Otumahi Public Water Supply – Water Safety Plan

- Report Prepared for:

  Whakatāne District Council

- Report Prepared by:

  Pattle Delamore Partners Ltd

- Final, August 2018

- Report Updated by:

  Whakatāne District Council

- Version 2.00, August 2019

PATTLE DELAMORE PARTNERS LTD
PDP House, Level 4
235 Broadway, Newmarket, Auckland 1023
PO Box 9528, Auckland 1149, New Zealand

Tel +64 9 **523 6900** Fax +64 9 **523 6901**
Website **http://www.pdp.co.nz**
Auckland Tauranga Wellington Christchurch

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DOCUMENT CONTRIBUTORS

Prepared by

SIGNATURE

Sala Ranasinghe

Reviewed by

SIGNATURE

Mark Ellis

Michael Van Tilburg
(Whakatāne District Council)

Approved by

SIGNATURE

Azam Khan

Limitations:

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Whakatāne District Council and others (not directly contracted by PDP for the work). PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

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Executive Summary

Pattle Delamore Partners Ltd (PDP) has been engaged by Whakatāne District Council (WDC) to prepare a Water Safety Plan (WSP) for the Otumahi Public Water Supply Scheme (Otumahi Scheme).

The Otumahi Scheme commenced operations as a stand-alone scheme on the 1st of July 2018. Prior to this, the scheme was operating as part of the Rangitāiki Plains Public Water Supply Scheme (Plains Scheme).

This WSP was prepared by PDP in collaboration with WDC to identify and manage events that could occur in the Otumahi 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 Otumahi 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.
- 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 Tahuna Road and Paul Road water treatment plant and pump station sites, Te Teko reservoir site, 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	Reviewed by	Date
1.00	Prepared by PDP in collaboration with WDC, submitted to WDC for comments	PDP	31/07/2018
1.01	Modified with WDC comments and Final Version released from PDP to WDC	Neal Yeates (WDC) Michael Van Tilburg (WDC) Sala Ranasinghe (PDP) Robert Docherty (PDP)	7/08/2018
1.02	Updated Improvement Plans and submission to Drinking Water Assessor	Neal Yeates; Sala Ranasinghe & Michael Van Tilburg - WDC	18/07/2019
1.03	Modifications after teleconference with Drinking Water Assessor. Resubmit to Toi Te Ora Public Health	Sala Ranasinghe & Michael Van Tilburg - WDC	9/08/2019
2.00	Approval from DWA - change to 'Report on adequacy of a Drinking Water Supply's Water Safety Plan (OTU010_Otumahi_WSPadequacy_290719_v1)	DWA approval added by Michael Van Tilburg	13/08/2019

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. The Otumahi water supply scheme was created from a new bore extraction site and associated new water treatment plant and incorporates some reticulation watermains from the Rangitāiki Plains and Te Teko water supplies. This plan requires approval by the DWA and will supercede the existing Te Teko Water Supply - Water Safety Plan (due for expiry January 2020). The WSP is treated as 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 Otumahi Scheme within the 5-year period.

This water safety plan was prepared over a lengthy period of time whilst the industry waited for direction and the WSP has generally been developed prior to the handbook release, with this in mind, this safety plan may have a reduced timeframes imposed by Ministry of Health to comply with new handbook requirements.

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 read in conjunction with the 'Catchment Risk Assessment for Otumahi Bore Water Supply Scheme, Whakatāne District Council' report (PDP, October 2017).

2.0 Supply Summary

Table 2: Otumahi Scheme Summary	
Supply Details	
Supply Name	Otumahi Community Water Supply
Supply Code	OTU010
Supply Owner	Whakatāne District Council
General Manager Infrastructure	David Bewley
Manager Three Waters	Tomasz Krawczyk
Team Leader – Water Treatment Plant	Neal Yeates
Water Treatment Plant Operators	Ian Bowen Bryan Vautier Tasman Van der Woude
Team Leader Operations	Luke Shipton
Capital Projects Manager	Jim Finlay

Table 2: Otumahi Scheme Summary	
Team Leader Asset Management and Planning	Michael Van Tilburg
Population Served by Supply[1]	2,841 People
Number of Connections[2]	1,173 Connections
Source Details	
Te Teko Bore	
Source Code	G00208
Type of Source	Bore - 22 metres below ground level (bgl)
Consent No.	65622 - RM18-0540-WT.01+
Consent Expiry	30 September 2045
Maximum Consented water take:	1,920 m3/d
Map Reference (NZTM)	1933841E, 5778481N
Paul Road Bore	
Source Code	G03030
Type of Source	Bore - 169 metres bgl
Consent No.	66359
Consent Expiry	30 September 2045
Maximum Consented water take:	5,280 m3/d
Map Reference (NZTM 2000)	5786553 N 1928867 E
Treatment Details	
Tahuna Road	
TP code	TP00315
Treatment Processes	Filtration, Gas chlorination, UV Treatment
Daily Demand	Data not available. Bore designed to provide a peak flow of 11 L/s
Paul Road	

[1] Drinking-water Register for New Zealand.
[2] WDC records June 2019.

Table 2: Otumahi Scheme Summary	
WINZ TP code	TP04011
Treatment Processes	Gas chlorination
Average Daily Demand	Data not available. Bore designed to provide a peak flow of 35 L/s
Distribution Details	
Distribution Zone Code	OTU010
Distribution Zone materials	50% Polyvinyl Chloride (PVC), with 25% Asbestos Cement (AC), 16% Polyethylene (PE) and 9% Alkathene /Other.

3.0 Introduction

The Otumahi Scheme is owned and operated by WDC and has been formed to supply a population of approximately 2841 people. Water for the scheme is sourced from a shallow bore (22 metres bgl) at Tahuna Road and a deep bore (169 metres bgl) at Paul Road. Water is treated for bacteria at both treatment plants and for protozoa at Tahuna Road before being circulated to consumers.

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

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

- Chief Executive (CE) – Steph O'Sullivan
- General Manager Planning and Infrastructure (GM) – David Bewley
- Manager Three Waters (MTW) – Tomasz Krawczyk
- Manager Public Affairs (M-PA) – *(Vacant Position)*
- Team Leader - Water Treatment Plant (TL-WTP) - Neal Yeates
- Water Treatment Plant Operator (WTP-O) – Ian Bowen / Bryan Vautier / Tasman Van der Woude
- 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) – Sala Ranasinghe & Joe Xie
- Senior Project Planner (SPP) – Nicholas Woodley
- Manager - Capital Projects (PM) – Jim Finlay
- Project Engineer - Three Waters (PE) – Leilani Salanguit

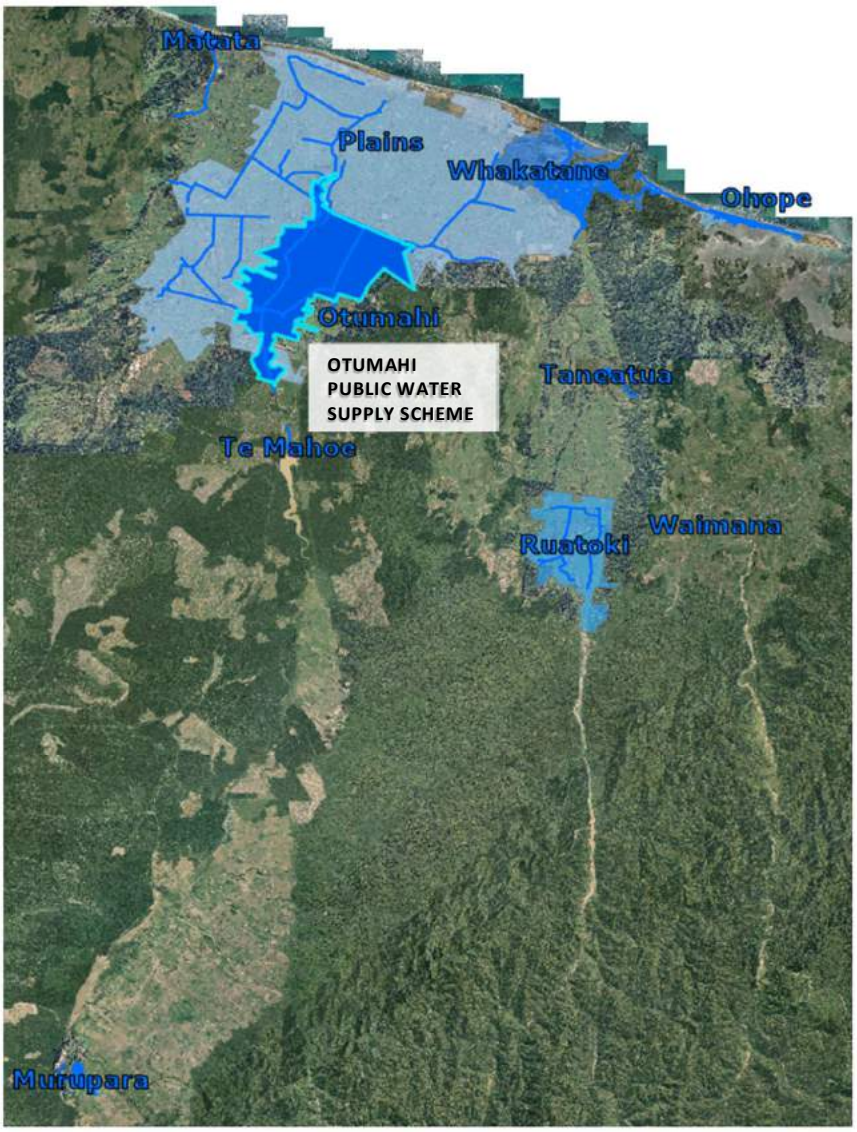


Figure 1: Whakatāne District Water Supplies

4.0 Description of Otumahi Water Supply

4.1 Scheme Details

The Otumahi Scheme commenced operations as a stand-alone scheme on the 1 July 2018. The Otumahi Scheme boundary has 1,173 connections serving an estimated population of 2,841 people and supplies two townships situated southwest of Whakatāne, Edgecumbe and Te Teko townships. The scheme has two bore sources, one situated at Paul Road and one at Tahuna Road near Te Teko.

All consumers within the scheme's boundary are supplied reticulated water, with a majority of the connections being domestic, along with a few farm, cowshed and non-domestic connections. Non domestic, farm and cow shed connections are fitted with backflow devices and new metered residential connections are fitted with dual check valves and a Backflow Policy is being developed.

The Otumahi scheme was formed as a result of the need to supply water that meets NZDWS standards to the urban populated Edgecumbe township. The township was operating as part of the Rangitāiki Plains scheme and was therefore receiving water supplied from Braemar Springs which contained elevated levels of arsenic, which is non-compliant with the Drinking-water Standards New Zealand (DWSNZ 2005, (Revised 2018)). A number of options for the upgrade of the drinking water supply were considered by WDC as part of recommendations put forward by the 'Plains 50 Year Water Strategy' document. Council's preferred option was to install a bore field at Paul Road and undertake upgrade works at the Tahuna Road treatment plant involving upgrade of the bore headworks, the installation of UV irradiation and cartridge filtration treatment. The project was part funded by a subsidy granted by the Ministry of Health (MoH) to the Te Teko township.

The scheme has been designed to supply a peak demand of 35 L/s from the Paul Road bore and 11 L/s from the Tahuna Road bore. The bores can achieve maximum flows of 51 L/s and 18 L/s respectively. The water take consents for the Paul Road and Tahuna Road are administered by the Bay of Plenty Regional Council (BOPRC). Maximum consented takes for the two supplies are 5,280 m^3/day and 1,920 m^3/day respectively, with both consents expiring 30 September 2045.

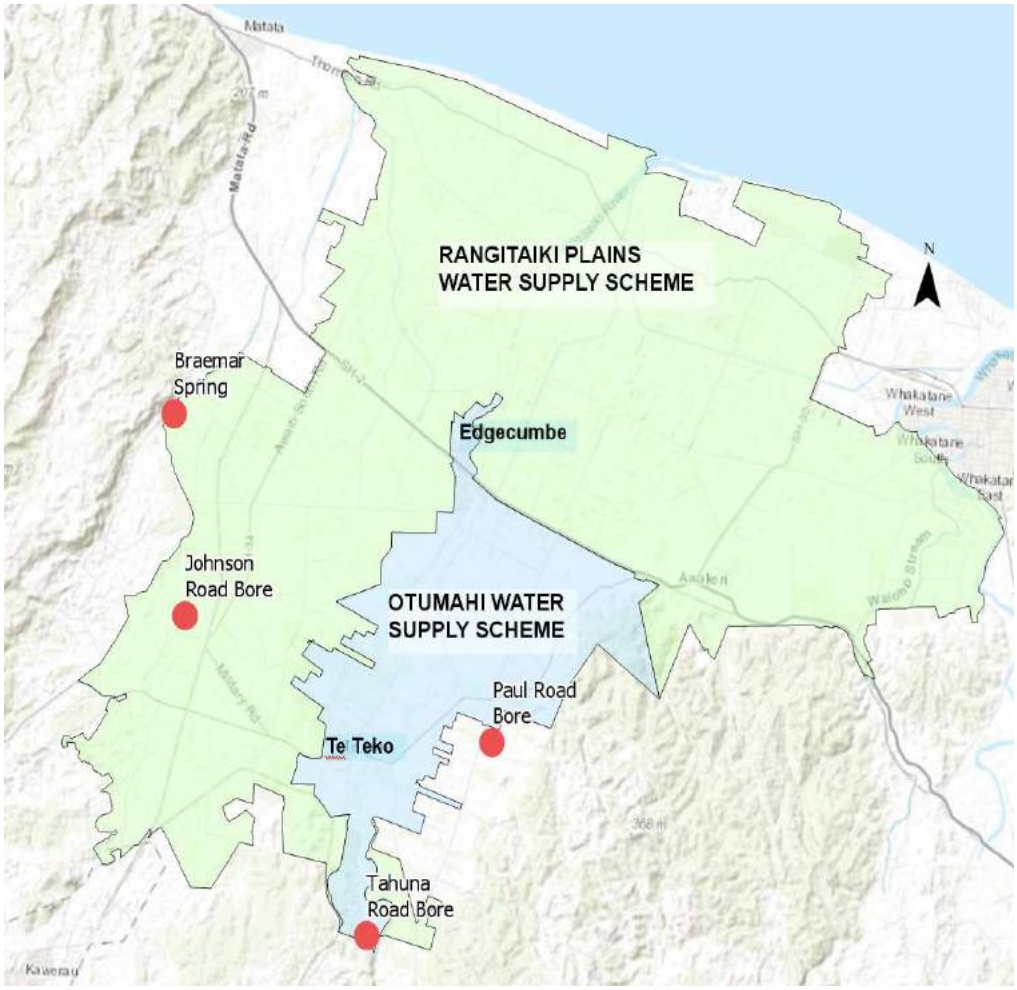


Figure 2: Boundary of the Otumahi Scheme

4.1.1 Water Source and Catchment

Paul Road Bore

The Paul Road bore site is located at 124 Paul Road, Te Teko, approximately 8 km south of Edgecumbe. The bore site consists of a single groundwater abstraction bore of 250mm diameter and a bore pump. The bore is cased to 169 metres with a screen intake between 106 and 166 metres.

The Paul Road recharge zone is approximately 3 km (Appendix D: Groundwater Capture Zone) and is considered to be primarily recharged from a deep semi-confined Matahina ignimbrite aquifer. Given the depth of abstraction and semi-confining nature of the overlying alluvium, contamination of the ignimbrite aquifer from surface contamination is considered unlikely.

Groundwater testing has been carried out and age of the water has been confirmed to be over 65 years with 0% young fraction (<1 year), therefore complying with bore water security criterion 1, indicating a lack of surface or climatic influence on the groundwater.

Activities in the catchment: A series of large scale orchards are situated in close proximity, to the northeast and south of the bore site. A few sheep have been observed in the neighbouring property adjoining the bore site. There are 8 consented HAIL sites within the groundwater capture zone associated with 'persistent pesticide use' associated with fruit production. There is 1 consented discharge of 'Diquat herbicide to surface water'. Approximately 11 bores have been identified in a 5km radius that are at a similar depth to Paul Road and therefore considered to be abstracting from the same aquifer.

No historical flood water inundation has been observed at this site.

Figure 3: Paul Road Borehead and security enclosure

Tahuna Road Bore

The Tahuna Road bore water supply is covered by an existing Water Safety Plan (Te Teko Water Safety Plan) expiring in January 2020 and will be superceded by this Otumahi Water Safety Plan. Tahuna Road bore site is located at 485B Tahuna Road, Te Teko, approximately 5 km south of the Te Teko township. The supply consists of a single abstraction bore situated on the Rangitāiki flood plain and a bore pump. The bore is approximately 22 metres deep with a screen intake depth of 19 metres.

The Tahuna Road recharge zone is approximately 400 m (Appendix D: Groundwater Capture Zone) and is considered to be primarily recharged from the Rangitāiki River through direct hydraulic connection with shallow groundwater. The site is known to have persistent high turbidity issues during periods of heavy rainfall.

Activities in the catchment: The wider area is characterised by agricultural and farming activities and surface water contamination from agricultural land use activities such as stock effluent, chemical fertiliser and pesticides are considered to be the primary risks to the Tahuna Road bore water supply. There are no consented discharges or HAIL sites within the groundwater capture zone of 400 metres.

The site is known to have been inundated with flood waters from the Rangitāiki River and is considered to be at risk of flooding during a 1% AEP event.

A detailed assessment of the catchments for Paul Road and Tahuna Road can be found in the catchment risk assessment carried out for Otumahi[3].

Figure 4: Tahuna Road Water Treatment Plant borehead

[3] Catchment Risk Assessment for Otumahi Bore Water Supply Scheme, Whakatāne District Council report (PDP, October 2017)

4.1.2 Treatment

Respective treatment plants are located on the same site as the bore and pump stations.

Bacterial Compliance: Gas chlorination disinfection treatment is provided at both sites and is capable of providing treatment to achieve full bacterial compliance requirements according to the DWSNZ 2005, (Revised 2018), at both sites.

Protozoa Compliance: There is currently no protozoa treatment installed at the Paul Road site. The Tahuna Road site qualifies for 3 log credit treatment attributed to UV disinfection; this site will qualify for a further 2 log credits (total of 5 log credits treatment) once the current on-site cartridge filtration system is verified. The Paul Road bore was assigned secure bore status by the DWA in November 2018 (Appendix E) further to meeting Bore Water Security Criteria 1 (no surface water influence), Security Criteria 2 (protected bore head) and Security Criteria 3 (no E. coli present during the 1 year interim monitoring period), and evaluation of the catchment risk assessment carried out by PDP (2017). Tahuna road bore was assigned a protozoa log credit of 3 by the DWA upon evaluation of the catchment risk assessment submitted. As the site is capable of achieving treatment equivalent to a protozoa log credit of 3 it is considered to be fully compliant for protozoa compliance.

The Otumahi Scheme is therefore currently compliant with the protozoa compliance criteria as outlined in the DWSNZ 2005 (Revised 2018).

pH Correction: pH correction is carried out at the Paul Road site with caustic soda dosing of raw water (30% sodium hydroxide). No pH correction is carried out at the Tahuna Road site.

Gas chlorination provided at both treatment plant sites utilise automatic chlorine cylinder changeover when the supply is low. Chlorine dosing adjusts automatically based on Free Available Chlorine (FAC) readings. When FAC leaving the treatment plant reaches outside operational limits equipment is checked and dose rate adjusted manually to achieve the required FAC, if required.

Cartridge filtration treatment at Tahuna Road consists of a 5 µm cartridge and a 1 µm cartridge connected in series. The cartridges are replaced periodically depending on run-times and gauge pressure, which are recorded in a Log book. Disinfection of cartridge housing is carried out after each cartridge replacement and testing is carried out to check successful changeover by passing water at maximum flow rate through the cartridges and recording residual pressure. Cartridges are sourced from recommended suppliers and the filtration units are operated according to manufacturer's instructions. WTP operators are trained in operating and maintaining the cartridge system according to manufacturer's specifications and best practice.

The UV disinfection unit at Tahuna road is required to deliver a UV dose of 40 mJ/cm^2 which is dependent on the flow rate of water and intensity of the UV supplied. Spare UV lamps are stored on site in case of lamp outages. The UV unit is maintained regularly by

cleaning lamp sleeves, UV sensor lens and lamp surface to prevent build up and therefore reduction of UV intensity.

Flow proportional caustic soda dosing (30% sodium hydroxide) is carried out at the Paul road site for pH correction. Caustic soda is dosed depending on pH of the bore water entering the treatment plant. Two pH meters measure the pH of the bore water and that of the treated water exiting the treatment plant and have set limits for pH which trigger alarms outside of acceptable levels.

FAC, pH, flow and turbidity (NTU) are monitored continuously at the water treatment plant and the plant is designed to alarm when these parameters exceed set limits. If turbidity exceeds critical limits, both the Paul Road and Tahuna Road treatment plants are set up so that the plant stops operating. In instances where automatic shut-down occurs as a result of high turbidity, either plant can be manually overridden by WDC to provide water to the scheme accompanied by relevant procedures such as boil water notices and appropriate notification to the DWA. This process is especially true for the Tahuna Road site which has persistent issues with turbidity during periods of high rainfall. The process is currently being reviewed to allow some chlorine disinfection to occur when auto shut-off has been over-ridden.

Regular maintenance and calibration of all water treatment plant equipment is carried out by WDC staff and recorded in the appropriate log books.

Figure 5: Paul Road Pump Station/ Treatment Plant Site (Above) and Tahuna Road Pump Station/ Treatment Plant Site (Below)

4.1.3 Storage and Distribution

Treated water from the Paul Road site is pumped to a 250 m^3 holding tank at the treatment plant site before being pumped directly to the Otumahi distribution network with the use of two 37 kW pumps that work on duty/standby basis and one 11 kW pump during low flows. The pumps work on VSD control and pumps directly to the distribution system based on the pressure in the distribution network; the pumps maintain a fixed outlet pressure of approximately 72 metres. Levels in the holding tank are pre-set, and are controlled by level sensors connected to the bore pump.

Treated water from the Tahuna Road site is pumped to a 25 m^3 holding tank at the treatment plant site before being pumped to a 230 m^3 concrete reservoir situated nearby, before being gravity fed to the distribution system.

There have been no issues accessing either of the reservoir sites in the past due to extreme weather.

An investigative study carried out by OPUS (Edgecumbe and Te Teko Security of Supply, OPUS July 2017) concluded that the Otumahi Scheme is able to operate with just the Paul Road supply in service. However, it is highly recommended that the scheme is supplied by two sources due to the security of supply it provides. It was also concluded that the scheme is unable to operate with just the Tahuna Road source alone.

The Otumahi Scheme distribution system is interconnected to the Rangitāiki Plains distribution system via isolation valve for resilience of these systems. This is a controlled

interconnection operated by manually opening isolation valves, situated within the Edgecumbe township area. As added security each valve box has a bolted plate installed.

In the event of low pressures within a system or when emergency supply of water is required, these valves can be opened, in accordance with the 'Otumahi – Rangitāiki Plains Emergency Connection Protocol' procedure document.

The distribution system consists of 74 km of water pipes consisting of 45.6 km of watermains and 28.4 km metres of rider mains. The majority of water pipes were laid in mid 1970s, 1990s and 2017 with the pipe material type being 50% of PVC, 25% of AC, 16% of PE and 9% being Alkathene /Other.

Te Teko township is not connected to a reticulated sewerage system and is on individual septic tanks and Edgecumbe township is connected to council sewerage system. The level of contamination of soil as a result of wastewater seepage is unknown for both areas.

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.

All existing connections have water meters, and Non domestic, farm and cow shed connections fitted with backflow devices and new metered residential connections are fitted with dual check valves. Backflow Policy being developed. Currently no routine testing of existing backflow prevention devices are carried out. A number of Council reticulation operators have undertaken training for backflow testing and are ready to test devices as required.

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 Otumahi Scheme (Otumahi pump station/ water treatment site and reservoir site) to the WDC main control room at Valley Road, Whakatāne, where it is monitored and controlled by WDC staff.

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

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

Monitoring of water quality in the Otumahi scheme reticulation system is carried out through routine manual E. coli and FAC sampling. Sampling is carried out in accordance with the DWSNZ 2005 (Revised 2018) sampling schedule. Continuous remote FAC monitoring is located within the Otumahi reticulation, in Edgecumbe and Te Teko. CHLOROCLAM FC1 3G PACKAGE Chloroclam® is used as the remote water quality monitor for Free Chlorine residual.

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

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

5.0 Compliance with Drinking Water Standards

The Tahuna road bore is currently graded as U (unclassified) and D (Unsatisfactory) according to the MoH grading for water supply schemes. The Paul Road bore has not been graded. MoH recommends a grading of at least Cc for a drinking water supply of this size.

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 Otumahi Scheme that eliminate, minimize or isolate contamination were identified and is presented in Table 3. A multi-barrier approach would provide the most robust system ensuring processes are in place to reduce contamination at each stage of the scheme.

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

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

Critical Points are areas in the scheme where there is potential for contamination or loss of supply of water. These were identified and presented in Table 4.

Figure 6 (Paul Road) and Figure 7 (Tahuna Road) show the Critical Control Points (CCPs) of the Otumahi Scheme and the Control Parameters that are to be monitored and measured at each CCP.

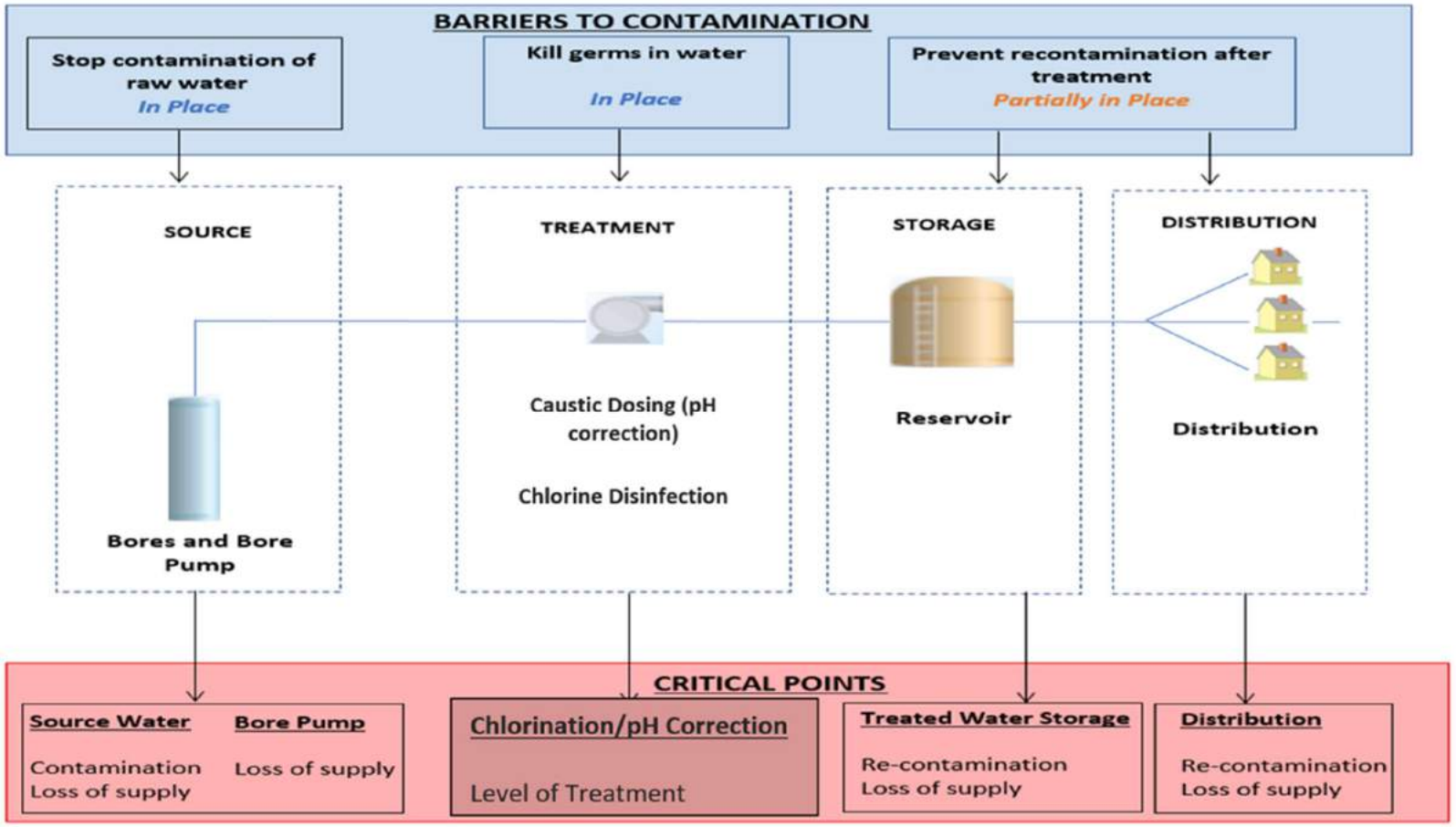


Figure 6: Barriers to Contamination and Critical Points of Paul Road Source and Treatment

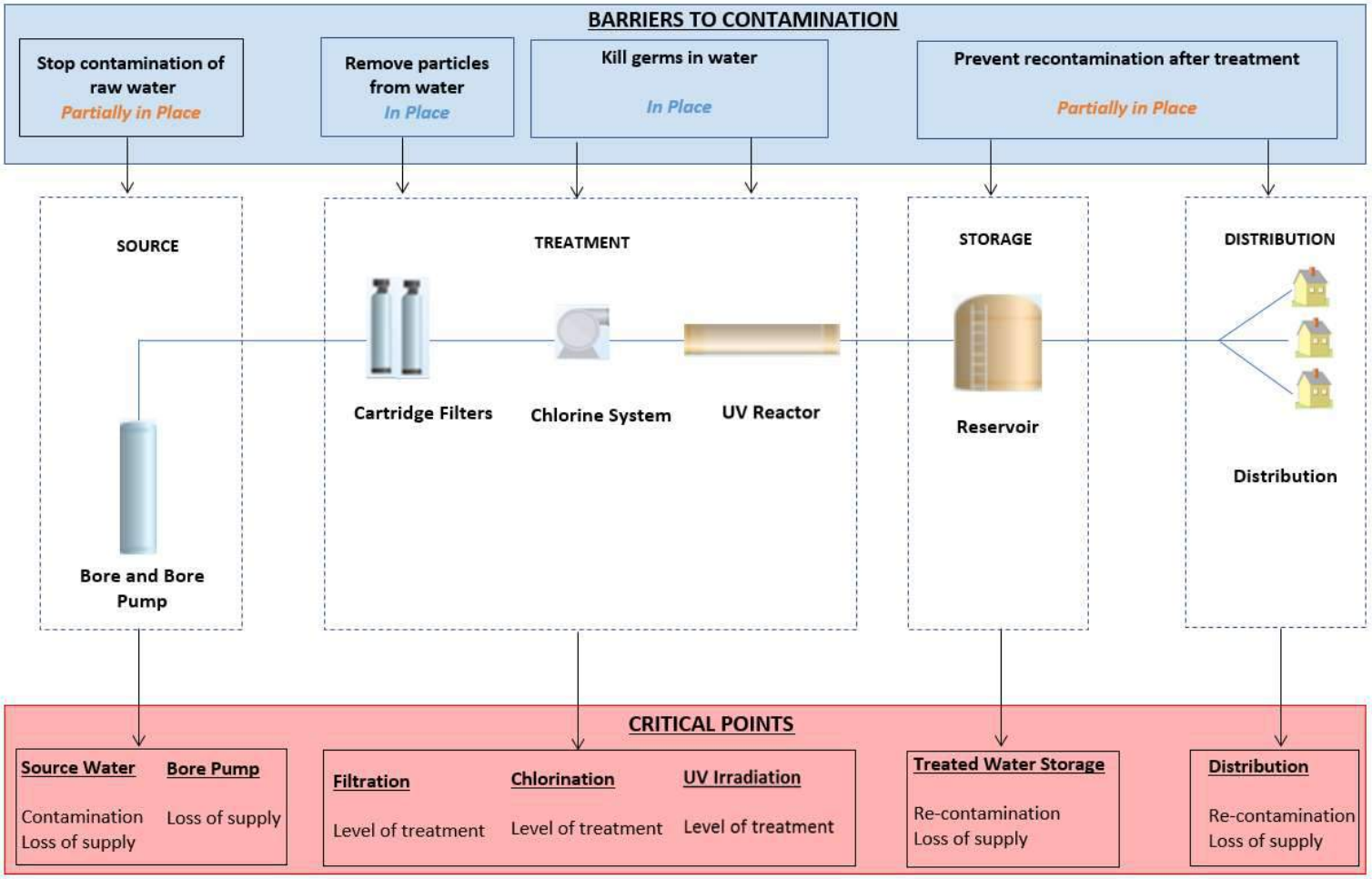


Figure 7: Barriers to Contamination and Critical Points of Tahuna Road Source and Treatment

Table 3: Barriers to Contamination	
Barriers to:	**Actions/Supply elements contributing to the barrier**
Stop contamination of raw water (At Source) ***Paul Road:*** ***In Place*** ***Tahuna Road:*** ***Partially in Place***	• **Security of groundwater source:** ***Partially in Place*** - Shallow Tahuna Road bore is heavily influenced by changes in catchment. ***In Place*** - Paul Road bore water is not influenced by surface catchment activity due to depth of bores. • **Abstraction point positioned and constructed to avoid contamination:** ***In Place*** - Both sources compliant with protected borehead requirements. • **Source protected from contamination:** Catchment risk assessment carried out to identify activities in the two catchments; ongoing monitoring of activities required.
Remove particles from the water (Treatment) ***Paul Road:*** ***Not Required*** ***Tahuna Road:*** ***In Place***	• **Filtration:** ***In Place*** - Available at the Tahuna Road site.
Kill germs in water (Treatment) ***Paul Road:*** ***In Place*** ***Tahuna Road:*** ***In Place***	• **Disinfection (Chlorine, UV):** ***In Place*** - Chlorine disinfection present in both treatment plants in line with bacterial removal, plus UV treatment present at Tahuna Road. pH correction at Paul Road to increase disinfection efficacy.
Prevent recontamination after treatment (Storage & Distribution) ***Paul Road:*** ***Partially in place*** ***Tahuna Road*** ***Partially in place***	• **Measures to stop contamination of storage tanks:** ***Partially in place*** • **Maintenance of a disinfecting residual:** ***In Place*** - as continuous FAC monitoring is carried out at the treatment plants. FAC leaving treatment plant maintained within target limits. FAC and E. coli 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, farm and cow shed connections fitted with backflow devices and new metered residential connections are fitted with dual check valves. Backflow Policy being developed.

Table 4: Critical Points	
Critical Point	**Description**
Groundwater bores: Contamination of source supply	• Highly variable source water quality in Tahuna Road bore due to shallow depth of bore and hydraulic connection to the river.
Groundwater bores: Loss of source supply	• Failure of bore pump leading to loss of supply. • Access to the pump station and treatment plant site restricted during heavy storm events due to flooding of road leading to Tahuna Road site. • Loss of supply due to failure of bore pump at Paul Road due to lack of storage.
Treatment	• Insufficient chlorine dosing resulting in harmful microbiological contaminants remaining in water. • Overdosing of chlorine leading to chemical contamination of water. • Insufficient maintenance of treatment equipment leading to failures and subsequent inadequate treatment. • Infrequent calibration and verification of equipment leading to false measurements of water quality.
Treated water storage	• Possible contamination of treated water storage in the reservoirs if routine inspections and maintenance not undertaken and access by vermin and birds from gaps in the roof and overflow pipe at Tahuna Road. • 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. 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. • Leakage rates in the distribution system leading to possible contamination of water through back flow. • Possible illegal connections leading to contamination of network.

7.0 Risk Assessment Tables

Based on the Barriers to Contamination and Critical Points identified in Section 6.0, it is possible to identify 'Risk Events' that could occur in the Otumahi 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 5) and Consequence scale (Table 6) were defined and set by WDC staff according to how they perceived risks and the corresponding Risk Matrix (Table 7) was used to assign the level of Current Risk and Residual Risk as 'Low', 'Medium', 'High' or 'Extreme'.

Table 5: 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 6: 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	No reported illness	Significant modification to

Table 6: Consequence Scale as Defined by WDC				
		event that requires flushing.		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 7: 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 Otumahi 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 8) and the date by which WDC intends to carry it out.

Improvements are listed in order of Priority as follows: High Priority (Table 9), Medium Priority (Table 10) and Low Priority (Table 11).

Items were assigned by WDC based on the timeline achievability, cost of implementation, the ease of implementation and the current risk to the Otumahi Scheme if the improvements are not carried out.

It should be noted that items in the Improvement Plan relate to both Paul Road and Tahuna Road treatment plants, associated reservoirs and distribution system, unless items are specifically stated as relating to an individual part of the scheme.

Table 8: 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	PE
Manager Public Affairs	M-PA
Senior Project Planner	SPP

Table 9: Improvement Plan – High Priority Items						
Item	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Estimated Cost/Time**	**Due by Date**
1	**S2.1 (PM1) S3.1**	**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 July	AE / TL-AM	80 hours	August Annually
2	**S3.1 (PM1G)**	**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	October 2019
3	**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 shall be prepared.	AE / TL-AM	24 hours	October 2019
4	**S1.2 (PM1b) T3.1 (PM1b)**	**Power failure**	Tahuna WTP: provision of a dedicated generator - for the interim, install a dedicated generator plug-in point	AE/TL-AM	$10,000	November 2019
5	**T4.1 (PM1) T5.1 (PM1) T11.1 (PM1) T11.3 (PM1) T11.4 (PM1) T11.5 (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 2019
6	**D5.2 (PM1G)**	**Inadequate operating Procedures**	Review 'Incident Response Plan – Three Waters Assets (Water, Wastewater and Stormwater)' document. Modify, where required to 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	December 2019
7	**D5.2 (PM2G) D5.3 (PM2G)**	**Inadequate operating Procedures**	Develop and implement a Council SOP (Hygiene code of practice for working on water supply systems). The document to reflect industry best practice and how Council will manage preventing cross contamination in the unlikely event that staff alternate on wastewater and water reticulation work. The Hygiene Code of Practice to include start up employment arrangements, sickness statement and medical clearance requirements.	TL-WTP/TL-O/TL-AS / RC	40 hours	December 2019
8	**S1.3 (PM2) R3.1 (PM1)**	**Insufficient storage capacity**	Operators to be trained in following the 'Otumahi – Rangitāiki Plains Emergency Connection Protocol' document	TL-WTP / WTP-O	16 hours	December 2019
9	**S1.3 (PM3)**	**Inadequate operating Procedures**	Purchase a spare pumpset for Paul Rd bore as replacement parts may have a lead time of up to several weeks.	AE / PE	$30,000	March 2020

Table 9: Improvement Plan – High Priority Items						
Item	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Estimated Cost/Time**	**Due by Date**
10	**D5.1 (PM1G)**	**Poor planning of scheduled work by WDC staff and their contractors affecting critical customers**	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	May 2020
11	**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 2020
12	**S2.1 (PM5)**	**Managing activities in the catchment**	WDC to monitor activities within the groundwater capture zone of each site: 1) Paul Rd site: To liaise with consent holders of the 8 HAIL sites and consented discharges to make them aware of the effects of activities around the bore on water quality.	SPP / AE / TL-AM	240 hours	June 2021
13	**S1.2 (PM1a) T3.1 (PM1a)**	**Power failure**	Tahuna WTP: Investigate the installation and/or provision of a dedicated generator for this site to provide minimum flow requirement during power outage.	AE/TL-AM	40 hours + $40,000 (tentative)	September 2021
14	**S2.1 (PM2) S3.1 T1.3 (PM2)**	**Managing activities in the catchment**	Catchment Risk Assessment undertaken September 2017. Programme activities to submit a catchment risk assessment to the DWA before 5 year period, for approval.	AE / TL-AM	240 hours	July 2022
15	**S1.3 (PM4)**	**Inadequate operating Procedures**	Investigate drilling a second bore at Paul Rd and have pipework and electrics ready to activate because it takes several days to withdraw the existing pumpset and replace it.	SPP / TL-AM / AE / PM	$500,000	December 2022
16	**S1.9 (PM1)**	**Resource consent limitations**	Apply for new water take consent in accordance with requirements (at least six months prior to expiry). Both Paul Road and Tahuna Road Consents expire (2045).	SPP / AE / TL-AM	$100,000	January 2045

Table 10: Improvement Plan – Medium Priority Items						
Item	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Estimated Cost/Time**	**Due by Date**
1	**WSPs**	**WSP Review**	Carry out 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	120 hours	May (annually)
2	**D4.1 (PM3G)**	**Pressure fluctuations in the system**	Carry out a periodic water balance to identify levels of leakage in system.	AE	8 hours	August (annually)
3	**T7.1 (PM1)**	**Short circuiting or lack of contact tank**	New Otumahi distribution zone: Review distribution sample points to ensure points of higher risks are covered and develop sampling point schedule (e.g. points furthest away from treatment plant, dead ends and points of low usage, points of high draw off, service reservoirs, old pipework, low pressure areas).	TL-WTP / TL-O / AE / TL-AM	8 hours	December 2019
4	**T4.4 (PM2G) T10.2 (PM1G) T10.3 (PM1G T10.7 (PM1G))**	**Inadequate Training Cartridge Filtration**	Develop training and competency system (T&CS) The T&CS to incorporate operators training for the replacement of cartridge for filtration systems	TL-AS / TL-WTP / WTP-O	80 hours	December 2019
5	**T10.4 (PM1)**	**Cartridge Filtration**	Recorded log records to be detailed and located in corporate system for review upon request	TL-AS / TL-WTP / WTP-O	80 hours	December 2019
6	**D6.1 (PM1G)**	**Third party contractor/developer work on WDC reticulation (not directly engaged by WDC)**	WDC to develop policy and procedure whereby Third party contractors/developers are made liable for any damages to the network to increase accountability.	TL-O / AE / TL-AM	40 hours	December 2019
7	**S1.6 (PM1) S1.7 (PM1)**	**Natural disasters - Flooding and extreme storm events**	Develop a disaster management plan for the water supply which could be included as part of a wider disaster management plan for the district.	MTW / TL-O / TL-WTP	120 hours	March 2020
8	**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 2020

Table 10: Improvement Plan – Medium Priority Items						
Item	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Estimated Cost/Time**	**Due by Date**
9	**T7.1 (PM2)**	**Short circuiting or lack of contact tank**	New Otumahi distribution zone. Confirm/recalculate scheme population utilising latest NZ censuses data (due for released later 2019) or other applicable method and if significant change apply to update drinking water register.	AE / TL-WTP	8 hours	May 2020
10	**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	May 2020
11	**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	May 2020
12	**T4.2 (PM1G)**	**Inadequate plant records and procedures**	Ensure all plant records such as manuals, drawings, procedures, Incident 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	May 2020
13	**T1.1 (PM1)**	**Insufficient bacterial treatment installed Sediment/slime**	Investigate best practice for monitoring/ assessing and responding to total coliforms and indicate what costs and benefits this would deliver for this water supply. If feasible and able to adequate resource council to develop protocol and modify Incident Response Plan appropriately.	TL-WTP / WTP-O / AE	40 hours	May 2020
14	**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 / renewals programme.	AE / PM	$5,000	December 2020 (subject to Council Policy)
15	**T5.2 (PM1G) T5.3 (PM1G) T5.4 (PM1G) T8.1 (PM1G) T8.2 (PM1G) T8.3 (PM1G)**	**Water quality control, i.e.- Excessive colour, turbidity, temperature, water hardness**	Internal monitoring parameters verification audit. Establish in-house standard operating procedure (SOP) for testing/challenging of established set points, thus verifying alarms and plant shut down functionality. The SOP to include methodology, frequency of audit/testing, documentation/record keeping requirements and SOP review requirements (i.e. when installation of new technology/equipment).	TL-WTP / WTP-O	40 hours	December 2020
16	**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 2020

Table 10: Improvement Plan – Medium Priority Items						
Item	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Estimated Cost/Time**	**Due by Date**
17	**D5.3 (PM1G)**	**Inadequate training and registers**	Review staff certificates and maintain updated training and health register. Develop a training and competency system for working on reticulated network.	TL-O / TL-AS / TL-WTP	20 hours + $500	December 2020
18	**T1.4 (PM1)**	**Other - Insufficient pH treatment**	Tahuna Road - Investigate options to install pH correction and cost benefit of installation of pH correction. If feasible budget and programme for works to occur	TL-WTP/PM / TL-AM	60 hours	December 2022
19	**S2.2 (PM 4)**	**Bore head Security**	Paul Road: Work closely with Bay of Plenty Regional Council to undertake a bore survey of active and decommissioning/abandoned bores within the 3km groundwater capture zone.	AE / TL-AM	40 hours	December 2022
20	**D4.1 (PM1)**	**Pressure fluctuations in the system**	Identify problem pressure areas by carrying out hydraulic computer modelling and network analysis coupled with customer complaint records.	AE	$15,000	December 2022

Table 11: Improvement Plan – Low Priority Items						
Item	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Estimated Cost/Time**	**Due by Date**
1	**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	November 2019
2	**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
3	**R2.1 (PM1)**	**Loss of structural integrity of reservoirs**	Carry out condition assessment of all concrete reservoirs in 2019 and formulate a condition assessment programme thereafter.	AE	$2,000	December 2019
4	**D2.1 (PM1G) D2.1 (PM2G) D2.2 (PM3G) D4.1 (PM2G) S1.3 (PM1) S1.4 (PM1) S2.2 (PM2) R2.1 (PM2) R4.1 (PM1) T2.1(PM1) 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 2020
5	**T10.1 (PM2)**	**Cartridge Filtration**	Identify correct cartridge/s (and suppliers) required for filtration unit and utilise Asset Management System for renewals / replacements	TL-WTP / TL-AS / AE	20 hours	May 2020
6	**R4.3 (PM1)**	**Sediment/slime accumulation and resuspension of sediment.**	Utilise Asset Management System to schedule and implement a CCTV inspection of reservoirs and vacuum cleaning programmes as required.	TL-AS / TL-O	4 hours	May 2020
7	**D2.2 (PM1)**	**Inability to isolate or shut down the system**	Carry out a routine maintenance plan for valve exercising with priority given to critical valves i.e.-those supplying a large or critical customer base, valves on rising and falling mains and those used for bore and reservoir isolation.	TL-AS / TL-O	12 hours	May 2020

Table 11: Improvement Plan – Low Priority Items						
Item	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Estimated Cost/Time**	**Due by Date**
8	**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	September 2020
9	**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	September 2020
10	**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	November 2020
11	**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	November 2020
12	**R1.1 (PM1)**	**Insufficient storage capacity for daily demand**	Council to investigate long-term option of providing a reservoir with minimum 24 hours and up to 48 hours storage.	MTW/ PM/ TL-AM	120 hours	December 2020
13	**T1.2 (PM1)**	**Insufficient protozoal treatment installed**	Obtain verification of cartridge filtration from manufacturer	TL-WTP	8 hours	December 2020
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	**T4.3 (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
16	**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
17	**S2.2 (PM3)**	**Bore-head Security**	Carry out CCTV inspection of bore casing to ascertain condition, as required.	TL-AM	$5,000	February 2022

Table 11: Improvement Plan – Low Priority Items						
Item	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Estimated Cost/Time**	**Due by Date**
18	**D3.1 (PM1G)**	**Pipe, valve and hydrant failure due to age, condition and material of pipe**	Develop asset renewals programme based on condition sampling and assessments, analysis of asset age, material, frequency of breakages and increase in maintenance costs. Asset renewals to prioritize critical assets such as rising mains/falling mains, pipes supplying a critical consumers or large consumer base, critical valves and hydrants.	AE / TL-AM	240 hours	June 2022
19	**D4.1 (PM4)**	**Pressure fluctuations in the system**	Once hydraulic models are completed and in-line with annual water balance calculations develop and implement leak detection programme	AE	$8,000	April 2023
20	**S2.1 (PM6) S3.1 (PM4G)**	**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. It is therefore recommended 'Process Control Summaries' are used as a guide by WDC treatment plant operators in day to day operations.

Table 12: Process Control Definitions	
Critical Control Points (CCPs)	Points and processes in the Otumahi Scheme that can be controlled to prevent contamination of water.
Control Parameters (CPs)	Parameters that can be measured and monitored in order to determine if a process is performing as required.
Target Range	Desired range within which each CP is required to operate in the normal day-to-day operation of the system.
Action Limits and Critical Limits	When CPs reach these limits Corrective Actions are required to be carried out by persons responsible to bring CPs back within the Target Range.
Corrective Actions	Actions to be carried out when CPs reach Action Limits and Critical Limits.
Process Control Summaries (PCS)	Target Range, Action Limits and Critical Limits for CPs and a list of corrective actions to be taken when CPs reach Action Limits and Critical Limits, along with person/s responsible for carrying them out.

Process Control Summaries have been prepared for the Treatment CCPs of the Otumahi 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 Section 9.1 (Caustic Soda Dosing), Section 9.2 (Chlorination), Section 9.3 (Cartridge Filtration) and Section 9.4 (UV Irradiation) and Appendix B and Appendix C sets out Process Control Summaries for each of the Treatment CCPs for each plant.

9.1 Paul Road Treatment Critical Control Point: Caustic Soda Dosing (pH Correction)

Process Objectives:

- Provide a pH correction CCP to increase efficacy of the chlorination process.

Process Location:

- Located after borewater take and before chlorine dosing point.

Parameters and day-to-day monitoring:

- pH (pH units) – Continuous monitoring through pH meter connected to SCADA and Telemetry.

Parameter Monitoring Points:

- For Paul Road: (1) After bore water extraction: pH (2) After contact tank, and (3) At exit from treatment plant.

Process Records:

- Manual: WTP Log book and manual sampling sheets. In-house information system to record manual sampling results. Results regularly uploaded to Drinking Water Online to be assessed by the DWA for compliance purposes.
- Online: Telemetry and SCADA system to record and display data.

Process Controller:

- WDC water treatment plant operator on duty.

Supporting Programmes:

- Weekly checks of continuous monitoring equipment and calibration of monitoring instruments.
- Regular calibration and verification of field instruments.
- Training and competency assessment by DWA of operators in equipment operation and monitoring.
- IANZ accredited laboratory verification checks for E. coli weekly with transgression reporting to Operator and DWA as per DWSNZ 2005 (Revised 2018).

9.2 Paul Road and Tahuna Road Treatment Critical Control Point: Gas Chlorination (Disinfection Treatment)

Process Objectives:

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

Process Location:

- For Paul Road: chlorine dosing is located after caustic soda dosing.
- For Tahuna Road: chlorine dosing is located after the cartridge filters.

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
- Conductivity (µS/cm) – Continuous monitoring

Parameter Monitoring Points:

- For Paul Road: (1) After bore water extraction and before caustic dosing: turbidity, conductivity and pH, (2) After chlorine dosing: FAC, and (3) After contact tank: turbidity, conductivity, pH and FAC, and (4) At exit from treatment plant: turbidity, conductivity, pH and FAC.
- For Tahuna Road: (1) After bore water extraction and before cartridge filters: turbidity , (2) After cartridge filters: turbidity, (3) After chlorine dosing point: FAC (4) After contact tank: pH, and (5) After UV treatment: turbidity, FAC.
- Manual sampling of E. coli in water leaving the Tahuna Road treatment plant, twice a week.

Process Records:

- Manual: WTP Log book and manual sampling sheets. In-house information system to record manual sampling results. Results regularly uploaded to Drinking Water Online to be assessed by the DWA for compliance purposes.
- Online: Telemetry and SCADA system to record and display data.

Process Controller:

- WDC water treatment plant operator on duty.

Supporting Programmes:

- Weekly checks of continuous monitoring equipment and calibration of monitoring instruments.
- Regular calibration and verification of field instruments.
- Training and competency assessment by DWA of operators in equipment operation and monitoring.
- IANZ accredited laboratory verification checks for E. coli weekly with transgression reporting to Operator and DWA as per DWSNZ 2005 (Revised 2018).

9.3 Tahuna Road Critical Control Point: Cartridge Filtration (Particle Removal)

Process Objectives:

- Provide a particle removal critical control point to remove suspended particles containing pathogens that may have entered upstream of dosing point.

Process Location:

- Cartridge filter unit situated after the bore uptake and upstream of chlorine dosing system.

Parameters and day-to-day monitoring:

- Flow (m^3/hr) – Continuous monitoring through magnetic flow meter connected to SCADA via Telemetry. Flow rate to be within the rating specified on the cartridge filters.
- Turbidity (NTU units) – Continuous monitoring through turbidity meter connected to SCADA and Telemetry.
- Pressure Differential (KPa) – Connected to SCADA via Telemetry.

Parameter Monitoring Points:

- Pressure differential is monitored by three pressure gauges, one gauge situated before and after each cartridge filter unit.
- Turbidity and Flow are both monitored immediately upstream and downstream of the filtration unit.

Process Records:

- Manual: WTP Log book and manual sampling sheets. In-house information system to record manual sampling results.
- Online: Telemetry and SCADA system to record and display data.

Process Controller:

- WDC water treatment plant operator on duty.

Supporting Programmes:

- Daily checks and calibration of monitoring instruments.
- Training and competency assessment of operators in cartridge filter unit operation and changing of cartridges, and turbidity monitoring.

9.4 Tahuna Road Critical Control Point: UV Irradiation (Disinfection Treatment)

Process Objectives:

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

Process Location:

- UV treatment unit situated downstream of chlorine dosing system.

Parameters and day-to-day monitoring:

- Flow (m^3/hr) – Continuous monitoring through magnetic flow meter connected to SCADA via Telemetry.
- UV Intensity UV(I) (W/m^2) – Continuous monitoring through UV unit connected to SCADA via Telemetry.
- UV Transmissivity (UV(T)) (mw/sm^3) – Manual monitoring, once in 10 days.
- Lamp outages (number of outages) – Per incident of occurrence.

Parameter Monitoring Points:

- UV parameters (Turbidity, UV Flow, UVI, UVT and UV Alarm) are monitored within or immediately downstream of the UV reactor.

Process Records:

- Manual: WTP Log book and manual sampling sheets. In-house information system to record manual sampling results.
- Online: Telemetry and SCADA system to record and display data.

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.
- Use of only utilise potable water grade chlorine stock solution from approved suppliers.
- Lab verification checks for E. coli with transgression reporting to Operator and DHB if results are outside DWSNZ 2005 (Revised 2018).

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 13: 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 – refer to 'Incident Response Plan – Three Waters Assets (Water, Wastewater and Stormwater (A1376861)' section WATER SUPPLY RESPONSE PROCEDURE *Note: this includes all aspects of water reticulation responses including items such as flushing, main breaks, boil water notices etc.*	Operations
	Undertake Incident Response Plan – Three Waters Assets (Water, Wastewater and Stormwater (A1376861) – 'Communication in the Event of a Boil Water Notice' and when directed by MTW or DWA notify customers using M-PA department. • High risk customers to be notified as a priority.	Public Affairs/ Operations
	Carry out increased monitoring according to DWSNZ 2005 (Revised 2018).	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 via supply specific flushing plan	Operations
Following in water leaving treatment plant: E. coli, low FAC, High Turbidity, 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 2005 (Revised 2018).	Operations
Following in distribution system: E. coli, low FAC, High Turbidity as a result of, but not limited to, the following: • Backflow into system • Insufficient FAC residual in water leaving treatment plant • Leaks in system • Inadequate maintenance of distribution system leading to	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
	Undertake Incident Response Plan – Three Waters Assets (Water, Wastewater and Stormwater (A1376861) –	Public Affairs/ Operations

Table 13: Contingency Plans

Event	Actions	Responsibility
slime build up, leaching and poor circulation.	'Communication in the Event of a Boil Water Notice' and when directed by MTW or DWA notify customers using M-PA department. • High risk customers to be notified as a priority.	
	Carry out increased monitoring according to DWSNZ 2005 (Revised 2018).	Operations
	Notify the DWA of event.	Operations
	Where appropriate, carry out flushing of reservoirs and distribution system that may be affected.	Operations
	Undertake the following depending on nature of event: • Identify and fix leaks in the system and instruct customers to carry out the same on private property reticulation.	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 • Seasonal loss of supply	Procedure for sourcing water from emergency supply: alternative groundwater/surface water supply or providing tankered water. Utilise the 'Otumahi – Rangitāiki Plains Emergency Connection Protocol' document for temporary back-up supply	Operations
	Undertake Incident Response Plan – Three Waters Assets (Water, Wastewater and Stormwater (A1376861) – 'Communication in the Event of a Boil Water Notice' and when directed by MTW or DWA notify customers using M-PA department. • 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
	Demand management plan for seasonal loss of supply (including water conservation notice).	Operations
	Provide extra temporary storage if possible.	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. Utilise the 'Otumahi – Rangitāiki Plains Emergency Connection Protocol' document for temporary back-up supply	Operations
	Increased monitoring according to DWSNZ 2005 (Revised 2018).	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.

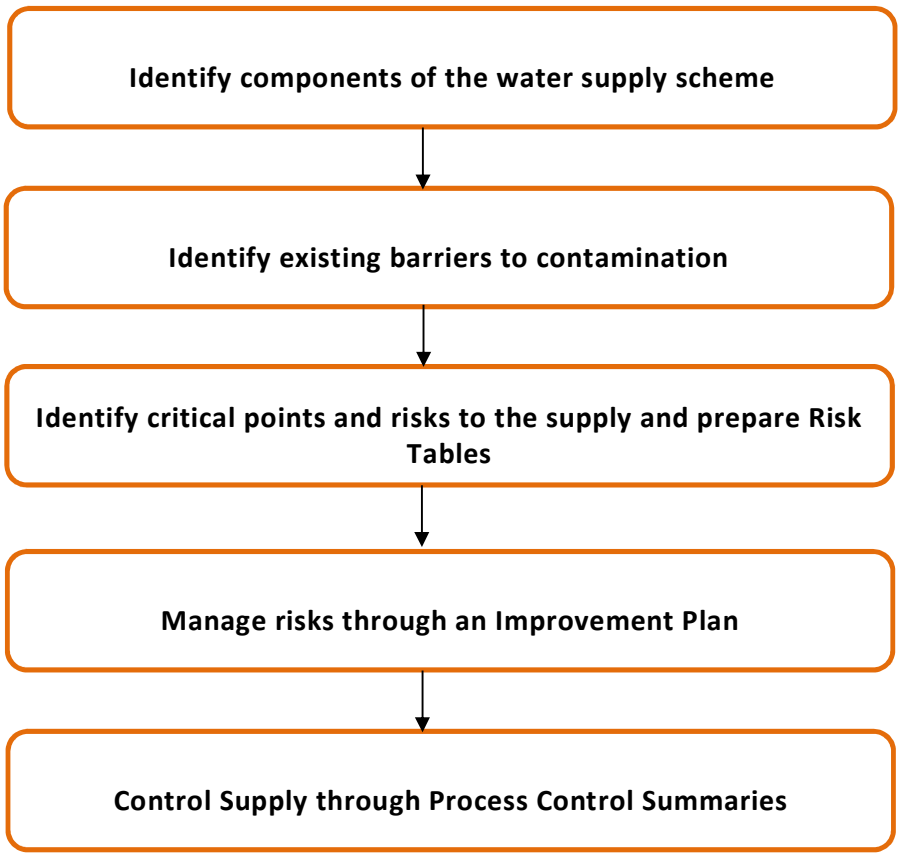


Figure 8: Methodology

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

- The series of "Water Safety Plan Guides for Drinking Water Supplies (2014)".
- The document "A Framework on How to Prepare and Develop Water Safety Plans for Drinking-water Supplies (2014)".
- New Zealand Drinking-water Safety Plan Framework (2018)

Information used in this report has been gathered as follows:

- Documents and reports:
  - Water Asset Management Plans (WDC).
  - Asset condition assessments for reservoirs and pipes (WDC).
  - Various Council Policies and Procedures (WDC).
  - Maintenance checklists and schedules (WDC).
  - Council Annual Plan and Long Term Plan (WDC).
  - MoH Compliance Reports and PHRMP verification reports (DWA, MoH).
  - Reservoir cleaning and structural assessments (WDC).
  - Catchment Risk Assessment for Otumahi Water Supply Report (November 2017, PDP).
- Site Visits carried out by PDP to the following locations: Paul Road and Tahuna Road treatment plant and pump station sites (11/10/2017), Te Teko reservoir (11/10/2017).
- Consultation workshop carried out by PDP with participation of WDC, 10th October 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:

Gareth Phillips – Manager Three Waters Operations (position held up till May 2018); Neal Yeates – Team Leader Water Treatment Plant; Luke Shipton – Team Leader Operations; Leilani Salanguit – Project Engineer; Inka Krawczyk – Project Engineer; Michael Van Tilburg – Team Leader Three Waters Assets Management and Planning; Joe Xie – Asset Engineer Three Waters Assets Management and Planning.

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

Appendix A: Otumahi Scheme Risk Tables

Table 14: 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 District 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 not experienced at the two sites. **PM1**: Two water sources therefore one source is likely to be available when the other is unavailable.	Yes	Low (Rare x Minor)	Risk Managed	N/A	N/A
S1.2	Power failure	• Power failure alarms. • Reduced or no flows.	• No generator available at the Tahuna Road pump station site. • Automatic change over backup generator installed at Paul Road site. **PM1a:** Generator hired from local contractor and taken to site when required.	Partially	Medium (Possible x Minor)	**PM1a:** Tahuna WTP: Investigate the installation and/or provision of a dedicated generator for this site to provide minimum flow requirement during power outage. **PM1b:**: Tahuna WTP: provision of a dedicated generator - for the interim, install a dedicated generator plug-in point	Low (Unlikely x Minor)	**PM1a:** TL-O / AE / PE **PM1b** TL-O / AE / PE
S1.3	Bore pump failure	• Pump failure alarms. • Reduced or no flows.	**PM1**: Some storage available at Te Teko Reservoir (50 m^3) and Paul Road contact tank (250 m^3). **PM2:** The 'Otumahi – Rangitāiki Plains Emergency Connection Protocol' document exists for temporary supply **PM3**: Two water sources therefore one source is likely to be available when the other is unavailable, although Tahuna cannot supply sufficient volume. **PM4:** Regular bore maintenance carried out.	Partially	Extreme (Likely x Major)	**PM1:** Utilise Asset Management System to schedule routine preventative maintenance of pumps. **PM2:** operators to be trained in the 'Otumahi – Rangitāiki Plains Emergency Connection Protocol' document for temporary supply **PM3:** Purchase a spare pumpset for Paul Rd bore as replacement parts may have a lead time of up to several weeks. **PM4:** Investigate drilling a second bore at Paul Rd and have pipework and electrics ready to activate because it takes several days to withdraw the existing pumpset and replace it.	Medium (Possible x Minor)	**PM1:** TL-AS **PM2:** TL-O / TL - WTP **PM3:** AE / PE **PM4**: SPP / TL-AM / AE / PM
S1.4	Damage to bore headworks and pumping equipment/wiring due to	• Visual damage to intake/pump equipment/ electrical cables.	• No history of vandalism at the Tahuna Road site. • Perimeter security gate with locks at Paul Road site with bore headworks enclosed in	Partially	Low (Unlikely x Minor)	**PM1:** Vermin/rodent poison stations placed on site and added to schedule monitoring and maintenance via Asset Management System	Low (Unlikely x insignificant)	**PM1**: TL-AS / TL-O

Table 14: 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 District Water Safety Plans)	Residual Risk	Responsibility
	vandalism and/or vermin and animals.	• Reduced or no flows from bore. • No signal or no readings received from equipment and/or equipment failure.	a locked enclosure. Tahuna Road has locked gates to the site; bore headworks is not enclosed. • All treatment plant equipment including chlorination equipment, flow meters, pumps, etc. are contained within locked concrete housing at both sites. • Site visited weekly for sampling and inspection. • Two water sources (bore source and spring source) therefore one source is likely to be available when the other is unavailable.					
S1.5	Restricted access to bore site due to absence of right of access.	• Restricted access to site during normal operating conditions.	• Water take sites are situated on WDC owned land/easements and WDC has no legal restrictions to access either site.	Yes	Low Unlikely x Minor)	Risk Managed	N/A	N/A
S1.6	Natural disasters – Flooding and extreme storm events.	• Restricted access to site. • Inability to operate and maintain equipment.	• Tahuna Road site historically known to flood and is situated below 1% AEP flood level. • No historical flooding observed at Paul Road site. **PM1**: Borehead was raised as part of treatment plant upgrades.	Partially	Medium (Possible x Minor)	**PM1:** Develop a disaster management plan for the water supply which could be included as part of a wider disaster management plan for the district.	Low (Possible x Insignificant)	**PM1**: MTW / TL-O / TL-WTP
S1.7	Natural disasters – slips and earthquakes.	• Restricted access to site. • Inability to operate and maintain equipment.	• Restricted access to Tahuna Road site during high rainfall events.	Partially	Medium (Possible x Minor)	**PM1:** Develop a disaster management plan for the water supply which could be included as part of a wider disaster management plan for the district.	Low Possible x Insignificant)	**PM1**: MTW / TL-O / TL-WTP
S1.8	Clogged bore screen/s	• Reduced or no flows.	• No historical screen clogging issues at either site. However, it should be noted that Tahuna Road supply has high turbidity during rainfall events. **PM1:** Some temporary storage available if maintenance required: Te Teko Reservoir (230 m^3) and Paul Road contact tank (250 m^3). **PM2**: Two water sources therefore one source is likely to be available when the other is unavailable.	Yes	Low Possible x Insignificant)	Risk Managed	N/A	N/A

Table 14: 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 District Water Safety Plans)	Residual Risk	Responsibility
S1.9	Resource consent limitations	• Loss of right to abstract water. • Increase in take compared to extraction limit granted.	• Both Paul Road and Tahuna Road Consents expire (2045). **PM1:** WDC has consent management System currently in place, alerting conditions of consent and when consents are nearing expiration (the consents database-management tool is called CS-VUE).	Yes	Medium (Possible x Minor)	**PM1:** Apply for new water take consent in accordance with requirements (at least six months prior to expiry). Both Paul Road and Tahuna Road Consents expire (2045).	Low (Rare x Minor)	**PM1:** SPP / AE / TL-AM
S2: EVENT: MICROBIAL CONTAMINATION OF BORE WATER								
S2.1	Discharge/leachate/runoff from the following activities in the catchment: **Agriculture:** Manure from grazing livestock, Manure fertiliser, silage leachate, dairy shed washwater, effluent spray irrigation, effluent ponds. **Forestry:** Sewage from sludge application. **Industry:** Wastewater discharges from industrial processes, biological washwater. **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	Water not compliant with DWSNZ 2005 (Revised 2018): • E. coli transgressions • Concentrations of health significant determinands, agrichemicals and other contaminants more than 50% of their MAV in the source water. • Unsatisfactory practices being used in farming and forestry activities, especially related to fertiliser application and sediment control.	• Recharge zone Tahuna Rd: Primary recharge from the Rangitaiki River through direct hydraulic connection with shallow groundwater. The site is known to have persistent high turbidity issues during periods of heavy rainfall. (400 m groundwater capture zone). • Recharge zone Paul Rd: Primary recharge from a deep semi-confined Matahina ignimbrite aquifer; surface contamination unlikely. 3 km groundwater capture zone. Groundwater testing has been carried out and age of the water has been confirmed to be over 65 years over 65 years with 0% young fraction (<1 year). • Activities Tahuna Rd: Agricultural and farming activities. No consented discharges or HAIL sites within the groundwater capture zone of 400 m. • Activities Paul Rd: Large scale orchards situated in close proximity, few sheep have been observed in the neighbouring property adjoining the bore site. 8 consented HAIL sites within the 3 km groundwater capture zone associated with 'persistent pesticide use' for fruit production. 1 consented discharge of 'Diquat herbicide to surface water'. Approximately 11 bores have been identified in a 5 km radius that are at a similar depth to Paul Road and therefore	Partially	Extreme Likely x Major)	**PM1:** Monitor changes in activities in the catchment and modify catchment risk assessment annually. **PM2:** Submit a catchment risk assessment to the DWA every 5 years for approval. • **WDC to monitor activities within 250 metres of the water source:** **PM5:** Paul Rd site: To liaise with consent holders of the 8 HAIL sites and consented discharges to make them aware of the effects of activities around the bore on water quality. **PM6:** 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)	**PM1**: AE/TL-AM **PM2**: AE/TL-AM **PM5**: AE/TL-AM **PM6**: SPP/AE/ TL-AM

Table 14: 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 District Water Safety Plans)	Residual Risk	Responsibility
			considered to be abstracting from the same aquifer. **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:** BOPRC to inform WDC of new discharge consents to the recharge zone at both Tahuna Rd and Paul Rd sites, and WDC to provide comments on these consents. **PM4:** WDC to send BOPRC submissions opposing new applications for septic tanks within the groundwater capture zone for each site.					
S2.2	Contamination of bore/well from surface ingress due to: • Inappropriate bore/ well head design, not complying with the standards set by DWSNZ 2005 (Revised 2018) 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 2005 (Revised 2018). • E. coli transgressions. • No system for backflow prevention. Inappropriate casing material selected, or old casing.	• Bore heads at both sites were compliant against the DWSNZ 2005 (Revised 2018) and DWA requirements. • No damage to bore headworks or pipework could be assessed visually. • Condition of Tahuna Road casing not known. • Te Teko - animal exclusion zone extended to 5 m from the centre of the bore head.	Partially	Extreme (Possible x Major)	**PM2:** Utilise the Asset management system to programme the testing of backflow preventer annually. **PM3:** Carry out CCTV inspection of bore casing to ascertain condition, as required. **PM4:** Paul Road: Work closely with Bay of Plenty Regional Council to undertake a bore survey of active and decommissioning/abandoned bores within the 3km groundwater capture zone.	Medium (Unlikely x Moderate)	**PM2:** TL-AM **PM3:** TL-AM **PM4:** AE / TL-AM
S3.1	Discharge/leachate/runoff from the following activities in the catchment: **Agriculture**: Pesticides (including stock dip), chemical fertiliser, dairy shed washwater, stock effluent, effluent spray irrigation, effluent ponds, increase in turbidity from soil and silt due to cultivation (tilling).		• Possible chemical contamination risk from pesticide spraying in Paul Rd groundwater capture zone. • Currently no chemical treatment carried out on source water, therefore high risk in the event of chemical contamination. • **PM3G:** Pesticide suite testing on raw water was undertaken in September 2013 and again in July 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. **PM2:** WDC to liaise with BOPRC as follows: 1) BOPRC to inform WDC of new	Medium (Rare x Moderate)	**PM1G**: SPP/TL-AM **PM2:** AE/TL-AM

Table 14: 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 District Water Safety Plans)	Residual Risk	Responsibility
	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					discharge consents to the recharge zone at both Tahuna Rd and Paul Rd sites, and WDC to provide comments on these consents. 2) WDC to send BOPRC submissions opposing new applications for septic tanks within groundwater capture zone at each site. **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 **PM4G:** 3 Waters Asset Manager to provide input into district plan (WDC) and regional plan (BOPRC) with regards to protection of catchment; input into activities such as sediment control from earthworks and riparian strip management.		**PM3G:** AE/TL-AM **PM4G:** SPP/TL-AM
S3.2	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 2005 (Revised 2018).	No historic issues with mineral deposits at this source.	N/A	N/A	N/A	N/A	N/A
S3.3	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.	No known issues at either site.	N/A	N/A	N/A	N/A	N/A

Table 15: Treatment – Chlorination, Filtration, Ultra Violet Irradiation (UV) and pH correction

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 District 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 2005 (Revised 2018) requirements; gas Chlorination treatment installed at both treatment plant sites.	Yes	Low (Rare x Minor)	**PM1:** Investigate best practice for monitoring/ assessing and responding to total coliforms and indicate what costs and benefits this would deliver for this water supply. If feasible and able to adequate resource council to develop protocol and modify Incident Response Plan appropriately.	Low (Rare x Insignificant)	**PM1:** TL-WTP / WTP-O / AE
T1.2	Insufficient protozoal treatment installed	• High turbidity and E. coli levels	• Protozoa log credit 3 required at Tahuna Rd and 0 required at Paul Rd after 1 year monitoring. Currently 3 log credit protozoa treatment installed at Tahuna Road (with potential to increase to 5 with verification of cartridge filtration), and no protozoa treatment installed at Paul Road (current log credit is 0). • Both sources are considered compliant for protozoa requirements (provided conditions for Paul Road source are met). **PM1**: Turbidity monitored continuously at treatment plant; pumps stop when turbidity exceeds set limits.	Partially	Medium (Rare x Moderate)	**PM1:** Obtain verification of cartridge filtration from manufacturer	Low (Rare x Minor)	**PM1:** TL-WTP
T1.3	Insufficient chemical treatment installed	• Chemicals exceed set MAVs	• Arsenic assigned as a priority 2 determinand to the previous Rangitaiki Rural distribution zone, part of which now belongs to the Otumahi Scheme. **PM1:** Tested for Maximum Allowable Values (MAVs) for Arsenic in the Otumahi distribution zone once to determine P2D requirement of the zone. **PM2:** 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)	**PM2:** Catchment Risk Assessment undertaken September 2017. Programme activities to submit a catchment risk assessment to the DWA before 5 year period, for approval.	Medium (Rare x Moderate)	**PM2:** AE/TL-AM
T1.4	Other – Insufficient pH treatment	• pH below 7 or pH above 8.5	• Caustic soda pH correction is carried out at Paul Road and no pH correction is carried out at Tahuna Road. **PM1**: pH is monitored continuously at treatment plants.	Partially	Medium (Possible x Minor)	**PM1: Tahuna Road -** 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	Low (Rare x Insignificant)	**PM1:** TL-WTP/PM / TL-AM **PM2G:** M-PA / AE

Table 15: Treatment – Chlorination, Filtration, Ultra Violet Irradiation (UV) and pH correction

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 District Water Safety Plans)	Residual Risk	Responsibility
			PM2: Plumbosolvency notice circulated among customers every 6 months.			copper pipes and fittings (including lead jointing) for internal plumbing by circulating information flyer and notification on Council Website		
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.	Partially	Low (Unlikely x Minor)	**PM1:** Vermin/rodent poison stations placed on site and added to schedule monitoring and maintenance via Asset Management System	Low (Unlikely x insignificant)	**PM1**: TL-AS / TL-O
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, also refer to S1.2 and S1.3. • When treatment plant equipment fails (loss of power) alarms are triggered. **PM1:** Generator hired from local contractor and taken to site when required.	Partially	Medium (Possible x Minor)	**PM1a:** Tahuna WTP: Investigate the installation and/or provision of a dedicated generator for this site to provide minimum flow requirement during power outage. **PM1b:** Tahuna WTP: provision of a dedicated generator - for the interim, install a dedicated generator plug-in point	Low (Unlikely x Minor)	**PM1a:** TL-O / AE / PE **PM1b:** TL-O / AE / PE
T4: EVENT: INADEQUATE CALIBRATION/VERIFICATION, MAINTENANCE, PROCEDURES, SAMPLING, TRAINING								
T4.1	Inadequate calibration, verification and maintenance of treatment plant equipment.		• pump station / treatment plant monitoring equipment (i.e. pH, turbidity, FAC) are verified weekly • pump station / treatment plant monitoring equipment (i.e. pH, turbidity, FAC) are calibrated, along with pipework, once a year • zone FAC are calibrated yearly **PM1:** Routine maintenance of chlorination equipment (Dosing regulator, dosing pump, chlorine injector, booster pump) undertaken in according with manufacture specifications.	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 (Unlikely x Minor)	**PM1:** TL-WTP / WTP-O **PM2G:** TL-AS

Table 15: Treatment – Chlorination, Filtration, Ultra Violet Irradiation (UV) and pH correction								
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 District Water Safety Plans)**	**Residual Risk**	**Responsibility**
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	Low (Unlikely x Minor)	**PM1G:** Ensure all plant records such as manuals, drawings, procedures, incident response plan, etc. are controlled documents within Council corporate record system and hard copy located at the Water Treatment Plant.	Low (Unlikely x insignificant)	**PM1:** TL-WTP / WTP-O / TL-AS
T4.3	Inadequate/incorrect sampling		**PM1**: Treatment plant sampling spreadsheet updated periodically for anomalies. **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 2005 (Revised 2018) requirements	Partially	Medium (Possible x Minor)	**PM2G:** Water Operator Authorisation. Authorisation assessments by DWA undertaken with WDC operators in September 2018. The next assessments will be carried out in 2021.	Low (Unlikely x Minor)	**PM2G**: TL-WTP/ WTP-O
T4.4	Inadequate training of staff		Annual budget set aside for training. **PM1:** Treatment plant operators obtain national diploma certificate **PM2G:** listing of training kept in spreadsheet no evidence of competency system	Partially	Medium (Possible x Minor)	**PM1G:** 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 (Unlikely x Minor)	**PM1G:** MTW/ TL-WTP **PM2G:** TL-AS / TL-WTP / WTP-O
CHLORINATION								
T5: EVENT: MICROBIOLOGICAL CONTAMINATION DUE TO INADEQUATE CHLORINATION								
T5.1	Dosing malfunction (Dosing regulator and/or dosing pump, chlorine injector)	• 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 (Unlikely 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 2005 (Revised 2018).	Yes	Medium (Possible x Minor)	**PM1G:** Internal monitoring parameters verification audit. Establish in-house standard operating procedure (SOP) for testing/challenging of established set points, thus verifying alarms and plant shut down functionality. The SOP to include methodology, frequency of audit/testing, documentation/record keeping requirements	Low (Unlikely x Minor)	**PM1G:** TL-WTP / WTP-O

Table 15: Treatment – Chlorination, Filtration, Ultra Violet Irradiation (UV) and pH correction

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 District Water Safety Plans)	Residual Risk	Responsibility
						and SOP review requirements (i.e. when installation of new technology/equipment).		
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	Medium (Possible x Minor)	**PM1G:** Internal monitoring parameters verification audit. Establish in-house standard operating procedure (SOP) for testing/challenging of established set points, thus verifying alarms and plant shut down functionality. The SOP to include methodology, frequency of audit/testing, documentation/record keeping requirements and SOP review requirements (i.e. when installation of new technology/equipment).	Low (Unlikely x Minor)	**PM1G:** TL-WTP / WTP-O
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.	Yes	Medium (Possible x Minor)	**PM1G:** Internal monitoring parameters verification audit. Establish in-house standard operating procedure (SOP) for testing/challenging of established set points, thus verifying alarms and plant shut down functionality. The SOP to include methodology, frequency of audit/testing, documentation/record keeping requirements and SOP review requirements (i.e. when installation of new technology/equipment).	Low (Unlikely x Minor)	**PM1G:** TL-WTP / WTP-O
T5.5	Chlorine supply exhausted	• FACE concentration below 0.2 mg/l. • E. coli detected in water leaving treatment plant.	• All sites have auto changeover of chlorine bottles when supply exhausted. **PM1:** Continuous FAC monitoring at treatment plant; alarm triggered outside normal operation range, plant shuts down if critical limits reached.	Yes	Low (Unlikely x Minor)	Risk Managed	N/A	N/A
T5.6	Inadequate chlorine supply from chlorine booster stations	• FACE concentration below 0.2 mg/l. • E. coli detected in water leaving treatment plant.	• No chlorine booster stations in the reticulation system. **PM1:** FAC leaving treatment plant maintained at 0.8 mg/L which is sufficient to last through the distribution system. **PM2:** Manual FACE sampling in distribution system according to DWSNZ 2005 (Revised 2018).	Yes	Low (Rare x Insignificant)	Risk managed	N/A	N/A

Table 15: Treatment – Chlorination, Filtration, Ultra Violet Irradiation (UV) and pH correction

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 District Water Safety Plans)	Residual Risk	Responsibility
T6: EVENT: CHEMICAL CONTAMINATION DUE TO OVER CHLORINATION								
T6.1	Overchlorination due to dosing malfunction, inadequate calibration, dosing regulator set point wrong	• 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 (Unlikely 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.	• Contact tank after chlorine injection at both sites. **PM1:** Manual FACE sampling in distribution system according to DWSNZ 2005 (Revised 2018).	Partially	High (Unlikely x Major)	**PM1:** New Otumahi distribution zone: Review distribution sample points to ensure points of higher risks are covered and develop sampling point schedule (e.g. points furthest away from treatment plant, dead ends and points of low usage, points of high draw off, service reservoirs, old pipework, low pressure areas). **PM2:** New Otumahi distribution zone. Confirm/recalculate scheme population utilising latest NZ censuses data (due for released later 2019) or other applicable method and if significant change apply to update drinking water register.	Low (Rare x Minor)	**PM1:** TL-WTP / TL-O / AE / TL-AM **PM2:** AE / TL-WTP

Table 15: Treatment – Chlorination, Filtration, Ultra Violet Irradiation (UV) and pH correction								
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 District Water Safety Plans)**	**Residual Risk**	**Responsibility**
ULTRA VIOLET IRRADIATION – TAHUNA ROAD SITE								
T8: EVENT: MICROBIOLOGICAL CONTAMINATION DUE TO INSUFFICIENT ULTRA VIOLET DOSE								
T8.1	Insufficient UV intensity at the required wavelength due to inadequate cleaning and maintenance of: UV lamp, lamp sleeve, UV sensor	• E. coli detected in water leaving treatment plant. • Scale formation on sleeve and lamp. Alarms activated for low UV intensity.	**PM1:** UV lamps changed regularly and spare lamps available on site. **PM2:** Regular maintenance of UV unit carried out by WDC staff (clean lamp sleeve and UV sensor lense and lamp surface) **PM3:** Annual full service carried out by manufacturer i.e. new hose work, diaphragms and O rings replacement, etc. **PM4:** UV intensity continuously monitored by sensors on the lamps; alarm triggered outside normal operation range, plant shuts down if critical limits reached.	Yes	Medium (Unlikely x Moderate)	**PM1G:** Internal monitoring parameters verification audit. Establish in-house standard operating procedure (SOP) for testing/challenging of established set points, thus verifying alarms and plant shut down functionality. The SOP to include methodology, frequency of audit/testing, documentation/record keeping requirements and SOP review requirements (i.e. when installation of new technology/equipment).	Low (Unlikely x Minor)	**PM1G:** 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)	**PM1G:** Internal monitoring parameters verification audit. Establish in-house standard operating procedure (SOP) for testing/challenging of established set points, thus verifying alarms and plant shut down functionality. The SOP to include methodology, frequency of audit/testing, documentation/record keeping requirements and SOP review requirements (i.e. when installation of new technology/equipment).	Low (Unlikely x Minor)	**PM1G:** TL-WTP / WTP-O
T8.3	Water quality control, i.e.- Excessive colour, turbidity, temperature, water hardness		• Water filtered via cartridge filtration before entering UV system. **PM1:** pH and turbidity continuously monitored at treatment plant and plant automatically shuts down at high turbidity.	Partially	Medium (Unlikely x Moderate)	**PM1G:** Internal monitoring parameters verification audit. Establish in-house standard operating procedure (SOP) for testing/challenging of established set points, thus verifying alarms and plant shut down functionality. The SOP to include methodology, frequency of audit/testing, documentation/record keeping requirements and SOP review requirements (i.e. when installation of new technology/equipment).	Low (Unlikely x Minor)	**PM1G:** TL-WTP / WTP-O

Table 15: Treatment – Chlorination, Filtration, Ultra Violet Irradiation (UV) and pH correction

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 District Water Safety Plans)	Residual Risk	Responsibility
T9: EVENT: MICROBIOLOGICAL CONTAMINATION DUE TO REVIVAL OF MICRO ORGANISMS								
T9.1	Revival of micro-organisms in the distribution system.	• E. coli detected in the distribution system.	**PM1:** Network is chlorinated and FACE in the distribution system is sampled.	Yes	Low (Rare x Insignificant)	N/A	N/A	N/A
CARTRIDGE FILTRATION – TAHUNA ROAD SITE								
T10: EVENT: MICROBIOLOGICAL CONTAMINATION DUE TO FILTER NOT REMOVING PARTICLES TO 2-3 µM IN SIZE								
T10.1	Incorrect type of cartridge filter	• E. coli detected in water leaving treatment plant. • Scale formation on sleeve	**PM1:** Filters have been certified by FILTEC (Filtration Technologies) to ensure particles of sizes 3 Micron are removed. **PM2:** Cartridge is compatible with filter housing and purchased from certified manufacturer (FILTEC).	Yes	High (Unlikely x Major)	**PM2:** Identify correct cartridge/s (and suppliers) required for filtration unit within Asset Management System for renewals / replacements	Low (Rare x Minor)	**PM2**: TL-WTP / TL-AS / AE
T10.2	Damage to the seal (cartridge or filter housing)	• E. coli detected in water leaving treatment plant.	Pressure gauges installed on cartridge filtration to measure pressure differential of unit. **PM1:** Filter housing and cartridge seal condition checked during filter changes.	Yes	High (Unlikely x Major)	**PM1G:** Develop training and competency system that incorporates operators training for the replacement of cartridge for filtration systems	Low (Rare x Minor)	**PM1G**: TL-AS / TL-WTP / WTP-O
T10.3	Cartridge is incorrectly seated		Cartridge fitted according to manufacturer's instructions **PM1G:** Cartridge filter changes carried out by trained water treatment plant operators aware of the procedure.	Yes	High (Unlikely x Major)	**PM1G:** Develop training and competency system that incorporates operators training with replacement of cartridge for filtration	Low (Rare x Minor)	**PM1G**: TL-AS / TL-WTP / WTP-O
T10.4	Cartridge failure		**PM1:** A log of filter maintenance kept, including any damages observed and filter change dates.	Yes	High (Unlikely x Major)	**PM1:** Log details to be located in corporate system and available upon request	Low (Rare x Minor)	**PM1**: TL-WTP / WTP-O
T10.5	Filter housing contamination		**PM1:** Filter housing disinfected during installation of cartridges and residual disinfectant flushed to waste. **PM2:** Cartridge filter changes carried out by trained water treatment plant operators aware of the procedure.	Yes	Medium (Unlikely x Moderate)	Risk Managed	N/A	N/A
T10.6	Flowrate too high		**PM1:** Flow rate maintained and controlled by pumping and measured by magnetic flow meter out of bore.	Yes	Low (Rare x Minor)	Risk Managed	N/A	N/A

Table 15: Treatment – Chlorination, Filtration, Ultra Violet Irradiation (UV) and pH correction								
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 District Water Safety Plans)**	**Residual Risk**	**Responsibility**
T10.7	Growth of germs in filter		• Filters changed regularly as required. **PM1:** A log of filter maintenance kept, including any damages observed and filter change dates.	Yes	High (Unlikely x Major)	**PM1G:** Develop training and competency system that incorporates operators training for the replacement of cartridge for filtration systems	Low (Rare x Minor)	**PM1G**: TL-AS / TL-WTP / WTP-O
pH ADJUSTMENT – PAUL ROAD SITE								
T10: EVENT: MICROBIOLOGICAL AND CHEMICAL CONTAMINATION DUE TO INADEQUACY OR FAILURE IN PH ADJUSTMENT								
T11.1	Dosing system failure	Final water pH outside the target range as per process control summary	PM1: Continuous monitoring and alarms in place related to specified 'Indicators' • On pH alarm, plant shuts down • Spare pump inline which can be used for either pre-pump and post pump for caustic correction dosing • Full annual service (filtration technology) • Critical equipment carried in stock • 3 field meters available to verify pH.	Yes	**Medium** (Possible x Minor)	**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** (Unlikely x Minor)	**PM1:** TL-WTP / WTP-O
T11.2	Blockages in dosing system	Final water pH outside the target range as per process control summary	PM1: Continuous monitoring and alarms in place related to specified 'Indicators' • PE lines are replaced every year during full service (soft tubing replaced) • Full annual service (filtration technology)	Yes	**Medium** (Unlikely x Moderate)	Risk Managed	N/A	N/A
T11.3	Incorrect dosing rate or set point	Final water pH outside the target range as per process control summary	PM1: Continuous monitoring and alarms in place related to specified 'Indicators' • Check for actual set point • Manual adjustment of set point	Yes	**Medium** (Possible x Minor)	**PM1:** Council to review calibration and maintenance procedures of treatment plan equipment and incorporate into Operations and Maintenance manual with appropriate Standard Operating Procedures (SOP)	**Low** (Unlikely x Minor)	**PM1:** TL-WTP / WTP-O
T11.4	pH probe failure	Final water pH outside the target range as per process control summary	PM1: Continuous monitoring and alarms in place related to specified 'Indicators' • Probe checked with buffer solutions weekly • Calibrate pH analysers consistent with the requirements of the DWSNZ 2005 (Revised 2018) and retain calibration records	Yes	**Medium** (Possible x Minor)	**PM1:** Council to review calibration and maintenance procedures of treatment plan equipment and incorporate into Operations and Maintenance manual with appropriate Standard Operating Procedures (SOP)	**Low** (Unlikely x Minor)	**PM1:** TL-WTP / WTP-O
T11.5	Localised power failure	Final water pH outside the target range as per process control summary	PM1: Continuous monitoring and alarms in place related to specified 'Indicators' • Plant shuts down if pre- caustic soda pH meter power lost • Plant alarm if post caustic soda pH power lost • Power supply monitored via telemetry	Yes	**Medium** (Possible x Minor)	**PM1:** Council to review calibration and maintenance procedures of treatment plan equipment and incorporate into Operations and Maintenance manual with appropriate Standard Operating Procedures (SOP)	**Low** (Unlikely x Minor)	**PM1:** TL-WTP / WTP-O

Table 15: Treatment – Chlorination, Filtration, Ultra Violet Irradiation (UV) and pH correction								
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 District Water Safety Plans)**	**Residual Risk**	**Responsibility**
T11.6	Chemical supply exhausted	Final water pH outside the target range as per process control summary	• Continuous monitoring and alarms in place related to specified 'Indicators' • Minimum of 2-3 weeks stock held at plant – visual check conducted daily	Yes	**Medium** (Unlikely x Moderate)	Risk Managed	N/A	N/A
T11.7	Controller failure	Final water pH outside the target range as per process control summary	• Continuous monitoring and alarms in place related to specified 'Indicators'	Yes	**Medium** (Unlikely x Moderate)	Risk Managed	N/A	N/A

Table 16: 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 District 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:** Storage available in holding tank at Paul Road 250 m^3 and Te Teko reservoir 50 m^3. • Two water sources therefore one source is likely to be available when the other is unavailable.	Yes	Low (Unlikely x Minor)	**PM1**: Council to investigate long-term option of providing a reservoir with minimum 24 hours and up to 48 hours storage.	Low (Unlikely x Insignificant)	**PM1**: MTW/ PM/ TL-AM
R2: EVENT: LOSS OF SUPPLY DUE TO STRUCTURAL FAILURE								
R2.1	Poor condition of reservoirs leading to leakages, collapse or loss of structural integrity.	Drop in reservoir levels do not match demand. Increased pump starts. Loss of supply. Insufficient pressure/flow for firefighting purposes.	**PM1:** Reservoir inspections carried out periodically. • Two water sources therefore one source is likely to be available when the other is unavailable.	Partially	Medium (Rare x Moderate)	**PM1:** Carry out condition assessment of all concrete reservoirs in 2019 and formulate a condition assessment programme thereafter. **PM2:** Develop and implement a preventative maintenance programme for reservoirs.	Low (Rare x Minor)	**PM1**: AE **PM2**: TL-AS
R2.2	Vandalism to reservoir structure	Loss of supply. Insufficient pressure/flow for firefighting purposes.	• Te Teko reservoir situated in private land which is not accessible by the public. • No ladder access to reservoir on site. • Two water sources therefore one source is likely to be available when the other is unavailable.	Yes	Low (Rare x Minor)	N/A	N/A	N/A
R3: EVENT: LOSS OF SUPPLY DUE TO INSUFFICIENT SOURCE WATER								
R3.1	Insufficient storage capacity to store additional treated water due to seasonal variations in source.	Treated water storage levels unacceptably low. Insufficient pressure/flow for firefighting purposes. Reservoir telemetry indicates loss in levels.	No seasonal variations in source water at this site, therefore no additional storage required. Controlled interconnection with Rangitāiki Plains Water scheme to supplement reservoir filling	Yes	Medium (Possible x Minor)	**PM1:** operators to be trained and following the 'Otumahi – Rangitāiki Plains Emergency Connection Protocol' document	Low (Unlikely x minor)	**PM1:** TL-O / TL - WTP
R4: EVENT: MICROBIAL AND/OR CHEMICAL CONTAMINATOIN OF STORED WATER								
R4.1	Access by animals/birds.	Visual evidence of animal and bird access	• Unable to check there is a mesh on the overflow pipe, was told by WDC staff that the overflow is meshed at	Partially	High (Unlikely x Major)	**PM1:** Carry out maintenance of the site as required to prevent breeding of vermin/animals	Medium (Unlikely x Moderate)	**PM1:** TL-WTP

Table 16: 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 District Water Safety Plans)	Residual Risk	Responsibility
		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.	the exit from the Te Teko reservoir and inlets and outlets to holding tank at Tahuna Road site and contact tank at Paul Road site. • Mesh installed on overflow pipes at all sites. • Te Teko Reservoir site inspected once a month.					
R4.2	Vandalism and sabotage, staff access	Visual evidence of vandalism to reservoir structure, evidence of unauthorized human access (broken glass, bottles, rubbish). Unexplained deterioration/change in water quality. FAC residual less than 0.2 mg/L and cannot be maintained and E. coli or coliforms detected.	• Te Teko reservoir situated in private land which is not accessible by the public. • No ladder access to reservoir on site. • Two water sources therefore one source is likely to be available when the other is unavailable.	Partially	Low (Unlikely x Minor)	N/A	N/A	N/A
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. High turbidity levels.	**PM1:** Reservoir inspections carried out in 2008 and 2015. **PM2:** FAC residual maintained, checked weekly **PM3**: Procedure for reservoir cleaning to include disinfection of equipment, appropriate isolation from network, minimising sediment stir up, etc.	Partially	Medium (Unlikely x Moderate)	**PM1:** Utilise Asset Management System to schedule and implement a CCTV inspection of reservoirs and vacuum cleaning programmes as required.	Low (Unlikely x Minor)	**PM1:** TL-AS
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.	Contact tanks available at both Tahuna Road and Paul Road treatment plant sites.	Yes	Low (Unlikely x Minor)	N/A	N/A	N/A

Table 17: 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 District 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 • Otumahi 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 backflow device and water meter. **PM5G:** Operations department to discuss with building control department to include backflow prevention devices as part of the building control checklist when carrying out building inspections.	Partially	High (Unlikely x Major)	**PM1G**: Develop and implement a backflow prevention policy to match device to risk level of activity, including testing requirements of the devices. This has political ramifications and will be difficult to implement thus long lead in time. **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 / renewal 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 in adhoc manner.	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

Table 17: 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 District Water Safety Plans)	Residual Risk	Responsibility
D2.2	Inability to isolate or shut down the system due to missing or failed valves.	• Dirty water • E. coli present • Aesthetic issues • Low/not enough FAC	Critical valves need to be identified	Partially	Medium (Possible x Minor)	**PM1:** Carry out a routine maintenance plan for valve exercising with priority given to critical valves i.e. those supplying a large or critical customer base, valves on rising and falling mains and those used for bore and reservoir isolation. **PM2:** Undertake a programme of marking valve boxes for ease of location and to indicate whether they are open or closed. **PM3:** Utilise Asset Management System to schedule and monitor preventative maintenance.	Low (Rare x Insignificant)	**PM1:** AE **PM2:** AE/TL-O **PM3:** 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. **PM1**: AMP for 2017 prepared but data need verification and assessment. **PM2:** Pipe sampling has been carried out in certain areas. **PM3:** New Asset Management System implement recording maintenance carried out and cost of maintenance per asset has been introduced March 2018	Partially	Medium (Possible x Minor)	**PM1G**: Develop asset renewals programme based on condition sampling and assessments, analysis of asset age, material, frequency of breakages and increase in maintenance costs. Asset renewals to prioritize critical assets such as rising mains/falling mains, pipes supplying a critical consumers or large consumer base, critical valves and hydrants. **PM2G**: Update water asset management plan as required and republish every 3 years.	Low (Rare x Insignificant)	**PM1G:** AE / TL-AM **PM2G:** TL-AM / AE
D4: EVENT: CONTAMINATION DUE TO PRESSURE FLUCTUATIONS IN THE SYSTEM								
D4.1	Pressure fluctuations in the system due to: pipe failure, accidental penetration by contractors and leaks in the system, major fire events, Low pressure areas (hills/ extremities).		• 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**: Utilising asset management system, undertake periodic hydrant testing exercises to test effects on pressure in the system. **PM3G**: Carry out a periodic water balance to identify levels of leakage in system. **PM4**: Once hydraulic models are completed and in-line with annual water balance calculations develop and implement leak detection programme **PM5G**: Develop and adopt internal procedure for maintaining an up-to-date Asset Management System and GIS system **PM7**: Install backflow prevention devices on all connections; priority given to connections identified	Low (Rare x Insignificant)	**PM1:** AE **PM2G:** AE **PM3G:** AE **PM4:** AE **PM5G:** TL-AM / AE **PM7:** TL-AM / AE

Table 17: 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 District Water Safety Plans)	Residual Risk	Responsibility
						as high risk. Dual check manifolds to be installed on residential connections as part of the meter installation / renewal programme.		
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. • Work 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 design, construct and delivery of capital works and as-built drawings for recording on Asset Management System and GIS. **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/stormwater systems and then on Water reticulation • Staff returning to work after waterborne illness	**PM1G:** Existing operations procedure 'Incident Response Plan – Three Waters Assets (Water, Wastewater and Stormwater)' last updated 2018. **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 'Incident Response Plan – Three Waters Assets (Water, Wastewater and Stormwater)' document. Modify, where required to clearly define steps for each process, items to be recorded and objectives of the process, with reference to other documents. **PM2G**: Develop and implement a Council SOP (Hygiene code of practice for working on water supply systems). The document to reflect industry best practice and how Council will manage preventing cross contamination in the unlikely event that staff alternate on wastewater and water reticulation work. The Hygiene Code of Practice to include start up employment arrangements, sickness statement and medical clearance requirements.	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	Partially	Medium (Possible x Minor)	**PM1G**: Review staff certificates and maintain updated training and health register. Develop a training and competency system for working on reticulated network.	Low (Rare x Insignificant)	**PM1G:** TL-O / TL-AS / TL-WTP

Table 17: 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 District Water Safety Plans)	Residual Risk	Responsibility
			vaccinated against Hepatitis A/B and Tetanus to immunised against these known water borne diseases • Tool box meetings carried out weekly.			**PM2G:** Develop and implement a Council SOP (Hygiene code of practice for working on water supply systems). The document to reflect industry best practice and how Council will manage preventing cross contamination in the unlikely event that staff alternate on wastewater and water reticulation work. The Hygiene Code of Practice to include start up employment arrangements, sickness statement and medical clearance requirements.		**PM2G**: TL-WTP /WTP-O / TL-AS
D6: EVENT: CONTAMINATION AND LOSS OF SUPPLY DUE TO THIRD PARTY CONTRACTORS								
D6.1	Third party contractor/developers work on WDC reticulation (not directly engaged by WDC).		• Implement procedures for third party contractors/developers that require them to obtain a Permit to Work before any work is carried out. **PM2** Contractors to submit disinfection procedures, Health and Safety plans, detailed design of work to be carried out prior to works commencing • WDC supervises 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	High (Possible x Moderate)	**PM1G**: 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)	**PM1G:** TL-O/AE/TL-AM

Appendix B: Tahuna Road Process Control Summaries

Cartridge Filtration – 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 2005 (Revised 2018) for each performance parameter (NTU).

Table 18: Tahuna Road Cartridge Filtration – DWSNZ 2005 (Revised 2018) Limits and Process Performance Parameters

DWSNZ 2005 (Revised 2018) Monitoring Parameters:

- Flow below 79.5 m3/hr.
- Turbidity does not exceed 0.50 NTU for more than 5 percent of the time over the compliance monitoring period.
- Turbidity does not exceed 1.0 NTU for any 3-minute period.
- Turbidity does not exceed turbidity of the feed water into cartridges for any 3-minute period.
- Minimum differential pressure to always exceed the differential pressure corresponding to a clean filter.

Performance Parameter		Turbidity (NTU) Note: Pressure into filter is maintained at 1000 KPa.	
Monitoring Location		Raw Water	(1) Exit from Treatment Plant (post treatment)
Target Range			NTU <0.5
Action Limits	Low Alarm	N/A	N/A
	High Alarm	1.0	0.5
Critical Limits	Low Low Alarm	N/A	N/A
	High High Alarm	**2.0**	**1.0**

Plant automatically shuts down when NTU exceeds the stated 'Critical Limits', monitored at the given locations.

Cartridge Filtration – Triggers and Corrective Actions

Corrective actions to be taken when trigger limits are reached:

Table 19:	Tahuna Road Cartridge Filtration - Triggers and Corrective Actions	
Limits	**Triggers**	**Corrective Actions**
Target Range	During day to day monitoring or inspection.	• Adjust flow rate. • Change filters when reaching below minimum differential pressure limits.
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. • Cartridge filter checks: – Check filter housing and seal and cartridge seals for leaks or incorrect seating. – Flush flow to waste before putting the filters back online. – Check log books to identify date of last filter replacement and replace if required. • 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. – Re-calibrate field equipment against equipment calibrated at Whakatāne WTP. – Run lines to waste until turbidity reaches target range. – Carry out a visual check of boreheads, treatment plant equipment and surrounding site for signs of vandalism. Check around borehead area and vicinity for any visible signs of contamination. – Carry out manual E. coli test. • 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 19:	Tahuna Road Cartridge Filtration - Triggers and Corrective Actions	
Limits	**Triggers**	**Corrective Actions**
Critical Limits	Alarms and/or plant shut down.	***Plant automatically shuts down when treated water turbidity exceeds 1.0 NTU or when raw water turbidity exceeds 2.0 NTU*** • 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 2005 (Revised 2018). • 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 2005 (Revised 2018) 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.

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 2005 (Revised 2018) for each performance parameter (FAC, pH, Turbidity).

Table 20: Tahuna Road Chlorination – DWSNZ 2005 (Revised 2018) Limits and Process Performance Parameters

Performance Parameters		FAC (mg/L)	pH (pH units)	Turbidity (NTU)
DWSNZ 2005 (Revised 2018) Monitoring Parameters		<0.20 mg/L for >2% of 1 day	Guideline: Between 7.0 and 8.0	<1.0 NTU for >5% of 1 day
		>5.00		<2.0 NTU for 3 minutes of 1 day
Monitoring Location		(1) Immediately After Chlorination, (2) Exit from Treatment Plant	After Contact Tank (post treatment)	(1) Raw Water, (2) Exit from Treatment Plant
Target Range		0.80 < FAC <1.0	6.0< pH <7.0	NTU <0.5
Action Limits	Low Alarm	0.4	5.0	-
	High Alarm	1.9	7.0	0.50
Critical Limits	Low Low Alarm	**0.3**	**4.5**	**N/A**
	High High Alarm	**2.0**	**7.5**	**1.0**

Plant automatically shuts down when FAC, Turbidity exceeds the stated 'Critical Limits', monitored at the given locations.

Chlorination – Triggers and Corrective Actions

Corrective actions to be taken when trigger limits are reached:

Table 21:	Tahuna Road Chlorination - Triggers and Corrective Actions	
Limits	**Triggers**	**Corrective Actions**
Target Range	During day to day monitoring or inspection.	• Chlorine dosing adjusted automatically. If parameters outside target range, instrument is checked and verified to see if operating correctly, and check if target range is achieved.
Action Limits	Alarms	• Treatment Plant Operator to turn plant off by turning off the pump remotely and travel to site to carry out an inspection. • Carry out a site inspection to investigate reason for turbidity and/or pH and/or FAC outside action limits: – Check Turbidity meter/ Rotometer / pH meter for any mechanical problems e.g. a jammed rotometer. – Check if chlorine dosing is correct or if the chlorine supply exhausted. – Carry out manual tests to obtain turbidity, FAC and pH readings to verify against turbidity meter/ chlorine analyser/ pH meter readings to check equipment is operating correctly. – Sample to be collected manual for additional E. coli test. • Verify online instruments with calibrate field equipment as per the Water Treatment Plants SOP and/or the manufacturer's instructions. • Carry out a visual check of borehead, treatment plant equipment and surrounding site for signs of vandalism. Check around borehead area and vicinity for any visible signs of contamination. • Adjust chlorine dosing rate manually until target range is achieved. • Increase monitoring frequency. • Once problem is identified and resolved, remote in from laptop disable appropriate alarm and set up the plant to run automatically. Alarms to be reset once plant has settled and returned within normal target range of operation. • Log incident in the water treatment plant log book.

Table 21:	Tahuna Road Chlorination - Triggers and Corrective Actions	
Limits	**Triggers**	**Corrective Actions**
		• Record event details, manual test results any re-calibration information in the water treatment plant log book.
Critical Limits	Alarms and/or plant shut down.	***Plant automatically shuts down when critical limits are exceeded for FAC 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 2005 (Revised 2018). • 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 2005 (Revised 2018) 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 2005 (Revised 2018) for each performance parameter (Flow, UV(I), UV(T)).

Table 22: Tahuna Road UV- DWSNZ 2005 (Revised 2018) Limits and Process Performance Parameters

Limits		Performance Parameters				
		Turbidity (NTU)	**UV Flow**	**UV Intensity**	**UV Transmittance**	**UV Alarm**
DWSNZ Monitoring Parameters (Section 5.16)		>1.0 NTU for >5% of 1 month	>89.7m³/hr (24.9 L/s) for >5% of 1 month	<63.5 W/m² for >5% of 1 month	<90.35 % for any sample	UV Dose <40 mJ/cm² for >5% of 1 month
		>2.0 NTU for any 3-minute period		<50.8 W/m² for any 3-minute period	5.16.1 (5.a.ii.B.) does not apply	UV Dose <32 mJ/cm² for any 3-minute period
					5.16.1 (5.a.ii.C.) does not apply	
Target Range	**Low Limit**	-	-	> 68 W/m²	n/a – Not a CCP	-
	High Limit	0.50 NTU	52 m³/hr	-		
Action Limits	**Low Alarm**	-	-	66.7 W/m²		"Alarm"
	High Alarm	1.00 NTU	-	-		
Critical Limits	**Low Low Alarm**	-	-	**63.5 W/m²**		**"Alarm"**
	High High Alarm	**2.00 NTU**	**>52 m³/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:	Tahuna Road UV Irradiation - 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:	Tahuna Road UV Irradiation - 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 2005 (Revised 2018). • 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 2005 (Revised 2018) 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: Paul Road Process Control Summaries

Caustic Dosing – 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 2005 (Revised 2018) for each performance parameter (pH).

Table 24: Paul Road Caustic Dosing – DWSNZ 2005 (Revised 2018) Limits and Process Performance Parameters

Performance Parameter		pH (pH units)	
Monitoring Location		Raw Water	After Contact Tank (post treatment)
Target Range		6.0< pH <7.0	
Action Limits	Low Alarm	6.0	6.0
	High Alarm	8.0	8.0
Critical Limits	Low Low Alarm	**5.0**	**5.0**
	High High Alarm	**8.5**	**9.0**

Plant automatically shuts down when pH exceeds the stated 'Critical Limits', monitored at the given locations.

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 2005 (Revised 2018) for each performance parameter (FAC, Turbidity, Conductivity).

Table 25: Paul Road Chlorination – DWSNZ 2005 (Revised 2018) Limits and Process Performance Parameters

Performance Parameter		Turbidity (NTU)		FAC (mg/L)	Conductivity (µS/cm)
Monitoring Location		Raw Water	After Contact Tank (post treatment)	(1) Immediately After Chlorination and (2) After Contact Tank (post treatment)	(1) Raw Water (2) After Contact Tank (post treatment)
Target Range		NTU <1.0		0.5< FAC <1.8	<225
Action Limits	Low Alarm	N/A	N/A	0.4	N/A
	High Alarm	2.2	1.0	1.9	225
Critical Limits	Low Low Alarm	N/A	N/A	**0.3**	N/A
	High High Alarm	**2.50**	**1.5**	**2.0**	**250**

Plant automatically shuts down when Turbidity, FAC and Conductivity exceeds the stated 'Critical Limits', monitored at the given locations.

Caustic Dosing and Chlorination – Triggers and Corrective Actions

Corrective actions to be taken when trigger limits are reached:

Table 26:	Paul Road Caustic Dosing and Chlorination - Triggers and Corrective Actions	
Limits	**Triggers**	**Corrective Actions**
Target Range	During day to day monitoring or inspection.	• Deplox units installed adjust caustic dosing and chlorine dosing automatically based on pH and FAC readings. If parameters are outside target range, instrument is checked and verified to see if operating correctly, and check if target range is achieved.
Action Limits	Alarms	• Treatment Plant Operator to turn plant off by turning off the pump remotely and travel to site to carry out an inspection. • Carry out a site inspection to investigate reason for turbidity and/or FAC and/or Conductivity outside action limits: – Check Turbidity meter/ Rotometer / Conductivity meter for any mechanical problems e.g. a jammed rotometer. – Check if chlorine dosing is correct or if the chlorine supply and/or caustic supply exhausted. – Carry out manual tests to obtain turbidity and FAC readings to verify against turbidity meter/ chlorine analyser/ conductivity meter readings to check equipment is operating correctly. – Sample to be collected manual for additional E. coli test. • Verify online instruments with calibrate field equipment as per the Water Treatment Plants SOP and/or the manufacturer's instructions. • Carry out a visual check of borehead, treatment plant equipment and surrounding site for signs of vandalism. Check around borehead area and vicinity for any visible signs of contamination. • Adjust chlorine dosing rate manually until target range is achieved. • Increase monitoring frequency. • Once problem is identified and resolved, remote in from laptop disable appropriate alarm and set up the plant to run automatically. Alarms to be reset once plant has settled and returned within normal target range of operation. • Log incident in the water treatment plant log book.

Table 26:	Paul Road Caustic Dosing and Chlorination - Triggers and Corrective Actions	
Limits	**Triggers**	**Corrective Actions**
		• Record event details, manual test results any re-calibration information in the water treatment plant log book.
Critical Limits	Alarms and/or plant shut down.	***Plant automatically shuts down when critical limits are exceeded for FAC, turbidity, and conductivity.*** • 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 2005 (Revised 2018). • 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 2005 (Revised 2018) 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.

Appendix D: Paul Road and Tahuna Road Sources - Localised Groundwater Capture Zone

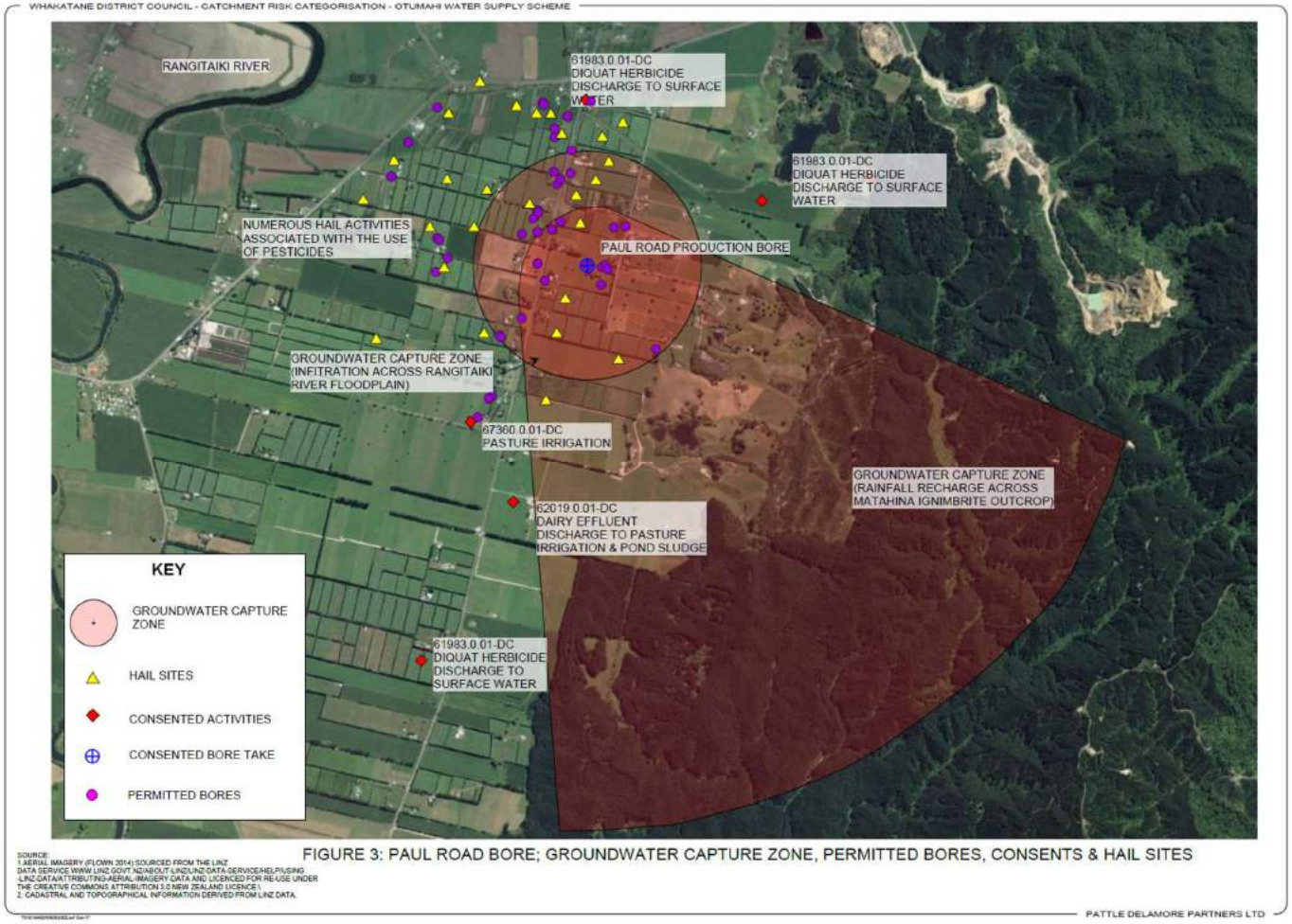


FIGURE 3: PAUL ROAD BORE; GROUNDWATER CAPTURE ZONE, PERMITTED BORES, CONSENTS & HAIL SITES

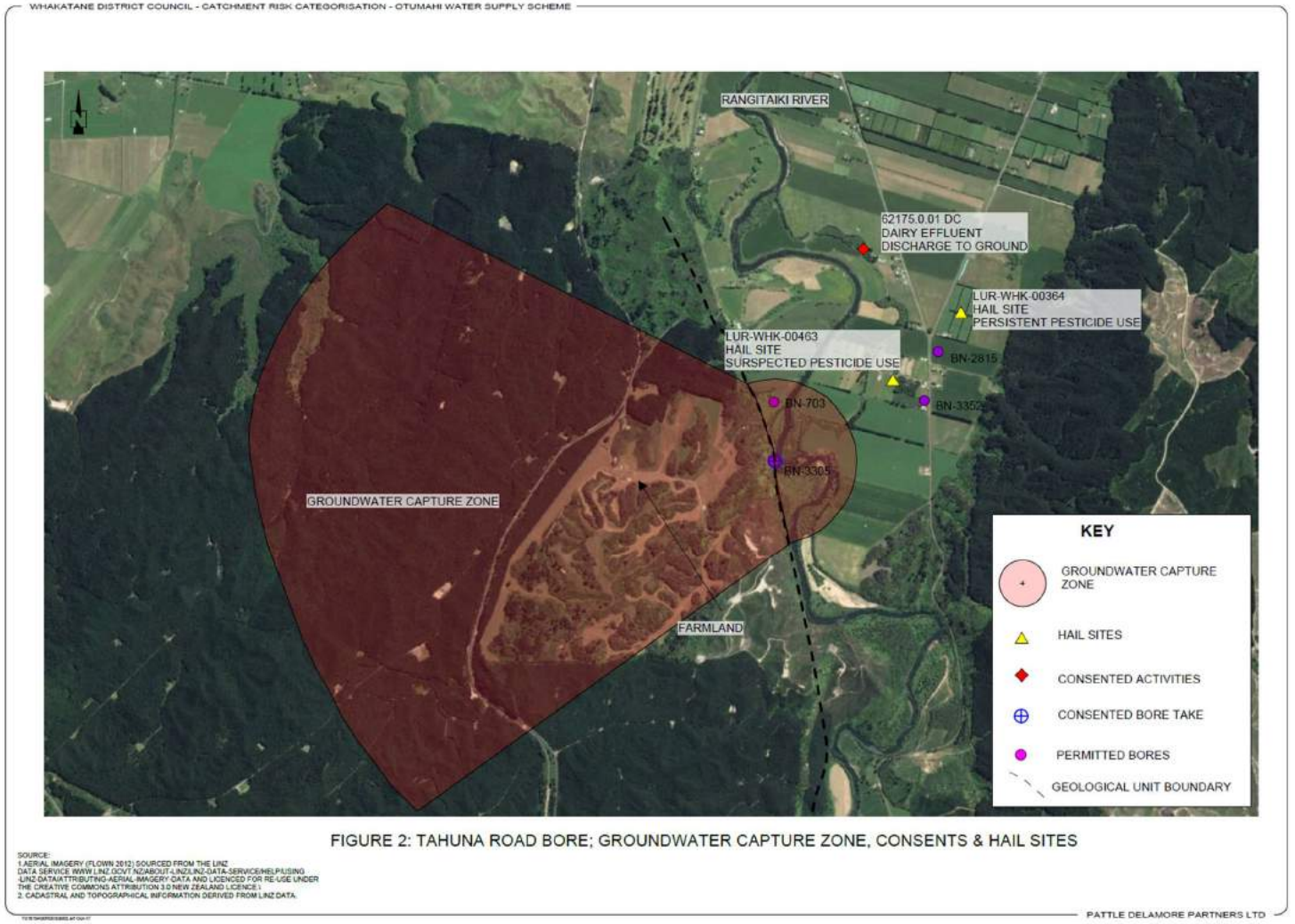


FIGURE 2: TAHUNA ROAD BORE; GROUNDWATER CAPTURE ZONE, CONSENTS & HAIL SITES

Appendix E: Otumahi Water Supply –Paul Road Secure Groundwater

Toi Te Ora Public Health
PO Box 2120
TAURANGA 3140

22 November 2018

Diana Kim

Asset Engineer – Three Waters

Whakatane District Council

<Diana.Kim@whakatane.govt.nz>

Dear Diana

Otumahi (Paul Road) Bore (G03030): evidence of secure groundwater criterion 3: *E.coli* must be absent from bore water.

Whakatane District Council has provided the following documentation for assessment:

1. Drinking-water Online *E. coli* sample entries from Otumahi (Paul Road) Bore (G03030) covering the period 12 October 2017 to 01 November 2018.

The results indicate that the Otumahi (Paul Road) Bore (G03030) has met the requirements for secure bore water.

The following criteria for demonstrating that a bore water is secure under the Drinking Water Standards for New Zealand 2005 (Revised 2008) (DWSNZ) has been demonstrated for the Otumahi (Paul Road) Bore (G03030):

Security criteria 1 – Surface influence

Demonstration 1 (Residence Time)

GNS Groundwater Residence Time Determination for the Paul Road Well (CR 2014/295 LR) states that the Paul Road Well satisfies the residence time criterion (DWSNZ section 4.5.2.1). Note this was previously assessed and reported in the interim secure status letter dated 04 January 2018.

Security criteria 2 – Bore head

Pattle Delamore Partners Catchment Risk Assessment and Bore inspection report (T01616400R004) indicates that the bore head satisfies the security criterion (DWSNZ section 4.5.2.2). Note this was previously assessed and reported in the interim secure status letter dated 04 January 2018.

Security Criteria 3 – E.coli absent

Drinking-water Online *E. coli* sample entries from Otumahi (Paul Road) Bore (G03030) covering the period 12 October 2017 to 01 November 2018 results provided for this assessment indicate that the sampling frequency as per table DWSNZ 4.5 have been met or exceeded and that no *E. coli* was detected.

Please note that secure groundwater status is not permanent and there are ongoing compliance requirements (see DWSNZ section 4.5.4) and *E. coli* results for the Paul Road source are expected to continue to be reported in Drinking-water Online.

Please note that the *Report of the Havelock North Drinking Wat Inquiry: Stage 2* has made several recommendations regarding the secure classification system and changes in this area may occur in the near future.

The Institute of Environmental Science and Research will be informed of any changes to the security designation and or log credit requirement assignation for a source so that the national drinking-water database can be updated.

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

Yours sincerely,
Grant King

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

cc: Tomasz.Krawczyk@whakatane.govt.nz
Michael.VanTilburg@whakatane.govt.nz
Neal.Yeates@whakatane.govt.nz

Appendix F: Protozoal Log Credit Requirement for Otumahi Water Supply – Tahuna Road

Toi Te Ora Public Health
PO Box 2120
TAURANGA 3140

10 July 2018

Tomasz Krawczyk
General Manager Infrastructure
Whakatane District Council
Tomasz.Krawczyk@whakatane.govt.nz

Dear Tomasz

Te Teko (Tahuna Road) Plant (TP00315): 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 Otumahi Bore Water Supply Scheme (A1212111).

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 Tahuna Road Plant is 3.

The CRA states that the Tahuna Road bore treatment is already compliant with 5 log removal with the recent installation of cartridge filtration. Some validation information has been provided but WDC have not formally requested that the cartridge filtration be recognised for protozoa treatment. Until otherwise notified only the UV system will be recognised as providing the protozoa treatment.

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

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

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

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

Yours sincerely,
Grant King

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

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

Appendix G: Improvement Plan – Completed Projects

Table 27: Improvement Plan – Completed Items

Priority	Risk Table Item No.	Area of Work	Work To be Implemented	Responsibility	Comment	Date
Low	**D3.1 (PM3G)**	**Pipe, valve and hydrant failure due to age, condition and material of pipe**	Record condition of asset, maintenance carried out and cost of maintenance against each asset on the Asset Management System during routine maintenance/repair programmes in order to utilise this information in asset renewal programmes.	TL-AM / TL-O	Implemented with new Asset Management System	March 2018
Low	**D4.1 (PM6G) D6.1 (PM2)**	**Third party contractor/developer work on WDC reticulation (not directly engaged by WDC)**	This is part of engagement of contractors. Contractors to submit disinfection procedures, Health and Safety plans, detailed design of work to be carried out and communications plan for affected customers to the relevant WDC staff for approval before work is carried out.	Contractors and AE / PE	Implemented	March 2018
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 and WDC to provide comments on these consents. 2) WDC to send BOPRC submissions opposing new applications for septic tanks within groundwater capture zone.	Business as usual with resource consents	implemented	March 2018
Medium	**T4.3 (PM1)**	**Inadequate/incorrect sampling**	Review treatment plant sampling spreadsheet periodically for anomalies.	TL-WTP	completed	June 2018
High		**Managing activities in the catchment**	Apply to MoH to register Otumahi as a new supply in the drinking water registry with new scheme boundary and scheme population and update other details of the treatment and distribution zones as required.	MTW / PE / TL-AM	Completed	June 2018
Low	**D1.1 (PM5G)**	**Contamination from backflow**	Operations department to discuss with building control department to include backflow prevention devices as	AE / TL-AM	Discussions held - Part of building	July 2018

Table 27: Improvement Plan – Completed Items						
Priority	**Risk Table Item No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Comment**	**Date**
			part of the building control checklist when carrying out building inspections.		inspection process for consented works	
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	TL-WTP	Completed	July 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	Completed	September 2018
Medium	**T5.5 (PM1)**	**Chlorine supply exhausted**	Spare chlorine cylinder on site with auto changeover when supply is exhausted.	TL-WTP / WTP-O	Completed	November 2018

Appendix H: Assessment of Chlorine Contact Time for Tahuna Rd and Paul Rd Reservoirs

Contact Time Calculation for Tahuna Road Reservoir

1. Total contact time in Reservoir and Rising Main calculated to be approximately 5.5 hours, and CT concentration is well above the minimum 6 mg-min/l required for sufficient disinfection treatmet, at 278 mg-min/l
2. Maximum design pump rate of 21.50 l/s was used (both high lift pumps operating in tandem)
3. CT is calculated conservatively, from the pump station to the reservoir exit (excludes falling main).

Calculation

Max Pumping rate	21.50	l/s	*Design report
Rising main volume	9.2	m3	*520m of 150mm PVC pipe
Residence time in Rising Main RT(RM)	**7.13**	**min**	Rising main volume/Max pump rate
Reservoir Storage Volume	172	m3	*based on min operating level of 75%
Reservoir Outflow rate	507	l/min	*SCADA data
Residence time in Reservoir RT(Res)	**340**	**min**	Res storage volume/Res outflow rate

Contact Time Parameters

Total Contact Time (T) (rising main+res)	**347**	**min**	
CT = Conc of Res Chlorine x Total Contact Time	**278**	**mg-min/l**	* based on 0.8 mg/l FAC

Contact Time Calculation for Paul Road Reservoir

1. Total contact time in Reservoir calculated to be approximately 2.5 hours, and CT concentration is well above the minimum 6 mg-min/l required for sufficient disinfection treatmet, at 118 mg-min/l
2. Maximum design pump rate of 24 l/s was used (peak hour demand)
3. CT is calculated conservatively, from the pump station to the reservoir exit (excludes delivery line upto first customer at Western Drain Road).

Calculation

Reservoir Storage Volume	188	m3	*based on min operating level of 75%
Reservoir Outflow rate	1440	l/min	*SCADA data
Residence time in Reservoir RT(Res)	**130**	**min**	Res storage volume/Res outflow rate

Contact Time Parameters

Contact Time (T) (res)	**130**	**min**	
CT = Conc of Res Chlorine x Total Contact Time	**119**	**mg-min/l**	* based on 0.8 mg/l FAC in system

Appendix I: 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
Otumahi (OTU010)

Central North Island Drinking Water Assessment Unit – Toi Te Ora
510 Cameron Road
TAURANGA 3010

Report Identifier
OTU010_Otumahi_WSPadequacy_290719_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.

Non-conformances: These are areas of the WSP that must be corrected or amended before the plan can be approved. These relate directly to, or give practical effect to the requirements of the Health Act.

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

The Otumahi public water supply - Water Safety Plan (WSP) comprehensively sets out details of the water supply including descriptions, control points and critical control points, risk identification and assessment information, planned improvements, and corrective actions and contingency plans.

Whakatane District Council's (WDC) adoption of a more comprehensive approach to water safety planning is commendable and acknowledged by the Bay of Plenty and Lakes District Health Boards.

The WSP for Otumahi public water supply WSP has been approved with two recommendations.

Description of drinking water supply

The WSP describes a WDC owned and operated public water supply with two sources feeding two respective treatment plants. Tahuna Road has a bore that is influenced by the Rangitāiki flood plain. Treatment consists of cartridge filtration, gas chlorination and UV disinfection. Paul Road has a deep bore with secure ground water status, pH adjustment with caustic, and gas chlorination. Storage consists of a 250 m3 holding tank at Paul Road, and a 25 m3 holding tank and a 230 m3 concrete reservoir near Tahuna Road. The population supplied is approximately 2,840 people.

The supply has recently been created from reconfiguring Rangitāiki Plains, Edgecumbe and Te Teko supplies and can be connected to the Rangitāiki Plains scheme in emergency situations. The Tahuna Road source has known turbidity issues and the treatment plant is at risk in flood events.

Adequacy of risk assessment methodology

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

Adequacy of risk identification and analysis

The risk identification and analysis is adequate. Public health risks for all common supply elements and there possible causes have been adequately identified. The qualitative risk assessment as per the Ministry of Health framework is adequate.

Adequacy of control measures

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. At Tahuna Road cartridge filtration, UV disinfection and chlorination have been identified as the current operational Critical Control Points. At Paul Road caustic dosing and chlorination have been identified as the current operational Critical Control Points. UV intensity, 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, indicators and corrective actions for non-Critical Control Point risks are considered adequate for this supply.

Preventative measures around checks and maintenance (including scope, schedule and recording) of bore heads/intakes is referred to in the water safety plan but it is not adequately detailed. WDC have advised verbally that these items are either largely in place or in development as part of the improvement schedule item for operational procedures. The checking and verification of supply processes after significant events or changes such as, near misses, weather events, or the return to business as usual after planned works or significant reactive maintenance should also be considered in the development of operational procedures.

Recommendation 1: Similar to recent previous WDC WSPs, ensure procedures that are under development adequately cover (including scope, schedule and recording) the bore head, treatment instruments, and reservoir checks and maintenance.

Assessment of Chlorine Contact Time for Tahuna Rd and Paul Rd Reservoirs is included. Calculations do not appear to consider applying a baffle factor as per section 15.2.9 Disinfectant mixing and retention time section of the Guidelines for Drinking-water Quality Management for New Zealand. Applying a conservative baffle factor still gives an acceptable contact time but it is recommended that WDC review whether contact time calculations have been completed in accordance with the guidelines for all WDC plants.

Recommendation 2: WDC review whether contact time calculations have been completed in accordance with the guidelines for all WDC plants.

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 Otumahi has been approved.

It is expected that the water supplier begin to implement this WSP within one month.

The Health Act sets out the maximum expiry of a WSP however due to the transition to the new WSP framework it is expected that plans approved now may need to be updated to include elements of the new framework that are absent or deficient. Therefore the approval of this WSP is subject to the DWA requiring its alteration (to meet the new WSP framework) within a specified period of time in consultation with WDC.

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).

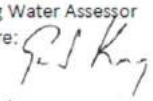
Attachments

Nil.

Completed 12 August 2019.

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

Assessment Report Information

Report identifier	OTU010_Otumahi_WSPadequacy_290719_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	29/07/2019
Description of assessment work	Assessment of adequacy of Water Safety Plan for Supply: OTU010 Otumahi Zone: OTU010OT Otumahi Plant: TP04011 Otumahi (Paul Road) Source: G03030 Otumahi (Paul Road) Bore Plant: TP00315 Te Teko Plant Source: G00208 Te Teko Spring
Equipment Used	Nil.
Water Supply Owner / Person Responsible	Whakatane District Council Tomasz Krawczyk
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 2018) • 20190718_Otumahi Public Water Supply - Water Safety Plan WSP (A1317113) – Version 1.02, July 2019 • 20190809_Otumahi Public Water Supply - Water Safety Plan WSP (A1317113) – Version 1.03, August 2019 • 20171013 Catchment sanitary inspection and risk assessment OTUMAHI - A1212111 • OPUS (Edgecumbe and Te Teko Security of Supply, OPUS July 2017) • Otumahi – Rangitāiki Plains Emergency Connection Protocol'
Site of Assessment	Central North Island Drinking Water Assessment Unit – Toi Te Ora 510 Cameron Road, Tauranga
Omissions from proposed assessment	Nil
Sub-contracted work	Nil
Document checked by:	Braden Leonard Drinking Water Assessor Date: 12th August 2019
Release of report authorised by:	Grant King Drinking Water Assessor Signature:  Date: 13th August 2019

If you do not agree with the findings of this report a written appeal must be lodged with the *Peter Wood, Technical Manager, Central North Island Drinking Water Assessment Unit, C/- MidCentral Public Health Service, PO Box 11-036, Palmerston North 4442* 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.