Ashburton DISTRICT COUNCIL

Hinds Water Supply

Water Safety Plan

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Water Safety Plan

Version 2.1: August 2018

Authorised by: _____

Andrew Guthrie
Assets Manager
Ashburton District Council

Ashburton District Council
PO Box 94
Ashburton 7740

Prepared by: _____

Berna Dabbak
Environmental Engineer
Opus International Consultants

Phone: +64 3 307 7700
Facsimile: +64 3 308 1836

Approved by: _____
Drinking Water Assessor

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Document Control

Version No	Description	Authorised	Approval Date
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	Revision to include CCPs	CS	August 2018

Contents

1 Background

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

Under the 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.

Hinds 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 Hinds. 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 Ashburton District Council's Activity Management Plan (AMP) for prioritisation and funding via Ashburton District Council's Long Term Plan (LTP).

3 Supply Details

Supply	
Supply Name	*Hinds*
WINZ Community Code	*HIN001*
Supply Owner	*Ashburton District Council*
Supply Manager	*Andrew Guthrie*
Supply Operator	*Ashburton Contracting Ltd – Robin Jenkinson (NZCE Civil, R.E.A.)*
Population Served by Supply	*340 (WINZ)*
Supply Grading	*uU (current)*
Source	
Source Name	*Hinds Well*
Source WINZ Code	*G00230*
Location	*Hinds Lismore Road*
Map Reference of Source	*NZTM 1484761 easting, 5127536 northing*
Type of Source	*Bore - ECan Ref: K37/2085*
Depth of Bore	*101.7m*
Consent Number	*CRC041517*
Consent Expires	*18 February 2039*
Maximum Consented water take:	*18 L/s, 648 m^3/day*
Treatment Plant	
Treatment Plant Name	*Hinds*
Treatment Plant WINZ Code	*TP00339*
Location	*Hinds Lismore Road*
Map Reference	*NZTM 1484760 easting, 5127525 northing*
Treatment Processes	*Chlorination*
Consented Daily Volume	*648 m^3/day*
Peak Daily Volume	*650 m^3/day*
Distribution	
Distribution Zone Name	*Hinds*
Distribution Zone WINZ Code	*HIN001HI*
Distribution Zone Population	*340*

Regulatory Compliance	
Standards compliance assessed against	*DWSNZ 2005 (rev 2008)*
Laboratory undertaking analyses	*Ashburton District Council*
Secure bore water	*Yes*
Bacterial compliance criteria used for water leaving the treatment plant	*Not Required, secure bore*
Bacterial compliance for water leaving the treatment plant has been achieved for the last four quarters	*Yes*
Protozoa log removal requirement required for the supply	*Not Required, secure bore*
Protozoa treatment process	*None, secure bore*
Protozoa compliance for water leaving the treatment plant has been achieved for the last four quarters	*Yes*
Compliance criteria used for water in the distribution zone	*Criterion 6A*
Bacteria compliance for water in the distribution zone has been achieved for the last four quarters	*Yes*
P2 determinands allocated to supply	*Nitrate*
Chemical compliance achieved for the last four quarters	*Yes*
Cyanobacteria identified in the supply	*No*
Cyanobacterial compliance has been achieved for the last four quarters	*N/A*
Identify any transgressions that have occurred in the last four quarters *Nil*	

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 for 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

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

Table 2 Consequence Scale

Consequences	Microbiologically contaminated water	Chemically contaminated water	Supply interruption	Poor aesthetic water quality
Negligible		Minor chemical contamination event	Unplanned supply interruption for up to 8 hours	Poor aesthetic water quality of nuisance value only
Minor	Microbiological contamination (<100 population)	Recurrent chemical contamination (<100 population)	Unplanned supply interruption for in excess of 8 hours (<100 population)	
Medium	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)
Major	Microbiological contamination (500-5000 population)	Recurrent chemical contamination (500-5000 population)	Unplanned supply interruption for in excess of 8 hours (500-5000 population)	
Substantial	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

	Consequence				
Likelihood	**Negligible**	**Minor**	**Medium**	**Major**	**Substantial**
Likely	Low	Medium	Very High	Extreme	Extreme
Quite Common	Low	Medium	High	Very High	Extreme
Unlikely	Low	Medium	High	Very High	Very High
Unusual	Low	Low	Medium	High	Very High
Rare	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 the next AMP and 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 through the provision of water treatment systems that are appropriate to the raw water quality and catchment conditions, and that are compliant 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.

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 Hinds water supply scheme serves a population of 340 (WINZ). There are 132 connections to the Hinds Town Supply.
The water abstraction is consented under CRC041517, which allows for a combined total of 18 L/s and 648 m^3/day from the bore.
There is an old bore, which is physically isolated from the rest of the system.

The average winter demand is approximately 300 m^3/day. This is an average of around 2,270 litres per property per day, or 880 litres per person per day. The average summer peak demand is approximately 650 m^3/day. This is an average of around 4,925 litres per property per day, or 1,910 litres per person per day.

5.1 Location Map

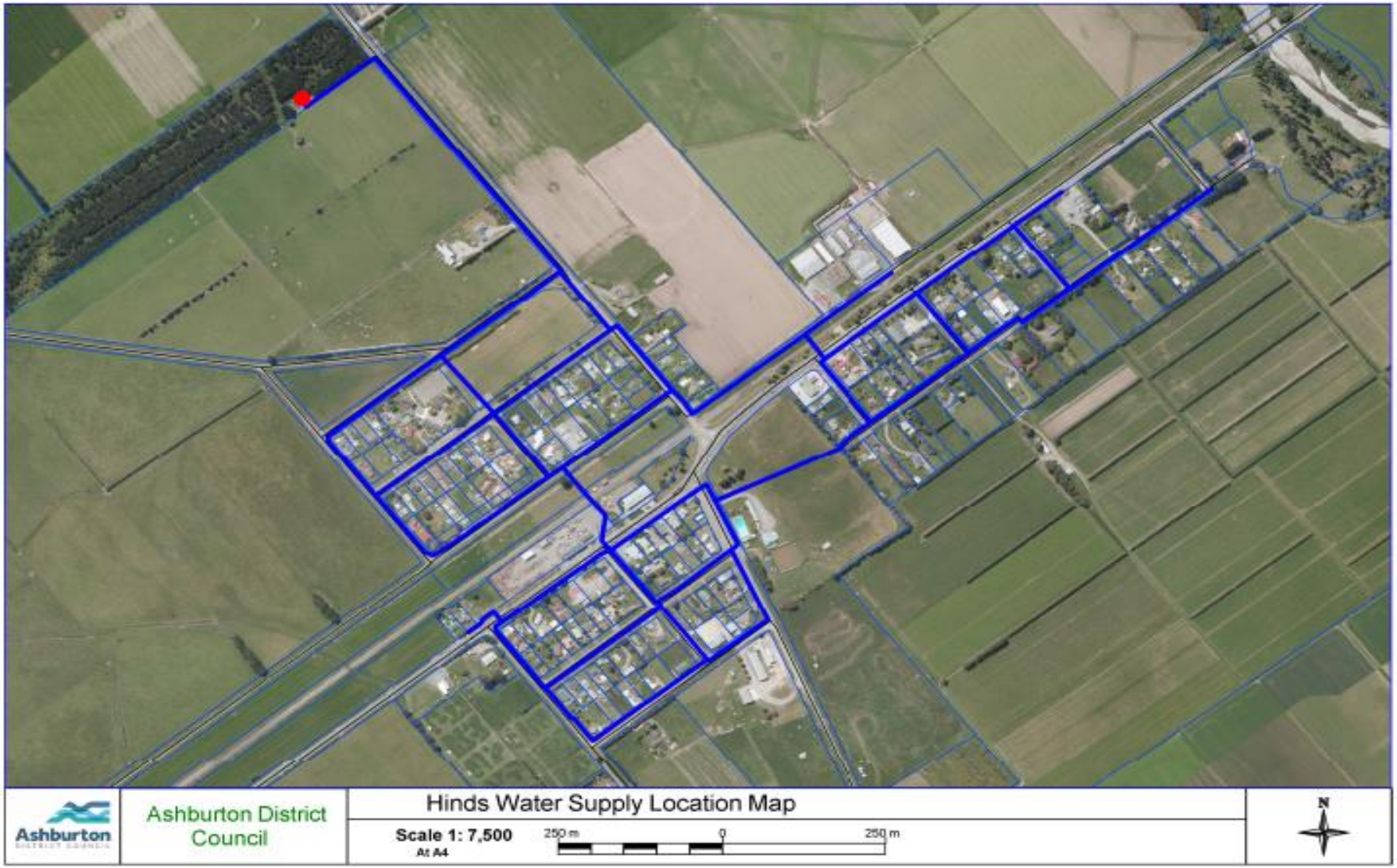

Figure 1 -Location Map

5.2 Description of Source

The current source is groundwater from one bore, ECan number K37/2085 (see map above), drilled to a depth of 101.7m BGL in December 2003. The bore is 200mm in diameter and is located west of Lismore Road, down the driveway beside a pine plantation and beside the tanks.
A fixed speed pump is installed in the bore. The abstraction rate is monitored and recorded using SCADA telemetry. The operation of the bore pump is directly controlled by a level probe mounted in Reservoir Tank 1. There is a transducer installed to monitor the ground water level in the bore. There is a back flow prevention system installed directly after the well head.

5.3 Treatment and Distribution

The raw water is treated by direct injection of a 2.7% sodium hypochlorite solution through a dosing pump, whenever the bore pump is running. Clear instructions are provided on site in an obvious location for the dilution of sodium hypochlorite solution.

There are six 30m^3 PE tanks with high level inlets, low level outlets and over flow pipes. The tanks are interlinked for balancing and constant water turnover. Each of the tanks can be isolated for inspection and maintenance. There is room for two more tanks if future demand requires them.

Two variable speed pumps (duty and duty-assist) supply the distribution zone using a pressure vessel and a pressure sensor. There is room for one more pump if future demand requires it.

Water is supplied from the pressure pumps to Hinds reticulation down a 125mm PVC trunk main. Flow is metered after the pumps. There are three other flow meters on key locations within the Hinds reticulation 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 linked and recorded by SCADA.
A depiction of the Hinds water supply process is included below in Figure 2.

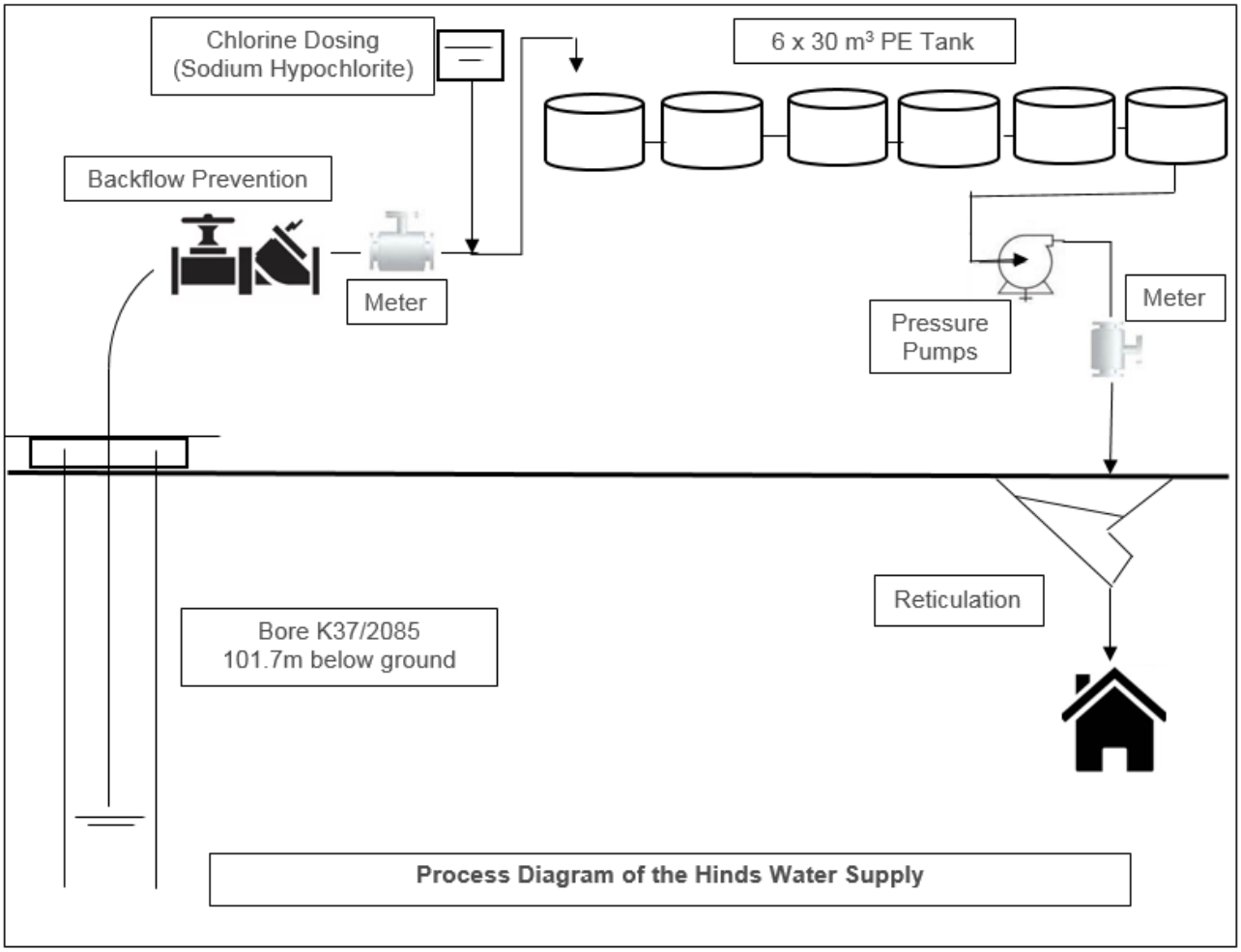

Figure 2 - Hinds Water Supply Process Diagram

5.4 Monitoring and Alarms

There is a flow sensor that sets off an alarm if the bore pump is running and there is no flow.
The chlorine solution is administered at a constant rate. The dosage can be manually adjusted by the operator if required. Council and the operator manually check the free available chlorine (FAC) at the plant and in the reticulation. These results are recorded.

All pumping information is linked and 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:

- Cumulative bore flow volume
- Plant output volume
- Bore and treatment plant pump run hours
- Generator run hours
- Pressure information on the booster pumps
- Storage tank and bore levels
- Alarms for low bore level, pump failure, low flow, generator fault and run, high and low storage tank levels, power failure, chlorine pump fail, and SCADA communication failure

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 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.

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).

No E.coli samples are collected at the plant (post-treatment) because the source is secure groundwater (sampling not required).

E.coli samples are collected monthly from the reticulation network, in accordance with bacterial compliance criterion 6A of the DWSNZ. The samples are analysed by Ashburton District Council’s own MoH-recognised facilities for post-treatment bacteriological levels. Manual readings are taken for FAC, pH and turbidity at the treatment plant weekly, and in the distribution zone whenever an E.coli sample is collected. The manual readings are only used for process monitoring, not for compliance.

Water age samples from the bore were collected in 2016, 2012 and 2006. ADC is currently awaiting the results for the 2016 sample.

Hinds has an official P2 for nitrate. Monthly nitrate samples are taken in the reticulation zone. Samples are also collected monthly from the treatment plant (post-treatment) for monitoring purposes.

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	Booster Pump 1	Fault	0				RDI 10
OFF	Booster Pump 1	Remote Shutdown	0				RDO 1
	Booster Pump 1	StartsLast2	0				
ON	Booster Pump 1	Run	1				RDI 9
	Booster Pump 1	HoursLast2	2				
	Booster Pump 1	HoursLast24	23.5	Hours			
	Booster Pump 1	Speed	14	Hz			RAI 7
	Booster Pump 1	Pressure	276	kPa			RAI 8
	Booster Pump 1	StartsLast24	3	Starts			
NML	Booster Pump 2	Fault	0				RDI 12
	Booster Pump 2	HoursLast2	0				
OFF	Booster Pump 2	Remote Shutdown	0				RDO 2
OFF	Booster Pump 2	Run	0				RDI 11
	Booster Pump 2	StartsLast2	0				
	Booster Pump 2	HoursLast24	0.5	Hours			
	Booster Pump 2	Speed	0	Hz			RAI 9
	Booster Pump 2	Pressure	296	kPa			RAI 10
	Booster Pump 2	StartsLast24	2	Starts			
NML	Chlorinator Pump	Power Fail	0				RDI 6
NML	Generator	Fault	0				RDI 19
	Generator	HoursLast2	0				
NML	Generator	Run	0				RDI 20
	Generator	StartsLast2	0				
	Generator	HoursLast24	0.5	Hours			
	Generator	StartsLast24	1	Starts			
NML	Pumps	Both Boosters Fail	0				
NML	Site	Battery Low	0				
NML	Site	Booster Pump Cutout Active	0				RDI 16
NML	Site	Bore 2 Low	0				RDI 15
NML	Site	Comms Fail	0				
NML	Site	Low Flow Fault	0				RDI 18
NML	Site	Power Fail	0				RDI 3
NML	Site	Storage Tank Level Fault	0				RDI 17
NML	Site	Storage Tank Low	0				RDI 21
	Site	Last Comms	2017-05-10 09:13:53				
	Site	Comms Usage Yesterday (%)	3.31	%			
	Site	Comms Usage Today (%)	3.49	%			
	Site	Tank Level	71.5	%			RAI 4
	Site	Bore Pump Flow	0	l/s			RAI 11
	Site	Booster Pump Flow	3.3	l/s			RAI 5
	Site	Bore 2 Level	25.92	m			RAI 13
	Submersible Pump 1	HoursLast2	0				
NML	Submersible Pump 1	Overload	0				RDI 4
OFF	Submersible Pump 1	Run	0				RDI 1
	Submersible Pump 1	StartsLast2	0				
	Submersible Pump 1	Current	0	Amps			RAI 1
	Submersible Pump 1	HoursLast24	0	Hours			
	Submersible Pump 1	StartsLast24	0	Starts			
	Submersible Pump 2	HoursLast2	0				
NML	Submersible Pump 2	Overload	0				RDI 5
OFF	Submersible Pump 2	Run	0				RDI 2
	Submersible Pump 2	StartsLast2	0				
	Submersible Pump 2	Current	0	Amps			RAI 2
	Submersible Pump 2	HoursLast24	4.8	Hours			
	Submersible Pump 2	StartsLast24	7	Starts			
	Totalised Booster Flow	Daily Flow Total	106	m³			NAI 1
	Totalised Booster Flow	Weekly Flow Total	1886.4	m³			NAI 2
OFF	Totalised Bore Flow	Daily Quantity Reset	0				NDO 1
OFF	Totalised Bore Flow	Daily Reset Chkbk	0				NDI 1
OFF	Totalised Bore Flow	Weekly Quantity Reset	0				NDO 2
OFF	Totalised Bore Flow	Weekly Reset Chkbk	0				NDI 2
	Totalised Bore Flow	Weekly Flow Total	1998.2	m³			NAI 4
	Totalised Bore Flow	Daily Flow Total	87.9	m³			NAI 3

Figure 3 - Telemetry monitoring and alarms

5.5 Maintenance and Administration

The Hinds 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

A major upgrade of the plant occurred in 2004. The upgrade included drilling a new bore, its associated appurtenances and isolating the old shallow bore. It also included installation of the six reservoirs, the

pipework involved and removal of the water tower. The pump station, treatment facilities, buildings and security were upgraded.

A PHRMP was prepared for this scheme in 2011 with a focus on identifying the most significant risks relating to water quality and reliability of supply.
The primary risks in 2011 were those with respect to:

1) Treatment:
   - over-chlorination
2) Storage and distribution:
   - Insufficient stored water
   - introduction of contaminants into the distribution system
3) Other
   - system performance
   - Inadequate controls on construction and maintenance work.

7 Water Supply Distribution

7.1 Description of Storage

Six 30m^3 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 4.2km of 50mm or smaller PE pipe and 2.6km of 80-125mm PVC pipe installed in 1983. Additional extensions were installed in 1997 (117m of DN32 PE) and 2003 (223m of 50mm PE). No records have been kept of minor repairs in the general network.

7.3 Pump Systems

Two variable speed pumps (duty and duty assist) supply the distribution zone.

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

7.5 Supply Pressure

The SCADA system records pressure information from the booster pumps in the plant. The booster pumps are controlled based on a pressure setpoint. An alarm is set for SCADA communication failure.

7.6 Backflow Prevention

A backflow prevention system at the well head prevents any flow of water back into the source.
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.

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.

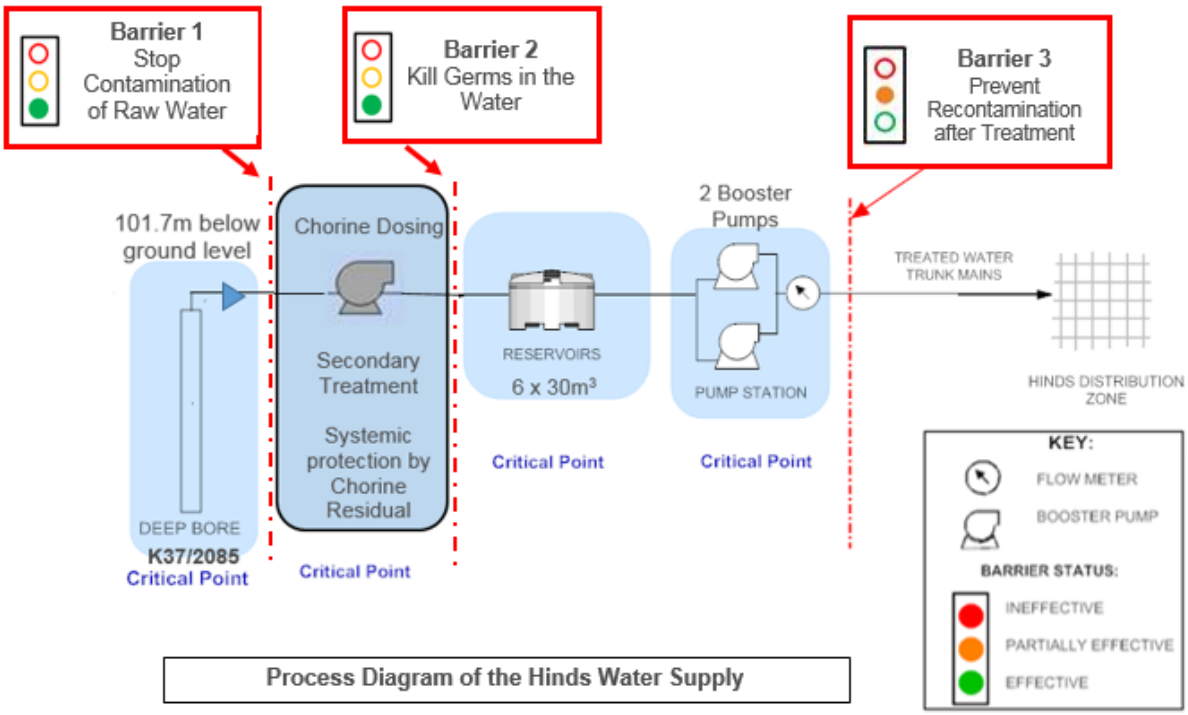

Figure 4 - Hinds Water Critical Points and Barriers to Contamination

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

Critical Point	Description
Wellhead	*Possible point for microbiological contamination* *Possible point for loss of supply*
Chlorine Dosing	*Overdosing may exceed chemical MAV* *Possible failure of chlorine dosing would result in loss of the systemic protection provided by the chlorine residual*
Treated Water Storage	*Possible point for microbiological contamination* *Possible point for loss of supply*
Pump Station	*Possible point for loss of supply*
Reticulation	*Possible point for microbiological contamination* *Possible point for loss of supply*

9 Barriers to Contamination

The following section discusses what barriers are in place to reduce the risk to public health from the Hinds 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 the Contamination of Raw Water

The water is sourced from deep groundwater which has been age dated and found to be appropriately old and thus at low risk of microbiological contamination. The source is deemed “Secure” under Section 4.5 of the Drinking Water Standards for New Zealand (DWSNZ).

The abstraction bore is 101.7m 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, a surrounding concrete pad. It is in a clean, locked shed.

A backflow prevention system at the well head prevents any flow of water back into the source.

Chemical contamination of the water is possible, in particular through rising nitrate levels in Canterbury groundwater. ADC is active in working with Environment Canterbury to advocate for measures to reduce nitrate contamination of groundwater.

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. Turbidity is generally under 0.3 NTU.

9.3 Kill Germs in the Water

Chlorine dosing provides a secondary partially effective barrier to contamination.

Liquid sodium hypochlorite solution is injected into the water main 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 necessary Free Available Chlorine (FAC) is maintained under varying conditions.
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 post-treatment at the treatment plant.
- The treated water from the pump station can be sampled from a tap on the outside of 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

- The two pressure pumps at the plant provide redundancy, reducing the risk of backflow contaminating the reticulation due to a loss of pressure.

General

- New connections are fitted with a non-testable double check valve as a minimum.

- Maintenance procedures and hygiene practices, alongside trained and experienced operators, reduce the contamination risks associated with working on water mains. The building housing the treatment equipment and pump station is clean and locked. The area surrounding the building, reservoir and bore is fenced and locked.

Summary

The following measures contribute to provision of a **partially effective barrier against recontamination** of water following treatment:

- The tanks are covered/secured to prevent unauthorised access, ingress of rainwater or contaminants, and to exclude birds and vermin.
- Hygiene procedures are documented and followed for all distribution system maintenance.
- A disinfection residual is maintained within the distribution zone.
- The plant is on mains electricity supply with a backup generator that is regularly tested and the results are recorded. The generator is locked.
- New domestic connections are assessed against the backflow prevention policy and as a minimum are installed with a non-testable double check valve.

This barrier could be enhanced by:

- Assessing the risk of backflow from properties on the scheme and ensuring that the current protection is appropriate / sufficient.
- Monitoring FAC leaving the plant.
- Adding a second sampling point in the reticulation.
- Installing of rodent protection on reservoir overflow pipes.

10 Photographs of supply elements

Figure 5 – Wellhead (Outside)

Figure 6 – Wellhead (Inside)

Figure 7 - Six 30m^3 PE Supply Reservoirs

Figure 8 – Water Distribution Pumps

Figure 9 – Pump Station and Treatment Building

Figure 10 - Generator

Figure 11 – Chlorine Storage

Figure 12 - Chlorine Injection

Figure 13 - Electrical and Control Equipment

Figure 14 - Hinds Water Treatment Plant

11 Risk Tables

11.1 Risk Assessment Worksheet – Bore and Source Abstraction

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**
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				Develop educational material to provide to landowners within the groundwater protection zone. Carry out annual wellhead protection and groundwater protection zone checks.
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				Develop educational material to provide to landowners within the groundwater protection zone. Carry out annual wellhead protection and groundwater protection zone checks.

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**
B3	Contamination of source water	Contaminant entry via well head e.g. vandalism, flooding	The borehead is sealed at the surface and within a covered, locked enclosure.	Yes				Complete formal borehead security assessment (per Section 4.5.2.2)
B4	Chemical contamination of source water – nitrates	Changing nitrate levels in the groundwater	Regular monthly monitoring of nitrate-nitrogen in the distribution zone. Depth of groundwater means that changes are slow and can be planned for.	Yes				
B5	Contamination of source water	Catastrophic failure, e.g. seismic activity disrupting the aquifer confinement or wellhead protection	Inspection of facilities following a significant earthquake. Annual water chemistry profiles to determine that the water quality is relatively unchanged over time. Monthly monitoring of nitrate-nitrogen in abstracted water.	Partial	Unusual	Medium	Medium	Investigate resilience of plant to natural hazards. Develop site-specific Emergency Response Plan and implement if water supply cannot be maintained from this source.

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**
B6	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. Bore water levels are monitored through telemetry and there is a low level alarm. On-site generator provides a source of backup power should power failure occur. There are six reservoirs that have a combined storage of over half an average day's water demand. The decommissioned bore can be reinstated in the event of an emergency. The bore pump failure alarm is on telemetry so any failure will be immediately investigated.	Partial	Unlikely	Negligible	Low	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. Carry out end to end testing of critical alarms. Develop a schedule for routine testing of critical alarms and signals.

B7	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	Annual water chemistry profiles to determine that the water quality is relatively unchanged over time. Chlorine disinfection for residual protection in network Wellhead constructed to DWSNZ standards. Wellhead is secured from casual access. Quarterly E.coli testing of raw water. Monthly testing of FAC residual in network (low/no FAC could indicate potential contamination). Systems are in place to ensure that any transgressions are thoroughly investigated.	Partial	Unusual	Medium	Medium	Ensure age dating of water, wellhead inspections and updates to the water safety plan are carried out at intervals no greater than 5 years. 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. Develop protocols for recording all maintenance works on wellheads and re-inspection of wellheads for security following any maintenance work. 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 Hinds supply.

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				

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**
T2	Inadequate secondary disinfection (not enough free available chlorine)	Dosing pump malfunction, control system malfunction, SCADA malfunction or inaccuracy	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. The chlorination process is aimed at disinfection in the reticulation network. Routine plant checks and inspections. Standby power generation. Power failure SCADA alarm. Regular manual E. coli, FAC, and pH monitoring. A sample tap is available for testing on the pump station output.	Yes				Carry out end to end testing of critical alarms. Develop a schedule for routine testing of critical alarms and signals.

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**
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. Clear instructions for refilling and diluting the chlorine solution are on site. Regular manual E. coli, FAC, pH and turbidity monitoring.	Partial	Rare	Medium	Medium	Install chlorine analyser. Install high/low chlorine residual alarms. Install low chlorine tank alarm. Carry out end to end testing of critical alarms. Develop a schedule for routine testing of critical alarms and signals.
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				

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**
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				
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 power failure alarm.	Partial	Unlikely	Negligible	Low	Install alarm for chlorine dosing pump faults. Install chlorine residual high/low alarms. Carry out end to end testing of critical alarms. Develop a schedule for routine testing of critical alarms and signals.

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**
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. Clear instructions for refilling and diluting the chlorine solution are on site. Calibration device for the dosing pump installed.	Partial	Unusual	Negligible	Low	Install chlorine residual high/low alarms. Carry out end to end testing of critical alarms. Develop a schedule for routine testing of critical alarms and signals.
T8	Failure to remove other chemical contaminants from raw water	Treatment system inadequate. Nitrate contamination (assigned as P2 determinand in Q3 2013).	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.

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**
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

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**
S1	Introduction of contaminants into the distribution system	Deliberate or accidental contamination via storage tanks	Storage tanks covered and the area is fenced and locked. Chlorine residual is maintained in the reservoirs. Air vents have rodent protection.	Partial	Unusual	Medium	Medium	Consider replacing the existing reservoir hatches with lockable hatches. Improve rodent protection for reservoir overflow pipes.
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.

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**
S3	Introduction of contaminants into the distribution system	Operation and maintenance activities	Contractor has documented practices and procedures for working on water supplies. Contractor is experienced in working with water supplies. Chlorine residual is maintained in the distribution zone.	Yes				
S4	Introduction of contaminants into the distribution system	Pipe materials, age and condition, plumbosolvency	Lifecycle management plan for pipe maintenance and renewals. Consumers are notified of plumbosolvency twice per year as required by DWSNZ.	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	Pressure maintained will help prevent ingress of foreign material. PE pipe is more resilient against seismic activity. Damaged sections of reticulation can be isolated.	Partial	Rare	Medium	Medium	Develop site-specific Emergency Response Plan.

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**
S6	Insufficient water available	Pump or power failure	There are two pressure booster pumps, providing redundancy. Alarms for pump faults are monitored on the telemetry system. Six reservoirs provide half a day of storage under average conditions. Backup generator for the event of power failure. Power failure and generator run alarms.	Yes				Carry out end to end testing of critical alarms. Develop a schedule for routine testing of critical alarms and signals.
S7	Insufficient water available	Lack of storage	There are six reservoirs, each of which can be isolated. Reservoir level is monitored (SCADA alarm). Reservoirs are inspected regularly. The reservoirs provide half a day of storage under average conditions.	Yes				Carry out end to end testing of critical alarms. Develop a schedule for routine testing of critical alarms and signals.

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

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**
S9	Insufficient water	Vandalism or unauthorised access to storage tanks	Reservoir level is monitored (SCADA alarm). Reservoir site is not situated in a location prone to vandalism. Operators check for evidence of vandalism as part of routine site visits.	Yes				Carry out end to end testing of critical alarms. Develop a schedule for routine testing of critical alarms and signals.

11.4 Risk Assessment Worksheet – Other

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**	**Additional Measures to Control Risk**	**Controlled Yes/ No/ Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level**	**Additional Measures to Control Risk**
O1	Incorrect water quality data used for supply management (failure to identify inadequate water quality)	Inappropriate/ inadequate/ incorrect sampling and reporting	Council have a sampling programme for sampling compliance. Staff are trained to take samples and alternate personnel are available to cover for absences. Results are reported through the WINZ system to the Drinking Water Assessor. Sampling locations are clearly labelled. Annual IANZ audit for Council laboratory's MoH recognition.	Yes				

O2	System does not perform as intended	Incorrect operation, inadequate maintenance.	Operators have sound knowledge of systems. There is an Operation and Maintenance manual. Key operation instructions are displayed permanently on site. An operations log is kept on site Plant records are copied and filed.	Partial	Unusual	Negligible	Low	Review and maintain activity management plans and associated asset renewal programmes to plan for regular maintenance and inspection/monitoring tasks. Ensure all plant records – including manuals, drawings, procedure instructions and emergency response plan are up to date and available at the plant. 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. Implement and use Asset management System (AMS) for programming and monitoring regular maintenance and inspection/monitoring tasks.

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**	**Additional Measures to Control Risk**	**Controlled Yes/ No/ Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level**	**Additional Measures to Control Risk**
O3	System does not perform as intended	Inadequate skills or training.	Staff are skilled and experienced.	Partial	Unusual	Negligible	Low	Council to place a requirement on the service provider to provide staff with relevant training and skills and to provide evidence to Council. Identify and record any staff training needs. Develop a skills framework for operations and management staff, and carry out a skills gap analysis.

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**	**Additional Measures to Control Risk**	**Controlled Yes/ No/ Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level**	**Additional Measures to Control Risk**
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				

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**	**Additional Measures to Control Risk**	**Controlled Yes/ No/ Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level**	**Additional Measures to Control Risk**
O6	Loss of monitoring and alarm systems	Failure of SCADA system	Pumping and treatment control systems are independent of SCADA system so there will be no interruption to supply or treatment. SCADA operates from battery backup in event of power failure. Failure of remote SCADA equipment triggers alarm at the SCADA base station, sent to ACL, prompting site attendance to investigate. All work on SCADA systems is undertaken by specialist telemetry contractor.	Yes				Carry out end to end testing of critical alarms. Develop a schedule for routine testing of critical alarms and signals.

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

12.1 Part I: Major Projects and Capital Works

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

12.2 Part II: Minor Projects and Operational Improvements

Hinds Water Supply Improvement Schedule 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	S4, O2	Review and maintain Activity Management Plans and associated asset renewal programmes to minimise failures.	AM	Staff time	Ongoing
1	Very High	Distribution	S4, S8	Undertake a criticality analysis of the network to assist renewals planning.	AM	Staff time	30/6/2018
2	High	Distribution	S2	Ensure existing connections are replaced in accordance with backflow policy when maintenance/ renewal works permit.	AM	Staff time	1/7/2018 + Ongoing
3	Medium	Source, treatment, distribution, other	B6, T2, T3, T6, S6, S7, S8, S9, O6	Carry out end to end testing of critical alarms	AM	$1,000 + staff time	31/12/2017
3	Medium	Source, treatment, distribution, other	B6, T2, T3, T6, S6, S7, S8, S9, O6	Develop a schedule for routine testing of critical alarms and signals.	AM	Staff time	31/12/2017
3	Medium	Distribution	S1	Replace the existing reservoir hatches with lockable hatches	AM	$5,000 + Staff time	30/6/2019
3	Medium	Distribution	S1	Improve rodent protection for reservoir overflow pipes	AM	$3,000 + Staff time	30/6/2019

Hinds 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, treatment, distribution	B5, T10, S8	Investigate resilience of plant to natural hazards.	AM	Staff time	30/6/2019
3	Medium	Source, treatment, distribution	B5, T10, S5, S8	Develop and adopt a site-specific Emergency Response Plan.	AM	$5,000 + Staff time	30/6/2019
3	Medium	Treatment	T3	Installing a low chlorine tank alarm	AM	$2,000 + Staff time	30/6/2019
3	Medium	Treatment	T3	Install chlorine analyser	AM	$10,000 + Staff time	30/6/2019
3	Medium	Treatment	T3,T6, T7	Install low/high chlorine residual alarms.	AM	$2,000 + Staff time	30/6/2019
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	30/6/2019 + Ongoing
3	Medium	Other	O4	Maintain accurate as-constructed records and make readily available to all parties working on or in vicinity of system. Implement permit to work system for third parties wishing to work in vicinity of water supply assets. Inspect third party work to ensure water services are adequately protected.	AM	Staff time	30/6/2019

Hinds 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	Treatment	T8	Add a second sampling point in the reticulation.	AM	$5,000 + Staff time	30/6/2019
3	Medium	Source	B7	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	30/6/2019
3	Medium	Source	B7	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	30/6/2019
3	Medium	Source	B7	Develop protocols for recording all maintenance works on wellheads and re-inspection of wellheads for security following any maintenance work.	AM	Staff time	30/6/2019
3	Medium	Source	B7	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 Hinds supply.	AM	$5,000 + Staff time	30/6/2019
4	Low	Source	B6	Review need for increased demand management.	AM	Staff time	30/6/2020

Hinds 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	Source	B6	Carry out leak detection	AM	$10,000 + Staff time	30/6/2020
4	Low	Source	B6	Regularly check bore pump records for any anomalies that may indicate a potential pump fault.	AM	Staff time	30/6/2020 + Ongoing
4	Low	Source	B3	Document procedure to reinstate the decommissioned bore, including flushing, testing increased disinfection monitoring.	AM	Staff time	30/6/2020
4	Low	Treatment	T6	Consider installing telemetry alarm for chlorine dosing pump faults.	AM	$1,000 + Staff time	30/6/2020
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	30/6/2020 + 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	30/6/2020

Hinds 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	O3	Identify and record any staff training needs. Develop a skills framework for operations and management staff, and carry out a skills gap analysis.	AM	Staff time	31/12/2017
5	Very low	Source	B1, B2	Develop educational material to provide to landowners within the groundwater protection zone. Carry out annual wellhead protection and groundwater protection zone checks.	AM	Staff time	30/6/2020
5	Very Low	Source	B3	Complete formal borehead security assessment (per Section 4.5.2.2)	AM	$1,000 + Staff time	31/12/2017

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

Indicators	A contamination event in the catchment may be observed by or reported to ADC staff Reported illness among consumers Positive E. coli monitoring results
Actions	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 (e.g. reinstate decommissioned bore or use tankers) Disinfect contaminated reservoirs and flush mains Keep customers informed and advise once regular service is restored
Responsibility	Assets Manager

13.2 Chemical Contamination of Source Water

Indicators	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 Nitrates in excess of MAV through monthly tests
Actions	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
Responsibility	Assets Manager

13.3 Insufficient Source Water Available

Indicators	Observed or reported low ground water levels
Actions	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
Responsibility	Assets Manager

13.4 Insufficient Water Available due to Leakage

Indicators	Observed or reported reduction in pressure or water availability
Actions	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
Responsibility	Assets Manager

13.5 E. coli Transgression in Water Leaving Treatment Plant

Indicators	E. coli transgression reported following routine monitoring
Actions	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
Responsibility	Assets Manager

13.6 Over-Chlorination

Indicators	Monitoring shows high FAC Complaints of strong chlorine taste/ smell from customers
Actions	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
Responsibility	Assets Manager

13.7 Inadequate Disinfection

Indicators	Monitoring shows low or no FAC
Actions	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
Responsibility	Assets Manager

13.8 E. coli Transgression in Water in the Distribution Zone

Indicators	E. coli transgression reported following routine monitoring
Actions	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
Responsibility	Assets Manager

13.9 Chemical Contamination of Water in Distribution Zone

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

13.10 Insufficient Water Available in the Distribution Zone

Indicators	Low pressure and flow in the distribution
Actions	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
Responsibility	Assets Manager

13.11 Insufficient Water Available due to Unplanned Shutdown

Indicators	Unplanned shutdown will be reported to ADC staff by contractor
Actions	Keep customers informed and advise once regular service is restored Arrange emergency water supply if necessary
Responsibility	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

Operational monitoring of control process:	
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

Process performance criteria at the operational monitoring point:		**Correction if operating criteria are not met:**
Target Range:	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.
Action Limits:	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.
Critical Limits:	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 disinfection) 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 - Reticulation

Process objectives:

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

Operational monitoring of control process:	
What	Free available chlorine (FAC) concentration in mg/L
When	ADC monthly ACL twice weekly
Where	ADC staff: Hinds has two zone sample taps, located on 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: Plant log-book ADC: Water Outlook

Process performance criteria at the operational monitoring point:		**Correction if operating criteria are not met:**
Target Range:	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.
Action Limits:	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.
Critical Limits:	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 disinfection) 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.