water Care
services limited

ANNUAL WATER QUALITY REPORT 2010

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REVIEW OF WATER QUALITY MANAGEMENT SYSTEM

CRF Consulting has been retained by Watercare to undertake an independent review of its water quality management system. The review covered Watercare's:

- Annual sampling programme to ensure it meets the requirements of its contractual obligations with its customers and the requirements of the Drinking Water Standards for New Zealand.
- Sampling methodologies to ensure that samples collected are representative of the water supplied at that point.
- Watercare Services Laboratory's analytical methods and procedures to ensure accuracy and reliability of results can be maintained.
- Water quality data management systems to ensure that records of analytical results are stored adequately.

The findings of this review were that Watercare makes use of appropriate controls to ensure accurate and reliable water quality sampling and analysis which provide results that are representative of the water being supplied to customers. I am also satisfied with the recording and management of test results and water quality information. Where recommendations for improvements were made, Watercare has implemented actions to ensure these are met.

I have reviewed this Water Quality Annual Report and consider that it represents an accurate reflection of the water quality testing carried out this year.

Dr Colin Fricker

Principal, CRF Consulting

REPORT PREPARED FOR

metrowater

NORTH SHORE CITY

United Water

MANUKAU WATER

Waitakere City Council
Te Taiao o Waitakere

Rodney
DISTRICT COUNCIL

THIS REPORT DETAILS WATER QUALITY PERFORMANCE FOR THE PERIOD 1 JULY 2009 – 30 JUNE 2010.

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Wairoa Dam in the Hunua Ranges. The protected catchments of Watercare's dams help to maintain the highest quality of raw water.

Introduction

WATERCARE'S COMMITMENT TO WATER QUALITY

Watercare aims to provide a safe and reliable supply of drinking water. Watercare achieves this by:

- Supplying water at the minimum price consistent with maintaining the long-term integrity of its assets, as required by its founding legislation
- Supplying drinking water in accordance with all national and local legislative requirements
- Meeting New Zealand drinking water standards
- Managing its sources, treatment facilities and supply network in accordance with the standards and its own policies and procedures to maintain its 'A' and 'a' gradings – or whichever standard is required by its customers
- Developing and maintaining its facilities in accordance with the principles of sustainability to ensure the optimum balance of environmental, social and economic factors over the life of its assets
- Participating in and helping to develop the Auckland Water Incident and Coordination Plan in co-operation with customers and the Auckland District Health Board
- Undertaking such external and peer reviews as deemed appropriate to assess and benchmark performance against industry best practice.

WATERCARE TODAY

Watercare is committed to developing water and wastewater infrastructure to support the region's growth and prosperity in ways that maximise social, environmental and economic benefits.

Watercare collects and treats water and supplies it to council-owned, -operated or -contracted distribution and retail organisations, known as Local Network Operators (LNOs). Watercare owns and operates dams, treatment plants and the high-capacity main water supply network, delivering water to bulk supply points throughout the Auckland region.

At these bulk supply points, it supplies water to six territorial local authority areas.

Watercare provides drinking water to approximately 1.2 million people. It is New Zealand's largest bulk water supplier, delivering typically 373 megalitres (million litres) of high quality drinking water a day from 10 dams, one aquifer and one river source. Source waters are treated at six treatment plants and supplied through 450 kilometres of water main.

Watercare also collects wastewater from the four territorial local authorities on the Auckland isthmus and treats it at its Mangere Wastewater Treatment Plant. Watercare regulates industrial effluent from more than 600 trade waste customers discharging into Watercare's wastewater system. Watercare Laboratory Services provides water, wastewater and air quality testing services for internal and an increasing number of external customers.

REGULATORY AND CONTRACTUAL REQUIREMENTS

HEALTH (DRINKING WATER) AMENDMENT ACT 2007

The Health (Drinking Water) Amendment Act 2007 came into effect on 1 July 2008. The Act allows water suppliers the choice of complying with the Drinking Water Standards 2000 or 2005 (Revised 2008) until 1 January 2015 when the DWSNZ 2005 (Revised 2008) becomes mandatory. Watercare has opted to comply with the DWSNZ 2005 (Revised 2008) from 1 July 2009.

DRINKING WATER STANDARDS FOR NEW ZEALAND

The Drinking Water Standards for New Zealand 2005 (Revised 2008) prescribe Maximum Acceptable Values (MAVs) for determinands of public health significance and provide a yardstick against which drinking water quality is measured. They also specify monitoring requirements, laboratory competence and remedial measures to be taken in the event of the standards being breached.

AGREEMENT RELATING TO THE SUPPLY OF BULK WATER

Watercare has signed contracts setting out the terms under which Watercare supplies bulk water to each of its customers, the LNOs, which recognises their separate obligations under the Local Government Acts 1974 and 2002.

Terms include using reasonable endeavours to:

- Minimise risks to persons, property and the environment
- Plan for contingencies
- Plan cooperatively
- For Watercare, maintain ‘A’ grading for water treatment plants and ‘a’ grading for bulk distribution zones
- For LNOs, to achieve and maintain ‘a’ grading for their reticulation networks.

The bulk water agreements also vary from customer to customer, for example, in the water quality parameters at each bulk supply point. These specific requirements are outlined in Appendix 2.

Introduction

PUBLIC HEALTH GRADING OF COMMUNITY SUPPLIES

As the Ministry of Health's explanatory notes say: "The grading provides an assessment of the Ministry of Health's confidence in the public health safety of each community drinking-water supply. The grading is a measure of confidence that a drinking-water supply system will not become contaminated, rather than an absolute indication of quality at a specific time."

The grading has two letters. The first letter (upper case) represents the source and treatment grading, while the second letter (lower case) grades the water in the distribution zone.

Reticulated water in Auckland is delivered through two distribution networks – the bulk network operated by Watercare and the LNOs' own networks, which are graded separately.

Watercare staff distribute water at the Round the Bays Event.

PROTECTING OUR SOURCES

The quality of water at the source is a major consideration in determining the level of treatment supplied.

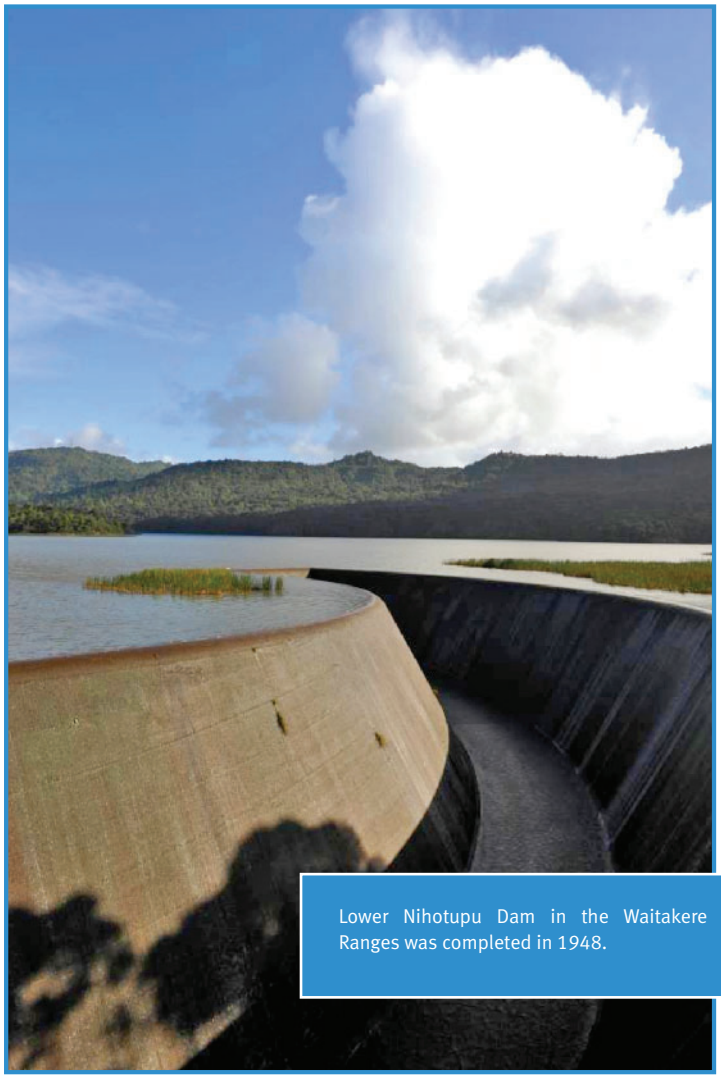
The Auckland region is fortunate in its water sources. Since the early days of the city's development, Auckland has drawn water from man-made dams in the bush-clad Waitakere Ranges in the west of the city, and later from the Hunua Ranges.

Watercare now operates 10 dams, five in the Waitakere Ranges, four in the Hunua Ranges, and Hays Creek Dam near Papakura. With the exception of Hays Creek (currently not in service), the dams are surrounded by bush or forest. These areas have been protected from development and preserved for many years to minimise any risk of contamination. The Auckland Regional Council controls activities within the water supply catchments and allows passive recreational use of the land. Watercare's dam lakes are not available for boating or other water sports, to protect water quality. Nevertheless, treatment is still required to make the water safe to drink.

The Waikato River provides up to 15 per cent of the region's water. While the river carries mineral compounds sourced from geothermal activity and its catchment is predominantly farmland, the quality of the water is far superior to many major overseas river sources such as the Thames and the Rhine. These factors, and an expectation of tighter new drinking water standards, determined the design of the Waikato Water Treatment Plant, one of the most advanced treatment plants in the Southern Hemisphere. As a result, the treated water from this source is now Watercare's best.

Watercare recognises that Tainui Maori have a special relationship with the river and acknowledges Tainui's guardianship role over the river. Watercare actively supports Tainui in its endeavours to protect and enhance river quality. Watercare makes submissions on resource consent applications that will affect the river and also sponsors Waikato RiverCare, an incorporated society working to improve river quality through shoreline planting programmes.

Watercare also takes water from a groundwater source in Onehunga.



Lower Nihotupu Dam in the Waitakere Ranges was completed in 1948.

Introduction

PRODUCING HIGH QUALITY DRINKING WATER

Watercare uses tried and trusted processes to produce safe drinking water. Commonly referred to as barriers, they are designed to meet the drinking water standards, which are in turn are based on World Health Organisation drinking water guidelines, Australian drinking water guidelines and the United States' national primary drinking water standards.

The following table summarises the barriers used at the different treatment plants, which are appropriate to the different sources.

This table shows that all treatment plants have at least two barriers to contamination.

Station process	Ardmore	Huia	Huia Village	Onehunga	Waikato	Waitakere
Coagulation	✓	✓	✓	✓	✓	✓
Clarification	✓	✓			✓	✓
Sand filtration	✓	✓		✓		✓
Membrane filtration			✓		✓	
Disinfection	✓	✓	✓	✓	✓	✓
Activated carbon			✓		✓	
pH adjustment	✓	✓	✓	✓	✓	✓
Alkalinity adjustment					✓	✓
Fluoridation	✓	✓		see note*	✓	✓

* Water supplied from Onehunga into the main network is fluoridated.

COAGULATION/CLARIFICATION

Coagulation/clarification is the primary treatment process. Positively charged alum is added to the water as it enters clarifiers. It attracts negatively charged particles in the water, allowing them to bind together.

A polyelectrolyte can be added to aid this process, forming a floc blanket which continually grows and settles out. This allows clear water at the surface to flow on to the next stage of treatment.

Coagulation and clarification can remove up to 95 per cent of the dirt in the water – most of the organic and inorganic compounds (including the coagulants), bacteria and other organisms.

FILTRATION

All of Watercare's water treatment plants employ filters as barriers. Most have traditional sand filter beds. They are fully monitored and washed automatically to ensure they operate optimally.

The Waikato and Huia Village treatment plants feature membrane filters instead of sand filters. These filters comprise cassettes of thousands of narrow tubes covered with a semi-permeable membrane. The water is drawn through the membranes and out of the tubes. The holes in the membranes are just 0.035 microns in diameter, providing higher removal rates of bacteria, protozoa and some viruses.

ACTIVATED CARBON

Activated carbon reduces organics and taste and odour compounds. At the Waikato and Huia Village plants activated carbon is a standard part of the process. It can be added as required at Huia and Ardmore. Compounds, produced by algae, can have a disproportionate impact on taste and odour, even in minute quantities and at high levels have an impact on public health.

DISINFECTION

Chlorination is the most common form of disinfection used by water utilities throughout the world. The concentration of chlorine is maintained within a tight range to ensure adequate disinfection while having minimum aesthetic effect. Chlorine is added as a final stage of the treatment process for two reasons. Firstly, it kills any remaining bacterial contaminants and it maintains that protection as the water travels through the distribution system. Secondly, it can take several days for water to travel the hundreds of kilometres of pipe to the furthest extent of the network.

FINAL TREATMENT

At the request of its customers, Watercare adds fluoride at a concentration of less than one part per million, in accordance with drinking water standards. While not required to ensure the safety of the water, Watercare also adds small quantities of lime or caustic soda to adjust the water's pH as required.

PROTECTION AND MAINTENANCE OF DISTRIBUTION SYSTEMS

Reticulation Serviceperson Mihaka Williams pictured hosing the inside of Mt Eden Reservoir.

Water supply distribution systems can also affect water quality. Any breaks in the water mains are isolated and repaired, then the pipes are chlorinated, flushed and reconnected to the water supply system. This minimises the risk of any potential contamination entering the distribution system.

New mains and reservoirs are also disinfected before use.

All service reservoirs are covered with roofs to avoid contamination from birds, animals, leaves or other airborne sources. Service reservoirs are tanks, usually on higher ground. They help to maintain pressure in the supply lines by smoothing out the peaks and troughs in demand. While they may be supplied at a constant rate, typically they are drawn down during the day and refilled at night.

Introduction

MONITORING AND PROCESS CONTROL

In accordance with the drinking water standards and the bulk water agreements with Local Network Operator (LNO) customers, Watercare has an extensive water quality monitoring programme to monitor chemical, physical, radiological and aesthetic parameters as well as bacteriological parameters. We take more than 26,000 water samples each year from water sources, treatment plants and network meters that supply our customers. Our contracted analytical laboratory, Watercare Laboratory Services, carries out nearly 550,000 individual analyses each year.

Watercare Laboratory Services is IANZ accredited and experienced in sampling and analysis for a range of chemical and biological tests for water wastewater, landfill, marine and environmental samples including soils and sludges. Air quality expertise includes point emission, biogas, odour and ambient sampling and testing. The laboratory works with a wide range of external organisations including councils, environmental consultants and industries, nationwide.

The laboratory recognises that customer needs go beyond analysis to providing advice on test programmes and results, electronic methods of data transfer, provision of innovative sampling services, continual improvement of test methods, quality assurance and a high level of customer service.

All our water quality monitoring and reporting is coordinated through our Water Quality Management System Database. This software was developed 'in house' and is used to review performance against drinking water standards, contractual requirements and operational parameters. The system also enables trends to be observed and provides exception reports on test results exceeding drinking water standard guidelines.

Data from monitoring equipment is also collected through online monitoring systems at the company's treatment plants and within the reticulation system, allowing staff to control and respond to changing conditions remotely. The results are faster response times, more consistent water quality and more effective management and control.

VERIFICATION OF DRINKING WATER QUALITY

Watercare complied with all of the DWSNZ 2005 (Revised 2008) microbiological, protozoal and chemical criteria for 2009/10 at its treatment plants. Results for each treatment plant are summarised in Appendix 1.

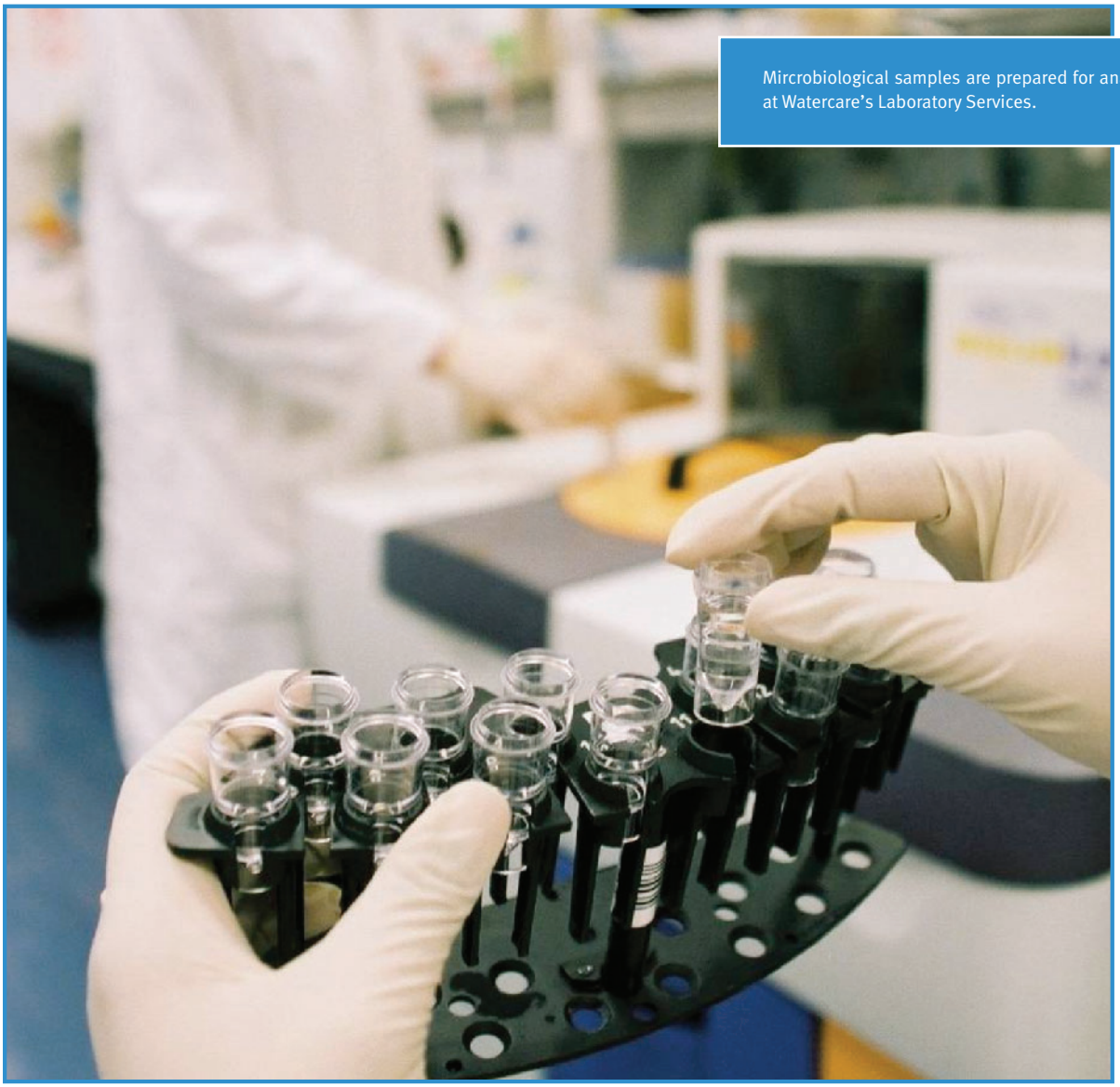
Watercare also complied with all contractual microbiological water quality standards at all of its bulk supply points for 2009/10, and almost all of the aesthetic standards met the required compliance. These figures are reported in Appendix 2. Compliance is based on results for the financial year 1 July 2009 to 30 June 2010.

Appendix 3 shows water quality information at each of the bulk supply points including turbidity, pH and chlorine residuals.

MICROBIOLOGICAL MONITORING

Microbiological tests are carried out to ascertain the presence or absence of potential disease-causing organisms. It is impracticable to monitor water supplies for all potential human pathogens, so surrogates are used to indicate possible contamination. As required by the drinking water standards, Watercare uses E.coli (Escherichia coli) as the primary compliance indicator for microbiological contamination.

Introduction



Mircrobiological samples are prepared for analysis at Watercare's Laboratory Services.

Heterotrophic plate counts are also used as a general indication of all organisms that may be present in a water supply, and are a useful indicator of operational performance. The count shows mainly environmental organisms, as well as some faecal organisms. It is a useful measure of general water quality in addition to the indicator organism *E.coli*.

PROTOZOAN MONITORING

Protozoa such as Cryptosporidium and Giardia occur in many New Zealand water sources. They are found in the faeces of humans and wild, farm and domestic animals.

A key objective of the drinking water standards is to protect the population against such protozoa, which can have an immediate and serious impact on public health.

Watercare has significantly increased the monitoring and control capability at its plants. The aim is to ensure that control systems react appropriately when any individual process or filters approaches the borders of the target zone.

Introduction

Ardmore Water Treatment Plant is the largest of six plants.

CHEMICAL AND PHYSICAL MONITORING

Watercare also monitors a range of physical and chemical parameters as required by the drinking water standards to ensure that drinking water is safe over a person's lifetime.

Watercare aims for a pH of 7.9 which is the midpoint of the customer-specified target of 7.6 to 8.2. pH control is important to ensure adequate disinfection of the water supply.

Fluoride is one of the most abundant elements in the Earth's crust, and is typically found as the fluoride ion or as organic or inorganic fluorides. It is found naturally in groundwater supplies, and is present in most food and beverage products and toothpaste. At the request of our customers, Watercare adds fluoride to its treated water except at its two smallest plants, the Onehunga and Huia Village treatment plants. Watercare is required to monitor fluoride on a weekly basis. The drinking water standards state a maximum acceptable value (MAV) of 1.5 mg/L. Watercare did not exceed this value in 2009/10.

Chlorine is the primary defence against disease causing microbiological contaminants in public water supply systems. Chlorine is used in sufficient amounts to kill microbes at the treatment plants and provide a residual in the distribution system.

Introduction

AESTHETIC PARAMETERS

As mentioned above, aesthetic parameters pose no threat to human health but can affect drinking water appearance, taste and odour.

Groundwater is often high in dissolved solids (salts) and hardness (calcium), which can cause calcification on hot water systems and fixtures. However, Watercare's sources can all be considered surface water sources, as the Onehunga aquifer is not deep enough to acquire typical groundwater attributes. As such it is comparatively low in salts and calcium and is considered 'soft' water.

It is worth noting that as water in New Zealand is generally low in minerals and metal salts it will attempt to acquire them. The Ministry of Health has warned that water sitting overnight in contact with some low-quality fittings such as taps and mixers can absorb some oxides of these metals. For that reason, they advise flushing away the first cupful of water from taps each day.

Alum (aluminium sulphate) is a coagulant that is added to aid the removal of colour and turbidity. Aluminium can accumulate in pipe sediments, and be re-suspended during periods of rapid changes to flow patterns. The drinking water standards guideline value is 0.10 mg/L. Aluminium detected in treated water at the plants is typically less than this value.

Iron and manganese are naturally occurring minerals. They have no health implications and can be found in food supplements in much higher concentrations than are likely to occur in a glass of water. Unusual changes to the flow within the system can stir up deposits that have settled out of the water within the mains.

Taste and odour are sometimes related to fluctuating chlorine levels due to changing water demand.

The chlorine residual throughout the reticulation network is regularly monitored. Chlorine is added in areas remote from the treatment plants to ensure the required levels are maintained through to the consumers' taps.

Algal blooms, particularly in the Lower Nihotupu Dam, can also prompt taste and odour complaints. The dam is usually taken out of supply in early summer before this becomes a problem. Watercare has also commissioned NIWA to advise on monitoring and management strategies to minimise cause for further complaints. Typical algal levels at each of Watercare's raw water sources are shown in Appendix 4.

Colour in water originates mainly from soil and vegetable matters such as leaves in the catchment. Corroding metal pipes can also colour the water, with iron producing a brownish colour and copper a faint blue colour.

APPENDIX 1 : Water quality at treatment plants

ARDMORE	Units	Samples	Max	Min	Average	Standard Deviation	MAV DWSNZ	GV DWSNZ	Detection Limit	Compliant DWSNZ 2005
MICROBIOLOGY										
E.coli	MPN/100mL	730	ND	ND	ND		<1/100 ml		1	✓
HPC	cfu/100mL	105	220	ND	2.3	21.5			1	
Giardia (Untreated Water)	cysts/100L	14	4.6	ND	0.3	1.2			0.1	
Giardia (Treated Water)	cysts/100L	13	ND	ND	ND		<1/100 ml		0.1	✓
Cryptosporidium (Untreated Water)	cysts/100L	14	14	ND	2.0	4.0			0.1	
Cryptosporidium (Treated Water)	cysts/100L	13	ND	ND	ND		<1/100 ml		0.1	✓
CHEMICAL AND PHYSICAL										
Residual Chlorine	mg/L	Continuous	1.40	0.97	1.22	0.10	5.00	0.60		✓
pH	pH Units	Continuous	8.3	7.6	7.9	0.1		7.0 - 8.5	0.1	✓
Conductivity	mS/cm	104	11.71	9.66	10.71	0.45			0.5	
Turbidity	NTU	Continuous	0.0522	0.0269	0.0344	0.0042		2.5		✓
Suspended solids	mg/L	104	0.40	ND	0.04	0.10			0.2	
Total dissolved solids	mg/L	13	116.5	58	76.88	14.52		1000		✓
True Colour	Hazen Units	104	5	ND	0.1	0.7		10	5	✓
UV absorption	Abs	104	0.02	0.01	0.01	0.00				
Total organic carbon	mg/L	104	2.2	0.8	1.1	0.2			0.1	
Total Hardness	mg/L	104	29.22	21.25	24.79	1.68		200	0	✓
Hardness calcium	mg/L	104	22.47	15.48	18.60	1.44			0	
Hardness Magnesium	mg/L	104	7.41	5.35	6.19	0.41			0	
Total Alkalinity	mg/L $CaCO_3$	104	22.09	13.19	18.31	1.81			1	
Sulphate	mg/L	104	11.80	7.60	8.69	0.88		250	0.02	✓
Chloride	mg/L	104	15.00	12.00	13.15	0.67		250	0.02	✓
Fluoride	mg/L	Continuous	0.98	0.53	0.81	0.06	1.5		0.02	✓
Bromide	mg/L	13	0.04	ND	0.01	0.02			0.01	
Iodide	mg/L	13	0.006	0.003	0.004	0.001			0.001	
Silica	mg/L	13	15.00	11.00	13.23	1.30			0.1	
Bromate	mg/L	13	ND	ND	ND		0.025		0.005	✓
Chlorate	mg/L	13	0.092	0.010	0.039	0.027	0.3		0.01	✓
Chlorite	mg/L	13	ND	ND	ND		0.3		0.005	✓
Iron (Total)	mg/L	104	0.021	0.007	0.011	0.003		0.2	0.002	✓
Manganese	mg/L	104	0.01	0.001	0.004	0.002	0.5	0.05	0.0005	✓
Aluminium	mg/L	104	0.03	0.02	0.03	0.00		0.10	0.005	✓
Calcium	mg/L	104	9.00	6.20	7.45	0.58			0.01	
Magnesium	mg/L	104	1.80	1.30	1.50	0.10			0.005	
Sodium	mg/L	104	10.00	7.80	8.90	0.50		200	0.1	✓
Potassium	mg/L	104	1.30	0.93	1.07	0.07			0.1	
NUTRIENTS										
Phosphorus (Total)	mg/L	13	0.02	ND	0.00	0.01			0.01	
Phosphorus (Soluble Reactive)	mg/L	13	0.01	ND	0.00	0.00			0.01	
Nitrate Nitrogen	mg/L	13	0.08	0.02	0.04	0.02	50		0.002	✓
Nitrite Nitrogen	mg/L	13	ND	ND	ND		3		0.002	✓
Ammonia	mg/L N	13	0.01	ND	0.00	0.00		1.5	0.01	✓
Total Kjeldahl Nitrogen	mg/L N	13	0.30	ND	0.11	0.10			0.1	
TRACE ELEMENTS										
Antimony	mg/L	13	0.0015	ND	0.00012	0.0004	0.003		0.001	✓
Arsenic	mg/L	13	0.0003	0.0002	0.0002	0.0001	0.01		0.0001	✓
Boron	mg/L	13	0.016	0.011	0.013	0.001	1.4		0.005	✓
Barium	mg/L	13	0.0079	0.0055	0.0066	0.0008	0.7		0.0002	✓
Cadmium	mg/L	13	ND	ND	ND		0.003		0.00005	✓
Chromium	mg/L	13	0.0001	ND	0.0000	0.0000	0.05		0.0001	✓
Copper	mg/L	13	0.0077	0.0003	0.0010	0.0020	2	1	0.0003	✓
Cyanide	mg/L	13	ND	ND	ND		0.08		0.01	✓
Lead	mg/L	13	0.0003	ND	0.0000	0.0001	0.01		0.0001	✓
Lithium	mg/L	13	0.0007	0.0005	0.0006	0.0001	0.9		0.0003	✓
Molybdenum	mg/L	13	0.0003	ND	0.0000	0.0001	0.07		0.0002	✓
Mercury	mg/L	13	ND	ND	ND		0.002		0.00008	✓
Nickel	mg/L	13	0.0002	ND	0.0000	0.0001	0.02		0.0005	✓
Selenium	mg/L	13	ND	ND	ND		0.01		0.0005	✓
Zinc	mg/L	13	0.004	ND	0.001	0.001		3	0.003	✓

ND stands for Not Detected

APPENDIX 1 : Water quality at treatment plants

ARDMORE	Units	Samples	Max	Min	Average	Standard Deviation	MAV DWSNZ	GV DWSNZ	Detection Limit	Compliant DWSNZ 2005
TRIHALOMETHANES										
Bromodichloromethane	mg/L	117	0.0119	0.0026	0.0061	0.0017	0.06		0.0001	✓
Bromoform	mg/L	117	0.0008	0.0002	0.0005	0.0002	0.1		0.0001	✓
Chloroform	mg/L	117	0.0134	0.0033	0.0070	0.0018	0.2		0.0001	✓
Dibromochloromethane	mg/L	117	0.0083	0.0021	0.0045	0.0012	0.15		0.0001	✓
Sum of the ratio to the MAV	Ratio	104	0.3143	0.0803	0.1672	0.0456	1	0.5	0.0001	✓
VOLATILE ORGANIC COMPOUNDS A total of 60 specific compounds are analysed in this group. Only those for which a MAV is listed are reported here.										
Benzene	mg/L	13	ND	ND	ND		0.01		0.0001	✓
Carbon tetrachloride	mg/L	13	ND	ND	ND		0.002		0.0001	✓
1,4-dichlorobenzene	mg/L	13	ND	ND	ND		0.4	0.0003	0.0001	✓
1,2-dichlorobenzene	mg/L	13	ND	ND	ND		1	0.001	0.0001	✓
1,2-dichloroethane	mg/L	13	ND	ND	ND		0.03		0.0001	✓
Ethylbenzene	mg/L	13	ND	ND	ND		0.3	0.002	0.0001	✓
m- & p-Xylene	mg/L	13	ND	ND	ND		0.6		0.0001	✓
Styrene	mg/L	13	ND	ND	ND		0.03	0.004	0.0001	✓
Tetrachloroethene	mg/L	13	ND	ND	ND		0.05		0.0001	✓
Toluene	mg/L	13	ND	ND	ND		0.8	0.03	0.0001	✓
trans-1,2-dichloroethene	mg/L	13	ND	ND	ND		0.06		0.0001	✓
1,1,1-trichloroethane	mg/L	13	ND	ND	ND		2		0.0001	✓
trichloroethene	mg/L	13	ND	ND	ND		0.08		0.0001	✓
1,2,3-trichlorobenzene	mg/L	13	ND	ND	ND		0.03	0.005	0.0001	✓
1,2,4-trichlorobenzene	mg/L	13	ND	ND	ND		0.03	0.005	0.0001	✓
SEMI VOLATILE ORGANIC CONTAMINANTS										
hexachlorobenzene	mg/l	13	ND	ND	ND		0.001		0.0001	✓
Lindane	mg/l	13	ND	ND	ND		0.002		0.00001	✓
Heptachlor	mg/l	13	ND	ND	ND		0.00004		0.00001	✓
Aldrin	mg/l	13	ND	ND	ND		0.00003		0.00001	✓
Heptachlor epoxide	mg/l	13	ND	ND	ND		0.00004			✓
Procymidone	mg/l	13	ND	ND	ND		0.7			✓
a-Chlordane	mg/l	13	ND	ND	ND		0.0002		0.00001	✓
pp-DDT	mg/l	13	ND	ND	ND		0.002			✓
Methoxychlor	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Cis permethrin	mg/l	13	ND	ND	ND		0.02			✓
Trans permethrin	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Organophosphorus pesticides:										
Diazinon	mg/l	13	ND	ND	ND		0.01			✓
Pirimiphos methyl	mg/l	13	ND	ND	ND		0.1		0.0002	✓
Chlorpyriphos	mg/l	13	ND	ND	ND		0.07		0.0002	✓
Organonitrogen herbicides:										
Trifluralin	mg/l	13	ND	ND	ND		0.03		0.0002	✓
Simazine	mg/l	13	ND	ND	ND		0.002		0.0001	✓
Atrazine	mg/l	13	ND	ND	ND		0.002		0.0001	✓
Terbuthylazine	mg/l	13	ND	ND	ND		0.008		0.0002	✓
Propanil	mg/l	13	ND	ND	ND		0.02		0.0001	✓
Alachlor	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Metolachlor	mg/l	13	ND	ND	ND		0.01		0.0001	✓
Pendimethalin	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Molinate	mg/l	13	ND	ND	ND		0.007			✓
Plasticisers:										
bis (2-ethylhexyl) adipate	mg/l	13	ND	ND	ND		0.1		0.002	✓
bis (2-ethylhexyl) pthalate	mg/l	13	ND	ND	ND		0.009		0.002	✓
Polychlorinated Biphenyls	mg/l	13	ND	ND	ND				0.0001	✓
Polycyclic aromatic hydrocarbons:										
benzo(a)pyrene	mg/l	13	ND	ND	ND		0.0007		0.0001	✓
ACIDIC HERBICIDES										
Mecoprop	mg/l	15	ND	ND	ND		0.01		0.0001	✓
MCPA	mg/l	15	ND	ND	ND		0.002		0.0001	✓
Dichlorprop	mg/l	15	ND	ND	ND		0.1		0.0001	✓
2,4-Dichlorophenoxyacetic acid (2,4-D)	mg/l	15	ND	ND	ND		0.04		0.0001	✓
Triclopyr	mg/l	15	ND	ND	ND		0.1		0.0001	✓
2,4,5-trichlorophenoxyacetic acid	mg/l	15	ND	ND	ND		0.01		0.0001	✓
4-(2,4-dichlorophenoxy) butanoic (2,4-DB)	mg/l	15	ND	ND	ND		0.1		0.0001	✓
Bentazone	mg/l	15	ND	ND	ND		0.4		0.0001	✓
Picloram	mg/l	15	ND	ND	ND		0.2		0.0001	✓

ND stands for Not Detected

APPENDIX 1 : Water quality at treatment plants

WAIKATO	Units	Samples	Max	Min	Average	Standard Deviation	MAV DWSNZ	GV DWSNZ	Detection Limit	Compliant DWSNZ 2005
MICROBIOLOGY										
E.coli	MPN/100mL	365	ND	ND	ND		<1/100 ml		1	✓
HPC	cfu/100mL	365	300	ND	1.0	15.7			1	
Giardia (Untreated Water)	cysts/100L	13	29	ND	6.4	8.5			0.1	
Giardia (Treated Water)	cysts/100L	51	0	ND	0.008	0.05	<1/100 ml		0.1	✓
Cryptosporidium (Untreated Water)	cysts/100L	13	70	ND	16.6	18.5			0.1	
Cryptosporidium (Treated Water)	cysts/100L	51	ND	ND	ND		<1/100 ml		0.1	✓
CHEMICAL AND PHYSICAL										
Residual Chlorine	mg/L	Continuous	1.20	0.87	0.99	0.03	5.00	0.60		✓
pH	pH Units	Continuous	8.2	7.5	7.9	0.1		7.0 - 8.5	0.1	✓
Conductivity	mS/cm	13	25.90	20.60	23.02	1.30			0.5	
Turbidity	NTU	Continuous	0.0490	0.0118	0.0145	0.0043		2.5		✓
Total dissolved solids	mg/L	13	211.5	140	168.88	21.33		1000		✓
True Colour	Hazen Units	65	5	ND	0.2	0.9		10	5	✓
UV absorption	Abs	13	0.04	0.01	0.02	0.01				
Total organic carbon	mg/L	52	3	0.6	1.3	0.5			0.1	
Total Hardness	mg/L	52	81.39	47.75	59.26	6.12		200	0	✓
Hardness calcium	mg/L	52	64.92	37.46	47.64	5.44			0	
Hardness Magnesium	mg/L	52	16.47	9.06	11.63	1.08			0	
Total Alkalinity	mg/L CaCO3	26	58.00	32.58	46.38	7.11			1	
Sulphate	mg/L	13	29.90	20.90	25.00	3.03		250	0.02	✓
Chloride	mg/L	13	25.60	19.20	21.36	2.05		250	0.02	✓
Fluoride	mg/L	Continuous	0.96	0.59	0.79	0.05	1.5		0.02	✓
Bromide	mg/L	13	0.03	ND	0.00	0.01			0.01	
Iodide	mg/L	13	0.005	ND	0.003	0.001			0.001	
Silica	mg/L	52	38.00	7.20	21.87	9.82			0.1	
Bromate	mg/L	52	ND	ND	ND		0.025		0.005	✓
Chlorate	mg/L	52	0.210	0.080	0.142	0.025	0.3		0.01	✓
Chlorite	mg/L	52	0.178	ND	0.003	0.025	0.3		0.005	✓
Iron (Total)	mg/L	52	0.054	0.021	0.031	0.005		0.2	0.002	✓
Manganese	mg/L	52	0.0029	0.001	0.002	0.000	0.5	0.05	0.0005	✓
Aluminium	mg/L	363	0.18	0.02	0.06	0.01		0.10	0.005	✓
Calcium	mg/L	52	26.00	15.00	19.08	2.18			0.01	
Magnesium	mg/L	52	4.00	2.20	2.82	0.26			0.005	
Sodium	mg/L	13	22.00	15.00	19.00	2.58		200	0.1	✓
Potassium	mg/L	13	3.50	3.00	3.28	0.18			0.1	
NUTRIENTS										
Phosphorus (Total)	mg/L	13	0.02	ND	0.01	0.01			0.01	
Phosphorus (Soluble Reactive)	mg/L	13	0.01	ND	0.00	0.01			0.01	
Nitrate Nitrogen	mg/L	13	1.25	0.13	0.53	0.33	50		0.002	✓
Nitrite Nitrogen	mg/L	13	ND	ND	ND		3		0.002	✓
Ammonia	mg/L N	13	0.06	ND	0.01	0.02		1.5	0.01	✓
Total Kjeldahl Nitrogen	mg/L N	13	0.41	ND	0.24	0.12			0.1	
TRACE ELEMENTS										
Antimony	mg/L	52	0.002	ND	0.0002	0.0005	0.003		0.001	✓
Arsenic	mg/L	52	0.0025	0.0005	0.0012	0.0006	0.01		0.0001	✓
Boron	mg/L	13	0.250	0.130	0.184	0.046	1.4		0.005	✓
Barium	mg/L	13	0.0260	0.0150	0.0191	0.0030	0.7		0.0002	✓
Cadmium	mg/L	13	ND	ND	ND		0.003		0.00005	✓
Chromium	mg/L	13	0.0002	ND	0.0001	0.0001	0.05		0.0001	✓
Copper	mg/L	13	0.0004	ND	0.0003	0.0001	2	1	0.0003	✓
Cyanide	mg/L	13	ND	ND	ND		0.08		0.01	✓
Lead	mg/L	65	0.0003	ND	0.0001	0.0001	0.01		0.0001	✓
Lithium	mg/L	13	0.0850	0.0350	0.0586	0.0169	0.9		0.0003	✓
Molybdenum	mg/L	52	0.0007	ND	0.0002	0.0002	0.07		0.0002	✓
Mercury	mg/L	52	0.0001	ND	ND	0.0000	0.002		0.00008	✓
Nickel	mg/L	52	0.0004	ND	0.0002	0.0001	0.02		0.0005	✓
Selenium	mg/L	13	ND	ND	ND		0.01		0.0005	✓
Zinc	mg/L	13	0.013	0.001	0.003	0.003		3	0.003	✓

ND stands for Not Detected

APPENDIX 1 : Water quality at treatment plants

WAIKATO	Units	Samples	Max	Min	Average	Standard Deviation	MAV DWSNZ	GV DWSNZ	Detection Limit	Compliant DWSNZ 2005
TRIHALOMETHANES										
Bromodichloromethane	mg/L	65	0.0088	0.0012	0.0045	0.0017	0.06		0.0001	✓
Bromoform	mg/L	65	0.0015	ND	0.0006	0.0004	0.1		0.0001	✓
Chloroform	mg/L	65	0.0199	ND	0.0055	0.0044	0.2		0.0001	✓
Dibromochloromethane	mg/L	65	0.0070	0.0005	0.0041	0.0013	0.15		0.0001	✓
Sum of the ratio to the MAV	Ratio	52	0.2375	0.0565	0.1373	0.0414	1	0.5	0.0001	✓
VOLATILE ORGANIC COMPOUNDS										
Benzene	mg/L	13	ND	ND	ND		0.01		0.0001	✓
Carbon tetrachloride	mg/L	13	ND	ND	ND		0.002		0.0001	✓
1,4-dichlorobenzene	mg/L	13	ND	ND	ND		0.4	0.0003	0.0001	✓
1,2-dichlorobenzene	mg/L	13	ND	ND	ND		1	0.001	0.0001	✓
1,2-dichloroethane	mg/L	13	ND	ND	ND		0.03		0.0001	✓
Ethylbenzene	mg/L	13	ND	ND	ND		0.3	0.002	0.0001	✓
m- & p-Xylene	mg/L	13	ND	ND	ND		0.6		0.0001	✓
Styrene	mg/L	13	ND	ND	ND		0.03	0.004	0.0001	✓
Tetrachloroethene	mg/L	13	ND	ND	ND		0.05		0.0001	✓
Toluene	mg/L	13	ND	ND	ND		0.8	0.03	0.0001	✓
trans-1,2-dichloroethene	mg/L	13	ND	ND	ND		0.06		0.0001	✓
1,1,1-trichloroethane	mg/L	13	ND	ND	ND		2		0.0001	✓
trichloroethene	mg/L	13	ND	ND	ND		0.08		0.0001	✓
1,2,3-trichlorobenzene	mg/L	13	ND	ND	ND		0.03	0.005	0.0001	✓
1,2,4-trichlorobenzene	mg/L	13	ND	ND	ND		0.03	0.005	0.0001	✓
SEMI VOLATILE ORGANIC CONTAMINANTS										
hexachlorobenzene	mg/l	13	ND	ND	ND		0.001		0.0001	✓
Lindane	mg/l	13	ND	ND	ND		0.002		0.00001	✓
Heptachlor	mg/l	13	ND	ND	ND		0.00004		0.00001	✓
Aldrin	mg/l	13	ND	ND	ND		0.00003		0.00001	✓
Heptachlor epoxide	mg/l	13	ND	ND	ND		0.00004			✓
Procymidone	mg/l	13	ND	ND	ND		0.7			✓
a-Chlordane	mg/l	13	ND	ND	ND		0.0002		0.00001	✓
pp-DDT	mg/l	13	ND	ND	ND		0.002			✓
Methoxychlor	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Cis permethrin	mg/l	13	ND	ND	ND		0.02			✓
Trans permethrin	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Trans permethrin	mg/L	13	ND				0.02		0.0002	✓
Organophosphorus pesticides:										
Diazinon	mg/l	13	ND	ND	ND		0.01			✓
Pirimiphos methyl	mg/l	13	ND	ND	ND		0.1		0.0002	✓
Chlorpyriphos	mg/l	13	ND	ND	ND		0.07		0.0002	✓
Organonitrogen herbicides:										
Trifluralin	mg/l	13	ND	ND	ND		0.03		0.0002	✓
Simazine	mg/l	13	ND	ND	ND		0.002		0.0001	✓
Atrazine	mg/l	13	ND	ND	ND		0.002		0.0001	✓
Terbuthylazine	mg/l	13	ND	ND	ND		0.008		0.0002	✓
Propanil	mg/l	13	ND	ND	ND		0.02		0.0001	✓
Alachlor	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Metolachlor	mg/l	13	ND	ND	ND		0.01		0.0001	✓
Pendimethalin	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Molinate	mg/l	13	ND	ND	ND		0.007			✓
Plasticisers:										
bis (2-ethylhexyl) adipate	mg/l	13	ND	ND	ND		0.1		0.002	✓
bis (2-ethylhexyl) pthalate	mg/l	13	ND	ND	ND		0.009		0.002	✓
Polychlorinated Biphenyls	mg/l	13	ND	ND	ND				0.0001	✓
Polycyclic aromatic hydrocarbons										
benzo(a)pyrene	mg/l	13	ND	ND	ND		0.0007		0.0001	✓
ACIDIC HERBICIDES										
Mecoprop	mg/l	13	ND	ND	ND		0.01		0.0001	✓
MCPA	mg/l	13	ND	ND	ND		0.002		0.0001	✓
Dichlorprop	mg/l	13	ND	ND	ND		0.1		0.0001	✓
2,4-Dichlorophenoxyacetic acid (2,4-D)	mg/l	13	ND	ND	ND		0.04		0.0001	✓
Triclopyr	mg/l	13	ND	ND	ND		0.1		0.0001	✓
2,4,5-trichlorophenoxyacetic acid	mg/l	13	ND	ND	ND		0.01		0.0001	✓
4-(2,4-dichlorophenoxy) butanoic (2,4-DB)	mg/l	13	ND	ND	ND		0.1		0.0001	✓
Bentazone	mg/l	13	ND	ND	ND		0.4		0.0001	✓
Picloram	mg/l	13	ND	ND	ND		0.2		0.0001	✓

ND stands for Not Detected

APPENDIX 1 : Water quality at treatment plants

HUIA	Units	Samples	Max	Min	Average	Standard Deviation	MAV DWSNZ	GV DWSNZ	Detection Limit	Compliant DWSNZ 2005
MICROBIOLOGY										
E.coli	MPN/100mL	365	ND	ND	ND		<1/100 ml		1	✓
HPC	cfu/100mL	52	2	ND	0.3	0.6			1	
Giardia (Untreated Water)	cysts/100L	13	6.3	ND	0.8	2.1			0.1	
Giardia (Treated Water)	cysts/100L	15	ND	ND	ND		<1/100 ml		0.1	✓
Cryptosporidium (Untreated Water)	cysts/100L	13	12.5	ND	3.4	4.8			0.1	
Cryptosporidium (Treated Water)	cysts/100L	15	ND	ND	ND		<1/100 ml		0.1	✓
CHEMICAL AND PHYSICAL										
Residual Chlorine	mg/L	Continuous	1.08	0.76	0.92	0.05	5.00	0.60		✓
pH	pH Units	Continuous	8.0	7.6	7.8	0.1		7.0 - 8.5	0.1	✓
Conductivity	mS/cm	52	16.76	13.25	14.83	0.93			0.5	
Turbidity	NTU	Continuous	0.0688	0.0334	0.0452	0.0059		2.5		✓
Suspended solids	mg/L	52	2.00	ND	0.15	0.31			0.2	
Total dissolved solids	mg/L	13	154.5	84	106.73	17.97		1000		✓
True Colour	Hazen Units	52	5	ND	0.1	0.7		10	5	✓
UV absorption	Abs	52	0.03	ND	0.02	0.00				
Total organic carbon	mg/L	52	2.2	1.3	1.6	0.2			0.1	
Total Hardness	mg/L	52	41.06	29.62	34.56	2.65		200	0	✓
Hardness calcium	mg/L	52	27.47	20.23	23.86	1.58			0	
Hardness Magnesium	mg/L	52	13.59	7.82	10.71	1.36			0	
Total Alkalinity	mg/L CaCO3	52	25.49	8.98	18.55	3.80			1	
Sulphate	mg/L	52	17.00	11.20	14.62	1.33		250	0.02	✓
Chloride	mg/L	52	28.10	18.70	21.36	1.61		250	0.02	✓
Fluoride	mg/L	Continuous	0.97	0.50	0.80	0.05	1.5		0.02	✓
Bromide	mg/L	13	0.06	ND	0.02	0.02			0.01	
Iodide	mg/L	13	0.005	ND	0.003	0.002			0.001	
Silica	mg/L	13	16.00	10.00	13.31	1.70			0.1	
Bromate	mg/L	13	ND	ND	ND		0.025		0.005	✓
Chlorate	mg/L	13	ND	ND	ND		0.3		0.01	✓
Chlorite	mg/L	13	ND	ND	ND		0.3		0.005	✓
Iron (Total)	mg/L	52	0.15	0.011	0.018	0.019		0.2	0.002	✓
Manganese	mg/L	52	0.0068	0.001	0.003	0.001	0.5	0.05	0.0005	✓
Aluminium	mg/L	52	0.05	0.01	0.03	0.01		0.10	0.005	✓
Calcium	mg/L	52	11.00	8.10	9.55	0.63			0.01	
Magnesium	mg/L	52	3.30	1.90	2.60	0.33			0.005	
Sodium	mg/L	52	14.00	11.00	12.21	0.85		200	0.1	✓
Potassium	mg/L	52	1.00	0.76	0.89	0.07			0.1	
NUTRIENTS										
Phosphorus (Total)	mg/L	13	0.03	ND	0.01	0.01			0.01	
Phosphorus (Soluble Reactive)	mg/L	13	0.01	ND	0.00	0.00			0.01	
Nitrate Nitrogen	mg/L	13	0.04	0.01	0.03	0.01	50		0.002	✓
Nitrite Nitrogen	mg/L	13	0.01	ND	0.00	0.00	3		0.002	✓
Ammonia	mg/L N	13	ND	ND	ND			1.5	0.01	✓
Total Kjeldahl Nitrogen	mg/L N	13	0.40	ND	0.12	0.14			0.1	
TRACE ELEMENTS										
Antimony	mg/L	13	ND	ND	ND		0.003		0.001	✓
Arsenic	mg/L	13	0.0002	ND	0.0001	0.0001	0.01		0.0001	✓
Boron	mg/L	13	0.017	0.013	0.016	0.001	1.4		0.005	✓
Barium	mg/L	13	0.0053	0.0032	0.0042	0.0007	0.7		0.0002	✓
Cadmium	mg/L	13	ND	ND	ND		0.003		0.00005	✓
Chromium	mg/L	13	0.0001	ND	0.0000	0.0001	0.05		0.0001	✓
Copper	mg/L	13	0.0020	0.0007	0.0011	0.0004	2	1	0.0003	✓
Cyanide	mg/L	13	ND	ND	ND		0.08		0.01	✓
Lead	mg/L	13	0.0004	ND	0.0000	0.0001	0.01		0.0001	✓
Lithium	mg/L	13	0.0005	0.0003	0.0004	0.0001	0.9		0.0003	✓
Molybdenum	mg/L	13	0.0003	ND	0.0000	0.0001	0.07		0.0002	✓
Mercury	mg/L	13	ND	ND	ND		0.002		0.00008	✓
Nickel	mg/L	13	0.0009	ND	0.0004	0.0003	0.02		0.0005	✓
Selenium	mg/L	13	ND	ND	ND		0.01		0.0005	✓
Zinc	mg/L	13	0.009	0.002	0.004	0.002		3	0.003	✓

ND stands for Not Detected

APPENDIX 1 : Water quality at treatment plants

HUIA	Units	Samples	Max	Min	Average	Standard Deviation	MAV DWSNZ	GV DWSNZ	Detection Limit	Compliant DWSNZ 2005
TRIHALOMETHANES										
Bromodichloromethane	mg/L	65	0.0130	0.0042	0.0077	0.0021	0.06		0.0001	✓
Bromoform	mg/L	65	0.0015	0.0002	0.0007	0.0003	0.1		0.0001	✓
Chloroform	mg/L	65	0.0126	0.0040	0.0082	0.0022	0.2		0.0001	✓
Dibromochloromethane	mg/L	65	0.0106	0.0030	0.0060	0.0016	0.15		0.0001	✓
Sum of the ratio to the MAV	Ratio	52	0.3508	0.1177	0.2149	0.0538	1	0.5	0.0001	✓
VOLATILE ORGANIC COMPOUNDS										
Benzene	mg/L	13	ND	ND	ND		0.01		0.0001	✓
Carbon tetrachloride	mg/L	13	ND	ND	ND		0.002		0.0001	✓
1,4-dichlorobenzene	mg/L	13	ND	ND	ND		0.4	0.0003	0.0001	✓
1,2-dichlorobenzene	mg/L	13	ND	ND	ND		1	0.001	0.0001	✓
1,2-dichloroethane	mg/L	13	ND	ND	ND		0.03		0.0001	✓
Ethylbenzene	mg/L	13	ND	ND	ND		0.3	0.002	0.0001	✓
m- & p-Xylene	mg/L	13	ND	ND	ND		0.6		0.0001	✓
Styrene	mg/L	13	ND	ND	ND		0.03	0.004	0.0001	✓
Tetrachloroethene	mg/L	13	ND	ND	ND		0.05		0.0001	✓
Toluene	mg/L	13	ND	ND	ND		0.8	0.03	0.0001	✓
trans-1,2-dichloroethene	mg/L	13	ND	ND	ND		0.06		0.0001	✓
1,1,1-trichloroethane	mg/L	13	ND	ND	ND		2		0.0001	✓
trichloroethene	mg/L	13	ND	ND	ND		0.08		0.0001	✓
1,2,3-trichlorobenzene	mg/L	13	ND	ND	ND		0.03	0.005	0.0001	✓
1,2,4-trichlorobenzene	mg/L	13	ND	ND	ND		0.03	0.005	0.0001	✓
SEMI VOLATILE ORGANIC CONTAMINANTS										
hexachlorobenzene	mg/l	13	ND	ND	ND		0.001		0.0001	✓
Lindane	mg/l	13	ND	ND	ND		0.002		0.00001	✓
Heptachlor	mg/l	13	ND	ND	ND		0.00004		0.00001	✓
Aldrin	mg/l	13	ND	ND	ND		0.00003		0.00001	✓
Heptachlor epoxide	mg/l	13	ND	ND	ND		0.00004			✓
Procymidone	mg/l	13	ND	ND	ND		0.7			✓
a-Chlordane	mg/l	13	ND	ND	ND		0.0002		0.00001	✓
pp-DDT	mg/l	13	ND	ND	ND		0.002			✓
Methoxychlor	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Cis permethrin	mg/l	13	ND	ND	ND		0.02			✓
Trans permethrin	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Organophosphorus pesticides:										
Diazinon	mg/l	13	ND	ND	ND		0.01			✓
Pirimiphos methyl	mg/l	13	ND	ND	ND		0.1		0.0002	✓
Chlorpyriphos	mg/l	13	ND	ND	ND		0.07		0.0002	✓
Organonitrogen herbicides:										
Trifluralin	mg/l	13	ND	ND	ND		0.03		0.0002	✓
Simazine	mg/l	13	ND	ND	ND		0.002		0.0001	✓
Atrazine	mg/l	13	ND	ND	ND		0.002		0.0001	✓
Terbuthylazine	mg/l	13	ND	ND	ND		0.008		0.0002	✓
Propanil	mg/l	13	ND	ND	ND		0.02		0.0001	✓
Alachlor	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Metolachlor	mg/l	13	ND	ND	ND		0.01		0.0001	✓
Pendimethalin	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Molinate	mg/l	13	ND	ND	ND		0.007			✓
Plasticisers:										
bis (2-ethylhexyl) adipate	mg/l	13	ND	ND	ND		0.1		0.002	✓
bis (2-ethylhexyl) pthalate	mg/l	13	ND	ND	ND		0.009		0.002	✓
Polychlorinated Biphenyls	mg/l	13	ND	ND	ND				0.0001	✓
Polycyclic aromatic hydrocarbons:										
benzo(a)pyrene	mg/l	13	ND	ND	ND		0.0007		0.0001	✓
ACIDIC HERBICIDES										
Mecoprop	mg/l	13	ND	ND	ND		0.01		0.0001	✓
MCPA	mg/l	13	ND	ND	ND		0.002		0.0001	✓
Dichlorprop	mg/l	13	ND	ND	ND		0.1		0.0001	✓
2,4-Dichlorophenoxyacetic acid (2,4-D)	mg/l	13	ND	ND	ND		0.04		0.0001	✓
Triclopyr	mg/l	13	ND	ND	ND		0.1		0.0001	✓
2,4,5-trichlorophenoxyacetic acid	mg/l	13	ND	ND	ND		0.01		0.0001	✓
4-(2,4-dichlorophenoxy) butanoic (2,4-DB)	mg/l	13	ND	ND	ND		0.1		0.0001	✓
Bentazone	mg/l	13	ND	ND	ND		0.4		0.0001	✓
Picloram	mg/l	13	ND	ND	ND		0.2		0.0001	✓

ND stands for Not Detected

APPENDIX 1 : Water quality at treatment plants

ONEHUNGA	Units	Samples	Max	Min	Average	Standard Deviation	MAV DWSNZ	GV DWSNZ	Detection Limit	Compliant DWSNZ 2005
MICROBIOLOGY										
E.coli	MPN/100mL	365	ND	ND	ND		<1/100 ml		1	✓
HPC	cfu/100mL	52	1	ND	0.1	0.3			1	
Giardia (Untreated Water)	cysts/100L	15	ND	ND	ND				0.1	
Giardia (Treated Water)	cysts/100L	13	ND	ND	ND		<1/100 ml		0.1	✓
Cryptosporidium (Untreated Water)	cysts/100L	15	ND	ND	ND				0.1	
Cryptosporidium (Treated Water)	cysts/100L	13	ND	ND	ND		<1/100 ml		0.1	✓
CHEMICAL AND PHYSICAL										
Residual Chlorine	mg/L	Continuous	1.06	0.78	0.93	0.05	5.00	0.60		✓
pH	pH Units	Continuous	8.1	7.7	7.9	0.1		7.0 - 8.5	0.1	✓
Conductivity	mS/cm	52	27.10	20.60	23.89	1.97			0.5	
Turbidity	NTU	Continuous	0.3746	0.0293	0.0416	0.0236		2.5		✓
Suspended solids	mg/L	52	0.20	ND	0.00	0.03			0.2	
Total dissolved solids	mg/L	13	225.5	147	172.73	20.24		1000		✓
True Colour	Hazen Units	52	5	ND	0.1	0.7		10	5	✓
UV absorption	Abs	52	0.01	ND	0.01	0.00				
Total organic carbon	mg/L	52	0.7	0.4	0.6	0.1			0.1	
Total Hardness	mg/L	52	67.41	45.48	56.60	6.10		200	0	✓
Hardness calcium	mg/L	52	27.47	17.48	22.47	2.94			0	
Hardness Magnesium	mg/L	52	39.94	28.00	34.13	3.37			0	
Total Alkalinity	mg/L CaCO3	52	76.96	38.81	57.79	8.57			1	
Sulphate	mg/L	52	17.10	12.00	13.83	1.36		250	0.02	✓
Chloride	mg/L	52	23.20	18.10	20.14	1.34		250	0.02	✓
Fluoride	mg/L	Continuous	1.14	0.16	0.78	0.09	1.5		0.02	✓
Bromide	mg/L	13	0.10	ND	0.04	0.03			0.01	
Iodide	mg/L	13	0.009	0.003	0.007	0.002			0.001	
Silica	mg/L	13	38.00	27.00	33.62	3.36			0.1	
Bromate	mg/L	13	ND	ND	ND		0.025		0.005	✓
Chlorate	mg/L	13	0.250	0.023	0.058	0.061	0.3		0.01	✓
Chlorite	mg/L	13	0.008	ND	0.001	0.002	0.3		0.005	✓
Iron (Total)	mg/L	52	0.018	ND	0.001	0.003		0.2	0.002	✓
Manganese	mg/L	52	ND	ND	ND		0.5	0.05	0.0005	✓
Aluminium	mg/L	52	0.04	0.02	0.03	0.00		0.10	0.005	✓
Calcium	mg/L	52	11.00	7.00	9.00	1.18			0.01	
Magnesium	mg/L	52	9.70	6.80	8.29	0.82			0.005	
Sodium	mg/L	52	26.00	19.00	22.27	1.99		200	0.1	✓
Potassium	mg/L	52	3.70	2.50	3.04	0.32			0.1	
NUTRIENTS										
Phosphorus (Total)	mg/L	13	0.07	0.02	0.05	0.01			0.01	
Phosphorus (Soluble Reactive)	mg/L	13	0.07	0.02	0.05	0.01			0.01	
Nitrate Nitrogen	mg/L	13	3.66	3.10	3.30	0.18	50		0.002	✓
Nitrite Nitrogen	mg/L	13	ND	ND	ND		3		0.002	✓
Ammonia	mg/L N	13	ND	ND	ND			1.5	0.01	✓
Total Kjeldahl Nitrogen	mg/L N	13	0.20	ND	0.13	0.09			0.1	
TRACE ELEMENTS										
Antimony	mg/L	13	ND	ND	ND		0.003		0.001	✓
Arsenic	mg/L	13	0.0003	0.0002	0.0003	0.0001	0.01		0.0001	✓
Boron	mg/L	13	0.074	0.050	0.060	0.006	1.4		0.005	✓
Barium	mg/L	13	0.0022	0.0013	0.0017	0.0003	0.7		0.0002	✓
Cadmium	mg/L	13	ND	ND	ND		0.003		0.00005	✓
Chromium	mg/L	13	0.0011	0.0005	0.0007	0.0002	0.05		0.0001	✓
Copper	mg/L	13	0.0031	0.0015	0.0021	0.0005	2	1	0.0003	✓
Cyanide	mg/L	13	ND	ND	ND		0.08		0.01	✓
Lead	mg/L	13	ND	ND	ND		0.01		0.0001	✓
Lithium	mg/L	13	0.0005	0.0003	0.0004	0.0001	0.9		0.0003	✓
Molybdenum	mg/L	13	0.0012	0.0007	0.0009	0.0001	0.07		0.0002	✓
Mercury	mg/L	13	ND	ND	ND		0.002		0.00008	✓
Nickel	mg/L	13	0.0005	ND	0.0002	0.0002	0.02		0.0005	✓
Selenium	mg/L	13	0.0007	ND	0.0004	0.0003	0.01		0.0005	✓
Zinc	mg/L	13	0.004	0.001	0.002	0.001		3	0.003	✓

ND stands for Not Detected

APPENDIX 1 : Water quality at treatment plants

ONEHUNGA	Units	Samples	Max	Min	Average	Standard Deviation	MAV DWSNZ	GV DWSNZ	Detection Limit	Compliant DWSNZ 2005
TRIHALOMETHANES										
Bromodichloromethane	mg/L	65	0.0016	ND	0.0002	0.0003	0.06		0.0001	✓
Bromoform	mg/L	65	0.0025	0.0009	0.0016	0.0004	0.1		0.0001	✓
Chloroform	mg/L	65	0.0007	ND	0.0001	0.0002	0.2		0.0001	✓
Dibromochloromethane	mg/L	65	0.0018	0.0006	0.0012	0.0003	0.15		0.0001	✓
Sum of the ratio to the MAV	Ratio	52	0.0525	0.0158	0.0283	0.0080	1	0.5	0.0001	✓
VOLATILE ORGANIC COMPOUNDS										
Benzene	mg/L	13	ND	ND	ND		0.01		0.0001	✓
Carbon tetrachloride	mg/L	13	ND	ND	ND		0.002		0.0001	✓
1,4-dichlorobenzene	mg/L	13	ND	ND	ND		0.4	0.0003	0.0001	✓
1,2-dichlorobenzene	mg/L	13	ND	ND	ND		1	0.001	0.0001	✓
1,2-dichloroethane	mg/L	13	ND	ND	ND		0.03		0.0001	✓
Ethylbenzene	mg/L	13	ND	ND	ND		0.3	0.002	0.0001	✓
m- & p-Xylene	mg/L	13	ND	ND	ND		0.6		0.0001	✓
Styrene	mg/L	13	ND	ND	ND		0.03	0.004	0.0001	✓
Tetrachloroethene	mg/L	13	0.0008	ND	0.0001	0.0002	0.05		0.0001	✓
Toluene	mg/L	13	ND	ND	ND		0.8	0.03	0.0001	✓
trans-1,2-dichloroethene	mg/L	13	ND	ND	ND		0.06		0.0001	✓
1,1,1-trichloroethane	mg/L	13	ND	ND	ND		2		0.0001	✓
trichloroethene	mg/L	13	ND	ND	ND		0.08		0.0001	✓
1,2,3-trichlorobenzene	mg/L	13	ND	ND	ND		0.03	0.005	0.0001	✓
1,2,4-trichlorobenzene	mg/L	13	ND	ND	ND		0.03	0.005	0.0001	✓
SEMI VOLATILE ORGANIC CONTAMINANTS										
hexachlorobenzene	mg/l	13	ND	ND	ND		0.001		0.0001	✓
Lindane	mg/l	13	ND	ND	ND		0.002		0.00001	✓
Heptachlor	mg/l	13	ND	ND	ND		0.00004		0.00001	✓
Aldrin	mg/l	13	ND	ND	ND		0.00003		0.00001	✓
Heptachlor epoxide	mg/l	13	ND	ND	ND		0.00004			✓
Procymidone	mg/l	13	ND	ND	ND		0.7			✓
a-Chlordane	mg/l	13	ND	ND	ND		0.0002		0.00001	✓
pp-DDT	mg/l	13	ND	ND	ND		0.002			✓
Methoxychlor	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Cis permethrin	mg/l	13	ND	ND	ND		0.02			✓
Trans permethrin	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Organophosphorus pesticides:										
Diazinon	mg/l	13	ND	ND	ND		0.01			✓
Pirimiphos methyl	mg/l	13	ND	ND	ND		0.1		0.0002	✓
Chlorpyriphos	mg/l	13	ND	ND	ND		0.07		0.0002	✓
Organonitrogen herbicides:										
Trifluralin	mg/l	13	ND	ND	ND		0.03		0.0002	✓
Simazine	mg/l	13	ND	ND	ND		0.002		0.0001	✓
Atrazine	mg/l	13	ND	ND	ND		0.002		0.0001	✓
Terbuthylazine	mg/l	13	ND	ND	ND		0.008		0.0002	✓
Propanil	mg/l	13	ND	ND	ND		0.02		0.0001	✓
Alachlor	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Metolachlor	mg/l	13	ND	ND	ND		0.01		0.0001	✓
Pendimethalin	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Molinate	mg/l	13	ND	ND	ND		0.007			✓
Plasticisers:										
bis (2-ethylhexyl) adipate	mg/l	13	ND	ND	ND		0.1		0.002	✓
bis (2-ethylhexyl) pthalate	mg/l	13	ND	ND	ND		0.009		0.002	✓
Polychlorinated Biphenyls	mg/l	13	ND	ND	ND				0.0001	✓
Polycyclic aromatic hydrocarbons:										
benzo(a)pyrene	mg/l	13	ND	ND	ND		0.0007		0.0001	✓
ACIDIC HERBICIDES										
Mecoprop	mg/l	13	ND	ND	ND		0.01		0.0001	✓
MCPA	mg/l	13	ND	ND	ND		0.002		0.0001	✓
Dichlorprop	mg/l	13	ND	ND	ND		0.1		0.0001	✓
2,4-Dichlorophenoxyacetic acid (2,4-D)	mg/l	13	ND	ND	ND		0.04		0.0001	✓
Triclopyr	mg/l	13	ND	ND	ND		0.1		0.0001	✓
2,4,5-trichlorophenoxyacetic acid	mg/l	13	ND	ND	ND		0.01		0.0001	✓
4-(2,4-dichlorophenoxy) butanoic (2,4-DB)	mg/l	13	ND	ND	ND		0.1		0.0001	✓
Bentazone	mg/l	13	ND	ND	ND		0.4		0.0001	✓
Picloram	mg/l	13	ND	ND	ND		0.2		0.0001	✓

ND stands for Not Detected

APPENDIX 1 : Water quality at treatment plants

WAITAKERE	Units	Samples	Max	Min	Average	Standard Deviation	MAV DWSNZ	GV DWSNZ	Detection Limit	Compliant DWSNZ 2005
MICROBIOLOGY										
E.coli	MPN/100mL	365	ND	ND	ND		<1/100 ml		1	✓
HPC	cfu/100mL	52	1	ND	0.3	0.4			1	
Giardia (Untreated Water)	cysts/100L	11	4.8	ND	0.4	1.4			0.1	
Giardia (Treated Water)	cysts/100L	13	ND	ND	ND		<1/100 ml		0.1	✓
Cryptosporidium (Untreated Water)	cysts/100L	11	4.9	ND	0.9	2.0			0.1	
Cryptosporidium (Treated Water)	cysts/100L	13	ND	ND	ND		<1/100 ml		0.1	✓
CHEMICAL AND PHYSICAL										
Residual Chlorine	mg/L	Continuous	1.11	0.59	0.88	0.10	5.00	0.60		✓
pH	pH Units	Continuous	8.3	7.6	7.9	0.1		7.0 - 8.5	0.1	✓
Conductivity	mS/cm	46	17.45	12.55	14.86	1.17			0.5	
Turbidity	NTU	Continuous	0.0278	0.0167	0.0224	0.0027		2.5		✓
Suspended solids	mg/L	46	0.45	ND	0.13	0.16			0.2	
Total dissolved solids	mg/L	13	152	94	111.19	15.58		1000		✓
True Colour	Hazen Units	46	5	ND	0.1	0.7		10	5	✓
UV absorption	Abs	46	0.04	0.01	0.02	0.00				
Total organic carbon	mg/L	46	2.5	1.1	1.6	0.3			0.1	
Total Hardness	mg/L	46	44.43	26.63	33.33	3.97		200	0	✓
Hardness calcium	mg/L	46	34.96	17.98	23.71	4.12			0	
Hardness Magnesium	mg/L	46	11.53	6.18	9.62	1.34			0	
Total Alkalinity	mg/L CaCO3	46	22.35	8.99	16.35	3.69			1	
Sulphate	mg/L	46	25.50	11.10	14.84	3.74		250	0.02	✓
Chloride	mg/L	46	26.40	14.20	22.15	2.53		250	0.02	✓
Fluoride	mg/L	Continuous	0.98	0.21	0.82	0.10	1.5		0.02	✓
Bromide	mg/L	13	0.05	ND	0.02	0.02			0.01	
Iodide	mg/L	13	0.005	ND	0.003	0.001			0.001	
Silica	mg/L	13	17.00	7.20	12.39	2.94			0.1	
Bromate	mg/L	13	ND	ND	ND		0.025		0.005	✓
Chlorate	mg/L	13	ND	ND	ND		0.3		0.01	✓
Chlorite	mg/L	13	ND	ND	ND		0.3		0.005	✓
Iron (Total)	mg/L	46	0.022	0.010	0.015	0.002		0.2	0.002	✓
Manganese	mg/L	46	0.017	0.002	0.005	0.004	0.5	0.05	0.0005	✓
Aluminium	mg/L	46	0.08	0.01	0.03	0.02		0.10	0.005	✓
Calcium	mg/L	46	14.00	7.20	9.50	1.65			0.01	
Magnesium	mg/L	46	2.80	1.50	2.34	0.32			0.005	
Sodium	mg/L	46	15.00	9.40	12.63	1.25		200	0.1	✓
Potassium	mg/L	46	1.30	0.74	0.95	0.13			0.1	
NUTRIENTS										
Phosphorus (Total)	mg/L	13	0.04	ND	0.01	0.01			0.01	
Phosphorus (Soluble Reactive)	mg/L	13	0.01	ND	0.00	0.00			0.01	
Nitrate Nitrogen	mg/L	13	0.06	ND	0.02	0.02	50		0.002	✓
Nitrite Nitrogen	mg/L	13	0.01	ND	0.00	0.00	3		0.002	✓
Ammonia	mg/L N	13	ND	ND	ND			1.5	0.01	✓
Total Kjeldahl Nitrogen	mg/L N	13	0.30	ND	0.15	0.10			0.1	
TRACE ELEMENTS										
Antimony	mg/L	13	ND	ND	ND		0.003		0.001	✓
Arsenic	mg/L	13	0.0002	ND	0.0001	0.0001	0.01		0.0001	✓
Boron	mg/L	13	0.020	0.012	0.017	0.002	1.4		0.005	✓
Barium	mg/L	13	0.0072	0.0048	0.0059	0.0008	0.7		0.0002	✓
Cadmium	mg/L	13	ND	ND	ND		0.003		0.00005	✓
Chromium	mg/L	13	0.0002	ND	0.0000	0.0001	0.05		0.0001	✓
Copper	mg/L	13	0.0039	0.0020	0.0027	0.0007	2	1	0.0003	✓
Cyanide	mg/L	13	ND	ND	ND		0.08		0.01	✓
Lead	mg/L	13	ND	ND	ND		0.01		0.0001	✓
Lithium	mg/L	13	0.0007	0.0004	0.0006	0.0001	0.9		0.0003	✓
Molybdenum	mg/L	13	ND	ND	ND		0.07		0.0002	✓
Mercury	mg/L	13	0.0001	ND	0.0000	0.0000	0.002		0.00008	✓
Nickel	mg/L	13	0.0002	ND	0.0001	0.0001	0.02		0.0005	✓
Selenium	mg/L	13	ND	ND	ND		0.01		0.0005	✓
Zinc	mg/L	13	0.006	0.002	0.003	0.001		3	0.003	✓

ND stands for Not Detected

APPENDIX 1 : Water quality at treatment plants

WAITAKERE	Units	Samples	Max	Min	Average	Standard Deviation	MAV DWSNZ	GV DWSNZ	Detection Limit	Compliant DWSNZ 2005
TRIHALOMETHANES										
Bromodichloromethane	mg/L	58	0.0172	0.0058	0.0112	0.0032	0.06		0.0001	✓
Bromoform	mg/L	58	0.0046	ND	0.0013	0.0011	0.1		0.0001	✓
Chloroform	mg/L	58	0.0323	0.0036	0.0117	0.0065	0.2		0.0001	✓
Dibromochloromethane	mg/L	58	0.0168	0.0023	0.0092	0.0033	0.15		0.0001	✓
Sum of the ratio to the MAV	Ratio	45	0.4940	0.1528	0.3265	0.0834	1	0.5	0.0001	✓
VOLATILE ORGANIC COMPOUNDS										
Benzene	mg/L	13	ND	ND	ND		0.01		0.0001	✓
Carbon tetrachloride	mg/L	13	ND	ND	ND		0.002		0.0001	✓
1,4-dichlorobenzene	mg/L	13	ND	ND	ND		0.4	0.0003	0.0001	✓
1,2-dichlorobenzene	mg/L	13	ND	ND	ND		1	0.001	0.0001	✓
1,2-dichloroethane	mg/L	13	ND	ND	ND		0.03		0.0001	✓
Ethylbenzene	mg/L	13	ND	ND	ND		0.3	0.002	0.0001	✓
m- & p-Xylene	mg/L	13	ND	ND	ND		0.6		0.0001	✓
Styrene	mg/L	13	ND	ND	ND		0.03	0.004	0.0001	✓
Tetrachloroethene	mg/L	13	ND	ND	ND		0.05		0.0001	✓
Toluene	mg/L	13	ND	ND	ND		0.8	0.03	0.0001	✓
trans-1,2-dichloroethene	mg/L	13	ND	ND	ND		0.06		0.0001	✓
1,1,1-trichloroethane	mg/L	13	ND	ND	ND		2		0.0001	✓
trichloroethene	mg/L	13	ND	ND	ND		0.08		0.0001	✓
1,2,3-trichlorobenzene	mg/L	13	ND	ND	ND		0.03	0.005	0.0001	✓
1,2,4-trichlorobenzene	mg/L	13	ND	ND	ND		0.03	0.005	0.0001	✓
SEMI VOLATILE ORGANIC CONTAMINANTS										
hexachlorobenzene	mg/l	13	ND	ND	ND		0.001		0.0001	✓
Lindane	mg/l	13	ND	ND	ND		0.002		0.00001	✓
Heptachlor	mg/l	13	ND	ND	ND		0.00004		0.00001	✓
Aldrin	mg/l	13	ND	ND	ND		0.00003		0.00001	✓
Heptachlor epoxide	mg/l	13	ND	ND	ND		0.00004			✓
Procymidone	mg/l	13	ND	ND	ND		0.7			✓
a-Chlordane	mg/l	13	ND	ND	ND		0.0002		0.00001	✓
pp-DDT	mg/l	13	ND	ND	ND		0.002			✓
Methoxychlor	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Cis permethrin	mg/l	13	ND	ND	ND		0.02			✓
Trans permethrin	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Organophosphorus pesticides:										
Diazinon	mg/l	13	ND	ND	ND		0.01			✓
Pirimiphos methyl	mg/l	13	ND	ND	ND		0.1		0.0002	✓
Chlorpyriphos	mg/l	13	ND	ND	ND		0.07		0.0002	✓
Organonitrogen herbicides:										
Trifluralin	mg/l	13	ND	ND	ND		0.03		0.0002	✓
Simazine	mg/l	13	ND	ND	ND		0.002		0.0001	✓
Atrazine	mg/l	13	ND	ND	ND		0.002		0.0001	✓
Terbuthylazine	mg/l	13	ND	ND	ND		0.008		0.0002	✓
Propanil	mg/l	13	ND	ND	ND		0.02		0.0001	✓
Alachlor	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Metolachlor	mg/l	13	ND	ND	ND		0.01		0.0001	✓
Pendimethalin	mg/l	13	ND	ND	ND		0.02		0.0002	✓
Molinate	mg/l	13	ND	ND	ND		0.007			✓
Plasticisers:										
bis (2-ethylhexyl) adipate	mg/l	13	ND	ND	ND		0.1		0.002	✓
bis (2-ethylhexyl) pthalate	mg/l	13	ND	ND	ND		0.009		0.002	✓
Polychlorinated Biphenyls	mg/l	13	ND	ND	ND				0.0001	✓
Polycyclic aromatic hydrocarbons:										
benzo(a)pyrene	mg/l	13	ND	ND	ND		0.0007		0.0001	✓
ACIDIC HERBICIDES										
Mecoprop	mg/l	53	0.0044*	ND	0.0001	0.0006	0.01		0.0001	✓
MCPA	mg/l	53	0.0045*	ND	0.0001	0.0006	0.002		0.0001	
Dichlorprop	mg/l	53	ND	ND	ND		0.1		0.0001	✓
2,4-Dichlorophenoxyacetic acid (2,4-D)	mg/l	53	ND	ND	ND		0.04		0.0001	✓
Triclopyr	mg/l	53	ND	ND	ND		0.1		0.0001	✓
2,4,5-trichlorophenoxyacetic acid	mg/l	53	ND	ND	ND		0.01		0.0001	✓
4-(2,4-dichlorophenoxy) butanoic (2,4-DB)	mg/l	53	ND	ND	ND		0.1		0.0001	✓
Bentazone	mg/l	53	ND	ND	ND		0.4		0.0001	✓
Picloram	mg/l	53	ND	ND	ND		0.2		0.0001	✓

*A sanitary survey identified point source contamination as the most probable cause. A number of security improvements have been made to the site and all subsequent samples have been satisfactory.

ND stands for Not Detected

APPENDIX 2 : Compliance with bulk water agreement

WATER TREATMENT PLANTS COMPLIANCE WITH BWA WATER QUALITY STANDARDS

Water Quality Test (and unit of measurement)	Standard		Watercare Target for each 12 month period	No. of samples collected	Percentage of samples meeting target		
	Min Level	Max Level		2009-10	2009-10	2008-09	2007-08
E.coli (Number / 100 mL)	N/A	0	Number of water samples exceeding the maximum under section 4.3.1 of the Drinking Water Standards of New Zealand (2000)	2190	100%	100%	100%
Colour (Hazen Units)	N/A	10	95% (or more) of water samples taken must contain less than 10 hazen units	319	100%	100%	100%
Fluoride (mg/L) (Daily Average when added)	0.7	1.0	95% (or more) of fluoride water samples must be in the range.	Continuous Data	100%	100%	99%
Iron (mg/L) (Total)	N/A	0.2	95% (or more) of water samples must contain less than 0.2 mg/L of iron.	306	100%	100%	99%
Manganese (mg/L) (Total)	N/A	0.05	95% (or more) of water samples taken must contain less than 0.05 mg/L of manganese.	306	100%	100%	100%
Aluminium (mg/L) (Total)	N/A	0.15	95% (or more) of water samples taken must contain less than 0.15 mg/L of aluminium	613	99%	100%	100%
Total Hardness (mg/L)	N/A	200	95% (or more) of water samples taken must contain less than 200 mg/L of total hardness	306	100%	100%	100%
pH (Value) Daily Average	7.6	8.2	95% (or more) of water samples taken will have a level of pH that is within the range.	Continuous Data	99%	98%	99%
Taste and Odour (Threshold Odour Number) excluding chlorine.	N/A	3	95% or more of water samples taken must have a threshold odour number of 3 or less	214	95%	94%	98%

APPENDIX 2 : Compliance with bulk water agreement

METROWATER COMPLIANCE WITH BWA WATER QUALITY STANDARDS AT SUPPLY POINTS

Water Quality Test (and unit of measurement)	Standard		Watercare Target for each 12 month period	Auckland	CBD	Hillsborough	Maungawhau	Mt Hobson	Otahuhu	Percentage of Total samples meeting target			
	Min Level	Max Level								2009-10	2008-09	2007-08	2006-07
E. coli (Number/100 mL)	N/A	0	Number of water samples exceeding the maximum allowed by the Drinking Water Standards of New Zealand (2000 & 2005)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Chlorine (mg/L)	0.3	1.5	95% (or more of water samples taken will have a concentration of FAC that is within the range.	95%	100%	100%	98%	95%	100%	97%	98%	98%	97%
pH (value)	7.5	8.5	95% (or more) of water samples taken will have a concentration of pH that is within the range.	100%	100%	100%	100%	100%	100%	100%	99%	99%	99%
Turbidity (NTU)	N/A	0.5	98% (or more) of water samples taken will contain less than 0.5 NTU	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%
Heterotrophic Plate Count (HPC) (cfu/mL)	N/A	50	98% (or more) of water samples taken will contain less than 50 cfu/mL of HPC	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

MANUKAU COMPLIANCE WITH BWA WATER QUALITY STANDARDS AT SUPPLY POINTS

Water Quality Test (and unit of measurement)	Standard		Watercare Target for each 12 month period	High-Head	Manukau Misc	Percentage of Total samples meeting target			
	Min Level	Max Level				2009-10	2008-09	2007-08	2006-07
E. coli (Number/100 mL)	N/A	0	Number of water samples exceeding the maximum allowed by the Drinking Water Standards of New Zealand (2000 & 2005)	100%	100%	100%	100%	100%	100%
Chlorine (mg/L)	0.3	1.5	95% (or more of water samples taken will have a level of FAC that is within the range.	100%	100%	100%	98%	100%	99%
pH (value)	7.5	8.5	95% (or more) of water samples taken will have a level of pH that is within the range.	100%	100%	100%	99%	97%	99%
Turbidity (NTU)	N/A	0.5	98% (or more) of water samples taken will contain less than 0.5 NTU	100%	100%	100%	100%	98%	99%
Heterotrophic Plate Count (HPC) (cfu/mL)	N/A	50	98% (or more) of water samples taken will contain less than 50 cfu/mL of HPC	98%	99%	99%	100%	100%	100%

APPENDIX 2 : Compliance with bulk water agreement

ECOWATER COMPLIANCE WITH BWA WATER QUALITY STANDARDS AT SUPPLY POINTS

Water Quality Test (and unit of measurement)	Standard		Watercare Target for each 12 month period	Glen Eden	Henderson	Swanson	Whenuapai	Percentage of Total samples meeting target			
	Min Level	Max Level						2009-10	2008-09	2007-08	2006-07
E. coli (Number/100 mL)	N/A	0	Number of water samples exceeding the maximum allowed by the Drinking Water Standards of New Zealand (2000 & 2005)	100%	100%	100%	100%	100%	100%	100%	100%
Chlorine (mg/L)	0.3	1.5	90% (or more of water samples taken will have a level of FAC that is within the range.	100%	98%	100%	96%	99%	96%	97%	96%
pH (value)	7.5	8.5	95% (or more) of water samples taken will have a level of pH that is within the range.	100%	100%	100%	95%	99%	100%	96%	97%
Turbidity (NTU)	N/A	0.5	98% (or more) of water samples taken will contain less than 0.5 NTU	100%	99%	98%	100%	100%	100%	98%	98%
Heterotrophic Plate Count (HPC) (cfu/mL)	N/A	50	98% (or more) of water samples taken will contain less than 50 cfu/mL of HPC	99%	99%	98%	99%	99%	100%	99%	100%

RODNEY COMPLIANCE WITH BWA WATER QUALITY STANDARDS AT SUPPLY POINTS

Water Quality Test (and unit of measurement)	Standard		Watercare Target for each 12 month period	Percentage of Total samples meeting target			
	Min Level	Max Level		2009-10	2008-09	2007-08	2006-07
E. coli (Number/100 mL)	N/A	0	Number of water samples exceeding the maximum allowed by the Drinking Water Standards of New Zealand (2000 & 2005)	100%	100%	100%	100%
Chlorine (mg/L)	0.3	1.5	80% (or more of water samples taken will have a level of FAC that is within the range.	97%	91%	99%	94%
pH (value)	7.5	9.5	95% (or more) of water samples taken will have a level of pH that is within the range.	100%	100%	100%	100%
Turbidity (NTU)	N/A	0.5	98% (or more) of water samples taken will contain less than 0.5 NTU	100%	99%	99%	99%
Heterotrophic Plate Count (HPC) (cfu/mL)	N/A	50	98% (or more) of water samples taken will contain less than 50 cfu/mL of HPC	100%	94%	99%	98%

APPENDIX 2 : Compliance with bulk water agreement

UNITED WATER COMPLIANCE WITH BWA WATER QUALITY STANDARDS AT SUPPLY POINTS

Water Quality Test (and unit of measurement)	Standard		Watercare Target for each 12 month period	Takanini	Papakura	Red Hill	Ardmore School	Percentage of Total samples meeting target			
	Min Level	Max Level						2009-10	2008-09	2007-08	2006-07
E. coli (Number/100 mL)	N/A	0	Number of water samples exceeding the maximum allowed by the Drinking Water Standards of New Zealand (2000 & 2005)	100%	100%	100%	100%	100%	100%	100%	100%
Chlorine (mg/L)	0.3	1.5	95% (or more of water samples taken will have a level of FAC that is within the range.	100%	100%	100%	100%	100%	100%	100%	100%
pH (value)	7.5	8.5	95% (or more) of water samples taken will have a level of pH that is within the range.	100%	99%	100%	100%	100%	100%	99%	99%
Turbidity (NTU)	N/A	0.5	98% (or more) of water samples taken will contain less than 0.5 NTU	98%	100%	100%	100%	99%	100%	98%	97%
Heterotrophic Plate Count (HPC) (cfu/mL)	N/A	50	98% (or more) of water samples taken will contain less than 50 cfu/mL of HPC	100%	100%	100%	100%	100%	100%	100%	100%

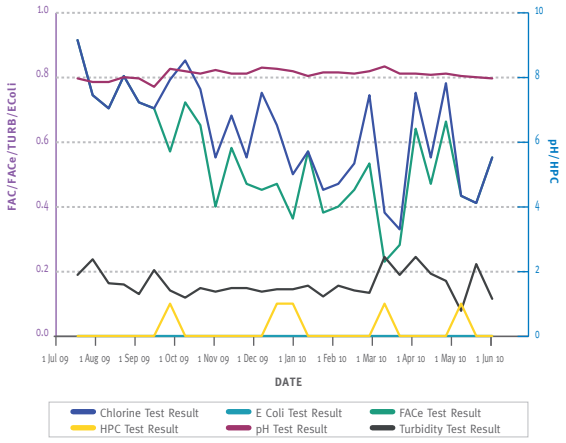
NORTH SHORE COMPLIANCE WITH BWA WATER QUALITY STANDARDS AT SUPPLY POINTS

Water Quality Test (and unit of measurement)	Standard		Watercare Target for each 12 month period	West	South	Percentage of Total samples meeting target			
	Min Level	Max Level				2009-10	2008-09	2007-08	2006-07
E. coli (Number/100 mL)	N/A	0	Number of water samples exceeding the maximum allowed by the Drinking Water Standards of New Zealand (2000 & 2005)	100%	100%	100%	100%	100%	100%
Chlorine (mg/L)	0.3	1.5	75% (or more of water samples taken will have a level of FAC that is within the range.	99%	98%	98%	94%	99%	94%
pH (value)	7.5	8.5	95% (or more) of water samples taken will have a level of pH that is within the range.	100%	100%	100%	100%	99%	99%
Turbidity (NTU)	N/A	0.5	98% (or more) of water samples taken will contain less than 0.5 NTU	99%	100%	100%	99%	100%	98%
Heterotrophic Plate Count (HPC) (cfu/mL)	N/A	50	98% (or more) of water samples taken will contain less than 50 cfu/mL of HPC	99%	100%	100%	99%	99%	100%

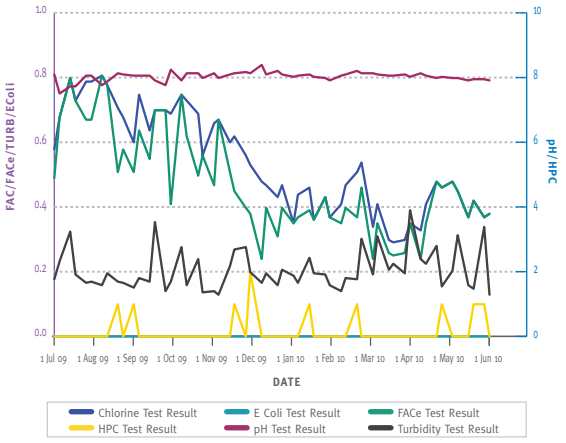
APPENDIX 3 : Bulk supply points

NORTH SHORE CITY

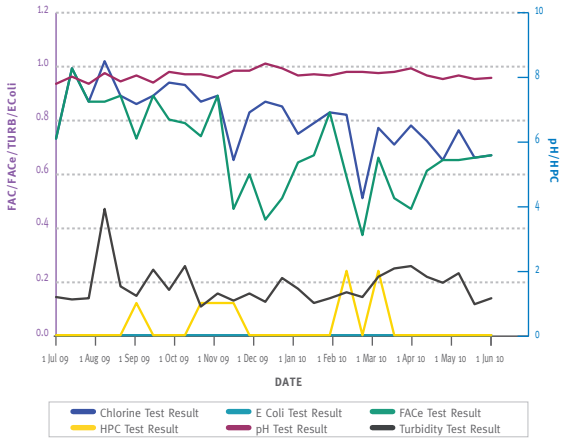
LNO: North Shore Grading Zone: South
Meter: Bank Street (NNBH020)



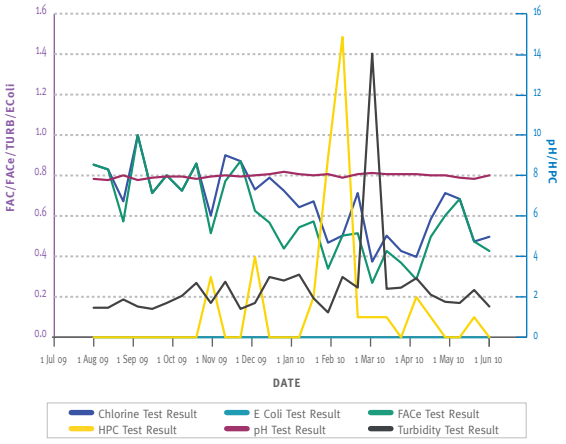
LNO: North Shore Grading Zone: South
Meter: Birkenhead Reservoir (NNBH020)



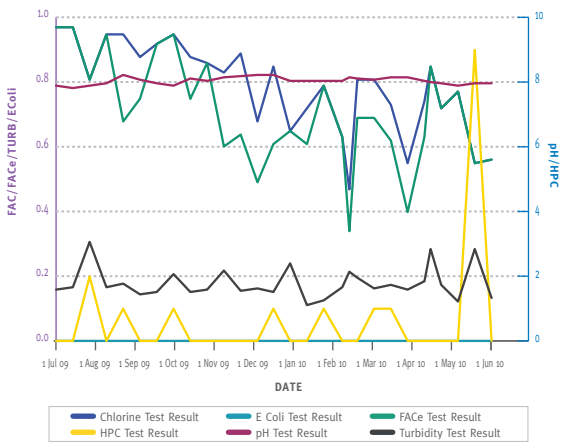
LNO: North Shore Grading Zone: South
Meter: Nile Road (NNTK070)



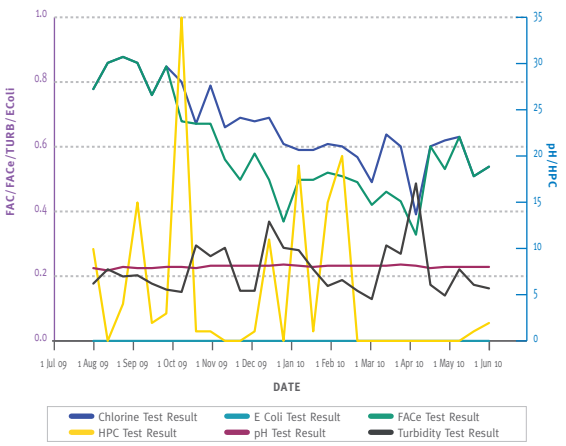
LNO: North Shore Grading Zone: South
Meter: Lake Road 1 (NNTK011)



LNO: North Shore Grading Zone: South
Meter: Northcote Road 2 (NNTK031)



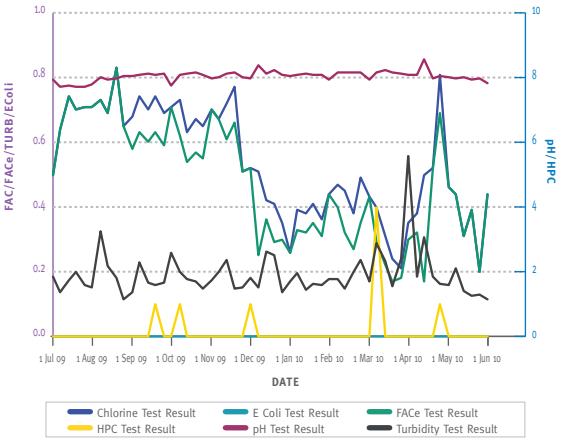
LNO: North Shore Grading Zone: South
Meter: Kowhai Road (NNEC020)



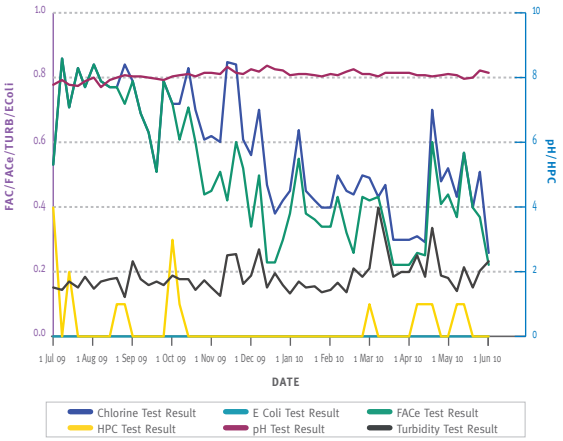
APPENDIX 3 : Bulk supply points

NORTH SHORE CITY
CONTINUED

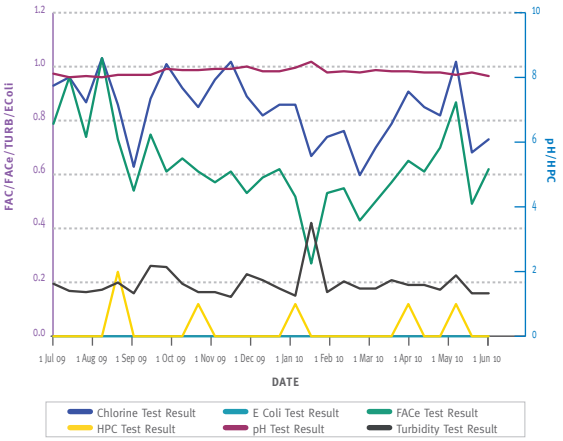
LNO: North Shore Grading Zone: South
Meter: Pinehill Reservoir (NNEC011)



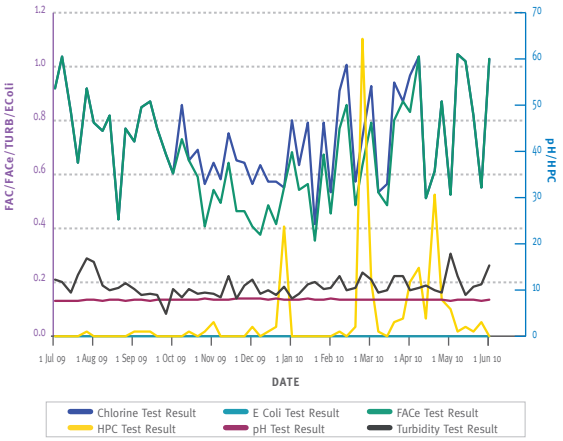
LNO: North Shore Grading Zone: West
Meter: Eskdale Road (NNTK044)



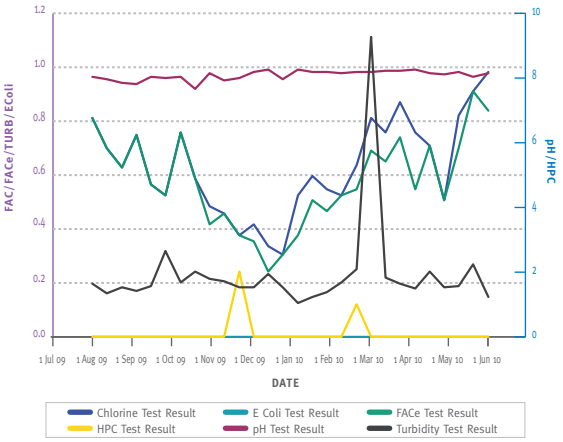
LNO: North Shore Grading Zone: West
Meter: Glenvar Reservoir (NNTK253)



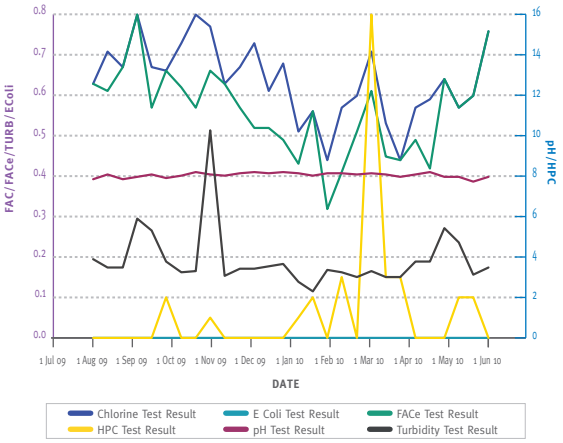
LNO: North Shore Grading Zone: West
Meter: Schnapper Rock Road (NNTK151)



LNO: North Shore Grading Zone: West
Meter: Sunset Road 2 (NNTK033)



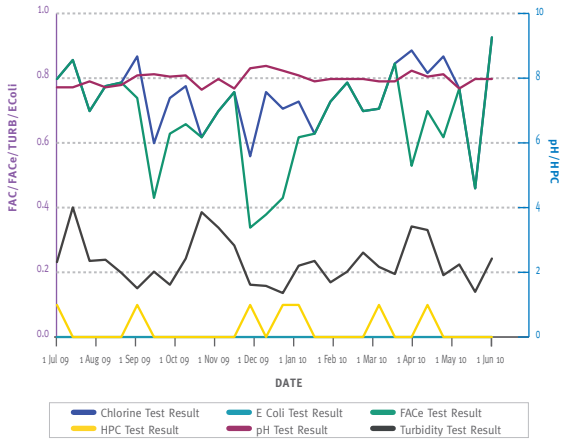
LNO: North Shore Grading Zone: West
Meter: Tauhinu Road (NNTH140)



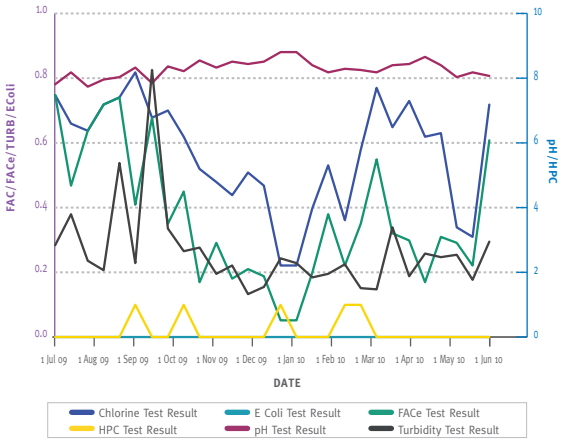
APPENDIX 3 : Bulk supply points

ECOWATER

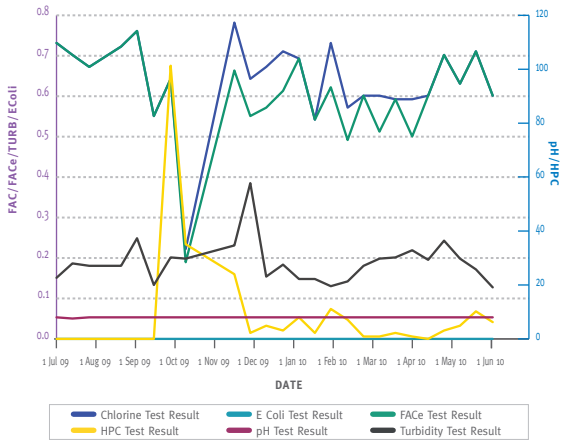
LNO: EcoWater Grading Zone: Whenuapai
Meter: Birdwood (WWWT190)



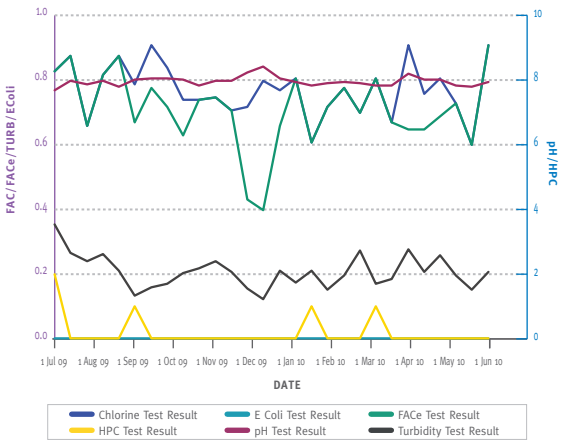
LNO: EcoWater Grading Zone: Whenuapai
Meter: Trigg Road HP (WWWT332)



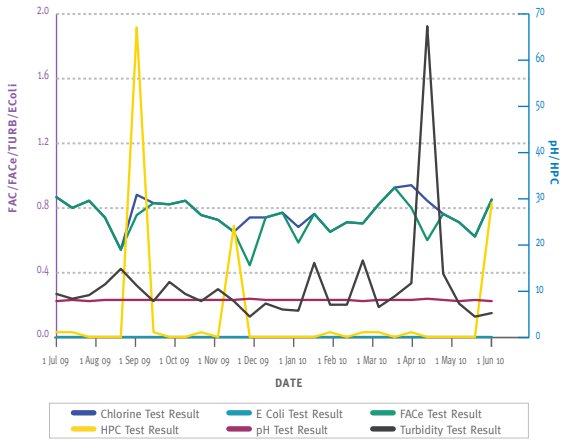
LNO: EcoWater Grading Zone: Whenuapai
Meter: Buckley Avenue (WWAF010)



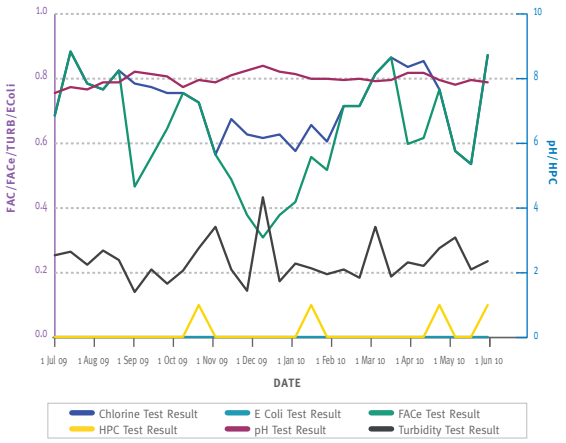
LNO: EcoWater Grading Zone: Swanson
Meter: Candia Road (WWWT150)



LNO: EcoWater Grading Zone: Swanson
Meter: Tram Valley Road (WWWT171)



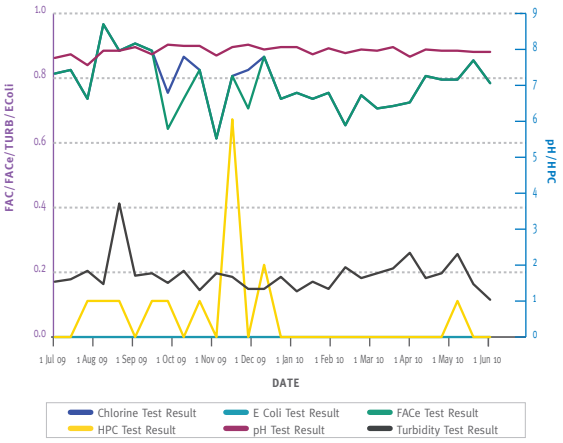
LNO: EcoWater Grading Zone: Henderson
Meter: Don Buck Road (WWWT200)



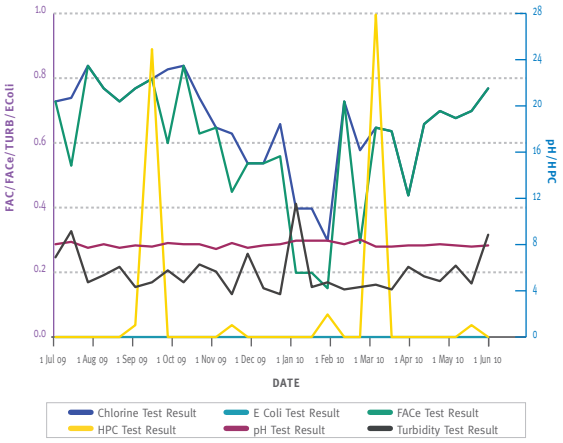
APPENDIX 3 : Bulk supply points

ECOWATER
CONTINUED

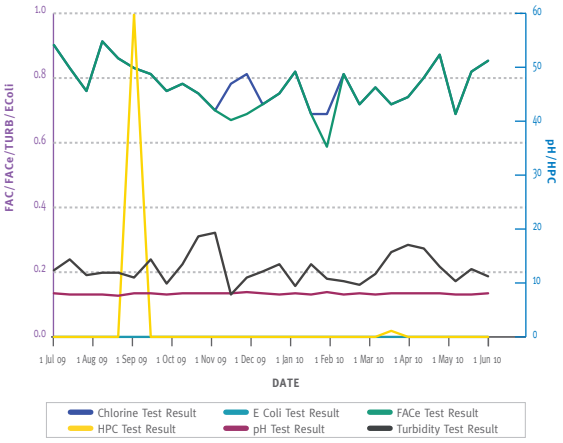
LNO: EcoWater Grading Zone: Henderson
Meter: Henderson Valley Road (WWHN031)



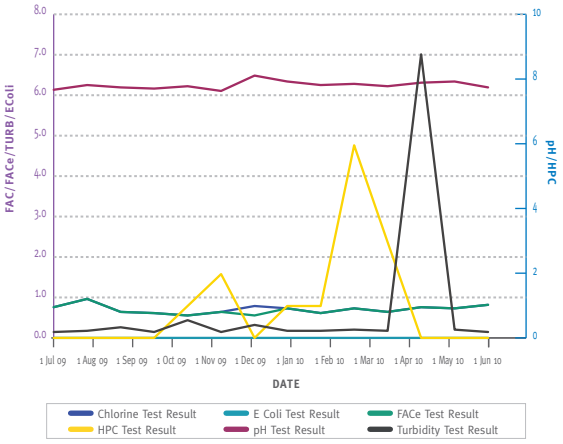
LNO: EcoWater Grading Zone: Henderson
Meter: Trigg Road LP (WWWT332)



LNO: EcoWater Grading Zone: Henderson
Meter: Lincoln Road (WWWT161)

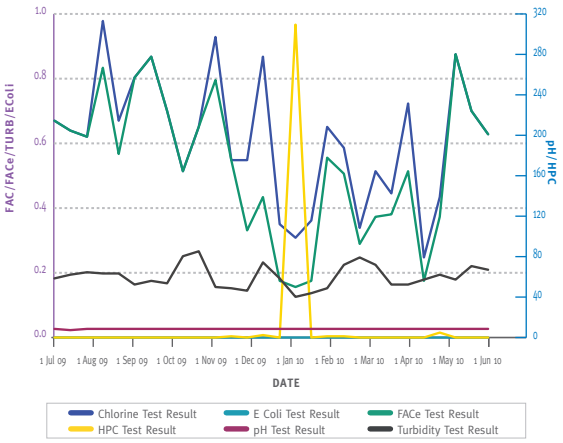


LNO: EcoWater Grading Zone: Henderson
Meter: Swanson Road (WWWT242)



LNO: EcoWater Grading Zone: Henderson
Meter: Sunhill Road (WWWT121)

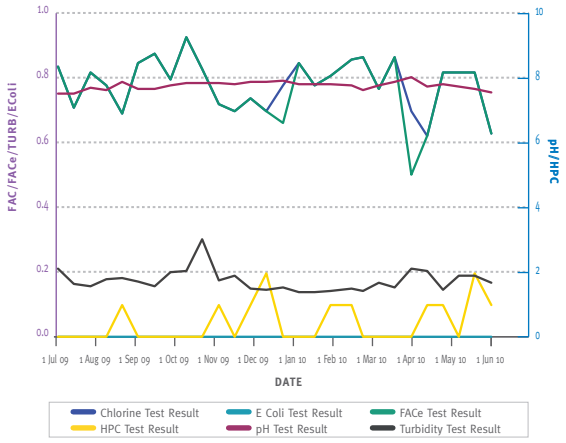
LNO: EcoWater Grading Zone: Henderson
Meter: Great North Road (WWWT091)



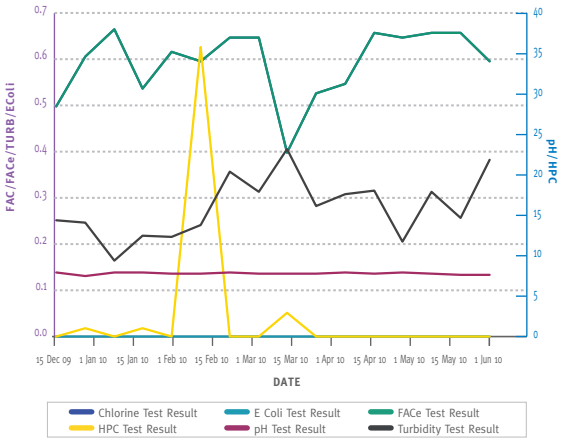
APPENDIX 3 : Bulk supply points

ECOWATER
CONTINUED

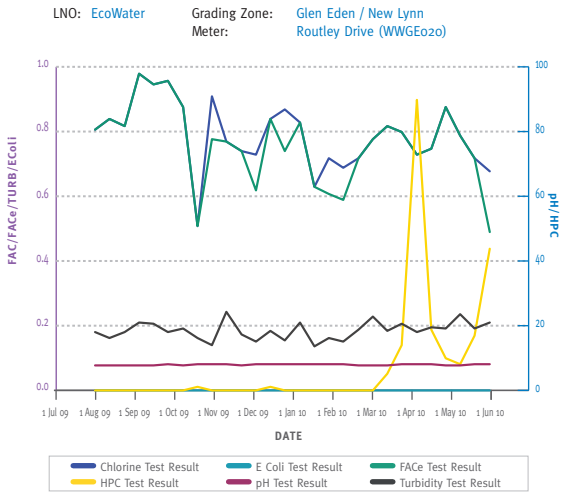
LNO: EcoWater Grading Zone: Glen Eden / New Lynn
Meter: Golf Road (WWWT011)



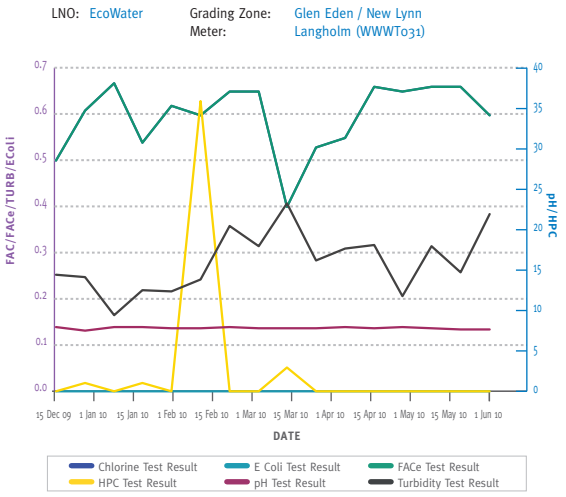
LNO: EcoWater Grading Zone: Glen Eden / New Lynn
Meter: Margan Avenue (WWNL021)



LNO: EcoWater Grading Zone: Glen Eden / New Lynn
Meter: Routley Drive (WWGE020)



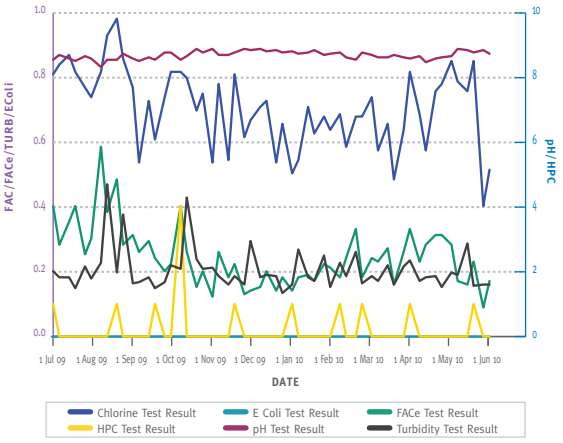
LNO: EcoWater Grading Zone: Glen Eden / New Lynn
Meter: Langholm (WWWT031)



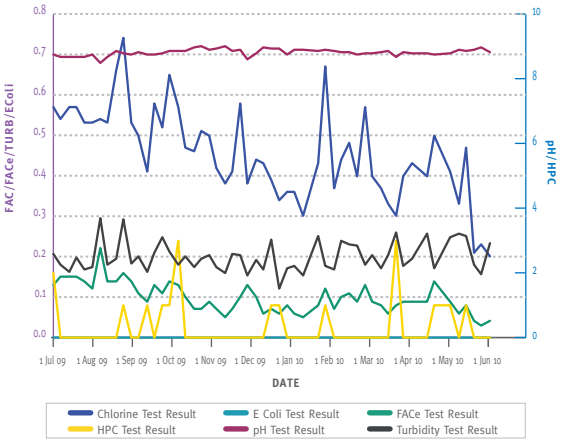
APPENDIX 3 : Bulk supply points

RODNEY

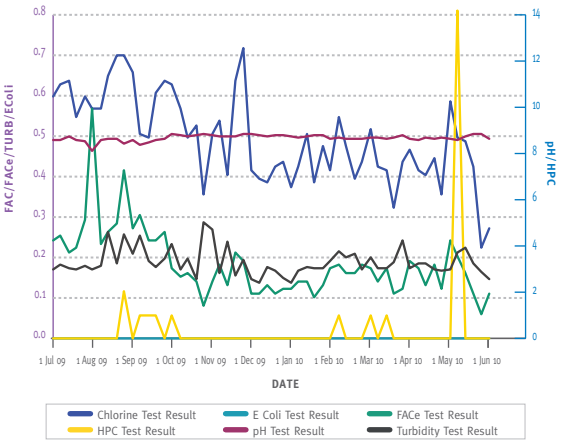
LNO: Rodney Grading Zone: Rodney
Meter: Glenelg Road (RODN020)



LNO: Rodney Grading Zone: Rodney
Meter: Maire Road (RODN011)



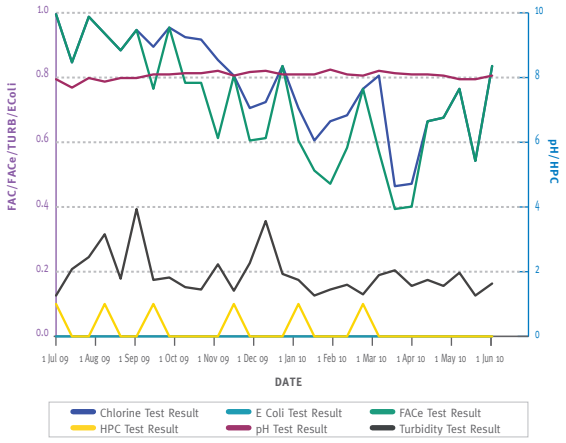
LNO: Rodney Grading Zone: Rodney
Meter: Scott Road (RODN070)



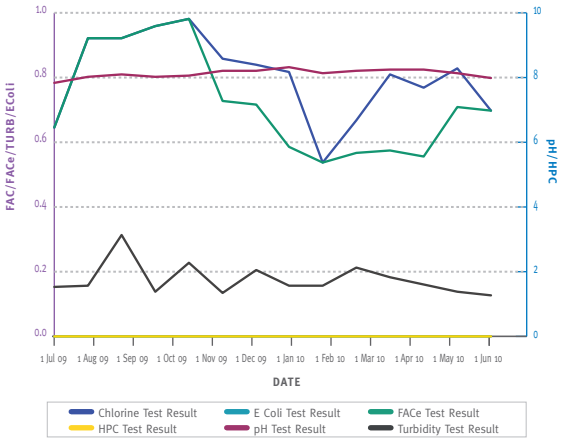
APPENDIX 3 : Bulk supply points

METROWATER

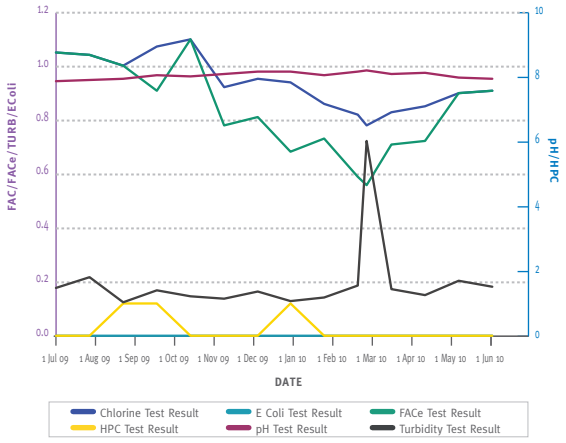
LNO: Metrowater Grading Zone: Auckland
Meter: Gundry Street (AEAC170)



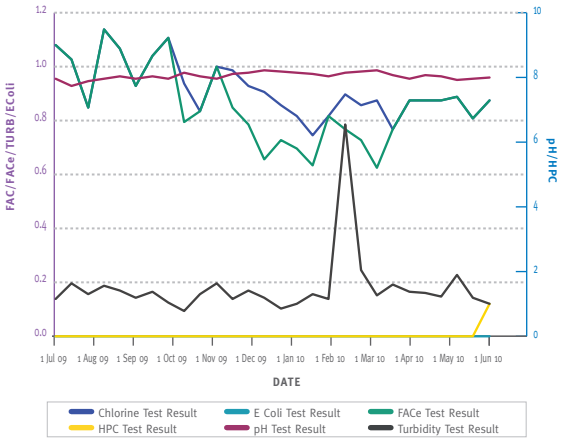
LNO: Metrowater Grading Zone: Auckland
Meter: Henry Street (AWAC081)



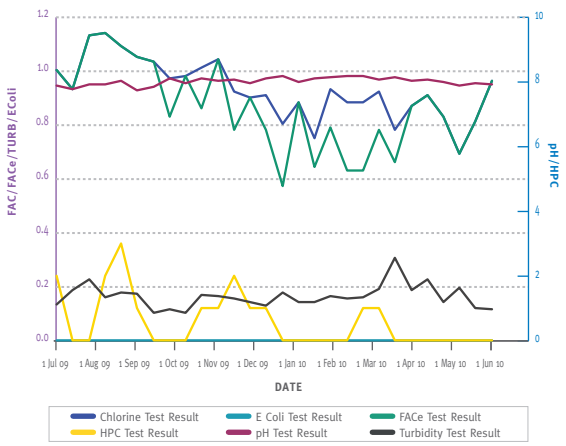
LNO: Metrowater Grading Zone: Auckland
Meter: Hugo Johnston Drive (ASOT081)



LNO: Metrowater Grading Zone: Auckland
Meter: Mountain Road (ASTM520)



LNO: Metrowater Grading Zone: Auckland
Meter: Mt Wellington Highway (ASTM550)



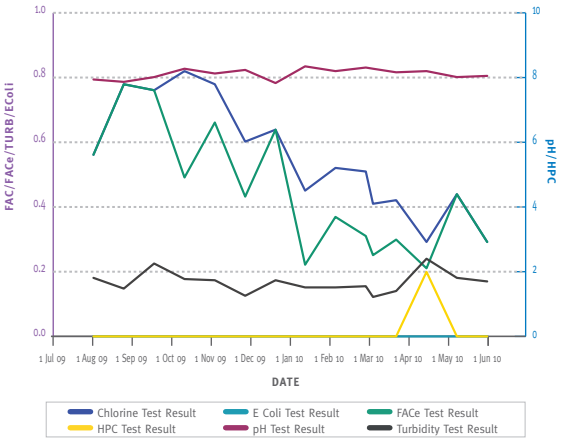
LNO: Metrowater Grading Zone: Auckland
Meter: New North Road (AWMA010)

APPENDIX 3 : Bulk supply points

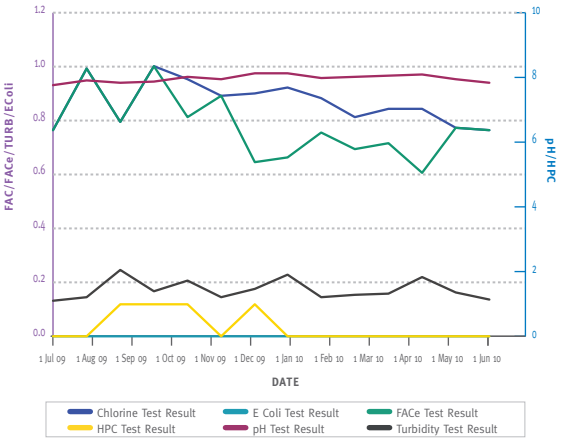
METROWATER
CONTINUED

LNO: Metrowater Grading Zone: Auckland
Meter: Owairaka Reserve (AWMA060)

LNO: Metrowater Grading Zone: Auckland
Meter: St Heliers Bay Road (AEAC490)

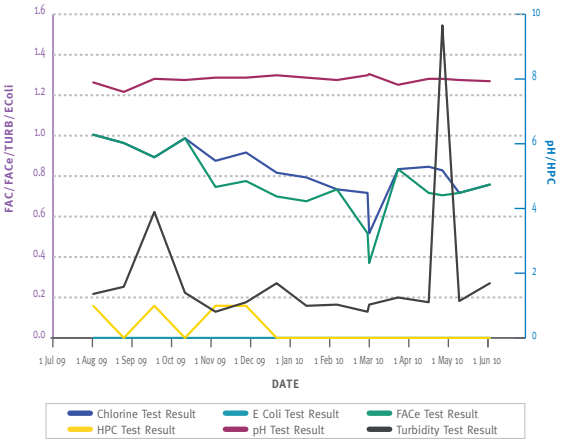


LNO: Metrowater Grading Zone: Auckland
Meter: Sutherland Road (AWAC090)

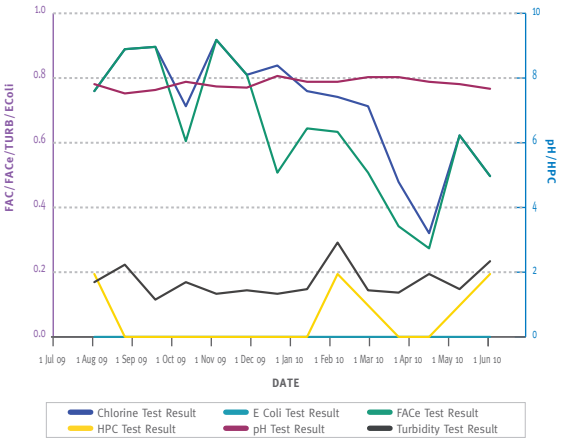


LNO: Metrowater Grading Zone: Auckland
Meter: Tay Street (AWAC100)

LNO: Metrowater Grading Zone: Auckland
Meter: Westhaven (AWAC126)



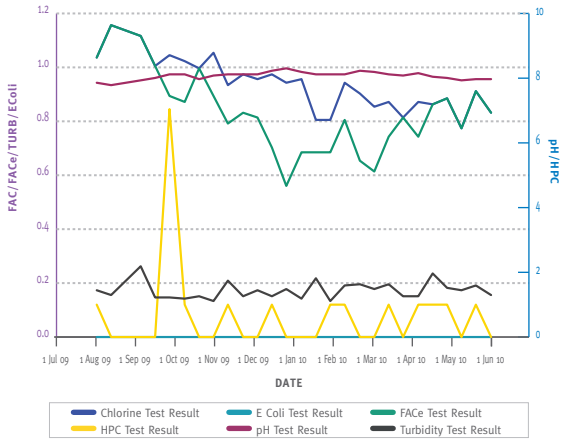
LNO: Metrowater Grading Zone: Auckland
Meter: Whau Bridge (AWAC060)



APPENDIX 3 : Bulk supply points

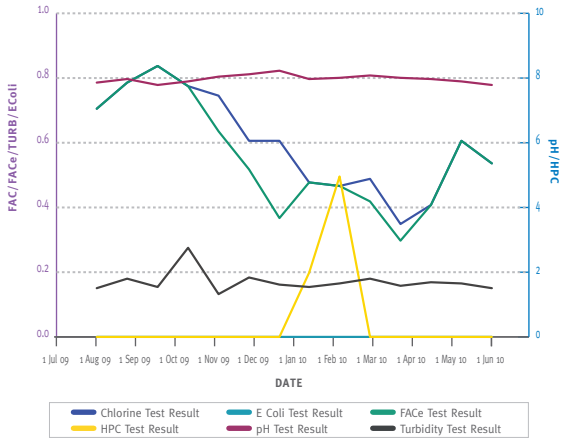
METROWATER
CONTINUED

LNO: Metrowater Grading Zone: Auckland
Meter: Abbatoir Lane (ASAC900)

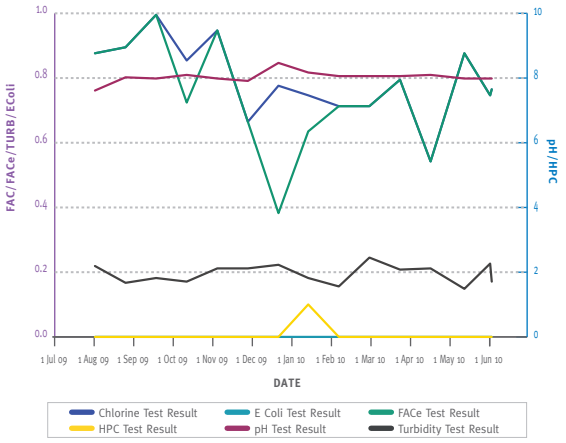


LNO: Metrowater Grading Zone: Auckland
Meter: Columbia Road (AWMA020)

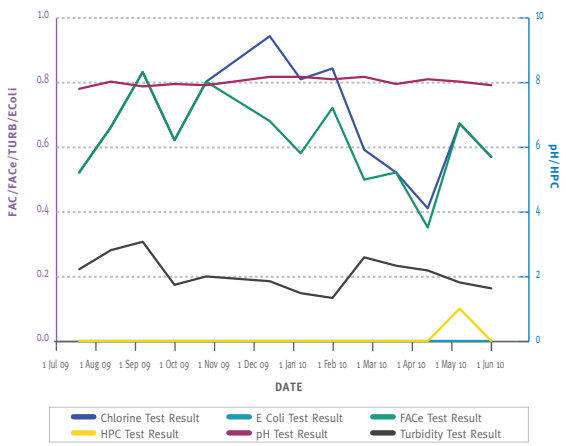
LNO: Metrowater Grading Zone: Auckland
Meter: Parau Street (ANME030)



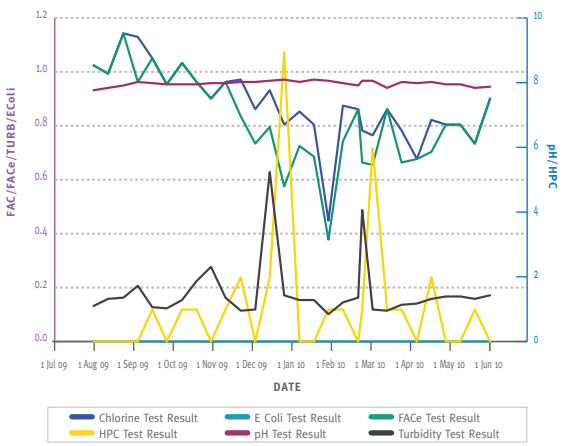
LNO: Metrowater Grading Zone: Auckland
Meter: Huntly Avenue (AEAC200)



LNO: Metrowater Grading Zone: Auckland
Meter: Symonds Street (AEAC171)



LNO: Metrowater Grading Zone: Auckland
Meter: Ranui Road (AEAC420)

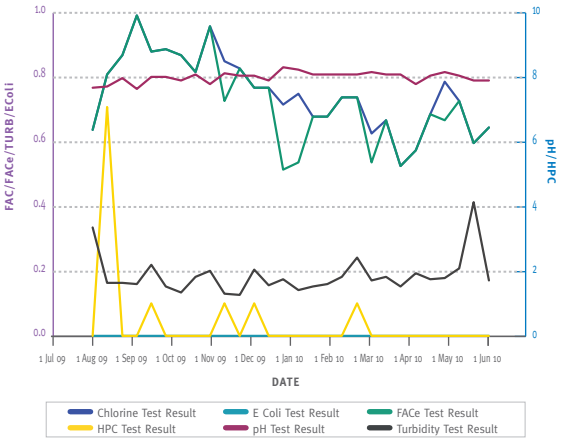


APPENDIX 3 : Bulk supply points

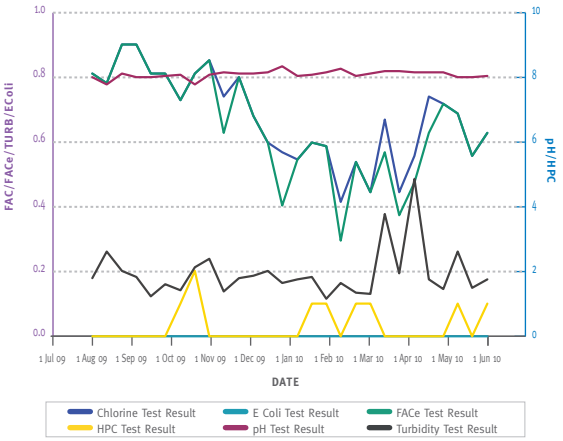
METROWATER
CONTINUED

LNO: Metrowater Grading Zone: Auckland
Meter: St Johns Reservoir (ASAC450)

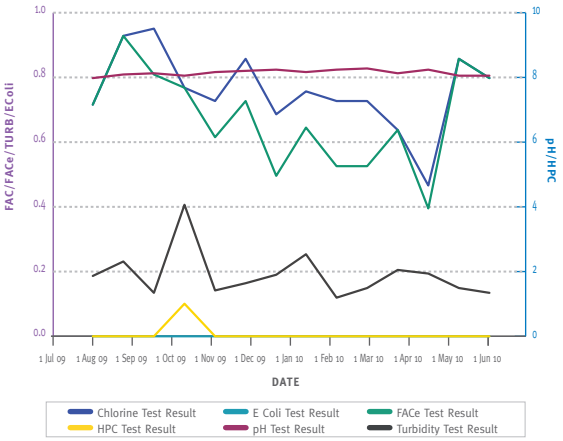
LNO: Metrowater Grading Zone: CBD
Meter: Domain Reservoir (AEAC230)



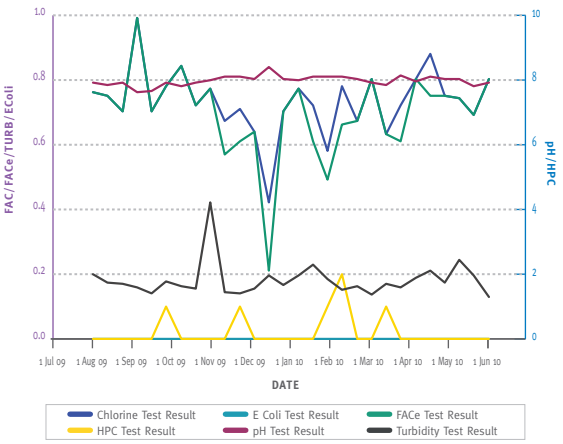
LNO: Metrowater Grading Zone: Hillsborough
Meter: Ponsonby Reservoir (AEAC130)



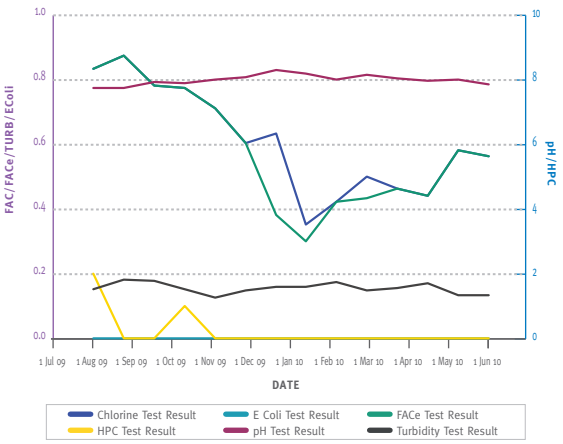
LNO: Metrowater Grading Zone: Hillsborough
Meter: Duke Street (ANMR030)



LNO: Metrowater Grading Zone: Hillsborough
Meter: May Road (ANMR060)



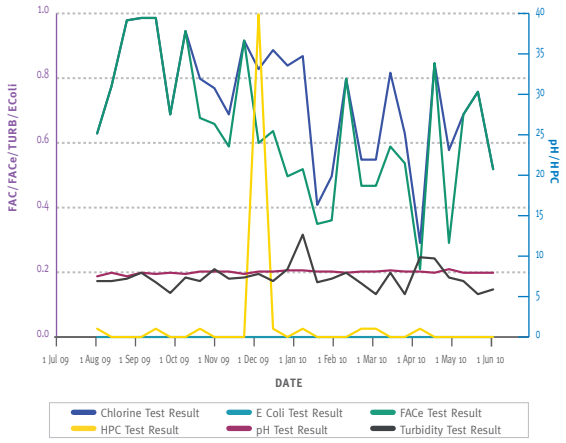
LNO: Metrowater Grading Zone: Maungawhau
Meter: Cornwall Park (ASOT040)



APPENDIX 3 : Bulk supply points

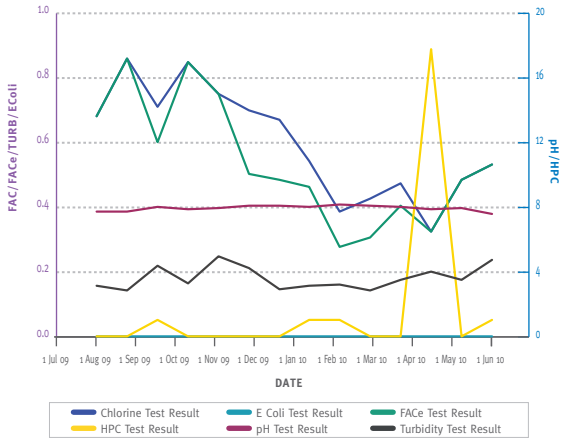
METROWATER
CONTINUED

LNO: Metrowater Grading Zone: Maungawhau
Meter: Mt Eden Summit (ANME291)

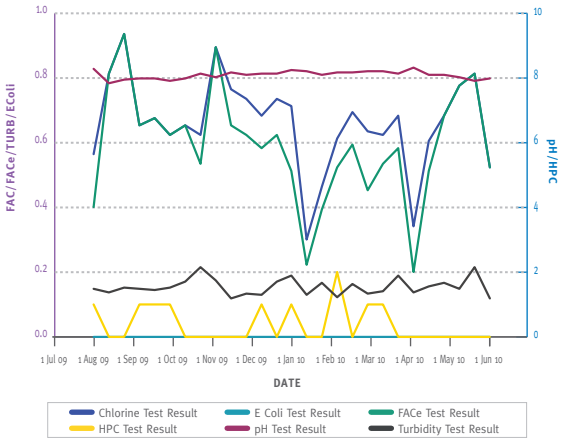


LNO: Metrowater Grading Zone: Maungawhau
Meter: St Marks Road (AEAC330)

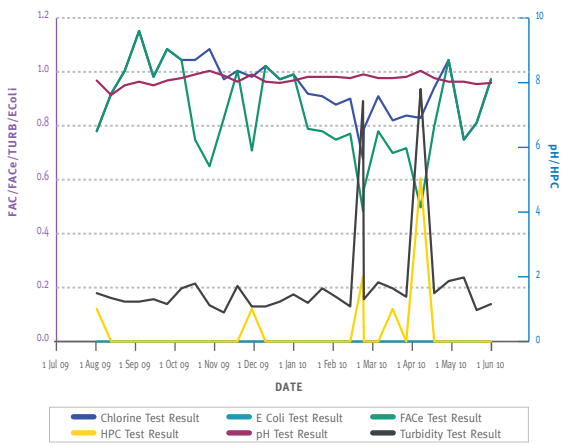
LNO: Metrowater Grading Zone: Maungawhau
Meter: The Drive (ANMR020)



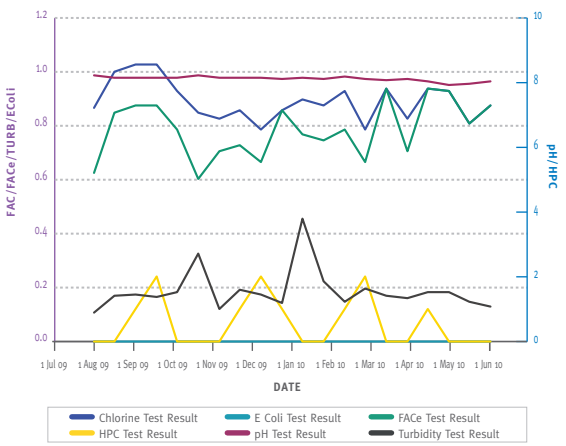
LNO: Metrowater Grading Zone: Mt Hobson
Meter: Mt Hobson (AEAC300)



LNO: Metrowater Grading Zone: Otahuhu
Meter: Nixon Street (ASTM430)



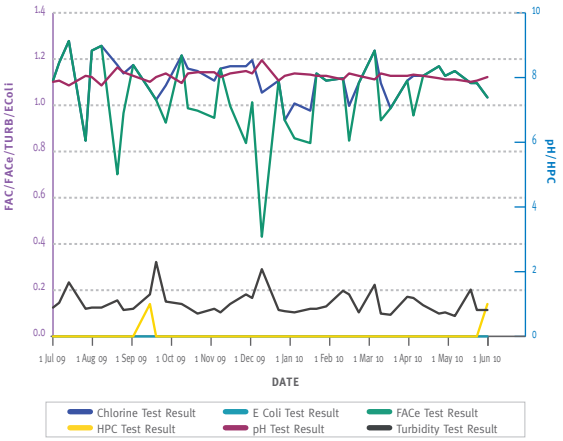
LNO: Metrowater Grading Zone: Otahuhu
Meter: Hans Street (ASTM420)



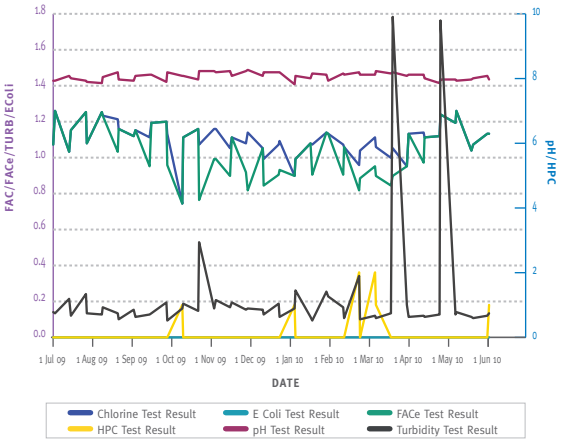
APPENDIX 3 : Bulk supply points

UNITED WATER

LNO: United Water Grading Zone: Takanini
Meter: Airfield Road no.1 (PPPK160)

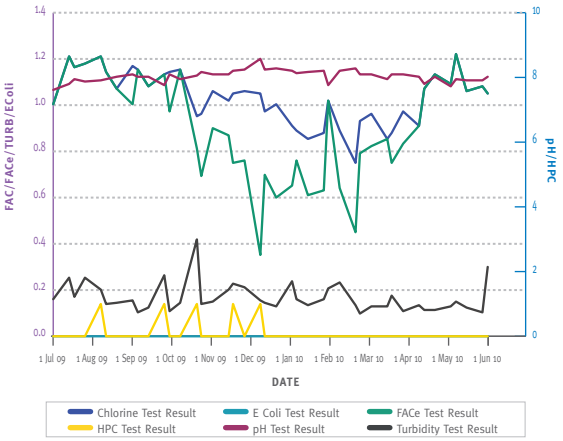


LNO: United Water Grading Zone: Takanini
Meter: Airfield Road no.2 (PPPK180)

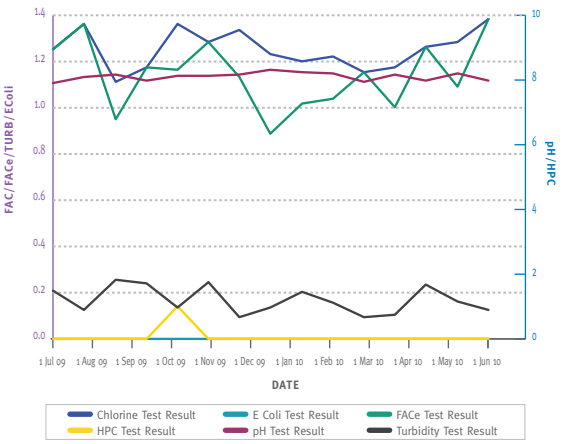


LNO: United Water Grading Zone: Papakura
Meter: Hunua Road (PPPK271)

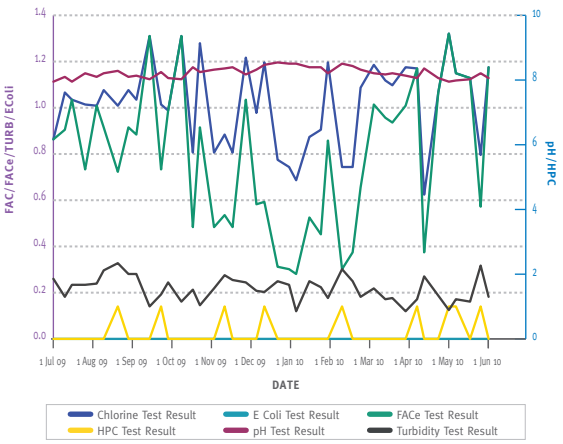
LNO: United Water Grading Zone: Papakura
Meter: Dominion Road (PPPK261)



LNO: United Water Grading Zone: Ardmore School
Meter: Ardmore School (PPPK170)



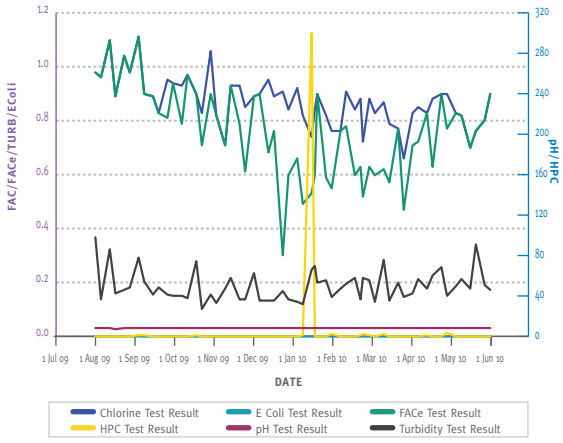
LNO: United Water Grading Zone: Red Hill
Meter: Kaipara Reservoir (PPPK250)



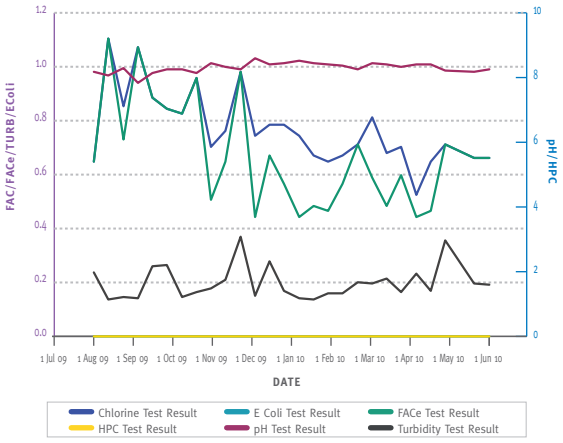
APPENDIX 3 : Bulk supply points

MANUKAU CITY

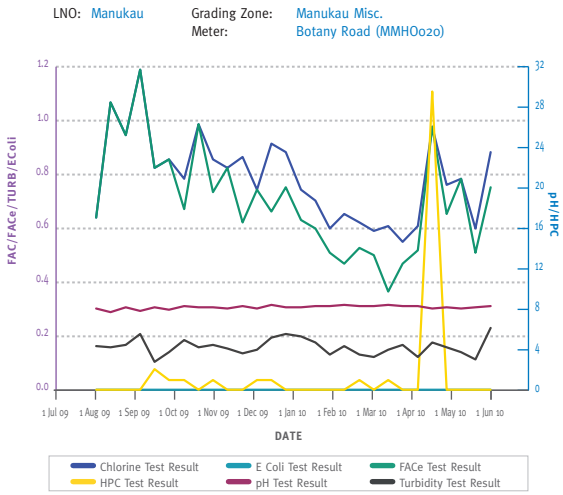
LNO: Manukau Grading Zone: Manukau Misc.
Meter: Ascot Road (MMMK070)



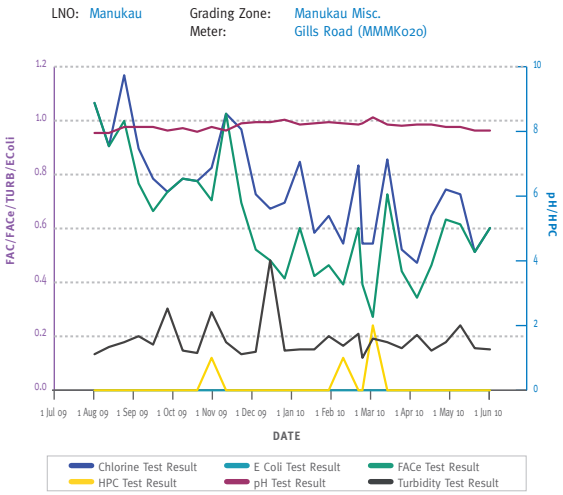
LNO: Manukau Grading Zone: Manukau Misc.
Meter: Bleakhouse Road (MMHO010)



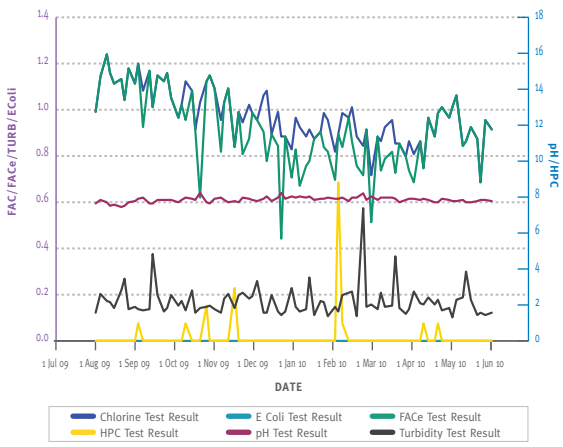
LNO: Manukau Grading Zone: Manukau Misc.
Meter: Botany Road (MMHO020)



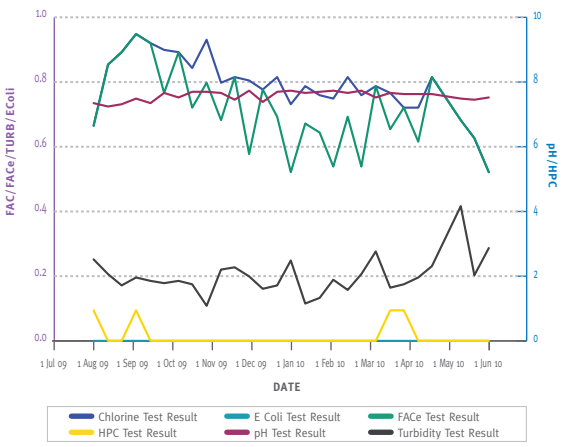
LNO: Manukau Grading Zone: Manukau Misc.
Meter: Gills Road (MMMK020)



LNO: Manukau Grading Zone: Manukau Misc.
Meter: Harris Road (MMMK041&42)



LNO: Manukau Grading Zone: Manukau Misc.
Meter: Mill Road 1 (MMMK151)



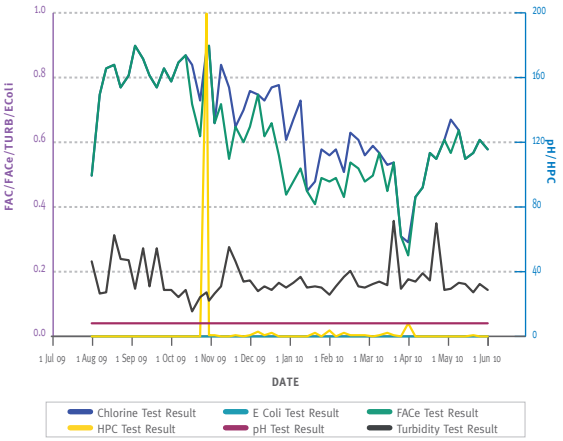
APPENDIX 3 : Bulk supply points

MANUKAU CITY
CONTINUED

LNO: Manukau Grading Zone: Manukau Misc.
Meter: Hollyford Drive (MMMK143)

LNO: Manukau Grading Zone: Manukau Misc.
Meter: Wymondley Road (MMMK080)

LNO: Manukau Grading Zone: Manukau Misc.
Meter: Redoubt Road (MMMK211)



APPENDIX 4 : Water quality at sources

WATER QUALITY TESTS AT SOURCES

	Total Algae (Cells/mL)				Cyanobacteria (Cells/mL) 'Blue-Green Algae'			
SOURCE	No. of Tests	Maximum	Minimum	Average	Detections	Maximum	Minimum	Average
COSSEYS	42	7,038	230	1,762	42	6,041	0	708
WAIROA	34	2,507	256	1,018	34	970	0	46
MANGATAWHIRI	38	6,056	294	1,508	38	224	0	12
MANGATANGI	37	3,114	138	578	37	114	0	6
HAYS CREEK	39	2,760	475	1,246	39	968	0	164
UPPER HUIA	37	9,179	210	1,487	37	893	0	88
LOWER HUIA	38	3,459	652	1,642	38	434	0	42
UPPER NIHOTUPU	36	1,843	95	714	36	426	0	22
LOWER NIHOTUPU	51	4,217	704	1,828	51	367	0	64
WAITAKERE	42	4,815	258	802	42	1,800	0	113
WAIKATO RIVER	69	236,783	1,104	22,796	69	227,725	0	16,393

Water Data Analyst Sarah Muir gathers a sample from Mangatawhiri Dam.

water Care
services limited

ANNUAL WATER QUALITY REPORT 2010

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