PORT WAIKATO WATER SUPPLY
WATER SAFETY PLAN

Organisation and Supply Details:	
Community Name	Port Waikato (POR005)
Supply owner/organisation name:	Waikato District Council
Prepared by:	Opus International Consultants and Waikato District Council staff
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Signed off by	Karl Pavlovich – Waters Manager

Contents

1. Introduction

This Water Safety Plan (WSP) has been developed to identify the public health risks for the Port Waikato public water supply registered to the Waikato District Council (WDC). This WSP assesses risks from source to supply point and ranks risks according to their likelihood and consequence. Necessary improvements are identified and prioritised as part of a larger process which has considered the risks across all of the Waikato water supplies and prioritised the greatest risks for prioritised improvement. The improvements specific for Port Waikato have been included in this plan.

2. Waikato district

Waikato District is located in the Waikato region and has a resident population of 63,381 which is relatively evenly mixed between urban and rural. The main urban populations are centred in the towns of Huntly, Ngaruawahia, Raglan, Te Kauwhata and Tuakau. The small community of Port Waikato has a usual resident population of about 60.

WDC is responsible for the management and operation of the public water supply systems which include nearly 700km of reticulation, ten water treatment plants with a total capacity of 19,000 cubic metres per day and 30 reservoirs with a total capacity of 19,527 cubic metres. Council also has an agreement with Hamilton City Council to take up to 12,000 cubic metres per day and Te Kauwhata Water Association to take up to 4000 cubic metres per day for parts of the district. The supplies are managed by Council Operations staff with the assistance of specialist contractors as needed. Most residential properties are unmetered, with some rural properties metered and all commercial and industrial properties being metered with the majority of rural, commercial and industrial properties being metered. WDC operates a 24 hour call center for customer complaints about faults and a 24 hour operation on-call service to address issues as necessary.

3. Purpose of the WSP

This WSP assesses the current risks and preventive measures in place in the Port Waikato water supply system. The residual risk is then assessed and a risk rank given. These are then prioritised for improvement. An improvement list and timeframe for implementation has been developed and is included

4. Objectives

The objective of this project is to:

- Ensure that the water supply assets that Waikato District Council is responsible for, are proactively managed from a health related risk point of view for its end users.
- Ensure the requirements of the Health Act 1956 and current amendments are met.

5. Scope

This WSP is for the Port Waikato water supply (POR005). The registration information is below:

Table 1. Port Waikato registration details

Component	Code	Name
Community	POR005	Port Waikato
Zone	POR005PW	Port Waikato
Plant	TP00698	Port Waikato
Source	S00920	Port Waikato Stream

The Port Waikato water supply is currently ungraded.

6. Structure of the WSP

The risk assessments are undertaken in six sections based on the elements of the supply with a further section (other) to cover general aspects including staff training and monitoring

Relevant detail can also be found in the Waikato DC Annual Plan, Activity Management Plan for Water Supplies, the Council Long Term Plan, and the Port Waikato Treatment Plant Operations and Maintenance Manual. These documents can be provided upon request.

7. Plan Review and Performance

This plan will be revised and submitted for approval before March 2023.

Assessment of the performance of the plan

Assessment of the performance of the plan will be undertaken annually. The assessment will consider any events, non-compliances, near misses and unexpected situations that have occurred, progress against the improvement schedule and any changes to any of the supply elements.

Reporting of the plan

A brief report on the performance of the plan, including information from the assessment of the plan will be provided by the Waters Compliance Officer to the Waters Manager annually on the anniversary of finalisation of the plan.

8. Risk assessment method

The risk assessment methodology used to qualify risk is consistent with the AS/NZS 4360:2004 Risk Management Standards, WDC risk evaluation methods and the Ministry of Health, WSP Guides and publication *A Framework on How to Prepare and Develop Water Safety Plans for Drinking-water Supplies*, Ministry of Health (2014).

Meetings were held with operational staff, compliance staff and management to establish the possible events and risks.

The WSP is the responsibility of the Waters Manager. Technical information is contributed by those who manage and operate the supply. The Waters Manager will ensure staff hold the most up to date and current copies. Tracking of versions and copies of the plan will be undertaken in line with Waikato District Councils Quality System.

9. Consultation

In October 2014 a site visit to the Port Waikato water supply was carried out by Nick Hewer-Hewitt of Opus Consultants with Karl Pavlovich, Treatment Plant Operator, Waikato District Council.

An inspection of the treatment plant was undertaken and operation of the plant was discussed with Karl. As part of the site visit, discussions covered the operation and performance limits of the plant, the critical points, the operation of treatment barriers, the risks that have been identified, how these risks are managed currently, and the improvements that could be put in place. A further inspection was made of the reservoir and a drive through of parts of the community included.

The information provided during this consultation has been used to compile the risk tables. Subsequent to this consultation telephone discussions and email contact has been used to provide further information necessary for the preparation of this WSP. The WSP was then reviewed by all divisions of the water team and signed off by the Waters Manager.

10. Risk assessment criteria

Potential public health risks have been evaluated using the Likelihood and Consequence scales (based on the WDC Risk Management Framework) tabulated below to determine a risk level – low, moderate, high or extreme. The assessed risk level allows prioritisation of the associated improvement measures.

Table 2. Likelihood Scale

Likelihood	Descriptor	Probability
Frequent	Will most certainly occur in the foreseeable future. Continuous or will happen frequently.	5
Often	Will possibly occur in the foreseeable future. 5- 12 times per year.	4
Likely	Good possibility of occurrence. 1 – 5 times per year.	3
Possible	Little chance it will occur in the foreseeable future. Once every 2 – 10 years	2
Rare	Occurrence is unlikely in the foreseeable future.	1

Table 3. Consequence Scale

Consequences	Descriptor	Probability
Catastrophic	Significant and prolonged effect on levels of service and business function/ Life threatening injuries or fatalities/ Significant and prolonged lack of resource capacity/ Major financial loss (>$1M in any 12 month period)/ Serious or sustained national media attention/ Significant environmental disaster or natural hazard causing wide spread environmental degradation/ damage.	5
Major	Major but short term effects to levels of service and business function/ Single life threatening injury or fatality/ Significant but short term lack of resource capacity/ Major financial loss ($150k to $1M in any 12 month period)/ Short term national media attention/ Major but localised environmental degradation/damage.	4
Moderate	Moderate short term effects to levels of service and business function/ Injury requiring moderate medical care/ Moderate & short term lack of resource capacity/ Moderate financial loss ($50k-$150k in any 12 month period)/ Moderate public interest/ Moderate localised environmental degradation/ damage.	3
Minor	Minor effects to day to day business function/ Minor incident (no medical attention required)/ Uncertainty of resource capacity/ Minor financial loss ($10k-$50k in any 12 month period)/ Minimal public interest/ Minor localised environmental damage.	2
Insignificant	Negligible effects to day to day business function/ Regular health & safety monitoring required to avoid injury/ Negligible financial loss (<$10k in any 12 month period)/ Negligible localised environmental damage.	1

Table 4. Risk Level Allocation Table

	Consequence				
Likelihood	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Frequent (5)	5 (low)	10 (moderate)	15 (high)	20 (extreme)	25 (extreme)
Often (4)	4 (low)	8 (moderate)	12 (high)	16 (high)	20 (extreme)
Likely (3)	3 (low)	6 (moderate)	9 (moderate)	12 (high)	15 (high)
Possible (2)	2 (low)	4 (low)	6 (moderate)	8 (moderate)	10 (high)
Rare (1)	1 (low)	2 (low)	3 (low)	4 (moderate)	5 (high)

For further information on risk derivation refer to WDC Risk Management Framework.

11. Improvement cost benefit and prioritisation matrix

The following tables have been used to determine the cost benefit and prioritisation of any improvements. Required improvements are allocated risk benefit (A), ease of implementation (B) and cost of implementation (C) scores from the tables below. The scores are multiplied (AxBxC) to determine the cost benefit. The scores are included in the improvement schedule.

Table 5. Risk Benefit table

A	No	Risk Benefit
	1	No benefit
	2	Reduces risks consequence and/or likelihood for one risk area
	3	Reduces risks consequences and/or likelihood in more than one risk area
	4	Reduces risk from extreme or high to moderate
	5	Reduces risk to low

Availability of physical resources and competency

Table 6. Ease of implementation table

B	No	Ease of implementation
	1	Physical resources or expertise exists but not available for more than two years
	2	Physical resources or expertise exists but not available for at least one year
	3	Physical resources and expertise does not exist within council but easily found
	4	Physical resources and expertise available within council
	5	Physical resources and expertise available within water services

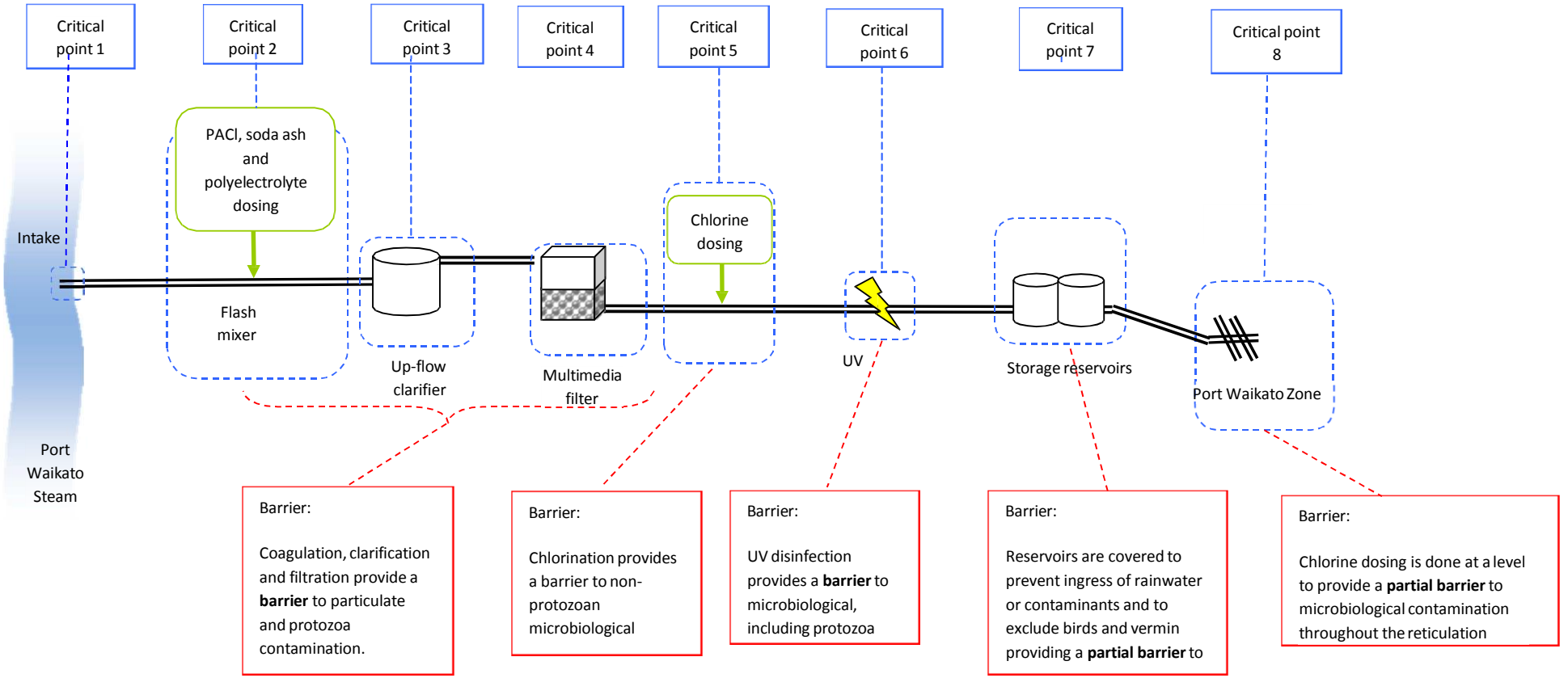
Staff time and capital costs

Table 7. Cost of implementation table

C	No	Cost
	1	Greater than $50,000
	2	$20,000 - $50,000
	3	$5,000 – $20,000
	4	$1,00 - $5,000
	5	Less than $1,00 or already funded project

12. Flow Chart/Schematic of the Supply

Figure 1 Supply schematic



13. Critical Points and Barriers to Contamination

Table 8. Critical points

Critical points where hazards can be eliminated, minimised or isolated include:

	Critical Point	Description
1.	Source water abstraction	*Failure of abstraction pump may result in loss of supply*
2.	PACl dosing	*Failure of coagulant dosing will result in reduced particle and protozoa removal in the clarification and filtration processes*
3.	Clarification	*Failure will result in reduced particulate and protozoa removal and possible operational issues with the multimedia filter*
4.	Multimedia Filter	*Failure will result in reduced particulate and protozoa removal*
5.	Chlorine dosing	*Failure will result in a lack of bacterial and viral control* *Overdosing may exceed chemical MAV* *UV disinfection after chlorine dosing will reduce Free Available Chlorine residuals*
6.	UV disinfection	*Failure will result in reduced microbiological disinfection*
7.	Reticulation water storage	*Possible point for microbiological contamination*
8.	Distribution system connections	*Possible access point for contamination due to backflow*

Existing barriers to contamination include:

1. Coagulation and clarification and filtration

The treatment plant uses the addition of coagulants to stabilise and flocculate contaminants to enable settling and filtration of the water removing microbiological organisms, organic material and suspended solids. This process step **provides a barrier to protozoan, and particulate contamination**.

2. Chlorination

The treatment plant uses chlorination to disinfect the water of non-protozoan micro-organisms. This provides **a barrier to bacterial and viral contamination**.

3. UV Disinfection

A UV disinfection reactor inactivates microbiological organisms. This provides **a barrier to microbial and protozoal contamination**.

4. Prevention of contamination of treated water in storage

The reservoirs are sealed to prevent unauthorised access, ingress of rainwater or contaminants, and to exclude birds and vermin. The following measures contribute to provision of a **partial barrier against recontamination** of water following treatment.

5. Prevention of contamination of treated water while it is in the network reticulation

A chlorine residual provides some protection against micro-biological contamination within the storage and reticulation providing a **partial barrier against recontamination** of water following treatment.

The process control summaries for identified Critical Control Points (Critical Points) are stored in Council's Promapp process management online repository.

14. Supply Description

The Port Waikato drinking-water supply consists of stream abstraction, a small treatment plant with a clarifier, chlorine contact tank, and a sludge storage tank before supply to the Port Waikato village.

The Port Waikato water supply's source and treatment plant is located on the Waikaretu to Port Waikato road, 800m south from the Maunsell Rd junction.

Water is abstracted from the Port Waikato Stream via a wet well located next to the stream intake. The water is pumped from the wet well into the treatment shed. Soda ash is used for pH correction. Poly Aluminium Chloride (PACl) is added as the coagulant, followed by the addition of a polyelectrolyte. The water then goes into a clarifier to allow particulate settling. Clarified water is then pumped into the multimedia filter. Sludge from the clarifier is periodically drained to the sludge tank. The filtered water is then chlorinated, followed by ultraviolet light disinfection, and then into the chlorine contact tank.

After treatment the water is pumped to the Port Waikato village to 2 concrete storage reservoirs located at the top of Cobourne Road and is fed down to the village by gravity. Pump activity at the treatment plant is continuously monitored and this is transmitted by telemetry to the site control. The abstraction pump is activated based on the level in the storage reservoir. Once the abstraction pump starts, all other processes start as well.

The village has only 19 connections, none of which are residential properties. Water is only supplied to the camping ground, the school camp, the Marae, the fire station, surf club, and Council facilities

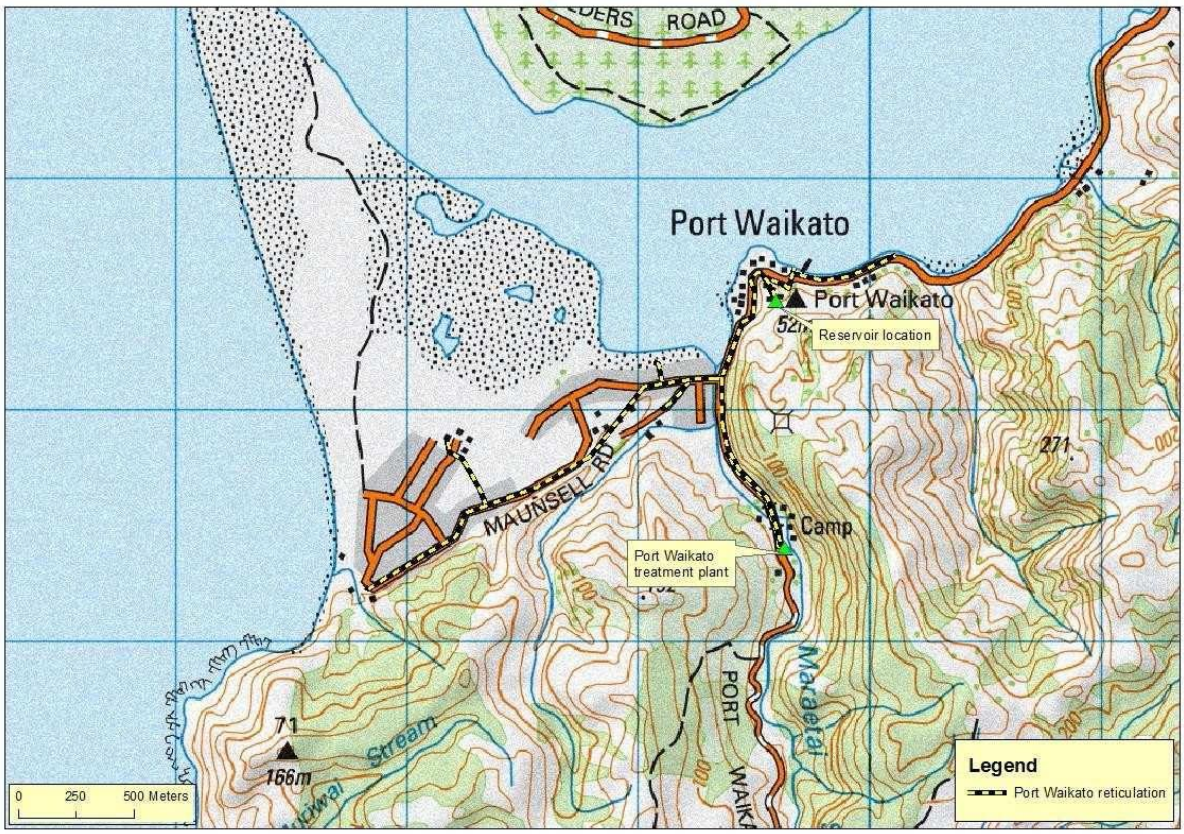
A Catchment Assessment has been conducted for the Port Waikato source water. It recommended 3-log protozoa treatment under section 10 of the DWSNZ.

15. Supply Management

The following people are responsible for the operation of the supply:

Waters Manager	Karl Pavlovich
Treatmetn & Servcies Team Leader	Mark Curtis
Treatment Supervisor	David Kennington
Waters Compliance Officer	Jaime Wara

Figure 2. Location of the Port Waikato supply



16. Photographs of Port Waikato Water Supply

The following photos were taken on a site visit to the Port Waikato drinking water supply by Opus staff in October 2014.

Figure 3. Source Catchment

Figure 4. Stream intake

Figure 5. Raw storage and wet well

Figure 6. Abstraction pump plug and switch

Figure 7. Soda ash and PACl dosing pumps

Figure 8. Clarifier

Figure 9. Clarifier launder

Figure 10. Multimedia filter

Figure 11. Post filter turbidity meter

Figure 12. Chlorine

Figure 13. Wedeco UV Unit

Figure 14. Reticulation service reservoirs

Version:

17. Risk Tables

WM – Waters Manager TL – Treatment & Services Team Leader PE – Plant Engineer TS - Treatment Supervisor

WCO – Waters Compliance Office TPO – Plant Operator

Table 9. Risk Tables

1. Catchment

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp
Microbiological Contamination	1.1	Contamination of source water	Moderate (frequent x minor)	High raw water E. coli results. Turbidity in raw water. Illness in community.	Full conventional treatment in place Supply from tankered water	Yes	Low (possible x minor)	None required	TL PE TPO
Chemical Contamination	1.2	Naturally occurring chemical contaminants	Moderate (possible x moderate)	High chemical levels identified in sampling.	Supply from tankered water 5 yearly source water chemical analysis program in place	Yes	Moderate (possible x moderate)	None required	WCO
Chemical Contamination	1.3	Chemical contamination from upstream land use e.g. agrichemicals	Moderate (likely x minor)	High chemical levels identified in sampling.	Upstream land owners are aware stream is used for water supply Supply from tankered water 5 yearly source water chemical analysis program in place	Yes	Low (possible x minor)	None required	TL PE WCO

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp
Loss of Supply	1.4	Drought	Moderate (often x minor)	Low inlet flow Low stream level	SCADA monitoring of inlet flow Supply from tankered water	Yes	Moderate (often x minor)	None required	TL PE WCO
Loss of Water Right	1.5	Resource consent is not renewed or is declined by Regional Council	Low (possible x minor)	Regional Council indicates concerns about water take	Current consent expires in 2051. A new consent will be sought 12 months before the existing consent expires	Yes	Low (rare x minor)	None required	TL WCO

2. Abstraction

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp.
Loss of supply	2.1	Vandalism to abstraction pump switch.	Moderate (likely x minor)	Low reservoir level alarm Low inlet flow alarm	SCADA monitoring of the supply	Partially	Moderate (likely x minor)	Relocate pump plug and switch to inside the WTP	PE
Loss of supply	2.2	Failure of pump due to power failure	Moderate (often x minor)	Low reservoir level alarm Low inlet flow alarm Phase alarm	Approximately 36 hours storage in reservoir SCADA monitoring of the supply	Yes	Low (often x insignificant)	None required	PE TPO
Loss of Supply	2.3	Failure of pump/s due to mechanical failure	Moderate (likely x minor)	Low reservoir level alarm Low inlet flow alarm	Approximately 36 hours storage in reservoir 'Off the shelf' replacement pumps are easily available SCADA monitoring of the supply	Yes	Low (rare x minor)	None required	PE

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp
Loss of Supply	2.4	Weir structure fails	Moderate (likely x minor)	Low reservoir level alarm Low inlet flow alarm	Approximately 36 hours storage in reservoir SCADA monitoring of the supply Regular physical inspections	Yes	Low (possible x minor)	None required	PE

3. Coagulation and Clarification

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp
Particles not removed	3.1	Coagulant dose pump failure	Moderate (often x minor)	No or poor floc formation High turbidity in water leaving the filter	High filter turbidity alarm Online SCADA monitoring Regular physical inspections	Yes	Moderate (often x minor)	None required	PE TPO
Particles not removed	3.2	Inappropriate dose rate of coagulant chemicals	Moderate (often x minor)	No or poor floc formation High turbidity in water leaving the filter	High filter turbidity alarm Online SCADA monitoring Operators trained to understand appropriate dose rates	Yes	Moderate (often x minor)	None required	PE TPO
Particles not removed	3.3	Poor coagulant mixing	Moderate (often x minor)	No or poor floc formation High turbidity in water leaving the filter.	High filter turbidity alarm Online SCADA monitoring Inline static mixer Operators check coagulant mixing when they attend plant	Yes	Low (possible x minor)	None required	PE TPO

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp
Particles not removed	3.4	Coagulant chemical supply exhausted	Moderate (often x minor)	No or poor floc formation High turbidity in water leaving the filter.	High filter turbidity alarm Online SCADA monitoring Regular physical inspections Delivery is within 3 days of being ordered WDC has shared services JV with other local Councils that would enable access to coagulant replenishment	Yes	Low (possible x minor)	None required	PE TPO
Particles not removed	3.5	Inappropriate or poor quality chemicals used	Moderate (often x minor)	No or poor floc formation High turbidity in water leaving the filter.	Online SCADA monitoring and high filter turbidity alarm Delivery is within 3 days of being ordered WDC has shared services JV with other local Councils that would enable access to coagulant replenishment Chemical supplier has a QA system in place	Yes	Low (possible x minor)	None required	PE TPO

4. Filtration

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp
Particles not removed	4.1	Filter performance compromised by inadequate floc formation	Moderate (often x minor)	High turbidity in water leaving the filter.	High filter turbidity alarm Online SCADA monitoring Regular physical inspections Differential pressure is monitored.	Yes	Moderate (often x minor)	None required	PE
Particles not removed	4.2	Failure of backwash pump to backwash properly	Moderate (often x minor)	High turbidity in water leaving the filter. Pump doesn't run during manual backwash	High filter turbidity alarm Online SCADA monitoring Regular plant inspections and manual initiation of backwash	Yes	Moderate (often x minor)	None required	PE
Particles not removed	4.3	Caking and mudballing	Moderate (often x minor)	High turbidity in water leaving the filter.	High filter turbidity alarm. Online SCADA monitoring. Regular plant inspections and automated initiation of backwash. Differential pressure is monitored. 5 yearly inspection and maintenance schedule in place.	Yes	Moderate (often x minor)	None required	PE TPO

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp
Particles not removed	4.4	Failure of filter nozzles	Moderate (often x minor)	High turbidity in water leaving the filter.	High filter turbidity alarm. Online SCADA monitoring. Regular plant inspections and manual initiation of backwash. Differential pressure is monitored. 5 yearly inspection and maintenance schedule in place.	Yes	Moderate (often x minor)	None required	PE TPO

5. Chlorination

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp
Inadequate Chlorination	5.1	Hypochlorite dosing supply exhausted	Moderate (likely x minor)	Low FAC alarm Low FAC residual during operator testing E.coli found in reticulation Checks by operators indicate that chlorine gas supply is unexpectedly low	Operators check the hypochlorite levels when they attend the plant Regular onsite testing Regular sampling and independent testing SCADA monitoring UV provides additional disinfection	Yes	Moderate (likely x minor)	None required	TPO
Inadequate Disinfection	5.2	Dosing equipment failure.	Moderate (often x minor)	Low FAC alarm Low FAC residual during operator testing E.coli found in the reticulation Checks by operators indicate that low FAC residual	Regular onsite testing Regular sampling and independent testing Online SCADA monitoring UV provides additional disinfection	Yes	Moderate (likely x minor)	None required	TPO

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp
Inadequate Disinfection	5.3	Post filter Turbidity >0.5NTU	Moderate (often x minor)	High turbidity value shown on filter turbidity meter Turbidity test shows high value Low UV intensity alarm	Regular onsite testing Regular sampling and independent testing SCADA monitoring Post filter turbidity monitoring	Yes	Moderate (often x minor)	None required	PE TPO
Formation of disinfection by-products	5.4	High level of organic material in filtered water combining with chlorine disinfectant	Moderate (Often x minor)	Evidence of high organic loading in source water Poor or ineffective filtration process	Treatment processes remove organic material Regular onsite testing Regular sampling and independent testing Post filter turbidity monitoring	Yes	Moderate (Often x minor)	None required	TL PE
Over chlorination dosing	5.5	Dosing system failure	Moderate (likely x minor)	High Chlorine alarm Consumer complaints High FAC Residual	Regular onsite testing Regular sampling and independent testing Online SCADA monitoring	Yes	Low (possible x insignificant	None required	PE TPO

6. UV Disinfection

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp
Inadequate Disinfection	6.1	UV intensity insufficient due to build-up of deposits on sleeve	Moderate (often x minor)	E. coli detected in water or illness in the community Visible build-up of deposits on sleeve Low intensity alarm	Operators clean sleeve at regular maintenance intervals Operators replace sleeves at regular intervals	Yes	low (possible x minor)	None required	PE TPO
Inadequate Disinfection	6.2	Flow rate through UV unit too rapid for effective treatment	Moderate (often x minor)	Flow rate through plant greater than UV unit maximum	UV reactor is restricted to an optimal flow rate Chlorination provides further disinfection	Yes	Low (possible x minor)	None required	PE TPO
Inadequate Disinfection	6.3	Excessive turbidity in water decreases the effectiveness of the treatment	Moderate (often x minor)	High turbidity levels detected in post filtration water Low UV intensity alarm	Coagulation and filtration prior to the UV disinfection unit removes turbidity Chlorination provides further disinfection	Yes	Low (possible x minor)	None required	PE TPO

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp
Inadequate Disinfection	6.4	Power failure resulting in UV unit being unable to operate	Moderate (often x minor)	Low reservoir level alarm Low inlet flow alarm Phase alarm	Approximately 36 hours storage in reservoir Chlorination provides further disinfection	Yes	Moderate (often x minor)	None required	PE TPO

7. pH Correction

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp
pH Adjustment too high or Low	7.1	Dosing system failure	Low (often x insignificant)	pH of the treated water is outside required parameters	pH is checked routinely (every 2 days) pH adjustment is not critical	Yes	Low (possible x insignificant)	None required	PE TPO
pH Adjustment too high or Low	7.2	Soda Ash supply exhausted	Low (often x insignificant)	pH of the treated water is outside required parameters	Soda Ash levels are checked routinely (every 2 days) pH adjustment is not critical	Yes	Low (possible x insignificant)	None required	PE TPO

8. Storage Reservoirs

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp
Microbiological contamination	8.1	Leakage through structure or access by birds or vermin.	Moderate (likely x minor)	E. coli in water within the reticulation Reservoir level low	Residual chlorine in water Reservoir is inspected regularly and condition assessed Online SCADA monitoring	Yes	low (possible x minor)	None required	PE TPO
Microbiological contamination	8.2	Vandalism to reservoir.	Moderate (likely x minor)	E. coli in water within the reticulation Reports from the public Visual evidence of damage to reservoir	Residual chlorine in water Reservoir is inspected regularly and condition assessed Online SCADA monitoring	Yes	Low (possible x minor)	None required	TPO PE
Microbiological contamination	8.3	Sediment accumulation within reservoir	Low (possible x minor)	Visible suspended matter in water exiting reservoir Complaints from consumers	Coagulation and filtration process combined with a sealed reticulation between treatment and the reservoirs effectively removes particulate material	Yes	Low (possible x minor)	None required	PE TPO

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp
Microbiological Contamination	8.4	Contamination through insanitary maintenance or sampling procedures.	Moderate (Likely x minor)	E. coli in water within the reticulation	Residual chlorine in water Shared laboratory services Access to reservoir is restricted to trained staff	Yes	Low (Possible x minor)	None required	PE TPO

9. Reticulation

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp.
Loss of Supply	9.1	Pipe failure.	Moderate (often x minor)	Complaints from consumers about loss of supply Change in flow or pressure in reticulation	Failures, maintenance and renewals are recorded in council asset management system	Yes	Moderate (likely x minor)	None required	TS
Microbiological Contamination	9.2	Inadequate controls on maintenance and construction work.	Moderate (often x minor)	E. coli present in reticulation system Illness in community	Contractors are required to have appropriate reticulation qualifications and to undertake maintenance and construction work in a sanitary manner	Yes	Moderate (Likely x minor)	None required	TS
Chemical or Microbiological Contamination	9.3	Backflow from consumer connections	Moderate (Likely x minor)	Illness in community. Contaminants present in the reticulation Taste or odour complaints from consumers	Non-testable devices are installed at all new connections FAC maintained at suitable levels throughout the reticulation There are no industrial connections to the supply	Partially	Moderate (Likely x minor)	Prepare and implement a council water supply backflow prevention policy which includes preparation of a register of all backflow protection devices and a register of annual testing of all devices	WM

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp.
Loss of Supply	9.4	Breaks or leaks in pipes	High (often x minor)	Loss of supply pressure	Breaks and leaks repaired as a priority.	Yes	Moderate (likely x minor)	None required	TS
Loss of Supply	9.5	Excessive demand in network or inadequate system capacity.	Low (possible x minor)	Complaints from consumers about low pressure or loss of supply. Change in flow or pressure in reticulation	Approximately 36 hours storage. Community size is stable and demand has not significantly increased for many years	Yes	Low (possible x minor)	None required	TL PE
Inadequate Supply	9.6	Silt build up within reticulation pipes.	Low (possible x minor)	Reduced flows in reticulation. Complaints from consumers about quality of water	Flushing is undertaken in response to consumer complaints and at regular intervals	Yes	Low (possible x minor)	None required	TS

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp.
Inadequate Supply	9.7	Poor planning of maintenance and construction work leaves consumers without water supply.	Low (likely x minor)	No supply or reduced pressure in areas where upgrading is undertaken. Scheduled maintenance or renewals	24 hours' notice is given for planned shutdowns of network. Customer service is kept informed. Temporary alternative supply provided if shut down exceeds 8 hours	Yes	Low (possible x minor)	None required	TL PE

10. Other

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp
Sampling Failure	10.1	Inadequate sampling programme or sample collection error.	Moderate (often x minor)	DWSNZ compliance failure due to days of week, days between samples, insufficient samples, information gaps, positive results or sampling error	Sampling programme prepared and checked against standards. Dedicated sampling and analysis team are appropriately trained	Yes	Moderate (likely x minor)	None required	WCO
Unrecognised Contamination	10.2	Inadequate sampling programme, sample collection error or response to transgression.	Moderate (often x minor)	Gaps in records from weekly testing regime.	Sampling programme prepared and checked against standards. Relevant staff well trained and qualified.	Yes	Moderate (likely x moderate)	None required	WCO
Failure of Supply due to Inadequate Maintenance.	10.3	Supply equipment fails due to inadequate asset information and inadequate maintenance planning.	Moderate (Frequent x minor)	Unexpected plant equipment failure. Not having an updated asset register and maintenance programme	Maintenance is planned and undertaken by competent staff Specialist maintenance is contracted out as required Asset information is held by Council	Yes	Moderate (possible x moderate)	None required	TL TS

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp
Failure of Supply due to Unavailability of Spare Parts	10.4	Inadequate spare parts held or spare parts unavailable.	Moderate (Frequent x minor)	Plant is out of operation due to not having spare parts available.	Spare parts are held for some things and replacement spares parts are usually available overnight Approximately 36 hours storage allows supply to continue while parts are located and repairs made	Yes	Moderate (likely x minor)	None required	TL PE
Failure of Supply due to Inadequate Operating Procedures Loss of supply	10.5	Insufficient, inadequate out of date or incorrect manual of operational procedures.	Moderate (Frequent x minor)	Operational manuals not used Operational Manuals not up to date Operational manual copies are not the same	Plant has operations and maintenance manuals Plant operators have a good knowledge of plant operation	Yes	Moderate (Frequent x minor)	None required	TL PE
Complaints of Poor Taste or Odour in Water	10.6	Poor aesthetic quality of water not identified	Moderate (Likely x minor)	Taste and odour complaints Aesthetic sampling identifies determinands which exceed the NZDWS Guideline Values	Complaints investigated	Yes	Low (possible x minor)	None required	WCO

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp
Operator Error or Mismanagement	10.7	Inadequate training, professional development and up-skilling of operators	Moderate (frequent x minor)	Poor operation of plant Plant compliance failure Loss of supply Poor score on question about level of supervision in supply grading	Operators hold relevant NZ certificate and Diploma qualifications On-going training and up-skilling is provided for operators	Yes	Moderate (frequent x minor)	None required	TL TS WMO
Total Plant Failure	10.8	Catastrophic natural disaster or failure including earthquake, flooding, volcanic eruption	High (rare x catastrophic)	Major natural disaster occurs Intense sustained weather Land slide, flooding, volcanic eruption Total plant failure is evident Warnings from Govt agencies incl Met Office, Niwa, Civil Defence, Regional Council or Police	Prior warning from Govt agencies incl Met Office, Niwa, Civil Defence, Regional Council or Police Robust secure plant structures and buildings System and people backups Business continuity plan in place and exercised Emergency response plan Online SCADA Monitoring	Yes	Moderate (rare x major)	None required	TL PE TS WCO TPO

Event	No	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Risk Managed	Residual Risk	Additional Measures That Could be put in Place	Resp.
Loss of Supply	10.9	Failure of plant due to power outage	Moderate (often x minor)	Low reservoir levels Phase alarms	Approximately 36 hours storage A portable generator could be installed within two days	Yes	Low (likely x insignificant)	None required	TL PE
Tankered Supply not Safe for Consumption	10.10	Sanitary practice not observed in lifting and delivery of water	Moderate (possible x moderate)	E. coli present in reticulation system Illness in community	Water carrier required to have current registration	Yes	Low (rare x moderate)	None required	TL PE

3. Improvement schedule

The improvement schedule is derived from the risk tables present in Section 17. The improvement schedule outlines improvements that have been recommended for preventing, reducing or eliminating the identified public health risks in the Port Waikato drinking water supply. Possible improvements to the water supply have been identified in the 'Additional Measures That Could Be Put in Place' column of the risk tables. The most suitable option to improve the management of each unmanaged risk has then been included in the improvement schedule. It should be noted that costs are estimates only. Each project is ranked according to the priority to which projects should be completed. Improvement timelines will be enacted as per the improvement schedule adopted by The Waikato District Council Asset Management Plan 2017

No	Improvement	Related risk	Risk benefit	Ease of implementation	Cost of implementation	Cost benefit	Project cost	Responsibility
IMP002	Relocate abstraction pump plug and switch to inside the treatment plant	1.2 2.1 Vandalism to abstraction pump switch	2	2	3	40	$5000	Plants Engineer
IMP003	Prepare and implement a council water supply backflow prevention policy which includes	9.3 Backflow from consumer connections	2	5	4	40	Staff time	Waters Manager

4. Contingency plan

Port Waikato Water Supply Contingency Plan	
Type of Event	***Required Contingency Action***
Severe microbiological contamination of source water (such that treatment is ineffective) **Indicators: A contamination event in the catchment may be observed by or reported to WDC staff. May also be indicated by reported illness among consumers or positive E coli monitoring results.**	**Issue "Boil Water' notice** **Advise Drinking Water Assessor (DWA)** **Inspect catchment and catchment to identify source of contamination and rectify problem as quickly as possible** **Consider provision of emergency treatment or alternative water supply (eg bottled or tankered water)** **Disinfect contaminated reservoirs and flush mains** **Keep customers informed and advise once regular service is restored**
Chemical contamination of source water **Indicators: A contamination event in the catchment may be observed by or reported to WDC staff. May also be indicated by reported water quality concerns from consumers (taste, odour, colour) or illness among consumers.**	**Advise Drinking Water Assessor (DWA)** **Assess situation and advise customers regarding use/treatment/disposal of contaminated water** **Arrange emergency water supply (bottled or tankered water) if necessary** **Inspect catchment and intake to identify source of contamination and rectify problem as quickly as possible** **Flush contaminated reservoirs and mains** **Keep customers informed and advise once regular service is restored**
Insufficient water available for abstraction from stream **Indicators: Observed or reported low stream levels. Reduced flows from abstraction pump.**	**Advise customers to conserve water** **Implement demand management strategies as required** **Arrange emergency water supply (bottled or tankered water) if necessary** **Keep customers informed and advise once regular service is restored**

***E. coli* transgression in water leaving treatment plant or distribution zone**	**Follow transgression response procedure in DWSNZ** **Advise Drinking Water Assessor (DWA)** **Commence daily *E. coli* testing at Water Treatment Plant** **Use an enumeration test method** **Sample in distribution system** **Investigate cause, inspect plant and source**

Port Waikato Water Supply Contingency Plan	
Type of Event	***Required Contingency Action***
Indicators: *E. coli* transgression reported following routine monitoring.	**Take remedial action eg super chlorination, flushing etc** **Continue to sample for *E. coli* until 3 consecutive samples are free of *E. coli*** **If *E. coli* is found in repeat samples consult with DWA, intensify remedial action, increase disinfection, consider 'Boil Water' notice, consider alternative supply**
Loss of power supply to treatment plant	**Determine likely length of power outage** **If it is possible that power outage will exceed 24 hours implement demand management and locate a portable generator at the treatment plant to provide power if outage continues**
Natural disaster including earthquake and flood	**Refer to Council Emergency Management Plan and Business Continuity Plan**