



**Ashburton**  
DISTRICT COUNCIL

Chertsey Water Supply  
Water Safety Plan






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## Chertsey Water Supply Water Safety Plan

**Version 2.1: August 2018**

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Review Date: June 2017

## Document Control

<b>Version No</b>	<b>Description</b>	<b>Authorised</b>	<b>Approval Date</b>
V 1.0	For submission to DWA for approval	AG	May 2011
V 2.0	Revision to DWA for approval	AG	June 2017
V 2.1	Minor revision to add CCPs	CS	August 2018

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# 1 Background

Ashburton District Council (ADC) own and operate the Chertsey drinking water supply.

Under Health (Drinking Water) Amendment Act 2007 (the Act) Council has a responsibility to take all practicable steps to comply with the drinking water standards [Section 69V]. This requirement can be met in part by implementing the provisions of an approved Water Safety Plan that relate to the drinking water standards.

The purpose of a Water Safety Plan is to identify the public health risks associated with a drinking water supply. A Water Safety Plan includes a list of what could go wrong with a supply and what measures can be put in place to prevent or eliminate risk to public health.

Chertsey is classified as a small supply under the legislation and is required to be compliant with the Act by 01 July 2015. In 2011 the Ministry of Health (MoH) approved a PHRMP for Chertsey. The approved PHRMP expired in 2016. This WSP has been prepared to meet the requirements of section 69Z of the Act.

## **2 Implementation, Review and Reporting**

### **2.1 Implementation of the Plan**

The ADC Assets Manager is responsible for the implementation of the WSP within the timeframes indicated, subject to community and Council approvals, funding constraints and availability of resources. The Assets Manager is also responsible for the ongoing review and updating of the WSP and associated Improvement Schedule.

### **2.2 Review Plan Performance**

It is a requirement that the WSP be reviewed, revised and submitted for re-approval within five years of approval. During the five year period, the document will be kept current through the following steps:

- Collating comments from those regularly using the WSP and making any required changes;
- Monitoring customer complaints and making any required changes;
- Incorporating any minor changes that have been made to the water supply;
- Updating the risk tables as required;
- Updating the improvement schedule.

### **2.3 Duration of the Plan**

This Plan shall remain in force for a period of up to five years following approval.

### **2.4 Revision and Re-approval of the Plan**

It is a requirement that the Plan be reviewed, revised and submitted for re-approval within five years of approval. Revision processes are detailed above.

### **2.5 Links to other Quality Systems**

This Plan will contribute improvement measures to the AMP for prioritisation and funding via the LTP.



### 3 Supply Details

<b>Supply</b>	
Supply Name	<i>Chertsey</i>
WINZ Community Code	<i>CHE002</i>
Supply Owner	<i>Ashburton District Council</i>
Supply Manager	<i>Andrew Guthrie</i>
Supply Operator	<i>Ashburton Contracting Ltd – Robin Jenkinson (NZCE Civil, R.E.A.)</i>
Population Served by Supply	<i>230 (WINZ)</i>
Supply Grading	<i>Uu (current)</i>
<b>Source</b>	
Source Name	<i>Chertsey Well</i>
Source WINZ Code	<i>G00228</i>
Location	<i>Alexander Street</i>
Map Reference of Source	<i>NZTM 1514598 easting, 5149256 northing</i>
Type of Source	<i>Bore</i>
Depth of Bore	<i>144.98m</i>
Consent Number	<i>CRC991612</i>
Consent Expires	<i>04 March 2034</i>
Maximum Consented water take:	<i>5 L/s, 300 m<sup>3</sup>/day</i>
<b>Treatment Plant</b>	
Treatment Plant Name	<i>Chertsey</i>
Treatment Plant WINZ Code	<i>TP00337</i>
Location	<i>Alexander Street</i>
Map Reference	<i>NZTM 1514598 easting, 5149256 northing</i>
Treatment Processes	<i>Chlorine Dosing</i>
Consented Daily Volume	<i>300 m<sup>3</sup>/day</i>
Peak Daily Volume	<i>278 m<sup>3</sup>/day</i>
<b>Distribution</b>	
Distribution Zone Name	<i>Chertsey</i>
Distribution Zone WINZ Code	<i>CHE002CH</i>
Distribution Zone Population	<i>230</i>

<b>Regulatory Compliance</b>	
Standards compliance assessed against	<i>DWSNZ 2005 (rev 2008)</i>
Laboratory undertaking analyses	<i>Ashburton District Council</i>
Secure bore water	<i>Yes</i>
Bacterial compliance criteria used for water leaving the treatment plant	<i>Criterion 1</i>
Bacterial compliance for water leaving the treatment plant has been achieved for the last four quarters	<i>Yes</i>
Protozoa log removal requirement required for the supply	<i>N/A – Secure Groundwater.</i>
Protozoa treatment process	<i>None</i>
Protozoa compliance for water leaving the treatment plant has been achieved for the last four quarters	<i>Yes – Secure Groundwater</i>
Compliance criteria used for water in the distribution zone	<i>Criterion 6A</i>
Bacteria compliance for water in the distribution zone has been achieved for the last four quarters	<i>Yes</i>
P2 determinands allocated to supply	<i>None</i>
Chemical compliance achieved for the last four quarters	<i>Yes</i>
Cyanobacteria identified in the supply	<i>No</i>
Cyanobacterial compliance has been achieved for the last four quarters	<i>Yes</i>
Identify any transgressions that have occurred in the last four quarters	
<i>None</i>	

### 3.1 Contact Information

#### Water Supply Owner:

Ashburton District Council  
 PO Box 94, Ashburton  
 Contact: Andrew Guthrie, Assets Manager  
 Phone: 03 307-7741

#### Water Supply Operator:

Ashburton Contracting Ltd  
 PO Box 264, Ashburton  
 Contact: Robin Jenkinson  
 Phone 03: 308-4039

## 4 Methodology

This WSP has been prepared with regard to “Small Drinking-water Supplies: Preparing a Water Safety Plan”, Ministry of Health (2014).

A qualitative risk assessment approach based on the guidance notes in Appendix 2 of “A Framework on How to Prepare and Develop Water Safety Plans for Drinking-water Supplies”, Ministry of Health (2014), has been undertaken.

### 4.1 System Description

Within this WSP the water supply is described and a schematic diagram prepared to illustrate the key elements of the supply. Critical points and barriers to contamination are also illustrated.

### 4.2 Consultation

The WSP was drafted after consultation with Euan Cox, the Compliance Coordinator responsible of the Ashburton water supplies and Chris Stanley (Asset Management Officer – Utilities).

The document was reviewed and discussed with Andrew Guthrie, Assets Manager, Ashburton District Council, and Robin Jenkinson, Ashburton Contracting Ltd, prior to completion.

### 4.3 Risk Assessment

The qualitative risk assessment approach used allows for the prioritisation of improvement needs and the development of the Improvement Schedule.

Risk tables have been prepared to summarise:

- a) what could happen that may cause drinking water to become unsafe,
- b) what measures are in place to prevent this from occurring and whether this is sufficient,
- c) the assessed level of risk, and
- d) what could be done to eliminate, isolate or minimise the risks.

Potential public health risks have been evaluated using the Likelihood and Consequence scales tabulated below (tables 1-3) to determine a risk level from low to extreme.

The scales used have been adapted from those suggested in Appendix 2 of “A Framework on How to Prepare and Develop Water Safety Plans for Drinking-water Supplies”, Ministry of Health (2014). Changes have been made to achieve a better spread of risk level outcomes, and to ensure relativity between the risks assessed for supplies of varying sizes. This is necessary as it is intended that improvement schedule items from individual supplies can be consolidated into a master list for implementation.

Table 1, Table 2 and Table 3 detail the criteria used and their definitions.

**Table 1 Likelihood Scale**

<b>Likelihood</b>	<b>Frequency</b>	<b>Description</b>
<b>Likely</b>	More than once per year	The threat can be expected to occur
<b>Quite Common</b>	Once per 1-5 years	The threat will quite commonly occur
<b>Unlikely</b>	Once per 5-10 years	The threat may occur occasionally
<b>Unusual</b>	Once per 10-50 years	The threat could infrequently occur
<b>Rare</b>	Less than once per 50 years	The threat may occur in exceptional circumstances

**Table 2 Consequence Scale**

<b>Consequences</b>	<b>Microbiologically contaminated water</b>	<b>Chemically contaminated water</b>	<b>Supply interruption</b>	<b>Poor aesthetic water quality</b>
<b>Negligible</b>		Minor chemical contamination event	Unplanned supply interruption for up to 8 hours	Poor aesthetic water quality of nuisance value only
<b>Minor</b>	Microbiological contamination (<100 population)	Recurrent chemical contamination (<100 population)	Unplanned supply interruption for in excess of 8 hours (<100 population)	
<b>Medium</b>	Microbiological contamination (100-500 population)	Recurrent chemical contamination (100-500 population)	Unplanned supply interruption for in excess of 8 hours (100-500 population)	Ongoing poor aesthetic water quality (may lead consumers to obtain water from other sources)
<b>Major</b>	Microbiological contamination (500-5000 population)	Recurrent chemical contamination (500-5000 population)	Unplanned supply interruption for in excess of 8 hours (500-5000 population)	

Consequences	Microbiologically contaminated water	Chemically contaminated water	Supply interruption	Poor aesthetic water quality
<b>Substantial</b>	Microbiological contamination (>5000 population)  OR high potential for loss of life or hospitalisation with life threatening or long-term consequences	Recurrent chemical contamination (>5000 population).  OR high potential for loss of life or hospitalisation with life threatening or long-term consequences.	Unplanned supply interruption for in excess of 8 hours (>5000 population)	

**Table 3 Risk Level Allocation Table**

Likelihood	Consequence				
	Negligible	Minor	Medium	Major	Substantial
<b>Likely</b>	Low	Medium	Very High	Extreme	Extreme
<b>Quite Common</b>	Low	Medium	High	Very High	Extreme
<b>Unlikely</b>	Low	Medium	High	Very High	Very High
<b>Unusual</b>	Low	Low	Medium	High	Very High
<b>Rare</b>	Low	Low	Medium	Medium	High

#### 4.4 Improvement Schedule

An Improvement Schedule has been derived from the Risk Tables and is prioritised according to the assessed level of public health risk associated with hazards that are not adequately controlled at present.

Improvement measures identified in this WSP will be carried forward to Council’s next Activity Management Plan (AMP) and Long Term Plan (LTP) for approval and inclusion in annual budgets following the statutory public consultation process. Implementation of the Improvement Schedule is ultimately subject to Council funding approval, and/or obtaining alternative funding.

#### 4.5 Benefits of Proposed Improvements

The proposed improvements will provide public health benefits by reducing the risk of adverse health outcomes associated with drinking water quality. In particular, risks will be reduced by ensuring the new chlorine system is validated to ensure compliance with the Drinking-water Standards for New Zealand. Investigating the resilience of the plant to natural hazards and developing and adopting an emergency response plan would ensure the supply is managed in the occurrence of such events.

Improvements could also be made by the installation of a chlorine analyser and high / low residual alarms, as well as bore level monitoring and a low level alarm.

Uncertainties over the condition of pipes and equipment pose a risk of unexpected leaks, breakdowns and variations in performance which may lead to undesirable outcomes.

To address this, Council is implementing an asset management and information system (AMIS) which will assist with recording and programming maintenance and with performing criticality assessments to prioritise attention on the riskier elements of the infrastructure. It will also help to consolidate information about the plant and infrastructure. The maintenance tracking is likely to be implemented in 2017-2018.

#### **4.6 Contingency Plans**

Contingency plans have been prepared (section 13) 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. The Water Supply Operator is responsible for implementation of the contingency plans when monitoring has identified the occurrence of a risk event.

### **5 General Description**

The Chertsey community is served by one water supply bore. The Chertsey scheme supplies water to 83 connections, with a total population of approximately 230 people (WINZ).

The water abstraction is consented under CRC991612, which allows for a combined total of 5 L/s and 300 m<sup>3</sup>/day from the bore.

The typical winter demand is approximately 100 m<sup>3</sup>/day. This is an average of around 1,205 litres per property per day, or 435 litres per person per day. The typical summer demand is approximately 220m<sup>3</sup>/day. This is an average of around 2,651 litres per property per day, or 957 litres per person per day.

## 5.1 Location Map

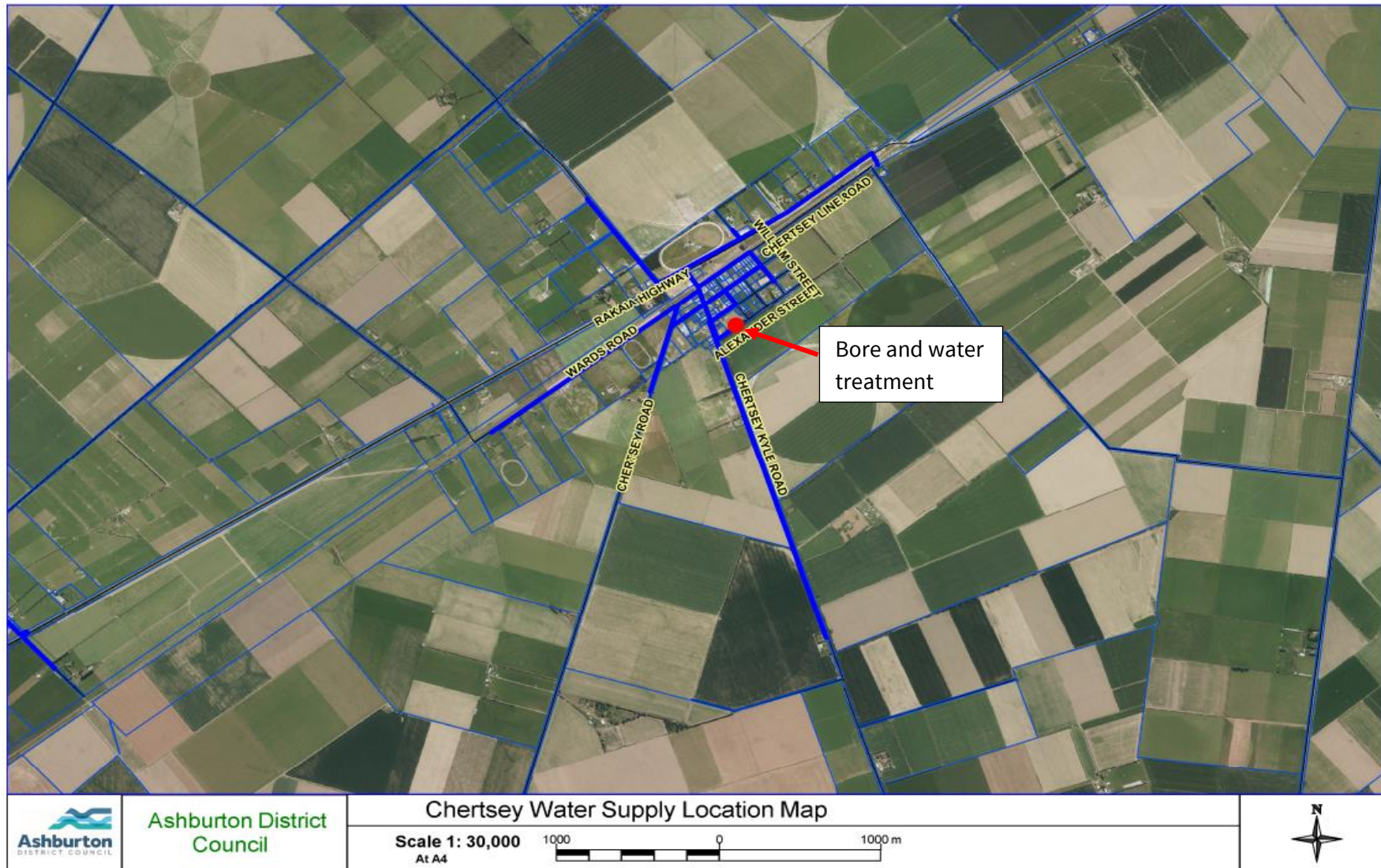


Figure 1: Location Map

## 5.2 Description of Source

The current source is groundwater from one bore, ECan number L36/0885 (see map above), drilled to a depth of 144.98m BGL in August 1999. The bore is 200mm in diameter and is located on Alexander Street, adjacent to Chertsey school.

One fixed speed submersible pump is installed in the bore. There is no bore level monitoring which is a risk factor. The operation of the bore pump is directly controlled by a level probe mounted in Reservoir Tank 1.

## 5.3 Treatment and Distribution

The raw water is treated by direct injection of sodium hypochlorite solution through a dosing pump, whenever the bore pump is running. There is no online analyser or chlorine tank level sensor.

Two 30m<sup>3</sup> PE storage tanks with high level inlets, low level outlets and over flow pipes are positioned on site and are interlinked for balancing and constant water “turn over”. There are two booster pumps, which supply the distribution zone using a pressure vessel and a pressure sensor control system.

A standby power generator is installed and is sufficient to operate the treatment plant and all pumps in the event of power supply interruption.

All pumping information is recorded by SCADA.

A process diagram of the Chertsey water supply is included below in Figure 2.

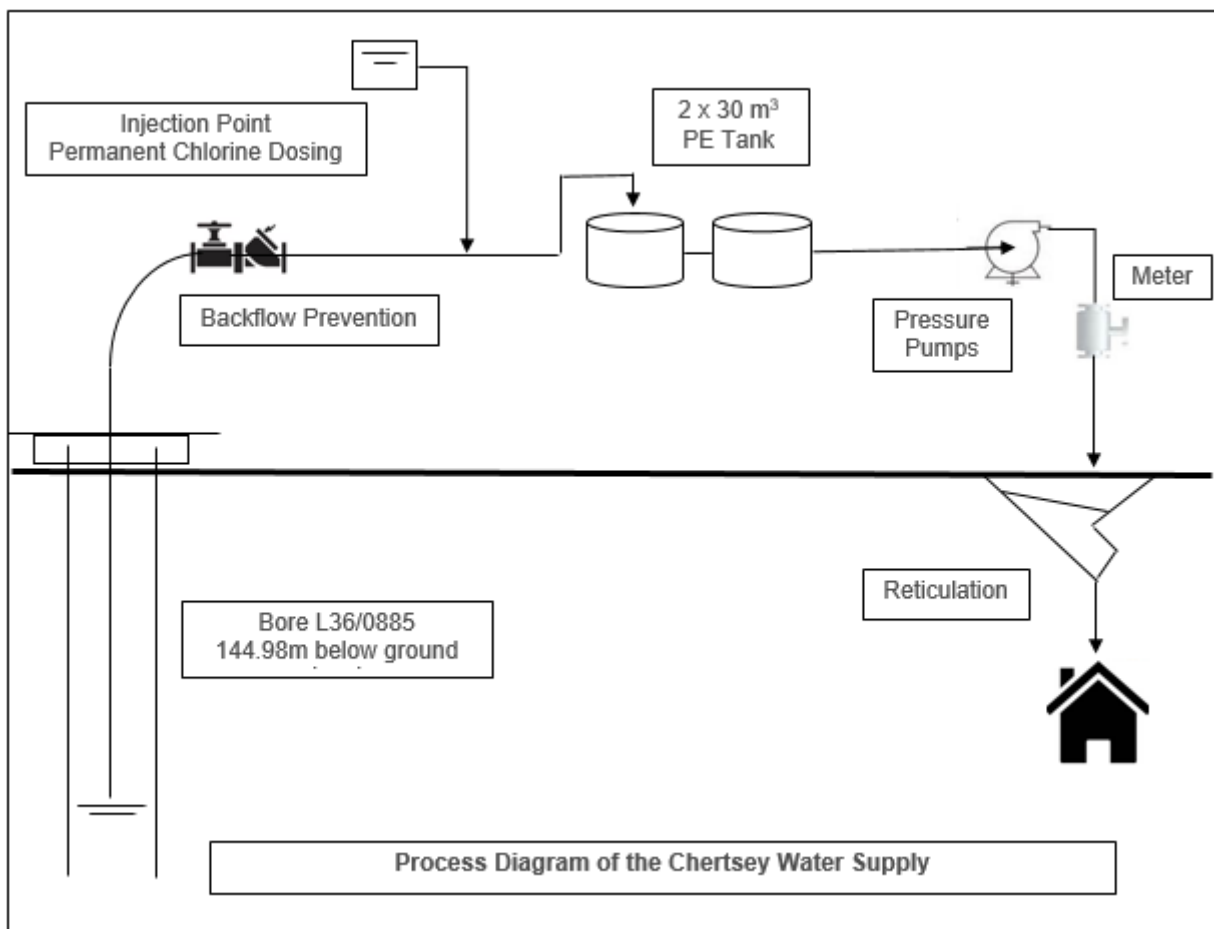


Figure 2: Chertsey Water Supply Process Diagram



## 5.4 Monitoring and Alarms

All pumping information is recorded by SCADA but there is no remote control functionality.

The SCADA system is currently only used for data acquisition and remote monitoring purposes. It is not an integral part of the pumping or treatment plant control systems. The basic information recorded by SCADA includes:

- Plant output volume and instantaneous flow
- Bore and booster pump run hours
- Service tank level
- Alarms for pump failure, high and low service tank levels, power failure, communication failure, generator fault, generator run

Regular inspections of the site are carried out by an ACL (Ashburton Contracting Ltd) staff member on a weekly basis. As part of the maintenance inspections, the staff take treated water samples for testing and carry out regular inspections of all plant, including chemical levels, any equipment faults signs of damage and “wear and tear”. A log is made of the inspection which includes details of any chemicals topped up, any irregularities and/or problems.

Water age samples from the bore were collected in 2012 and 2016, currently awaiting the results of the analysis from GNS.

E.coli samples are collected from the bore (raw water) on a quarterly basis as the bore is fully secure and has qualified for reduced monitoring (DWSNZ Table 4.5, note 5).

E.coli samples are collected weekly at the plant, post-treatment. This sampling is a holdover from before the supply was chlorinated and will cease in the next compliance year (from 1 July 2017) because the groundwater is secure (sampling not required). The samples are analysed by Ashburton District Council’s own MoH-recognised facilities.

E.coli samples are collected monthly from the reticulation network (Chertsey Line Road), in accordance with bacterial compliance criterion 6A of the DWSNZ.

Manual readings are taken for FAC, pH and turbidity at the treatment plant whenever an E.coli sample is collected. This manual sampling will continue on a weekly basis without the E.coli sample from 1 July 2017. Manual readings are taken for FAC, pH and turbidity at the distribution zone whenever an E.coli sample is collected.

Monthly nitrate samples are taken at the treatment plant.

Samples are also taken annually (in January) at the plant for basic water chemistry suite of chemical tests.

The list of monitored measures and alarms is shown below in Figure 3.

State	Equipment Name	Point Name	Value	Units	Notes Available	Output	I/O Point Reference
NML	Chlorine	Dosing Pump Fault	0				RDI 20
	Outflow	Instantaneous	1.35	L/s			RAI 2
	Outflow	Accumulated Today	54.9	m <sup>3</sup>			NAI 1
	Outflow	Accumulated Yesterday	143.62	m <sup>3</sup>			NAI 2
NML	Pressure Pump 1	Fault	0				RDI 5
	Pressure Pump 1	HoursLast2	0				
	Pressure Pump 1	HoursLast24	0	Hours			
OFF	Pressure Pump 1	Run	0				RDI 4
	Pressure Pump 1	StartsLast2	0				
	Pressure Pump 1	StartsLast24	0	Starts			
ON	Pressure Pump 2	Run	1				RDI 6
	Pressure Pump 2	HoursLast24	15.3	Hours			
	Pressure Pump 2	StartsLast2	9				
	Pressure Pump 2	StartsLast24	127	Starts			
	Pressure Pump 2	HoursLast2	1.4				
NML	Pressure Pump 2	Fault	0				RDI 7
	Site	Comms Usage Today (%)	4.07	%			
	Site	Tank Level	90.6	%			RAI 1
	Site	Last Comms	2017-05-10 10:35:43				
NML	Site	Comms Fail	0				
	Site	Comms Usage Yesterday (%)	3.77	%			
	Site	DLP Version	3	????			NAI 6
NML	Site	Generator Fault	0				RDI 17
NML	Site	Generator Run	0				RDI 18
NML	Site	Phase Fail	0				RDI 1
NML	Site	Tank High Level Alarm	0				NDI 3
NML	Site	Tank Low Alarm	0				RDI 19
NML	Site	Tank Low Level Warning	0				NDI 2
	Submersible Pump 1	HoursLast24	6.9	Hours			
ON	Submersible Pump 1	Run	1				RDI 2
	Submersible Pump 1	StartsLast24	5	Starts			
	Submersible Pump 1	StartsLast2	1				
NML	Submersible Pump 1	Fault	0				RDI 3
	Submersible Pump 1	HoursLast2	1.3				

Figure 3: Telemetry monitoring and alarms

## 5.5 Maintenance and Administration

The Chertsey water supply is owned and managed by Ashburton District Council. Ashburton Contracting Ltd (ACL) are contracted to operate and maintain the water supply. The personnel involved in the day-to-day management and operation of the water scheme are adequately trained and qualified, and ACL staff undertake on-going training.

## 6 History

The Chertsey water supply scheme was established in 1972 and the majority of the scheme reticulation dates from this time.

Major improvements to the scheme include:

- deepening the current water bore in 1999,
- installation of two new tanks in 2006,
- installation of a standby power generator in 2007,
- installation of Backflow prevention devices as part of a wellhead upgrade in July 2013
- extension of the concrete pad as part of a wellhead upgrade in July 2013
- installation of full-time chlorine dosing in July 2016
- carrying out some minor pipe extensions in 2006 and 2010

No other major reticulation upgrades have been carried out.

A PHRMP was prepared for this scheme in 2011 with a focus on identification of the most significant risks relating to water quality and reliability of supply.

The primary risks in 2011 were those with respect to:

- 1) Bore source and abstraction:
  - Bacterial, chemical or protozoa contamination of the source
  - insufficient water available
- 2) Treatment:
  - inadequate disinfection
  - failure to remove chemical contaminants from raw water
- 3) Storage and distribution:
  - introduction of contaminants into the distribution system
  - Insufficient water
- 4) Other
  - system performance
  - System damaged or contaminated by construction / maintenance work

## **7 Water Supply Distribution**

### **7.1 Description of Storage**

Two 30m<sup>3</sup> PE storage tanks are positioned on site and are interlinked for balancing and constant water “turn over”. The storage tanks provide contact time for the chlorine disinfection.

### **7.2 Description of Distribution**

The reticulation comprises approximately 6.5 km of DN 100 or smaller pipes installed in 1972. Records have been kept of minor upgrades in the general network, 170 m of DN100 on Alexander St (2006) and 135 m of DN100 on Chertsey Kyle Rd (2010).

### **7.3 Pump Systems**

Two pumps supply the distribution zone using a pressure vessel and a pressure sensor control system.

### **7.4 Power Supply Reliability**

Power supply to the site is usually reliable but storm and snow events may result in localised or widespread power outages in this area. This would cause loss of supply in case of power outages. The emergency standby generator was installed in 2007 and is regularly tested and maintained.

### **7.5 Supply Pressure**

Pressure is maintained in the network via a control system consisting of a pressure sensor, a pressure vessel, and the booster pumps.

### **7.6 Backflow Prevention**

Properties served by this supply could pose a backflow contamination risk. There is also the risk of backflow contamination from all other connections if pressure was to drop significantly.

All new connections are examined against the ADC backflow prevention policy and as a minimum include a non-testable double check valve.  
 A backflow prevention device has been installed at the source in accordance with section 4.5.2.2 of the DWSNZ.

### 7.7 Maintenance

The supply is maintained by Ashburton Contracting Ltd (ACL), who are contracted to operate and maintain all ADC water supplies.

ADC is implementing an Asset Management and Information System (AMIS) to assist with programming, monitoring and tracking regular maintenance and inspection/monitoring tasks. This will also allow regular condition assessments and signal areas at increased risk.

## 8 Critical Points for Hazard Management

Figure 4 below presents a schematic of the water supply critical points and barriers to contamination. Critical points, where hazards can be eliminated, minimised or isolated are indicated in blue. Barriers to contamination are indicated in red.

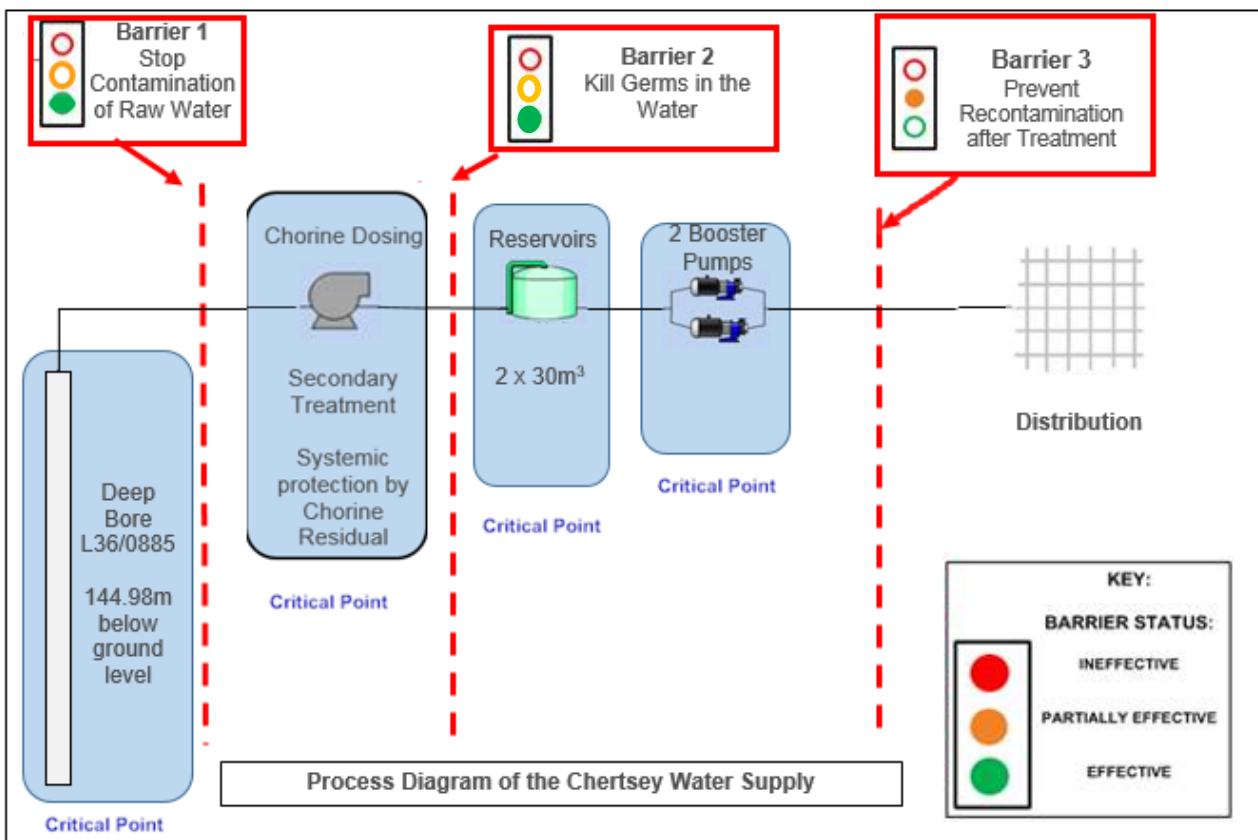


Figure 4 - Chertsey Water Critical Points and Barriers to Contamination

**Critical points** where hazards can be eliminated, minimised or isolated are tabulated below.

<b>Critical Point</b>	<b>Description</b>
Wellhead	<i>Possible point for microbiological contamination</i> <i>Possible point for loss of supply</i>
Chlorine Dosing	<i>Overdosing may exceed chemical MAV</i> <i>Note: Chlorination is not required for raw water disinfection as the source is secure groundwater</i>
Treated Water Storage	<i>Possible point for microbiological contamination</i> <i>Possible point for loss of supply</i>
Pump Station	<i>Possible point for loss of supply</i>
Reticulation	<i>Possible point for microbiological contamination</i> <i>Possible point for loss of supply</i>

## 9 Barriers to Contamination

The following section discusses what barriers are in place to reduce the risk to public health from the Chertsey drinking water supply. A Framework on How to Prepare and Develop Water Safety Plans for Drinking-water Supplies by the Ministry of Health (2014) states the barriers should:

- Stop the contamination of raw water
- Remove particles from the water
- Kill germs in the water
- Prevent recontamination after treatment

### 9.1 Stop Contamination of Raw Water

The bore is 149m deep, the large depth minimises the risk from surface contamination. The well head is constructed to prevent ingress of contaminants. It has a sealed well cap, a high air vent with a screen and a surrounding concrete pad. It is in a clean, locked concrete chamber.

This barrier was enhanced in 2013 by installing backflow prevention on the well head pipework and extending the concrete pad that surrounds the bore head.

Residence time testing has been completed. This water source is deemed “secure” under section 4.5 of DWSNZ.

The source therefore provides a **full barrier to contamination**.

## 9.2 Remove Particles from the Water

The groundwater source is secure, therefore this barrier is not applicable.

## 9.3 Kill Germs in the Water

Chlorine dosing provides a secondary partially effective barrier to contamination.

Sodium hypochlorite solution is injected into the water prior to delivery into the storage tanks, primarily as a residual disinfectant. The chlorine dosing pump system operates on a fixed dosing rate, and only runs at the same time as the bore pump.

The rate can be manually adjusted as indicated by manual FAC testing. There is no on-line monitoring to confirm that the desired Free Available Chlorine (FAC) is maintained.

There is no protozoa removal/inactivation process. This is not required for compliance with the DWSNZ as the water is considered secure groundwater.

Although not strictly necessary, the disinfection process further enhances the **full barrier to contamination** that is provided by the secure groundwater source

## 9.4 Prevent Recontamination After Treatment

### Disinfection

- A chlorine residual is maintained in the reticulation to provide protection in the case of bacterial contamination after treatment. The FAC levels in the water are tested by ADC staff weekly at the treatment plant post-treatment.
- The treated water from the pump station can be sampled from a tap in a sample bollard next to the pump shed.
- Council and the operator regularly test the chlorine levels in the reticulation system to ensure that FAC is maintained at an appropriate level.

### Reservoirs

- The reservoirs are covered with screw lid access hatches to prevent unauthorised access, ingress of rainwater or contaminants. The air vents have rodent protection.
- The tanks have high level inlets and low level outlets to promote circulation to ensure that water does not remain in the tank for long periods.
- Each of the tanks can be isolated independently, to allow for cleaning, inspection and repair without disrupting supply.

### Pumpstation

- There are two fixed speed pumps operating from a pressure sensor, and a pressure vessel to ensure that adequate pressure is maintained in the network.

### General

- New domestic connections are assessed against the backflow prevention policy and are fitted with a non-testable double check valve as a minimum.
- The shed housing the pump station is clean and locked. The area surrounding the shed, reservoir and bore is fenced on the side adjacent to Chertsey school.
- The plant is on mains electricity supply with a backup generator that is regularly tested and the results recorded. The generator is fenced and locked.

- The raw water is tested regularly to ensure that there is no contamination. There is a raw water sampling tap on the outside of the bore chamber.

These measures contribute to provision of a **partially effective barrier against contamination** of water following treatment:

This barrier could be enhanced by:

- Providing rodent protection on reservoir overflow outlets.
- Adding a second sampling point in the reticulation.

## 10 Photographs of supply elements



**Figure 5 - Wellhead**

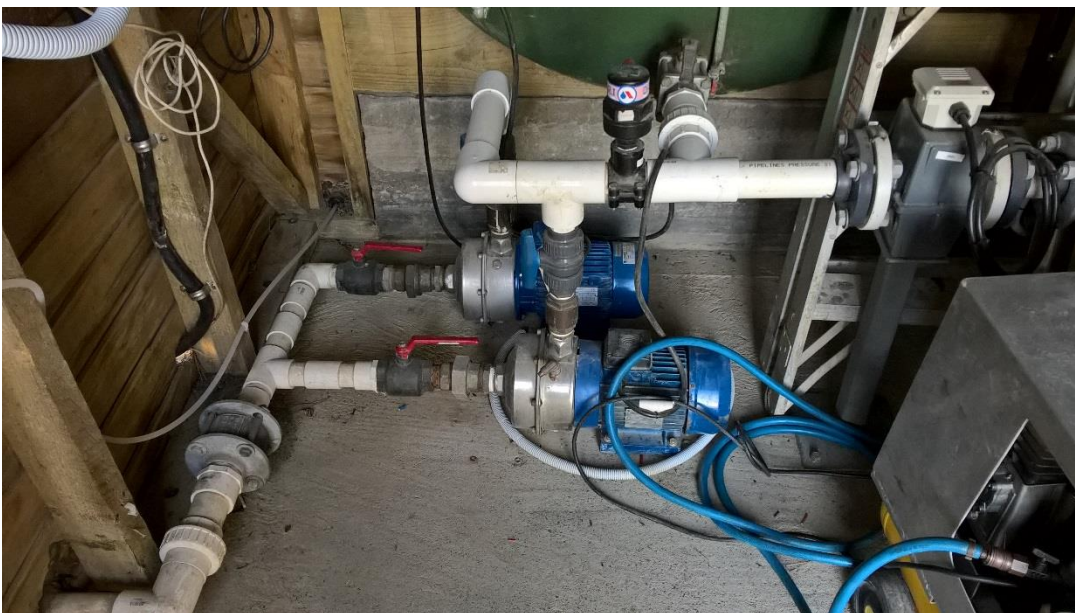


**Figure 6 - Outside of Bore Enclosure**





**Figure 7 - Two 30m<sup>3</sup> Supply Reservoirs**



**Figure 8 - Water Distribution Pumps**



**Figure 9 – Chertsey Pump Station Shed**



**Figure 10 – Chertsey Generator**



**Figure 11: Electrical and Control Equipment**



**Figure 12: Chlorine Dosing Facility**



**Figure 13: Chertsey Water Treatment Plant**

## 11 Risk Tables

### 11.1 Risk Assessment Worksheet – Bore and Source Abstraction

<i>List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)</i>			<i>Is this under control?</i>		<i>If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.</i>			<i>What improvements could be made?</i>
<b>Ref</b>	<b>Risk Event</b>	<b>Potential Cause of Risk Event</b>	<b>Measures in Place to Control Risk Event</b>	<b>Controlled Yes/ No/ Partial</b>	<b>Likelihood of Risk Event</b>	<b>Consequences of Risk Event</b>	<b>Risk Level</b>	<b>Additional Measures to Control Risk Event</b>
B1	Microbiological contamination of source water	Contaminated source water – humans, livestock, septic tanks, agricultural activities, surface runoff, etc	Secured wellhead to prevent contamination from surface run-off  Supply is from deep bore, confirmed to be secure source under Section 4.5.2 of NZDWS  Chlorine disinfection for residual protection in network	Yes				
B2	Chemical contamination of source water - general	Contaminated source water - agrichemicals, surface runoff, chemical spills	Wellhead constructed to DWSNZ standards. Wellhead is secured from casual access.  Annual basic water chemistry testing undertaken.  Supply is from deep bore, confirmed to be secure source under Section 4.5.2 of NZDWS	Yes				

<i>List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)</i>			<i>Is this under control?</i>		<i>If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.</i>			<i>What improvements could be made?</i>
<b>Ref</b>	<b>Risk Event</b>	<b>Potential Cause of Risk Event</b>	<b>Measures in Place to Control Risk Event</b>	<b>Controlled Yes/ No/ Partial</b>	<b>Likelihood of Risk Event</b>	<b>Consequences of Risk Event</b>	<b>Risk Level</b>	<b>Additional Measures to Control Risk Event</b>
B3	Contamination of source water - general	Contaminant entry via well head e.g. vandalism, flooding	The borehead is sealed at the surface and within a covered, locked enclosure.	Yes				
B4	Contamination of source water	Catastrophic failure, e.g. seismic activity disrupting the aquifer confinement or wellhead protection	<p>Inspection of facilities following a significant earthquake.</p> <p>Annual water chemistry profiles to determine that the water quality is relatively unchanged over time.</p> <p>Monthly monitoring of nitrate-nitrogen in abstracted water.</p>	Partial	Unusual	Medium	Medium	<p>Investigate resilience of plant to natural hazards.</p> <p>Develop site-specific Emergency Response Plan and implement if water supply cannot be maintained from this source.</p>

<i>List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)</i>		<i>Is this under control?</i>			<i>If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.</i>			<i>What improvements could be made?</i>
<b>Ref</b>	<b>Risk Event</b>	<b>Potential Cause of Risk Event</b>	<b>Measures in Place to Control Risk Event</b>	<b>Controlled Yes/ No/ Partial</b>	<b>Likelihood of Risk Event</b>	<b>Consequences of Risk Event</b>	<b>Risk Level</b>	<b>Additional Measures to Control Risk Event</b>
B5	Insufficient water available	Drought conditions will lead to lower groundwater levels  Power supply interruption  Bore pump failure	Monitoring resource consent applications nearby for possible impacts on the bore. New bores must be approved by ECan, therefore effects on ground water are assessed before new supplies are approved.  On-site generator provides a source of backup power should power failure occur.  There are two reservoirs that have a combined storage of over half an average days water demand.  The bore pump failure alarm is on telemetry so any failure will be immediately investigated.	Partial	Unlikely	Medium	High	Review need for increased demand management.  Carry out leak detection.  Regularly check bore pump records for any anomalies that may indicate a potential pump fault.  Install water level probe in bore, monitor water level via SCADA and install low level alarm.  Confirm pump depth inside bore.  Develop a schedule and carry out and to end testing of critical alarms and signals.

B6	Contamination of source water	Unexpected failure of barriers leading to loss of “secure” groundwater status, e.g. damage to or contamination of confined aquifer, sub-standard borehead maintenance	<p>Annual water chemistry profiles to determine that the water quality is relatively unchanged over time.</p> <p>Chlorine disinfection for residual protection in network</p> <p>Wellhead constructed to DWSNZ standards. Wellhead is secured from casual access.</p> <p>Quarterly E.coli testing of raw water.</p> <p>Monthly testing of FAC residual in network (low/no FAC could indicate potential contamination).</p> <p>Systems are in place to ensure that any transgressions are thoroughly investigated.</p>	Partial	Unusual	Medium	Medium	<p>Ensure age dating of water, wellhead inspections and updates to the water safety plan are carried out at intervals no greater than 5 years.</p> <p>Ensuring water quality data, and in particular any transgressions and recent water age dating results are provided to the person conducting wellhead inspections prior to the inspection.</p> <p>Develop protocols for recording all maintenance works on wellheads and re-inspection of wellheads for security following any maintenance work.</p> <p>Review the Havelock North Drinking Water Inquiry: Stage 1 report and any subsequent reports. Consider whether there are lessons learnt that could be applied to the Chertsey supply.</p> <p>Work with ECan to develop educational material to provide landowners within the</p>
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<i>List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)</i>			<i>Is this under control?</i>		<i>If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.</i>			<i>What improvements could be made?</i>
<b>Ref</b>	<b>Risk Event</b>	<b>Potential Cause of Risk Event</b>	<b>Measures in Place to Control Risk Event</b>	<b>Controlled Yes/ No/ Partial</b>	<b>Likelihood of Risk Event</b>	<b>Consequences of Risk Event</b>	<b>Risk Level</b>	<b>Additional Measures to Control Risk Event</b>
								groundwater protection zone.

## 11.2 Risk Assessment Worksheet – Treatment

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			Is this under control?		If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.			What improvements could be made?
Ref	Risk Event	Potential Cause of Risk Event	Measures in Place to Control Risk Event	Controlled Yes/ No/ Partial	Likelihood of Risk Event	Consequences of Risk Event	Risk Level	Additional Measures to Control Risk Event
T1	Inadequate primary disinfection	Treatment system inadequate  Uncertainty around plant monitoring arrangements	The supply bore is confirmed to be a secure source under Section 4.5 of NZDWS, therefore protozoa treatment is not required.  Plant monitoring arrangements in place	Yes				

<i>List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)</i>		<i>Is this under control?</i>			<i>If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.</i>			<i>What improvements could be made?</i>
<b>Ref</b>	<b>Risk Event</b>	<b>Potential Cause of Risk Event</b>	<b>Measures in Place to Control Risk Event</b>	<b>Controlled Yes/ No/ Partial</b>	<b>Likelihood of Risk Event</b>	<b>Consequences of Risk Event</b>	<b>Risk Level</b>	<b>Additional Measures to Control Risk Event</b>
T2	Inadequate secondary disinfection (not enough free available chlorine)	Dosing pump malfunction, control system malfunction, SCADA malfunction or inaccuracy	<p>The supply bore is confirmed to be a secure source under Section 4.5 of NZDWS, therefore disinfection is not required as a primary means of treatment.</p> <p>The chlorination process is aimed at disinfection in the reticulation network.</p> <p>Routine plant checks and inspections.</p> <p>Standby power generation.</p> <p>Power failure SCADA alarm.</p> <p>Regular manual E. coli, FAC, and pH monitoring.</p> <p>A sample tap is available for testing on the pump station output.</p>	Yes				

<i>List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)</i>			<i>Is this under control?</i>		<i>If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.</i>			<i>What improvements could be made?</i>
<b>Ref</b>	<b>Risk Event</b>	<b>Potential Cause of Risk Event</b>	<b>Measures in Place to Control Risk Event</b>	<b>Controlled Yes/ No/ Partial</b>	<b>Likelihood of Risk Event</b>	<b>Consequences of Risk Event</b>	<b>Risk Level</b>	<b>Additional Measures to Control Risk Event</b>
T3	Inadequate secondary disinfection (not enough free available chlorine)	Incorrect dose rate or solution strength too high/low.  Chlorine solution runs out	As per T1, item 1.  Routine checks and inspections.  Sodium hypochlorite solution supplied by regular and reputable supplier.  Chlorine solution is diluted to reduce rate of decay while in storage.  Regular manual E. coli, FAC, pH and turbidity monitoring.	Partial	Quite Common	Medium	High	Install chlorine analyser  Install high/low chlorine residual alarms.  Install chlorine tank level probe and low chlorine tank alarm.  Provide clear instructions for diluting sodium hypochlorite on site.  Develop a schedule and carry out and to end testing of critical alarms and signals.

<i>List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)</i>		<i>Is this under control?</i>			<i>If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.</i>			<i>What improvements could be made?</i>
<b>Ref</b>	<b>Risk Event</b>	<b>Potential Cause of Risk Event</b>	<b>Measures in Place to Control Risk Event</b>	<b>Controlled Yes/ No/ Partial</b>	<b>Likelihood of Risk Event</b>	<b>Consequences of Risk Event</b>	<b>Risk Level</b>	<b>Additional Measures to Control Risk Event</b>
T4	Inadequate secondary disinfection (not enough free available chlorine)	High chlorine demand as a result of high turbidity	As per T1, item 1. E. coli monitoring. Manual FAC monitoring. The water quality of the deep secure groundwater source is very stable and the dose rated does not need to be adjusted in order to maintain a steady FAC in the distribution zone.	Yes				
T5	Inadequate secondary disinfection	Short-circuiting through reservoir reducing contact time.	As per T1, item 1. Reservoirs essentially joined in a series to increase contact time.  High level inlets and low level outlets to encourage mixing.  Regular manual E. coli, FAC, pH and turbidity monitoring.	Yes				

<i>List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)</i>			<i>Is this under control?</i>		<i>If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.</i>			<i>What improvements could be made?</i>
<b>Ref</b>	<b>Risk Event</b>	<b>Potential Cause of Risk Event</b>	<b>Measures in Place to Control Risk Event</b>	<b>Controlled Yes/ No/ Partial</b>	<b>Likelihood of Risk Event</b>	<b>Consequences of Risk Event</b>	<b>Risk Level</b>	<b>Additional Measures to Control Risk Event</b>
T6	Over-chlorination (too much free available chlorine)	Dosing pump, control system or SCADA malfunction or inaccuracy.	Routine plant checks and inspections.  Regular manual E. coli, FAC, pH and turbidity monitoring.  The dosing pump only turns on when the bore pump is on.  Chlorine pump fault alarm.	Partial	Unlikely	Negligible	Low	Install chlorine analyser and residual high/low alarms.  Develop a schedule and carry out and to end testing of critical alarms and signals.
T7	Over-chlorination (too much free available chlorine)	Incorrect dose rate or solution strength too high	Sodium hypochlorite solution delivered by regular and reputable supplier.  Regular manual E. coli, FAC, pH and turbidity monitoring.  Experienced and trained operators.  Calibration device for the dosing pump installed.	Partial	Quite Common	Negligible	Low	Install analyser and chlorine residual high/low alarms.  Provide clear instructions for refilling and diluting the chlorine solution on site.

<i>List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)</i>			<i>Is this under control?</i>		<i>If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.</i>			<i>What improvements could be made?</i>
<b>Ref</b>	<b>Risk Event</b>	<b>Potential Cause of Risk Event</b>	<b>Measures in Place to Control Risk Event</b>	<b>Controlled Yes/ No/ Partial</b>	<b>Likelihood of Risk Event</b>	<b>Consequences of Risk Event</b>	<b>Risk Level</b>	<b>Additional Measures to Control Risk Event</b>
T8	Failure to remove other chemical contaminants from raw water	Treatment system inadequate.	Monthly nitrate sampling from the one zone sample point.  Water chemistry profile carried out annually.	No	Unusual	Medium	Medium	Cannot implement treatment based control measures to deal with all potential contaminants – control at source.  Consider adding a second sampling point in the reticulation.
T9	Insufficient water available	Inadequate treatment plant capacity	Capacity adequate for existing peak day with reservoir storage to meet peak instantaneous flow rate. The chlorination capacity is greater than the bore pump capacity.	Yes				
T10	Insufficient water available	Damage to plant by natural hazard	Storage on-site in the event of damage to treatment plant.  Contingency plans in place for alternative supply (e.g. tankers) if necessary.	Partial	Rare	Medium	Medium	Investigate resilience of plant to natural hazards.  Develop site-specific Emergency Response Plan and implement if water supply cannot be maintained.

### 11.3 Risk Assessment Worksheet – Storage and Distribution

<i>List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)</i>			<i>Is this under control?</i>		<i>If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.</i>			<i>What improvements could be made?</i>
<b>Ref</b>	<b>Risk Event</b>	<b>Potential Cause of Risk Event</b>	<b>Measures in Place to Control Risk Event</b>	<b>Controlled Yes/ No/ Partial</b>	<b>Likelihood of Risk Event</b>	<b>Consequences of Risk Event</b>	<b>Risk Level</b>	<b>Additional Measures to Control Risk</b>
S1	Introduction of contaminants into the distribution system	Deliberate or accidental contamination via storage tanks  Air vents have rodent protection	Storage tanks covered  Chlorine residual is maintained in the reservoirs.	Partial	Unusual	Medium	Medium	Consider replacing the existing reservoir hatches with lockable hatches.  Improve rodent protection for reservoir overflow pipes.  Investigate fencing around the site.
S2	Introduction of contaminants into the distribution system	Backflow	All new connections have some level of backflow preventer of the type indicated by the backflow prevention policy. As a minimum, all new connections must have a non-testable double check valve.  A chlorine residual is maintained in the distribution zone.  Two pressure booster pumps installed to provide redundancy.	Partial	Unlikely	Medium	High	Ensure existing connections are replaced in accordance with backflow policy when maintenance/ renewal works permit.



<i>List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)</i>		<i>Is this under control?</i>			<i>If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.</i>			<i>What improvements could be made?</i>
<b>Ref</b>	<b>Risk Event</b>	<b>Potential Cause of Risk Event</b>	<b>Measures in Place to Control Risk Event</b>	<b>Controlled Yes/ No/ Partial</b>	<b>Likelihood of Risk Event</b>	<b>Consequences of Risk Event</b>	<b>Risk Level</b>	<b>Additional Measures to Control Risk</b>
S3	Introduction of contaminants into the distribution system	Operation and maintenance activities	<p>Contractor has documented practices and procedures for working on water supplies.</p> <p>Contractor is experienced in working with water supplies.</p> <p>Chlorine residual is maintained in the distribution zone.</p>	Yes				
S4	Introduction of contaminants into the distribution system	Pipe materials, age and condition, plumbosolvency	<p>Lifecycle management plan for pipe maintenance and renewals.</p> <p>Consumers are notified of plumbosolvency twice per year as required by DWSNZ.</p>	Partial	Likely	Medium	Very High	Review and maintain Activity Management Plans and associated asset renewal programmes to minimise failures.
S5	Introduction of contaminants into the distribution system	Damage to distribution system by natural hazards	<p>Pressure maintained will help prevent ingress of foreign material.</p> <p>PE pipe is more resilient against seismic activity.</p> <p>Damaged sections of reticulation can be isolated.</p>	Partial	Rare	Medium	Medium	Develop site-specific Emergency Response Plan.

<i>List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)</i>		<i>Is this under control?</i>			<i>If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.</i>			<i>What improvements could be made?</i>
<b>Ref</b>	<b>Risk Event</b>	<b>Potential Cause of Risk Event</b>	<b>Measures in Place to Control Risk Event</b>	<b>Controlled Yes/ No/ Partial</b>	<b>Likelihood of Risk Event</b>	<b>Consequences of Risk Event</b>	<b>Risk Level</b>	<b>Additional Measures to Control Risk</b>
S6	Insufficient water available	Pump or power failure	<p>There are two pressure booster pumps, providing redundancy.</p> <p>Alarms for pump faults are monitored on the telemetry system.</p> <p>The reservoirs provide half a day of storage under average conditions.</p> <p>Backup generator for the event of power failure. Power failure and generator run alarms.</p>	Yes				
S7	Insufficient water available	Lack of storage	<p>There are two reservoirs, each of which can be isolated. Reservoir level is monitored (SCADA alarm). Reservoirs are inspected regularly.</p> <p>The reservoirs provide half a day of storage under average conditions.</p>	Yes				

S8	Insufficient water available	Damage to storage or distribution systems, e.g. water main failure, earthquake damage	<p>Lifecycle management plan for pipe maintenance and renewals.</p> <p>Damaged sections of the reticulation can be isolated.</p> <p>Ability to tanker water in to meet demand.</p> <p>ADC approval is required for third parties to work in the road corridor.</p> <p>Staff trained and skilled to repair water mains as required.</p> <p>Reservoir level monitoring and SCADA alarms.</p> <p>Shutdowns are managed to avoid pressure surges e.g. water hammer and undue damage to the existing mains.</p>	Partial	Unusual	Medium	Medium	<p>Implement and use Asset Management System (AMS) for programming and monitoring regular maintenance and inspection/monitoring tasks.</p> <p>Undertake a criticality analysis of the network to assist renewals planning.</p> <p>Investigate resilience of plant to natural hazards.</p> <p>Develop site-specific Emergency Response Plan and implement if water supply/quality cannot be maintained.</p> <p>Develop a schedule and carry out and to end testing of critical alarms and signals.</p>
S9	Insufficient water	Vandalism or unauthorised access to storage tanks	<p>Reservoir level is monitored (SCADA alarm).</p> <p>Reservoir site is not situated in a location prone to vandalism.</p>	Partial	Unusual	Negligible	Low	<p>Investigate fencing around the site.</p> <p>Develop a schedule and carry out and to end</p>

<i>List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)</i>			<i>Is this under control?</i>		<i>If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.</i>			<i>What improvements could be made?</i>
<b>Ref</b>	<b>Risk Event</b>	<b>Potential Cause of Risk Event</b>	<b>Measures in Place to Control Risk Event</b>	<b>Controlled Yes/ No/ Partial</b>	<b>Likelihood of Risk Event</b>	<b>Consequences of Risk Event</b>	<b>Risk Level</b>	<b>Additional Measures to Control Risk</b>
								testing of critical alarms and signals.

#### 11.4 Risk Assessment Worksheet – Other

<i>List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)</i>			<i>Is this under control?</i>		<i>If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.</i>			<i>What improvements could be made?</i>
<b>Ref</b>	<b>Risk Event</b>	<b>Potential Cause of Risk Event</b>	<b>Additional Measures to Control Risk</b>	<b>Controlled Yes/ No/ Partial</b>	<b>Likelihood of Risk Event</b>	<b>Consequences of Risk Event</b>	<b>Risk Level</b>	<b>Additional Measures to Control Risk</b>
O1	Incorrect water quality data used for supply management (failure to identify inadequate water quality)	Inappropriate/ inadequate/ incorrect sampling and reporting	<p>Council have a sampling programme for sampling compliance.</p> <p>Staff are trained to take samples and alternate personnel are available to cover for absences.</p> <p>Results are reported through the WINZ system to the Drinking Water Assessor.</p> <p>Sampling locations are clearly labelled.</p> <p>Annual IANZ audit for Council laboratory's MoH recognition.</p>	Yes				

O2	System does not perform as intended	Incorrect operation, inadequate maintenance.	<p>Operators have sound knowledge of systems.</p> <p>There is an Operation and Maintenance manual.</p> <p>Key operation instructions are displayed permanently on site.</p> <p>An operations log is kept on site</p> <p>Plant records are copied and filed.</p>	Partial	Unusual	Negligible	Low	<p>Review and maintain activity management plans and associated asset renewal programmes to plan for regular maintenance and inspection/monitoring tasks.</p> <p>Ensure all plant records – including manuals, drawings, procedure instructions and emergency response plan are up to date and available at the plant.</p> <p>Council to place a requirement in the service provider to ensure Operation and Maintenance Procedure Manual is up to date and available at the plant.</p> <p>Implement and use Asset management System (AMS) for programming and monitoring regular maintenance and inspection/monitoring tasks.</p>
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<i>List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)</i>			<i>Is this under control?</i>		<i>If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.</i>			<i>What improvements could be made?</i>
<b>Ref</b>	<b>Risk Event</b>	<b>Potential Cause of Risk Event</b>	<b>Additional Measures to Control Risk</b>	<b>Controlled Yes/ No/ Partial</b>	<b>Likelihood of Risk Event</b>	<b>Consequences of Risk Event</b>	<b>Risk Level</b>	<b>Additional Measures to Control Risk</b>
O3	System does not perform as intended	Inadequate skills or training.	Staff are skilled and experienced.	Partial	Unusual	Negligible	Low	<p>Council to place a requirement on the service provider to provide staff with relevant training and skills and to provide evidence to Council.</p> <p>Identify and record any staff training needs.</p> <p>Develop a skills framework for operations and management staff, and carry out a skills gap analysis.</p>

<i>List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)</i>			<i>Is this under control?</i>		<i>If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.</i>			<i>What improvements could be made?</i>
<b>Ref</b>	<b>Risk Event</b>	<b>Potential Cause of Risk Event</b>	<b>Additional Measures to Control Risk</b>	<b>Controlled Yes/ No/ Partial</b>	<b>Likelihood of Risk Event</b>	<b>Consequences of Risk Event</b>	<b>Risk Level</b>	<b>Additional Measures to Control Risk</b>
O4	System damaged or contaminated by construction/ maintenance work	Inadequate controls on construction and maintenance work	All maintenance is undertaken by contractor's trained/authorised staff.  Construction work is appropriately supervised.  Carriageway Access Request (CAR) and Before You Dig used to permit maintenance and construction works.	Partial	Unusual	Medium	Medium	Maintain accurate as-constructed records and make readily available to all parties working on or in vicinity of system.  Inspect third party work to ensure water services are adequately protected.
O5	Inability to access site for operation/ maintenance/ emergency works	Flood, slip, bridge washout, snow fall or other hazard preventing vehicular access	Access roads are in good condition and are not generally vulnerable to natural hazards.  Operations staff are equipped with suitable 4WD vehicles and given training in these use of these.	Yes				



<i>List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)</i>			<i>Is this under control?</i>		<i>If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.</i>			<i>What improvements could be made?</i>
<b>Ref</b>	<b>Risk Event</b>	<b>Potential Cause of Risk Event</b>	<b>Additional Measures to Control Risk</b>	<b>Controlled Yes/ No/ Partial</b>	<b>Likelihood of Risk Event</b>	<b>Consequences of Risk Event</b>	<b>Risk Level</b>	<b>Additional Measures to Control Risk</b>
O6	Loss of monitoring and alarm systems	Failure of SCADA system	<p>Pumping and treatment control systems are independent of SCADA system so there will be no interruption to supply or treatment.</p> <p>SCADA operates from battery backup in event of power failure.</p> <p>Failure of remote SCADA equipment triggers alarm at the SCADA base station, sent to ACL, prompting site attendance to investigate.</p> <p>All work on SCADA systems is undertaken by specialist telemetry contractor.</p>	Yes				

## 12 Improvement Schedule

The Improvement Schedule is presented in two sections:

### **Part I: Major Projects and Capital Works**

These projects will generally provide the greatest benefits in terms of addressing public health risks but typically require high levels of funding that may not be realistic for the community involved. It is noted that Council operate a targeted rating system such that costs associated with each water supply are borne by those ratepayers with connections to the supply. In many instances, major projects (e.g. new water source, additional treatment process) will require specific investigation and evaluation of options prior to confirmation of a suitable improvement solution. The Improvement Schedule may present a timetable for progressing such investigations, with the intention of incorporating specific upgrade projects in future versions of the WSP.

### **Part II: Management and Operational Improvements**

These improvements will generally not provide the same degree of risk reduction as the proposed capital works upgrades but collectively they contribute to providing and maintaining effective barriers to contamination and can often be undertaken within existing operational budgets. These works are prioritised on the basis of the risk level identified and budget/resource availability.

### **Prioritisation**

The priority for implementation is initially based on the identified risk level as follows:

Very High risk	=	Priority 1
High risk	=	Priority 2
Medium risk	=	Priority 3
Low risk	=	Priority 4
Very Low risk	=	Priority 5

Priorities have then been modified (generally elevated) where improvement items are related or need to be sequenced together.

### **Responsibility**

The responsibility for implementation of specific improvement items is identified.

AM	=	Assets Manager
ACL	=	Ashburton Contracting Limited

## **Timeframes**

The proposed timeframe for implementation reflects the assessed priority, anticipated funding arrangements and availability of resources. Some lower priority, low cost improvements may be completed at an earlier date where staff resources are available.

## **Compliance Timeframe**

The Chertsey water supply falls in the category of a Small drinking water supply under the Health Act. This requires that all practicable steps are taken to comply with the Drinking Water Standards by 1 July 2015.

As Chertsey has been granted secure groundwater status under Section 4.5 of DWSNZ, the Chertsey water supply is compliant with the DWSNZ.

## 12.1 Part I: Major Projects and Capital Works

Chertsey Water Supply Improvement Schedule					Part I: Major Projects and Capital Works				
Priority	Risk Level	Water Area	Supply	Reference to Risk Tables	Details of Proposed Works	Person Responsible	Expected Cost	Intended date of Completion	
Given the recent upgrade no major projects or capital works are anticipated at this stage.									

## 12.2 Part II: Minor Projects and Operational Improvements

Chertsey Water Supply Improvement Schedule Improvements				Part II: Minor Projects and Operational Improvements			
Priority	Risk Level	Water Supply Area	Reference to Risk Tables	Details of Proposed Works	Person Responsible	Expected Cost	Intended date of Completion
1	Very High	Distribution, other	S4, O2	Review and maintain Activity Management Plans and associated asset renewal programmes to minimise failures.	AM	Staff time	Ongoing
3	Medium	Distribution	S8	Undertake a criticality analysis of the network to assist renewals planning.	AM	Staff time	30/12/2017
2	High	Source, treatment, distribution	B5, T3, T6, S8, S9	Develop a schedule and carry out and to end testing of critical alarms and signals.	AM	\$1,000 + Staff time	31/12/2017
2	High	Treatment	T3,T7	Provide clear instructions for diluting sodium hypochlorite on site.	AM	Staff time	31/12/2017
4	Low	Other	O3	Council to place a requirement on the service provider to provide staff with relevant training and skills and to provide evidence to Council.	AM	Staff time	31/12/2017
4	Low	Other	O3	Identify and record any staff training needs.	AM	Staff time	31/12/2017 + ongoing
4	Low	Other	O3	Develop a skills framework for operations and management staff, and carry out a skills gap analysis.	AM	Staff time	31/12/2017

Chertsey Water Supply Improvement Schedule Improvements				Part II: Minor Projects and Operational			
Priority	Risk Level	Water Supply Area	Reference to Risk Tables	Details of Proposed Works	Person Responsible	Expected Cost	Intended date of Completion
2	High	Distribution	S2	Ensure existing connections are replaced in accordance with backflow policy when maintenance/ renewal works permit.	AM	Staff time	01/07/2018+ Ongoing
2	High	Treatment	T3	Install chlorine analyser.	AM	\$10,000 + Staff time	30/06/2018
2	High	Treatment	T3	Install chlorine tank level probe and low level alarm	AM	\$2,000 + Staff time	30/06/2018
2	High	Treatment	T3,T6, T7	Install low/high chlorine residual alarms.	AM	\$2,000 + Staff time	30/06/2018
2	High	Source	B5	Review need for increased demand management.	AM	Staff time	30/06/2018
2	High	Source	B5	Carry out leak detection.	AM	\$10,000 + Staff time	30/06/2018
2	High	Source	B5	Regularly check bore pump records for any anomalies that may indicate a potential pump fault.	AM	Staff time	30/06/2018+ Ongoing
2	High	Source	B5	Install water level probe in bore, monitor water level via SCADA and install low level alarm.	AM	\$6,000 + Staff time	30/06/2018
2	High	Source	B5	Confirm pump depth inside bore.	AM	\$2,000 + Staff time	30/06/2018

Chertsey Water Supply Improvement Schedule Improvements				Part II: Minor Projects and Operational			
Priority	Risk Level	Water Supply Area	Reference to Risk Tables	Details of Proposed Works	Person Responsible	Expected Cost	Intended date of Completion
3	Medium	Distribution	S1	Improve rodent protection for reservoir overflow pipes.	AM	\$3,000 + Staff time	30/06/2019
3	Medium	Source, treatment, distribution	B4, T10, S8	Investigate resilience of plant to natural hazards.	AM	Staff time	30/06/2019
3	Medium	Source, treatment, distribution	B4, T10, S5, S8	Develop and adopt a site-specific Emergency Response Plan.	AM	\$5,000 + Staff time	30/06/2019
3	Medium	Source	B6	Ensure age dating of water, wellhead inspections and updates to the water safety plan are carried out at intervals no greater than 5 years.	AM	\$8,000 + Staff time	30/06/2019
3	Medium	Source	B6	Ensuring water quality data, and in particular any transgressions and recent water age dating results are provided to the person conducting wellhead inspections prior to the inspection.	AM	Staff time	30/06/2019
3	Medium	Source	B6	Develop protocols for recording all maintenance works on wellheads and re-inspection of wellheads for security following any maintenance work.	AM	Staff time	30/06/2019
3	Medium	Source	B6	Review the Havelock North Drinking Water Inquiry: Stage 1 report and any subsequent reports. Consider whether there are lessons learnt that could be applied to the Chertsey supply.	AM	\$5,000 + Staff time	30/06/2019

Chertsey Water Supply Improvement Schedule Improvements				Part II: Minor Projects and Operational			
Priority	Risk Level	Water Supply Area	Reference to Risk Tables	Details of Proposed Works	Person Responsible	Expected Cost	Intended date of Completion
3	Medium	Source	B6	Work with ECan to develop educational material to provide landowners within the groundwater protection zone.	AM	Staff time	30/06/2019
3	Medium	Distribution	S8, O2	Implement and use Asset Management System (AMS) for programming and monitoring regular maintenance and inspection/monitoring tasks.	AM	Staff time	30/06/2019+ Ongoing
3	Medium	Distribution	S1	Consider replacing the existing reservoir hatches with lockable hatches.	AM	\$5,000 + Staff time	30/06/2019
3	Medium	Distribution	S1, S9	Investigate fencing around the site.	AM	Staff time	30/06/2019
3	Medium	Other	O4	Maintain accurate as-constructed records and make readily available to all parties working on or in vicinity of system.	AM	Staff time	30/06/2019
3	Medium	Other	O4	Inspect third party work to ensure water services are adequately protected.	AM	Staff time	30/06/2019 + ongoing
3	Medium	Treatment	T8	Consider adding a second sampling point in the reticulation.	AM	\$5,000 + Staff time	30/06/2019



Chertsey Water Supply Improvement Schedule Improvements				Part II: Minor Projects and Operational			
Priority	Risk Level	Water Supply Area	Reference to Risk Tables	Details of Proposed Works	Person Responsible	Expected Cost	Intended date of Completion
4	Low	Other	O2	Ensure all plant records – including manuals, drawings, procedure instructions and emergency response plan are up to date and available at the plant.	ACL	Staff time	30/06/2020 + Ongoing
4	Low	Other	O2	Council to place a requirement in the service provider to ensure Operation and Maintenance Procedure Manual is up to date and available at the plant.	AM	Staff time	30/06/2020 + Ongoing

## 13 Contingency Plan

The following contingency plan outlines appropriate responses to a range of potential situations where risk control measures fail to prevent a hazard event that may result in a situation of acute risk to public health.

The occurrence of a hazard, or risk event, may be indicated by monitoring systems, observed by ADC or ACL staff or reported by the public. Consumer complaints of illness or water quality issues may also indicate that a risk event has occurred.

The contingency actions identified are intended to provide a general guide and may need to be adapted to suit specific hazard situations.

### 13.1 Severe Microbiological Contamination of Source Water

<b>Indicators</b>	A contamination event in the catchment may be observed by or reported to ADC staff Reported illness among consumers Positive E. coli monitoring results
<b>Actions</b>	Issue "Boil Water" notice Advise Drinking Water Assessor (DWA) Inspect catchment and intake to identify source of contamination and rectify problem as quickly as possible Consider provision of emergency treatment or alternative water supply Disinfect contaminated reservoirs and flush mains Keep customers informed and advise once regular service is restored
<b>Responsibility</b>	Assets Manager

### 13.2 Chemical Contamination of Source Water

<b>Indicators</b>	A contamination event in the catchment may be observed by or reported to ADC staff Reported water quality concerns from consumers (taste, odour, colour) Illness among consumers Unexpected chemical presence in annual chemical testing
<b>Actions</b>	Advise Drinking Water Assessor (DWA) Assess situation and advise customers regarding use/treatment/disposal of contaminated water Arrange emergency water supply 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
<b>Responsibility</b>	Assets Manager

### 13.3 Insufficient Source Water Available

<b>Indicators</b>	Observed or reported low ground water levels (reduction in water available / loss of supply / bore pump fault)
<b>Actions</b>	Advise customers to conserve water Implement demand management strategies as required Arrange emergency water supply if necessary Keep customers informed and advise once regular service is restored
<b>Responsibility</b>	Assets Manager

### 13.4 Insufficient Water Available due to Leakage

<b>Indicators</b>	Observed or reported reduction in pressure or water availability
<b>Actions</b>	Advise customers to conserve water Implement demand management strategies as required Arrange emergency water supply if necessary Investigate system leakages Keep customers informed and advise once regular service is restored
<b>Responsibility</b>	Assets Manager

### 13.5 E. coli Transgression in Water Leaving Treatment Plant

<b>Indicators</b>	E. coli transgression reported following routine monitoring
<b>Actions</b>	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 Take remedial action Continue to sample for E. coli until three 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
<b>Responsibility</b>	Assets Manager

### 13.6 Over-Chlorination

<b>Indicators</b>	Monitoring shows high FAC Complaints of strong chlorine taste/ smell from customers
<b>Actions</b>	Assess potential hazard to consumers and advise accordingly Inspect treatment plant to identify cause of problem and rectify as quickly as possible Flush system if necessary Keep customers informed and advise once regular service is restored
<b>Responsibility</b>	Assets Manager

### 13.7 Inadequate Disinfection

<b>Indicators</b>	Monitoring shows low or no FAC
<b>Actions</b>	Inspect treatment plant to identify cause of low or no FAC, or potential contamination and rectify problem as quickly as possible Assess the situation and consider issuing a precautionary boil water notice if deemed appropriate Notify DWA of situation and actions taken Consider provision of emergency treatment equipment or alternative water supply (e.g. tankers) Disinfect reservoirs and flush mains Keep customers informed and advise once regular service is restored
<b>Responsibility</b>	Assets Manager

### 13.8 E. coli Transgression in Water in the Distribution Zone

<b>Indicators</b>	E. coli transgression reported following routine monitoring
<b>Actions</b>	Follow transgression response procedure in DWSNZ (Figure 4.2 in 2008 version), and ADC response procedures Advise Drinking Water Assessor (DWA) Inspect plant/source Collect sample at plant for E. coli test, enumerate E. coli Resample distribution at original and adjacent sites Investigate cause and undertake remedial action If E. coli < 10 per 100mL consult DWA, resample distribution zone and enumerate for E. coli for three days, continue investigation of fault If E. coli > 10 per 100mL consult DWA, consider 'Boil Water' notice, continue investigation of cause, begin disinfection, consider flushing contaminated water to waste, intensify action, consider providing alternative supply Continue until fault is corrected and E. coli is absent for three consecutive days and DWA is satisfied that there is no remaining contamination
<b>Responsibility</b>	Assets Manager

### 13.9 Chemical Contamination of Water in Distribution Zone

<b>Indicators:</b>	Chemical contaminant in distribution zone (including over-chlorination)
<b>Actions:</b>	<p>Advise Drinking Water Assessor (DWA)</p> <p>Assess situation and advise customers regarding use/treatment/disposal of contaminated water</p> <p>Arrange emergency water supply (tankers) if necessary</p> <p>Inspect catchment and intake to identify source of contamination and rectify problem as quickly as possible</p> <p>Flush contaminated reservoirs and mains If necessary</p> <p>Keep customers informed and advise once regular service is restored</p>
<b>Responsibility:</b>	Assets Manager

### 13.10 Insufficient Water Available in the Distribution Zone

<b>Indicators</b>	Low pressure and flow in the distribution
<b>Actions</b>	<p>Advise customers to conserve water</p> <p>Implement demand management strategies as required</p> <p>Arrange emergency water supply if necessary</p> <p>Keep customers informed and advise once regular service is restored</p>
<b>Responsibility</b>	Assets Manager

### 13.11 Insufficient Water Available due to Unplanned Shutdown

<b>Indicators</b>	Unplanned shutdown will be reported to ADC staff by contractor
<b>Actions</b>	<p>Keep customers informed and advise once regular service is restored</p> <p>Arrange emergency water supply if necessary</p>
<b>Responsibility</b>	ACL and Assets Manager

## 14 Critical Control Points

### 14.1 Chlorine Disinfection - Plant

#### Process objectives:

- Provide a **residual disinfection Quality Control Point** to help inactivate pathogens entering downstream of the dosing point

<b>Operational monitoring of control process:</b>	
What	Free available chlorine (FAC) concentration in mg/L
When	ADC weekly ACL twice weekly
Where	Sampling point at the treatment plant, sampling water leaving the reservoirs
How	Hand-held pocket Colorimeter with vendor-supplied reagents
Who	ADC Environmental Monitoring Officer and ACL Operator
Records	ACL: Log-book ADC: Water Outlook

<b>Process performance criteria at the operational monitoring point:</b>		<b>Correction if operating criteria are not met:</b>
<b>Target Range:</b>	FAC: 0.6-0.8 mg/L	Operator to adjust dosing system to achieve target range if noticed to be outside of target range during routine checking procedures.
<b>Action Limits:</b>	FAC: < 0.3 mg/L > 0.8 mg/L	Duty Operator to respond by adjusting dosing to within target limits Duty Operator to notify Duty Supervisor.
<b>Critical Limits:</b>	FAC: < 0.25 mg/L > 1.0 mg/L	Duty Operator to respond by adjusting dosing to within target limits Duty Operator to notify Duty Supervisor. Duty Supervisor to contact ADC Compliance Officer. Contingency plan 13.6 (over-chlorination) or contingency plan 13.7 (inadequate disinfection) is to be followed.

#### Supporting programs:

- Monthly monitoring (or manufacturer timescales) instrument checking and calibration by Operator as necessary.
- Monthly Operator check of accuracy of reagents and discarding of outdated reagents.
- Training and competency of Operator in chlorination of drinking water.
- Only utilise potable water grade chlorine stock solution from approved supplier.

## 14.2 Chlorine Disinfection

### Process objectives: - Reticulation

- Provide a **residual disinfection Quality Control Point** to help inactivate pathogens entering downstream of the dosing point

<b>Operational monitoring of control process:</b>	
What	Free available chlorine (FAC) concentration in mg/L
When	ADC monthly ACL twice weekly
Where	ADC staff: Chertsey has one zone sample tap, located on Chertsey Line Road.  ACL operators: Sampling bollards as above
How	Hand-held pocket colorimeter with vendor-supplied reagents
Who	ADC Environmental Monitoring Officer and ACL Operator
Records	ACL: Log-book ADC: Water Outlook

<b>Process performance criteria at the operational monitoring point:</b>		<b>Correction if operating criteria are not met:</b>
<b>Target Range:</b>	FAC: 0.6-0.8 mg/L	Operator to adjust dosing system to achieve target range if noticed to be outside of target range during routine checking procedures.
<b>Action Limits:</b>	FAC: < 0.3 mg/L > 0.8 mg/L	Duty Operator to respond by adjusting dosing to within target limits Duty Operator to notify Duty Supervisor.
<b>Critical Limits:</b>	FAC: < 0.25 mg/L > 1.0 mg/L	Duty Operator to respond by adjusting dosing to within target limits Duty Operator to notify Duty Supervisor. Duty Supervisor to contact ADC Compliance Officer. Contingency plan 13.6 (over-chlorination) or contingency plan 13.7 (inadequate disinfection) is to be followed.

#### Supporting programs:

- Monthly monitoring (or manufacturer timescales) instrument checking and calibration by Operator as necessary.
- Monthly Operator check of accuracy of reagents and discarding of outdated reagents.
- Training and competency of Operator in chlorination of drinking water.
- Only utilise potable water grade chlorine stock solution from approved supplier.