Tāneatua 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

- Version 1.05, December 2018

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Quality Control Sheet

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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 'Tāneatua Water Supply Public Health Risk Management Plan, V2' (2007) document for the Tāneatua Public Water Supply Scheme (Tāneatua 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 Tāneatua 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 Tāneatua 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 for preparation of Water Safety Plans. Information used in this report was gathered from documents and reports belonging to the Whakatāne District Council, during site visits carried out by PDP to the Tāneatua water treatment plant, pump station and reservoir sites, and during a consultation workshop with WDC staff. Contributors to this report are listed in Section 11.0.

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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	12/11/2018
1.04	Modification after email from DWA, typo's, UV lamp breakages SOP details, minor details. Resubmit to Drinking Water Assessor	WDC	30/11/2018
1.05	Approved by DWA and Report on adequacy of a Drinking Water Supply's Water Safety Plan	Toi Te Ora	5/12/2018

The Health (Drinking Water) Amendment Act 2007 requires drinking-water suppliers providing drinking water to over 500 people to develop and implement WSPs.

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 the WSP is a live document and should be updated as required; it is therefore recommended that WDC revise and

resubmit this WSP if there are significant changes to the operations or risks to the Tāneatua 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 Tāneatua Bore Water Supply Scheme, Whakatāne District Council' report (PDP, September 2017).

2.0 Supply Summary

Table 2: Tāneatua Scheme Summary	
Supply Details	
Supply Name	Tāneatua Community Water Supply
WINZ Community Code	TAN001
Supply Owner	Whakatāne District Council
General Manager Infrastructure	David Bewley
Manager Three Waters	Tomasz Krawczyk

Table 2: Tāneatua 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[1]	786 People
Number of Connections[2]	282 Connections
Source Details	
WINZ Source Code	G00218
Type of Source	Two shallow bores (Each approximately 18 metres deep cased to 9 metres)
Consent No.	21044
Consent Expiry	01/10/2026
Maximum Consented water take:	805 m^3/d
Map Reference (NZTM 2000)	2863309 E, 6339742 N
Treatment Details	
WINZ TP code	TP00321
Treatment Processes	UV, Chlorination
Average Daily Demand (July 2015 – June 2018)[3]	586 m^3/day
Peak Daily Demand (July 2015 – June 2018)[3]	1,096 m^3/day (High demand attributed to rising main break, December 2017)
Distribution Details	
WINZ Distribution Zone Code	TAN001TA
Distribution Zone materials	46% Asbestos Cement (AC) and 54% Polyvinyl Chloride (PVC)

[1] 2013 Census – Statistics New Zealand. Information based on Whakatāne District data
[2] WDC Correspondence, September 2017.
[3] WDC Tāneatua Water Returns for period July 2015 – June 2018.

3.0 Introduction

The Tāneatua Scheme is owned and operated by WDC and supplies a population of approximately 790 people. The water is sourced from two bores 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 at Valley Road, Whakatāne and travel to the Tāneatua 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

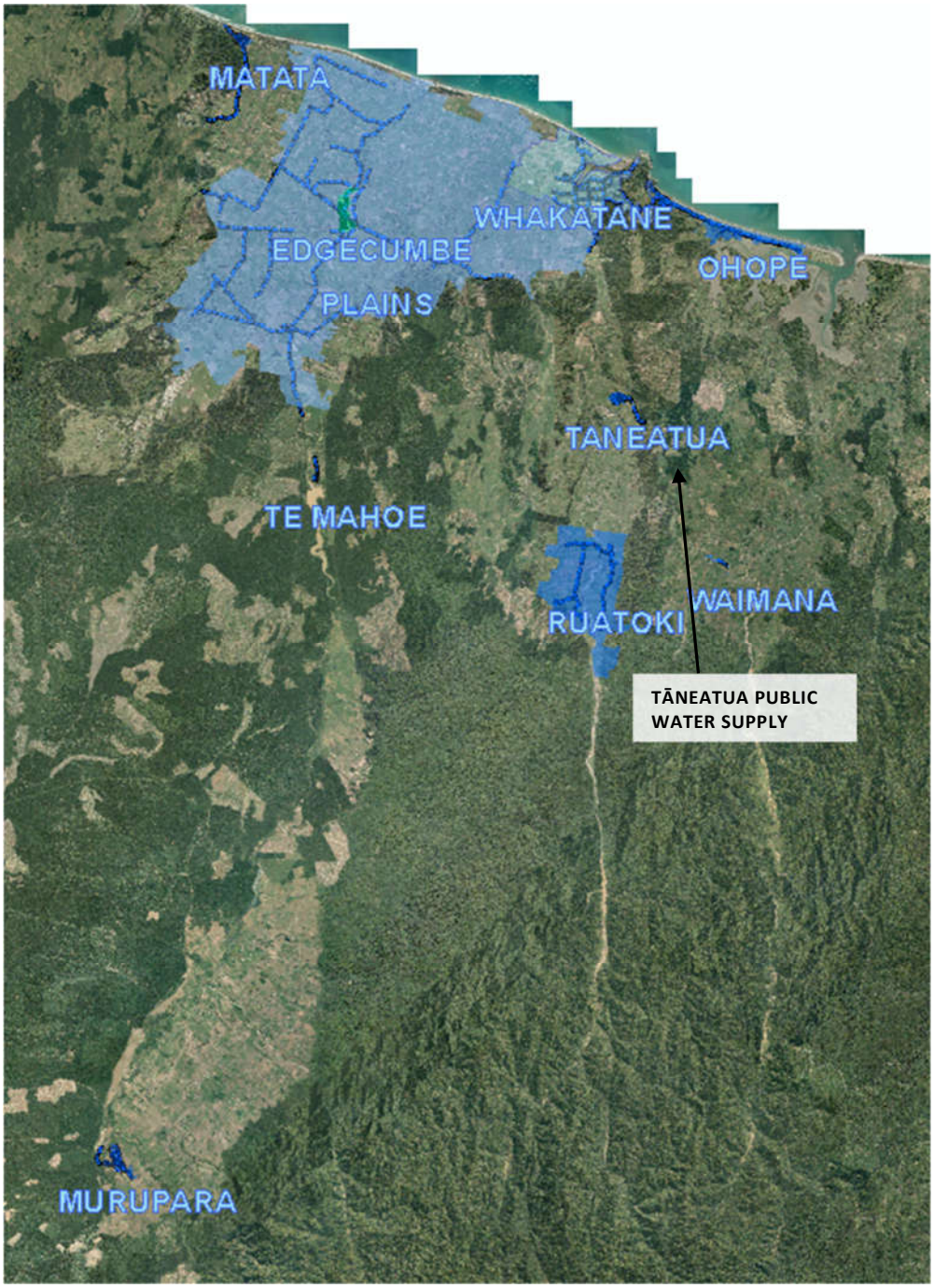


Figure 1: Whakatāne District

4.0 Description of the Tāneatua Water Supply

4.1 Scheme Details

The Tāneatua water supply scheme was established in 1964 and is owned and operated by the WDC. The scheme supplies all residents within the Tāneatua water supply scheme boundary and has 282 connections serving an estimated population of 790 people. The water treatment plant, reservoir and reticulation infrastructure of Tāneatua is considered sufficient to meet projected demand up to the year 2025.

The supply is predominantly unmetered with just 28 commercial and high-use consumer connections being metered including the following: a school, swimming pool, Te Kōhanga reo, service station, Bakehouse café and food-processing factory (Zealpak).

The average daily demand and maximum peak demand between July 2015 - June 2018 was 586 m^3/day and 1,096 m^3/day High demand attributed to rising main break, December 2017 respectively.

The Bay of Plenty Regional Council (BOPRC) administers the water take consent for the scheme and the maximum consented take for the supply is 805 m^3/day. The consent (Consent Number 21044) expires in 2026 whereby a new water take resource consent will be required.

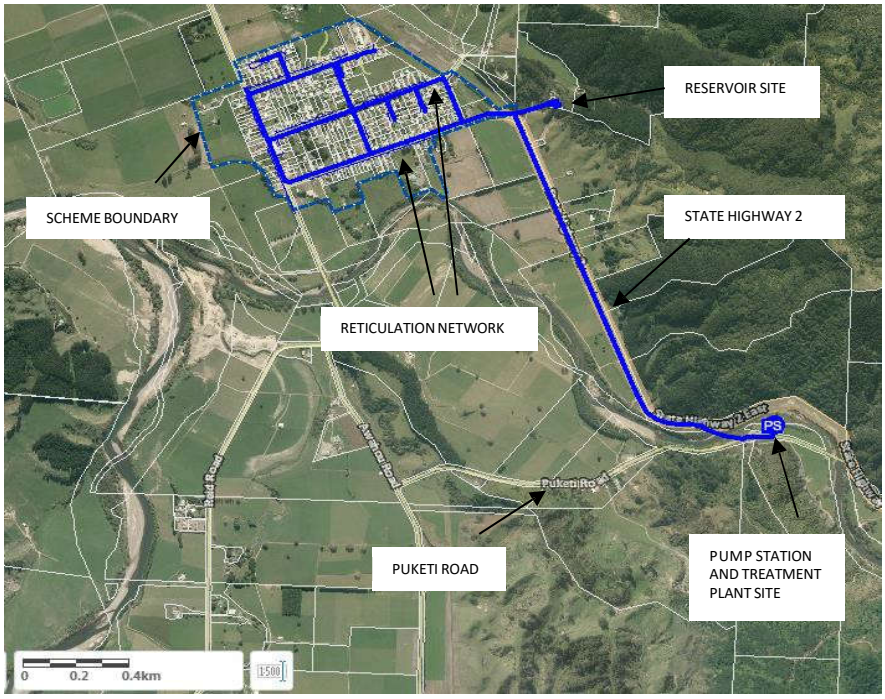


Figure 2: Tāneatua Water Supply Scheme

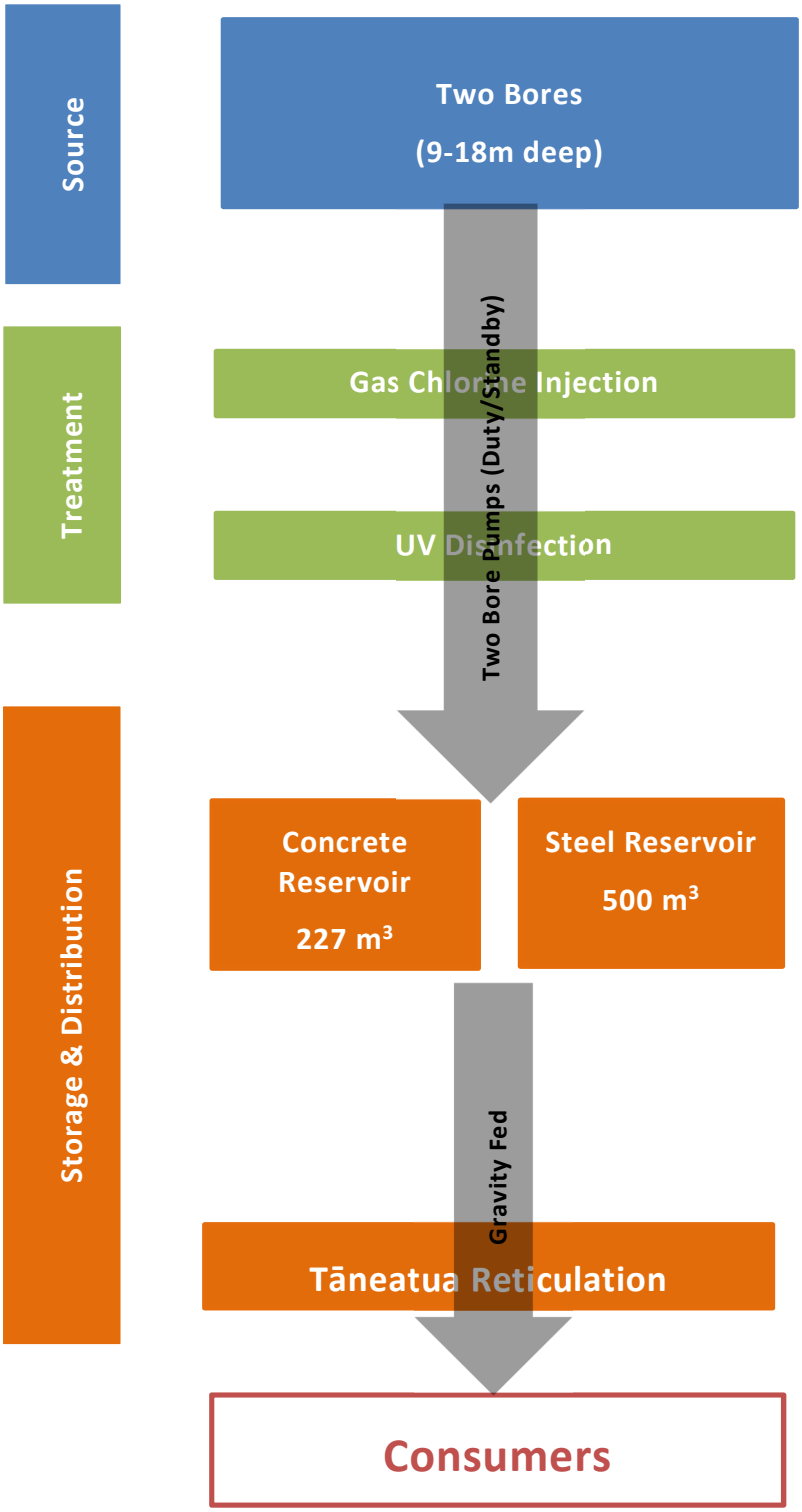


Figure 3: Schematic of Tāneatua Water Supply Scheme

4.1.1 Water Source and Catchment

Water is abstracted from two shallow bores located at the pump station/treatment plant site on Puketi Road that is located on the bank of the Tauranga River (formerly known as Waimana River). The bores are cased to approximately 9 metres below ground level (m bgl) and believed to be drilled to a total depth of over 18 m bgl[4].

A catchment risk assessment (CRA) carried out in September 2017 has determined that the bores recharge primarily from the Tauranga River through the hydraulically connected gravel aquifer; therefore, raw water quality is believed to be largely influenced by surface water changes from activities carried out in the upstream Tauranga River catchment. High permeability of the surrounding soil has also indicated some secondary recharge of the bores through groundwater seepage. A localised groundwater capture zone of 400 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.

No consented discharges or HAIL activities are present within the groundwater capture zone. Further information on the activities within the Tauranga river catchment and localised groundwater capture zone can be found in the 'Catchment Risk Assessment for Tāneatua Bore Water Supply Scheme, Whakatāne District Council' report (PDP, September 2017).

Figure 4: Bore Heads, Electrical Cabinet at Pump Station/Treatment Plant Site

[4] Determined during maintenance of the pumps, WDC correspondence, August 2017.

A single submersible pump is located in each bore, with each bore pump operating on a duty/standby basis. This enables one bore to be utilised while the other is undergoing maintenance. The submersible pumps pump water from the bores through the water treatment plant and to the storage reservoirs. There are no booster pumps in the system.

Power supply to the site is highly irregular due to problems with the transformer supplying the area that is maintained by Horizon Networks, an independent power supplier; as a result, Council has no control over power supply disruptions. During prolonged power outages, a temporary generator is rented via a local contractor to power the bore pumps and water treatment plant.

The pump station/treatment plant site has no previous history of flooding. However, it is situated about 1.8-2.0 metres below the modelled 1% AEP flood level[5] and is therefore considered vulnerable to flooding. Access to the site has been restricted in the past due to flooding. Further to this, during the treatment plant site inspection (carried out by PDP, June 2017), access to the site was severely restricted due to the collapse of the river bank, rendering the road inaccessible to vehicles. However, at the time of writing this report, the road had been strengthened and vehicle access to the site restored[6].

Tankered water has been used as a contingency during loss of supply events in the past. However, the scarcity of authorised water tanker within the district has made this option quite costly to undertake. As a result, the Tāneatua scheme faces a high risk of loss of supply for prolonged periods.

Figure 5: Bore Heads and Electrical Cabinet

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

[6] WDC Correspondence, 14 March 2018.

4.1.2 Treatment

The treatment plant is located on the same site as the pump station and consists of gas chlorination and UV 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)[7].

Protozoa Compliance: The protozoa treatment required was changed from a log credit of 3 to a log credit of 4 by the DWA in January 2018, further to the catchment risk categorisation carried out in September 2017[8], 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 the treatment plant requires an additional filtration process to be incorporated into the existing treatment process.

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

A gas cylinder bottle weighs approximately 130kg which contains 70kg of chlorine gas. A cylinder sits on a scale and once this is depleted there is an automatic switch over to a spare cylinder stored on-site. Only one set of scales are at this treatment plant and once auto changeover has occurred, the treatment plant operator moves the cylinder onto the scales and a replenished cylinder is installed.

Chlorine dose rate is set manually and there is no automatic flow proportional or water quality proportional dosing. Chlorine residual (Free Available Chlorine, (FAC)) leaving the treatment plant is monitored continuously and when it 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.

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

[8] Catchment Risk Assessment for Tāneatua Bore Water Supply, PDP September 2017.

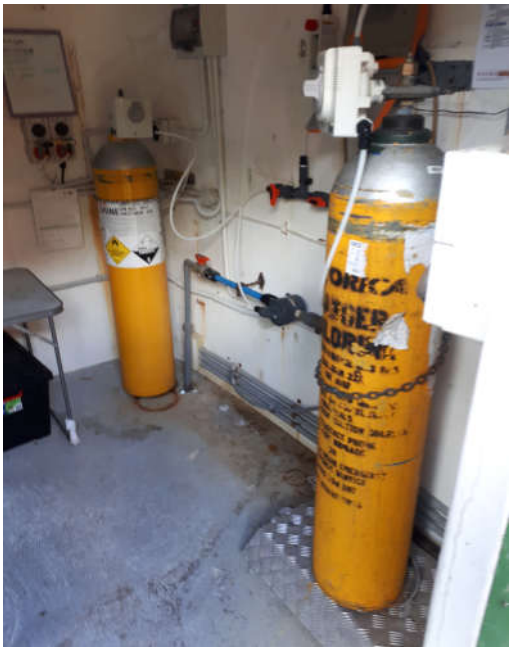


Figure 6: Chlorine Cylinders at Treatment Plant

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. Current the water treatment system monitors flowrate, turbidity, and UV(T) and adjusts the UV(I) accordingly. No pre-treatment of water is carried out before entry into the UV disinfection unit. If turbidity exceeds set limits the bore pump stops and no water is delivered to the UV disinfection unit. The UV disinfection unit is maintained regularly by cleaning lamp sleeve(s), UV intensity sensor and lamp surface to prevent build up and therefore reducing the intensity of UV provided by the unit.

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, Flow and UV(I) are monitored continuously at the water treatment plant and the plant is designed to alarm when 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 pumps. During instances of automatic shut -down of the plant this can be manually overridden by water treatment plant operators to deliver water to the scheme provided appropriate procedures have been followed.

This is further discussed in Section 9.0 Process Control Summaries.

Figure 7: Ultra Violet Disinfection Treatment

Figure 8: Ultra Violet Reactor and Cabinet nameplates for Tāneatua

4.1.3 Storage and Distribution

Treated water is pumped to two reservoirs located near State Highway 2 before being gravity fed to the Tāneatua reticulation system. The reservoirs consist of a concrete tank of capacity 227 m^3 and steel tank of capacity 500 m^3 and are connected in parallel. The total storage capacity of 727 m^3 available is sufficient to meet average daily demand and fire-fighting flows and provide 24-hour emergency storage. The concrete tank is bottom fed and the only protection of the source is via check valves located on pipework at each bore head with no additional backflow prevention device on the rising main; therefore, there is minor potential of source contamination through backflow.

Figure 9: Concrete (Left) and Steel (Right) Storage Reservoirs

The reticulation network consists of 9 km of water mains consisting of approximately 46% Asbestos Cement (AC) and 54% Polyvinyl Chloride (PVC) pipes. There are 4.5 km of rider mains of which 78% are of PVC material. The average age of over half the reticulation pipes is between 30 and 40 years (installed between 1978 and 1988)[9]. Replacement pipes are typically polyvinyl chloride (PVC).

A reticulation ring main throughout the township has been designed to allow sections of the network to be isolated fairly easily using isolating valves, assisting with any repairs and maintenance that may need to be carried out on the reticulation network.

The rising main that crosses under the Tauranga River bed to supply treated water from the pump station/treatment plant site to the reservoirs has historically failed three times, in 2007, 2015 and 2017. In 2015, the rising main failure was under the riverbed this section was slip-lined (125 mm PE pipe cased in 150mm HDPE) and additionally valving each side of the river was installed with the latest failure occurring along State Highway 2 East. The reservoirs are located on the same side of the river as the reticulation system, storage can be used in case a rising main repair is required to be carried out.

The Tāneatua Township has Council reticulated sewerage network and a treatment plant with two wastewater pumping stations both of which have had no recent records of overflows[10] and there are no wastewater reticulation pipes in proximity to the water take bores. The level of exfiltration from wastewater network is unknown but assumed to be within normal tolerances for ageing assets thus the level of contamination of soil from wastewater is unknown but not deemed critical.

The 2017/18 water balance undertaken in-house in accordance to the International Water Association (IWA) guidelines showed that the percentage of

[9] Water reticulation data extracted from Hansen, May 2014.

[10] WDC Correspondence, 14 March 2018.

real water losses in the system was 70% and the Infrastructure Leakage Index (ILI) was 19.13. The high leakage rates in the system poses risks of contamination in the water distribution network through backflow and potentially contaminated soil. The reticulation network is operated at approximately 600 kPa pressure and there are currently no plans to carry out pressure management in the Tāneatua 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, trade waste consents, change of use consents and 'new water connection' applications. However not all farm connections have backflow prevention devices installed. Dual check valve manifold meters are installed in some domestic connections; however, as the Tāneatua 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 but an 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.

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 Tāneatua Scheme (Tāneatua 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 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 two bore pumps operate on a duty standby basis according to pre-set minimum and maximum reservoir levels in order to fill the reservoirs.

Monitoring of water quality in the Tāneatua 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. In August 2018 continuous online FAC monitoring has been introduced in this reticulation system and the monitoring point is securely located within the township at the toilet block

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

Monitoring and control of the system is further discussed in Section 10.

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 Tāneatua water treatment plant was upgraded to include UV disinfection unit in 2010 as part of a $ 500,000 upgrade.

- Replacement of timber reservoir with steel reservoir

A 500 m^3 steel reservoir replaced a 500 m^3 timber reservoir in 2012 as part of capital work upgrades. Easements were obtained for access to the reservoirs and an access road constructed.

- CIPP lining of section of rising main

A section of the rising main from pump station to reservoir situated under the Tauranga riverbed was CIPP lined (125 mm PE pipe cased in 150mm HDPE) in July 2015.

- Mains and Connection Replacements

Mains and connection replacements were carried out in 2010 as part of capital works renewals, where copper and galvanized iron pipes were replaced 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 2016/17 can be found in Table 4

The Tāneatua 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:	
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.

Section 9.4 of the DWSNZ 2008 states that the monitoring frequency for radiological determinands is 10 years for bore water supplies that are not considered to be equivalent to surface water. Further to the catchment risk assessment carried out in September 2017 and the establishment of hydraulic connection between the Tāneatua bores and the Tauranga River, it is considered that radiological testing is no longer required. Accordingly, Tāneatua Scheme is now considered to be compliant for radiological compliance.

Table 4: Tāneatua 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	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	13 samples per quarter	Required: 52 Taken: 58	<1 E coli per 100 mL sample	Compliant
Protozoal Compliance						
Treatment Plant	Section 5.16	Flow	Continuous	Flow not >24.91 l/s for more than 5% of compliance period		Compliant
		UV Intensity (UV(I))	Continuous	UV(I) is not < 63.5 W/m2 for >5% of compliance period. UV(I) is not < 50.8 W/m2 (80%) for >= 3 continuous minutes.		
		Lamp outages	As required	N/A		
		UV Trans-missivity (UV(T))	Twice weekly	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	Last undertaken October 2016		Compliant
Cyanotoxin Compliance						
Not applicable to bore water.						

Notes:
1. Table 4.2a for the population band of 501 – 10,000 with 5 maximum days between samples and 6 minimum days of the week used.
2. Table 4.3a and 4.3b for the population band of 501 – 5,000 with 11 maximum days between samples and 5 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 DWSNZ 2008 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 Tāneatua 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 water safety plan 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.

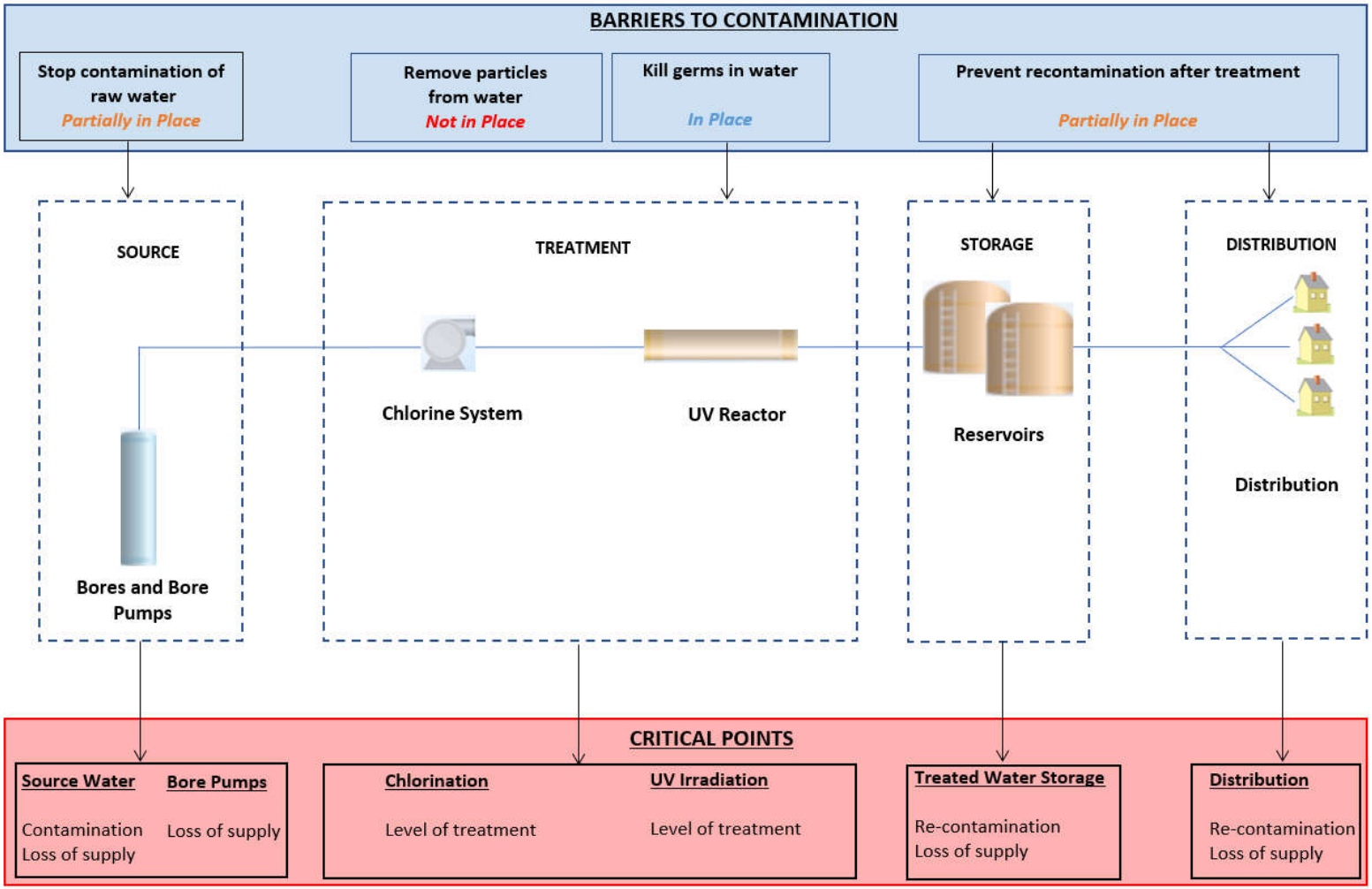


Figure 10: Barriers to Contamination and Critical Points of the Tāneatua Scheme

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 bores with hydraulic connection to Tauranga River, therefore influenced by changes in river water quality. • **Abstraction point positioned and constructed to avoid contamination:** ***Partially in place*****.** Bore heads have 1 metre concrete apron; bore heads and stock fence require upgrades to achieve protected bore head status. • **Source protected from contamination:** ***Partially in place*****.** Catchment risk assessment carried out to identify activities in the catchment. 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 bacterial removal and a 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 Residential connections to be installed with double check valves when metered. BFP Policy being developed.

Table 6: Critical Points	
Critical Point	**Description**
Groundwater bores: Contamination of source supply	• Highly variable source water quality: Shallow bores influenced by surface water quality and activities in the catchment which is predominantly farming and agricultural, 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 where the minimum 5 metre stock fence exclusion zone is not achieved on all four sides. Risk also increased due to vulnerability of site to flooding.
Groundwater bores: Loss of source supply	• Failure of bore pumps leading to loss of supply. • Security of source affected due to location of pump station and treatment plant site on the Tauranga River bank that is vulnerable to slips. This could result in prolonged loss of supply. • Possible restrictions to access to the pump station and treatment plant site due to flooding of access roads. • Intermittent power supply to pump station and treatment plant site due to failure of transformer maintained by Horizon Networks Power Company.
Chlorine and UV treatment	• Insufficient chlorine dosing and UV treatment resulting in harmful microbiological contaminants remaining in water. • 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. • Insufficient maintenance of treatment equipment leading to failures and subsequent inadequate treatment.

Table 6: Critical Points	
Critical Point	**Description**
	• Infrequent calibration and verification of equipment leading to false measurements of water quality.
Treated water storage	• Possible contamination of treated water storage in the concrete reservoir due to 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. • High leakage rates in the distribution system leading to possible contamination of water through back flow. Other risks are breach of consented takes (peak demand 1,096 m^3/day (due to rising main break), consented take 805 m^3/day). • 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 Tāneatua 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 Tāneatua 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 Tāneatua 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	R4.1 (PM2)	Access by animals/birds.	Install a mesh on outlet of the overflow pipes at reservoir site	WTP-O	5 hours	December 2018
2	T4.1 (PM1) T5.1 (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	December 2018
3	S3.1 (PM1)	Managing activities in the catchment	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.	SPP / TL-AM	80 hours	December 2018
4	S3.2 (PM1)	Cyanotoxins in river water	Develop a procedure to monitor cyanobacteria / cyanotoxins in the river.	TL-WTP	2 hours	May 2019
5	D5.2 (PM1G)	Inadequate operating Procedures	Review existing operating procedures and develop procedures that clearly define steps for each process, items to be recorded and objectives of the process, with reference to other documents.	TL-O/TL-WTP/WTP-O	40 hours	June 2019
6	D5.2 (PM2G)	Inadequate operating Procedures	Review past documents, develop and implement SOP (Hygiene procedure) for WDC operations staff working on the water network; focus on preventing cross contamination when staff alternate on wastewater and water reticulation work. Hygiene Procedure to include sickness statement and returning to work.	TL-WTP/TL-O/TL-AS	4 hours	June 2019
7	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
8	S2.1 (PM5, PM6, PM7) 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 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 any business owners that have potential to discharge contamination; Trade waste consents and building consents to act as triggers.	AE / TL-AM	240 hours	July 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
9	D5.1 (PM1G)	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
10	T7.1 (PM1)	Lack of chlorine contact time	Chlorine contact time calculated see Appendix F, review if pumping rate can be reduced and/or sizing and costing of installation of contact	AE	8 hours	October 2019
11	S1.6 (PM2) S1.7 (PM2)	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
12	S2.2 (PM3)	Bore head Security	Replace/modify concrete apron; sloping to prevent ponding of water around bore head, provide a bore casing seal and extend to at least 1 metre from the bore centre. Inspect sub-slab cable entry and install suitable cable seals.	TL-WTP	$10,000	October 2020
13	D5.3 (PM1G)	Inadequate training and registers	Review staff certificates and maintain training register. Develop a training and competency system for working on reticulated network.	TL-O / TL-AS / TL-WTP	20 hours + $500	December 2020
14	S2.2 (PM4)	Bore head Security	Install a testable backflow preventer (double check) on bore head arrangement.	AE / PM	$15,000	December 2021
15	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
16	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
17	S2.2 (PM2)	Bore head Security	Stock fence to be taken out to the minimum recommended 5 metres from the centre of the bore head, on the northern and eastern fence boundaries.	TL-WTP / PM	$25,000 (involves land matters)	December 2022
18	S1.9 (PM1)	Resource consent limitations	Apply for new water take consent in accordance with requirements (at least six months prior to expiry), consent expire 1/10/26.	SPP / AE / TL-AM	$40,000	March 2026

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	**WSP**	**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	**D4.1 (PM2G)**	**Pressure fluctuations in the system**	Carry out a periodic water balance to identify levels of leakage in system.	AE	8 hours	August (annually)
3	**R4.1 (PM3)**	**Access by animals/birds**	Routine inspection of vermin/pest control to be included as part of reservoir inspection schedule	WTP-O	2 hours	December 2018
4	**D1.1 (PM4G)**	**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	March 2019
5	**D1.1 (PM6G)**	**Contamination from backflow**	Develop and implement a policy to disconnect connections not in use, with special attention to connections provided to vacant lots during subdivisions.	MTW / M-PA / AE / TL-O / TL-AM	8 hours	March 2019
6	**D1.1 (PM7G)**	**Contamination from backflow**	Develop and implement a policy for identifying and dealing with illegal connections.	MTW / M-PA / AE / TL-O / TL-AM	4 hours	March 2019
7	**T7.1 (PM2)**	**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 (cemetery), points of high draw off, service reservoirs, old pipework, low pressure areas).	TL-WTP / TL-O / AE / TL-AM	8 hours	April 2019
8	**R4.4 (PM1)**	**Entry of contaminants due to reservoir design**	Investigate location of overflow and install appropriate marker post. Check location of any on-site sewer/drains will not cross contamination into overflow line if required install appropriate flap/non return valve device on overflow line	TL-O / TL-WTP	8 hours	May 2019
9	**R4.4 (PM2)**	**Entry of contaminants due to reservoir design**	Investigate the 'as-built' for this reservoir site to see what operational parameters the reservoirs can operate under (in series / parallel). Investigate valving arrangements of if individual reservoirs for isolated for cleaning and/or resilience.	AE	8 hours	June 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	**T7.2 (PM1)**	**Connections off rising main**	Council (owner) of the dog pound and cemetery to install appropriate signage. TL-AM to arrange file note on affected properties.	AM	8 hours	June 2019
11	**S1.4 (PM1)**	**Damage to equipment wiring due to vermin.**	Electrical cabinet to be made vermin proof.	TL-WTP	$2,000	June 2019
12	**S1.2 (PM1) T3.1**	**Power failure**	Investigate the installation and/or provision of a dedicated generator for this site to provide minimum flow requirement during power outage. Investigate alternative source prior to adoption of this option. For the interim, install dedicated generator plug-in point.	TL-AM	$5,000	June 2019
13	**R4.1 (PM1)**	**Reservoir access by animals/birds.**	Check if gaps between roof and timber supports are sufficiently sealed and seal if insufficient.	TL-WTP	completed	October 2019
14	**T8.3 (PM1)**	**Water quality control**	Investigate the options to improve water quality entering UV system. Detail options with costing for review, budgeting and inclusion into LTP	PM	60 hours	November 2019
15	**T4.4 (PM2G) T8.1 (PM1G)**	**Inadequate Training**	Develop training and competency system.	TL-AS / TL-WTP / WTP-O	80 hours	December 2019
16	**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	December 2019
17	**D1.1 (PM3G)**	**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
18	**D4.1 (PM4)**	**Pressure fluctuations in the system**	Install metering on all service connections.	AE / PM	$20,000	June 2020
19	**D1.1 (PM2) D4.1 (PM7)**	**Contamination from backflow**	Install backflow prevention devices on all connections; priority given to connections identified as high risk. Dual check manifolds shall be installed on residential connections as part of the meter installation programme.	AE / PM	$5,000	June 2020 (subject to Council Policy)

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
20	**D4.1 (PM3)** **S1.9 (PM2)**	**Pressure fluctuations in the system**	Undertake leak detection programme once water meters installed on all connections and programme for leaks to be fixed as matter of urgency.	AE / TL-O	20 hours + M & R costs depending on works	December 2020
21	**R5.1 (PM1)**	**Lack of chlorine short circuiting**	Investigate and cost the re-configuration of pipework to make reservoir top filling. If feasible programme for budget and inclusion into LTP.	AE / TL-AM / PM	8 hours	December 2021
22	**T4.3 (PM2G)**	**Water Operator Authorisation assessment**	Water Operator Authorisation. Authorisation assessments by DWA were undertaken with WDC operators in September 2018. The next assessments will be carried out in 2021.	TL-WTP / WTP-O	8 hours	August 2021
23	**S1.6 (PM1)** **S1.7 (PM1)** **S2.2 (PM1)** **T1.2 (PM2)**	**Natural disasters** **Bore head Security** **Insufficient treatment**	Investigate options to relocate bore site and pump station to a more secure location. If feasible programme for works and budget prior to obtaining new Water Take consent	MTW / TL-WTP SPP / TL-AM	$40,000	December 2021
24	**T1.4 (PM1)**	**Other - Insufficient pH treatment**	Investigate options to install pH correction and cost benefit of installation of pH correction. If feasible budget and programme for works to occur	PM / TL-AM	60 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
1	**D6.1 (PM4G)**	**Third party contractor damage to reticulation**	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	40 hours	February 2019
2	**D2.1 (PM1G)** **D2.1 (PM2G)** **D2.2 (PM3G)** **S1.3 (PM1)** **S1.4 (PM2)** **S2.2 (PM6G)** **R2.1 (PM3)** **R5.1 (PM2)** **T4.1 (PM2G)**	**Poor circulation in network** **Bore Pump failure** **Bore-head Security**	Utilise Asset Management System to schedule and/or monitor preventative maintenance. Utilise Asset Management System to schedule the maintenance, verification and calibration of treatment plant equipment.	TL-AS / TL-O	20 hours	March 2019
3	**D2.2 (PM1)**	**Inability to isolate or shut down the system**	Carry out a routine maintenance plan for valve exercising, 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
4	**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 plumbing by circulating information flyer and notification on Council Website	M-PA / AE	40 hours + $1,000	April 2019
5	**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
6	**T6.1 (PM1)**	**Over chlorination**	Undertake WTP site assessment to determine that all practical measures are in place via Electrical, Mechanical and Physical to avoid overdosing with particular emphasis on possibility of syphoning. Details to be recorded of the assessment and any recommendations	TL-WTP / WTP-O	4 hours	April 2019
7	**T6.1 (PM2)**	**Over chlorination**	Develop supply specific flushing plan to be implemented when treatment plant over doses and include in WTP operations manual	TL-WTP / WTP-O / TL-O	4 hours	April 2019
8	**R4.3 (PM1)**	**Sediment/slime accumulation**	Utilise Asset Management System to schedule and implement a CCTV inspection of reservoirs and vacuum cleaning programmes as required.	TL-AS	4 hours	June 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
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	August 2019
10	**D2.2 (PM2)**	**Inability to isolate or shut down the system**	Undertake a programme of marking valve boxes for ease of location and to indicate whether they are open or closed.	AE / TL-O	40 hours	December 2019
11	**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 (PM1)**	**Loss of structural integrity of reservoirs**	Carry out condition assessment of concrete reservoir by the end of 2019 (last carried out in 2010) and 5 yearly thereafter.	AE	$5,000	December 2019
13	**R2.1 (PM2)**	**Loss of structural integrity of reservoirs**	Carry out condition assessment of steel reservoir by 2019 (installed 2012) and 7 yearly thereafter.	AE	$5,000	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	**T4.4 (PM1)**	**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.	MTW / TL-WTP	$3,000	December 2021
16	**R2.2 (PM1) R4.2 (PM1)**	**Vandalism to reservoir structure**	Padlocked fencing to be installed at the reservoir site to restrict vehicle access and large animals.	TL-O	$20,000	December 2021
17	**D3.1 (PM1G)**	**Pipe, valve and hydrant failure due to age, condition and material of pipe**	Develop asset renewals programme based on condition, analysis of asset age, material, frequency of breakages and increase in maintenance costs, 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
18	**D4.1 (PM1)**	**Pressure fluctuations in the system**	Identify problem pressure areas by carrying out model network analysis coupled with customer complaint records.	AE	20 hours + $4,000	December 2022
19	**T5.5 (PM1)**	**Chlorine supply exhausted**	Install additional scale system to assist with automatic chlorine changeover.	TL-WTP	$2,000	December 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
20	**S2.1 (PM8) S3.1 (PM6G)**	**Managing activities in the catchment**	Team Leader - Three Waters Asset Management and Planning to provide input into next version district plan (WDC) and regional plan (BOPRC) concerning protection of catchment; input into activities such as sediment control from earthworks and riparian strip management.	SPP / TL-AM	240 hours	December 2026

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. Therefore, it is 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 (CCP)	Points and processes in the Tāneatua Scheme that can be controlled to prevent contamination of water.
Control Parameters (CP)	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 11 shows the Critical Control Points (CCPs) of the Tāneatua 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 Tāneatua 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.

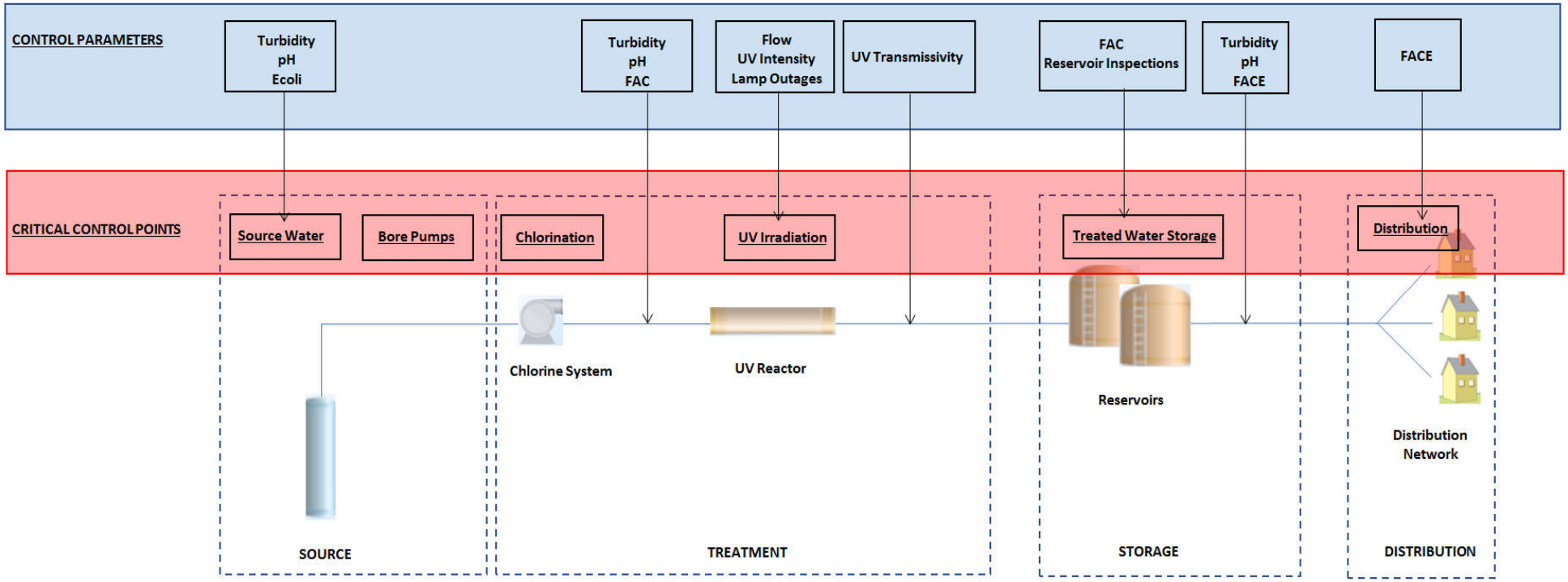


Figure 11: Critical Control Points and Corresponding Control Parameters for the Tāneatua Scheme for Source, Treatment, Storage and Distribution

9.1 Critical Control Point: Chlorination (Disinfection Treatment)

Process Objectives:

- Provide a disinfection critical control point 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

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, Drinking Water Online system to record information that can be accessed by the MoH for compliance.

Process Controller:

- WDC water treatment plant operator on duty.

Supporting Programmes:

- Daily checks and calibration of monitoring instruments.
- Periodic checks of currency of reagents and discarding of outdated reagents.

- Training and competency assessment of operators in equipment operation and monitoring.
- Lab verification checks for E. coli ≥ weekly; and chlorine ≥ monthly; with transgression reporting to Operator and DHB if results are outside DWSNZ 2008.

9.2 Critical Control Point: UV Irradiation (Disinfection Treatment)

Process Objectives:

- Provide a disinfection critical control point to inactivate protozoan pathogens that may have entered upstream of dosing point.

Process Location:

- UV treatment unit situated downstream of chlorine dosing system.

Parameters and day-to-day monitoring:

- Flow (m3/hr) – Continuous monitoring through magnetic flow meter connected to SCADA via Telemetry.
- UV Intensity UV(I) (W/m2) – Continuous monitoring through UV unit connected to SCADA via Telemetry.
- UV Transmissivity (UV(T)) (mw/sm3) – Manual monitoring, once in 10 days.
- Lamp outages (number of outages) – Per incident of occurrence.

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, Drinking Water Online system to record information that can be accessed by the MoH for compliance SCADA system, Drinking Water Online system.

Process Controller:

- WDC water treatment plant operator on duty.

Supporting Programmes:

- Daily checks and calibration of monitoring instruments.

- Periodic checks of currency of reagents and discarding of outdated reagents.
- Training and competency assessment of operators in UV reactor operation and turbidity monitoring.
- Lab verification checks for E. coli with transgression reporting to Operator and DHB 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 pumps 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 pumps when parameters exceed set limits (FAC, pH, Turbidity)	Automatic/ Operations
	Water to be diverted or sent to waste when parameters exceed set limits (FAC, pH, Turbidity)	Automatic/ Operations
	Inspect and calibrate/verify/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	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

Table 15: Contingency Plans

Event	Actions	Responsibility
distribution system leading to slime build up, leaching and poor circulation.	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	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 Public Affairs 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
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/pumps, 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 Ministry of Health.

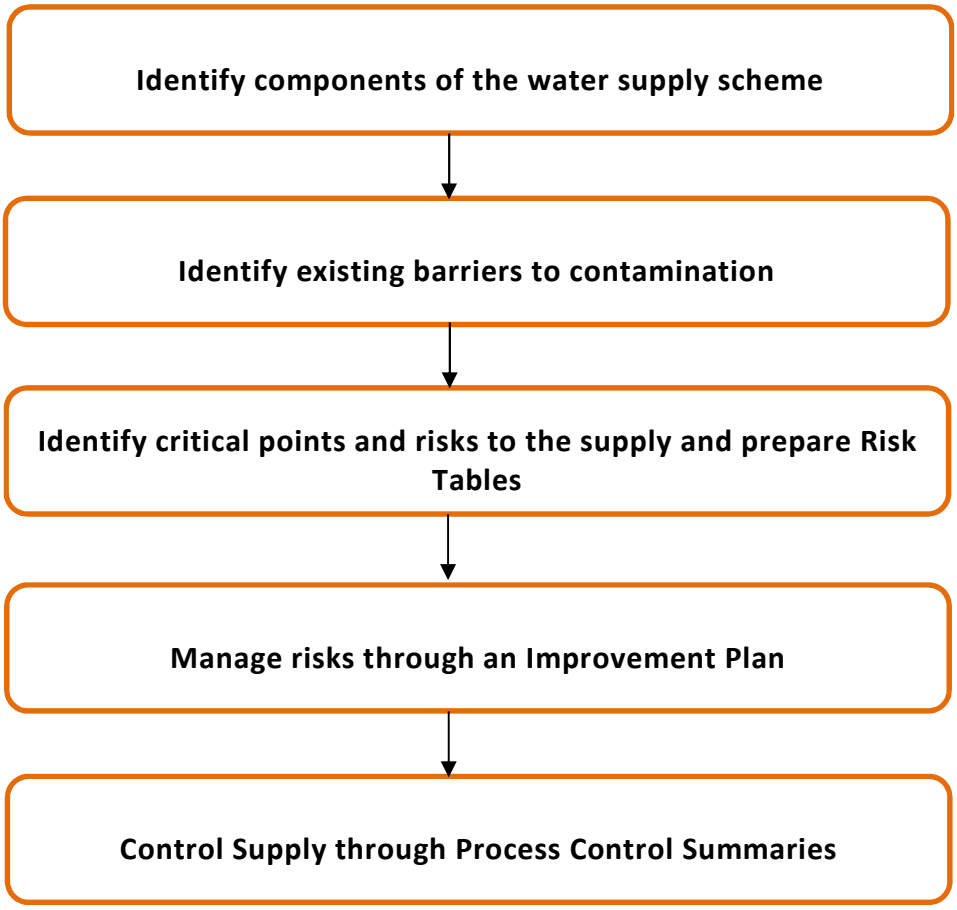


Figure 12: Methodology

The following supporting documents published by the Ministry of Health 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).
  - Drinking Water Assessor Compliance Reports and PHRMP verification reports (DWA, Ministry of Health).
  - Reservoir cleaning and structural assessments (WDC).
  - Catchment Risk Assessment for Tāneatua Bore Water Supply Scheme Report (September 2017, PDP).
- Site Visits carried out by PDP to the following locations on the 18th July 2017: Tāneatua treatment plant and pump station site, Tāneatua reservoir site (Appendix D: Tāneatua Scheme Reservoir Inspection Sheet).
- Consultation workshop carried out by PDP with participation of WDC, 3/4th of 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 – Team Leader Three Waters Asset Management and Planning; Gareth Phillips – Manager Three Waters Operations (position held up till May 2018), Leilani Salanguit – Project Engineer; Inka Krawczyk – Project Engineer; Neal Yeates – Team Leader Water Treatment Plant; Luke Shipton – Team Leader Operations; Joe Xie – Asset Engineer Three Waters .

The aim of the workshop was to identify risks to the Tāneatua 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 Tāneatua Scheme if not implemented along with the cost of implementation.

Appendix A: Tāneatua 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.	• Frequent ongoing disruptions to power supply due to issues with Horizon Networks owned transformer (out of control of WDC). • No generator on-site. • Sufficient storage available in reservoirs. • Power failure is detected by SCADA via telemetry; alarms on the SCADA screen and text messages to operator phones **PM1:** Generator hired from local contractor and taken to site when required.	Partially	Extreme (Almost Certain x Moderate)	**PM1:** Investigate the installation and/or provision of a dedicated generator for this site to provide minimum flow requirement during power outage. Investigate alternative source prior to adoption of this options For the interim, install a dedicated generator plug-in point	High (Almost Certain x Insignificant)	**PM1:** TL-O / AE / PM
S1.3	Bore pump failure	• Pump failure alarms. • Reduced or no flows.	**PM1:** Two bores on site with a bore pump each and used on duty/standby basis, therefore one bore available as backup in cases of bore pump failure or during maintenance.	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.	• Bore headworks exposed, however no history of vandalism and site situated off road leading to private land. • Electrical cabinet is not vermin proof. • Access to site through two sets of gates. • Perimeter stock fence to prevent entry of large grazing animals. • Site visited weekly for sampling and inspection. • Vermin/rodent poison stations placed on site.	Partially	Medium (Unlikely x Moderate)	**PM1:** Electrical cabinet to be made vermin proof. **PM2:** Vermin/rodent poison stations placed on site	Low (Unlikely x Moderate)	**PM1**: TL-WTP **PM2**: TL-AS / TL-O
S1.5	Restricted access to bore site due to absence of right of access.	• Restricted access to site during	• Bore/treatment plant site situated on WDC owned land and WDC has no legal	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
		normal operating conditions.	restrictions to access the site or the access road.					
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 2 metres above ground level for a 1% AEP event at the bore site. However no historical flooding on site. • Road leading to Tāneatua and Tāneatua Gorge prone to flooding during high rainfall events restricting access to these townships. • No alternate access route available to site.	No	Extreme (Almost Certain x Major)	**PM1:** Investigate options to relocate bore site and pump station to a more secure location. If feasible programme for works and budget prior to obtaining new Water Take consent **PM2:** Develop a disaster management plan for the water supply which could be included as part of a wider disaster management plan for the district.	High (Likely x Minor)	**PM1**:TL-AM / PM **PM2**: MTW / TL-O / TL-WTP
S1.7	Natural disasters – slips and earthquakes.	• Restricted access to site. • Inability to operate and maintain equipment.	• Bores situated on riverbank and vulnerable to slips; risk of prolonged loss of supply. **PM3:** January 2018 - Road into site was unusable for vehicle access for number of weeks - Schedule date with NZTA to fix road within the next 3 months.	No	Extreme (Almost Certain x Major)	**PM1:** Investigation options to relocate bore site and pump station to abstract water of better quality. **PM2:** Develop a disaster management plan for the water supply which could be included as part of a wider disaster management plan for the district.	High (Likely x Minor)	**PM1**: PM/SPP/TL-AM **PM2**: MTW / TL-O / TL-WTP
S1.8	Clogged bore screen/s	• Reduced or no flows.	**PM1:** Two bores on site with a bore pump each and used on duty/standby basis, therefore one bore available as backup in cases of bore pump failure or during maintenance.	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. • High leak rates in scheme (percentage of real water losses in the system was 70% and the Infrastructure Leakage Index (ILI) was 19.13) therefore risk of breaching consented take. **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).	Partially	Extreme (Unlikely x Catastrophic)	**PM1:** Apply for new water take consent in accordance with requirements (at least six months prior to expiry) **PM2:** Undertake leak detection programme once water meters installed on all connections and programme for leaks to be fixed as matter of urgency.	High (Rare x Catastrophic)	**PM1:** SPP/AE/TL-AM **PM2:** AE/PE
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,	Water not compliant with DWSNZ 2008: • Median E. coli count over 12 months is more than 500/100 ml	• Activities in catchment predominantly farming and agricultural, with immediate vicinity of pump station site situated in a paddock, therefore primary risk from stock effluent and grazing animals.	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.	Medium (Rare x Moderate)	**PM1**: 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
	dairy shed washwater, effluent spray irrigation, effluent ponds. **Forestry:** Sewage from sludge application. **Industry:** Wastewater discharges from industrial processes, biological washwater. **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	• 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.	**PM1:** Catchment risk assessment has been carried out in 2008 and most recently in 2017. Through the assessment, WDC has developed an understanding of the extent of the recharge zone and nature of activities in it. **PM3:** Business as usual - BOPRC informs WDC of new discharge consents to the recharge zone (Tauranga river catchment and 500 metre groundwater capture zone) and WDC to provide comments on these consents. **PM4:** WDC to send BOPRC submissions opposing new applications for septic tanks within 500 metre groundwater capture zone.			• **WDC to monitor activities within 250 metres of the water source:** **PM5:** 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. **PM6:** To make farmer aware of the effects of activities around the bore on water quality. **PM7:** To liaise with any business owners that have potential to discharge contamination; Tradewaste consents and building consents to act as triggers. **PM8:** Team Leader - Three Waters Asset Management and Planning 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.		**PM5**: AE/TL-AM **PM6**: AE/TL-AM **PM7**: AE/TL-AM **PM8**: 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 bore head ingress is increased due to flood vulnerability of the site. • No damage to bore headworks or pipework could be assessed visually. Condition of casing not known. **PM5:** 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. Works undertaken September 2018 **PM6:** Condition of casing good, CCTV carried out in September 2018.	Partially	Extreme (Likely x Major)	**PM1:** Investigate options to relocate bore site and pump station to a more secure location. If feasible programme for works and budget prior to obtaining new Water Take consent Refurbish boreheads to comply with DWSNZ 2008 and DWA requirements as follows: **PM2:** Stock fence to be taken out to the minimum recommended 5 metres from the centre of the bore head, on the northern and eastern fence boundaries. **PM3:** Replace/repair concrete apron; sloping to prevent ponding of water around bore head, provide a bore casing seal and extend to at least 1 metre from the bore centre. Inspect sub-slab cable entry and install suitable cable seals. **PM4:** Install a testable backflow preventer (double check) on bore head arrangement. **PM6G:** Programme for re-CCTV inspection of bore casing utilising Asset Management System to schedule and monitor preventative maintenance.	Medium (Rare x Moderate)	**PM1:** PM/SPP/TL-AM **PM2:** TL-WTP/PM **PM3:** TL-WTP **PM4:** AE/PM **PM6G**: TL-AS / TL-O

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
S3.1	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 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		• 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. **PM2G:** WDC to liaise with BOPRC as follows: 1) BOPRC to inform WDC of new discharge consents to the recharge zone (Tauranga river catchment and 500 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 500 metre groundwater capture zone. **PM3G:** Pesticide suite testing on raw water was undertaken in September 2013 and again in July 2018, a comparison of results is being undertaken and report to Toi Te Ora will be prepared in December 2018	No	High (Unlikely x Major)	**Also 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. **PM1G:** 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. **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; Tradewaste consents and building consents to act as triggers. **PM5:** Obtain groundwater monitoring results from consent holders in the vicinity if available, as a way of early warning of source contamination. **PM6G:** Team Leader - Three Waters Asset Management and Planning 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.	Medium (Rare x Moderate)	**PM1G**: SPP/TL-AM **PM4:** AE/TL-AM **PM5:** SPP **PM6G:** SPP/TL-AM
S3.2	Conditions suitable for algal growth such as elevated nutrient levels, sunshine, warmth, still water.	• Development of visible algal blooms, complaints of symptoms	**PM1:** BOPRC monitors cyanotoxin growth conditions upstream, and sampling was carried out by WDC 5 years ago and limits were found to be low. **PM2:** and WDC staff have had training to check algal bloom during low river water.	Partially	High (Unlikely x Major)	**PM1:** Develop a procedure to monitor cyanobacteria/cyanotoxin in the river.	Low (Possible x Insignificant)	**PM1**: TL-WTP

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
		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.						
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	• Protozoa log credit 3 required and currently meets this log credit. **PM1**: Turbidity monitored continuously at treatment plant; pumps stop when turbidity exceeds set limits (Water run to waste if turbidity exceeds set limits).	Partially	Extreme (Possible x Catastrophic)	Refurbish bore headworks according to DWSNZ 2008 (See S2.2) **PM2:** Investigate options to relocate bore site and pump station to abstract water of better quality.	Medium Rare x Moderate)	**PM2:** 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; pumps 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 and cost benefit of installation of pH correction. If feasible budget and programme for works to occur **PM2G:** Plumb solvency - 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	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 two locked concrete buildings.	Partially	Medium (Unlikely x Moderate)	Bore and treatment plant on same site, refer to S1.4.	Medium (Rare x Moderate)	

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
T3: EVENT: POWER FAILURE TO TREATMENT PLANT SITE AND EQUIPMENT								
T3.1	Power failure.	• Power failure alarms, Reduced or no flows. • No signal or no readings received from equipment.	• 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 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:** WDC to review and update calibration and maintenance procedures of treatment plan equipment and incorporate into Operations and Maintenance manual with appropriate Standard Operating Procedures (SOP) **PM2G:** Utilise Asset Management System to schedule the maintenance, verification and calibration of treatment plant equipment.	Low (Rare x Insignificant)	**PM1:** TL-WTP / WTP-O **PM2G:** TL-AS
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		**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 Authorisation. Authorisation assessments by DWA undertaken with WDC operators in September 2018. The next assessments will be carried out in 2021.	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. **PM2G:** listing of training kept in spreadsheet no evidence of competency system	Partially	Medium (Unlikely x Moderate)	**PM1:** All treatment plant operators to complete appropriate qualification for water treatment plant. WDC to keep records of training and produce when requested. **PM2G:** Develop training and competency system	Low (Rare x Minor)	**PM1:** MTW/ TL-WTP **PM2G:** TL-AS / TL-WTP / WTP-O

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**
CHLORINATION								
T5: EVENT: MICROBIOLOGICAL CONTAMINATION DUE TO INADEQUATE CHLORINATION								
T5.1	Dosing malfunction (Dosing regulator and/or dosing pump, chlorine injector)	• FACE 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:** Routine maintenance of dosing regulator, dosing pump, chlorine injector.	Yes	Low (Possible x Insignificant)	**PM1:** WDC to review calibration and maintenance procedures of treatment plan equipment and incorporate into Operations and Maintenance manual with appropriate Standard Operating Procedures (SOP)	Low (Possible x Insignificant)	**PM1:** TL-WTP / WTP-O
T5.2	Inadequate calibration of equipment (calibration of dosing regulator sensor)	• FACE 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	• FACE 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	• FACE 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	• FACE 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:** - 2 chlorine cylinder on site Chlorine – cylinders have auto changeover	Partially	Medium (Possible x Minor)	**PM1:** Install additional scale system to assist with automatic chlorine changeover.	Low (Unlikely x Minor)	**PM1:** TL-WTP
T5.6	Inadequate chlorine supply from chlorine booster stations	• FACE concentration below 0.2 mg/l.	• No chlorine booster stations in the reticulation system.	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
		• E coli detected in water leaving treatment plant.	**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.					
T6: EVENT: CHEMICAL CONTAMINATION DUE TO OVER CHLORINATION								
T6.1	Over chlorination due to dosing malfunction, inadequate calibration, dosing regulator set point wrong	• FACE 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)	**PM1:** Undertake WTP site assessment to determine that all practical measures are in place via Electrical, Mechanical and Physical to avoid overdosing with particular emphasis on possibility of syphoning. Details to be recorded of the assessment and any recommendations **PM2:** Develop supply specific flushing plan to be implemented when treatment plant over doses and include in WTP operations manual	Low (Possible x Insignificant)	**PM1:** TL-WTP / WTP-O **PM2:** TL-WTP / WTP-O / TL-O
T7: EVENT: MICROBIOLOGICAL CONTAMINATION DUE TO INSUFFICIENT CHLORINE CONTACT TIME								
T7.1	Short circuiting or lack of contact tank	• FACE concentration below 0.2 mg/l. • E coli detected in water leaving treatment plant.	• No contact tank after chlorine injection. • Manual FACE sampling in distribution system according to DWSNZ 2008. • Chlorine contact time calculated see Appendix F	Partially	High (Unlikely x Major)	**PM1:** Chlorine contact time calculated see Appendix F, review if pumping rate can be reduced and/or sizing and costing of installation of contact and see T7.2 for signage at cemetery **PM2:** 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 (cemetery), points of high draw off, service reservoirs, old pipework, low pressure areas).	Low (Rare x Minor)	**PM1:** MTW / TL-WTP / TL-AM **PM2:** TL-WTP/TL-O/AE / TL-AM
T7.2	Connections off rising main	• FACE concentration below 0.2 mg/l. • E coli detected in water leaving treatment plant.	• Two connections off rising main that may not have sufficient chlorine contact time: Dog pound and cemetery. • FACE sampling carried out at these locations.	Partially	High (Unlikely x Major)	**PM1:** Council (owner) of the dog pound and cemetery to install appropriate signage. TL-AM to arrange file note on affected properties	Low (Rare x Minor)	**PM1:** TL-AM

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
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. UV lamp breakages	• 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. Council refers to the "Tāneatua WTP ultraviolet UV disinfection system operations and maintenance manual (A1390160).pdf" document for SOP which have specific SOP in the unlikelihood that a UV lamp breaks. **PM2:** Regular maintenance of UV unit carried out by WDC staff (clean lamp sleeve and UV sensor lenses 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)	**PM1G:** Develop training and competency system that incorporates operators training with replacement of UV lamps. The training to incorporate the SOP for UV lamp breakages	Low (Rare x Insignificant)	**PM1G**: TL-AS / TL-WTP / WTP-O
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. • pH and turbidity continuously monitored at treatment plant. • turbidity set points adjusted so plant cuts off if turbidity level rises to inefficient treatment.	Partially	High (Possible x Moderate)	**PM1:** Investigate the options to improve water quality entering UV system. Detail options with costing for review, budgeting and inclusion into LTP	Low (Unlikely x Minor)	**PM1:** TWM / TL-WTP / WTP-O
T9: EVENT: MICROBIOLOGICAL CONTAMINATION DUE TO REVIVAL OF MICRO ORGANISMS								
T9.1	Revival of microorganisms 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 (1x500 m^3 steel tank and 1x227 m^3 concrete tank=727 m^3 total storage available for maximum daily demand 650 m^3/day).	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.	Site inspection of reservoirs showed steel reservoir in good condition. Concrete reservoir in Ok condition with some seepage visible. **PM1:** Reservoir inspections carried out periodically.	Partially	Medium (Rare x Moderate)	**PM1**: Carry out condition assessment of concrete reservoir by the end of 2019 (last carried out in 2010) and 5 yearly thereafter. **PM2**: Carry out condition assessment of steel reservoir by 2019 (installed 2012) and 7 yearly thereafter **PM3**: Develop and implement a preventative maintenance programme for reservoirs.	Low (Rare x Minor)	**PM1**: AE **PM2**: AE **PM3:** TL-AS
R2.2	Vandalism to reservoir structure	Loss of supply. Insufficient pressure/flow for firefighting purposes.	No gate at the immediate reservoir site, however, first gate leading from State Highway 2 is lock, therefore no unauthorized vehicle access to reservoir site. Reservoir can be accessed by foot by climbing the hill however this is considered unlikely. **PM1:** Ladder access to steel tank is locked, and no ladder access available for concrete tank.	Partially	Medium (Rare x Moderate)	**PM1**: Padlocked fencing to be installed at the reservoir site to restrict vehicle access and large animals. Land Matter issues at this site.	Low (Rare x Minor)	**PM1**: TL-O
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

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
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 coliforms detected in 100 mL of water.	Concrete reservoir: Gaps between tin roof and timber supports have been meshed to prevent entry of animals/birds, however unable to tell if coverage is adequate through visual inspection. Parts of openings were filled with foam. Large animal droppings were observed on site due to reservoir site not being fenced. **PM1:** FACE residual tested weekly. **PM2:** Reservoir site inspected periodically.	Partially	Extreme (Possible x Major)	**PM1:** Check if gaps between roof and timber supports are sufficiently sealed and seal if insufficient. **PM2:** Install a mesh on the overflow pipe. **PM3:** Carry out maintenance of the site as required to prevent breeding of vermin/animals	Medium (Unlikely x Moderate)	**PM1:** TL-WTP **PM2:** TL-O **PM3:** WTP-O
R4.2	Vandalism and sabotage, staff access	Visual evidence of vandalism to reservoir structure, evidence of unauthorized human access (broken glass, bottles, rubbish).	• No incidents of vandalism to structure in the past, however, reservoir can be accessed easily by foot.	Partially	High (Unlikely x Major)	**PM1**: Padlocked fencing to be installed at the reservoir site to restrict vehicle access and large animals. Land Matter issues at this site.	Low (Unlikely x Minor)	**PM1:** 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.	• Reservoir inspections carried out in 2008 and 2015. • FAC residual maintained, checked weekly • 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
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.	Unable to check roof hatches during site inspection. • Building paper was removed from concrete tank as it was disintegrating into the water leaching hydrocarbons. • Roof hatches designed to prevent rainwater ingress.	Partially	Medium (Unlikely x Moderate)	**PM1:** Investigate location of overflow and install appropriate marker post. Check location of any on-site sewer/drains will not cross contamination into overflow line if required install appropriate flap / non return valve device on overflow line **PM2:** Investigate the 'as-built' for this reservoir site to see what operational parameters the reservoirs can operate under (in series / parallel). Investigate valving arrangements of if individual	Low (Rare x Insignificant)	**PM1**: TL-O / TL-WTP **PM2**: AE / TL-O / TL-WTP

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
						reservoirs for isolated for cleaning and/or resilience.		
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.	**PM1:** Concrete reservoir bottom filling, therefore stratification tests carried out every 3 months. This is undertaken via a WDC procedure whereby two operators undertake full reservoir inspection and with WDC potable sampling pole arrangement takes individual sample at 300mm below surface and verify the FAC (undertaken 3 times) and these are verified against post reservoir FAC. All results are recorded in sampling folder and available for review.		Medium (Unlikely x Moderate)	**PM1:** Investigate and cost the re-configuration of pipework to make reservoir top filling. If feasible programme for budget and inclusion into LTP. **PM2:** Utilise Asset Management System to schedule this activity	Low (Rare x Insignificant)	**PM1:** AE **PM2:** TL-AS / TL-O

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 • Tāneatua not a fully metered scheme therefore not all residential connections fitted with dual check valves. • Testing of existing backflow preventers not currently carried out. • 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:** Discussion between 3 Waters and Building compliance has occurred. Building compliance utilities Building Code G12-Water supplies whereby if backflow prevention is required this is a condition of a building warrant of fitness (WOF) and follows the WOF process.	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. **PM2:** Install backflow prevention devices on all connections; priority given to connections identified as high risk. Dual check valve to be installed on residential connections as part of the meter installation programme. **PM3G:** Circulate educational material to customers, especially those considered high risk, about risks of backflow prevention and ways of minimising the risk. **PM4G:** Review policy for withdrawing water from hydrants; specify the use of standpipes fitted with approved backflow preventers **PM6G:** Develop and implement a policy to disconnect connections not in use, with special attention to connections provided to vacant lots during subdivisions. **PM7G:** Develop and implement a policy for identifying and dealing with illegal connections.	Medium (Possible x Minor)	**PM1G:** MTW / M-PA / AE / TL-O / TL-AM **PM2:** AE/PM **PM3G:** AE / M-PA **PM4G:** MTW / M-PA / AE / TL-O / TL-AM **PM6G:** MTW / M-PA / AE / TL-O / TL-AM **PM7G:** MTW / M-PA / 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.	Partially	Medium (Possible x Minor)	**PM1G:** 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)	**PM1G:** TL-AS/TL-O **PM2G:** TL-AS
D2.2	Inability to isolate or shut down the system due to missing or failed valves.		**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	Low (Rare x Insignificant)	**PM1:** AE

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
						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.		**PM2:** AE/TL-O **PM3G:** TL-AS
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. • AMP has been prepared to identify condition of existing components of the scheme. • Pipe sampling has been carried out in certain areas. • Rising main was slip lined in 2015. **PM3G:** New Asset Management System implement recording maintenance carried out and cost of maintenance per asset.	Partially	Medium (Possible x Minor)	**PM1G**: Undertake an 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 including the rising main supplying water from pump station to reservoirs. Other critical assets include 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).		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. **PM2G**:Carry out a periodic water balance to identify levels of leakage in system **PM3**: Once hydraulic models are completed and in-line with annual water balance calculations develop and implement leak detection programme. (also see **S1.9 PM2**) **PM4**: Install metering on all service connections. **PM5G**: Develop and adopt internal procedure for maintaining an up-to-date Asset Management System and GIS system **PM7**: 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 part of the meter installation.	Low (Rare x Insignificant)	**PM1:** AE **PM2G:** AE **PM3:** AE **PM4:** AE/PM **PM5G:** TL-AM/AE **PM7:** 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.		• Customer services department notified of work being carried out resulting in service disruption. • Works are carried out outside peak hours to ensure minimum disruption. • 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)	**PM1G**: 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)	**PM1G:** TL-AM **PM2G:** AE/TL-AM **PM3G:** AE/TL-AM
D5.2	Inadequate operating Procedures.	• Staff working on wastewater/storm water systems and then on Water reticulation • Staff returning to work after waterborne illness	**PM1G:** Existing operations procedures are currently being reviewed and updated by WDC. **PM2G:** As part of operators training well aware of Hygiene issues associated within the 3 Waters industry. Some common sense prevails.	Partially	Medium (Possible x Minor)	**PM1G**: Review existing operating procedures and develop procedures that clearly define steps for each process, items to be recorded and objectives of the process, with reference to other documents. **PM2G**: Review past documents, develop and implement SOP (Hygiene procedure) for WDC operations staff working on the water network; focus on preventing cross contamination when staff alternate on wastewater and water reticulation work. Hygiene Procedure to include sickness statement and returning to work.	Low (Rare x Insignificant)	**PM1G**: MTW / TL-WTP / WTP-O **PM2G**: TL-WTP /WTP-O / TL-AS
D5.3	Inadequate training of operations staff.		• Staff provided with relevant training. All staff hold appropriate certificate in water reticulation. • Prior to employment within 3 Waters Operation Section, staff are vaccinated against Hepatitis A/B and Tetanus to immunised against these known water borne diseases • Tool box meetings carried out weekly.	Partially	Medium (Possible x Minor)	**PM1G**: Review staff certificates and maintain training register. Develop a training and competency system for working on reticulated network.	Low (Rare x Insignificant)	**PM1G:** TL-O / 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
D6: EVENT: CONTAMINATION AND LOSS OF SUPPLY DUE TO THIRD PARTY CONTRACTORS								
D6.1	Third party contractor/developer 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: Tāneatua 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 continuous minutes
Target Range	Low Limit	0.80		-
	High Limit	0.90		-
Action Limits	Low Alarm	0.40	5.0	-
	High Alarm	2.00	8.0	1.70
Critical Limits	Low Low Alarm	0.30	4.5	-
	High High Alarm	2.10	8.5	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 pumps 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/ Rotameter / pH meter for any mechanical problems e.g. a jammed rotameter. – 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 bore head, treatment plant equipment and surrounding site for signs of vandalism. Check around bore head 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- DWSNZ 2008 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	>89.7m^3/hr (24.9 L/s) for >5% of 1 month	<63.5 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		<50.8 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	
Below parameters based on maximum achieved flows rates for Taneatua determined by system pumps						
Target Range	**Low Limit**	-	-	> 68 W/m^2	n/a – Not a CCP	-
	High Limit	0.50 NTU	52 m^3/hr	-		
Action Limits	**Low Alarm**	-	-	66.7 W/m^2		"Alarm"
	High Alarm	1.00 NTU	-	-		
Critical Limits	**Low Low Alarm**	-	-	**63.5 W/m^2**		**"Alarm"**
	High High Alarm	**2.00 NTU**	**>52 m^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 pumps 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 bore head, treatment plant equipment and surrounding site for signs of vandalism. Check around bore head 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 63.5 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: Tāneatua Scheme Localised Groundwater Capture Zone

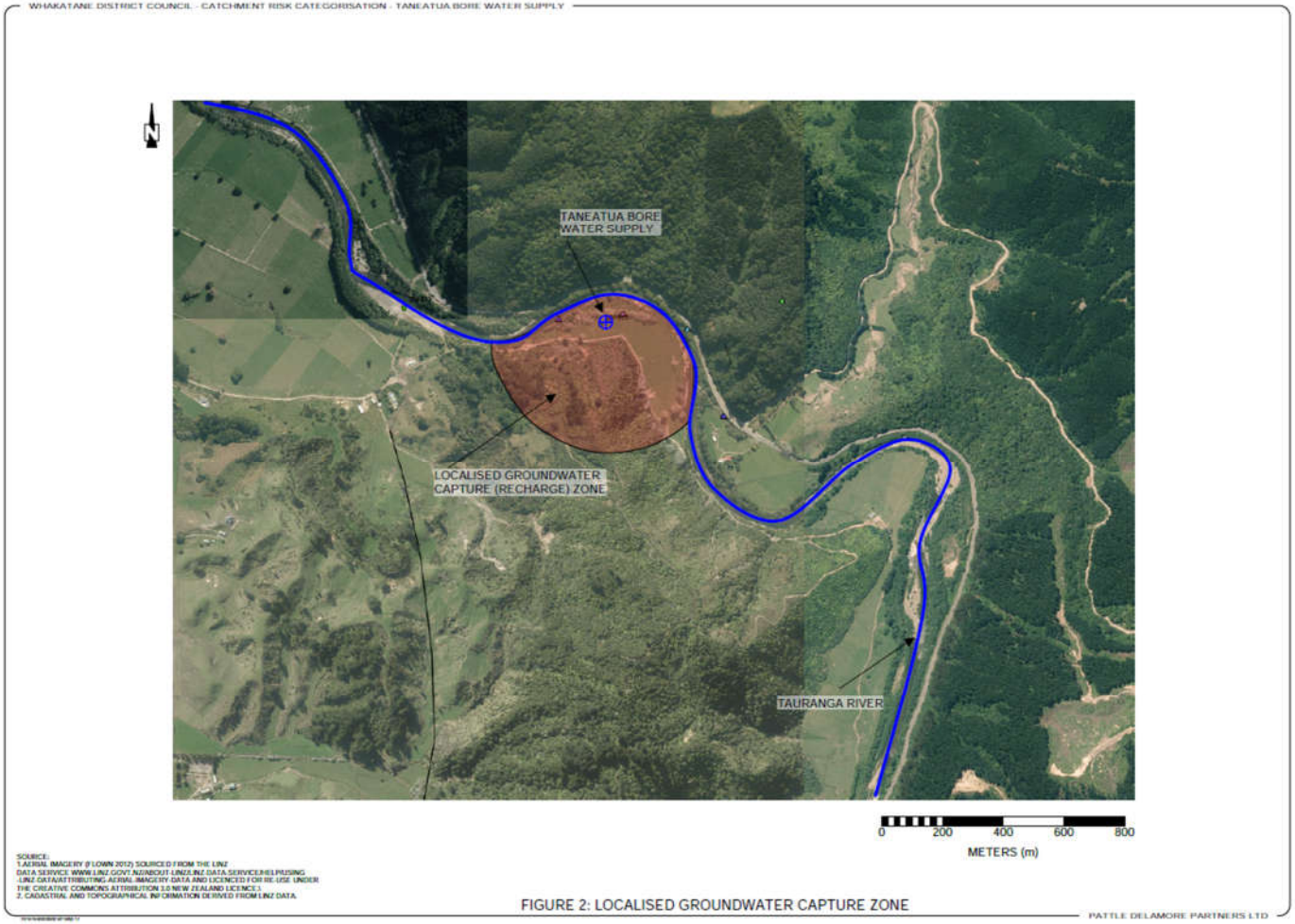


FIGURE 2: LOCALISED GROUNDWATER CAPTURE ZONE

Appendix D: Tāneatua Scheme Reservoir Inspection Sheet

Reservoir Inspection

General Information

Project:	Taneatua Water Safety Plan
Survey Carried out by:	Sala Ranasinghe/Dave Stafford
Date of Site Visit:	17th July 2017
Location of Reservoir/s:	State Highway 2
Number of Reservoirs on site:	2
Client Details:	Whakatane District Council

Assessment

Access to reservoir:	Gravel road			
Security to reservoir site:	Padlocked gate at the first gate on SH2 but not on the second gate leading to reservoirs.			
Security fence or stock fence?	No security/stock fence on site.			
Reservoir construction material (Concrete/Timber/Steel/Plastic/Other):	Material:	Steel (500 m3)	No:	1
	Material:	Concrete (277 m3)	No:	1
	Material:		No:	
	Material:		No:	
Condition of Reservoirs (Good/Average/Bad) please comment:	Reservoir 1:	Steel reservoir - Visual inspection, good condition, no visible leaks.		
	Reservoir 2:	Concrete reservoir - Visual inspection, average condition, few wet patches on the site of the reservoirs therefore further inspection required to determine structural integrity.		
	Reservoir 3:			
	Reservoir 4:			
	Reservoir 5:			
	Reservoir 6:			
Evidence of human or animal access on site?	Lack of security fence/stock gate therefore evidence of animals on site (large animal feeces) and a dog present on site during visit.			
Evidence of vandalism?	No visual evidence of vandalism.			
Any points of possible entry of animals into reservoir?	Could see gaps between roof and tank, however was told by WTP operator that it is meshed from the inside to prevent access from rodents and larger birds. Wasn't able to confirm this on site therefore further investigation required.			
	Overflow wasn't meshed to prevent animal entry.			
Any signs of leaks?	No obvious signs of leak but some staining and damping in certain areas around the concrete reservoir. Further investigation required.			
Check reservoir roof	As above.			
Any reservoirs not being used?	Both are in use.			
Is ladder access restricted?	Ladder access to steel tank was padlocked and restricted.			
Are roof hatches designed to prevent rainwater ingr	Wasn't able to confirm during site visit, WTP operator confirmed steel tank had padlocked roof hatches designed to prevent rainwater ingress.			
Are roof hatches padlocked?	As above.			

Photos

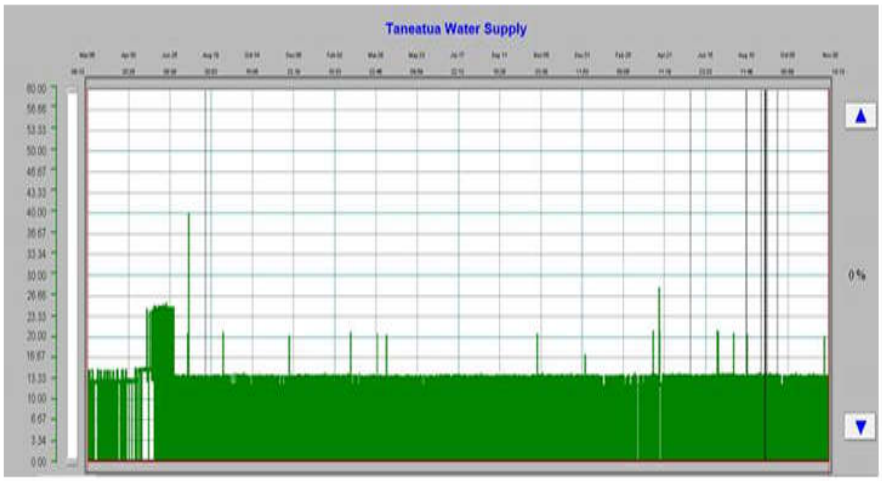
Reservoir Structure

Reservoir Roof

Appendix E: Assessment of Chlorine Contact Time

Chlorine contact time assessment

- The first consumer is the cemetery on WDC land which has a water tap, this is located at 75 State Highway 2 East on the supply line to the reservoir and is approximately 1,200 metres away from the source extraction. The second customer at 55 State Highway 2 East is approximately 1400 metres from the source extraction.



- Scada data indicates that the pump flow rate is pretty constant at 15 l/s, but does show an unusual peak of 40 l/s
- Calculating at the constant 15 l/s pump rate and based on the distance of 1,200 metres, 150mmØ uPVC pipe, the contact time to the cemetery land is approximately 24 minutes and the contact time to second customer is estimated at 27 minutes.
- Usually, contact time is calculated using peak flow (as it's the worst case scenario), in this case at 40 l/s the contact time is about 10 minutes.
- Based on these calculation, WDC will assess the risk to the first customer and investigate options such as:
    - costing of installation of contact tank
    - reviewing pump characteristics to see in settings can be modified to deliver a maximum pump rate of 11.7 l/s (this would give 30 minute contact time to cemetery)
    - signage to customers informing of the water status at the site

Appendix F: Improvement Plan – Completed Projects

Table 24: Improvement Plan – Completed Items

Priority	Risk Table No.	Area of Work	Work To be Implemented	Responsibility	Comment	Date
High	**S1.7 (PM3)**	**Natural disasters - slips and earthquakes**	Schedule date with NZTA to fix road within the next 3 months.	TL-O / PM / TWM	Completed	March 2018
High	**T5.5 (PM2)**	**Chlorine supply exhausted**	Additional chlorine cylinder on site with auto changeover.	TL-WTP	Completed	March 2018
Medium	**S2.1 (PM3, PM4) S3.1 (PM2G)**	**Managing activities in the catchment**	WDC to liaise with BOPRC as follows: 1) BOPRC to inform WDC of new discharge consents to the recharge zone (Tauranga river catchment and 500 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 500 metre groundwater capture zone.	Business as usual with resource consents	implemented	March 2018
Low	**D4.1 (PM6G) D6.1 (PM1G)**	**Third party contractor/developer work on WDC reticulation (not directly engaged by WDC)**	Included in engagement of contractors. Contractors submit disinfection procedures, Health and Safety plans, detail design of work to be carried out for Council approval.	Contractors and AE / PE	BAU Implemented	March 2018
Low	**D3.1 (PM3G)**	**Pipe, valve and hydrant failure due to age, condition and material of pipe**	Record 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
Medium	**T4.3 (PM1)**	**Inadequate/incorrect sampling**	Review treatment plant sampling spreadsheet periodically for anomalies.	TL-WTP	completed	June 2018

Table 24: Improvement Plan – Completed Items						
Priority	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Comment**	**Date**
High	**S3.1 (PM3G)**	**Managing activities in the catchment**	Pesticide suite testing on raw water was undertaken in September 2013 and again in July 2018, a comparison of results is being undertaken and report to Toi Te Ora will be prepared as part of business as usual	TL-WTP	Completed	July 2018
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 for consented works	July 2018
Medium	**S2.2 (PM5)**	**Bore-head Security**	Carry out checks to determine adequacy of cable gland seals and bore head seals including replacing any deteriorating gaskets with watertight gaskets.	TL-WTP	5 hours	September 2018
Medium	**S2.2 (PM6)**	**Bore head Security**	Carry out CCTV inspection of bore casing to ascertain condition.	TL-O	Completed	September 2018
Medium	**T4.3 (PM2G)**	**Water Operator Authorisation assessment**	Water Operator Authorisation. Authorisation assessments by DWA were undertaken with WDC operators in September 2018. The next assessments to be carried out in 2021.	TL-WTP / WTP-O	8 hours	September 2018

Appendix G: Tāneatua Plant (TP00326) Protozoal log credit assignation

Toi Te Ora Public Health
PO Box 2120
TAURANGA 3140

10 July 2018

Tomasz Krawczyk
General Manager Infrastructure
Tomasz.Krawczyk@whakatane.govt.nz

Dear Tomasz

Taneatua Plant (TP00321): 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 5.2.1.1 of the Drinking-water Standards for New Zealand 2005 (Revised 2008) (DWSNZ) and provided the Pattle Delamore Partners Catchment Risk Assessment for Taneatua Bore Water Supply, Whakatane District Council, Sep 2017 (A1212110).

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 Taneatua 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 Taneatua 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

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

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 H: 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

Tāneatua Public Water Supply (TAN001)

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

Report Identifier

TAN001_Tāneatua_WSPadequacy_201118_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

Under the Health Act, this supply falls into the category of a minor drinking water supply. Section 69Z of the Act requires that the supply have an approved and implemented water safety plan.

The Tāneatua Public Water Supply - Water Safety Plan 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 Tāneatua public water supply has been approved with no recommendations or non-conformances made.

Description of drinking water supply

The WSP describes a WDC owned and operated public water supply consisting of a groundwater source (two bores cased to approximately 9 m) with a groundwater capture zone that includes influence from the Tauranga River via a hydraulic link to the aquifer. Activities in the catchment are primarily agricultural and stock grazing. Treatment consists of gas chlorine and UV disinfection. Chlorine residual disinfection is maintained in the reticulation. Storage consists of a 227 m3 concrete reservoir and 500 m3 steel reservoir. The population supplied is approximately 786 people. Some commercial and farm connections have backflow prevention devices installed. Some residential connections have dual check backflow prevention devices installed. The Tāneatua township has a council reticulated wastewater system.

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 points and critical control points is adequate.

Adequacy of risk identification and analysis

The risk identification and analysis is adequate. Public health risks for all common supply elements and their possible causes have been adequately identified. The qualitative risk assessment is adequate.

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. Critical Points have been clearly identified. Chlorination and cartridge filtration have been identified as the current operational Critical Control Points. Continuous free available chlorine, pH and turbidity have been identified as the monitored and alarmed parameters. Critical limits for these parameters are clearly listed. Corrective actions associated with each critical limit are included and considered adequate for this supply. Preventative measures and indicators for non-Critical Control Point risks are considered adequate for this supply.

Contingency plans are included for typical major adverse events and are considered adequate.

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

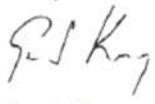
WSP for Tāneatua public water supply has been approved.

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 05 December 2018



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

Assessment Report Information

Report identifier	TAN001_Tāneatua_WSPadequacy_201118_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	20/11/2018
Description of assessment work	Assessment of adequacy of Water Safety Plan for: Supply: TAN001 Tāneatua Zone: TAN001TA Tāneatua Plant: TP00321 Tāneatua Plant Source: G00218 Tāneatua 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) • Tāneatua Public Water Supply –Water Safety Plan Draft Version 1.04, November 2018, T01616400R009 WSP Tāneatua_Final.docx • Pattle Delamore Partners Catchment Risk Assessment for Tāneatua Water Supply, Whakatane District Council, Sep 2017
Site of Assessment	Toi Te Ora, 510 Cameron road, Tauranga
Omissions from proposed assessment	Nil.
Sub-contracted work	Nil.
Document checked by:	Cameron Huxley trainee Drinking Water Assessor Date: 4/12/2018
Release of report authorised by:	Grant King IANZ Accredited Drinking Water Assessor Signature: G J King Date: 05/12/2018

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.