</u>	17.1	<u>0.024</u>	0.20	0.071	0.030	0.006	7	180	150	<u>0.036</u>	2.2	5.7
0.27	0.39	0.006	<u>0.046</u>	18.0	<u>0.024</u>	0.25	0.084	0.013	0.002	23	20	20	0.018	1.4	2.1

Note: < = less than the value stated

UD = upper decile flow (long-term record 1992-2011 inclusive)

\*New Zealand Standard Time

\*TP results under review.

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

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

## 5-Yearly Trace Metal Analysis

DATE	TIME*	AITR	AsTR	BTR	CdTR	CoTR	CrTR	CuTR	FeD	FeTR	HgT
dd/mm/yy	hh:mm	g/m <sup>3</sup>	g/m <sup>3</sup>	g/m <sup>3</sup>	g/m <sup>3</sup>	g/m <sup>3</sup>	g/m <sup>3</sup>	g/m <sup>3</sup>	g/m <sup>3</sup>	g/m <sup>3</sup>	g/m <sup>3</sup>

### 1131-127

#### Waikato River at Taupo Control Gates

06/07/10	10:05 a.m.	0.0020	0.0107	0.175	0.000022	<0.00004	<0.0006	0.0006	<0.005	<0.006	<0.00002
05/10/10	9:05 a.m.	0.0021	0.0111	0.164	<0.000011	<0.00004	<0.0006	<0.0003	<0.005	<0.006	0.0009
06/01/11	8:15 a.m.	0.0044	0.0107	0.159	0.00001	<0.00004	<0.0006	0.0002	<0.005	0.007	<0.00002
05/04/11	9:25 a.m.	0.0038	0.0099	0.159	<0.000011	<0.00004	<0.0006	<0.0003	<0.005	0.008	<0.00002

### 1131-107

#### Waikato River at Ohakuri Tailrace

06/07/10	11:55 a.m.	0.0300	0.0270	0.320	0.000019	<0.00004	<0.0006	0.0002	0.034	0.115	<0.00002
05/10/10	10:45 a.m.	0.0310	0.0250	0.260	<0.000011	<0.00004	<0.0006	<0.0003	0.053	0.131	0.0009
06/01/11	10:15 a.m.	0.0320	0.0460	0.410	<0.000011	<0.00004	<0.0006	0.0002	0.076	0.188	<0.00002
05/04/11	11:15 a.m.	0.0161	0.0300	0.300	<0.000011	<0.00004	<0.0006	0.0003	0.050	0.100	<0.00002

### 1131-101

#### Waikato River at Narrows Br

07/07/10	8:35 a.m.	0.0590	0.0200	0.300	0.000015	0.00004	<0.0006	0.0003	0.061	0.170	<0.00002
06/10/10	8:00 a.m.	0.0930	0.0170	0.198	<0.000011	0.00004	<0.0006	0.0003	0.060	0.194	0.0010
07/01/11	7:44 a.m.	0.0330	0.0300	0.260	<0.000011	<0.00004	<0.0006	0.0002	0.048	0.128	<0.00002
06/04/11	8:50 a.m.	0.0410	0.0240	0.260	<0.000011	0.00003	<0.0006	0.0002	0.049	0.143	<0.00002

### 1131-69

#### Waikato River at Horotiu Br

07/07/10	9:10 a.m.	0.0840	0.0210	0.300	0.000015	0.00007	<0.0006	0.0004	0.065	0.260	<0.00002
06/10/10	9:15 a.m.	0.1080	0.0163	0.210	<0.000011	0.00008	0.0005	0.0003	0.072	0.270	0.0010
07/01/11	8:55 a.m.	0.0440	0.0300	0.270	<0.000011	0.00004	<0.0006	0.0002	0.053	0.180	<0.00002
06/04/11	9:25 a.m.	0.0500	0.0230	0.270	<0.000011	0.00004	<0.0006	<0.0003	0.060	0.182	<0.00002

### 1131-133

#### Waikato River at Tuakau Br

07/07/10	10:50 a.m.	0.3000	0.0101	0.190	0.000019	0.00033	0.0006	0.0009	0.198	0.730	<0.00002
06/10/10	12:15 p.m.	0.2700	0.0095	0.131	<0.000011	0.00030	0.0007	0.0008	0.320	0.820	0.0010
07/01/11	10:55 a.m.	0.1250	0.0230	0.240	<0.000011	0.00012	<0.0006	0.0005	0.078	0.300	<0.00002
06/04/11	10:55 a.m.	0.1840	0.0180	0.250	<0.000011	0.00019	<0.0006	0.0005	0.164	0.520	<0.00002

LiT g/m <sup>3</sup>	MnD g/m <sup>3</sup>	MnTR g/m <sup>3</sup>	MoTR g/m <sup>3</sup>	NiTR g/m <sup>3</sup>	PbTR g/m <sup>3</sup>	SbTR g/m <sup>3</sup>	TiTR g/m <sup>3</sup>	UTR g/m <sup>3</sup>	ZnD g/m <sup>3</sup>	ZnTR g/m <sup>3</sup>
0.042	<0.0002	0.0011	0.0003	<0.0004	<0.00006	0.00024	0.000017	<0.00003	<0.0005	0.0009
0.038	<0.0002	0.0008	0.0003	<0.0004	<0.00006	0.00022	<0.000011	<0.00003	<0.0005	<0.0006
0.042	<0.0002	0.0008	0.0002	<0.0004	0.00007	0.00026	0.000016	<0.00003	0.0007	<0.0006
0.038	<0.0002	0.0011	0.0003	<0.0004	<0.00006	0.00020	<0.000011	<0.00003	<0.0005	<0.0006
0.118	0.0002	0.0143	0.0005	<0.0004	0.00006	0.00108	0.000055	<0.00003	<0.0005	0.0017
0.083	0.0035	0.0174	0.0004	<0.0004	0.00007	0.00073	0.000028	<0.00003	0.0006	0.0006
0.167	0.0002	0.0141	0.0007	<0.0004	0.00006	0.00142	0.000069	<0.00003	<0.0005	0.0009
0.104	0.0011	0.0121	0.0005	<0.0004	<0.00006	0.00085	0.000048	<0.00003	0.0007	0.0006
0.115	0.0004	0.0190	0.0005	<0.0004	0.00007	0.00096	0.000039	<0.00003	0.0006	0.0012
0.071	0.0005	0.0197	0.0004	<0.0004	0.00006	0.00059	0.000025	<0.00003	<0.0005	0.0006
0.104	0.0006	0.0250	0.0005	<0.0004	<0.00006	0.00072	0.000036	<0.00003	<0.0005	0.0006
0.095	0.0008	0.0260	0.0005	<0.0004	0.00007	0.00078	0.000032	<0.00003	<0.0005	<0.0006
0.116	0.0004	0.0290	0.0005	<0.0004	0.00016	0.00092	0.000043	<0.00003	0.0005	0.0021
0.070	0.0007	0.0290	0.0003	<0.0004	0.00010	0.00056	0.000027	<0.00003	0.0005	0.0010
0.105	0.0006	0.0310	0.0005	<0.0004	0.00006	0.00071	0.000035	<0.00003	<0.0005	0.0013
0.096	0.0011	0.0290	0.0004	<0.0004	0.00007	0.00078	0.000036	0.00003	<0.0005	0.0009
0.060	0.0014	0.0630	0.0003	0.0005	0.00030	0.00047	0.000034	0.00003	0.0015	0.0039
0.041	0.0138	0.0710	0.0003	0.0004	0.00028	0.00034	0.000024	0.00004	0.0012	0.0032
0.090	0.0009	0.0370	0.0005	<0.0004	0.00015	0.00065	0.000029	0.00002	0.0006	0.0017
0.083	0.0106	0.0460	0.0004	<0.0004	0.00020	0.00063	0.000025	0.00003	<0.0005	0.0016

# References

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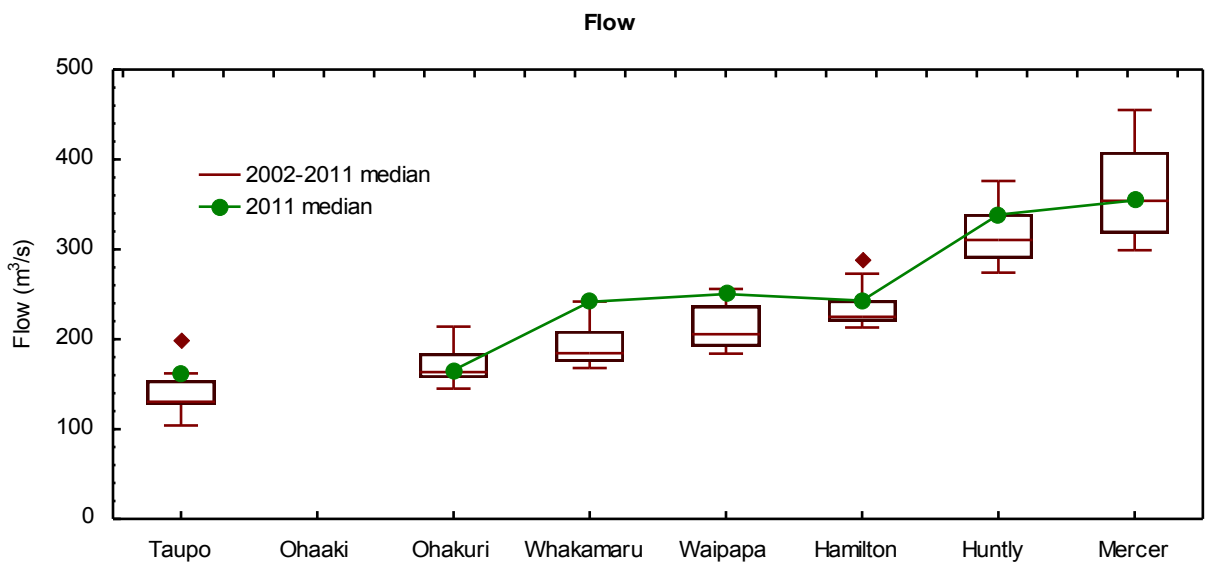
# Appendix I:

## Flow Information

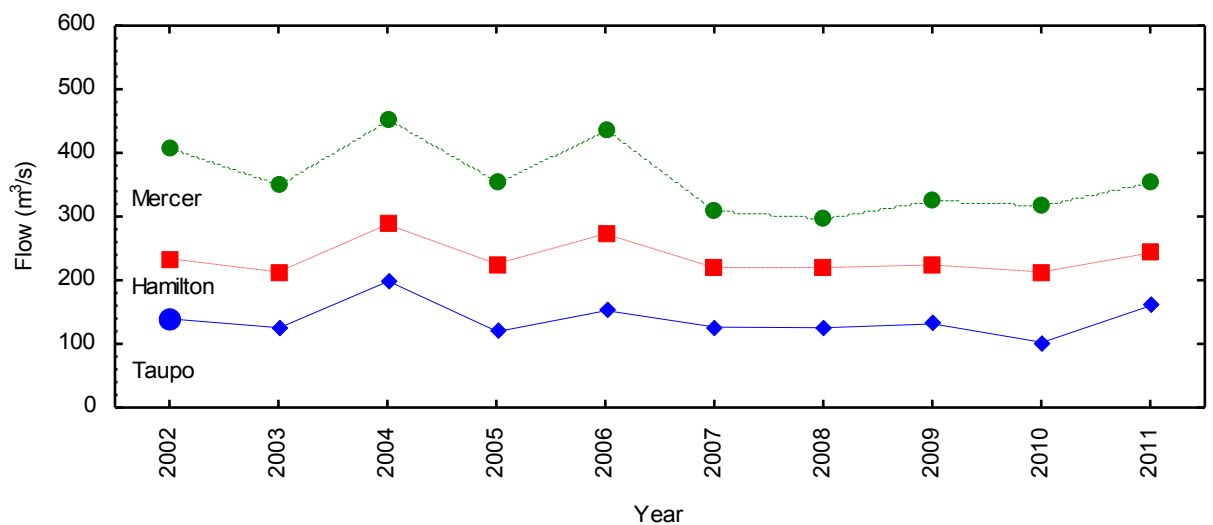
### Median Flows of the Waikato River and Main Tributaries

Location	DISTANCE	FLOW RATE+ (m <sup>3</sup> /s)										10 YEAR
	km	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Median
Taupo	4.2	141	127	200	121	154	128	127	133	104	162	130
Ohakuri	75.8	164	157	214	152	184	157	163	145	192	165	164
Whakamaru	105.0	183	168	224	175	208	178	186	170	209	242	184
Waipapa	126.1	211	192	256	200	237	190	211	184	198	250	205
Hamilton	211.5	234	213	288	226	273	220	220	224	213	243	225
Huntly	246.5	328	315	376	290	343	282	274	306	296	339	311
Mercer	286.3	408	353	455	355	437	312	299	328	318	355	354
Waiotapu Stm	46.6	2.8	2.6	3.7	3.6	3.8	2.9	3.0	2.7	3.2	3.8	3.1
Waipa River	232.7	73	61	87	56	61	39	43	52	40	57	57

+Rating curve errors mean estimates of flow are ± 8%



Yearly Flow Record (Median) at Taupo, Hamilton and Mercer.



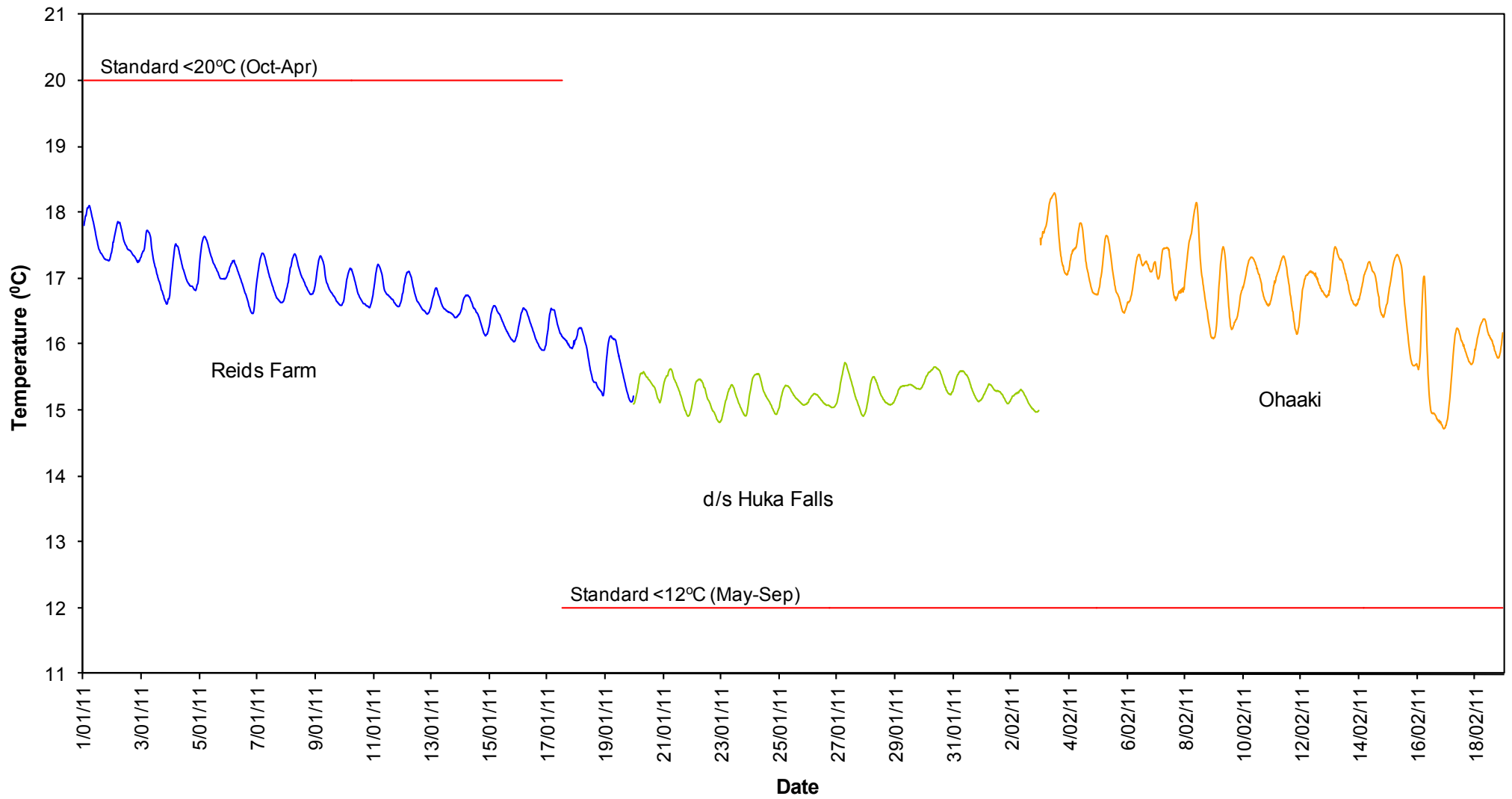
# **Appendix II**

## **Datasonde deployments**

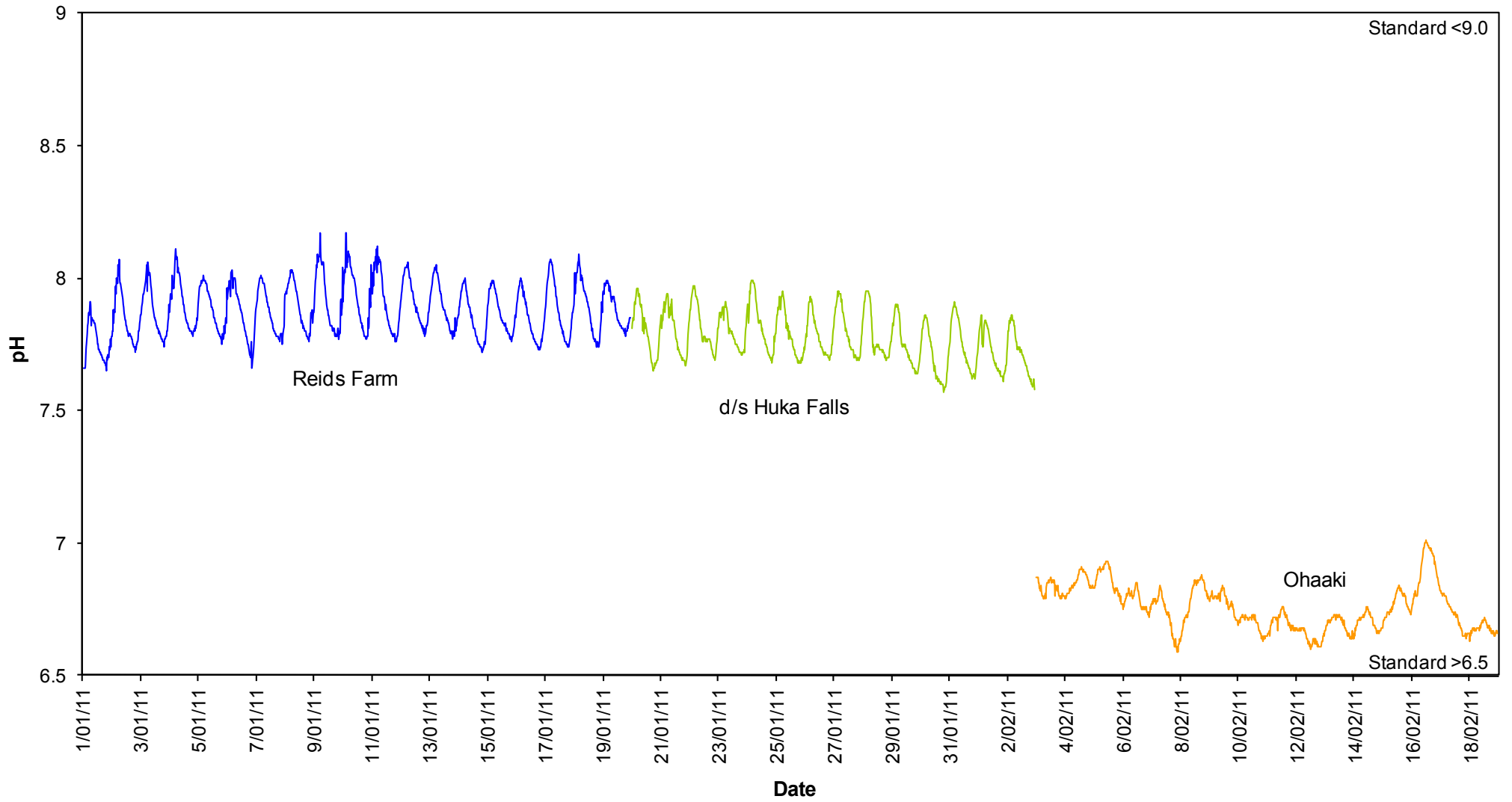
### **Diurnal variation of some water quality parameters**



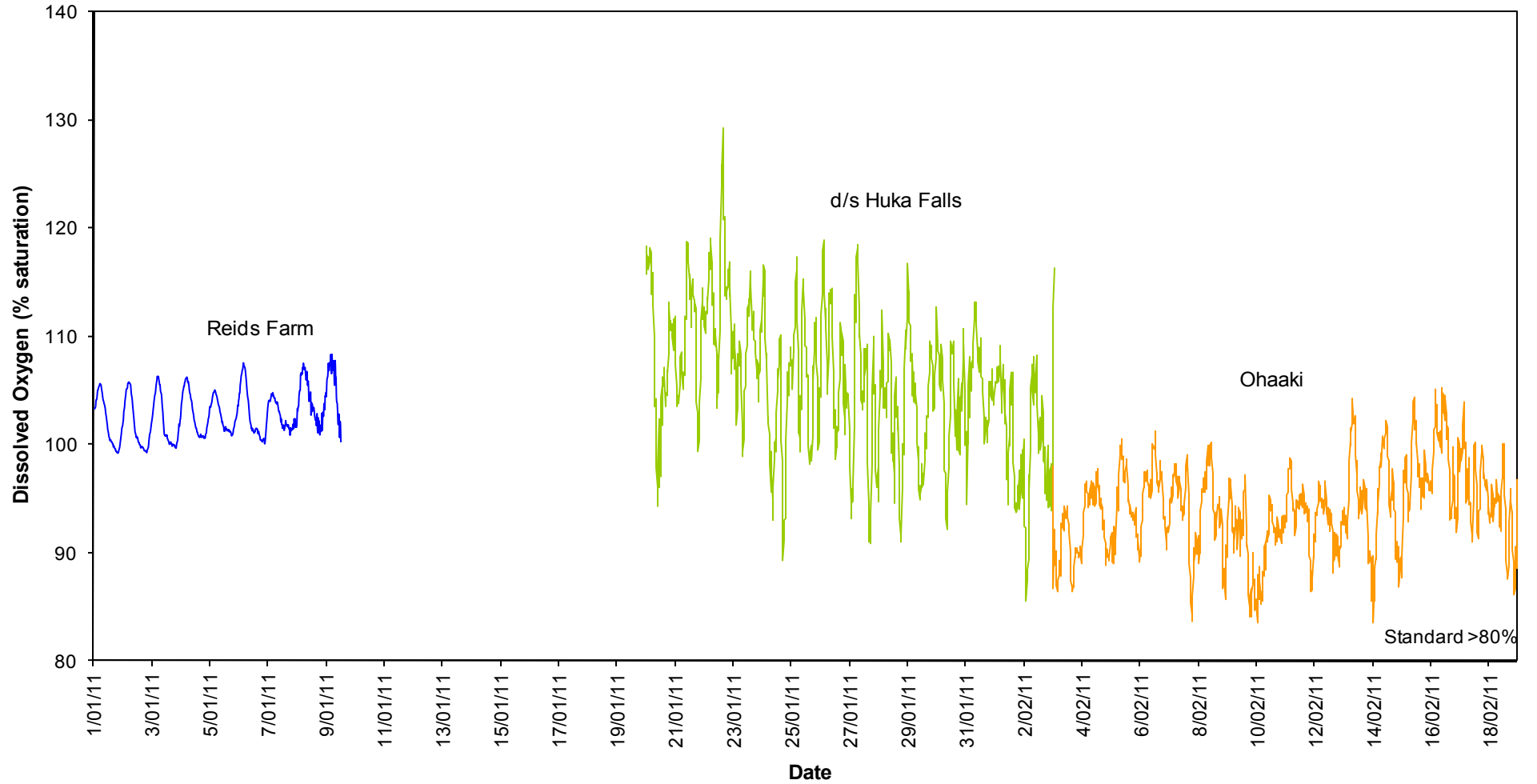
# Temperature: Upper Waikato (January - April)



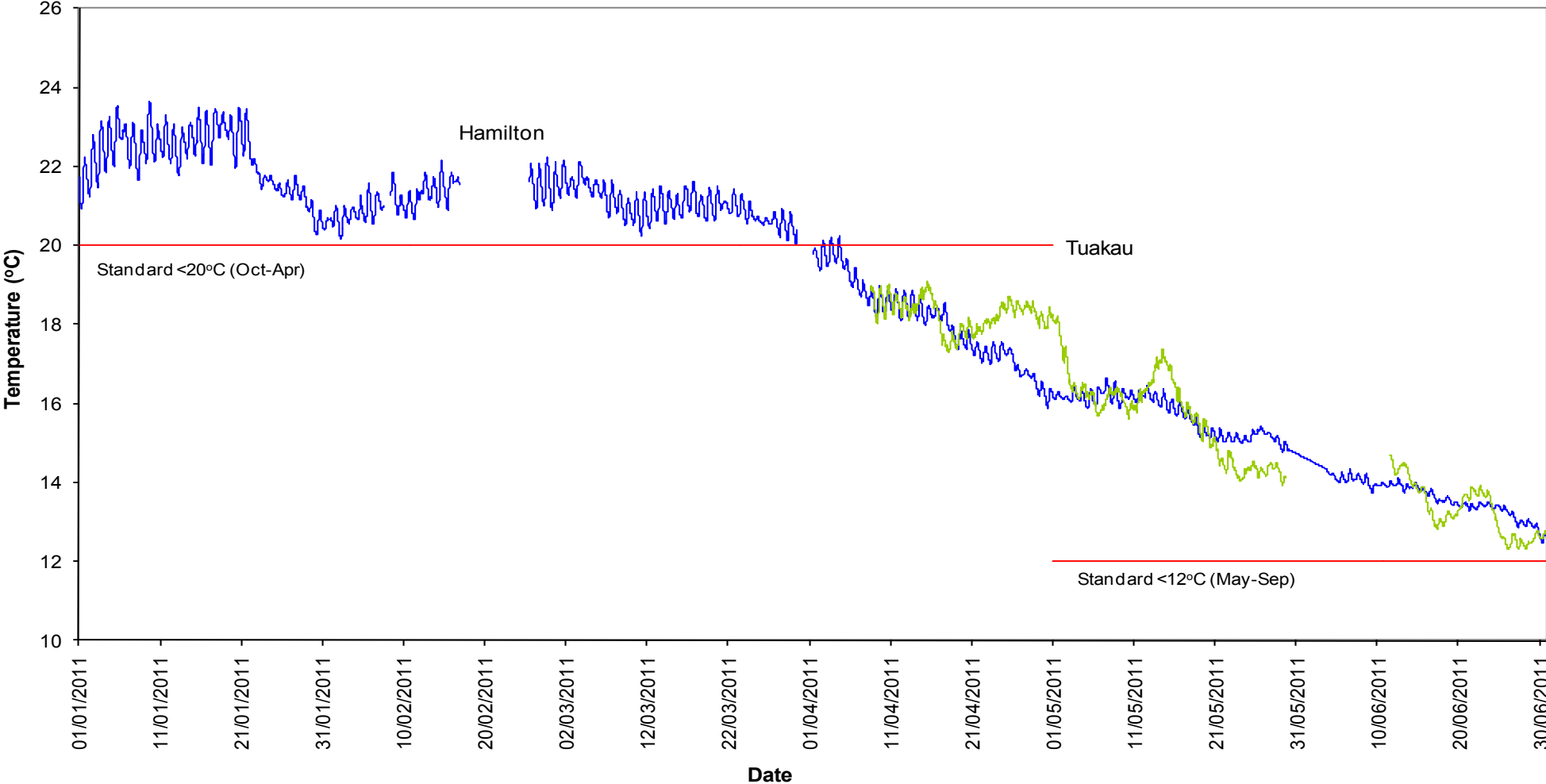
### pH: Upper Waikato (January - April)



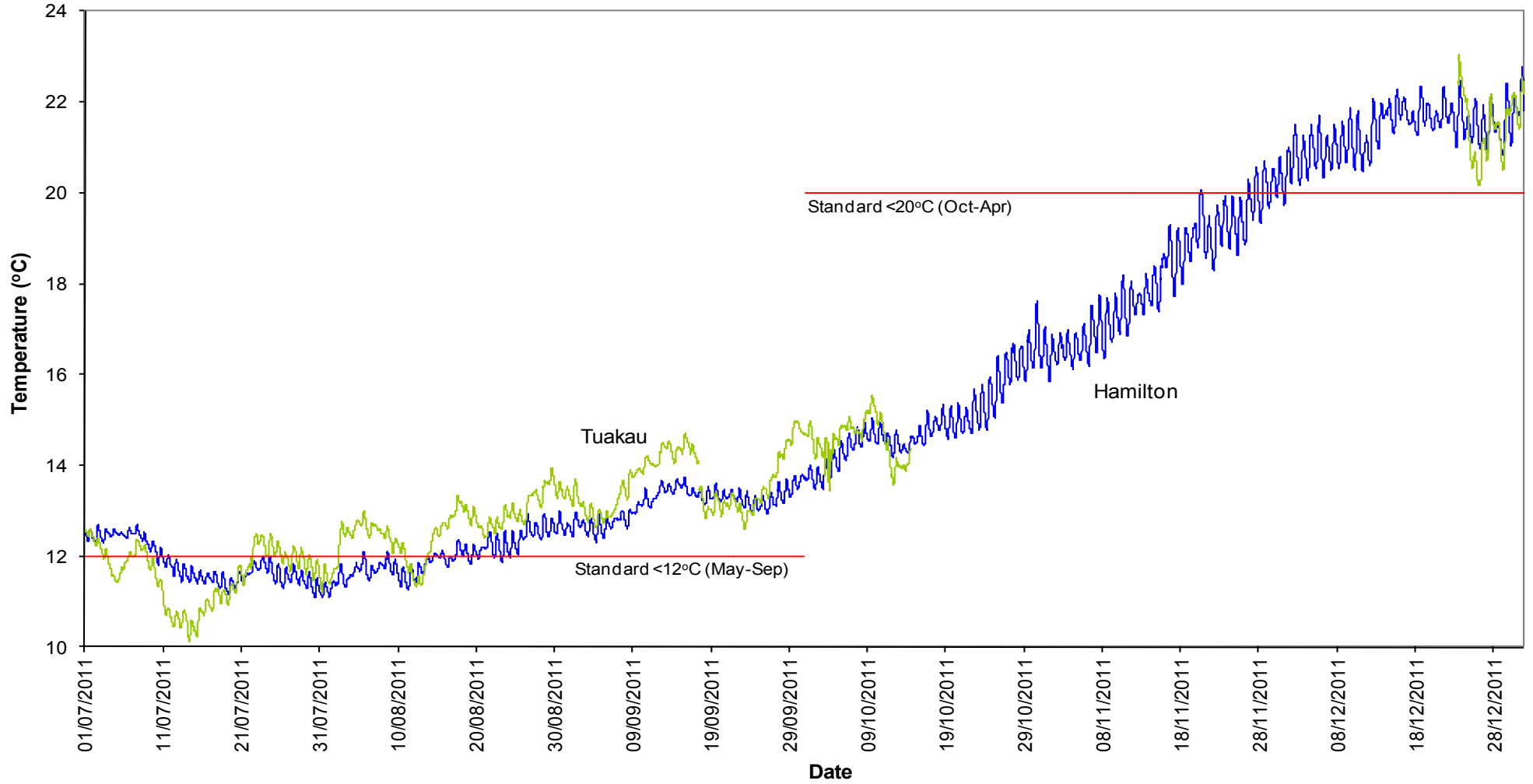
### Dissolved Oxygen, % saturation: Upper Waikato (January - April)



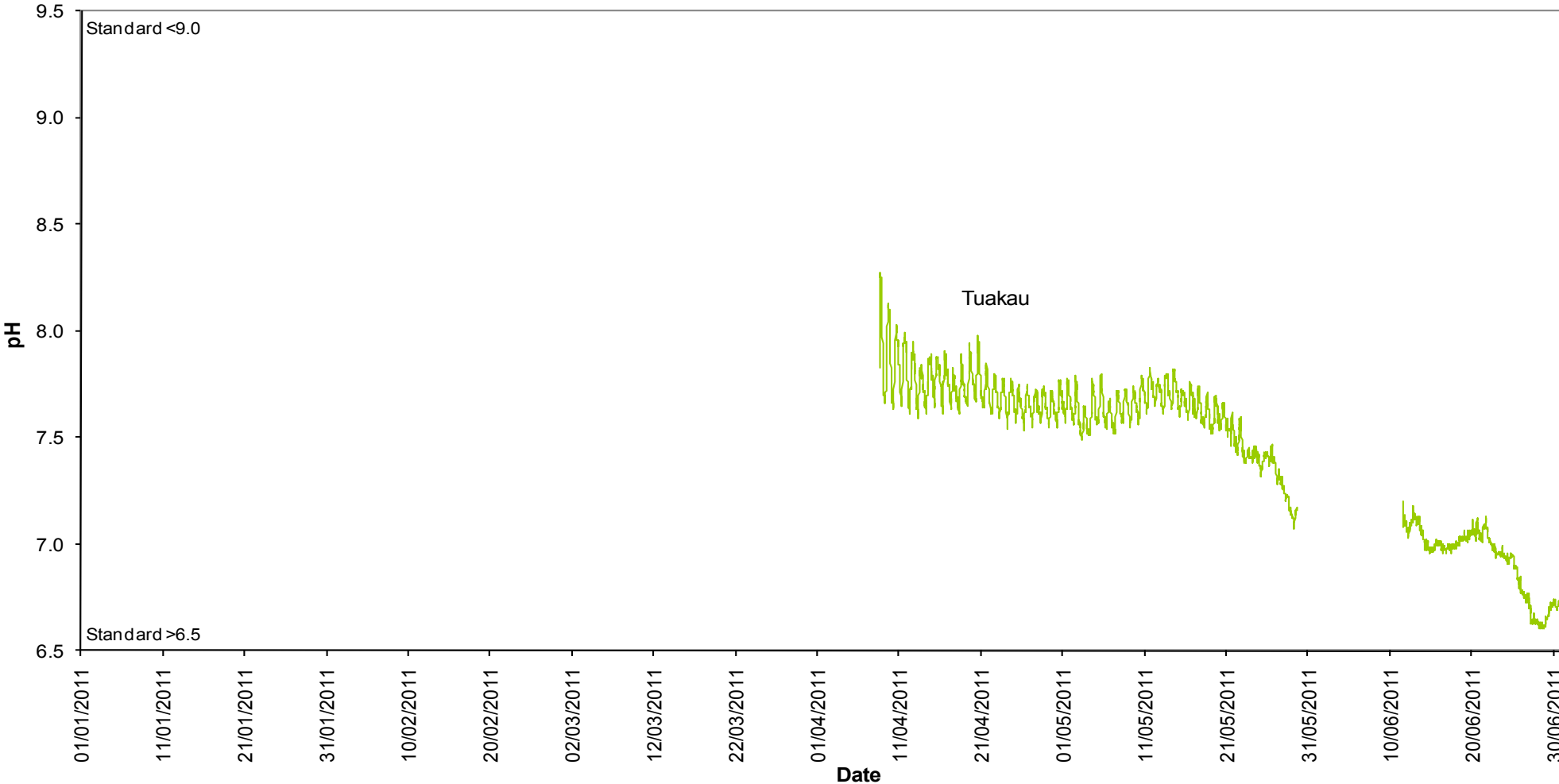
### Temperature: Lower Waikato (January-June)



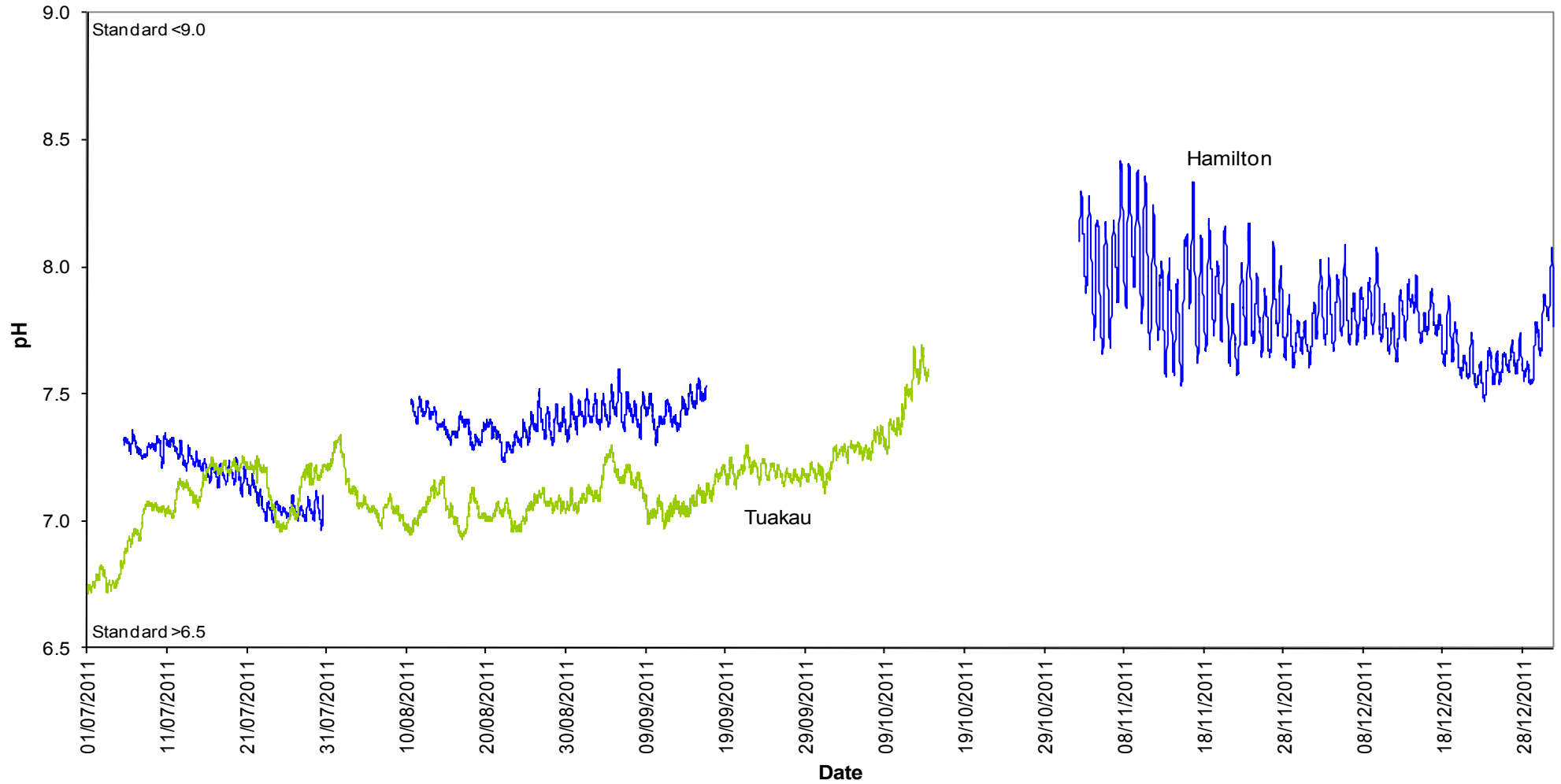
### Temperature: Lower Waikato (July-December)



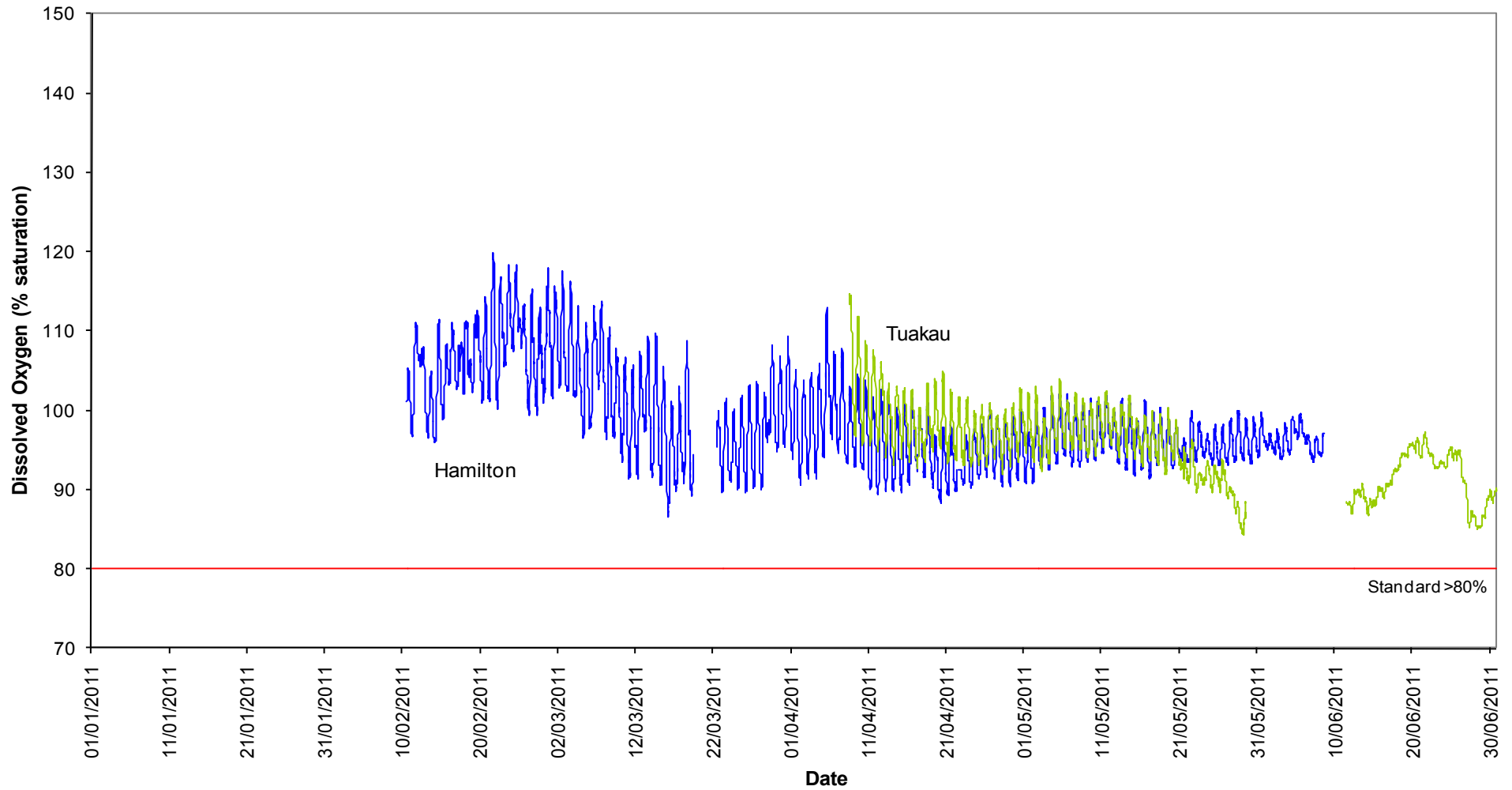
pH: Lower Waikato (January - June)



### pH: Lower Waikato (July - December)

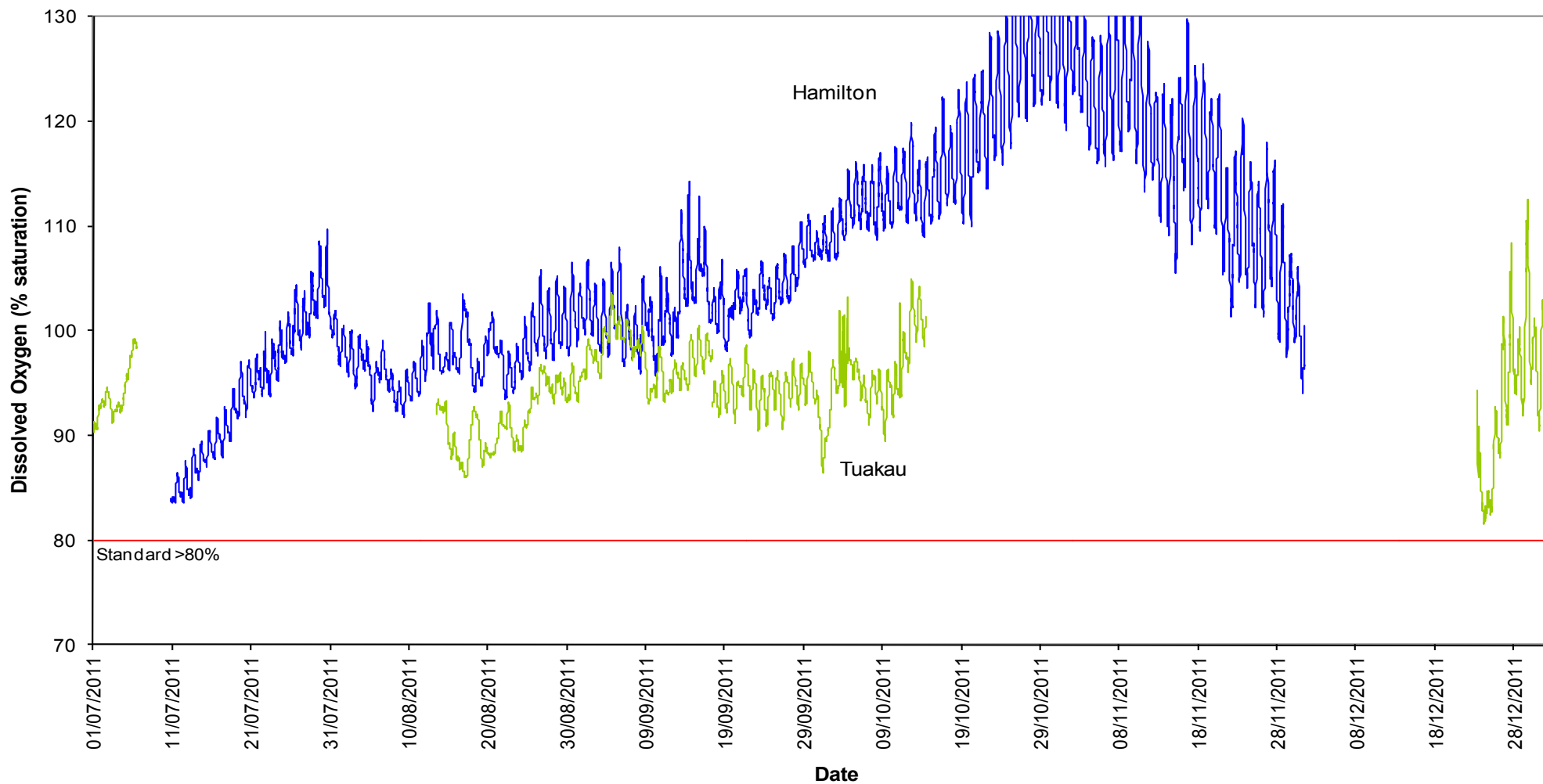


### Dissolved Oxygen (% saturation): Lower Waikato (January - June)

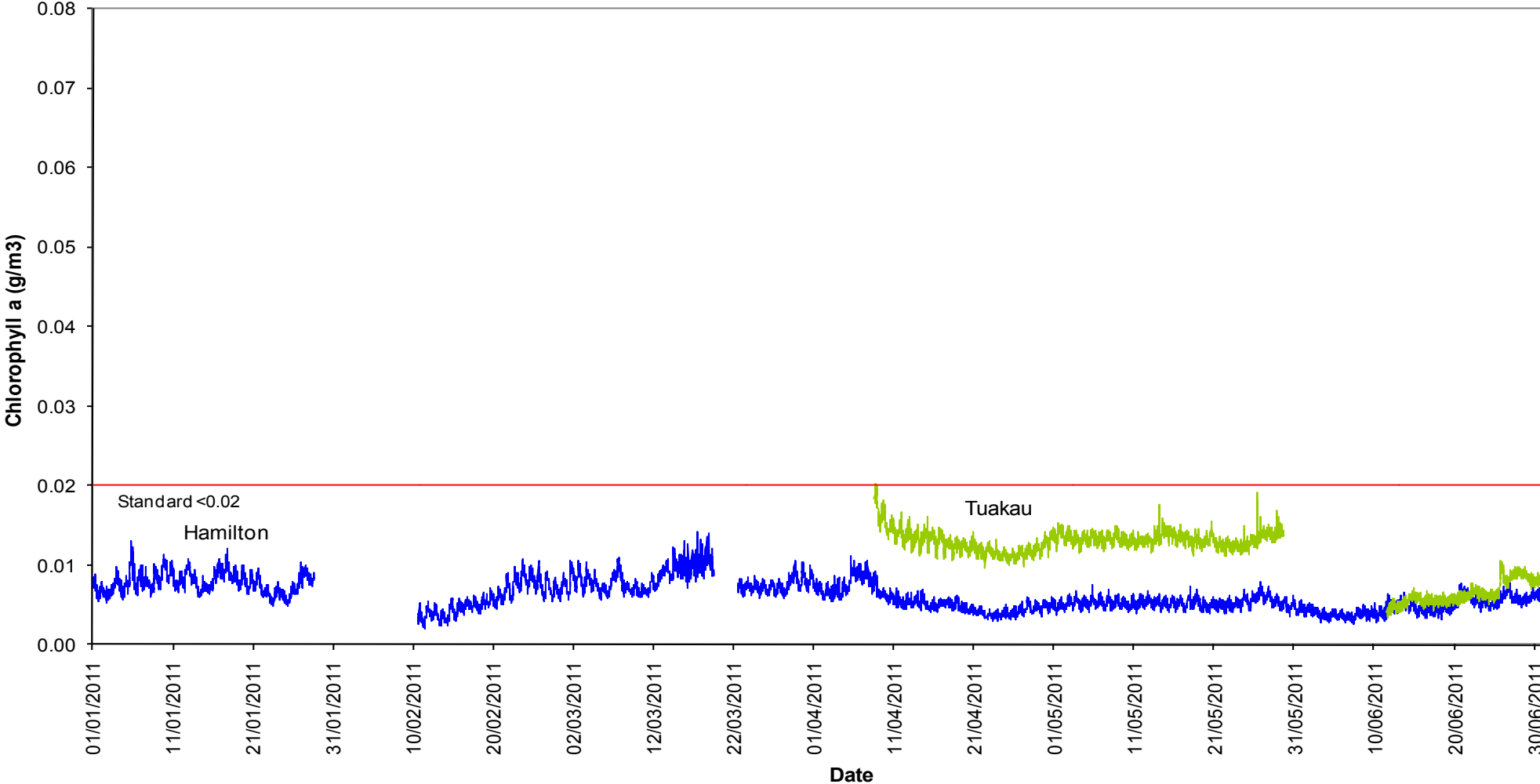




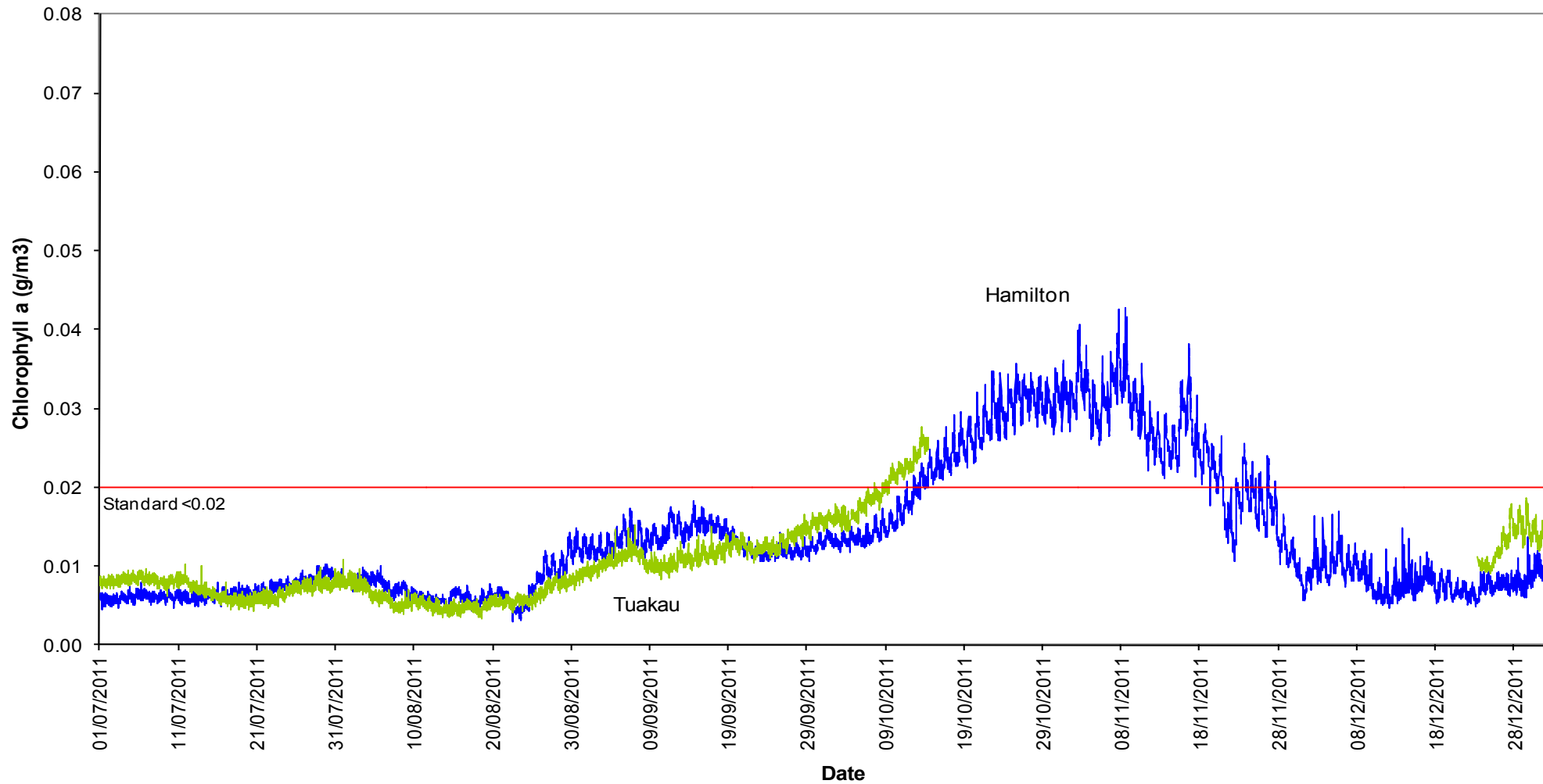
### Dissolved Oxygen (% saturation): Lower Waikato (July - December)



### 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 <sup>1</sup>	Comments <sup>2</sup>
<b>Dissolved oxygen</b>	- requirement for aquatic life	DO (conc.)	routine (field)
	- indicator of organic pollution	DO (%sat.)	routine (field)
	- indicator of photosynthesis (plant growth)		
<b>Temperature</b>	- indicator of biological activity	Temperature	routine (field)
	- requirement for aquatic life		
	- mixing processes		
	- modelling studies (e.g. nutrient uptake)		
<b>Conductivity</b>	- indicator of total salts dissolved in water	Conductivity	routine
	- indicator for geothermal input	TDS	routine
<b>pH</b>	- aquatic life protection	pH	routine
	- indicator of industrial discharges, mining		
<b>Clarity</b> - 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		
<b>Colour</b> - light absorption	- aesthetic appearance	Munsell colour	routine (field)
	- light availability for excessive plant growth	Absorbance at:	routine
	- indicator of presence of organic matter	340,440,780nm	
<b>Nutrients (N and P) chlorophyll a</b>	- enrichment, excessive plant growth	NO <sub>3</sub> -N+NO <sub>2</sub> -N	routine
	- nutrient limitation for plant/algal growth	NH <sub>4</sub> -N, TKN DRP, TP, Chl <i>a</i>	
<b>Geothermal contaminants</b>	- indicators of geothermal inflows	Cl, Li, B, As	routine
	- aquatic life protection (ecotoxicity)		
	- drinking water (human health aspects)		
<b>Organic carbon</b>	- indicator of organic pollution	BOD <sub>5</sub>	routine
	- catchment characteristics	TOC/DOC	routine
<b>Faecal bacteria</b> - E. coli - enterococci - faecal coliforms	- indicator of pollution with faecal matter	E. Coli	routine
	- disease risk for swimming etc.	ENT	routine
		FC	routine

<sup>1</sup> see the page 54 for the meaning of the abbreviations.

<sup>2</sup> 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 <sup>3</sup>	USEPA (1998) value for 1-hour exposure at pH 9.
Temperature	<12°C (May – Sep) <20°C (Oct – Apr)	Waikato Regional Council Proposed Regional Plan standards for trout fisheries and trout spawning (1998).
Total phosphorus	<0.04 g/m <sup>3</sup>	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 <sup>3</sup>	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 <sup>3</sup>	Ministry for the Environment (1992).
Arsenic	<0.01 g/m <sup>3</sup>	Ministry of Health (2001).
Boron	<1.4 g/m <sup>3</sup>	Ministry of Health (2001).

## Waikato River monitoring programme - water quality parameters and analytical methods

Id <sup>1</sup>	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
A780	Absorbance @ 780 nm filtered	Spectrophotometer, 1 cm path length, APHA method 5910B
As	Arsenic total	Nitric acid digestion, ICP-MS, APHA method 3125 B
B	Boron	ICP-MS, APHA method 3125 B
BDISK	Black disk	Field measurement, horizontal water transparency (20mm, 60mm, 100mm, 200mm disk) in river
BOD <sub>5</sub>	Biochemical oxygen Demand (5 day)	Incubation 5 days at 20°C, DO-meter, No nitrification inhibitor added, unseeded, APHA method 5210 B
CHLA	Chlorophyll a	Acetone extraction. Spectroscopy. APHA method 10200 H (modified)
Cl	Chloride	Filtered sample. Ferric thiocyanate colorimetry, Discrete analyser. APHA method 4500 Cl <sup>-</sup> E (modified)
COLOUR	Colour	Field measurement, Munsell colour patches
COND	Conductivity	Lab Meter @ 25°C. APHA method 2510B
DO	Dissolved oxygen	Field measurement (Hach DO meter, model HQ 30d)
DO (% Sat)	Dissolved oxygen (percent saturation)	Field measurement (Hach DO meter, model HQ 30d)
DOC	Dissolved organic Carbon	Filtration, acidification, purging to remove inorganic C, catalytic oxidation, IR detection. APHA method 5310 B (modified)
DRP	Dissolved reactive Phosphorus	Filtration, Molybdenum Blue Colorimetry. Discrete analyser. APHA 4500 PG (modified)
E. coli	Escherichia coli	Membrane Filtration (mFC Agar) confirmation by MUG Agar. APHA method 9222 G
ENT	Enterococci bacteria	Membrane Filtration (mE Agar) confirmation by EIA Agar. APHA method 9230 C
FC	Faecal coliforms	Membrane Filtration (mFC Agar). APHA method 9222 D
Flow	Flow – instantaneous	Calculated from rating curve ± 8%
Li	Lithium	ICP-MS, method APHA 3125 B
NH <sub>4</sub> -N	Ammoniacal Nitrogen (Total)	Phenol/Hypochlorite Colorimetry. Discrete analyser. APHA method 4500-NH <sub>3</sub> F (modified).
NNN	Nitrite/Nitrate Nitrogen	Automated Cadmium reduction. Flow injection analyser. APHA method 4500 – NO <sub>3</sub> <sup>-</sup> I (modified)
NO <sub>3</sub> -N	Nitrate nitrogen	Calculation: (Nitrate-N + Nitrite –N) – Nitrite - N
pH	pH	Lab Meter @ 25°C. APHA method 4500-H <sup>+</sup> B
TDS	Total dissolved solids	Filtration, gravimetric. APHA 2540 C (modified)
TEMP	Temperature	Field measurement (Hach DO meter, model HQ 30d)
TKN	Total Kjeldahl-Nitrogen	Acid digestion. Phenol/Hypochlorite colorimetry. Discrete analyser. APHA method 4500-N <sub>org</sub> B (modified)
TOC	Total Organic Carbon	Acidification, purging to remove inorganic C, catalytic oxidation, IR detection. APHA method 5310 B (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-P E (modified)
TURB	Turbidity	Turbidity Meter Hach 2100N. APHA method 2130 B

<sup>1</sup> Water quality parameter identification code refers to Waikato Regional Council's water quality database (TimeStudio) parameter short name.

APHA = Standards Methods for the Examination of Water and Wastewater, 21<sup>st</sup> Edition, 2005, APHA, AWWA, WEF

ICP-MS = Inductively Coupled Plasma – Mass Spectroscopy

## 5-Yearly Trace Metal Analysis - Parameters & Analytical Methods

Id <sup>1</sup>	Parameter	Method
<b>AlTR</b>	Aluminium Total Recoverable	Nitric acid digestion, ICP-MS, APHA 3125 B
<b>AsTR</b>	Arsenic Total Recoverable	Nitric acid digestion, ICP-MS, APHA 3125 B
<b>BTR</b>	Boron Total Recoverable	Nitric acid digestion, ICP-MS, APHA 3125 B
<b>CdTR</b>	Cadmium Total Recoverable	Nitric acid digestion, ICP-MS, APHA 3125 B
<b>CoTR</b>	Cobalt Total Recoverable	Nitric acid digestion, ICP-MS, APHA 3125 B
<b>CrTR</b>	Chromium Total Recoverable	Nitric acid digestion, ICP-MS, APHA 3125 B
<b>CuTR</b>	Copper Total Recoverable	Nitric acid digestion, ICP-MS, APHA 3125 B
<b>FeD</b>	Iron Dissolved	Filtered, ICP-MS, APHA 3125 B
<b>FeTR</b>	Iron Total Recoverable	Nitric acid digestion, ICP-MS, APHA 3125 B
<b>HgT</b>	Mercury Total Recoverable	Total Recoverable Extraction, bromine oxidation followed by atomic fluorescence. US EPA Method 245.7, Feb 2005.
<b>LiT</b>	Lithium Total Recoverable	Nitric acid digestion, ICP-MS, APHA 3125 B
<b>MnD</b>	Manganese Dissolved	Filtered, ICP-MS, APHA 3125 B
<b>MnTR</b>	Manganese Total Recoverable	Nitric acid digestion, ICP-MS, APHA 3125 B
<b>MoTR</b>	Molybdenum Total Recoverable	Nitric acid digestion, ICP-MS, APHA 3125 B
<b>NiTR</b>	Nickel Total Recoverable	Nitric acid digestion, ICP-MS, APHA 3125 B
<b>PbTR</b>	Lead Total Recoverable	Nitric acid digestion, ICP-MS, APHA 3125 B
<b>SbTR</b>	Antimony Total Recoverable	Nitric acid digestion, ICP-MS, APHA 3125 B
<b>TlTR</b>	Thallium Total Recoverable	Nitric acid digestion, ICP-MS, APHA 3125 B
<b>UTR</b>	Uranium Total Recoverable	Nitric acid digestion, ICP-MS, APHA 3125 B
<b>ZnD</b>	Zinc Dissolved	Filtered, ICP-MS, APHA 3125 B
<b>ZnTR</b>	Zinc Total Recoverable	Nitric acid digestion, ICP-MS, APHA 3125 B

<sup>1</sup> Water quality parameter identification code refers to Waikato Regional Council's water quality database (Timestudio) parameter short name.

APHA = Standards Methods for the Examination of Water and Wastewater, 21<sup>st</sup> Edition, 2005, APHA, AWWA, WEF

ICP-MS = Inductively Coupled Plasma – Mass Spectroscopy