Waimana Public Water Supply – Water Safety Plan

- Report Prepared for:

  Whakatāne District Council

- Original Report Prepared by:

  Pattle Delamore Partners Ltd

- Final, July 2018

- Report Updated by:

  Whakatāne District Council

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Limitations:

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Executive Summary

Pattle Delamore Partners Ltd (PDP) has been engaged by Whakatāne District Council (WDC) to update the existing 'Waimana Water Supply Public Health Risk Management Plan, V3' (March 2008) document for the Waimana Public Water Supply Scheme (Waimana Scheme).

This Water Safety Plan (WSP) (formerly known as Public Health Risk Management Plan, PHRMP) was prepared by PDP in collaboration with WDC to identify and manage events that could occur in the Waimana Scheme with potential to cause public health risks to consumers of the scheme.

The following were undertaken in the preparation of this WSP:

- Identifying components and operation of the Waimana Scheme.
- Identifying Contamination and Loss of Supply events that could occur in the scheme that could result in public health risks.
- Preparing Risk Tables to identify potential risks, by identifying existing and additional barriers to contamination and critical points in the scheme. In addition evaluate if the Preventative measures currently in place are able to reduce the risks were also identified.
- Preparing an Improvement Plan by introducing new preventative measures to manage risks that are not sufficiently managed.
- Identifying Critical Control Points (CCPs) in the scheme and limits within which the CCPs are operated to prevent contamination. Control actions to be carried out when CCPs operate outside these limits were also identified.
- Preparing Contingency Plans to mitigate events of acute health risk that may occur despite preventative measures being in place.

This report was prepared in line with the methodology recommended by the Ministry of Health (MoH) for preparation of WSPs. Information used in this report was gathered from documents and reports belonging to the WDC, during site visits carried out by PDP to the Waimana water treatment plant, pump station and reservoir sites, and during a consultation workshop with WDC staff. Contributors to this report are listed in Section 11.

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1.0 Revision and Performance Assessment

Table 1: Revision Details

Version No.	Revision Details	Author	Date
V1	Public Health Risk Management Plan - submission to DWA	OPUS	23/08/2007
V2	Public Health Risk Management Plan – revised to account for non -conformances	OPUS	19/09/2007
V3	Public Health Risk Management Plan – revised with DWA recommendations	OPUS	03/03/2008
1.00	Prepared by PDP in collaboration with WDC, submitted to WDC for comments	PDP	02/02/2018
1.01	Modified with WDC comments and further updates	WDC/ PDP	15/05/2018
1.02	FINAL version release from PDP to WDC	PDP	30/07/2018
1.03	Updated Improvement Plans and submission to Drinking Water Assessor	WDC	17/08/2018
1.04	Approved by DWA and Report on adequacy of a Drinking Water Supply's Water Safety Plan	Toi Te Ora	13/09/2018

Under Section 10.0 of the Drinking Water Standards New Zealand (DWSNZ 2008)1 (Small Water Supplies, Alternative Compliance Criteria), drinking-water supplies serving up to 500 people can be classed as 'participating supplies' and shall follow a WSP compliance criteria approach (sections 10.2 to 10.5) to demonstrate compliance with the DWSNZ 2008. Accordingly, this WSP has applied this approach for the Waimana Scheme.

WSPs are required to be revised and re-submitted to the Drinking Water Assessor (DWA) for approval every 5 years as a minimum. Accordingly, this plan was due for revision and approval by the DWA back in 2013! In recent times Council has increased in-house resources and will keep strict control of adhering to the regulatory requirements. It should be noted that Council treats this WSP as a live document and

[1] Drinking-water Standards for New Zealand 2005 (Revised 2008).

will be updated as required; Council will revise and resubmit this WSP if there are significant changes to the operations or risks to the Waimana Scheme within the 5-year period.

A draft plan of this WSP was reviewed by the contributors to the workshop before submitting to the DWA for final approval.

The performance of this WSP is to be assessed annually by reporting on the following items:

- any risk events.
- non-compliances or near misses that have occurred.
- contingency plans that have been used.
- changes made to the scheme operation and components.
- progress made against the Improvement Plan.
- any new risks or improvements that are required to be made and people responsible for carrying them out.

The performance assessment, in the form of a short report, will be submitted by the Manager Three Waters to the Drinking Water Assessor by 31 July each year.

The following staff will be responsible for including any relevant items arising from this report into the Annual Plan, Water Asset Management Plan and Long Term Plans: Manager Three Waters, Team Leader - Three Waters Asset Management and Planning, Manager - Capital Projects, Team Leader - Three Waters Operations

This WSP is to be linked to the Annual Plan, the Water Asset Management Plan and the Long Term Plan.

This WSP is to be read in conjunction with the 'Catchment Risk Assessment for Waimana Bore Water Supply, Whakatāne District Council' report (PDP, December 2017).

2.0 Supply Summary

Table 2: Waimana Scheme Summary	
Supply Details	
Supply Name	Waimana Community Water Supply
WINZ Community Code	WAI017
Supply Owner	Whakatāne District Council
General Manager Infrastructure	David Bewley
Manager Three Waters	Tomasz Krawczyk

Table 2: Waimana Scheme Summary	
Team Leader – Water Treatment Plant	Neal Yeates
Water Treatment Plant Operators	Ian Bowen Ross Dillon Bryan Vautier
Capital Projects Manager	Jim Finlay
Team Leader – Three Waters Assets Management and Planning	Michael Van Tilburg
Population Served by Supply[2]	160 People
Number of Connections3	51 Connections
Source Details	
WINZ Source Code	G00223
Type of Source	One shallow bore (Approximately 7 metres below ground level (bgl), cased from 4 metres bgl)
Consent No.	20283
Consent Expiry	01/10/2026
Maximum Consented water take:	200 m^3/d
Map Reference (NZTM 2000)	1957727.024 E, 5770021.607 N
Treatment Details	
WINZ TP code	TP00327
Treatment Processes	UV, Chlorination
Average Daily Demand (April 2014 – June 2016)[4]	92 m^3/day
Peak Daily Demand (April 2014 – June 2016)[3]	137 m^3/day
Distribution Details	
WINZ Distribution Zone Code	WAI017WA
Distribution Zone materials	Over 95% Polyvinyl Chloride (PVC)

[2] Drinking-water Register New Zealand.
[3] WDC Correspondence, September 2017.
[4] WDC Correspondence, July 2017, Waimana Water Returns for period April 2014 – June 2016.

3.0 Introduction

The Waimana Scheme is owned and operated by WDC and supplies a population of approximately 160 [2] people. The water is sourced from one bore supply and treated for bacteria and protozoa before being circulated to consumers.

Administration of the scheme is carried out at the Council head office located at Commerce Street, Whakatāne. Treatment plant operators are stationed at the main Whakatāne Water Treatment Plant located at Valley Road, Whakatāne and travel to the Waimana Scheme for routine testing and inspections and when required.

Key WDC personnel responsible for the management and operation of the scheme are as follows:

- General Manager Planning and Infrastructure (GM) – David Bewley
- Manager Three Waters (MTW) – Tomasz Krawczyk
- Manager Public Affairs (M-PA) – Ross Boreham
- Team Leader - Water Treatment Plant (TL-WTP) - Neal Yeates
- Water Treatment Plant Operator (WTP-O) – Ian Bowen / Bryan Vautier / Ross Dillon
- Team Leader - Three Waters Operations (TL-O) – Luke Shipton
- Team Leader - Three Waters Administration (TL-AS) – Helen Toby
- Team Leader - Three Waters Asset Management and Planning (TL-AM) - Michael Van Tilburg
- Asset Engineer - Three Waters (AE) – Diana Kim/ Joe Xie
- Senior Project Planner (SPP) – Nicholas Woodley
- Manager - Capital Projects (PM) – Jim Finlay
- Project Engineer - Three Waters (PE) – Leilani Salanguit

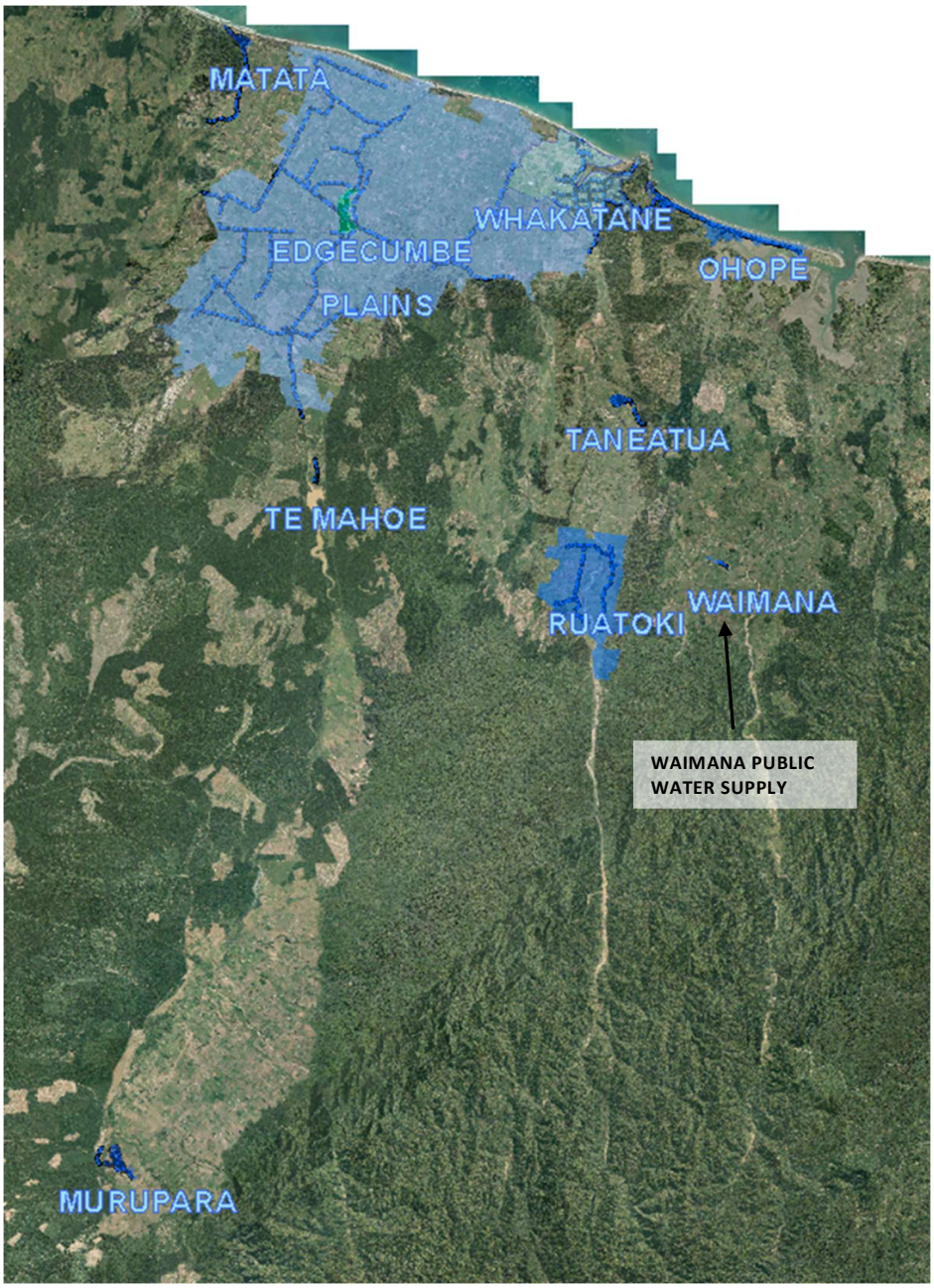


Figure 1: Whakatāne District

4.0 Description of Waimana Water Supply

4.1 Scheme Details

The Waimana Water Supply Scheme was established in the 1970's and is owned and operated by the WDC. The scheme supplies all residents within the Waimana Water Supply Scheme boundary and has 51 connections[5] serving an estimated population of 160 people[6]. The water treatment plant, reservoir and reticulation infrastructure of Waimana are considered sufficient to meet projected demand up to the year 2025[7] as there is no predicted future growth.

The supply is predominantly unmetered with just 9 commercial and high-use consumer connections being metered[2] including the following: grocery store, service station, school, butchery and five farm connections.

The average daily demand and maximum peak demand between April 2014 - June 2016 was 92 m^3/day and 137 m^3/day respectively. The water take consent for the scheme is administered by the Bay of Plenty Regional Council (BOPRC) and the maximum consented take for the supply is 200 m^3/day. The consent (Consent Number 20283) expires in 2026 whereby a new water take resource consent will be required.

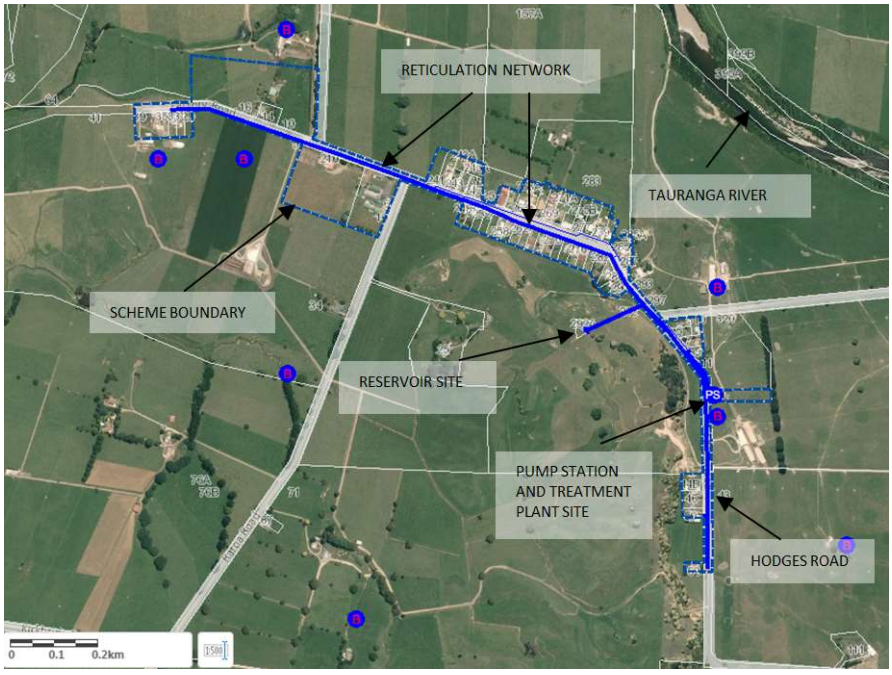


Figure 2: Waimana Water Supply Scheme

[5] WDC Correspondence, September 2017.

[6] Drinking-water Register New Zealand.

[7] Asset Management Plan 2014/15, Part B Page 11.

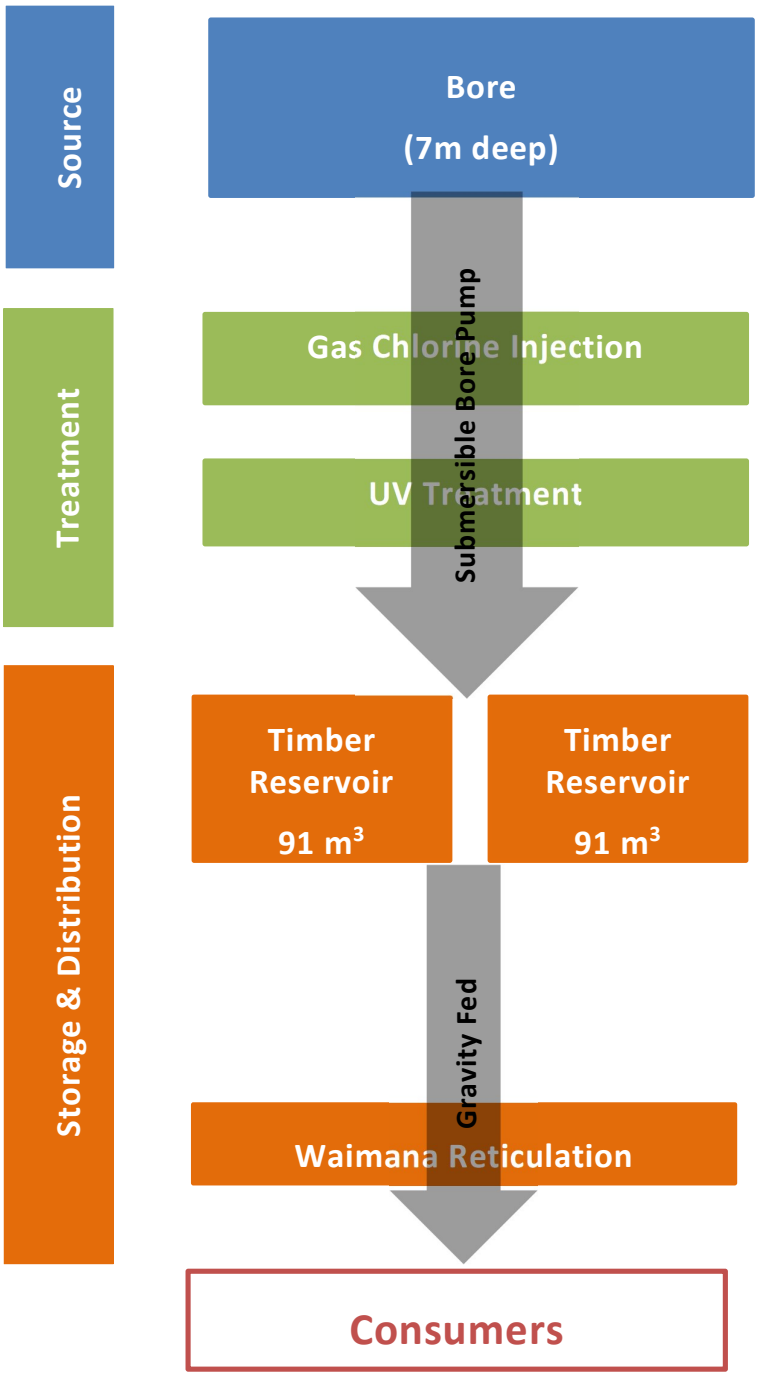


Figure 3: Schematic of Waimana Water Supply Scheme

4.1.1 Water Source and Catchment

Water is abstracted from one shallow bore located in a paddock at the pump station/ treatment plant site on Hodges Road which is located approximately half a kilometre to the South of the Tauranga River (formerly known as Waimana River). The bore is screened from approximately 4 metres below ground level (bgl) and drilled to a total depth of 7 m bgl.

A catchment risk assessment (CRA) carried out by PDP (Catchment Risk Assessment for Waimana Bore Water Supply, PDP, December 2017)' states that the aquifer within this area is likely recharged predominantly from rainfall seepage from the surrounding pastoral fields of the Tauranga River floodplain. Accordingly, the shallow bore is considered to primarily recharge from this aquifer. A localised groundwater capture zone of 540 metres from the bore water supply has been identified (Appendix C) and activities within this capture zone considered to have an effect on the bore water quality are primarily agricultural and stock grazing activities. A consented dairy effluent discharge 300 metres from the bore supply and a HAIL site 540 metres from the bore supply belonging to a motor vehicle workshop are both considered high risk activities that could affect the quality of bore water. Given the unconfined nature of the aquifer and the shallow groundwater abstraction zone of the supply bore and short transit time for localised recharge, the CRA considers it appropriate to designate a groundwater protection zone of 50 metres immediately surrounding the bore.

Further to groundwater recharge, Table 5.1a of the DWSNZ 2008 state that groundwater supplies compromising non-secure bore water from 0-10 metres deep are treated as requiring the same log credit as the surface water in the overlying catchment. Therefore, when assessing influences on the bore water quality, the Tauranga River surface water catchment is also considered a capture zone. Activities carried out in the Tauranga River catchment should therefore also be considered an influence on the bore water quality.

Further information on the activities within the Tauranga river catchment and localised groundwater capture zone can be found in the 'Catchment Risk Assessment for Waimana Bore Water Supply, Whakatāne District Council' report (PDP, December 2017).

Figure 4: Waimana Pump Station/Treatment Plan Site (Left) and Underground Bore Headworks (Right)

A submersible bore pump pumps water depending on reservoir water levels; pump starts/stops are controlled by set maximum and minimum levels in the reservoir with the help of level sensors. The bore pumps water through the treatment plant to the storage reservoirs. There is a standby bore pump available for the Waimana site which is situated at the Valley Road treatment plant half an hour away. There are no high-lift or booster pumps in the system.

The pump station/treatment plant site has no recorded history of flooding. However, the Waimana Township has been historically inundated with floods rendering the town inaccessible; therefore, it is assumed the pump station/ treatment plant site would have been flooded at this time. The site is situated 1.3 metres below the modelled 1% AEP flood level[8] and is therefore considered vulnerable to flooding. Roads leading to Waimana town have been known to flood in the past, therefore restricting access to the pump station/ treatment plant site during extreme storm events.

Bore headworks are situated below ground level and an inspection carried out as part of the catchment risk assessment identified some non-compliant features according to the protected bore requirements of the DWSNZ 2008. An inspection of the bore site reiterated Council's awareness that the 5-metre exclusion zone of livestock from the borehead was not present. High intensity grazing activities in the paddock made the 5-metre exclusion zone an immediate requirement and has since been rectified by WDC (November 2017). The CRA recommends extending the animal exclusion zone to as close to the groundwater protection zone (50 metres from the borehead) as practically possible due to the monitored E. coli exceedance responses to livestock effluent in the vicinity; however, it is understood that the fencing can only be extended as far as Council land ownership. The current newly constructed position is 100 metre perimeter and the closest side fence is approximately 12 metres from the bore head.

Further to this, cable and gland seals were required to be tested for adequacy to prevent ingress of water into the bore head. Due to the possibility of flooding, it is

[8] Information received from Bay of Plenty Regional Council, August 2017.

recommended that the bore headworks are located above ground and above the 1% AEP flood level.

Interruptions to power supply at this site is infrequent and approximately once or twice a year. As the scheme is relatively small and there is sufficient storage capacity in the reservoirs, a generator is not available on-site. During power interruptions a temporary generator owned by a local contractor is used to power the site.

Figure 5: Pump Station/Treatment Plan Site prior to (Left) and after (Right) installation of 5+ metre stock fence

4.1.2 Treatment

The treatment plant is located on the same site as the pump station and consists of gas chlorination followed by UV disinfection treatment.

Bacterial Compliance: The gas chlorination and UV disinfection treatment available are capable of providing treatment to achieve full bacterial compliance requirements according to the Drinking-water Standards New Zealand (DWSNZ 2008).

Protozoa Compliance: The protozoa treatment requirement of the scheme was changed from a log credit of 3 to a log credit of 4 by the DWA in January 2018, based on the evaluation of the catchment risk assessment complete by PDP (2017)[9], subsequently Council sought that due to shallow groundwater/spring source that a log credit of 3 was more appropriate. As a result, in July 2018 the DWA issued an amended assignation of log credit 3 for protozoa compliance. The current treatment system provides a protozoa log credit of 3; to achieve a log credit of 4 (or greater) the treatment plant requires an additional filtration process to be incorporated to the existing treatment process before UV and chlorine gas disinfection (DWSNZ 2008).

Gas chlorination is provided via a chlorine gas cylinder/ vacuum regulator/ chlorine injection/weighing scales system.

A gas cylinder bottle weighs approximately 130 kg which contains 70kg of chlorine gas. The cylinder is replaced once the weight reaches approximately 80kg. There are no

[9] Catchment Risk Assessment for Waimana Bore Water Supply Report, PDP December 2017.

chlorine cylinders stored on site; however, the cylinder weight is checked at least once a week by a treatment plant operator. Chlorine is dosed according to a manually set dose rate; there is no flow proportional or water quality proportional dosing. When the chlorine residual (Free Available Chlorine, FAC) leaving the treatment plant reaches outside operational limits the dose rate is adjusted manually to achieve the required FAC. During events that could change water quality such as during or immediately following storm events/earthquakes, treatment plant operators monitor the FAC levels frequently. WDC is currently looking at the installation of remote FAC monitoring throughout the district's water schemes and the Waimana Scheme may be included in this project.

Figure 6: Ultra Violet Disinfection Treatment

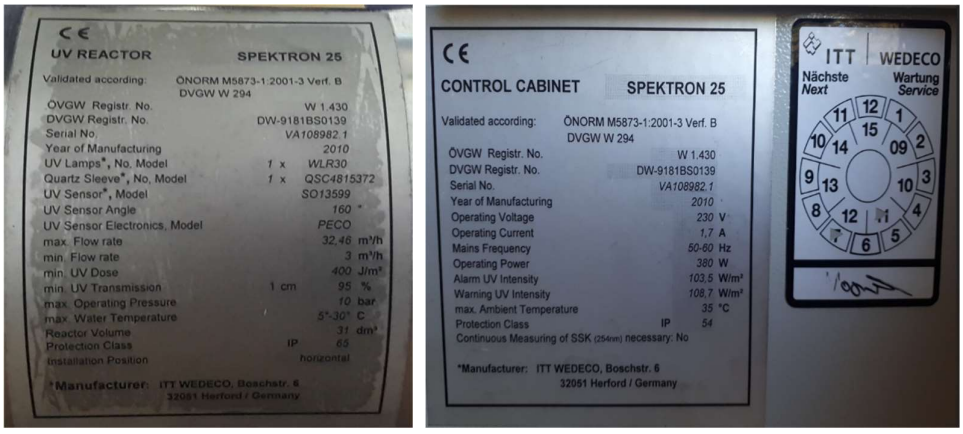


Figure 7: Ultra Violet Reactor and Cabinet Name Plates for Waimana

The UV disinfection unit has been designed to deliver a UV dose of 40 mJ/cm^2 which is dependent on the flow rate of water, UV transmittance UV(T), and UV intensity UV(I) provided by the unit of the UV supplied. Spare UV lamps are stored on site in case of lamp outages. No pre-treatment of water is carried out before entry into the UV reactor. If turbidity exceeds set limits the bore pump stops and no water is delivered to the UV treatment unit. The UV unit is maintained regularly by cleaning lamp sleeve, UV sensor lens and lamp surface to prevent build up and therefore reduction of UV intensity.

Regular maintenance and calibration of all water treatment plant equipment is carried out by WDC staff and recorded in the appropriate log books.
FAC, pH, Turbidity (NTU) and UV Intensity (UV(I)) are monitored continuously at the water treatment plant and the plant is designed to alarm when these parameters exceed set limits. When certain parameters exceeded certain limits the plant also has the ability to automatically shut down by cutting off power to the bore pump. During some instances automatic shut-down of the plant is manually overridden by WDC to provide water to the scheme accompanied by relevant procedures such as boil water notices and appropriate notification to the DWA. WDC is reviewing this process to allow some UV and chlorine disinfection to occur when auto shut-off has been over-ridden.

This is further discussed in Section 9.0 Process Control Summaries.

4.1.3 Storage and Distribution

Treated water is pumped to two reservoirs located on a nearby hill before being gravity fed to the Waimana reticulation system. The reservoirs are both timber and of capacity 91 m^3 each (182 m^3 total) and are connected in series. Both reservoirs have steel roofs installed and the liner replaced in 2010. The total storage capacity is more than sufficient to meet average daily demand and fire-fighting flows and provide 24-hour emergency storage.

The road leading to the reservoir site is difficult to access during bad weather due to condition of the gravel road leading to it.

Figure 8: Two Timber Storage Reservoirs with Steel Roofs

The reticulation network consists of 3.06 Km of water pipes consisting of 1.78 Km of watermains, 790 metres of rider mains and 493 metres of riser main. The majority of water pipes were laid in late 1970's and early 1980's with over 95% of the pipe material type being Polyvinyl Chloride (PVC).

The reticulation layout is straightforward with one water main running along one side of Waimana road and a rider main on the other side, feeding houses at the road boundary.

The Waimana township is not connected to a reticulated sewerage system and is on individual septic tanks. Therefore, the level of contamination of soil as a result of wastewater seepage is unknown.

An in-house water balance carried out for the year 2016/17 according to the International Water Association (IWA) guidelines showed that the percentage of real water losses in the system was 41% and the Infrastructure Leakage Index (ILI) was 5.27%. The leakage rates although not extremely high, poses risks of contamination in the water distribution network through backflow due to potentially contaminated soil. The water reticulation network is operated at approximately 600 kPa pressure and there are currently no plans to carry out pressure management in the Waimana Scheme.

Although some routine maintenance is carried out, a majority of the day-to-day operational work consists of reactive maintenance. Attention is required to develop appropriate routine maintenance schedules, procedures and protocols to ensure the system is maintained to optimise the lifecycle of the assets.

Backflow prevention devices are installed on farm and commercial connections triggered by building consents, change of use consents and 'new water connection' applications. It should be noted that no tradewaste consents are issued in the

Waimana Scheme as the scheme does not have a WDC owned wastewater reticulation system.

However, not all farm connections have backflow prevention devices installed. Dual check valve manifold meters are installed in some domestic connections; however, as the Waimana Scheme is not fully metered a majority of the domestic connections do not have dual check valves installed.

Currently no routine testing of existing backflow prevention devices are carried out. A dedicated WDC reticulation operator has recently obtained a certificate for backflow testing and is ready to undertake in-house testing once a backflow prevention policy has been adopted by the Council.

There are some procedures currently in place for third party contractors/ developers working on WDC reticulation such as the extension of existing reticulation during subdivision developments. However, procedures need to be further developed, documented and strictly enforced in order to minimise risks arising from these works. It is noted that the Waimana Scheme is a small scheme with relatively little work being carried out by third party contractors/developers on the network.

4.1.4 Monitoring & Control of Scheme

A combined telemetry and SCADA (Supervisory Control and Data Acquisition) system is used to transmit data from the remote sites of the Waimana Scheme (Waimana pump station/ water treatment site and reservoir site) to the WDC main control room at Valley Road, Whakatāne, where it is monitored and controlled by WDC staff.

Events causing signal failure from equipment such as power outages and malfunctioning of equipment trigger alarms via the SCADA/Telemetry system. Alarms can be seen on the control room monitors and are also delivered to operator mobile phones via text message.

Telemetry shows the bore pump status, flow rate from the bores and reservoir levels and the following parameters are continuously monitored for treated water quality leaving the treatment plant: Turbidity, pH, FAC, Flow, UV(I) and UV(T).

Reservoir levels are monitored with the use of level sensors. The bore pump operates according to pre-set minimum and maximum reservoir levels in order to fill the reservoirs.

Monitoring of water quality in the Waimana reticulation system is carried out through routine manual FACE sampling (FAC and E. coli). Sampling is carried out in accordance with the DWSNZ 2008 sampling schedule. As of October 2017, continuous online FAC monitoring has been introduced in the reticulation system in some schemes in Whakatāne in order to monitor residual chlorine in the distribution network. Continuous remote FAC monitoring for Waimana has been planned for the latter part of 2018 with the use of CHLOROCLAM FC1 3G PACKAGE Chloroclam® -remote water quality monitor for Free Chlorine residual.

Water quality in the reticulation is managed through routine maintenance such as mains flushing, through leak detection and through the use of backflow prevention devices on high risk and large users.

Monitoring and control of the system is further discussed in Section 9.

4.2 Changes to the Scheme since last WSP Report

The following significant changes have been carried out to the scheme since the previous WSP document:

- Installation of UV Disinfection Unit

The Waimana water treatment plant was upgraded to include UV disinfection as part of a subsidy received by the MoH for small water schemes and was completed in 2010.

- Reservoir Upgrades

Both timber reservoirs have been fitted with steel roofs and the liners have been replaced.

- Mains and Connection Replacements

Mains and connection replacements have been periodically carried out as part of capital works renewals to replace copper and galvanized iron pipes with PVC and MDPE pipes.

5.0 Compliance with Drinking Water Standards

Bacterial, protozoal, chemical, radiological and cyanotoxin compliance requirements and compliance achieved for the year 2017/18 can be found in Table 4.

The Waimana Scheme received a MoH Grading of Ee in 2007 which was later upgraded to a Da in 2012. MoH recommends a grading of at least Cc for a drinking water supply of this size. An explanation of the grading given can be found in Table 3.

Table 3: MoH Grading for Water Supply Schemes	
Source and Treatment Grading: Assessment based on source and treatment factors:	
A1:	Completely satisfactory, negligible level of risk, demonstrably high quality.
A:	Completely satisfactory, extremely low level of risk.
B:	Satisfactory, very low level of risk when the water leaves the treatment plant.
C:	Marginally satisfactory, low level of microbiological risk when the water leaves the treatment plant, but may not be satisfactory chemically.
D:	Unsatisfactory level of risk.
E:	Unacceptable level of risk.
Distribution Zone Grading: Assessment based on reticulation condition, management, and actual water quality:	

Table 3: MoH Grading for Water Supply Schemes	
a1:	Completely satisfactory, negligible level of risk, demonstrably high quality; meets Aesthetic Guidelines and has ISO 9001:2000 accreditation.
a:	Completely satisfactory, extremely low level of risk.
b:	Satisfactory, very low level of risk.
c:	Marginally satisfactory, moderate level of risk.
d:	Unsatisfactory level of risk.
e:	Unacceptable level of risk.

It should be noted that as the Waimana Scheme is being assessed under Section 10.0 as a participating supply, water quality monitoring can be carried out according to section 10.4 of the DWSNZ 2008. Most notably, bacterial compliance criterion for the Distribution Zone will change from Criterion 6A to Section 10.4.2 of the DWSNZ 2008 as Section 10.0 is adopted.

Further to this, Council is undertaking treatment compliance monitoring well above Section 10.5 requirements

Table 4: Waimana Compliance Criteria (DWSNZ 2008)

Compliance Type / Location	Section of DWSNZ 2008	Monitoring Parameters	Sampling Frequency	Samples per year	Compliance Criteria	Compliance 2017/18
Bacterial Compliance						
Treatment Plant	Compliance Criterion 5 (with approved backup criterion 2a)	As per Protozoal compliance below	As per Protozoal compliance below	As per Protozoal compliance below	As per Protozoal compliance below	Compliant
Distribution Zone	Compliance Criterion 6A (Section 4.4.1)	E Coli	3 samples per quarter[1]	Required: 12 Taken: 12	<1 E coli per 100 mL sample	Compliant
Protozoal Compliance						
Treatment Plant	Section 5.16	Flow	Continuous	Flow not >9.01 l/s for more than 5% of compliance period		Non-Compliant
		UV Intensity (UV(I))	Continuous	UV(I) is not < 103.5 W/m^2 for >5% of compliance period. UV(I) is not < 82.4 W/m^2 (80%) for >= 3 continuous minutes.		
		Lamp outages	As required	N/A		

Table 4: Waimana Compliance Criteria (DWSNZ 2008)						
Compliance Type / Location	**Section of DWSNZ 2008**	**Monitoring Parameters**	**Sampling Frequency**	**Samples per year**	**Compliance Criteria**	**Compliance 2017/18**
		UV Trans-missivity (UV(T))	Once a week	N/A		
		Turbidity	Continuous	Turbidity not >1.0 NTU for >= 5% of monitoring period. Turbidity not > 2.0NTU for >= 3 continuous minutes.		
P2D Compliance						
Treatment Plant	No priority 2 Determinands assigned to this scheme.					
Distribution Zone	No priority 2 Determinands assigned to this scheme.					
Radiological Compliance						
Treatment Plant	Section 9.4	Alpha and beta emitting radionuclides and radon-222	Once every 10 years	N/A	N/A	Compliant
Cyanotoxin Compliance						
Not applicable to bore water.						
Notes: 1. Table 4.3a and 4.3b for the population band of Up to 500 with 45 maximum days between samples and 2 minimum days of the week used. Sampling sites and sampling frequencies are as per Sections 4.4.3 and 4.4.4.1 of the DWSNZ2008 respectively.						

6.0 Critical Points and Barriers to Contamination

By considering both the existing Barriers to Contamination and Critical Points of the scheme it is possible to highlight areas in the scheme that require improvements.

Barriers to Contamination that are present in the Waimana Scheme that eliminate, minimize or isolate contamination were identified and is presented in Table 5. A multi-barrier approach would provide the most robust system ensuring processes are in place to reduce contamination at each stage of the scheme.

As defined by the WSP guides, barriers should be present to achieve the following:

- To stop contamination of raw water;
- To remove particles from water;
- To kill germs; and
- To prevent recontamination of treated water.

Critical Points are areas in the scheme where there is potential for contamination or loss of supply of water. These were identified and presented in Table 6.

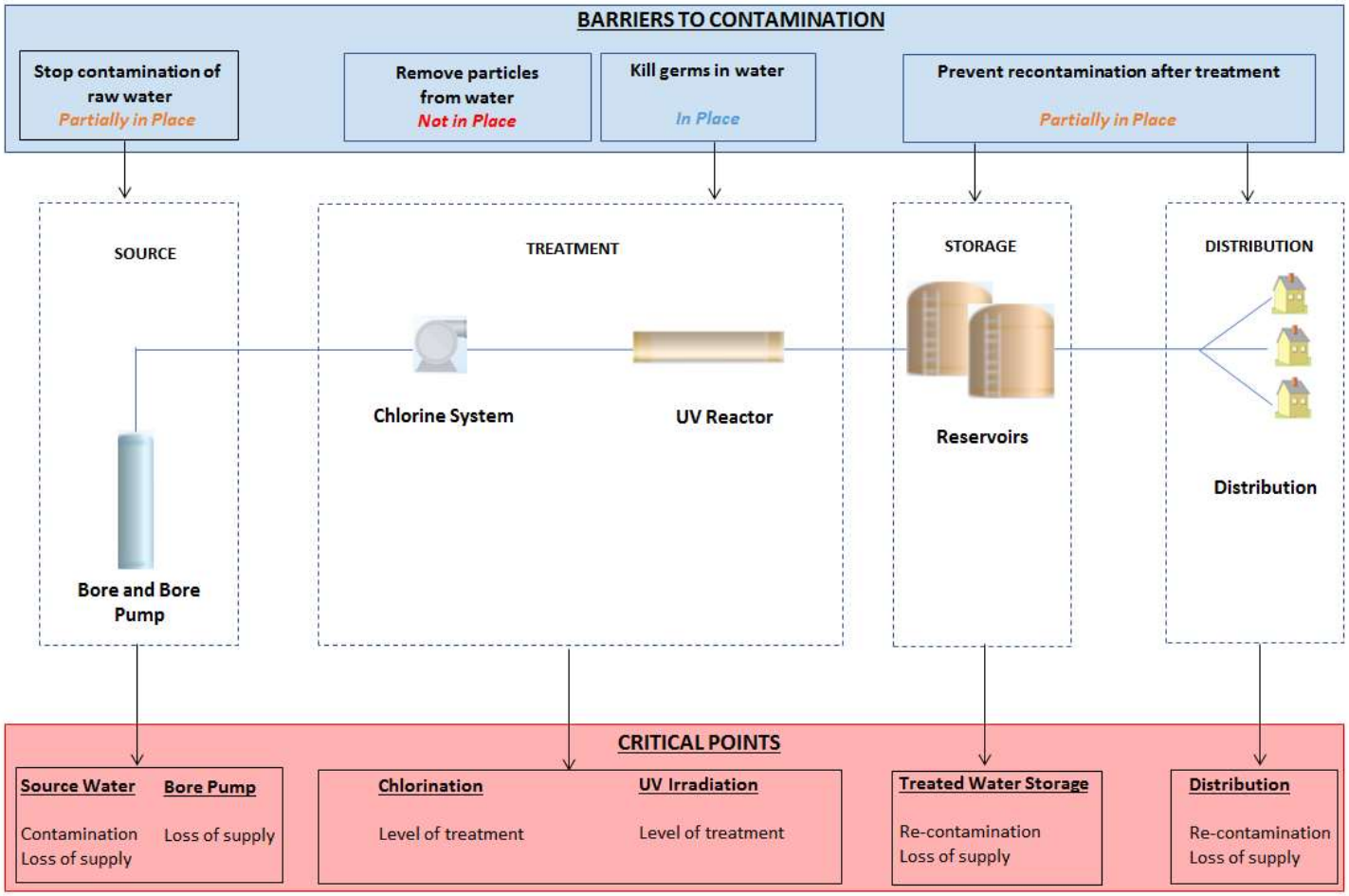


Figure 9: Barriers to Contamination and Critical Points of the Waimana Scheme

Table 5: Barriers to Contamination	
Barriers to:	**Actions/Supply elements contributing to the barrier**
Stop contamination of raw water (At Source) ***Partially In Place***	• **Security of groundwater source:** ***Partially in place*****.** Shallow bore with possible recharge from Tauranga river, therefore somewhat influenced by changes in river water quality. • **Abstraction point positioned and constructed to avoid contamination:** ***Partially in place*****.** 5 metre stock fence has been erected, however, a number of non-compliant features according to DWSNZ 2008. Bore headworks situated below ground. • **Source protected from contamination:** ***Partially in place*****.** Catchment risk assessment carried out to identify activities in the catchment; ongoing monitoring of activities required.
Remove particles from the water (Treatment) ***Not In Place***	• **Coagulation/Flocculation/Clarification:** ***Possible Requirement, Not in place***. Possible requirement to achieve log credit of 4. • **Dissolved air filtration:** ***Possible Requirement, Not in place***. Possible requirement to achieve log credit 4. • **Filtration:** ***Possible Requirement, Not in place***. Possible requirement to achieve log credit of 4.
Kill germs in water (Treatment) ***In Place***	• **Disinfection (Chlorine, UV):** ***In place*****.** Currently achieves complete bacterial removal and Protozoal removal of log credit 3.

Prevent recontamination after treatment (Storage & Distribution) ***Partially In Place***	• **Measures to stop contamination of storage tanks:** ***Partially in place***. Some measure in place. • **Maintenance of a disinfecting residual:** ***In place***. Continuous FAC monitoring at treatment plant. FAC leaving treatment plant maintained within target limits. FAC manually sampled at different points of distribution. • **Actions taken to avoid contamination during distribution:** ***Partially in place***. Some routine asset maintenance and asset replacements in place; these require further development along with current policies and procedures. • **Installation of backflow preventers:** ***Partially in place***. Non domestic connections with BFPs and metered residential connections w double check valves. BFP Policy being developed.

Table 6: Critical Points

Critical Point	Description
Groundwater bores: Contamination of source supply	• Highly variable source water quality: Shallow bore influenced by rainwater recharge of pastoral catchment and surface water quality of Tauranga river, resulting in insufficient treatment downstream. • Possible contamination of bore water by surface water ingress due to non-conformance of bore head to DWSNZ 2008 standards. Risk increased due to site being located in a stock grazing paddock with head works below ground and a site vulnerable to flooding.
Groundwater bores: Loss of source supply	• Failure of bore pump leading to loss of supply. • Access to the pump station and treatment plant site restricted during heavy storm events due to flooding of Waimana road. • Loss of power to site with no backup generator on site; especially vulnerable during heavy storm events when access to site is restricted.
Chlorine and UV treatment	• Insufficient chlorine dosing and UV treatment resulting in harmful microbiological contaminants remaining in water.

Table 6: Critical Points	
Critical Point	**Description**
	• Overdosing of chlorine leading to chemical contamination of water. • Chlorination and UV disinfection provide treatment sufficient for complete bacterial removal, however, does not provide sufficient treatment for complete protozoal removal. Filtration treatment is required to remove particles from raw water and achieve a combined protozoa log credit treatment of 4 as assigned by the DWA (January 2018). • Insufficient maintenance of treatment equipment leading to failures and subsequent inadequate treatment. • Infrequent calibration and verification of equipment leading to false measurements of water quality.
Treated water storage	• Possible contamination of treated water storage in the timber reservoirs if routine inspections and maintenance not undertaken and access by vermin and birds from gaps in the roof and overflow pipe. • Loss of structural integrity of reservoir leading to loss of supply.
Distribution system	• Insufficient routine maintenance such as flushing resulting in build-up of contaminants in the system. • Inadequate backflow prevention provided resulting in contamination of water. Not all connections have backflow prevention and no testing of existing devices is carried out at present. • Failure of distribution system components such as pipes, valves and hydrants due to lack of routine asset renewals, resulting in contamination of water and loss of supply. • Inadequate maintenance procedures and policies in place to maintain the distribution system (including hygiene/disinfection procedures, procedures for contractors) resulting in contamination of distribution system.

Table 6: Critical Points	
Critical Point	**Description**
	• High leakage rates in the distribution system leading to possible contamination of water through back flow. • Possible illegal connections leading to contamination of network.

7.0 Risk Assessment Tables

Based on the Barriers to Contamination and Critical Points identified in Section 6.0, it is possible to identify 'Risk Events' that could occur in the Waimana Scheme that has the potential to compromise public health by either contamination of water supply and/or loss of water supply.

These Risk Events are tabulated in the form of Risk Tables and grouped by Source, Treatment, Reservoirs and Distribution, and are found in Appendix A.

The '*Current Scenario*' section of the Risk Tables contain 'Preventative Measures' currently in place to prevent the Risk Event from occurring, and assesses the 'Current Risk' of the Risk Event occurring.

The '*To be Implemented*' section of the Risk Tables contain Preventative Measures that are to be implemented to reduce the Current Risk, and assesses the 'Residual Risk' of the Risk Event occurring once the new measures are implemented. The person/s responsible for the preventative measure/s to be implemented is also identified.

The Current Risk and Residual Risk were assessed according to the qualitative risk assessment methodology consistent with AS/NZS 4360:1999 Risk Management standard. A Likelihood scale (Table 7) and Consequence scale (Table 8) were defined and set by WDC staff according to how they perceived risks and the corresponding Risk Matrix (Table 9) was used to assign the level of Current Risk and Residual Risk as 'Low', 'Medium', 'High' or 'Extreme'.

Table 7: Likelihood Scale as Defined by WDC	
Almost Certain	Is expected to occur in most circumstances
Likely	Will probably occur (once in 1-2 Years)
Possible	Might occur (once in 5-10 Years)
Unlikely	Might occur (once in 10-20 Years)
Rare	Could occur (once in 50-100 Years)

Table 8: Consequence Scale as Defined by WDC				
	Loss of Supply	**Boil Water Notice**	**Illness**	**Operation Disruption**
Insignificant	Insignificant to none	None	No reported illness	Little disruption
Minor	Less than 1 hour	None. Aesthetic water quality event.	No reported illness	Manageable disruption
Moderate	Less than 4 hours	Up to 3 days. Water quality event that requires flushing.	No reported illness	Significant modification to normal operation
Major	Greater than 4 hours	Prolonged	Probable illness	Abnormal or cease of operation
Catastrophic	For 1 or more days	Prolonged	Severe illness and probable death	Complete failure of system

Table 9: Risk Matrix						
		Consequence				
		Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Likelihood	**Almost Certain**	High	High	Extreme	Extreme	Extreme
	Likely	Medium	High	High	Extreme	Extreme
	Possible	Low	Medium	High	Extreme	Extreme
	Unlikely	Low	Low	Medium	High	Extreme
	Rare	Low	Low	Medium	High	High

8.0 Improvement Plan

The Improvement Plan lists improvements to the Waimana Scheme identified during the preparation of this WSP. Each item has been allocated to a person/department that will be responsible for its implementation (Table 10) and the date by which WDC intends to carry it out.

Improvements are listed in order of Priority as follows: High Priority (Table 11), Medium Priority (Table 12) and Low Priority (Table 13).

Priority was assigned by WDC based on the cost of implementation, the ease of implementation and the current risk to the Waimana Scheme if the improvements are not carried out.

Table 10: Persons Responsible for Improvement Plan Items

Person Responsible	Code
General Manager Planning and Infrastructure	GM
Manager Three Waters	MTW
Team Leader - Water Treatment Plant	TL-WTP
Water Treatment Plant Operator	WTP-O
Team Leader - Three Waters Operations	TL-O
Team Leader - Three Waters Administration	TL - AS
Team Leader - Three Waters Asset Management and Planning	TL-AM
Asset Engineer - Three Waters	AE
Manager - Capital Projects	PM
Project Engineer - Three Waters	PE
Manager Public Affairs	M-PA
Senior Project Planner	SPP

Table 11: Improvement Plan – High Priority Items

Priority	Risk Table No.	Area of Work	Work To be Implemented	Responsibility	Estimated Cost/Time	Due by Date
1	**S3.1 (PM1)**	**Managing activities in the catchment**	Carry out pesticide suite testing on raw water once every 5 years and compare to previous results to monitor any changes. If two consecutive 5 year periods have been monitored, pesticide suits could be carried out less frequently provided no changes in limits are observed.	TL-WTP	$500	October 2018
2	**R4.1 (PM1)**	**Access by animals/birds.**	Install a mesh on outlet of the overflow pipes at reservoir and contact tank	WTP-O	5 hours	October 2018
3	**T7.1 (PM1)** **R5.1 (PM1)**	**Lack of chlorine contact time/ short circuiting**	Calculate if chlorine contact time of 30 minutes achieved before reaching first consumer; if insufficient, calculate size of contact tank required.	AE / TL-WTP	8 hours	October 2018
4	**T4.1 (PM1)**	**Inadequate calibration and maintenance of treatment plant equipment**	WDC to review calibration and maintenance procedures of treatment plan equipment and incorporate into Operations and Maintenance manual with appropriate Standard Operating Procedures (SOP)	TL-WTP / WTP-O	8 hours	October 2018
	T4.3 (PM2G)		Water Operators competence declaration have expired (to be carried out every 5 years, last carried out 2009). Arrangements for reassessment from DWA scheduled for August 2018.	TL-WTP / WTP-O	8 hours	October 2018
5	**D5.2 (PM1G)**	**Inadequate operating Procedures**	Review and update existing operating procedures for each process, items to be recorded and objectives of the process.	MTW/TL-WTP/WTP-O /TL-AS	40 hours	December 2018
6	**D5.3 (PM1G)**	**Inadequate training**	Review staff certificates and undertake additional training / personnel development as needed.	TL-O	8 hours	December 2018
7	**D5.2 (PM2)**	**Inadequate operating Procedures**	Review and update existing disinfection procedures for WDC operations staff working on the water network; focus on preventing cross contamination when staff alternate on wastewater and water reticulation work.	TL-WTP/TL-O/TL-AS	4 hours	June 2019
9	**T1.2 (PM1)** **T8.3 (PM1)**	**Water quality control, i.e.- Excessive colour, turbidity,**	Investigate and cost the installation of adequate filtration or alternative system to treat water quality prior to entering UV system.	MTW / TL-WTP / AE / PE	60 hours	June 2019

Table 11: Improvement Plan – High Priority Items

Priority	Risk Table No.	Area of Work	Work To be Implemented	Responsibility	Estimated Cost/Time	Due by Date
		temperature, water hardness				
10	**S2.1 (PM1) S3.1 T1.3 (PM1)**	**Managing activities in the catchment**	Monitor changes in activities in the catchment and modify catchment risk assessment where required with review of details Annually in June	AE / TL-AM	80 hours	July 2019
11	**S2.1 (PM3, PM4, PM5) S3.1 (PM4)**	**Managing activities in the catchment**	WDC to monitor activities within 250 metres of the water source. 1) To liaise with owners of the dairy farm on which bore site is located to limit livestock grazing if possible. 2) To make farmer aware of the effects of activities around the bore on water quality. 3) To liaise with owners of the motorcycle workshop in the vicinity any other business owners that have potential to discharge contamination; building consents to act as triggers.	AE / TL-AM	240 hours	July 2019
12	**T7.1 (PM2) R5.1 (PM2)**	**Lack of chlorine contact time/ short circuiting**	Install contact tank after chlorine injection if 30 minute contact time not achieved.	AE / TL-AM / PM	$30,000	December 2021
13	**D1.1 (PM1G)**	**Contamination from backflow**	Develop and implement a backflow prevention policy to match device to risk level of activity, including testing requirements of the devices. This has political ramifications and will be difficult to implement thus long lead in time.	GM / MTW / M-PA / TL-AM	100 hours	December 2022
14	**S2.1 (PM2) S3.1 T1.3 (PM2)**	**Managing activities in the catchment**	Catchment Risk Assessment undertaken September 2017. Programme activities to submit a catchment risk assessment to the DWA before 5 year period, for approval.	AE / TL-AM	240 hours	September 2022
15	**T4.4 (PM1G)**	**Inadequate training of staff**	All treatment plant operators to complete appropriate qualification for water treatment plant. WDC to keep records of training and produce when requested.	TL-WTP / WTP-O	$13,000 for diploma	As required

Table 12: Improvement Plan – Medium Priority Items						
Priority	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Estimated Cost/Time**	**Due by Date**
1	**WSPs**	**WSP Review**	Undertake WDC internal review of the WSP annually and report on improvement plan works that have been undertaken.	MTW / TL-WTP / TL-O / AE / TL-AM	24 hours	June (annually)
2	**R4.1 (PM2)**	**Access by animals/birds**	Rodent stations have been installed, routine inspection of vermin/pest control to be included as part of reservoir inspection schedule	WTP-O	2 hours	June 2018
3	**D4.1 (PM3G)**	**Pressure fluctuations in the system**	Carry out a periodic water balance to identify levels of leakage in system.	AE	8 hours	August (annually)
4	**D1.1 (PM3G)**	**Contamination from backflow**	Review policy for withdrawing water from hydrants; specify the use of standpipes fitted with approved backflow preventers.	MTW / M-PA / AE / TL-O / TL-AM	4 hours	December 2018
5	**T4.2 (PM1)**	**Inadequate plant records and procedures**	Ensure all plant records such as manuals, drawings, procedures, emergency response plan, etc. are controlled documents within Council corporate record system and hard copy located at the Water Treatment Plant.	TL-WTP / WTP-O / TL-AS	20 hours + $500	March 2019
6	**S1.2 (PM1)**	**Power failure**	Install dedicated plug point for mobile generator.	TL-AM	$4,000	July 2019
7	**D5.1 (PM1)**	**Poor planning of scheduled work by WDC staff and their contractors**	Where possible utilise WDC Asset Management System to maintain an up-to-date database of critical users such as dialysis patients/hospitals/businesses. Develop robust process for critical customer rating and updating data to maintain active list.	TL-AM	20 hours	July 2019
8	**D1.1 (PM2G)**	**Contamination from backflow**	Circulate educational material to customers, especially those considered high risk, about risks of backflow prevention and ways of minimising the risk.	AE / M-PA	4 hours	December 2019
9	**S1.6 (PM1)** **S1.7 (PM1)**	**Natural disasters - Flooding and extreme storm events**	Develop a disaster management plan for the water supply which could be included as part of a wider disaster management plan for the district.	MTW / TL-O / TL-WTP	120 hours	December 2019

Table 12: Improvement Plan – Medium Priority Items						
Priority	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Estimated Cost/Time**	**Due by Date**
10	**S2.2 (PM2)** **S1.4 (PM3)**	**Bore head Security**	Replace concrete apron; sloping to prevent ponding of water around borehead, provide a bore casing seal and extend to at least 1 metre from the bore centre. Also inspect sub-slab cable entry and install suitable cable seals.	TL-WTP / AE / PM	$12,000	December 2019
11	**T1.4 (PM1)**	**Other - Insufficient pH treatment**	This applies if pH is below the DWSNZ pH range 7.0-8.5 (At workshop said pH below 7). Investigate options and benefits of installing pH correction.	TL-WTP / WTP-O / TL-AM / PE	48 hours	April 2020
12	**S1.2 (PM2)**	**Power failure**	Investigate installing a control valve on the reservoir outlet to control water supply flow/pressure during power outages.	AE / PM	$15,000	December 2021
13	**D4.1 (PM1)**	**Pressure fluctuations in the system**	Identify problem pressure areas by carrying out hydraulic computer modelling and network analysis coupled with customer complaint records.	AE	$10,000	December 2022
14	**D1.1 (PM4)**	**Contamination from backflow**	Install backflow prevention devices on all connections; priority given to connections identified as high risk. Dual check manifolds to be installed on residential connections, as the scheme is not currently metred.	AE / TL-O / TL-AM	$30,000	February 2023 (Subject to Council adoption)
15	**T1.2 (PM2)**	**Insufficient protozoal treatment installed**	Investigate options to move bore site to abstract water of better quality if upgrade of treatment plant is not being implemented.	MTW / PM / SPP / TL-AM	$25,000	July 2024

Table 13: Improvement Plan – Low Priority Items						
Priority	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Estimated Cost/Time**	**Due by Date**
1	**S2.2 (PM7)**	**Bore-head Security**	Carry out CCTV inspection of bore casing to ascertain condition, as required.	TL-O / TL-WTP / TL-AM	$1,000	December 2018
2	**D6.1 (PM4G)**	**Third party contractor/developer work on WDC reticulation (not directly engaged by WDC)**	WDC to develop policy and procedure whereby Third party contractors/developers are made liable for any damages to the network to increase accountability	TL-O / AE / TL-AM	20 hours	December 2018
3	**R4.4 (PM1)**	**Entry of contaminants due to reservoir design**	Check 'as-built' drawings and carry out a trial run to ensure reservoir can be isolated for cleaning or in case of contamination/loss of structural integrity. If not, programme for installation of appropriate valving to achieve this.	AE	16 hours	February 2019
4	**D2.1 (PM1)** **D2.1 (PM2G)** **D2.2 (PM3G)** **S1.3 (PM1)** **R2.1 (PM3)**	**Poor circulation in network** **Bore Pump failure**	Utilise Asset Management System to schedule and monitor preventative maintenance.	TL-AS / TL-O	20 hours	March 2019
5	**D2.2 (PM1)**	**Inability to isolate or shut down the system**	Carry out a routine maintenance plan for valve exercising with priority given to critical valves i.e.-those supplying a large or critical customer base, valves on rising and falling mains and those used for bore and reservoir isolation.	TL-AS / TL-O	12 hours	March 2019
6	**R4.3 (PM1)**	**Sediment/slime accumulation and resuspension of accumulated sediment.**	Utilise Asset Management System to schedule and implement a CCTV inspection of reservoirs and vacuum cleaning programmes as required.	TL-AS / TL-O	4 hours	April 2019
7	**T1.4 (PM2G)**	**Other - Insufficient pH treatment**	Plumb solvency - Inform wider community and consumers about the use of copper pipes and fittings (including lead jointing) for internal	M-PA / AE	40 hours + $1,000	April 2019

Table 13: Improvement Plan – Low Priority Items

Priority	Risk Table No.	Area of Work	Work To be Implemented	Responsibility	Estimated Cost/Time	Due by Date
			plumbing by circulating information flyer and notification on Council Website			
8	**D5.1 (PM3G)**	**Poor planning of scheduled work by WDC staff and their contractors**	Maintain a systematic workflow procedure with control checks for the update of capital works arising from projects, subdivision work and daily replacements and renewals so that all paperwork is sent to the asset engineer for recording on Asset Management System and GIS.	AE / TL-AM	20 hours	April 2019
9	**D4.1 (PM5G)** **D5.1 (PM2G)**	**Pressure fluctuations in the system**	Develop and adopt internal procedure for maintaining an up-to-date Asset Management System and GIS system.	AE / TL-AM	40 hours	May 2019
10	**S2.2 (PM5)** **S1.6 (PM2)**	**Bore-head Security**	Raise bore head above ground and ideally relocate to 0.5 metres above 1% AEP flood level.	TL-AM / PM	$5,000	July 2019
11	**S2.1 (PM6)** **S3.1 (PM5)**	**Managing activities in the catchment**	Liaise with Regional Council to list water take consent holders within vicinity and if applicable obtain groundwater monitoring results from these consent holders as a way of early warning of source contamination.	SPP / TL-AM	32 hours	December 2019
12	**R2.1 (PM2)**	**Loss of structural integrity of reservoirs**	Carry out condition assessment of Timber reservoirs by 2019 and 5 yearly thereafter.	AE	$5,000	December 2019
13	**D2.2 (PM2)**	**Inability to isolate or shut down the system**	Undertake a programme of marking valve boxes for ease of location.	AE / TL-O	40 hours	December 2019
14	**D3.1 (PM2G)**	**Pipe, valve and hydrant failure due to age, condition and material of pipe**	Update water asset management plan as required and republish every 3 years.	TL-AM / AE	$4,000 Per system	June 2021
15	**D3.1 (PM1G)**	**Pipe, valve and hydrant failure due to age, condition and material of pipe**	Develop asset renewals programme based on condition sampling and assessments, analysis of asset age, material, frequency of breakages and increase in maintenance costs. Asset renewals to prioritize critical assets such as rising mains/falling mains, pipes supplying a critical consumers or large consumer base, critical valves and hydrants.	AE / TL-AM	240 hours	June 2022

Table 13: Improvement Plan – Low Priority Items						
Priority	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Estimated Cost/Time**	**Due by Date**
16	**D4.1 (PM4)**	**Pressure fluctuations in the system**	Once hydraulic models are completed and in-line with annual water balance calculations develop and implement leak detection programme	AE	$5,000	April 2023
17	**S1.9 (PM1)**	**Resource consent limitations**	Apply for new water take consent well ahead of expiry date of existing consent (2026) due to possible delays in obtaining consent as a high number of resource consents expiring throughout the country in 2026.	SPP / AE / TL-AM	$100,000	2024
18	**S2.1 (PM7)** **S3.1 (PM6G)**	**Managing activities in the catchment**	3 Waters Asset Manager to provide input into next version district plan (WDC) and regional plan (BOPRC) with regards to protection of catchment; input into activities such as sediment control from earthworks and riparian strip management.	SPP / TL-AM	240 hours	December 2026
19	**R2.1 (PM1)**	**Loss of structural integrity of reservoirs**	Renew/ replace timber reservoirs with new reservoirs.	SPP / AE / TL-AM / PM	$450,000	2043

9.0 Process Control Summaries

Several parameters within the water supply scheme known as 'Control Parameters' are routinely monitored by the operators to ensure the system is operating within the prescribed 'Target Range'. When any of these Control Parameters exceed the Target Range and reach 'Action Limits' or 'Critical Limits', the operator/s are required to undertake 'Corrective Actions' to restore the system back to the prescribed Target Range.

Effective process control occurs when operators are aware of the Target Range, the Corrective Actions required to be taken and who is responsible for carrying them out. It is therefore recommended 'Process Control Summaries' are used as a guide by WDC treatment plant operators in day to day operations.

Table 14: Process Control Definitions	
Critical Control Points (CCPs)	Points and processes in the Waimana Scheme that can be controlled to prevent contamination of water.
Control Parameters (CPs)	Parameters that can be measured and monitored in order to determine if a process is performing as required.
Target Range	Desired range within which each CP is required to operate in the normal day-to-day operation of the system.
Action Limits and Critical Limits	When CPs reach these limits Corrective Actions are required to be carried out by persons responsible to bring CPs back within the Target Range.
Corrective Actions	Actions to be carried out when CPs reach Action Limits and Critical Limits.
Process Control Summaries (PCS)	Target Range, Action Limits and Critical Limits for CPs and a list of corrective actions to be taken when CPs reach Action Limits and Critical Limits, along with person/s responsible for carrying them out.

Figure 9 shows the Critical Control Points (CCPs) of the Waimana Scheme and the Control Parameters that are to be monitored and measured at each CCP.

Process Control Summaries have been prepared for the Treatment CCPs of the Waimana Scheme. Process control summaries have not been prepared for the Source, Storage and Distribution CCPs further to guidance from the DWA.

A description of each Treatment CCP can be found in Sections 9.1 (Chlorination) and 9.2 (UV Irradiation) and Appendix B sets out Process Control Summaries for each of the Treatment CCPs.

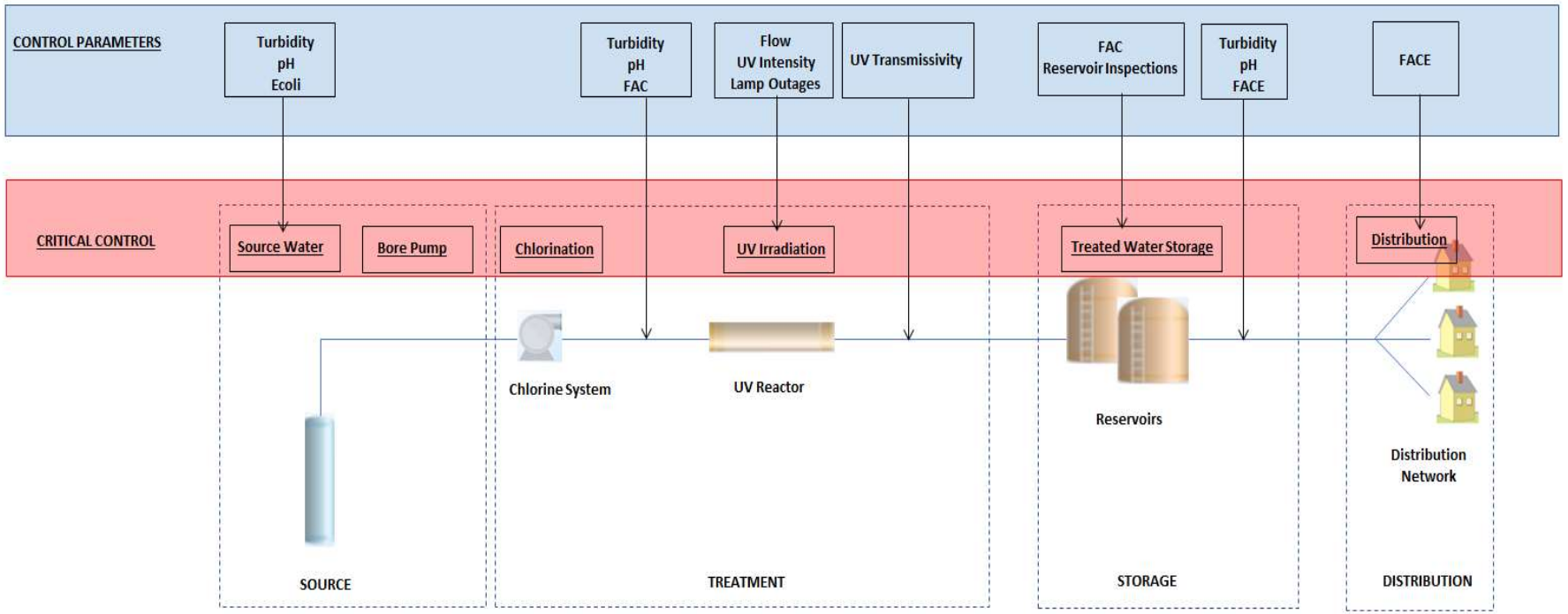


Figure 10: Critical Control Points and Corresponding Control Parameters for the Waimana Scheme for Source, Treatment, Storage and Distribution

9.1 Critical Control Point: Chlorination (Disinfection Treatment)

Process Objectives:

- Provide a disinfection CCP to inactivate bacterial, viral and some protozoan pathogens that may have entered upstream of dosing point.
- Provide residual disinfection quality control pit to help inactivate pathogens entering downstream of the dosing point.

Process Location:

- Chlorine dosing system located downstream of raw water intake and before UV treatment unit.

Parameters and day-to-day monitoring:

- Turbidity (NTU units) – Continuous monitoring through turbidity meter connected to SCADA and Telemetry.
- pH (pH units) – Continuous monitoring through pH meter connected to SCADA and Telemetry.
- Free Available Chlorine (FAC, mg/L) – Continuous monitoring through FAC meter connected to SCADA and Telemetry

Parameter Monitoring Points:

- All three parameters (Turbidity, pH and FAC) are monitored immediately downstream of the chlorine injection point and upstream of the UV reactor.

Process Records:

- Manual: WTP Log book, weekly and monthly sheets, manual sampling sheets.
- Online: SCADA system to record and display data, 'Water Online' system to record scheduling/sampling information that can be accessed by the MoH for compliance.

Process Controller:

- Water treatment plant operator/s on duty.

Supporting Programmes:

- Daily checks and weekly calibration of monitoring instruments.
- Periodic checks of reagents expiry date and discarding of outdated reagents.
- Training of operators of online instruments for turbidity, pH, FAC.

- Lab verification checks for *E. coli* ≥ weekly; and *chloride* ≥ monthly; with transgression reporting to Operator and DWA if results are outside DWSNZ 2008. – change similar to plains

9.2 Critical Control Point: UV Irradiation (Disinfection Treatment)

Process Objectives:

- Provide a disinfection critical control point and primary protozoal removal and disinfection CCP to inactivate protozoan, bacterial and viral pathogens that may be present.

Process Location:

- UV treatment unit situated downstream of chlorine dosing system and the raw water intake.

Parameters and day-to-day monitoring:

- Treated Water Turbidity (NTU units) – Continuous monitoring through turbidity meter connected to SCADA.
- Flow (m^3/hr) – Continuous monitoring through magnetic flow meter connected to SCADA.
- UV Intensity (UVI in W/m^2) – Continuous monitoring through UV unit connected to SCADA via Telemetry.
- UV Transmissivity (UVT in %) – Manual monitoring undertaken
- UV Alarm – Continuous monitoring through UV unit connected to SCADA.
- Lamp outages (number of outages) – Per incident of occurrence.

Parameter Monitoring Points:

- All parameters (Turbidity, pH and FAC) are monitored immediately downstream of the chlorine injection point and upstream of the UV reactor.

Process Records:

- Manual: WTP Log book, weekly and monthly sheets, manual sampling sheets.
- Online: SCADA system to record and display data, 'Water Online' system to record scheduling/sampling information that can be accessed by the MoH for compliance.

Process Controller:

- Water treatment plant operator/s on duty.

Supporting Programmes:

- Maintenance tasks at weekly, monthly, 3 monthly, 6 monthly and annual intervals.
- Training of operators in UV reactor operation at commissioning time and/or for new operators via established SOP.
- Scheduled validation (verification) and standardisation (calibration) of monitoring instruments.
- Lab verification checks for E. coli with transgression reporting to Operator and DWA if results are outside DWSNZ 2008.

10.0 Contingency Plans

Contingency Plans have been prepared to provide guidance in the event that control measures fail to prevent the occurrence of a risk event that may present acute risk to public health. WDC is responsible for implementation of the Contingency Plans when monitoring has identified the occurrence of a risk event.

If an event occurs despite preventive and corrective actions being in place, WDC is to consult with the Medical Officer of Health to assess the seriousness of the event.

Table 15: Contingency Plans

Event	Actions	Responsibility
Microbiological and/or Chemical contamination of source as a result of, but not limited, to the following: • High rainfall events • Change of activity in the catchment • Accidental spills	Plant to shut down by shutting off the pump when parameters exceed set limits (FAC, pH, Turbidity)	Operations
	Water to be diverted or sent to waste when parameters exceed set limits (FAC, pH, Turbidity).	Operations
	Isolate source – through turning the pump off.	Operations
	Carry out manual dosing – as per WTP reservoir dosing procedure.	Operations
	When directed by MTW or DWA notify customers using M-PA department appropriate communication plan e.g. Boil water notice. • High risk customers to be notified as a priority.	Public Affairs/ Operations
	Carry out increased monitoring according to DWSNZ 2008.	Operations
	Notify the DWA of event.	Operations
	Carry out following depending on nature of event: • Investigate changes to activities in the catchment. • If accidental spill contain the spill.	Operations
	Carry out flushing of reservoirs and distribution system that may be affected.	Operations
Following in water leaving treatment plant: E coli, low FAC, High Turbidity, UV lamp outages, UV intensity low/high as a result of, but not limited to, the following: • Malfunctioning equipment/sensors	Plant to shut down by shutting off pump when parameters exceed set limits (FAC, pH, Turbidity).	Automatic/ Operations
	Inspect, verify and if necessary carry out maintenance on treatment plant equipment	Operations
	Recalculate dose rates for chlorine.	Operations
	Notify DWA of the event.	Operations
	Carry out increased monitoring according to DWSNZ 2008.	Operations
Following in distribution system: E coli, low FAC, High Turbidity as a result of, but not limited to, the following: • Backflow into system • Insufficient FAC residual in water leaving treatment plant • Leaks in system • Inadequate maintenance of distribution system leading to slime build up, leaching and poor circulation.	Carry out appropriate actions when treatment parameters deviate from target limits (FAC, pH, Turbidity).	Operations
	Isolate parts of the system including reservoirs. Isolate sections of the distribution network and reservoirs through manual valve isolation.	Operations
	Carry out manual dosing of the network, where required	Operations
	When directed by MTW or DWA notify customers using M-PA department appropriate communication plan e.g. Boil water notice. • High risk customers to be notified as a priority.	Public Affairs/ Operations
	Carry out increased monitoring according to DWSNZ 2008.	Operations
	Notify the DWA of event.	Operations
	Where appropriate, carry out flushing of reservoirs and distribution system that may be affected.	Operations
	Undertake the following depending on nature of event: • Identify and fix leaks in the system and instruct customers to carry out the same on private property reticulation. • Fix backflow preventers on offending connections and carry out routine backflow preventer testing.	Operations
Loss of Supply of Source Water: • Prolonged loss of supply due to leaks, insufficient storage, loss of reservoir structural integrity, unplanned maintenance, pump breakdown	Utilise procedure for sourcing water from emergency supply: alternative groundwater/surface water supply or providing tankered water.	Operations
	When directed by MTW or DWA notify customers using M-PA department appropriate communication plan e.g. Boil water notice. • High risk customers to be notified as a priority.	Public Affairs/ Operations
	Notify the DWA for loss of supply over 8 hours.	Operations
	Monitor reservoir levels.	Operations

Table 15: Contingency Plans		
Event	**Actions**	**Responsibility**
Loss of Supply and Contamination of water due to natural disasters and high rainfall events	Undertake contingency plan as per civil defence emergency appropriate to the scenario.	Operations
	Procedure for sourcing water from emergency supply: alternative groundwater/surface water supply or providing tankered water.	Operations
	Increased monitoring according to DWSNZ 2008.	Operations
	Notify DWA of the event.	Operations
	Carry out inspections of the components of the intake/pump, treatment plant, reservoirs and distribution system for structural integrity.	Operations

11.0 Methodology and Consultation

This WSP has been prepared consistent with the approaches recommended by the MoH.

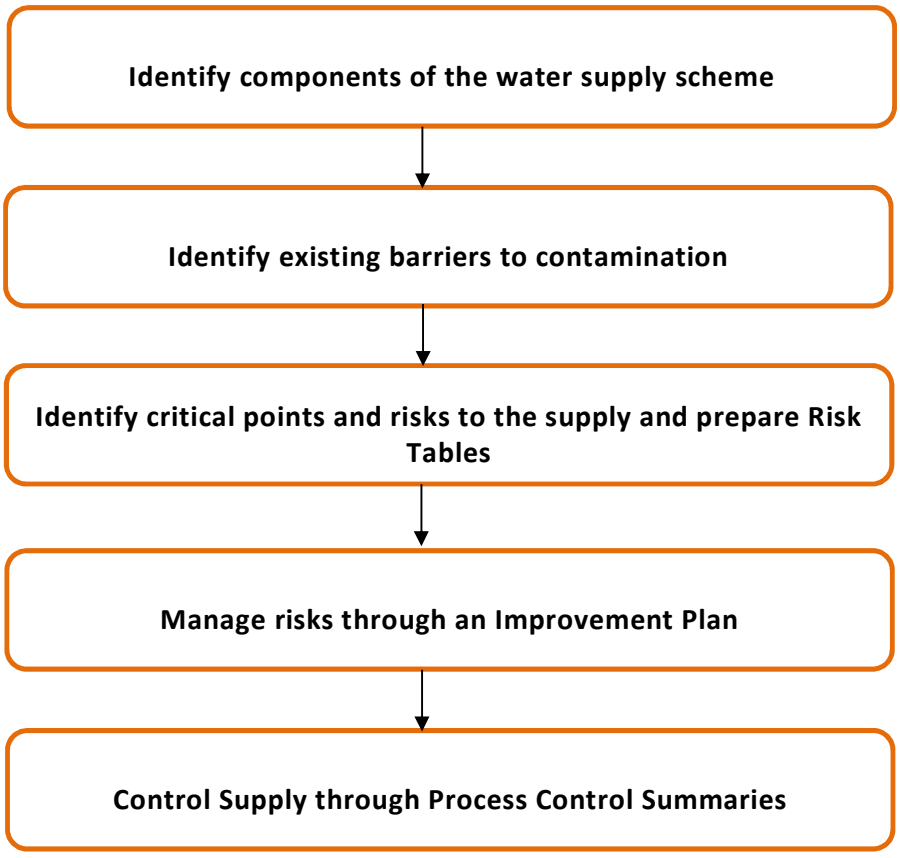


Figure 11: Methodology

The following supporting documents published by the MoH have been used in the preparation of this report:

- The series of "Water Safety Plan Guides for Drinking Water Supplies (2014)".
- The document "A Framework on How to Prepare and Develop Water Safety Plans for Drinking-water Supplies (2014)".

Information used in this report has been gathered as follows:

- Documents and reports:
  - Water Asset Management Plans (WDC).
  - Asset condition assessments for reservoirs and pipes (WDC).
  - Various Council Policies and Procedures (WDC).
  - Maintenance checklists and schedules (WDC).
  - Council Annual Plan and Long Term Plan (WDC).
  - MoH Compliance Reports and PHRMP verification reports (DWA, MoH).
  - Reservoir cleaning and structural assessments (WDC).
  - Catchment Risk Assessment for Waimana bore Water Supply Report (September 2017, PDP).
- Site Visits carried out by PDP to the following locations on the 18th July 2017: Waimana treatment plant and pump station site.
- Consultation workshop carried out by PDP with participation of WDC, 31st August 2017.

The consultation workshop was facilitated by Sala Ranasinghe (Senior Environmental Engineer) from PDP with the participation of key WDC personnel.

The following key WDC personnel participated in the workshop and contributed to the information provided in this report:

Michael Van Tilburg – Manager Three Waters Assets; Gareth Phillips – Manager Three Waters Operations (position held up till May 2018), Leilani Salanguit – Project Engineer; Neal Yeates – Team Leader Water Treatment Plant; Luke Shipton – Team Leader Operations.

The aim of the workshop was to identify risks to the Waimana Scheme as experienced by the operators of the scheme based on historical events and their knowledge of the scheme, and putting in place improvement measures to manage risks that are not currently managed.

The qualitative risk assessment was carried out using the AS/NZS 4360:1999 Risk Management Standard approach. A Likelihood scale and Consequence scale was defined and set by WDC staff according to how they perceived risks, and the corresponding risk matrix was used to assign risks to events.

The Improvement Plan was ranked by WDC in order of priority, taking into account current risks to the Waimana Scheme if not implemented along with the cost of implementation.

Appendix A: Waimana Scheme Risk Tables

Table 16: Source – Catchment and Bores

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
S1: EVENT: LOSS OF BORE WATER SUPPLY								
S1.1	Insufficient source water due to seasonal variations/drought (low levels in the river or water tables).	• Reduced or no flows. • Drop in system pressure. • Customer complaints about low pressure.	• Seasonal variations in bore water not experienced at this site.	Yes	Low (Rare x Minor)	N/A	N/A	N/A
S1.2	Power failure	• Power failure alarms. • Reduced or no flows.	• Interruptions to power supply about once or twice a year. No generator available on-site, hired by local contractor. **PM1:** Generator hired from local contractor and taken to site when required. **PM2:** Sufficient storage available in reservoirs.	Partially	Extreme (Almost Certain x Moderate)	**PM1:** Install dedicated plug point for mobile generator. **PM2:** Investigate installing a control valve on the reservoir outlet to control water supply flow/pressure during power outages.	Moderate (Possible x Minor)	**PM1: TL-**AM **PM2:** AE/PM
S1.3	Bore pump failure	• Pump failure alarms. • Reduced or no flows.	**PM1:** Small community and two reservoirs of 180 m^3 storage capacity, therefore sufficient storage available. **PM2**: Spare bore pump situated at operations depot on Valley road to be used as a backup. **PM3:** Regular bore maintenance carried out.	Yes	Low (Possible x Insignificant)	**PM1:** Utilise Asset Management System to schedule and monitor preventative maintenance.	Low (Possible x Insignificant)	**PM1:** TL-AS
S1.4	Damage to bore headworks and pumping equipment/wiring due to vandalism and/or vermin and animals.	• Visual damage to intake/pump equipment/ electrical cables. • Reduced or no flows from bore. • No signal or no readings received from equipment and/or equipment failure.	• Situated on public road frontage, however no history of vandalism. **PM1:** Perimeter security gate with locks. **PM2:** Bore headworks locked in a wooden cabinet, concrete housing containing chlorination and UV/flow meter equipment locked with padlocks. **PM4:** Rodent poison stations placed on site.	Partially	Medium (Possible x Minor)	**PM3:** Replace concrete apron; sloping to prevent ponding of water around borehead, provide a bore casing seal and extend to at least 1 metre from the bore centre. Also inspect sub-slab cable entry and install suitable cable seals.	Low (Possible x Insignificant)	**PM3:** TL-WTP / AE / PM
S1.5	Restricted access to bore site due to absence of right of access.	• Restricted access to site during normal operating conditions.	• Access to site is through a public road therefore no restrictions.	Yes	Low Unlikely x Minor)	N/A	N/A	N/A

Table 16: Source – Catchment and Bores

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
S1.6	Natural disasters – Flooding and extreme storm events.	• Restricted access to site. • Inability to operate and maintain equipment.	• BOPRC provides a flood level of 1.3 metres above ground level for a 1% AEP event at the bore site. However no historical flooding on site. • Road leading to Waimana and Waimana Gorge prone to flooding during high rainfall events restricting access to these townships. • No alternate access route available to site.	Partially	Medium (Possible x Minor)	**PM1:** Develop a disaster management plan for the water supply which could be included as part of a wider disaster management plan for the district. **PM2:** Raise bore head above ground and ideally relocate to 0.5 metres above 1% AEP flood level.	Low (Possible x Insignificant)	**PM1**: MTW / TL-O / TL-WTP **PM2**:TL-AM / PM
S1.7	Natural disasters – slips and earthquakes.	• Restricted access to site. • Inability to operate and maintain equipment.	• Road leading to Waimana and Waimana Gorge prone to flooding during high rainfall events restricting access to these townships.	Partially	Medium (Possible x Minor)	**PM1:** Develop a disaster management plan for the water supply which could be included as part of a wider disaster management plan for the district.	Low Possible x Insignificant)	**PM1**: MTW / TL-O / TL-WTP
S1.8	Clogged bore screen/s	• Reduced or no flows.	• No historical issues at this site. **PM1:** Sufficient reservoir storage available if maintenance required.	Yes	Low (Possible x Insignificant)	N/A	N/A	N/A
S1.9	Resource consent limitations	• Loss of right to abstract water. • Increase in take compared to extraction limit granted.	• Number of consents throughout the country expiring in 2026 therefore some risk in delay in having consent issued. **PM1:** WDC has consent management System currently in place, alerting conditions of consent and when consents are nearing expiration (the consents database-management tool is called CS-VUE).	Yes	Extreme (Unlikely x Catastrophic)	**PM1:** Apply for new water take consent well ahead of expiry date of existing consent (2026) due to possible delays in obtaining consent as a high number of resource consents expiring throughout the country in 2026.	High (Rare x Catastrophic)	**PM1:** SPP/AE/TL-AM
S2: EVENT: MICROBIAL CONTAMINATION OF BORE WATER								
S2.1	Discharge/leachate/runoff from the following activities in the catchment: **Agriculture:** Manure from grazing livestock, Manure fertiliser, silage leachate, dairy shed washwater, effluent spray irrigation, effluent ponds. **Forestry:** Sewage from sludge application. **Industry:** Wastewater discharges from industrial processes, biological washwater.	Water not compliant with DWSNZ 2008: • Median E. coli count over 12 months is more than 500/100 ml • Concentrations of health significant determinands, agrichemicals and other contaminants more than 50% of their MAV in the source water. • Unsatisfactory practices being used in farming and forestry activities, especially related to fertiliser application and sediment control.	• Recharge zone: Primary recharge from rainfall seepage (540 metre groundwater capture zone) and possibility of secondary recharge from Tauranga River during dry months (entire river catchment zone.) Activities: Landuse predominantly farming and agricultural. Bore site situated in a dairy farm paddock with intense livestock grazing in the vicinity, with a consented dairy effluent discharge and motorcycle workshop site within the groundwater capture zone. Primary microbiological risks considered to be from manure from intensive livestock grazing and effluent discharge in the groundwater capture zone and any activities carried out at the HAIL site workshop. Catchment risk assessment has been carried out in 2008 and most recently in 2017. Through the assessment WDC has developed an understanding of	Partially	Extreme Likely x Major)	**PM1:** Monitor changes in activities in the catchment and modify catchment risk assessment annually. **PM2:** Submit a catchment risk assessment to the DWA every 5 years for approval. • **WDC to monitor activities within 250 metres of the water source:** **PM3:** To liaise with farmer owning paddock on which bores are situated to limit stock density, and irrigation if any. To also find out future plans that may change activity within the zone that may increase stock grazing intensity. **PM4:** To make farmer aware of the effects of activities around the bore on water quality. **PM5:** To liaise with owners of the motorcycle workshop in the vicinity any other business owners that have potential to discharge contamination;	Medium (Rare x Moderate)	**PM1**: AE/TL-AM **PM2**: AE/TL-AM **PM3**: AE/TL-AM **PM4**: AE/TL-AM **PM5**: AE/TL-AM

Table 16: Source – Catchment and Bores

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
	Human activities: Wastewater discharge from human activities to land or water i.e. on-site disposal and septic tank. **Feral animals:** faecal matter. **Contaminated sites and landfill sites** **Other:** Stormwater runoff, construction sites, abandoned/unused bores		the extent of the recharge zone and nature of activities in it. **PM8:** Business as usual - BOPRC to inform WDC of new discharge consents to the recharge zone (Tauranga river catchment and 540 metre groundwater capture zone) and WDC to provide comments on these consents. WDC to send BOPRC submissions opposing new applications for septic tanks within 540 metre groundwater capture zone.			building consents to act as triggers (no tradewaste consents issued in the Waimana Scheme as no council wastewater reticulation in the Scheme). • **3 Waters Asset Manager to:** **PM6:** Liaise with Regional Council to list water take consent holders within vicinity and if applicable obtain groundwater monitoring results from these consent holders as a way of early warning of source contamination. **PM7:** 3 Waters Asset Manager to provide input into next version district plan (WDC) and regional plan (BOPRC) with regards to protection of catchment; input into activities such as sediment control from earthworks and riparian strip management.		**PM6**: AE/TL-AM **PM7**: SPP/TL-AM
S2.2	Contamination of bore/well from surface ingress due to: • Inappropriate bore/ well head design, not complying with the standards set by DWSNZ 2008 and the DWA. • Bore headworks and pipework damaged. • Poor joints, cracks or corrosion, in the bore casing.	• Inspection of bore/well head shows non-compliance with DWSNZ 2008. • E coli transgressions. • No system for backflow prevention. Inappropriate casing material selected, or old casing.	• Site inspection of the bore head identified some non-compliant features against the DWSNZ 2008 and DWA requirements. • Contamination risk through borehead ingress is increased due to flood vulnerability of the site and borehead situated below ground. • No damage to bore headworks or pipework could be assessed visually. • Condition of casing not known. **PM1:** Stock fence to be taken out to the minimum recommended 5 metres from the centre of the bore head on all sides or to 10 metres if practical due to high grazing intensity around the water source (Completed November 2017). **PM3:** 100 mm air gap on the inlet main at the reservoir confirmed by TL-WTP (December 2017).	Partially	Extreme (Likely x Major)	Refurbish boreheads to comply with DWSNZ 2008 and DWA requirements as follows: **PM2:** Replace concrete apron; sloping to prevent ponding of water around borehead, provide a bore casing seal and extend to at least 1 metre from the bore centre. Also inspect sub-slab cable entry and install suitable cable seals. **PM4:** Carry out checks to determine adequacy of cable gland seals and bore head seals including replacing any deteriorating gaskets in bore headworks with water tight gaskets. **PM5:** Raise bore head above ground and ideally relocate to 0.5 metres above 1% AEP flood level. **PM 6:** Programme for annually Test of backflow preventer. **PM 7: Carry** out CCTV inspection of bore casing to ascertain condition, as required.	Medium (Rare x Moderate)	**PM2:** TL-WTP **PM4:** TL-WTP **PM5:** TL-AM **PM6:** TL-O **PM7:** TL-O / TL-WTP / TL-AM
S3.1	Discharge/leachate/runoff from the following activities in the catchment: **Agriculture**: Pesticides (including stock dip), chemical fertiliser, dairy shed washwater, stock effluent, effluent spray irrigation, effluent ponds, increase in turbidity from		• Primary chemical contamination risk from farming, agricultural and forestry activities carried out in the catchment and any chemical spills/discharges to the Tauranga river catchment. • Currently no chemical treatment carried out on source water, therefore high risk in the event of chemical contamination.	No	High (Unlikely x Major)	**Refer to S2.1.** Monitor changes in activities in the catchment and modify catchment risk assessment annually. Submit a catchment risk assessment to the DWA every 5 years for approval. **PM1:** WDC to liaise with pesticide application companies and make them aware of locations of water sources, and to be informed of pesticide drops in vicinity of water source. **PM2:** WDC to liaise with BOPRC as follows: 1) BOPRC to inform WDC of new discharge consents to the	Medium (Rare x Moderate)	**PM1**: SPP/AE/TL-AM **PM2:** AE/TL-AM

Table 16: Source – Catchment and Bores

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
	soil and silt due to cultivation (tilling). **Forestry & Pesticides**: poison from feral animal control, 1080, cyanide, brodifacoum, fuel contamination from vehicles and fuel storage. **Industry and HAIL sites**: Chemical discharges depending on industry; underground fuel storage contamination, cyanide and metal contamination from ore extraction/mining, turbidity from open cast mining and quarrying. **Roading**: Asphalt, contamination due to fuel/ oil leaks and accidental spillages. **Other**: Contaminated/ landfill sites, Stormwater runoff, increased turbidity from construction sites, abandoned/unused bores					recharge zone (Tauranga river catchment and 540 metre groundwater capture zone) and WDC to provide comments on these consents. 2) WDC to send BOPRC submissions opposing new applications for septic tanks within 540 metre groundwater capture zone. **PM3:** Carry out pesticide suite testing on raw water once every 5 years and compare to previous results to monitor any changes. If two consecutive 5 year periods have been monitored, pesticide suits could be carried out less frequently provided no changes in limits are observed. **PM4:** WDC to monitor activities within 250 metres of the water source. 1) To liaise with farmer owning paddock on which bores are situated to limit stock density, and irrigation if any. To also find out future plans that may change activity within the zone that may increase stock grazing intensity. 2) To make farmer aware of the effects of activities around the bore on water quality. 3) To liaise with any business owners that have potential to discharge contamination; building consents to act as triggers (no tradewaste consents issued in the Waimana Scheme as no council wastewater reticulation in the Scheme). **PM5:** Obtain groundwater monitoring results from consent holders in the vicinity if available, as a way of early warning of source contamination. **PM6:** 3 Waters Asset Manager to provide input into district plan (WDC) and regional plan (BOPRC) with regards to protection of catchment; input into activities such as sediment control from earthworks and riparian strip management.		**PM3:** TL-WTP/WTP-O **PM4:** AE/TL-AM **PM5:** SPP **PM6:** SPP/TL-AM

Table 16: Source – Catchment and Bores

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
S3.2	Conditions suitable for algal growth such as elevated nutrient levels, sunshine, warmth, still water.	• Development of visible algal blooms, complaints of symptoms consistent with toxin poisoning. • Health-significant determinands are more than 50% of their MAV in the source water. • Elevated levels of contaminants (nutrients and toxins) in source water.	No historic issues with cyanotoxins at this source, sufficiently far away from Tauranga River.	Yes	Low (Rare x Minor)	N/A	N/A	N/A
S3.3	Saline intrusion due to very deep bores with proximity to sea, increased drawdown due to elevated abstraction causing ingress of seawater.	• Reticulated water not compliant with DWSNZ 2008.	No historic issues with saline intrusion at this source.	Yes	Low (Rare x Minor)	N/A	N/A	N/A
S3.4	Mineral deposits in the catchment and recharge zone due to characteristics of the catchment.	• Reticulated water not compliant with (note heavy metals due to corrosion are excluded) DWSNZ 2008.	No historic issues with mineral deposits at this source.	Yes	Low (Rare x Minor)	N/A	N/A	N/A
S3.5	Contamination of bore/well during construction by cross contamination and by residues from drilling process (e.g. barium)	• Concentrations of chemical determinands more than 50% of their MAV.	Bore has been in operation for a few years, no historic issues associated with bore construction.	Yes	Low (Rare x Minor)	N/A	N/A	N/A

Table 17: Treatment – Chlorination and Ultra Violet Irradiation

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
T1: EVENT: INADEQUATE TREATMENT INSTALLED								
T1.1	Insufficient bacterial treatment installed	• High turbidity and E coli levels	• Bacterial treatment complies with current DWSNZ 2008 requirements; Chlorination and Ultra Violet Irradiation treatment installed.	Yes	Low (Rare x Minor)	N/A	N/A	N/A
T1.2	Insufficient protozoal treatment installed	• High turbidity and E coli levels	**PM1**: Turbidity monitored continuously at treatment plant; pump stop when turbidity exceeds set limits.	Partially	Extreme (Possible x Catastrophic)	**PM1:** Investigate and cost the installation of adequate filtration or alternative system to treat water quality prior to entering UV system. AND; Refurbish bore headworks according to DWSNZ 2008 (See S2.2) **PM2: Option 2:** Investigate options to relocate bore site and pump station to abstract water of better quality.	Medium (Rare x Moderate)	**PM1:** MTW / TL-WTP / AE / PE **PM2:** MTW / PM / SPP / TL-AM
T1.3	Insufficient chemical treatment installed	• Chemicals exceed set MAVs	• No priority 2 determinands assigned. **PM1:** Activities in the catchment giving rise to chemical contamination identified by carrying out a catchment risk assessment every 5 years.	Partially	High (Unlikely x Major)	**PM1:** Monitor changes in activities in the catchment and modify catchment risk assessment annually. **PM2:** Submit a catchment risk assessment to the DWA every 5 years for approval.	Medium (Rare x Moderate)	**PM1:** AE/TL-AM **PM2:** AE/TL-AM
T1.4	Other – Insufficient pH treatment	• pH below 7 or pH above 8.5	• No pH correction installed, water pH approximately 6.1. **PM1**: pH monitored continuously at treatment plant; pump stop when pH exceeds set limits. **PM2:** Plumbosolvency notice circulated among customers every 6 months.	Partially	High (Possible x Moderate)	**PM1:** Investigate options to install pH correction. **PM2G:** Inform wider community and consumers about the use of copper pipes and fittings (including lead jointing) for internal plumbing by circulating information flyer.	Low (Rare x Insignificant)	**PM1:** PM/TL-AM **PM2G:** M-PA / AE
T2: EVENT: INADEQUATE PROTECTION OF TREATMENT PLANT SITE AND EQUIPMENT								
T2.1	Damage to treatment plant equipment due to vandalism and/or vermin and animals.	• Visual damage to treatment equipment/electrical cables. • No signal or no readings received from equipment and/or equipment failure.	• Bore and treatment plant on same site, refer to S1.4. **PM1:** Treatment plant equipment situated in a locked wooden building and bore headworks in a locked wooden box. **PM2:** Rodent poison stations placed on site.	Yes	Low (Rare x Minor)	N/A	N/A	N/A
T3: EVENT: POWER FAILURE TO TREATMENT PLANT SITE AND EQUIPMENT								
T3.1	Power failure.	• Power failure alarms, Reduced or no flows.	• Bore and treatment plant on same site, refer to S1.2 and S1.3.	Partially	Extreme (Almost Certain x Moderate)	Bore and treatment plant on same site, refer to S1.2 and S1.3.	High (Almost	

Table 17: Treatment – Chlorination and Ultra Violet Irradiation

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
		• No signal or no readings received from equipment.	**PM1:** When treatment plant equipment do not read alarms are triggered.				Certain x Insignificant)	
T4: EVENT: INADEQUATE CALIBRATION/VERIFICATION, MAINTENANCE, PROCEDURES, SAMPLING, TRAINING								
T4.1	Inadequate calibration, verification and maintenance of treatment plant equipment.		All monitoring equipment (i.e. pH, turbidity, FAC, UV sensors) are verified weekly and calibrated yearly according to procedures set in the DWSNZ 2008. **PM1:** Routine maintenance of chlorination equipment (Dosing regulator, dosing pump, chlorine injector, booster pump) according to manufacture specifications. Routine maintenance of UV equipment: flow rate controller, wiping of lamps, sleeve and sensor.	Yes	Medium (Unlikely x Moderate)	**PM1:** Review and update calibration and maintenance procedures of treatment plan equipment and incorporate into Operations and Maintenance manual with appropriate Standard Operating Procedures (SOP).	Low (Rare x Insignificant)	**PM1:** TL-WTP / WTP-O
T4.2	Inadequate plant records and procedures		• A set of procedures are documented and plant records are maintained for equipment calibration/verification and site visits. • Not all procedures are made available at each treatment plant site.	Partially	High (Unlikely x Major)	**PM1:** Ensure all plant records such as manuals, drawings, procedures, emergency response plan, etc. are controlled documents within Council corporate record system and hard copy located at the Water Treatment Plant.	Medium (Rare x Moderate)	**PM1:** TL-WTP / WTP-O / TL-AS
T4.3	Inadequate/incorrect sampling		**PM1:** Sampling carried out according to DWSNZ 2008 requirements and schedule is set up on a spreadsheet that triggers any inadequacies in sampling frequency, intervals and days of the week. **PM2:** WDC treatment plant operators trained and aware of correct sampling procedures. **PM3:** MoH approved accredited labs carry out testing of samples. **PM4:** Transgressions and non –compliances followed up as per DWSNZ 2008 requirements.	Partially	Medium (Unlikely x Moderate)	**PM1:** Review internal procedures and develop robust schedule sampling regime. **PM2G:** Water Operator's Competence declaration have expired (to be carried out every 5 years, last carried out 2009) Arrangements for reassessment from DWA scheduled for August 2018.	Medium (Unlikely x Moderate)	**PM1:** TL-WTP/ WTP-O **PM2G**: TL-WTP/ WTP-O
T4.4	Inadequate training of staff		Annual budget set aside for training. **PM1:** Three treatment plant operators with national diploma certificate and one treatment plant operator on the way to completing the certificate.	Partially	High (Unlikely x Major)	**PM1G:** All treatment plant operators to complete appropriate qualification for water treatment plant. WDC to keep records of training and produce when requested.	Low (Rare x Minor)	**PM1G:** TL-WTP / WTP-O
CHLORINATION								
T5: EVENT: MICROBIOLOGICAL CONTAMINATION DUE TO INADEQUATE CHLORINATION								
T5.1	Dosing malfunction (Dosing regulator and/or dosing pump, chlorine injector)	• FAC concentration below 0.2 mg/l. • E coli detected in water leaving treatment plant.	**PM1:** Continuous FAC monitoring at treatment plant; alarm triggered outside normal operation range, plant shuts down if critical limits reached.	Yes	Low (Possible x Insignificant)	N/A	N/A	N/A

Table 17: Treatment – Chlorination and Ultra Violet Irradiation

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
			PM2: Routine maintenance of dosing regulator, dosing pump, chlorine injector.					
T5.2	Inadequate calibration of equipment (calibration of dosing regulator sensor)	• FAC concentration below 0.2 mg/l. • E coli detected in water leaving treatment plant.	**PM1**: Equipment verified weekly and calibrated yearly; manual checks on calibration as per DWSNZ 2008.	Yes	Low (Rare x Insignificant)	N/A	N/A	N/A
T5.3	Dosing regulator set point wrong or incorrect due to incorrect calculation	• FAC concentration below 0.2 mg/l. • E coli detected in water leaving treatment plant.	**PM1:** Continuous FAC monitoring at treatment plant; alarm triggered outside normal operation range, plant shuts down if critical limits reached.	Yes	Low (Possible x Insignificant)	N/A	N/A	N/A
T5.4	High chlorine demand and poor dose control	• FAC concentration below 0.2 mg/l. • E coli detected in water leaving treatment plant.	**PM1:** Continuous FAC monitoring at treatment plant; alarm triggered outside normal operation range, plant shuts down if critical limits reached. **PM2:** Frequency of testing increased during high water quality change periods e.g. rainfall, earthquakes. **PM3:** Water further treated with UV downstream.	Yes	Low (Possible x Insignificant)	N/A	N/A	N/A
T5.5	Chlorine supply exhausted	• FAC concentration below 0.2 mg/l. • E coli detected in water leaving treatment plant.	• A gas cylinder bottle weighs approximately 130kg which contains 70kg of chlorine gas. The cylinder is manually replaced once the weight reaches approximately 80kg (cylinders placed on a weighing scale and weekly weight recorded on board next to scales). • No chlorine cylinders stored on site. **PM1:** Continuous FAC monitoring at treatment plant; alarm triggered outside normal operation range, plant shuts down if critical limits reached. **PM2:** Water further treated with UV downstream.	Partially	Medium (Possible x Minor)	**PM1:** NIL - Install automatic chlorine changeover at site was considered but due to existing robust system it is deemed that the costs to install additional bottle not warranted.	Low (Unlikely x Minor)	N/A
T5.6	Inadequate chlorine supply from chlorine booster stations	• FAC concentration below 0.2 mg/l. • E coli detected in water leaving treatment plant.	• No chlorine booster stations in the reticulation system. **PM1:** FAC leaving treatment plant maintained at 0.8 mg/L which is sufficient to last through the distribution system. **PM2:** Manual FACE sampling in distribution system according to DWSNZ 2008.	Yes	Low (Rare x Insignificant)	N/A	N/A	N/A

Table 17: Treatment – Chlorination and Ultra Violet Irradiation

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
T6: EVENT: CHEMICAL CONTAMINATION DUE TO OVER CHLORINATION								
T6.1	Overchlorination due to dosing malfunction, inadequate calibration, dosing regulator set point wrong	• FAC concentration is more than 50% of its MAV.	**PM1:** Continuous FAC monitoring at treatment plant; alarm triggered outside normal operation range, plant shuts down if critical limits reached.	Yes	Low (Possible x Insignificant)	N/A	N/A	N/A
T7: EVENT: MICROBIOLOGICAL CONTAMINATION DUE TO INSUFFICIENT CHLORINE CONTACT TIME								
T7.1	Short circuiting or lack of contact tank	• FAC concentration below 0.2 mg/l. • E coli detected in water leaving treatment plant.	• No contact tank after chlorine injection. **PM1:** Manual FACE sampling in distribution system according to DWSNZ 2008.	Partially	High (Unlikely x Major)	**PM1:** Calculate if chlorine contact time of 30 minutes is achieved in reticulation and reservoirs before reaching first consumer **PM2:** If not install contact tank after chlorine injection. **PM3:** Review distribution sample points to ensure points of higher risks are covered and develop sampling point schedule (e.g. points furthest away from treatment plant, dead ends and points of low usage, points of high draw off, service reservoirs, old pipework, low pressure areas).	Low (Rare x Minor)	**PM1:** AE / TL-WTP **PM2:** AE / TL-AM / PM **PM3:** TL-WTP/TL-O/AE / TL-AM
T7.2	Connections off rising main	• FAC concentration below 0.2 mg/l. • E coli detected in water leaving treatment plant.	• No known connections off rising main.	Yes	Low (Rare x Insignificant)	N/A	N/A	N/A
ULTRA VIOLET IRRADIATION								
T8: EVENT: MICROBIOLOGICAL CONTAMINATION DUE TO INSUFFICIENT ULTRA VIOLET DOSE								
T8.1	Insufficient UV intensity at the required wavelength due to inadequate cleaning and maintenance of: UV lamp, lamp sleeve, UV sensor	• E.coli detected in water leaving treatment plant. • Scale formation on sleeve and lamp. • Alarms activated for low UV intensity.	**PM1:** UV lamps changed regularly and spare lamps available on site. **PM2:** Regular maintenance of UV unit carried out by WDC staff (clean lamp sleeve and UV sensor lense and lamp surface) **PM3:** Annual full service carried out by manufacturer i.e. new hose work, diaphragms and O rings replacement, etc. **PM4:** UV intensity continuously monitored by sensors on the lamps; alarm triggered outside normal operation range, plant shuts down if critical limits reached.	Yes	Low (Rare x Insignificant)	N/A	N/A	N/A

Table 17: Treatment – Chlorination and Ultra Violet Irradiation

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
T8.2	Insufficient exposure time to UV radiation due to poor flow rate control, incorrect dose calculation, or low water temperature.	• E.coli detected in water leaving treatment plant. • UV dose at wavelength of 240-290 nm is less than 400 J/m^2.	**PM1:** UV intensity continuously monitored by sensors on the lamps; alarm triggered outside normal operation range, plant shuts down if critical limits reached.	Partially	Medium (Unlikely x Moderate)	N/A	N/A	N/A
T8.3	Water quality control, i.e. Excessive colour, turbidity, temperature, water hardness		• No pre-treatment of water before entering UV system. **PM1:** pH and turbidity continuously monitored at treatment plant.	Partially	High (Possible x Moderate)	**PM1:** Investigate and install adequate filtration system to treat water quality entering UV system. **PM2:** Lower turbidity set points so plant cuts off if turbidity level has potential to give rise to inefficient treatment.	Low (Unlikely x Minor)	**PM1:** PM **PM2:** TL-WTP
T9: EVENT: MICROBIOLOGICAL CONTAMINATION DUE TO REVIVAL OF MICRO ORGANISMS								
T9.1	Revival of micro-organisms in the distribution system.	• E coli detected in the distribution system.	**PM1:** Network is chlorinated and FACE in the distribution system is sampled.	Yes	Low (Rare x Insignificant)	N/A	N/A	N/A

Table 18: Reservoirs

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
R1: EVENT: LOSS OF SUPPLY DUE TO INSUFFICIENT STORAGE								
R1.1	Insufficient storage capacity to store treated water for daily demand.	Treated water storage levels unacceptably low. Reservoir telemetry indicates loss in levels. Decreased or no flow, loss of pressure in the system.	**PM1:** 24 hr storage currently available	Yes	Low (Unlikely x Minor)	N/A	N/A	N/A
R2: EVENT: LOSS OF SUPPLY DUE TO STRUCTURAL FAILURE								
R2.1	Poor condition of reservoirs leading to leakages, collapse or loss of structural integrity.	Drop in reservoir levels do not match demand. Increased pump starts. Loss of supply. Insufficient pressure/flow for firefighting purposes.	**PM1:** Reservoir inspections carried out periodically. **PM2:** Steel roofs installed. **PM3:** Re-lined in 2010.	Partially	Medium (Rare x Moderate)	**PM1**: Replace timber reservoirs with concrete reservoirs. **PM2**: Carry out condition assessment of Timber reservoirs by 2019 and 5 yearly thereafter. **PM3**: Develop and implement a preventative maintenance programme for reservoirs.	Low (Rare x Minor)	**PM1**: SPP / AE / TL-AM / PM **PM2**: AE **PM3:** TL-AS / TL-O
R2.2	Vandalism to reservoir structure	Loss of supply. Insufficient pressure/flow for firefighting purposes.	• Reservoir site not fenced. **PM1:** Road access to reservoirs difficult to travel on. **PM2:** No ladder access to reservoirs on site. **PM3:** Hot-wired gates on access road.	Partially	Medium (Rare x Moderate)	**PM1**: Padlocked security fence to be installed at the reservoir site to restrict vehicle access and large animals.	Low (Rare x Minor)	**PM1**: N/A
R3: EVENT: LOSS OF SUPPLY DUE TO INSUFFICIENT SOURCE WATER								
R3.1	Insufficient storage capacity to store additional treated water due to seasonal variations in source.	Treated water storage levels unacceptably low. Insufficient pressure/flow for firefighting purposes. Reservoir telemetry indicates loss in levels.	No seasonal variations in source water at this site, therefore no additional storage required.	Yes	Low (Unlikely x Minor)	N/A	N/A	N/A
R4: EVENT: MICROBIAL AND/OR CHEMICAL CONTAMINATOIN OF STORED WATER								
R4.1	Access by animals/birds.	Visual evidence of animal and bird access i.e. feral animal droppings, birds' nests. Unexplained deterioration/change in water quality. FAC residual less than 0.2 mg/L and cannot be maintained and E. coli or	Unable to check mesh on overflow pipe, was told by WDC staff that the overflow is meshed at the exit from the reservoir. **PM1:** FACE residual tested. **PM2:** Reservoir site inspected once a month.	Partially	Extreme (Possible x Major)	**PM1:** Install a mesh on the overflow pipe both at reservoirs and contact tank. **PM2:** Carry out maintenance of the site as required to prevent breeding of vermin/animals	Medium (Unlikely x Moderate)	**PM1:** WTP-O **PM2:** WTP-O

Table 18: Reservoirs

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
		coliforms detected in 100 mL of water.						
R4.2	Vandalism and sabotage, staff access	Visual evidence of vandalism to reservoir structure, evidence of unauthorized human access (broken glass, bottles, rubbish). Unexplained deterioration/change in water quality. FAC residual less than 0.2 mg/L and cannot be maintained and E. coli or coliforms detected in 100 mL of water.	**PM1:** Road access to reservoirs difficult to travel on. **PM2:** No ladder access to reservoirs on site. **PM3:** Hot-wired gates on access road.	Partially	High (Unlikely x Major)	**PM1:** Padlocked security fence to be installed at the reservoir site to restrict vehicle access and large animals. **PM2:** Develop disinfection procedures for staff to follow during sampling.	Low (Unlikely x Minor)	**PM1: N/A** **PM2:** TL-O
R4.3	Sediment/slime accumulation and resuspension of accumulated sediment.	Visible slime/ sediment and customer complaints. FAC residual concentration less than 0.2 mg/L and E. coli or coliforms detected in 100 ml of water. High turbidity levels.	**PM1:** Reservoir inspections carried out in 2008 and 2015. **PM2:** FAC residual maintained, checked weekly **PM3**: Procedure for reservoir cleaning to include disinfection of equipment, appropriate isolation from network, minimising sediment stir up, etc.	Partially	Medium (Unlikely x Moderate)	**PM1:** Utilise Asset Management System to schedule and implement a CCTV inspection of reservoirs and vacuum cleaning programmes as required.	Low (Unlikely x Minor)	**PM1:** TL-AS / TL-O
R4.4	Entry of contaminants due to reservoir design	Deterioration of water quality following new installation. Change in water quality after rain events, increased turbidity.	**Site inspection wasn't carried out due to access issues.** **PM1:** Both reservoirs installed with steel roof. **PM2:** New liner installed in both reservoirs in 2010.	Partially	Medium (Unlikely x Moderate)	**PM1:** Re-configure reservoir pipework to operate the two reservoirs in series. Check asbuilts and carry out a trial run to ensure each reservoir can be isolated for cleaning or in case of contamination/loss of structural integrity. If not, install valving to achieve this.	Low (Rare x Insignificant)	**PM1**: AE / PE
R5: EVENT: INSUFFICIENT CHLORINE CONTACT TIME								
R5.1	Insufficient turnover (Short-circuiting)	E. coli or coliforms detected in 100 mL of water despite adequate FAC residual concentration.	No contact tank at treatment plant. Reservoirs connected in series.		Medium (Unlikely x Moderate)	**PM1:** Calculate if chlorine contact time of 30 minutes is achieved in reticulation and reservoirs before reaching first consumer. **PM2:** Install contact tank after chlorine injection if sufficient contact time not achieved.	Low (Rare x Insignificant)	**PM1:** AE / TL-AM **PM2:** AE / TL-AM / PM

Table 19: Distribution

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
D1: EVENT: MICROBIAL AND CHEMICAL CONTAMINATION DUE TO BACKFLOW INTO DISTRIBUTION NETWORK								
D1.1	Backflow from individual properties into the distribution system due to a pressure drop in the reticulated system/elevated pressure in individual premises, where the property has no/malfunctioning backflow prevention device.	• E. coli or coliforms detected in 100 mL water sample. • Unexplained fluctuations in chemical and microbiological water quality. • Customer complaints of gross contamination of tap water.	• Backflow prevention policy is currently being developed by WDC • Waimana not a fully metered scheme therefore not all residential connections fitted with dual check valves. • Testing of existing backflow preventers not currently carried out. • Domestic connections installed with dual check valves; during capital renewals projects and 'new connection' applications. • All new commercial and farm connections installed with backflow preventers adhering to NZ Building Code standards; triggered during building/ land use/ tradewaste consents or 'new connection' applications. Specific hydrants assigned for water withdrawal by contractors for ease of policing. Applications are made to the operations depot and water to be withdrawn using standpipes with fitted BFP device and water meter. **PM5G:** Operations department to discuss with building control department to include backflow prevention devices as part of the building control checklist when carrying out building inspections.	Partially	High (Unlikely x Major)	**PM1G**: Develop and implement a backflow prevention policy to match device to risk level of activity, including testing requirements of the devices. This has political ramifications and will be difficult to implement thus long lead in time. **PM2G:** Circulate educational material to customers, especially those considered high risk, about risks of backflow prevention and ways of minimising the risk. **PM3G:** Review policy for withdrawing water from hydrants; specify the use of standpipes fitted with approved backflow preventers. **PM4:** Install backflow prevention devices on all connections; priority given to connections identified as high risk. Dual check manifolds to be installed on residential connections as the scheme is not currently metered.	Medium (Possible x Minor)	**PM1G:** GM / MTW / M-PA /TL-AM **PM2G:** AE / M-PA **PM3G:** MTW / M-PA / AE / TL-O / TL-AM **PM4:** AE / TL-O / TL-AM
D2: EVENT: CHEMICAL AND MICROBIOLOGICAL CONTAMINATION DUE TO LACK OF ROUTINE MAINTENANCE								
D2.1	Poor circulation due to lack of hydrant and mains flushing programme.	• Accumulation of sediments in the system. • Parts of the distribution network containing water with low FAC.	• The current routine maintenance schedule is being reviewed by WDC. **PM1**: Flushing of dead ends in the network is currently being carried out in adhoc manner	Partially	Medium (Possible x Minor)	**PM1:** Carry out a routine maintenance plan for flushing of mains and hydrants with priority given to flushing dead ends and areas of poor circulation. **PM2G:** Utilise Asset Management System to schedule and monitor preventative maintenance.	Low (Rare x Insignificant)	**PM1:** TL-AS/TL-O **PM2G:** TL-AS

Table 19: Distribution

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
D2.2	Inability to isolate or shut down the system due to missing or failed valves.	• Dirty water • E Coli present • Aesthetic issues • Low/not enough FAC	**PM1:** Critical valves have been identified through a study carried out by OPUS in 2016.	Partially	Medium (Possible x Minor)	**PM1:** Carry out a routine maintenance plan for valve exercising with priority given to critical valves i.e. those supplying a large or critical customer base, valves on rising and falling mains and those used for bore and reservoir isolation. **PM2:** Undertake a programme of marking valve boxes for ease of location and to indicate whether they are open or closed. **PM3G:** Utilise Asset Management System to schedule and monitor preventative maintenance.	Low (Rare x Insignificant)	**PM1:** TL-AS / TL-O **PM2:** AE/TL-O **PM3G:** TL-AS / TL-O
D3: EVENT: LOSS OF SUPPLY AND CONTAMINATION OF SUPLY DUE TO LACK OF ROUTINE ASSET REPLACEMENT								
D3.1	Pipe, valve and hydrant failure due to age, condition and material of pipe.	• Low FAC.	• Currently reactive maintenance being carried out. **PM1**: AMP for 2017 is being prepared to identify condition of existing components of the scheme. **PM2:** Pipe sampling has been carried out in certain areas. **PM3:** New Asset Management System implement recording maintenance carried out and cost of maintenance per asset. **PM4:** Rising main was slip lined in 2015.	Partially	Medium (Possible x Minor)	**PM1G**: Develop asset renewals programme based on condition sampling and assessments, analysis of asset age, material, frequency of breakages and increase in maintenance costs. Asset renewals to prioritize critical assets such as rising mains/falling mains, pipes supplying a critical consumers or large consumer base, critical valves and hydrants. **PM2G**: Update water asset management plan as required and republish every 3 years.	Low (Rare x Insignificant)	**PM1G:** AE / TL-AM **PM2G:** TL-AM / AE
D4: EVENT: CONTAMINATION DUE TO PRESSURE FLUCTUATIONS IN THE SYSTEM								
D4.1	Pressure fluctuations in the system due to: pipe failure, accidental penetration by contractors and leaks in the system, major fire events, Low pressure areas (hills/ extremities).		**PM1:** GIS system for WDC reticulation network can be accessed online by public or contractors. **PM6G:** Procedures for third party contractors/developers that require them to obtain a Permit to Work before any work is carried out as part of resource consent. Only Council approved contractors to work on council reticulation.	Partially	High (Possible x Moderate)	**PM1**: Identify problem pressure areas by carrying out model network analysis coupled with customer complaint records. **PM2**: Carry out periodic hydrant testing exercises to test effects on pressure in the system. **PM3G**: Carry out a periodic water balance to identify levels of leakage in system. **PM4**: Once hydraulic models are completed and in-line with annual water balance calculations develop and implement leak detection programme **PM5G**: Develop and adopt internal procedure for maintaining an up-to-date Asset Management System and GIS system.	Low (Rare x Insignificant)	**PM1:** AE **PM2:** AE **PM3G:** AE **PM4:** AE **PM5G:** AE/TL-AM

Table 19: Distribution

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
D5: EVENT: CONTAMINATION AND LOSS OF SUPPLY DUE TO POOR PLANNING, INADEQUATE PROCEDURES AND INADEQUATE TRAINING								
D5.1	Poor planning of scheduled work carried out by WDC staff and their contractors.		**PM1**: Customer services department notified of work being carried out resulting in service disruption. **PM2**: Work carried out outside peak hours to ensure minimum disruption. **PM3:** Public announcements made on radio/ newspaper for major work. 24 hour letter drop notice given to smaller projects. Critical users (dialysis patients/hospitals) notified as a priority.	Partially	High (Possible x Moderate)	**PM1**: Where possible utilise WDC Asset Management System to maintain an up-to-date database of critical users such as dialysis patients/hospitals/businesses. Develop robust process for critical customer rating and updating data to maintain active list. **PM2G**: Develop and adopt internal procedure for maintaining an up-to-date Asset Management System and GIS system. **PM3G**: Maintain a systematic workflow procedure with control checks for the update of capital works arising from projects, subdivision work and daily replacements and renewals so that all paperwork is sent to the asset engineer for recording on Asset Management System and GIS.	Low (Rare x Insignificant)	**PM1:** TL-AM **PM2G:** TL-AM AE / TL-AM **PM3G:** AE/ TL-AM
D5.2	Inadequate operating Procedures.		**PM1:** Council has over 40 existing standard operations procedures which are currently being reviewed and updated by appropriate staff.	Partially	Medium (Possible x Minor)	**PM1G**: Review and update existing operating procedures for each process, items to be recorded and objectives of the process. **PM2**: Review and update existing disinfection procedures for WDC operations staff working on the water network; focus on preventing cross contamination when staff alternate on wastewater and water reticulation work.	Low (Rare x Insignificant)	**PM1G:** MTW/TL-WTP/WTP-O/TL-AS **PM2:** TL-WTP/TL-O/TL-AS
D5.3	Inadequate training of operations staff.		• Staff provided with relevant training. At least 4 staff hold or are working towards national certificate in water reticulation. • Tool box meetings carried out weekly.	Partially	Medium (Possible x Minor)	**PM1G**: Reticulation team members to obtain National Certificate in Water Reticulation.	Low (Rare x Insignificant)	**PM1G:** TL-O
D6: EVENT: CONTAMINATION AND LOSS OF SUPPLY DUE TO THIRD PARTY CONTRACTORS								
D6.1	Third party contractor/developers work on WDC reticulation (not directly engaged by WDC).		Some procedures currently in place however no recorded procedures or workflow. **PM1G**: implement procedures for third party contractors/developers that require them to obtain a Permit to Work before any work is carried out. **PM2G**: Contractors to submit disinfection procedures, Health and Safety plans, detailed design of work to be carried out **PM3G**: WDC to supervise subdivision work at critical stages such as pressure testing, disinfection, connection to the water main and backfilling, in the presence of the Engineer to the developer. Part of resource consent	Partially	Extreme (Possible x Major)	**PM4G**: WDC to develop policy and procedure whereby Third party contractors/developers are made liable for any damages to the network to increase accountability	Medium (Unlikely x Moderate)	**PM4G:** TL-O/AE/TL-AM

Appendix B: Waimana Scheme Process Control Summaries

Chlorination – Performance Parameters

The alarms for each control parameter are set to ensure appropriate corrective action is taken before the performance parameters reach critical limits. The Target Range, Action limits and Critical limits are set within a percentage of the Maximum Acceptable Values (MAVs) set by DWSNZ 2008 for each performance parameter (FAC, pH, Turbidity).

Table 20: Chlorination – DWSNZ 2008 Limits and Process Performance Parameters

Limits		Performance Parameters		
		FAC (mg/L)	pH (pH units)	Turbidity (NTU)
DWSNZ 2008 Monitoring Parameters		<0.20 mg/L for >2% of 1 day	Guideline: Between 7.0 and 8.0	<1.0 NTU for >5% of 1 day
		>5.00		<2.0 NTU for 3 minutes of 1 day
Target Range	Low Limit	0.80		-
	High Limit	0.90		-
Action Limits	Low Alarm	0.40	5.5	-
	High Alarm	1.90	7.5	1.00
Critical Limits	Low Low Alarm	0.30	5.0	-
	High High Alarm	2.00	8.0	2.00

Plant automatically shuts down when 'Critical Limits' are exceeded.

Chlorination – Triggers and Corrective Actions

Corrective actions to be taken when trigger limits are reached:

Table 21: Chlorination - Triggers and Corrective Actions

Limits	Triggers	Corrective Actions
Target Range	During day to day monitoring or inspection.	• Adjust chlorine dosing rate manually until target range is achieved.
Action Limits	Alarms	• Treatment Plant Operator to turn plant off by turning off the pump remotely and travel to site to carry out an inspection. • Carry out a site inspection to investigate reason for turbidity and/or pH and/or FAC outside action limits: – Check Turbidity meter/ Rotometer / pH meter for any mechanical problems e.g. a jammed rotometer. – Check if chlorine dosing is correct or if the chlorine supply exhausted. – Carry out manual tests to obtain turbidity, FAC and pH readings to verify against turbidity meter/ chlorine analyser/ pH meter readings to check equipment is operating correctly. – Sample to be collected manual for additional E. coli test. • Verify online instruments with calibrate field equipment as per the Water Treatment Plants SOP and/or the manufacturer's instructions. • Carry out a visual check of borehead, treatment plant equipment and surrounding site for signs of vandalism. Check around borehead area and vicinity for any visible signs of contamination. • Adjust chlorine dosing rate manually until target range is achieved. • Increase monitoring frequency. • Once problem is identified and resolved, remote in from laptop disable appropriate alarm and set up the plant to run automatically. Alarms to be reset once plant has settled and returned within normal target range of operation. • Log incident in the water treatment plant log book. • Record event details, manual test results any re-calibration information in the water treatment plant log book.

Table 21: Chlorination - Triggers and Corrective Actions		
Limits	**Triggers**	**Corrective Actions**
Critical Limits	Alarms and/or plant shut down.	***Plant automatically shuts down when critical limits are exceeded for FAC, pH and turbidity*** • Water Treatment Plant operator to notify Water Treatment Plant Team Leader and Water Treatment Plant Team Leader to notify Three Waters Manager. • Travel to site, inspect, test and verify as per 'Action Limits' above. • Supply of water to the reservoir to be stopped while performance parameters are in the critical limit range and scheme to be supplied with compliant stored water using emergency storage or backup/alternative supply. • Carry out contingency plan as per civil defence emergency appropriate to the scenario. • Carry out transgression sampling according to section 4.3.9 of the DWSNZ 2008. • Increase monitoring frequency. • If there is a requirement for the plant to supply water to the scheme whilst performance parameters are in the critical limit range carry out the following: – Obtain approval from TL-WTP, MTW and DWA before supplying water to the scheme that may not satisfy DWSNZ 2008 limits. – Isolate alarms in order to operate the plant. – Confirm conditions of continued operation with the DWA and carry them out (i.e. boil water notice etc.). – Reinstate alarms so that the plant runs automatically once performance parameters are back to Target Range. • WTP-O to complete an incident report for the event, and the TL-WTP to develop a full transgression report.

UV Irradiation – Performance Parameters

The alarms for each control parameter are set to ensure appropriate corrective action is taken before the performance parameters reach critical limits. The Target Range, Action limits and Critical limits are set within a percentage of the Maximum Acceptable Values (MAVs) set by DWSNZ 2008 for each performance parameter (Flow, UV(I), UV(T)).

Table 22: UV Irradiation - DWSNZ Limits and Process Performance Parameters

Limits		Performance Parameters				
		Turbidity	**UV Flow**	**UV Intensity**	**UV Transmittance**	**UV Alarm**
DWSNZ Monitoring Parameters (Section 5.16)		>1.0 NTU for >5% of 1 month	>32.46 m^3/hr (9.02 L/s) for >5% of 1 month	<103.5 W/m^2 for >5% of 1 month	<90.35 % for any sample	UV Dose <40 mJ/cm^2 for >5% of 1 month
		>2.0 NTU for any 3-minute period		<82.8 W/m^2 for any 3-minute period	5.16.1 (5.a.ii.B.) does not apply	UV Dose <32 mJ/cm^2 for any 3-minute period
					5.16.1 (5.a.ii.C.) does not apply	
Plant automatically shuts down when critical limits are reached.						
Target Range	**Low Limit**	-	-	>75 W/m^2	n/a – Not a CCP	-
	High Limit	0.50 NTU	16.84 m^3/hr	-		
Action Limits	**Low Alarm**	-	-	73 W/m^2		"Alarm"
	High Alarm	1.00 NTU	-	-		
Critical Limits	**Low Low Alarm**	-	-	**71 W/m^2**		**"Alarm"**
	High High Alarm	**2.00 NTU**	**>16.84m^3/hr**	-		
Plant automatically shuts down when critical limits are reached.						

UV Irradiation – Triggers and Corrective Actions

Corrective actions to be taken when trigger limits are reached:

Table 23: Ultraviolet (UV) - Triggers and Corrective Actions		
Limits	**Triggers**	**Corrective Actions**
Target Range	During day to day monitoring or inspection.	• Check reactor sensor and lamps during routine checking procedures. • Check UVT, turbidity and raw water quality.
Action Limits	During day to day monitoring or inspection.	• Treatment Plant Operator to turn plant off by turning off the pump remotely and travel to site to carry out an inspection. • If high turbidity, carry out a site inspection to investigate reason and rectify situation if possible: – Check Turbidity meter for any mechanical problems. – Carry out manual tests to obtain turbidity readings to verify against turbidity meter to check equipment is operating correctly. – Undertake manual test of field equipment against equipment calibrated at Whakatāne WTP as per the Water Treatment Plants SOP and/or the manufacturer's instructions. – Carry out a visual check of borehead, treatment plant equipment and surrounding site for signs of vandalism. Check around borehead area and vicinity for any visible signs of contamination. • Turn UV reactor to manual operation until plant has achieved normal range (monitored via SCADA). • Increase monitoring frequency. • Once problem is identified and where possible resolved, notify Water Treatment Plant Team Leader, Manager Three Waters and Drinking Water Assessor of transgression. • Log incident in the water treatment plant log book. • Record event details, manual test results any re-calibration information in the water treatment plant log book.

Table 23: Ultraviolet (UV) - Triggers and Corrective Actions		
Limits	**Triggers**	**Corrective Actions**
Critical Limits	Alarms and/or plant shut down.	***Plant automatically shuts down when critical limits are reached UV Intensity falls below 71 W/m²*** • Water Treatment Plant operator to notify Water Treatment Plant Team Leader and Water Treatment Plant Team Leader to notify Manager Three Waters. • Travel to site, inspect, test and verify as per 'Action Limits' above. • Carry out contingency plan as per civil defence emergency appropriate to the scenario. • Carry out transgression sampling according to section 4.3.9 of the DWSNZ 2008. • Increase monitoring frequency. • Supply of water to the scheme is stopped while performance parameters are in the critical limit range. • If there is a requirement for the plant to supply water to the scheme whilst performance parameters are in the critical limit range carry out the following: – Obtain approval from TL-WTP, MTW and DWA before supplying water to the scheme that may not satisfy DWSNZ 2008 limits. – Isolate alarms in order to operate the plant. – Issue a boil water notice when indicated by DWA – Reinstate alarms so that the plant runs automatically once performance parameters are back to Target Range. • WTP-O to complete an incident report for the event, and the TL -WTP to develop a full transgression report.

Appendix C: Waimana Scheme Localised Groundwater Capture Zone

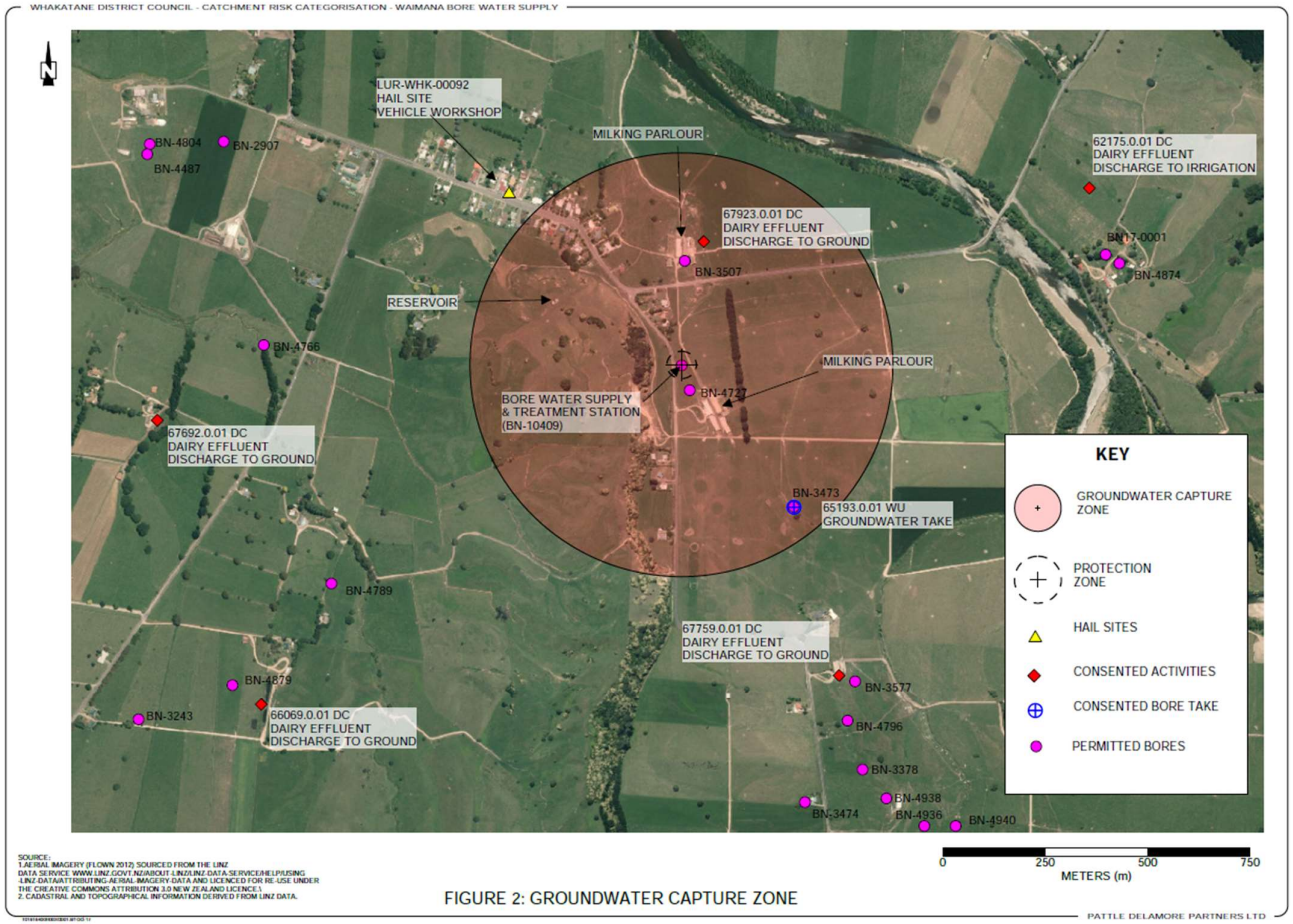


FIGURE 2: GROUNDWATER CAPTURE ZONE

Appendix D: Improvement Plan – Completed Projects

Table 24: Improvement Plan – Completed Items

Priority	Risk Table No.	Area of Work	Work To be Implemented	Responsibility	Comment	Date
Medium	**S2.2 (PM1)**	**Bore head Security**	Stock fence to be taken out to the minimum recommended 5 metres from the centre of the bore head on all sides or to 10 metres if practical due to high grazing intensity around the water source. (Ten Metres achieved)	TL-AM	completed	November 2017
Low	**D4.1 (PM6G) D6.1 (PM1G)**	**Third party contractor/developer work on WDC reticulation (not directly engaged by WDC)**	Develop and implement procedures for third party contractors/developers that require them to obtain a Permit to Work before any work is carried out. Part of engineering approval - Only Council approved contractors to work on council reticulation.	Contractors and AE / PE	Implemented	March 2018
High	**D6.1 (PM2G)**	**Third party contractor/developer work on WDC reticulation (not directly engaged by WDC)**	This is part of engagement of contractors. Contractors to submit disinfection procedures, Health and Safety plans, detailed design of work to be carried out and communications plan for affected customers to the relevant WDC staff for approval before work is carried out.	Contractors and AE / PE	Implemented	March 2018
High	**D6.1 (PM3G)**	**Third party contractor/developer work on WDC reticulation (not directly engaged by WDC)**	WDC to develop process for subdivision works at critical stages such as design, construction, testing and connection to the live reticulation system in the presence of the Engineer to the developer.	Contractors and AE / PE	Implemented	March 2018
Medium	**S2.1 (PM8) S3.1 (PM2)**	**Managing activities in the catchment**	WDC to liaise with BOPRC as follows:	Business as usual with	implemented	March 2018

Table 24: Improvement Plan – Completed Items						
Priority	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Comment**	**Date**
			1) BOPRC to inform WDC of new discharge consents to the recharge zone (Tauranga river catchment and 540 metre groundwater capture zone) and WDC to provide comments on these consents. 2) WDC to send BOPRC submissions opposing new applications for septic tanks within 540 metre groundwater capture zone.	resource consents		
Low	**D3.1 (PM3G)**	**Pipe, valve and hydrant failure due to age, condition and material of pipe**	Record condition of asset, maintenance carried out and cost of maintenance against each asset on the Asset Management System during routine maintenance/repair programmes in order to utilise this information in asset renewal programmes.	TL-AM / TL-O	Implemented with new Asset Management System	March 2018
High	**R4.2**	**Vandalism and sabotage, staff access**	Develop disinfection procedures for staff to follow during sampling.	TL-O	implemented	Assessed every 5 years by DWA (next assessment 2018)
Medium	**T4.3 (PM1)**	**Inadequate/incorrect sampling**	Review treatment plant sampling spreadsheet periodically for anomalies.	TL-WTP	completed	June 2018
High	**T7.1 (PM3)**	**Short circuiting or lack of contact tank**	Review distribution sample points to ensure points of higher risks are covered and develop sampling point schedule (e.g. points furthest away from treatment plant, dead ends and points of low usage, points of high draw off, service reservoirs, old pipework, low pressure areas).	TL-WTP/TL-O/AE / TL-AM	completed	July 2018

Table 24: Improvement Plan – Completed Items						
Priority	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Comment**	**Date**
Low	**D1.1 (PM5G)**	**Contamination from backflow**	Operations department to discuss with building control department to include backflow prevention devices as part of the building control checklist when carrying out building inspections.	AE / TL-AM	Discussions held - Part of building inspection process	July 2018

Appendix E: Protozoal log credit assignation

Toi Te Ora Public Health
PO Box 2120
TAURANGA 3140

10 July 2018

Tomasz Krawczyk
Manager Three Waters
Whakatane District Council
Tomasz.Krawczyk@whakatane.govt.nz

Dear Tomasz

Waimana Plant (TP00327): Protozoal log credit requirement assignation- amended June 2018.

Whakatane District Council (WDC) has requested the DWA reconsider the log credit assignation based upon the research findings detailed in the *Gastrointestinal Protozoa, Research and Services reports for the New Zealand Ministry of Health'* study.

Previously WDC had nominated to use a catchment risk category approach as per section 10, table 10.1 of the Drinking-water Standards for New Zealand 2005 (Revised 2008) (DWSNZ) and provided the Pattle Delamore Partners Catchment Risk Assessment for Waimana Bore Water Supply, Whakatane District Council, Dec 2017 (T01616400R002)

The Survey method and information presented in the catchment risk assessment (CRA) is acceptable for determining the protozoal log credit requirements and to inform the water safety plan. The CRA stipulated a log credit of 4 and this was accepted by the DWA.

However, the Ministry of Health research findings indicate that a log credit of 3 is most appropriate for shallow groundwater/spring sources.

Therefore, based on the CRA and the Ministry of Health research findings the log credit requirement assigned to the Waimana Plant is 3.

The CRA identifies a number of recommendations that are expected to be addressed in the pending water safety plan.

The Drinking Water Online database will be updated to reflect that the Waimana Plant requires a minimum 3 log protozoa treatment.

If you have any questions about this assessment please contact me 07 577 3788.

Yours sincerely,
Grant King

Phone us on 0800 221 555 • enquiries@toiteora.govt.nz • **www.toiteora.govt.nz**

Drinking Water Assessor
Central North Island Drinking-water Assessment Unit – Toi Te Ora

cc: Leilani.Salanguit@whakatane.govt.nz
Michael.VanTilburg@whakatane.govt.nz
Diana.Kim@whakatane.govt.nz

Appendix F: Report on adequacy of a Drinking Water Supply's Water Safety Plan

CNIDWAU
Central North Island Drinking Water Assessment Unit

IANZ
ACCREDITED INSPECTION BODY

Report on adequacy of a Drinking Water Supply's Water Safety Plan

Drinking Water Supply
Waimana Public Water Supply

Central North Island Drinking Water Assessment Unit – Toi Te Ora
PO Box 2120
Tauranga 3110

Report Identifier
WAI017_Waimana_WSPadequacy_070918_v1

Executive Summary

Water Safety planning is internationally recognised as the most effective means of consistently ensuring the safety of a drinking-water supply Six principles underpin the foundation of effective water safety planning:

1. A high standard of care must be embraced
2. Protection of source water is of paramount importance
3. Maintain multiple barriers against contamination
4. Change precedes contamination
5. Suppliers must own the safety of drinking water
6. Apply a preventive risk management approach

Please be aware that under the Health Act, this water supply is not legally required to have an approved WSP. The supplier must however take all practicable steps to comply with the Drinking Water Standards for New Zealand under Section 69V. If a decision has been made to seek compliance under Section 10 of the Drinking Water Standards, having an approved and implemented water safety plan is a mandatory requirement. In some cases a Medical Officer of Health can require a small, neighbourhood or temporary drinking water supply to prepare and implement a water safety plan (under Section 69ZA).

Recommendations – These are areas of the WSP where suggestions for improvement have been made that are not mandatory requirements. They do not affect approval of the plan.

The Waimana public water supply - Water Safety Plan (WSP) comprehensively sets out details of the water supply including descriptions, control points and critical control points, risk identification and assessment information, planned improvements, and corrective actions and contingency plans. Whakatane District Council's (WDC) adoption of a more comprehensive approach to water safety planning is commendable and acknowledged by the Bay of Plenty and Lakes District Health Boards.

The WSP for the Waimana public water supply has been approved with 14 recommendations.

Description of drinking water supply

The WSP describes a WDC owned and operated public water supply consisting of a shallow bore water source with a groundwater capture zone that includes intensive dairy farming. Treatment consists of gas chlorine and UV disinfection. Chlorine residual disinfection is maintained in the reticulation. Storage consists of two 91 m^3 timber reservoirs. The population supplied is approximately 160 people. Known connections commercial connections are metered and a backflow prevention device. Residential connections do not have a backflow prevention device. The source and treatment plant are at risk in the event of a significant flood.

Adequacy of risk assessment methodology

Risk assessment methodology is based on a mixture of Ministry of Health Guides and the AS/NZS 4360:1999 standard. The methodology, scope and description of the water supply, including identification and description of critical point and critical control points is adequate.

Adequacy of risk identification and analysis

The population listed in table 2 is apparently derived from the drinking-water register. The water supplier is required under the Health Act to keep their registered water supply details, including population, up to date.

Recommendation 1: Evaluate the supplied population and complete a WS01 registration form if the population of the Waimana (or any other WDC) public water supply has significantly changed.

Public health risks are largely adequately identified and analysed. However, several references are made to the Drinking-water Standards for New Zealand 2005 revised 2008 (DWSNZ) Maximum Acceptable Values (MAV) (See plan sections S2.1, S3.2, S3.5, T1.3, R4.4). It is not obvious what general chemical monitoring has been undertaken or what is regularly undertaken, except for the 5 yearly pesticide suite referenced in the improvement schedule. It may be that general water chemistry is analysed currently but this is not set out in the water safety plan. This also includes the assessment and monitoring of disinfection by-products.

Recommendation 2: Evaluate what general chemical testing should be done, where and at what frequency.

The pH value of the water is described as being around 6 (see T1.4). This is outside the guideline value and is associated with increased risk of corrosion and dissolution of metals from reticulation construction materials and a building's plumbing fixtures that can be a health concern. Reference is made in the improvement schedule to investigate pH correction in April 2020 and "inform wider community and consumers about the use of copper pipes and fittings (including lead jointing) for internal plumbing by circulating information flyer and notification on Council Website".

It is acknowledged that the investigation into pH correction is associated with alternative water source investigations and council's long term planning but it is recommended that the education activity be completed as soon as possible.

Recommendation 3: Complete plumbosolvency education activity as soon as possible.

Adequacy of control measures (including Critical Points and Critical Control Points)

Preventative or control measures have been identified for most public health risks/events and are considered to be adequate. However, several areas were lacking in detail or not sufficiently covered.

Preventative measures around checks and maintenance (including scope, schedule and recording) of bore heads (S1.3), treatment instruments (including spare parts and critical spares T4.1)), and reservoirs (R2.1) is referred to in the water safety plan but it is not adequately detailed. WDC have advised verbally that these items are either largely in place or in development as part of the improvement schedule item for operational procedures.

The checking and verification of supply processes after significant events or changes such as, near misses, weather events, or the return to business as usual after planned works or significant reactive maintenance should also be considered in the development of operational procedures.

Recommendation 4: Ensure procedures, that are under development, adequately cover (including scope, schedule and recording) the bore head, treatment instruments, and reservoir checks and maintenance that are referred to in the water safety plan.

Staff training and monitoring is referred to in the water safety plan but staff training is limited to improvement schedule items relating to operators being suitably qualified or relating only to reticulation operations (T4.4, D5.3). Training and competency assessment of operators in equipment operation and monitoring is listed as a supporting programme to the CCPs. Improvements are included around procedures but it is not clear how WDC ensures operators are competent. It is recommended that, for critical points, WDC has a system of ensuring staff are competent e.g., recording systems for formal training undertaken, and agreement and signoff on operational procedures.

Recommendation 5: Develop a training and competency system relating to critical point operations.

Reference is also made to "Staff to be tested for water borne diseases" (R4.2). The context or process around this is not detailed. It is recommended that this is further assessed and documented in the proposed "disinfection procedures for WDC operations staff working on the water network; focus on preventing cross contamination when staff alternate".

Recommendation 6: Assess and document the details around the proposed testing of staff for water borne diseases within the proposed disinfection procedures.

The risk items relating to inadequate calibration, verification and maintenance of treatment plant equipment (T4.1, T5.1) incorrectly reference weekly verification and yearly calibration.

Recommendation 7: Amend risk tables to be more general to accurately reflect that different methods have different timeframes e.g., some are three months or six months or defined by the manufacturer.

The water safety plan doesn't make reference to UV lamp breakage as a risk or what preventative or corrective actions are in place to manage this. WDC have verbally communicated that such procedures are in place, therefore they need to be included or referenced in the water safety plan.

Recommendation 8: Include preventative measures for UV lamp breakages and include or make reference to corrective actions in response to UV lamp breakages.

Proposed preventative measure (T5.5) This was later reviewed and not considered necessary. However, the risk table (T5.5) should be amended as this review is not in itself a preventative measure and not all preventative measures are included (WDC verbally communicated that spare cylinders were able to be obtained from nearby supplies).

Recommendation 9: Amend the error in the risk table and consider adding that chlorine cylinders can be obtained at short notice.

For the event chemical contamination due to over chlorination the only preventative measure is alarming and automatic shutdown (T6.1). While this is best practice and a critical control point, the relatively common occurrence of treatment plant chemical overdosing around the country has been demonstrated to occur despite alarms and automatic shut downs being in place. It is important for site-specific assessments be made to ensure that all practical physical, mechanical, electrical and personnel barriers are in place to reduce the risk of treatment plant chemical overdosing, in particular to prevent syphoning.

Recommendation 10: Review chemical dosing processes to ensure that all practical physical, mechanical, electrical and personnel barriers are in place to reduce the risk of treatment plant chemical overdosing

Improvement schedule table 13, priority number 11 regarding liaison with Regional Council and groundwater monitoring results could also consider what backflow preventative measures are in place on bores that are likely to be abstracting water from within the same ground water capture zone as the Waimana water supply bore.

Recommendation 11: Consider what investigation and action can be undertaken with regards to backflow prevention on bores that are likely to be abstracting water from within the same ground water capture zone as the Waimana water supply bore. This was raised as a recommendation in the Catchment Risk Assessment.

The event Discharge/leachate/runoff from the following activities in the catchment Risk (S3.1) includes the proposed preventative measure (PM1) for WDC to liaise with pesticide application companies and make them aware of locations of water sources, and to be informed of pesticide drops in vicinity of water source. However, this does not appear in the improvement schedule and does not appear to be explicitly included in another improvement item.

Recommend 12: Include this proposed preventative measure in the improvement schedule similar to the Rūātoki WSP.

The identification and monitoring in relation to critical points and critical control points is considered adequate.

Corrective actions are not included in the risk tables against every event but are detailed for transgressions and monitoring equipment failure in the critical control point process summaries. The contingency plans also have some corrective actions.

Contingency plans are included for typical major events. WDC have communicated verbally that a council-wide incident response plan is in place and this includes roles and responsibilities and communication strategies. It is recommended that water safety plans have (or make reference to) adequate emergency response plans covering major events and natural disasters and adequately address communication with the public, emergency alternative treatment, water conservation and alternative water sources and distribution.

At an operational level, response plans could include supply-specific flushing plans for use during the event of a treatment plant chemical overdosing and noting the risk to customers near to treatment plants and the water delivery times to those connections.

Recommendation 13: Review the WDC incident response plan to ensure it adequate for drinking-water emergencies and formally reference it in the water safety plan.

Recommendation 14: Consider developing supply-specific flushing plans.

Adequacy of improvement schedule

An improvement schedule is included and appears to be aimed at addressing preventative measures, monitoring or corrective actions that are currently absent or ineffective. Many improvement schedule items cover multiple council-owned water supplies. The scope and detail of the improvement item is considered adequate.

Decision

WSP for Waimana public water supply has been approved.

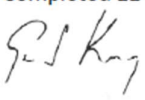
It is expected that the water supplier begin to implement this WSP within one month. The WSP approval remains in force for a maximum period of five years (earlier if otherwise stated in the WSP). Please be aware that if significant changes are made to either the processes used to treat water or to the raw water source, the WSP must be revised and re-submitted for approval by a drinking water assessor.

Information in this report will be provided to the Ministry of Health (in accordance with requirements of Section 69ZZZB of the Health Act).

Attachments

Nil.

Completed 11 September 2018



Grant King
Drinking Water Assessor
Central North Island Drinking Water Assessment Service – Toi Te Ora

Assessment Report Information

Report identifier	WAI017_Waimana_WSPadequacy_070918_v1
Drinking Water Assessment Unit (Inspection Body)	Central North Island Drinking Water Assessment Unit – Toi Te Ora PO Box 2120 Tauranga 3110 07 5773788
District Health Board	Bay of Plenty District Health Board
Drinking Water Assessor	Grant King
Assessment Date	07 September 2018
Description of assessment work	Assessment of adequacy of Water Safety Plan for: Supply: WAI017 Waimana Zone: WAI017WA Waimana Plant: TP00327 Waimana Plant Source: G00223 Waimana Bore
Equipment Used	Drinking Water Online Database.
Water Supply Owner / Person Responsible	Whakatane District Council Tomasz Krawczyk , Manager Three Waters
Assessment method	Standard assessment as per Scope Procedure 3 Standard specified in Health Act 1956
Documents and Information	• Drinking Water Standards for New Zealand 2005 (revised 2008) • Waimana Public Water Supply –Water Safety Plan Draft Version 1.03, August 2018 T01616400R010 WSP Waimana_Final.docx WDC OBJECTIVE FILE A1249157 • Catchment Risk Assessment for Waimana Bore Water Supply, Whakatane District Council, Dec 2017 (T01616400R002)
Site of Assessment	Toi Te Ora, 510 Cameron road, Tauranga
Omissions from proposed assessment	Nil.
Sub-contracted work	Nil.
Document checked by:	IANZ Accredited Drinking Water Assessor Date:12/09/2018
Release of report authorised by:	Grant King IANZ Accredited Drinking Water Assessor Signature: G J King Date: 13/09/2018

If you do not agree with the findings of this report a written appeal must be lodged with the Technical Manager, Peter Wood, PO Box 11036, Palmerston North 4440, within 2 months of receipt of this report. The Technical Manager will arrange for a review to be undertaken using the Ministry of Health appeals procedure.