


Public Health Risk Management Plan

Glenorchy Water Supply

June 2012

QUEENSTOWN LAKES DISTRICT COUNCIL

CHANGE CONTROL REGISTER						
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QUEENSTOWN LAKES DISTRICT COUNCIL

Glenorchy Water Supply
Public Health Risk Management Plan

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1 Introduction

1.1 Purpose

The purpose of this Public Health Risk Management Plan (PHRMP) is to identify public health risks to the Glenorchy water supply and develop ways of reducing these risks. This PHRMP also ensures that contingency plans are in place should an event occur that puts the public health at risk.

This PHRMP for Glenorchy sets out the means by which the Queenstown Lakes District Council (QLDC) intends to meet the requirements of the Health (Drinking Water) Amendment Act 2007, which includes taking "all practicable steps" towards compliance with DWSNZ 2005 (revised 2008).

1.2 Background

This PHRMP specifically relates to the Glenorchy water supply in its current condition. The risks associated with future changes made to water, wastewater or stormwater infrastructure as a result of future development have not been considered in this PHRMP. Any upgrades or changes to the water supply will require this PHRMP to be revised to reflect the changes.

The development of the PHRMP is an iterative process with the aim of continuous and systematic improvement.

Based on the Ministry of Health (MoH) Guideline documents, this PHRMP is set out as follows:

Section 1 - Introduction to the PHRMP

Section 2 - Description of the Glenorchy Water Supply Scheme

Section 3 - Drinking Water Standards Compliance

Section 4 - Risks to Public Health

- Identify risk events and risk analysis
- Describe preventative measures currently undertaken by Council;
- Describe methods of checking preventative measures;
- Describe corrective actions should an event occur.

Section 5 - Improvements Plan

Section 6 - Contingency Planning

Section 7 - Performance Review

1.2.1 Scheme Ownership

The Glenorchy water supply scheme is registered to QLDC on the Water Information New Zealand (WINZ) database. All water related assets are owned by QLDC.

The day to day operation and maintenance of the water supply infrastructure assets is undertaken by Veolia Water New Zealand (Veolia). Water monitoring of the water supply is contracted to Watercare Laboratories with Veolia receiving and managing the laboratory data.

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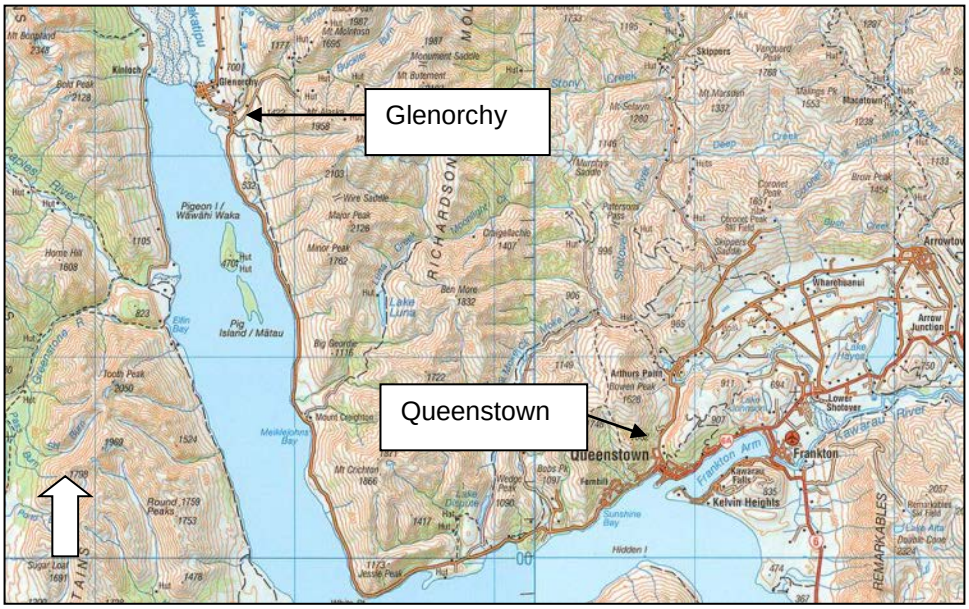
Queenstown Lakes District Council
Private Bag 50072
Queenstown 9348
Phone: 03 443 0024
Contact Person: Gerry Essenberg

Supply operator contact details:
Veolia Water New Zealand
PO Box 2573, Wakatipu,
Queenstown 9349
Phone: 03 450 9240
Contact Person: Jason Climo

1.2.2 Location of the Scheme

Glenorchy is situated on the shoreline at the northern end of Lake Wakatipu, approximately 47km northwest of Queenstown.

Figure 1-1 Glenorchy Water Supply – Location



1.2.3 The Health, (Drinking Water) Amendment Act 2007

Under the HDWAA 2007, Glenorchy is defined as a "minor drinking-water supply" meaning a drinking-water supply that is used to supply drinking water to between 501 and 5000 people (inclusive) for at least 60 days per year. Sections 69S to 69ZC of the HDWAA 2007 requires the networked supplier who uses a minor drinking-water supply to comply with sections 69S to 69ZC of the HDWAA 2007, on and after 1 July 2014.

The most immediate, and arguably most important, changes for water suppliers are contained in Sections 69S and 69Z of the Act as follows:

1. 69S - Drinking water supply to be adequate at all supply points
2. 69T - Imminent risk in the supply to be reported to MoH without delay
3. 69U - Duty to protect water sources/catchments from contamination – "all practicable steps approach"
4. **69V - "All practicable steps" to be taken to comply with DWSNZ**
5. 69W - Duty to provide wholesome water
6. 69X - New source water determinands not to exceed the maximum acceptable values,(MAV's) in DWSNZ
7. **69Y - Monitoring of the supply to be in accordance with DWSNZ**
8. **69Z - Duty to implement a PHRMP on or before the date on which this section begins to apply to the supply**
9. **69ZZZ – Protecting supplies from risk of backflow**

These requirements are now mandatory for water suppliers and are legally enforceable with heavy penalties prescribed in the Act for non-compliance. The "all practicable steps" requirement for section 69V means that strict compliance with DWSNZ is not required as long as the supplier has adopted all practicable and affordable steps to comply with DWSNZ 2005. It is generally expected by the Ministry of Health that large local

authorities such as Queenstown Lakes District Council with adequate funding streams will be able to comply fully with the DWSNZ.

The PHRMP for Glenorchy sets out the means by which the Queenstown Lakes District Council intends to meet the requirements of the H(DW) Amendment Act 2007, which includes taking "all practicable steps" towards compliance with DWSNZ 2005, (revised 2008), by I July 2014.

1.2.4 Water Information New Zealand (WINZ) Registration Details

The Glenorchy water supply is registered on the Ministry of Health national water supply database called WINZ. The following details are registered on the database.

Table 1-1 WINZ Registration Details

Supply Element	WINZ Name	WINZ Code
Sources	Bucklerburn River bore	G00313
	Bucklerburn River bore 2	G01975
Treatment Plants	Glenorchy	TP00477
Distribution zones	Glenorchy	GLE003GL (1093 consumers)

Source: WINZ database

1.2.5 Water Grading

In order to compare water supplies and identify those which may not be delivering quality water, the Ministry of Health grades each supply. Currently, Glenorchy is ungraded (Uu). The current system would likely achieve a 'Cc' grading, but could potentially achieve a 'Bb' grade if improvements to the system are made.

Table 1-2 Glenorchy Water Grading

Community	Current Public Health Grading	Indicative Grading	Indicative Grading with planned upgrades
Glenorchy	Uu	Cc	Bb by 2014

2 Description of Water Supply Scheme

2.1 Scheme Overview

The community's water is abstracted from two bores adjacent to Buckler Burn. The water is pumped via a rising main to a series of four 22.5m^3 concrete storage tanks located part of the way up Bible Terrace from where it is fed by gravity to the township. The water is not treated in any way. The existing system will not be able to accommodate further growth without improvements to water demand and is inadequate for fire fighting.

Key supply statistics are provided in Table 2-1.

Table 2-1 Glenorchy Asset Summary – Base Statistics

Community	Measure	Units	Glenorchy
Current Consumption	Total Volume	m3/yr	96,529
	Average Daily	m3	264
	Average per residential connection	m3/yr	6
	Peak Daily	m3	884
	Peak Per Connection	m3	-
No. of properties in area of benefit	Accommodation	No.	-
	Commercial	No.	-
	Other	No.	-
	Residential	No.	139
	Rural Residential	No.	-
	Industrial	No.	-
	Multi Use	No.	-
	TOTAL Connections	No.	**139**
	Unconnected	No.	131
Physical Statistics	Hydrants	No.	34
	Meters	No.	2
	Reticulation	m	7,884
	Valves	No.	150
	Rising Mains	m	1,701
	Pumpstation	No.	1
	Storage/Reservoirs	No.	1
	Treatment	No.	-
	Intake	No.	-
Population Served	Average Day		1,093
	Peak Day		1,913

Source: SharePoint, accessed 21 November 2011

2.1.1 Scheme Boundary & Schematic Diagram

The scheme boundary and layout of water supply facilities are illustrated in Figure 2-1. A schematic diagram is provided in Figure 2-2.

Figure 2-1 Glenorchy Water Supply – Scheme Boundaries

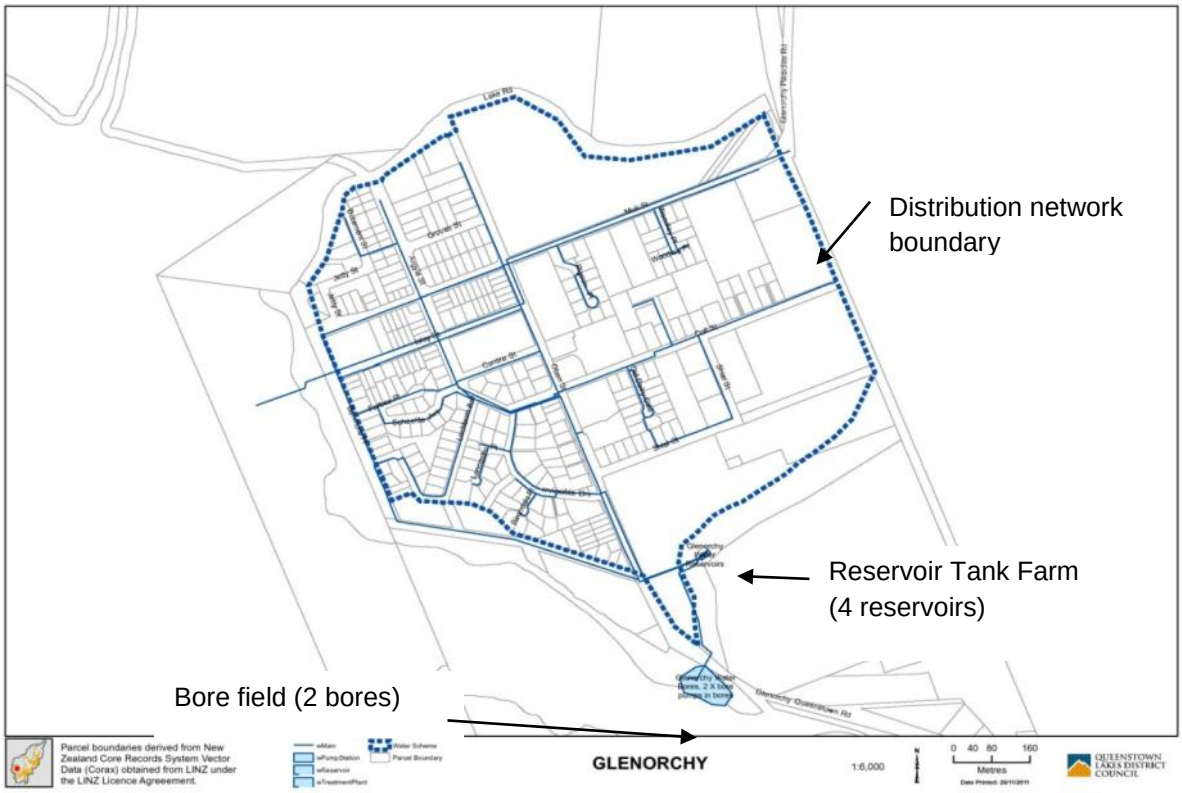
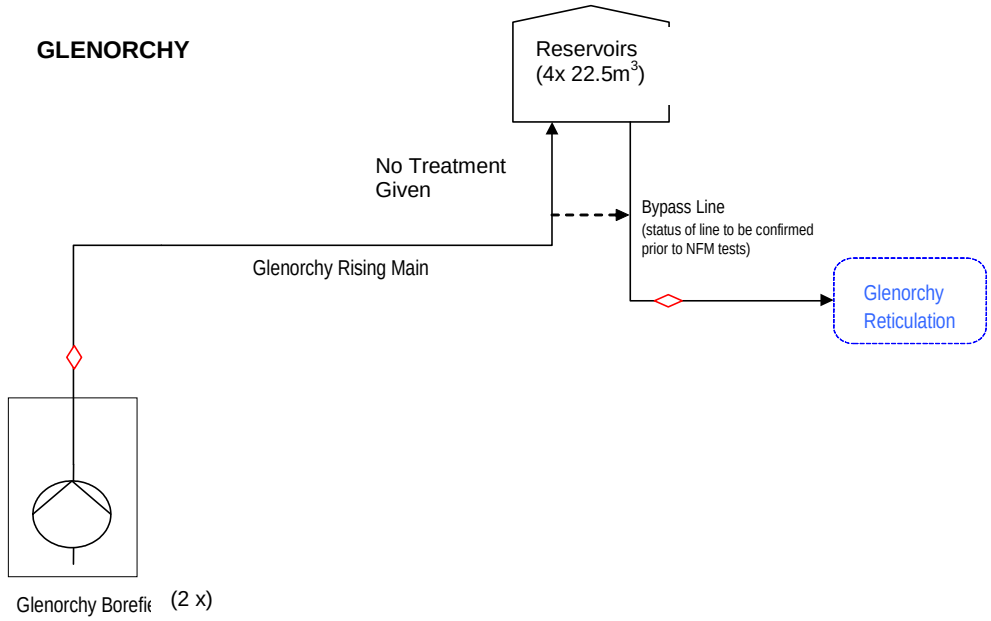


Figure 2-2 Glenorchy Water Supply Schematic Diagram



2.2 Water Source and Abstraction

The raw water is sourced from two bores that draw from a non-secure aquifer underlying the area. The associated assets are shown below.

Table 2-2: Glenorchy Bore/Pump Details

System	Bore			Pump			Rising Main		
	No.	Diameter (mm)	Depth (m)	Type	Operating Point		Nominal Diameter (mm)	Length (m)	Capacity (L/s)
					Flow (L/s)	Head (m)			
Glenorchy	2	150	15	Pleuger SP27-7 New 1991	14.6	68.1	100	340	16.2

Source: Hansen via SharePoint, accessed 28 November 2011

The bores are located in a paddock adjacent to the Queenstown – Glenorchy Road and Buckler Burn. The bores are fenced but animals have access to the paddock where the bores are located. Water is abstracted from two 15m deep 150mm internal diameter bores. The bore-heads comprise a concrete chamber and pad that is raised above the level of the surrounding ground, however, one of the bore-heads is nearly level with the surrounding ground and water is known to pond in this area. Backflow prevention mechanisms are installed.

Inside the chambers the boreheads proper are well sealed with concrete around the steel casing so surface water cannot pass down to the groundwater. The bore heads have been deemed secure by the Drinking Water Assessor (October 2011).

Figure 2-3: Photograph showing the location of bores in paddock by Buckler Burn. Note animals grazing in paddock.

Figure 2-4: Close up photograph of one of borehead chambers which are now fenced and have a new lightweight lockable lid for ease of access.

The draft 2012-2022 LTP provides for two new bores to be sunk, together with pump stations and upgraded storage to meet peak demands which at times now exceed the water take limits.

2.2.1 Catchment Description

Glenorchy is situated at the northern end of Lake Wakatipu, at the base of the Rees and Dart Rivers. The township lies on a low flat terrace which is the meeting point of the Buckler Burn and combined Rees and Dart gravel deltas (Figure 2-5). Buckler Burn is at the southern extent of the township and drains a steep catchment covering an area of approximately 52km^2. Its lower reaches have formed an extensive debris fan between the Glenorchy-Queenstown Road bridge and Lake Wakatipu. A site visit identified that the debris fan on which the borefield lies may be susceptible to flooding and aggregation.

2.2.1.1 Hydrogeology

Glenorchy is located on deltaic fan material overlying Otago (Haast) Schist which forms the basement unit of the region. Drill records revealed silty sandy gravels to a depth of 22.15m below ground in Borehole 1 (furthest from Glenorchy). Similar material was revealed in the drill records for Borehole 2 (closest to Glenorchy) but contained a greater proportion of silts and some cobbles between 0.0 and 18.70m below ground. This material is thought to be locally derived from the Buckler Burn catchment and is Quaternary in age. These units provide the main source of groundwater for Glenorchy.

Studies undertaken on the groundwater quality of Glenorchy[1] suggest that groundwater is recharged from Buckler Burn and flows to the north, through the borefield, and towards the Glenorchy township. Groundwater discharges to the west and north of the township into Lake Wakatipu and the Glenorchy Lagoon respectively. The static water level is approximately 10-13 metres below ground level and it is believed that the aquifer is unconfined.

Although the borefield is located away from the township the aquifer is likely to be vulnerable to land use impacts such as pastoral grazing due to its unconfined and shallow nature, however such use is limited to very low intensity grazing within 100 metres of the borefield.

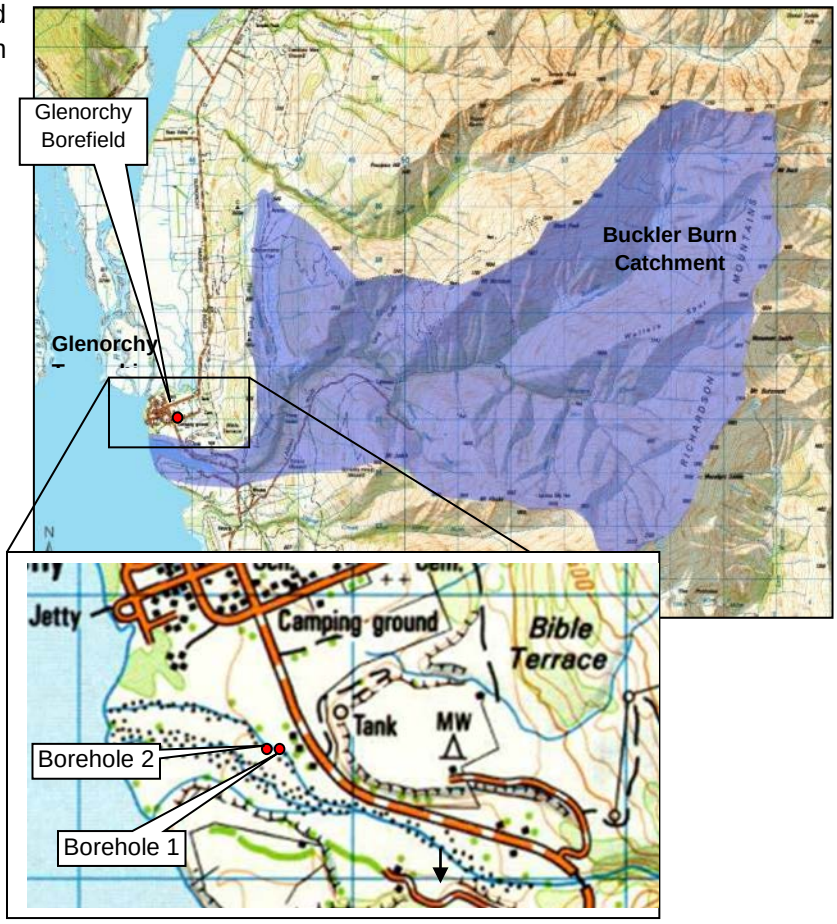


Figure 2-5: Buckler Burn Catchment, Glenorchy

2.2.1.2 Vegetation

Vegetation to the north and south of the borefield contains high producing exotic grasslands. This gives way to low producing grassland at low altitude slopes and tall tussock grasslands at higher elevations. For the most part, manuka scrub and beech forest grow alongside the Buckler Burn. Alpine gravel and rock are exposed on mountain peaks and are inhabited by specialized plants.

2.2.1.3 Climate

The nearest rainfall site to Glenorchy is the Rees Valley Station. Between 1988 and 1994, the mean annual rainfall was 1448mm. Mean monthly rainfall was evenly distributed over this period.

2.2.1.4 Land use

The Glenorchy bores are located within the General Rural zone and are designated No. 45 (Water & Pump Station) under the Queenstown Lakes District Council District Plan. The borefield lies within a paddock where horses are grazed. A residential dwelling is located within 100m of the borefield.

[1] ORC, August 2006: Groundwater Quality in Kingston and Glenorchy.

Glenorchy Township zone begins approximately 80 metres to the north of the borefield and extends to the Glenorchy Lagoon. Within the township zone, a number of commercial activities operate including jet boat operators, cafes, and accommodation facilities. QLDC also manages the Glenorchy Closed landfill, located approximately 500m north (down hydraulic gradient) of the borefield. The land within the Buckler Burn catchment, comprises grazed farmland.

2.2.1.5 Waste Water Services

Sewage is generally not reticulated in Glenorchy. One small privately owned and operated sewage treatment plant services a small subdivision on Lancaster Place. There are no records of operations and maintenance activities or the performance of this system.

Two smaller systems each service approximately 12-13 properties to the north of the township, at Pigeon Place and Woodley Place. Both were constructed approximately 2006 and are privately owned. There is minimal asset information and no operations or performance records.

A search of resource consents from the Otago Regional Council database revealed that four discharge permits lie within a 1 km radius of the borefield. All land discharges are located downgradient of the borefield. However, not all discharges are required to have a consent as they may be a permitted activity under the Otago Regional Council Plan. This is the case for most residential dwellings as they dispose of small quantities of wastewater to septic tanks and soakage fields. The nearest septic tank associated with a residential dwelling is located about 50m down gradient of the borefield, while the nearest upgradient septic tanks are in excess of 300m from the borefield. According to the ORC (2006), Glenorchy town bores are not at immediate risk from septic tank discharges but the ORC will continue to monitor groundwater in the area. If any contamination is found the ORC is obliged to inform the Council under the terms of the *National Environmental Standards for Sources of Human Drinking Water* which are now operative.

In the future, Council Is considering installing a community wastewater scheme. Details are to be confirmed.

Like wastewater, stormwater is also not reticulated in Glenorchy. Stormwater tends to be disposed of via direct soakage to ground, runoff to local waterways, or soak pits and mudtanks.

2.2.1.6 Raw Water Quality

A raw water sampling programme was carried out over a 12 month period from November 2008 to December 2009 as part of the Water Treatment Strategy (GHD, 2010). The following tables summarises the water quality data.

Table 2-3: Summary Table of Raw Water Quality

Supply	Parameter	Unit	No	Min	Max	Mean	SD	95%ile
Glenorchy Intake	Bicarbonate Alkalinity	mg/L as HCO3	16	47.50	62.14	**69.50**	6.24	69.50
	Carbonate Alkalinity	mg/L as CO3	16	1.00	1.00	**1.00**	0.00	1.00
	Total Alkalinity	mg/L as CaCO3	16	38.90	50.94	**56.97**	5.12	56.95
	Ammonia Nitrogen	mg/L	16	0.01	0.01	**0.02**	0.00	0.02
	Apparent Colour	Degree Hazen	16	5.00	5.31	**10.00**	1.25	6.25
	Calcium Hardness	mg/L as CaCO3	16	37.95	48.54	**55.93**	4.79	55.18
	Total Calcium	mg/L	16	15.20	19.44	**22.40**	1.92	22.10
	Calcium	mg/L	2	22.00	22.00	**22.00**	0.00	22.00
	Conductivity	mS/cm	16	9.95	12.09	**13.10**	0.84	12.88
	Soluble Iron	mg/L	16	0.005	0.010	**0.010**	0.001	0.010
	Total Iron	mg/L	16	0.011	0.011	**0.011**	0.000	0.011
	Magnesium (as Calcium Hardness)	mg/L as CaCO3	16	2.91	3.44	**4.01**	0.30	3.93
	Total Magnesium	mg/L	16	0.71	0.84	**0.97**	0.07	0.96

Supply	Parameter	Unit	No	Min	Max	Mean	SD	95%ile
	Soluble Magnesium	mg/L	16	0.01	0.01	**0.01**	0.00	0.01
	Total Manganese	mg/L	16	0.006	0.006	**0.006**	0.000	0.006
	pH Test 1	-	7	7.41	7.68	**7.93**	0.19	7.91
	pH Test 2	-	7	7.50	7.60	**7.70**	0.08	7.70
	Langelier Saturation Index (LSI)	-	4	-1.00	-0.88	**-0.70**	0.15	-0.72
	Total Dissolved Solids	mg/L	16	28.00	67.88	**101.00**	19.78	101.00
	Total Hardness	mg/L as CaCO3	16	40.87	51.98	**59.39**	4.86	58.98
	Turbidity Test 1 (Portable Meter)	NTU	9	0.07	0.11	**0.19**	0.04	0.17
	Turbidity Test 2 (Lab)	NTU	7	0.10	0.43	**1.20**	0.38	1.02
	UVA at 254 nm	Abs/m	16	98.00	99.38	**100.00**	0.57	100.00
	UVT at 254 nm	%UVT	16	0.002	0.004	**0.013**	0.003	0.009

Source: Water Treatment Strategy Results, March 2011, GHD.

The water quality is generally very good. As shown in the table above, and in Table 3-2 in Section 3, the levels of turbidity indicate a relatively secure source. However the water quality is likely to be subject to surface influence from time to time from the adjacent Buckler Burn as the on line turbidity data shows significant oscillation in turbidity (GHD, 2010).

2.3 Pump Stations

Both of the bores have a submersible pump which operate on a duty/assist basis. There is no standby power generation to allow for pump operation during power failures. However, Veolia has a portable generator that could be used. Power failure, bore pump failure, communications failure or phase drop are recorded on the SCADA system with alarms and the operators are paged. The pumps were installed in 1991.

The electrical control cabinet and telemetry system are located a few meters from the bores. The electrical cabinet is securely locked.

2.4 Water Treatment

There is no treatment prior to storage. However, Veolia has the ability to dose chlorine into the reservoirs using its mobile chlorinator if the need arose at short notice and a boil water notice could also be promulgated to consumers.

2.5 Storage

The water is pumped via a 100mm diameter 340m long rising main (installed in 1991) to a series of four 22.5m^3 concrete tanks at the top of the hill overlooking the town with a combined volume of 90m^3 (equivalent to about 2 hours storage at peak demand).

Table 2-4 Summary of Glenorchy Storage Facilities

System Location	Asset Type	Quantity	Total Volume (m^3)	Top Water Level (m)
Glenorchy	Reservoir	4	90	354.5

Source: Hansen via SharePoint, accessed 28 Nov 2011

The tanks have been assigned a condition grade of 3 i.e. poor. There is some minor leakage. Each tank has a new close fitting steel lid which can be securely locked. The reservoir level is monitored at hourly intervals and the data sent to the SCADA system. Operators are paged on high and low level.

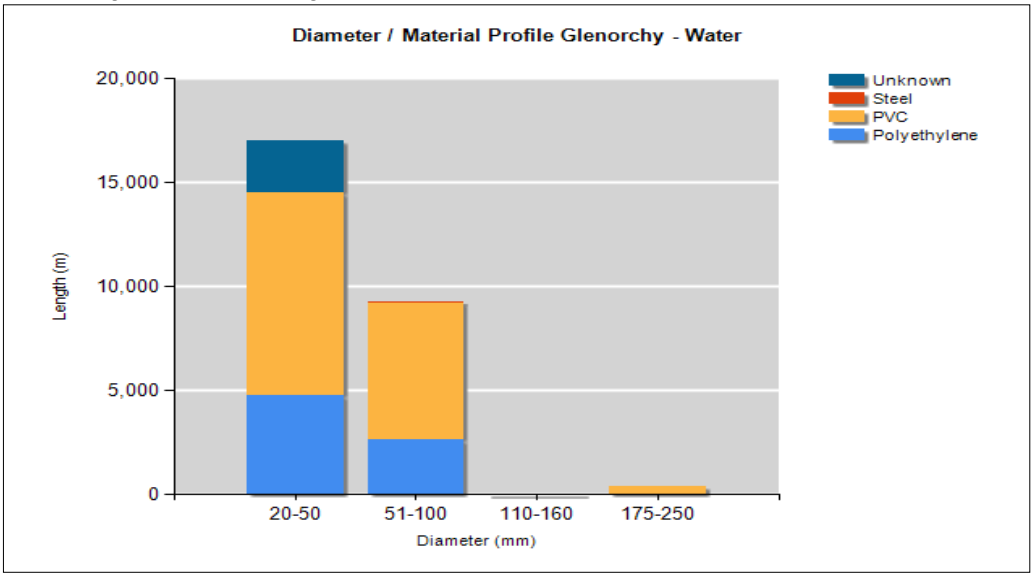
Figure 2-6: Photograph showing the tank farm above Glenorchy.

Figure 2-7: Photograph showing reservoirs have been fitted with new lightweight lockable covers to exclude contamination and prevent interference.

2.6 Reticulation

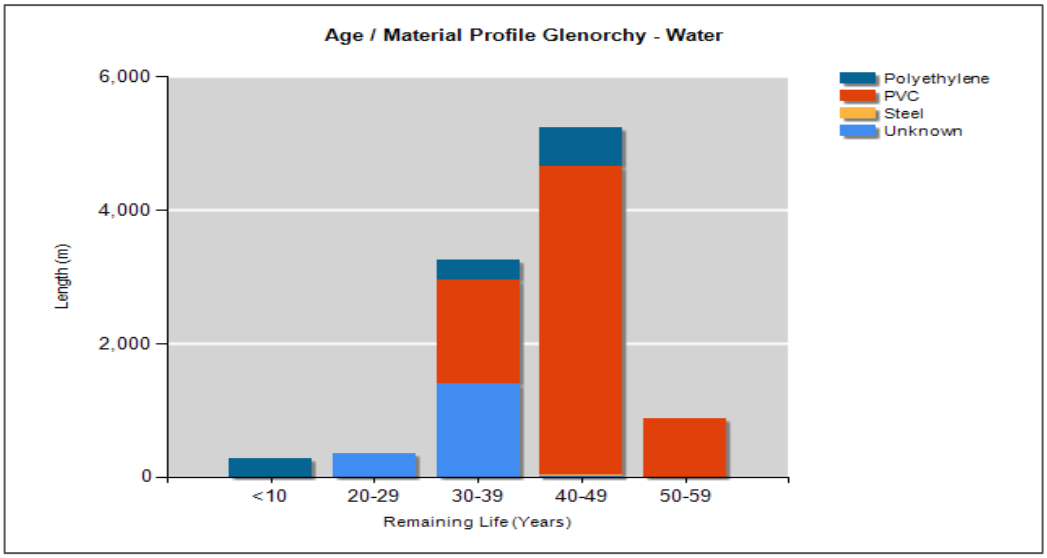
The water for Glenorchy is gravity fed from the tanks to the township below via 7884m of pipe of predominantly MDPE and uPVC 40mm, 50mm and 100 mm diameter pipe in approximately equal quantities (Figure 2-8). There is some unknown pipe work that will need to be assigned a material type and condition.

Figure 2-8 Glenorchy Reticulation by Diameter and Material



Source: Hansen via SharePoint, accessed 28 November 2011

Figure 2-9 Glenorchy Reticulation by Diameter and Age



Source: Hansen via SharePoint, accessed 28 November 2011

Parts of the town remain un-reticulated and these properties source their water from private bores or roof water collection systems. Glenorchy's reticulation network has few isolation valves to facilitate cleaning, maintenance and pipe repairs. More valves are required at key locations within the reticulation network.

2.6.1 Other Reticulation Improvements

The draft 2012-2022 LTP has a current and future projects list which includes several improvements aimed at improving supply volumes and security to developments. These mainly involve replacing existing pipe assets and installation of new mains where required to improve supply volume and pressure. These improvements contribute to the adequacy of water supply at all points as required by Section 69S of the Health (Drinking Water) Amendment Act 2007 and indirectly impact on public health but are not all specifically detailed in the PHRMP Improvements Schedule.

2.7 Backflow Prevention

Section 69ZZZ of the Health (Drinking Water) Amendment Act 2007 briefly sets out detailed requirements in respect of backflow prevention. This section applies if a supplier considers that backflow risk is an issue for the reticulation network. The supplier may install backflow prevention devices or require connected consumers to do so and requires annual checking and verification to ensure the devices are effective.

The Glenorchy water supply is thought to have a moderate risk of backflow. The reticulation system is low lying relative to the reservoirs and low pressure has been identified to some parts of Glenorchy. Therefore, there is a risk of backflow.

QLDC currently have no policy on backflow prevention. Some measures have been taken to install backflow prevention devices in known risk areas and on Council owned properties. But this has not been implemented on a district wide basis. QLDC is investigating a policy that will target commercial and agricultural or lifestyle premises for installation of backflow prevention devices and make installation compulsory on new properties.

2.8 Tankered Water Carriers

This activity presents a risk to the mains water if backflow is allowed to occur from the tanker back into the mains. DWSNZ 2005 (revised 2008) in Section 11 requires water carriers to have a PHRMP and be registered

on WINZ. The MoH *Guidelines for the Safe Carriage and Delivery of Drinking-water 2008* set out the standards for this activity. It is prudent for Councils to have a register of all water carriers in their district and to ensure all are registered on WINZ and have a PHRMP as conditions of allowing water to be drawn from Council water mains. In addition it is advisable to keep the register up to date and audit the carriers annually either randomly or on a selected basis to ensure backflow prevention measures are being taken to protect the mains water. This issue is included in the PHRMP Risk Information Table and Improvement Schedule.

The legislation does not cover tankers taking water for other purposes such as road works or similar but the risks from such water tankers are probably greater so it is prudent to ensure all water tankers have adequate backflow prevention measures in place and that periodic checks are made on compliance.

2.9 Management Systems

The Council owns, controls and manages the public water supply systems. The council does this through its council and staff. The council has from 2009, taken seriously the responsibility for this activity and established a 3 Waters unit to deliver the management of these assets. Prior to this there had been various delivery models involving the use of consultants.

The day to day operation and maintenance of the Glenorchy water supply infrastructure assets is contracted to Veolia. QLDC Infrastructure Services department undertake supervision of the maintenance contract.

Figure 2-10 shows the management hierarchy and reporting lines currently active.

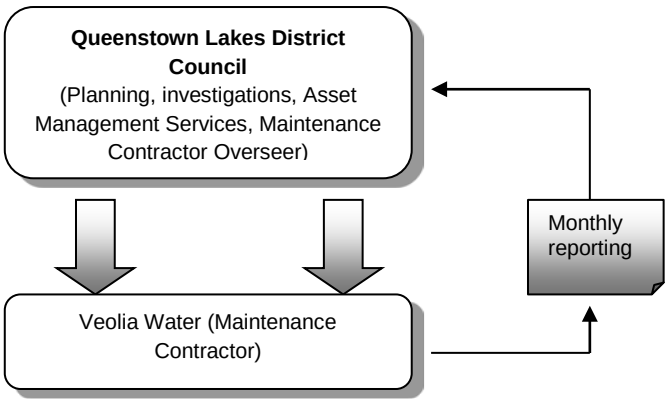


Figure 2-10: Water Supply Management Structure

With the council taking over responsibility for its core activities it enables a whole of life approach across the asset.

2.9.1 Operations and Maintenance

The responsibilities of the contractor are detailed in the latest *Management, Operation and Maintenance of Utilities Contract* document dated 1 July 2011. The O&M contract with Veolia details their daily, weekly, monthly and annual checks and procedures including:

- Routine checks on hydrants, valves, pumps and pipelines.
- Repairs and maintenance for items such as leaks, breaks and failures.
- Routine checks and day to day operation of the Water treatment plants including:
  - Regular inspection;
  - Plant operation;
  - Testing and analysis.

- Non-structural maintenance of buildings and reservoirs.
- Emergency and supplementary works as required.
- A pro-active approach to the work whereby the contractor is expected to report any system weak points and suggest corrective measures to the Three Waters Manager QLDC by means of "Early Warning" notices.
- Procedures for hygienic pipe repairs and disinfection and hygiene policies for staff carrying out both sewer repairs and water pipe repairs to avoid cross contamination.
- Staff training levels and competency to be maintained by the contractor and records kept as to training needs and levels achieved for each staff member.
- Operate the SCADA system as it is to monitor and control the assets as best it can given the acknowledged limitations of the SCADA system to accurately report data and trends for key parameters such as FAC, pH and turbidity.

2.9.1.1 Standards and Specification

Council's O&M contractor works to specified levels of service and performance indicators. Important key performance indicators are defined and include time taken to respond to pipe leak reports from RFS, response to waste water leak reports, and response to pump failure alarms as examples. Appendix B provides detail of these requirements.

2.9.1.2 Request for Service (RFS) System

An important component of the O&M system is Councils Request for Service, (RFS), database which allows for the dispatch and the tracking of complaints and referrals to Council in an efficient and measurable way to ensure KPI's are met, or if not met, where the failure has occurred. The operators are e-mailed tasks from the RFS system to electronic tablets carried with them and report back to RFS on a standard form when the job is done.

2.9.1.3 Performance Monitoring - SCADA

Supervisory Control and Data Acquisition, SCADA, is the tool for taking the information of what is occurring at the various pump stations, reservoirs, treatment plants and other remotes sites to make the information useful for driving the operation of the networks as well as reporting on how they are working. SCADA is a high risk system that is still to progress to resolution. The SCADA network, apart from Lake Hayes, has the following overall risks attached to it:

- No contract in place with the Service Provider
- No operating manuals for the work undertaken by the Service Provider.
- Intellectual property for the transfer of raw data into council compatible data is owed by the Service Provider
- No back up to the Service Provider
- Unknown reliability of SCADA network under the control of the Service Provider

A project to remove these risks and also look at the communication network from the individual sites is underway.

Over the last year the Maintenance Contractor has developed the Aspex, Graphical User Interface (GUI)) front end for SCADA which is for the first time giving council staff visibility of the operational aspects of the network. This has simplified the process for viewing information and has identified numerous shortcomings in the operation of Three Waters. It has become obvious that contractors have not resourced the management side of the maintenance contracts and faults such as incorrectly operating pumps, valves and flowmeters have had to be identified to them. The Aspex screens are still in development and once in place the Contractor needs to become familiar with the interpretation and operation.

2.9.1.4 Sampling and Reporting Requirements under the O&M Contract

Veolia staff, in accordance with their contract, take water samples for *E.coli*, pH and turbidity testing from the rising main post treatment plant and at three points in the reticulation system, (post reservoir), storage. Samples are submitted to the Watercare Laboratory located near to the Veolia base premises in Frankton. Watercare Laboratories is an IANZ accredited laboratory approved by the Ministry of Health for pH, turbidity and *E.coli* testing. The results are entered into an Excel workbook and this is forwarded to QLDC once per month.

The contractor is also required to send a monthly activity report to the Council detailing all activities undertaken under the contract scope. Separate Incident Reports are also supplied for any incidents that occur such as sewage spills or loss of supply or pressure to an area detailing action taken and resolution.

2.9.1.5 Staff Training

The senior staff at Veolia have relevant water industry qualifications and the operators receive on-the-job training under the supervision of experienced Supervising Operators. Veolia has its own very extensive and detailed policy and procedure documents which are applicable in a generic way to the infrastructure managed. Veolia have also written specific O&M manuals for each supply they manage which are useful staff training tools.These will require updating every three years.

The two experienced Supervising Operators from Veolia are responsible for inducting and training new staff depending on skill level and they adopt a hands-on practical approach to bringing new operators on line. The table in Appendix C shows the present qualifications of the Veolia staff involved in running the water supply assets and their designations.

The staff have a range of qualifications that are all applicable to the work they do but in terms of current Water Industry Training Organisation and New Zealand Water and Wastes Association training guidelines, (which are incorporated into the Ministry of Health protocols for the grading of drinking water supplies), there are staff training gaps which should be corrected. The following minimum qualifications are recommended for staff involved with drinking-water supplies serving 500 to 5,000 consumers:

Treatment plant(s) serving an aggregate population of:

- 500–5000
  - Management or supervision — Until 1 May 2005: Water Treatment C Grade Certificate. Thereafter category (d).
  - Operational process performance — Until 1 May 2005: Water Treatment C Grade Certificate. Thereafter category (c).

Reticulation systems serving an aggregate population of:

- 500–5000
  - Management or supervision — (b), as shown in Table 2-3 below
  - Operational process performance — (e) to be completed by 1 January 2006 or earlier

Table 2-5 details the current Water ITO and NZWWA qualifications (a) to (e) as set out above.

Table 2-5: Minimum Recommended Qualifications to Obtain a Bb Grading for Water Treatment and Distribution

	New Qualification*	Old Equivalent
		Water Treatment A Grade Certificate, equivalent National Certificate, or other equivalent (for example, NZCE and five years' relevant experience).
(a)	National Diploma in Drinking-water strand Water Treatment (Site Technician).	Expanded Water Treatment Grade B Certificate.
(b)	Professional degree (i.e., BE Civil or Chemical, BSc or B Tech) with demonstrated competence as a technical professional in the water treatment or reticulation area including additional unit standards from the National Diploma in Drinking-water strand Water Treatment (Site Technician) as specified by the Water ITO (see Note 1).	Professional degree (i.e., BE Civil or Chemical, BSc or B Tech) with demonstrated competence as a technical professional (i.e., registered engineer or equivalent).
(c)	National Certificate in Water Treatment (Site Operator).	Basic enhanced Water Treatment Grade C Certificate.
(d)	National Certificate in Water Treatment (Site Operator) plus additional unit standards from the National Diploma in Drinking-water strand Water Treatment (Site Technician) as specified by the Water ITO.	Basic enhanced Water Treatment Grade C Certificate with additional units depending upon the types of treatment process operating in the plant
(e)	National Certificate in Water Reticulation (Service Person Level 3) with strands in water and wastewater.	None.

* Categories A, B, C, and D above all require that there shall be continuing personal development education (CPD) that is recognised as contributing to minimising public health risk. The extent of ongoing education requirements shall be the subject of consultation with the water industry.

Note 1: Intent to obtain appropriate unit standards as part of part of the required CPD within a two-year timeframe is an acceptable solution.

Timetable for qualifications:

- National Certificate in Water Treatment (Site Operator): registered with the NZQA July 2001
- National Diploma in Drinking-Water Water Treatment (Site Technician Strand): registered with the NZQA April 2003
- National Certificate in Water Reticulation (Service Person) (Level 3) with strands in water and wastewater: registered with the NZQA August 2002.

Veolia has a comprehensive training programme in place to ensure staff training gaps are filled. Staff training is included in the PHRMP Improvements Schedule.

2.9.2 Demand Management Plans

Managing water demand is now a key priority for the community and a key strategic priority for Council. The measures recommended for implementation on a district wide basis for the short and long-term are detailed in Section 4.4 of the QLDC Water Supply Activity Management Plan Summary document and summarised below.

Table 2-6 3-Waters Strategy – Demand Management Actions

ACTIONS	
Short Term (0-3 years)	• Continue demand management planning and monitoring ➢ Continue night flow monitoring programme ➢ Complete bulk metering programme ➢ Develop a database of water use ➢ Calculate economic level of leakage ➢ Continued evaluation of demand management options
	• Implement short-term actions from demand management plans e.g. ➢ Water loss reduction programmes ➢ Public education ➢ Targeted education for commercial properties ➢ Metering without charging for new properties
	• Analysis of water quality risk management options

ACTIONS	
Medium Term (3-10 years)	• Demand management option implementation e.g. ➢ Water efficient fixtures; ➢ Universal metering / volumetric pricing
Long term (10 years and beyond)	• New strategic water intakes with treatment

The WDMP programme is listed in the Improvements Schedule of the PHRMP because of its importance to the sustainability and security of the supply which has impacts on public health in the wider sense.

2.9.3 Data Management

Critical to the management of 3-Waters assets, and therefore service delivery to consumers and safety of water supply, is the need to capture and update data on the individual networks. Information is fundamental for establishing systems models, their calibration and planning future options. Council currently hold information on water, wastewater and stormwater facilities within the Hansen Asset Management System. Further details on the types of data management systems are found in Appendix B Management Systems – Additional Information.

2.9.4 Water Supply Bylaw

The QLDC Water Supply Bylaw came into force on 1 December 2008. The Bylaw currently has provision to allow Council to enforce water management tools such as metering, restrictions, protection of water supply. However, enforcement actions have not been actioned under the Water Supply Bylaw 2008 to date as there is no mechanism for collecting and processing fines or bill for water use. This should be addressed to enable enforcement of the Bylaw.

2.9.5 The Long-Term Plan, (LTP)

The LTP is the outcome of a community consultative budgeting process and shows allocated funding for asset renewals and acquisition over the next ten years. Capital works items from the draft 2012-2022 LTP have been transferred to the PHRMP where these are relevant to the public health safety and continuity and sustainability of the drinking water supply. However, provisions in the LTP may be subject to change as a result of further public consultation for future Annual Plans, LTP's and revised spending priorities by Council.

2.9.6 The Emergency Management Plan

QLDC has obligations under the Civil Defence Emergency Management Act 2002 to manage the effects of emergency events on Council's Water Services Networks. The Emergency Management plan (EMP) defines the roles and responsibilities of the various parties involved in managing and operating Council's Water Services during an emergency event. This plan is only applicable up until the point at which a state of Civil Defence Emergency is declared.

The Emergency Management Plan contains the following information in relation to an emergency event:

- Roles, practices and procedures for dealing with an emergency;
- Names, contact details and specific duties of Emergency Co-ordinator's staff;
- Details of the communication and information systems to be used;
- Flow charts specifically outlining the procedures and responsibilities.

3 Drinking Water Standards (revised 2008) Compliance

3.1 DWSNZ Compliance Requirements & Status

The following table identifies the requirements that Glenorchy must meet to achieve the Drinking Water Standards for New Zealand 2005 (revised 2008) and current compliance status.

Table 3-1 DWSNZ 2005 (revised 2008) Monitoring Requirements and Compliance Status

DWSNZ Monitoring Requirements			WINZ Annual Survey Compliance Results 2010/11	Comments
	Criteria	Monitoring Requirements		
Bacterial Compliance				
E.coli Treatment Plant Monitoring	1	Frequency = 2x week Max days between samples= 5 Min days of week used= 6	Non compliant with Criteria 1	Veolia staff presently sample at a rate of one sample every two to five days. This equates to two samples per week or 25 per quarter. In 2010/11 non compliance due to inadequate number of samples, sampling on the days of the week, max number between samples. Veolia has amended the sample schedule to ensure future compliance.
E.coli Distribution Zone Monitoring	**6A**	Frequency = 13 per quarter Max days between samples= 11 Min days of week used= 5	Compliant with Criteria 6A	Samples are taken every 4 to 10 days from one of two points in the reticulation which equates to around 13 samples per quarter. An inadequate numbers of samples were taken in 2010/11 (2 samples), however leniency was granted by Public Health South.
Bore Water Security		Bore head must be sealed Animals must be excluded from within 5m of the bore head. Contaminant sources and migration pathways must be addressed in the PHRMP.	Not reported – see notes on right.	Bore heads were assessed by the Drinking Water Assessor (DWA). The existing fences are not 5m from the bore heads. However, the existing fences serve the purpose of keeping animals out and were deemed appropriate by the DWA.
Protozoal Compliance				
	TBC	TBC – dependant on log credit agreed by DWA and additional treatment process chosen.	Not Compliant	Treatment plant upgrades are planned to become compliant with DWSNZ 2005.
Cyanotoxin Compliance				
	Na	No requirements as does not apply to groundwater sources.	Not applicable	It is unlikely that algal blooms in the Bucklerburn River will ever present a significant risk to the supply as the river gravels act as a good filter for large algal cells.
Chemical Compliance				
Chemical Compliance	P2a	No P2a chemical determinand monitoring requirements registered.	No P2a chemical determinand registered	Sampling shows that raw water chemical organic and inorganic constituents are at low levels and well below the GV and MAV values set out in DWSNZ 2005 (rev. 2008).
	P2b	No disinfection by-products (DBP's) currently registered on WINZ as P2b monitoring requirements.	No P2b chemical determinand registered	Raw water sampling required to include natural organic matter, (NOM), measurements after moderate to heavy rainfall events to gauge the extent of likely DBP formation.

DWSNZ Monitoring Requirements			WINZ Annual Survey Compliance Results 2010/11	Comments
	Criteria	Monitoring Requirements		
	P2c	Public notices are required in the format described in DWSNZ 2005 (rev 2008) section 8.2.1.4 to warn the public to flush taps for Plumbosolvent water.	Not reported	No testing has been done to demonstrate that it is not plumbosolvent. Public notices are issued regularly.

Source: QLDC Water Treatment Strategy, Raw Water Quality and DWSNZ 2005 (Revised 2008) Compliance Evaluation March 2010.

3.2 Water Quality Monitoring

Regular sampling for E.*Coli,* pH and turbidity is carried out by Watrcare. Appendix D illustrates the water sample locations.

Water quality data is held in QLDC's Data Warehouse, which is regularly updated from WINZ. The following table summarises the raw water quality data taken from the Glenorchy supply for the February 2007 and June 2011 period.

Table 3-2: Drinking Water Quality Results / Standards Compliance

Test	Drinking Water Standards GV / MAV Limit	Raw Results 2007-2011*		
		Max	Min	Median
E. coli	0 (zero/100ml)	2[1]	<1	**<1**
Turbidity	<2.5 (NTU)	2.60	0.04	**0.22**
pH	7.0 – 8.5	7.80	6.97	**7.56**

Source: *WINZ via SharePoint accessed 21 Nov 2011. [1] one transgression in 2008.

For the most part, E coli results from 2007 and 2011 indicate the source water is free of bacterial contamination, however, one E.coli transgression was recorded in 2008. This sample result also corresponded with elevated turbidity reading of 2.6NTU.

There have been no complaints from consumers over the years about taste, odour or colour in the water and considering the rudimentary treatment a lot of credit for this has to go to the operator's diligent management and experience with the supply. The reticulation monitoring shows fairly consistent levels of turbidity within acceptable GV values. Overall the water is of a good potable standard and has high acceptability from consumers and most would not want to see the supply chlorinated.

3.3 Protozoa Compliance

The Glenorchy supply is not protozoa compliant for the treatment plant as yet. For Council to become compliant with the protozoa compliance criteria, Council must first confirm the protozoal log credit requirement based on the perceived risk related to the surface water catchment or groundwater categories as defined in Table 5.1a. in the DWSNZ 2005.

The protozoal log removal requirement can be determined using a catchment risk category approach, which is the standard approach for water supplies serving a population **up to** 10,000. The catchment risk categorisation procedure involves a survey of the catchment. A catchment risk assessment was completed

for Glenorchy in March 2009[2]. A summary of this assessment is provided in the "Catchment Risk Categorisation Survey Result Form" (as set out in Appendix 3 of the DWSNZ 2005) in Appendix E.

Weekly sampling undertaken between 2009 and 2010 as part of the Water Treatment Strategy (GHD, 2010)[3] to check the feasibility of adding UV to gain 3 log removal credits for protozoa has shown the following:

- The water is pH neutral and soft (mean total hardness 52 mg/L as CaCO).
- The Langelier Saturation Index (LSI) indicates a well balanced water (mean -0.61).
- Levels of iron, manganese and ammonia are very low and well within the MAVs. Conductivity of the water is low and consistent with the other recorded mineral parameters.
- Ultraviolet Transmission (UVT) and Ultraviolet Absorbance (UVA) are excellent (UVT > 99%) and meets the requirements for UV to meet Section 5 DWSNZ for protozoa.
- The on line turbidity data shows significant oscillation in turbidity and between 0.1 and 2 NTU. Four data points exceed 2 NTU in the three month period monitored however (the upper threshold for UV compliance).

The turbidity data indicates that pre filtration is likely to be required. However, evaluation of the full 12 month data cycle from the on line turbidimeter, in line with the DWSNZ, is required in order to confirm this position. Note the data resolution recorded is poor and this should be to a minimum of two significant figures.

Based on the following information:

- existing Catchment Sanitary Survey Assessment results;
- the water quality monitoring results summarised above;
- bore head security status gained for the Glenorchy bores indicating satisfactory protection to the groundwater, as required by DWSNZ 2005, S4.5.2.2; and
- Table 5.1a. in the DWSNZ 2005.

it is suggested that a low to moderate risk from protozoa exists and therefore a **log 3 protozoa removal** is required for the Glenorchy supply.

Reassessments of catchment risks must be made at least five-yearly intervals in accordance with the DWSNZ 2005 (revised 2008). Baseline data supporting the catchment surveys should be recorded appropriately to enable future review of the catchment survey to take place. This is included in the Improvement Plan.

[2] QLDC Catchment Risk Assessment – Arthurs Point Water Supply, March 2009

[3] QLDC Water Treatment Strategy – Raw Water Quality and DWSNZ 2005 (Rev 2008) Compliance Evaluation, March 2010.

4 Risks to Public Health

The tables below list the barriers to contamination for Glenorchy. Risks and improvements to the water supply are provide in Section 5.

Table 4-1: Glenorchy Water Supply Barriers to Contamination

Barriers	Description	Status
Stop contamination of raw water	Limited formal management of the catchment to control activities that may pollute the water supply. The bores draw from a shallow unconfined aquifer. Bores are in a lightly grazed paddock but are fenced off out to approximately 2 metres.	**Absent**
Remove particles from the water	The water is naturally filtered through gravels. There is no additional filtration process at the plant for removing particles if present. Historically, monitoring has shown turbidity is low.	**Partially Effective**
Kill germs in the water	Monitoring has shown the absence of *E.coli*. There is no chlorine disinfection or protection against protozoa e.g. Cryptosporidium.	**Ineffective**
Prevent recontamination after treatment	Covered reservoirs, plant and reticulation monitoring of *E.coli* but no residual disinfection is provided. Hygienic pipe repair procedures under the O&M contract. Reticulation flow and pressure modelling is incomplete. Backflow prevention is not consistent and checking of installed devices is not assured under current procedures. Leakage rates and consumption rates are excessive indicating numerous pipe leaks which could allow negative pressures and backflow into mains and laterals.	**Partially Effective**

The risk analysis tables and method used to assess risk follows that shown in the Ministry of Health PHRMP Guidelines for water supplies and are designed to reflect the specific nature of and temporal dynamics of water supplies in which changes can occur hour to hour, or minute to minute and require a corrective response.

Events related to the Glenorchy water supply system that could potentially have an impact on public health have been listed in the following Risk Summary Tables. Each event has been evaluated on the basis of likelihood and the consequence (or outcome) if it occurs. Definitions for likelihood and consequence are provided in Appendix F. The overall risk estimate for each event is determined by combining likelihood and consequence using the matrix provided in Appendix F.

Risk Information Table 4-2 gives the full details of the risk analysis. Risks from the Catchment Risk Assessment (March 2009) classified as Moderate or above have been included also.

Table 4-2 Public Health Risks and Improvements for Glenorchy

Supply Process Element	Risk Event	Potential Cause	Likelihood	Consequence	Overall Risk	Preventive / Mitigating Measures	Essential Monitoring Checks and Records	Immediate Corrective Actions	Future Preventive Measures/Corrective Actions
Source and Abstraction	Groundwater becomes contaminated	Accidental spillage of wastes or chemicals during handling or transport.	Ra	Ma	2	No chemicals likely to be transported near to the bores	Monitor for chemical determinands if incident occurs	Emergency response to chemical spill events by ORC and QLDC to minimise impacts on the groundwater Rely on emergency supply if water quality cannot be maintained.	
		Agrichemicals or pesticides used within catchment enter the groundwater	Un	Ma	3	Strict controls on pesticide application under ERMA and MoH supervision.	Monitor for chemical determinands for impact of land use activities on water		Implement a programme of grab samples for chemical parameters, in conjunction with UVT, NOM and telemetred turbidity meters to assess surface water influences
		Heavy rain in catchment leads to groundwater contamination	Un	Mo	3	Groundwater at 15 metre depth is reasonably well protected from surface influences	Raw water turbidity data recorded on plant log sheets	Refer to Contingency Plan as above for E.coli transgressions.	
							E.coli samples twice weekly		
						Raw water turbidity is in the range 0.3 to 1.0NTU for the most part	Operators check pre-reservoir turbidity manually weekly	Rely on emergency supply if water quality cannot be maintained.	Improve knowledge of the catchment area generally and any trends likely to impact on the groundwater supply in future (will involve reassessment of catchment risks at least five-yearly intervals in accordance with the DWSNZ 2005, revised 2008).
		Livestock and other animals within catchment contaminate the groundwater with E.coli and protozoa.	Un	Ma	3	No intensive activity in the catchment to cause significant contamination events near to the bores	Checks for presence of E. coli in water samples as per DWSNZ 2005 twice weekly	Record all E.coli transgression events and actions in an Incidents Log or WINZ as appropriate.	
		Upstream waste discharges into the groundwater including: -septic tanks -landfill leachate; -contaminated sites.	Un	Ma	3	Bore site is not subject to flooding except under exceptional circumstances	Monitor turbidity	Respond to turbidity event as per the operational contract and take corrective action as required	Implement a programme of grab samples for chemical parameters, in conjunction with UVT, NOM and telemetred turbidity meters to assess surface water influences
						Boreheads are contained in concrete chambers above ground level with secure steel lids	Operator checks on raw water turbidity during plant visits twice weekly.	Repair damage and failed bore seal and pump the bore till clear E.coli test result is obtained	
							Operator site checks weekly including bore and well installation checks for damage and signs of interference		Check the bore and wellhead security in terms of DWSNZ 2005 and upgrade as necessary to meet groundwater security Criterion 2
						Regional Council District Plan Rules require resource consents for any discharges and all consents are monitored	Monitor turbidity	Record all E.coli transgression events and actions in an Incidents Log or WINZ as appropriate.	Ensure QLDC Water and Waste staff are informed by the Regional Council of new discharge consent applications in the catchment likely to affect groundwater quality (NES requirement)
						Turbidity monitoring records show generally low results indicating that the source is not ordinarily affected by surface activity and wet weather events	Sample general suite of contaminants to assess any groundwater contamination	If turbidity remains high stop the plant and do not start up till the cause is found and rectified.	Determine the final protozoa log credit removal requirement for the supply to guide treatment upgrade design
	Too little water can be drawn from the bore.	Bore and treatment plant site flooded by the river or damaged by natural disaster (earthquake)	Ra	Ma	2	No history of flooding to date and the boreheads are well sealed to exclude surface water ingress	Weekly visits by the operator	Rely on stored water till plant is restored and impose water restrictions	Complete an emergency supply plan in the event of prolonged loss of the water supply.
		Bore Pump failure	Po	Ma	4	SCADA alarms on plant intake flow warn of pump failure. Standby pump operational	Monitor and record raw water flow rates on SCADA	Provide an alternative emergency supply.	
		Bore screens damaged or blocked	Un	Ma	3	No history of bore screen blockage to date		Carry out emergency work to reinstate/repair screens and/ or pumps.	
		Drought depletes the groundwater	Un	Ma	3	Rainfall is adequate all year round to recharge the groundwater aquifer	Record any low flow alarm causes and corrective actions taken	Use reservoir storage in the short term if sufficient.	
		Increasing demand from new subdivisions and commercial activity	Po	Ma	4	Water Demand Management Plan has been adopted by Council	Consumer demand and leakage data from the WDMP programme	Invoked water supply restriction under the WDMP and water supply bylaw If corrective actions fail invoke Loss of Water Contingency Plan 6.3	Identify and install facilities to meet future water supply demand
		Major pipeline or valve failure	Po	Ma	4	Veolia staff can repair any pipe breaks quickly under the O&M contract	Record Observations / Corrective Actions taken in an Incidents Log.	Carry out emergency work to reinstate/repair screens and/ or pumps.	Complete an emergency supply plan in the event of prolonged loss of the water supply.
		Major power or control failure	Po	Ma	4	Power outages are infrequent and of short duration only. Regular inspection of electrics undertaken	Inspect electric control panel as part of regular maintenance	Invoke and enforce emergency water use restrictions to curb demand	
		Serious sabotage or vandalism	Po	Ma	4	The bores are fenced to prevent animal access and wellheads securely locked in a	Operator checks all plant for interference or damage	Upgrade security if vandalism becomes a problem	Consider moving fences to at least 5m from bore head to ensure compliance

Supply Process Element	Risk Event	Potential Cause	Likelihood	Consequence	Overall Risk	Preventive / Mitigating Measures	Essential Monitoring Checks and Records	Immediate Corrective Actions	Future Preventive Measures/Corrective Actions
						concrete chamber			with DWSNZ 2005
Treatment	pH Correction: pH level too high or too low in the finished water i.e. below pH 6.5 or above pH 8.5	Chemical spill or overuse in the catchment	Un	Mo	2	ORC rules prohibit the use of toxic chemicals near waterways	pH is tested manually during operator visits and recorded on the plant log sheets.	Shut off the supply if a serious pH problem is suspected during plant visits i.e. pH above 9	
		Excessive raw water turbidity causes particle breakthrough.	Li	Ma	5	Operator awareness and training and clear instructions in the O&M manual as to when to cease abstraction if possible	Turbidity is monitored continuously at the treatment plant and logged to SCADA	Follow O&M manual procedure	Produce an adequate O&M Manual for the supply
		Incorrect calibration of pH probe	Un	Mo	2	pH meters are calibrated weekly and service yearly under contract.	Check calibration of pH meter manually and recordon plant log sheets by the operators	Calibrate the pH meter as per manufacturers' instructions.	
		Natural Raw water pH variations	Un	Mo	2	Raw water pH is stable around pH 6.6 to 7.2 from a stable catchment area	Monitor turbidity and pH -Control Limit is pH in the range 6.5 to 8.0. - Control limit is 2 NTU maximum	No pH correction ability is in place at present	Improve SCADA reliability and capability to ensure reliable data transmission and trends analysis by the operator remotely
		No pH control in place	Un	Mo	2	Operator vigilance and training.		Rely on stored water if this is clearly not affected by the event.	
	Treatment: Particles not removed by a treatment process	Local contamination due to stormwater flows and run-off from the land	Li	Ma	5	No history of flooding to date and the boreheads are well sealed to exclude surface water ingress	Monitor turbidity- Control limit is 2 NTU maximum	Rely on stored water if this is clearly not affected by the event.	Implement a programme of UVT grab samples , NOM and telemetred turbidity meters to assess the feasibility of the proposed UV upgrade
		No effective particle removal or inactivation barrier is provided for protozoa	Ac	Ma	5	No effective particle removal or inactivation barrier in place	Monitoring of the process in accordance with DWSNZ 2005 for the chosen technology once installed	Use stored water till supply can be resumed at less than 2NTU turbidity If corrective actions fail invoke the Contaminated Water Contingency Plan 6.2 and Figs 4.1 and 4.2 DWSNZ 2005	Upgrade treatment processes in line with the results of the QLDC raw water sampling to achieve the required log credit removal for protozoa as far as practicable
		Re-suspension of sediments at the pump intake	Li	Ma	5	Raw water turbidity is generally low and <1NTU	Operators check turbidity manually during plant visits weekly and record on plant log sheets	Plant shut down if the turbidity Control Limit is exceeded.	
Distribution	Reservoirs: Contamination of water in reservoir/s passes into the reticulation system	Contamination enters the roof or inspection covers	Un	Mo	3	Reservoir cleaned to remove any accumulated sediment when required	Operator checks site monthly	Invoke Contingency Plan 6.2 if a reservoir contamination event has occurred	
						Reservoirs have new lids and are well sealed against outside influence			
		Sabotage or vandalism	Un	Mo	3	Tanks are on private property and not open to public view or readily accessible	Operator checks site monthly	Report any damage or interference to Council immediately and undertake repairs.	
		Sediment in reservoir and/or re-suspension	Un	Mo	3	Operator checks reservoir monthly	Reticulation pH and turbidity taken manually weekly by Watercare staff	Respond to low chlorine alarm and adjust chlorine dose if FAC is less than 0.5 mg/l ex reservoir in any sample	Review O&M cleaning procedures for reservoir and distribution system.
	Reservoirs: Not enough water in post-treatment storage to meet demand	High lift pumps from treatment plant fail	Po	Mo	3	Pumps at the treatment plants can be repaired quickly locally.	Check pump intakes	Repair pumps using standby capability. If Corrective Action fails refer to Loss of Water Contingency Plan 6.3	
		Inadequate storage capacity exacerbated by high demand and excessive water leakage	Po	Mo	3	Reservoir is generally adequate for the existing average and peak demand	Records of consumer complaints (e.g. regarding low pressures or loss of supply) through the RFS database	Attend to consumer complaints about loss of pressure or supply as per the O&M contract and report to Council	Install reliable flow meters to capture flow and pressure data to calibrate the dynamic water supply models
						Reservoir low level probe initiates plant start up	Monitor reservoir levels. Control limits for reservoir level generally set at 95% high and at 80% low	Issue immediate notice of water restrictions to the community if supply is seriously interrupted for more than 4hrs	Upgrade storage to meet peak future demand and allow for 24 hours contingency storage
						Water Demand Management Plan has been drafted and submitted to QLDC	Monitor plant flows. Log to SCADA		Implement the Water Demand Management Plan Recommendations and Water Supply by-law to reduce water losses to an acceptable level.
		Pipeline failure or break causes loss of water in reservoir	Po	Mo	3	O&M Contract requires immediate attention to any pipe failures.	Visual and aural checks on the pumps weekly.	Repair breaks in mains as required as per O&M service contract.	Fit earthquake (high flow) shut off valve to the reservoir to ensure at least 50% of stored water volume can be saved.
		Sabotage or vandalism	Po	Mo	3				
		Structural failure of the reservoir	Po	Mo	3	SCADA low reservoir alarms are fitted to warn the operator	Monitor plant flows. Log to SCADA	Issue immediate notice of water restrictions to the community if supply is seriously interrupted for more than 4hrs	
	Reticulation:	Dead end resulting in aged water	Li	Mo	4	Prompt attention by VEOLIA (eg flushing) to	RFS system records on water quality	Flush line and check turbidity and pH to	

Supply Process Element	Risk Event	Potential Cause	Likelihood	Consequence	Overall Risk	Preventive / Mitigating Measures	Essential Monitoring Checks and Records	Immediate Corrective Actions	Future Preventive Measures/Corrective Actions
	Contamination of water from within the distribution system itself					discoloured water complaints via the RFS customer service at Council.	complaints.	ensure it is back to normal level for the area based on past monitoring results	
							VEOLIA monthly reports to Council on complaints and response actions taken		
		Development of biofilm and resuspension of sediment	Li	Mi	3	QLDC to consider a pipe scouring and cleaning programme under the O&M contract should it be identified as necessary.	RFS system records on water quality complaints	Contractor respond to the notification via RFS or to direct observation and investigate the affected line/s as per VEOLIA procedures.	Implement the hydraulic model for the scheme to identify at risk areas for low flow and pressure
		Plumbosolvent water leaching heavy metals out of private pipes and fittings	Li	Mo	4	Public notices re plumbosolvency and the need to flush taps.	Check notices issued during PHRMP Review process.	Send out the notices as required	Investigate plumbosolvency testing in water as per DWSNZ 2005 (rev 2008) , S8.2.1.4
	Reticulation: Inadequate backflow protection	No, or faulty, backflow devices installed	Po	Ma	4	Controls on taking of water from Council Hydrants	Check water quality at remote ends of the reticulation	Prohibit use of the Council mains by unregistered water carriers	Develop a formal policy and guidelines covering backflow protection
						Council policy (in Bylaw) on backflow prevention requires existing at-risk commercial consumers to have back flow preventers installed	Record any consumer complaints or incident reports on VEOLIA database	VEOLIA Engineer and operator attend site of the incident and assess the extent of the problem.	Check commercial high risk premises at least annually for back-flow testing or get a report from the Building Control Section annually
						Pressure in the retic is generally maintained at 300 kPa	Check reticulation pressures under high demand in known vulnerable areas	Isolate the affected part if possible and purge the affected water.	Fit additional isolation valves at key points in the reticulation to allow isolation and repair of affected areas
							Annual check on backflow preventers fitted to high risk premises.	Issue public notice to affected residents and shut off supply if possible	Implement the hydraulic model for the scheme to identify at risk areas for low flow and pressure
									Installation of Acuflow devices on domestic properties where existing toby requires replacement
		Water Carriers introduce contaminants while filling up tankers	Un	Ma	3	Adherence to the MoH Guidelines for the Safe Delivery of Drinking Water	Maintain an up to date register of DWC's	If corrective action fails refer to the Contaminated Water Contingency Plan 6.2 and Figs 4.1 and 4.2 DWSNZ 2005	Set up a register for water carriers using Council mains and audit annually on a random or selected basis
						Compliance with S11 DWSNZ 2005 Tankered Drinking water compliance criteria			
						Controls on taking of water from Council Hydrants	Council audits on Water Carriers on a random basis with emphasis on back flow protection for mains	Report any unregistered water carriers to the Medical Officer of Health and DWA for follow up	
						Council Register of Water Carriers			
	Reticulation: Introduction of contamination by pressure fluctuations and during repairs	Burst or leaking mains causes water and pressure loss.	Po	Mo	3	Condition assessment of mains in the Hansen database identifies life expectancy of pipes	Record incidences of pipe failure and repairs undertaken on Hansen and GIS and report to Council monthly	Isolate the affected part if possible and purge the affected water.	
						O&M contract with VEOLIA requires prompt attention to leaks and bursts		If corrective action fails refer to Contaminated Water Contingency Plan 6.2 and Figs 4.1 and 4.2 DWSNZ 2005 if a contamination event has occurred	
						Reticulation system is built to a modern standard and is well managed by VEOLIA	Council independent audit of hygienic pipe repair procedures and post disinfection by the contractor.	Undertake hygienic pipe repairs as required in the O&M contract and record on VEOLIA database.	
		High demand causing low pressure areas and backflow risk	Po	Mo	3	Emergency water restrictions can be invoked at any time.	Plant flow rates at peak demand times are measured and recorded on SCADA	Invoke water use restrictions to slow demand and maintain pressures and flows	Implement the hydraulic model for the scheme to identify at risk areas for low flow and pressure
						Reservoir elevation ensures pressures can be met at all times in the reticulation system	Operator site checks and plant flow monitoring reveals water losses		
General Risks	Water loss and contamination to supply	Catastrophic failure due to landslip or Civil Defence Emergency situation	Ra	Ma	3	No stability issues identified for the Glenorchy water supply assets	Check that the EM Plan is relevant and up to date	Refer to Contaminated Water Contingency Plan 6.2 and Figs 4.1 and 4.2 DWSNZ 2005 if a significant contamination event has occurred	Consider installation of Bypass Line to allow water supply system to operate in the event of landslip at reservoir site.
						QLDC Emergency Response Plan is in place		As per the EM Plan	
General (Management System) Risks	Monitoring and Management: Deficiencies	Delay in obtaining test results from lab	Po	Mi	2	Only an MoH approved laboratory is used,(Watercare), and alert notices for non-compliant test results, and E.coli transgressions, are specified in their contract	The Watercare laboratory is audited annually by IANZ	Advise the lab of any incorrect or erroneous results.	Use WINZ to record supply monitoring and compliance status and for the Annual Survey returns

Supply Process Element	Risk Event	Potential Cause	Likelihood	Consequence	Overall Risk	Preventive / Mitigating Measures	Essential Monitoring Checks and Records	Immediate Corrective Actions	Future Preventive Measures/Corrective Actions
	cause non-compliance					with VEOLIA			
							Check all test results as soon as received.	Corrective action may still be possible for tardy test results if the problem is ongoing. IANZ follows up on any corrective actions needed for accreditation	
		Failure of staff to follow QLDC QA procedures	Po	Mi	2	Regular monthly audit of Contractor performance under the O&M contract to ensure the required 'Levels of Service' are met.			VEOLIA needs to carry out internal staff performance audits against key performance indicators
		Inadequate monitoring and documentation of results and actions taken	Un	Mi	2	Contractor key performance measures include completeness of required documentation and recording of all supply data.	Monthly reports to Council on water quality monitoring activities by the contractor and recorded on WINZ.	Carry out E.coli follow -up sampling following all transgressions under the Watercare Lab contract as per Figs 4.1 and 4.2 DWSNZ 2005.	Ensure checks and monitoring are undertaken as per Planned Maintenance Schedule and accessible in format that is auditable
						Implementation of ASPEX provides council staff visibility of the operational aspects of the network			Contractor to improve interpretation and operation of ASPEX
						Contractor reports monthly on service provided against the O&M contract to Council.	Contractor is audited by Council staff against the contract monthly.		Ensure the WINZ information for the supply is corrected to reflect the current supply data
		Inadequate labelling or identification of plant and infrastructure components causes confusion and errors.	Po	In	2	Clearly labelled plant components and functions in the O&M manual	Hansen administrator checks that Hansen is updated with current assets		Clearly label and identify plant components and functions and update the O&M Manuals accordingly.
						Comprehensive Asset Management database Hansen is now in use		Update Hansen to reflect current assets	Develop the Assets Management Database (Hansen) to manage all water supply assets in future
		Inadequate or outdated QA and O&M manuals.	Po	Mo	3	Up to date QA and O&M manuals	PHRMP review checks that the O&M Manuals are up to date. Update O&M Manual for the supply on a 3 yearly basis	Update the O&M Manual when deficiencies are found	Update O&M Manual for the supply on a 3 yearly basis or after the introduction of any significant upgrades to facilities
		Inadequate staff training in correct procedures	Un	Mo	2	VEOLIA has a staff training programme in place	Record training all staff training attendances	Train staff to water ITO requirements	Set up a training needs assessment and training recording system for staff to meet water ITO and NZWWA training requirements
							Monthly reporting to Council on all activities under the O&M contract		
		Inadequate/incorrect sampling methods used.	Un	Mo	2	Regular staff training for new staff in particular in correct methods by VEOLIA.	Log any incidents and corrective actions taken in the incidents register and on WINZ	Amend the contract if service levels are inappropriate and/ or Council audit reveals weaknesses	Ensure follow up sampling is done following E.coli transgressions as per Fig 4.1 or 4.2 DWSNZ 2005
		PHRMP not properly understood and followed by staff	Un	Mo	2	Include key staff in the PHRMP process and provide training before and during implementation.	Regular PHRMP reviews as set out in Section 7.	Amend the PHRMP to include any new circumstances that have arisen.	Ensure PHRMP is understood by Council Staff and Operations and Maintenance Contractor's staff
		PHRMP Review not carried out as per the PHRMP Schedule	Po	Mo	3	Reviews carried out as per the PHRMP schedule	Three Waters Manager to check that PHRMP Review has been done and findings actioned	Review PHRMP and amend as necessary and action any findings	Ensure PHRMP and schedule of improvements are reviewed and updated at least annually for the first 2 years or after major works have been completed to reflect changing circumstances and requirements.
		SCADA Failure – no data received.	Po	Mo	3	Reliable SCADA system in place for basic functions Onsite local control on SCADA failure	SCADA records continuously for the parameters monitored and alarms are raised to the operator	Attend to the SCADA no data alarm and repair under the O&M contract or out contract the work if necessary	Upgrade the SCADA system to allow fully continuous monitoring and reporting on turbidity, FAC and pH in line with DWSNZ 2005 Chapter 3 and allow easy operator access to real time data.
						SCADA monitors continuously and alarm are raised to the operator immediately on failure.		Update the O&M manual to reflect new items and functions	

5 Improvement Plan

5.1 Overview

An important element in developing a PHRMP is to determine what can go wrong with the supply but this must be followed up by improving the supply system to mitigate any potential risks. Ensuring these improvements are integrated in to the Council's existing system of asset management and water supply management is vital to ensure the process is effective.

The improvements have been broken down into capital works and procedural improvements. Capital improvements require the addition of new assets to the water supply system and these are listed in the improvement schedule in Table 5-1.

Procedural updates are improvements that are required to the operational procedures used to run the water supply system. They comprise both reinforcing existing practices and adding additional procedures which assist to safeguard public health. These are also listed in the improvement schedule in Table 5-2.

The improvements are listed in terms of priority, similar to the Risk Rating, and are given a subjective priority ranking of 1 to 5 where 1 corresponds to a low priority improvement and 5 the higher priority. Improvements related to monitoring of water quality and source security are given higher priority in the LTP and PHRMP Improvements schedule.

A cost benefit estimation has also been included in the Improvements Schedule. A low cost - high benefit improvement is one where the cost is low compared to the significant public health benefit that will result from the improvement. Conversely, a high cost - low benefit improvement is one where the cost or expenditure does not result in a significant public health outcome. The Ministry of Health has stated that low cost - high benefit improvements should be given priority for actioning and the Improvements Schedule reflects this by scheduling most low cost benefit improvements for actioning during 2012 to 2013 where possible.

NB: In the table any reference to DWSNZ 2005 means DWSNZ 2005 (revised 2008).

Table 5-1 Public Health Risk Improvement Schedule for Glenorchy : Capital Works

Scheme	Supply Process Element	Future Preventive Measures/Corrective Actions	QLDC Project Code	Timeframe	Priority	Cost estimate	Comments	Who is Responsible	Project Type	Cost benefit estimation	Status
Glenorchy	Source and Abstraction	Identify and install facilities to meet future water supply demand	4048	2014-2016	3	$44,7208	Augmentation of the existing bore and well is required to meet future predicted demand	Three Waters Manager	Capex	High cost - high benefit	Planned
		Consider moving fences to at least 5m from bore head to ensure compliance with DWSNZ 2005		2012	4	<$5,000	Secure fencing is in place at the bore site to exclude animals and humans who may interfere with the assets. However fences. to be moved out to ensure compliance with DWSNZ.	Three Waters Manager	Capex	Low cost – mod benefit	To be completed
	Treatment	Improve SCADA reliability and capability to ensure reliable data transmission and trends analysis by the operator remotely	4045	2011/12	4	$2,068	Presently SCADA is hard to access and does not show FAC trends easily for operators . Water treatment Strategy recommends improved resolution of turbidity data.	Three Waters Manager	Capex	Low cost - high benefit	Planned
		Upgrade treatment processes in line with the results of the QLDC raw water sampling to achieve the required log credit removal for protozoa as far as practicable	5835 / 4048	2014 - 2016	5	$150,000	UVT / UVA sampling meets requirements for UV as per DWSNZ. Interim UV installation to gain 3 log credits for protozoa suggested.	Three Waters Manager	Capex	Mod cost - high benefit	Planned
	Distribution	Fit additional isolation valves at key points in the reticulation to allow isolation and repair of affected areas		2011 onwards	3	$5,000-15,000	Insufficient valves fitted presently	Three Waters Manager	Capex	Low cost - high benefit	In Progress
		Fit earthquake (high flow) shut off valve to the reservoir to ensure at least 50% of stored water volume can be saved.	5249	2012/13	4	$40,000	Presently the reservoirs would drain down after a major pipe break or other high flow event. Capital upgrade to be aligned with reservoir upgrade	Three Waters Manager	Capex	Low cost - high benefit	Planned
		Implement the Water Demand Management Plan Recommendations and Water Supply by-law to reduce water losses to an acceptable level.	4062	2011-2019	4	$21,000	These initiatives are required if long term sustainability is to be achieved. A Draft Water Demand Management Plan has been presented to QLDC	Three Waters Manager	Capex	Low cost - high benefit	Planned
		Install reliable flow meters to capture flow and pressure data to calibrate the dynamic water supply models	5818	2011/12	3	$10,000	Lack of flow metering at present hampers the water demand management work and the reticulation modelling work	Three Waters Manager	Capex	Low cost - high benefit	Planned
		Upgrade storage to meet peak future demand and allow for 24 hours contingency storage	5828	2012/13	3	$170,000	Water Demand study showed that storage is not adequate to meet current and future demand and the current water losses in the system	Three Waters Manager	Capex	Mod cost - high benefit	Planned
	General (Management System) Risks	Upgrade the SCADA system to allow fully continuous monitoring and reporting on turbidity, FAC and pH in line with DWSNZ 2005 Chapter 3 and allow easy operator access to real time data.	4045	2011/12	4	$2,068	Upgrade to the operator interface, data storage and reporting capability in terms of DWSNZ 2005 (rev 2008) and remote access for the operators. Also project to address: • No contract in place with the Service Provider • No operating manuals for the work undertaken by the Service Provider. • Intellectual property for the transfer of raw data into council compatible data is owed by the Service Provider • No back up to the Service Provider	Three Waters Manager	Capex	Low cost - high benefit	Planned

Table 5-2 Public Health Risk Improvement Schedule for Glenorchy: Procedural Improvements

Scheme	Supply Process Element	Future Preventive Measures/Corrective Actions	Timeframe	Priority	Cost estimate	Comments	Who is Responsible	Project Type	Project Sub Type	Cost benefit estimation	Status
Glenorchy	Source and Abstraction	Check the bore and wellhead security in terms of DWSNZ 2005 and upgrade as necessary to meet groundwater security Criterion 2	2011	4	<$5,000	Sealing around the riser pipes and aprons of the bores for compliance with DWSNZ 2005 S4.5.2.2 has been checked by an expert in the field and judged to be secure.	Three Waters Manager	Procedural	Management	Low cost - high benefit	Complete
		Complete an emergency supply plan in the event of prolonged loss of the water supply.	2012	4	<$5,000	An overall Contingency Plan is needed to bulk out the general Loss of Water Contingency Plan in the PHRMP	Three Waters Manager	Procedural	Management	Low cost - high benefit	To be actioned
		Determine the final protozoa log credit removal requirement for the supply to guide treatment upgrade design	2012	4	< $5,000	The Catchment Risk Assessment and bore depth at 19m suggest a 3 log credit requirement for the supply is likely. The boreheads comply with groundwater security criterion 2, DWSNZ 2005. Consultation with the DWA required	Three Waters Manager	Procedural	Management	Low cost - high benefit	To be actioned
		Ensure QLDC Water and Waste staff are informed by the Regional Council of new discharge consent applications in the catchment likely to affect groundwater quality (NES requirement)	2011 onwards	3	< $5,000	Liaison is needed with the Otago Regional Council on catchment protection issues under the NES.	Three Waters Manager	Procedural	Management	Low cost - high benefit	Ongoing
		Implement a programme of grab samples for chemical parameters, in conjunction with UVT, NOM and telemetred turbidity meters to assess surface water influences	2009/10	4	$5,000 - $15,000	Sampling has been completed and results show very low levels of determinands tested	Three Waters Manager	Procedural	Management	Low cost - high benefit	Complete
		Improve knowledge of the catchment area generally and any trends likely to impact on the groundwater supply in future.	2011 onwards	3	$5,000-15,00	Catchment sanitary survey needs to be reviewed annually along with the PHRMP	Three Waters Manager	Procedural	Management	Low cost - high benefit	Ongoing
	Treatment	Implement a programme of UVT grab samples, NOM and telemetred turbidity meters to assess the feasibility of the proposed UV upgrade	2009-2010	5	$5,000-$15,000	QLDC grab sampling has been completed with low turbidity and high UVT levels found. Still requires completion of turbidity monitoring to obtain 12 months data	Three Waters Manager / contractor	Procedural	Management	Low cost - high benefit	To be finalised
		Produce an adequate O&M Manual for the supply	2010/11	4	$5,000-15,000	O&M Manual complete	Veolia	Procedural	Maintenance	Low cost - high benefit	Complete
	Distribution	Check commercial high risk premises at least annually for back-flow testing or get a report from the Building Control Section annually	2011 onwards	3	< $5,000	High risk premises not yet identified for audit checks so degree of risk is unknown	Three Waters Manager	Procedural	Management	Low cost - high benefit	To be actioned
		Develop a formal policy and guidelines covering backflow protection	2012	3	< $5,000	No written policy or strategy exists at present for the contractor to work to	Three Waters Manager	Procedural	Management	Low cost - high benefit	To be actioned
		Implement the hydraulic model for the scheme to identify at risk areas for low flow and pressure	2012 /13	3	$15,00-50,000	To be undertaken	Three Waters Manager	Procedural	Management	Low cost - high benefit	To be actioned
		Investigate plumbosolvency testing in water as per DWSNZ 2005 (rev 2008) , S8.2.1.4	2012 onwards	3	< $5,000	Public warning notices are currently issued 6 monthly as required under DWSNZ 2005 requirement under S8.2.1.4. Demonstrating water is non plumbosolvent by direct testing could be considered.	Three Waters Manager	Procedural	Management	Low cost - high benefit	To be actioned
		Review O&M cleaning procedures for reservoir and distribution system.	2012	3	<$5,000	VEOLIA have such procedures to adapt to the supply.	Veolia	Procedural	Maintenance	Low cost - high benefit	To be actioned
		Set up a register for water carriers using Council mains and audit annually on a random or selected basis	2011	4	< $5,000	Only registered water carriers are allowed to use Council water mains. Currently there are no registered water carriers in the Queenstown Lakes district. The maintenance contractor is currently considering becoming a registered water carrier.	Three Waters Manager	Procedural	Management	Low cost - high benefit	In Progress
		Installation of Acuflow devices on domestic properties where existing toby requires replacement	2012 onwards	4	$15,000	Acuflow devices installed as an ongoing maintenance item when domestic toby's fail.	Veolia	Procedural	Maintenance	Low cost - high benefit	Ongoing
	General (Management System) Risks	Ensure the WINZ information for the supply is corrected to reflect the current supply data	2011	2	< $5,000	Second bore is now recorded as the source on WINZ.	Three Waters Manager	Procedural	Maintenance	Low cost - high benefit	Complete
		Clearly label and identify plant components and functions and update the O&M Manuals accordingly.	2011	2	< $5,000	O&M Manuals provide photographed and labelled components of each facility. Not yet all plant components have been labelled on-site for new operator staff and external auditing staff. Commenced but not yet complete.	Veolia	Procedural	Maintenance	Low cost - high benefit	In Progress
		Develop the Assets Management Database (Hansen) to manage all water supply assets in future	2009-2022	4	$15,000-50,000	A full assets stock take has been done as a preliminary step and Hansen is now operational. Development is DONE.	Three Waters Manager	Procedural	Management	Low cost - high benefit	Ongoing

Scheme	Supply Process Element	Future Preventive Measures/Corrective Actions	Timeframe	Priority	Cost estimate	Comments	Who is Responsible	Project Type	Project Sub Type	Cost benefit estimation	Status
						Ongoing data validation, maintenance and updating required.					
		Ensure follow up sampling is done following E.coli transgressions as per Fig 4.1 or 4.2 DWSNZ 2005	2011 onwards	3	< $5,000	If this is not done the supply will fail E.coli compliance in the Annual Survey and receive a negative report	Veolia	Procedural	Maintenance	Low cost - high benefit	Ongoing
		Ensure PHRMP and schedule of improvements are reviewed and updated at least annually for the first two years or after major works have been completed to reflect changing circumstances and requirements.	2011 onwards	2	< $5,000	Part of the annual PHRMP review process	Three Waters Manager	Procedural	Management	Low cost - high benefit	In Progress
		Ensure PHRMP is understood by Council Staff and Operations and Maintenance Contractor's staff	2012	2	< $5,000	Workshops should be held for this	Three Waters Manager	Procedural	Management	Low cost - high benefit	To be actioned
		Update O&M Manual for the supply on a 3 yearly basis or after the introduction of any significant upgrades to facilities	2011 onwards	3	< $5,000	This assists training of new operators and PHRMP audits by the regulatory authority	Veolia	Procedural	Management	Low cost - high benefit	Ongoing
		Set up a training needs assessment and training recording system for staff to meet water ITO and NZWWA training requirements	2011	2	< $5,000	Full training programme now implemented at VEOLIA. Records held at head office.	Veolia	Procedural	Management	Low cost - high benefit	Ongoing
		Use WINZ to record supply monitoring and compliance status and for the Annual Survey returns	2011 onwards	3	< $5,000	WINZ is now used by VEOLIA	Veolia	Procedural	Maintenance	Low cost - high benefit	Ongoing
		VEOLIA to carry out internal staff performance audits against key performance indicators	2011 onwards	2	< $5,000	An internal system is in place to check on operator performance under the O&M contract. Records held at HR at head office. Confidential.	Veolia	Procedural	Management	Low cost - high benefit	Ongoing
		Ensure checks and monitoring are undertaken as per Planned Maintenance Schedule and accessible in format that is auditable	2012	4	< $5,000	Planned Maintenance Schedule currently not in auditable format.	Three Waters Manager / Veolia	Procedural	Management	Low cost - high benefit	To be actioned
		Contractor to improve interpretation and operation of ASPEX	2012	4	< $5,000	The Aspex screens are still in development and once in place the Contractor needs to become familiar with the interpretation and operation.	Three Waters Manager / Veolia	Procedural	Management	Low cost - high benefit	To be actioned

5.2 Summary of Monitoring and Checks

The following tables summarises checks and maintenance identified in Risk Tables that are to be carried out on the Glenorchy water supply, how often they need to be made and who is responsible.

5.2.1 Maintenance Schedule

Table 5-3 Checks Performed on Distributed Assets - Glenorchy

Asset Description	Work Description	Responsibility	Interval
Dead Ends	Flushing	Operator	6 monthly
Sample Points	Bores: Sampling for E.coli, pH & Turbidity	Operator	3-5 days*
	Reticulation: Sampling for E.coli, pH & Turbidity	Operator	6 days*
Water Network	O & M Manual Updates	Operator	36 monthly

*or as specified in New Zealand Drinking Water Standards 2005 (revised 2008) according to population size and seasonal population changes.

Table 5-4 Checks Performed on Facilities- Glenorchy

Facility Description	Work Description	Responsibility	Interval
Glenorchy Water Bores	Electrical Panel Inspection	Operator	12 monthly
Glenorchy Water Bores	Fire extinguisher Servicing	Operator	12 monthly
Glenorchy Water Bores	Flow Meter Check	Operator	12 monthly
Glenorchy Water Bores	Grounds Maintenance	Operator	Monthly
Glenorchy Water Bores	Inspect and Validate on line Analysers	Operator	Weekly
Glenorchy Water Bores	Operation and Maintenance Manual	Operator	36 monthly
Glenorchy Water Bores	Risk Assessment	Operator	36 monthly
Glenorchy Water Bores	Service Water Quality Instruments	Operator	12 monthly
Glenorchy Water Bores	Site Safety Inspection	Operator	3 monthly
Glenorchy Water Bores	Telemetry System Inspection	Operator	12 monthly
Glenorchy Water Bores	Water Intake Inspection	Operator	Weekly
Glenorchy Water Bores	Water Pump Check	Operator	6 monthly
Glenorchy Water Reservoirs	Flow Meter Check	Operator	12 monthly
Glenorchy Water Reservoirs	Grounds Maintenance	Operator	Monthly
Glenorchy Water Reservoirs	Reservoir Level Calibration	Operator	12 monthly
Glenorchy Water Reservoirs	O&M Manual	Operator	36 monthly
Glenorchy Water Reservoirs	Risk Assessment	Operator	36 monthly
Glenorchy Water Reservoirs	Service Reservoir Inspection	Operator	Monthly
Glenorchy Water Reservoirs	Telemetry System Inspection	Operator	12 monthly
Glenorchy Water Reservoirs	Water Pump Check	Operator	6 monthly
Glenorchy Water Reservoirs	Water Pump Station Inspection	Operator	Monthly
Glenorchy Water Reservoirs	Inspection	Operator	Monthly

5.2.2 Management Checks

Table 5-5 Management Checks- Glenorchy

Description	Task Description	Responsibility	Interval
Flow records	Report on low flow alarms and unusual flow patterns from SCADA data	Veolia	Monthly
Complaints	Report of Request for Service (RFS) data and actions taken	Veolia	Monthly
Scouring & flushing	Report of activities undertaken	Veolia	Monthly
Plumbosolvency Notices	Issue Plumbosolvency Notices (until proven not plumbosolvent)	QLDC - 3 Waters Manager	6-Monthly
Back flow	Report on checks taken	Veolia	Yearly
Water Carriers	Audit of water carrier activities and issues	QLDC - 3 Waters Manager	Random
Pipe Failures	Input records into Maximo/Hansen database	Veolia / QLDC – 3 Waters Engineer	As required
	Audit of hygienic pipe repair procedures	QLDC – 3 Waters Engineer	As required
Water Quality	Record of IANZ audit/accreditation	Veolia	Yearly
	Check sample results on receipt	Veolia	As required
	Input sampling results and any incidents into WINZ	Veolia	Monthly
	Reports to Council on water sampling activities and results	Veolia	Monthly
New Facilities / Assets	Inputs details of new facilities or assets into Hansen database	QLDC – 3 Waters Engineer	As required
Emergency Management	Check EM Plan up to date	QLDC - 3 Waters Manager	Yearly
O&M Contract	Report to Council on all activities under the O&M Contract	Veolia	Monthly
	Audit by Council on O&M Contract	QLDC - 3 Waters Manager	Monthly
Training	Records of all training attendances	Veolia/QLDC	Yearly
PHRMP	Review PHRMP	QLDC - 3 Waters Manager	Yearly for first 2 years, then as required
	Check understanding of staff regarding PHRMP content		

6 Contingency Planning

6.1 Introduction

The Ministry of Health requires that the every Public Health Risk Management Plan should contain contingency plans.

Contingency plans may be needed for events that happen despite preventive and corrective actions that may have been taken. The purpose of a contingency plan is to provide guidance on determining when hazards may have entered the water distribution system, and the actions to take to protect public health should this happen.

This section of the PHRMP contains contingency plans for the risks that are noted in the risk tables. The risks have been categorised into one of two general scenarios namely:

- Contaminated water problem (water quality too poor to treat or consume). i.e:
  - Environmental - biological (E coli, protozoa), high turbidity, chemical contamination;
  - Third Party network – power outage compromising treatment plant operations;
  - SCADA fault
  - Scheme headworks failure – chlorine equipment malfunction
- No water problem (not enough water reaching the treatment plant or reaching the consumers' taps).
  - Environmental - drought;
  - Third Party network – power outage compromising pumping ability;
  - SCADA fault
  - Scheme headworks failure – mechanical or structural failure
  - Excessive consumer demand

For each scenario a flow chart showing the procedural steps and the person responsible for the strip is carried out has been developed. The flow charts show the general procedures only and give guidance to Operators who should be aware of the operational requirements of the water supply system. Additional guidance can be found in the operational manuals for each water supply.

DWSNZ 2005 also set out response measures for treatment performance transgressions and *E.coli* transgressions in Figures 4.1, 4.2 and these are incorporated into the Contingency Plans for the supply. Figures 5.1 and 5.2 of DWSNZ 2005 relating to turbidity transgressions and disinfection transgressions in respect of protozoa compliance cannot be used as yet there being no particle removal process in place.

In addition, where an event is of a scale or its nature is beyond the day to day capabilities of the Operators, reference should be made to the **'QLDC Emergency Management Plan'**. This plan covers events which require significant additional resources or co-ordination across multi utilities or services.

6.2 Contaminated Water Contingency Plan

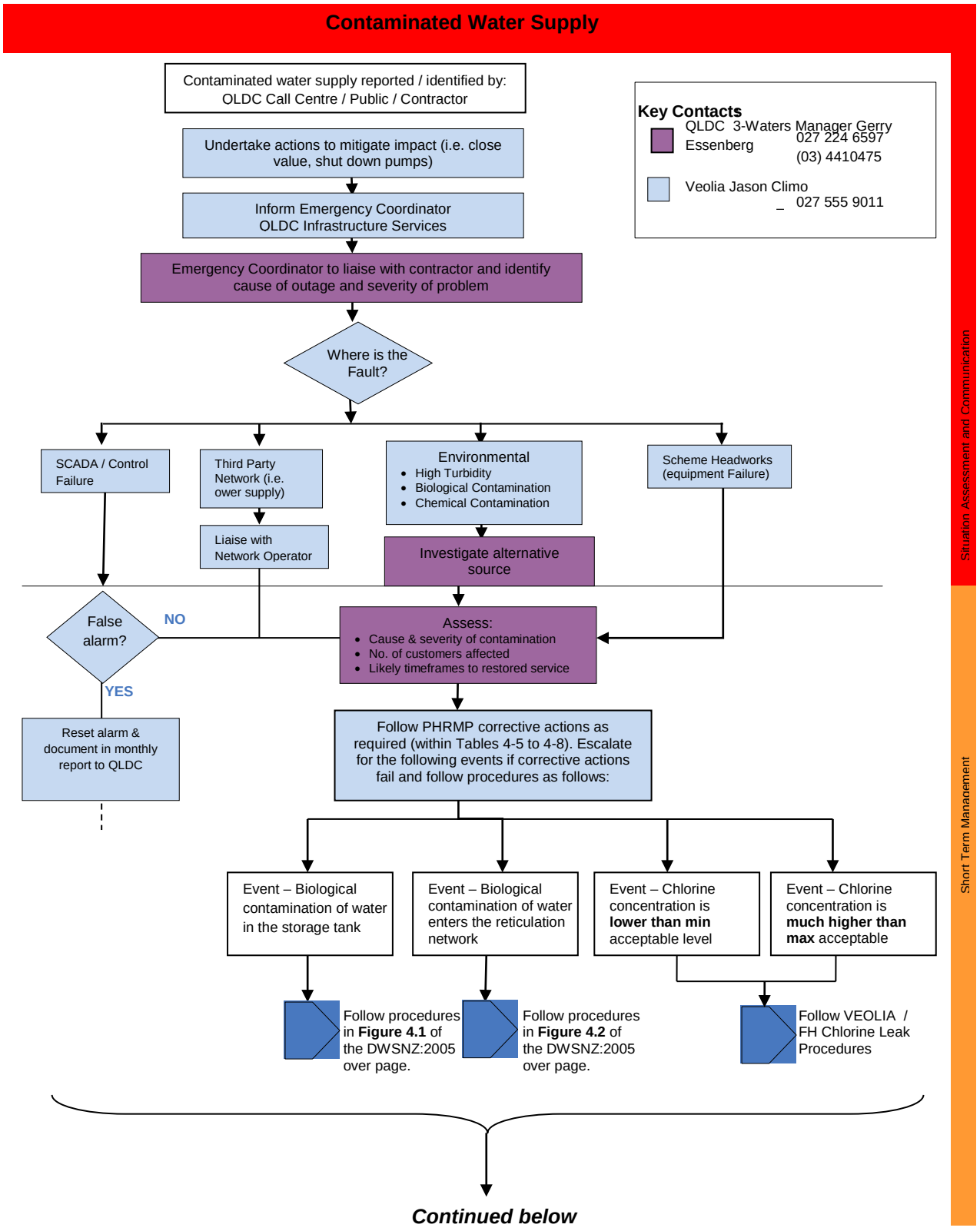


Figure 4.1: Response to *E. coli* contamination of drinking-water leaving treatment plant

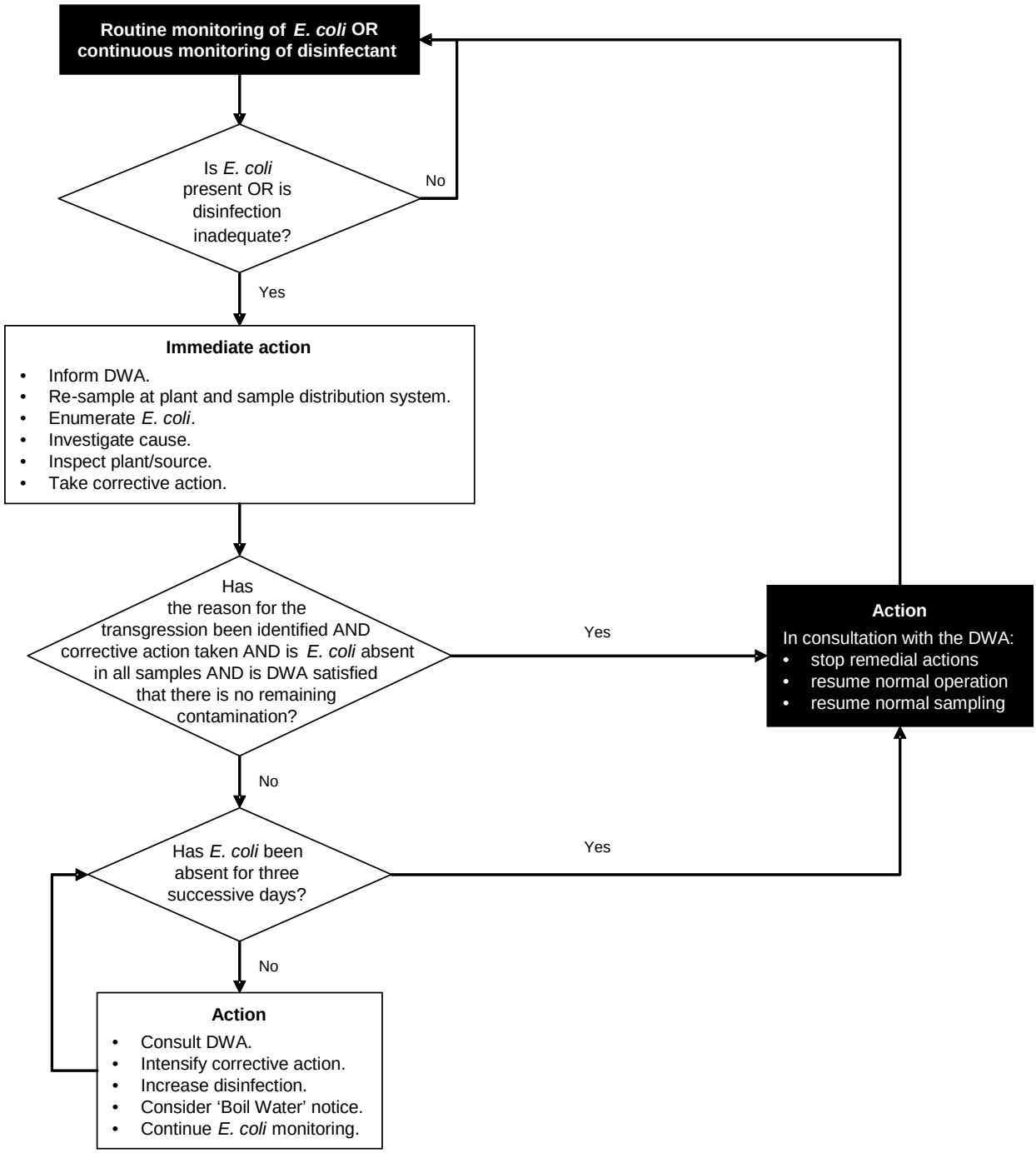
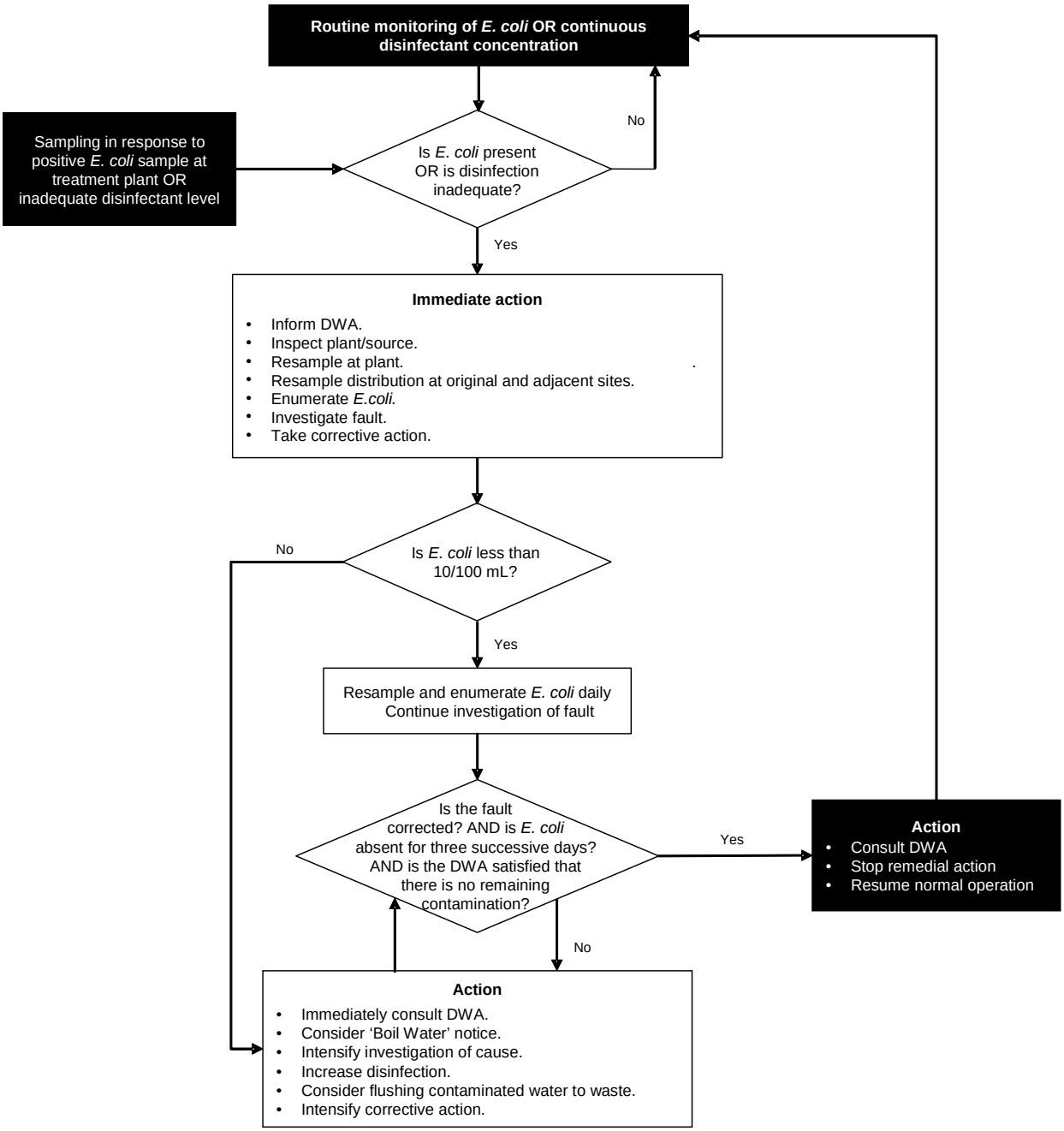
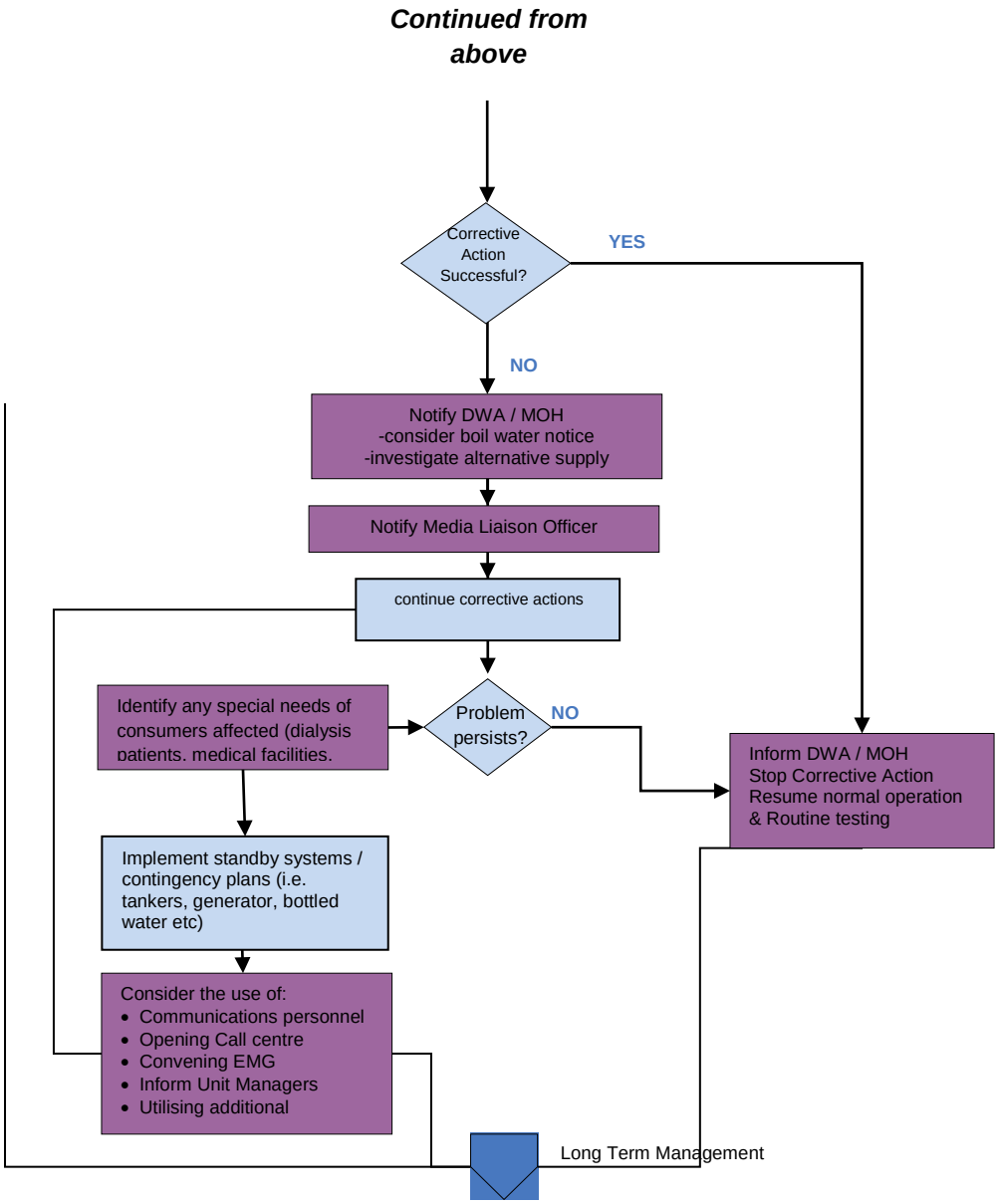


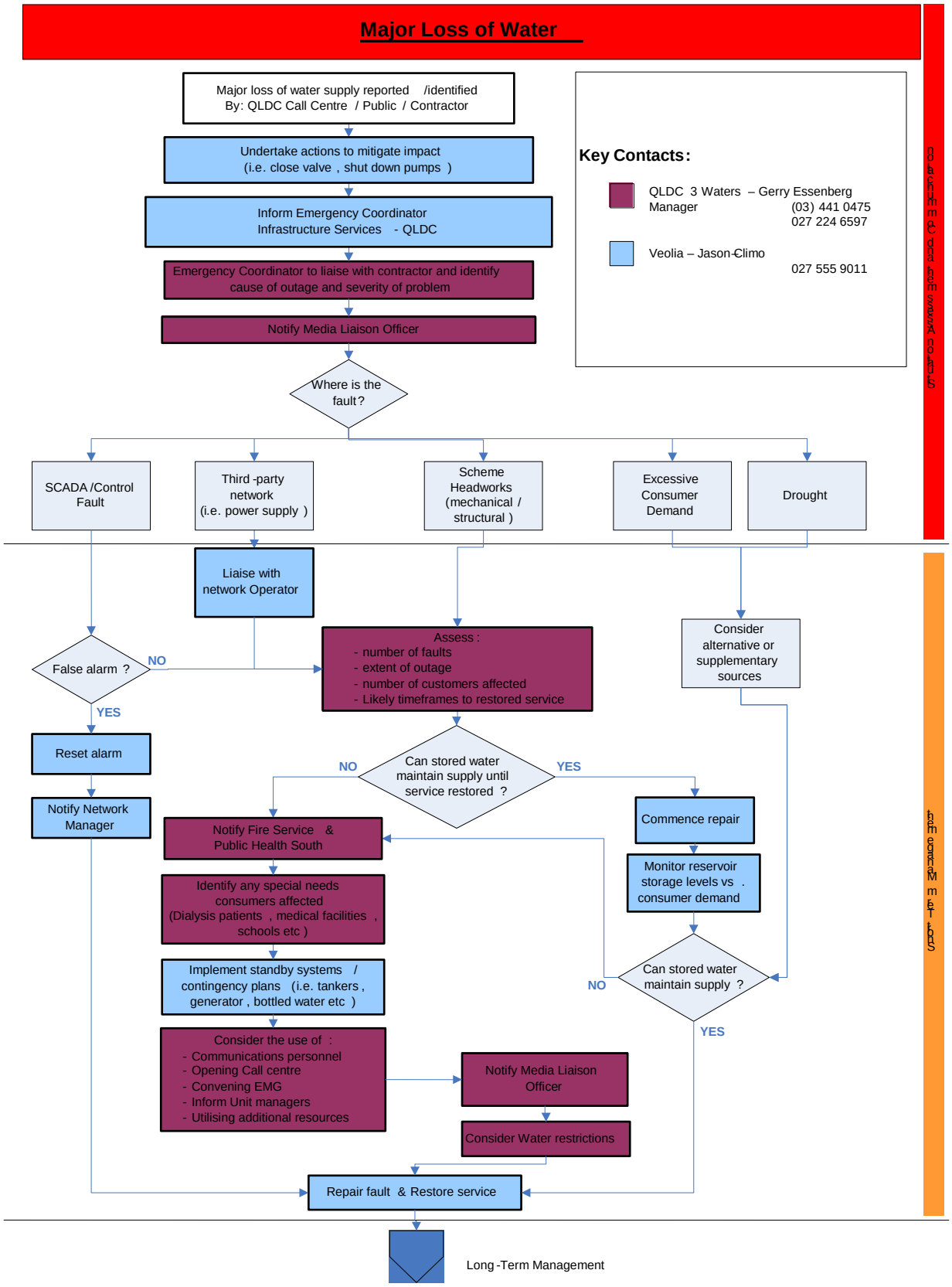
Figure 4.2: Response to *E. coli* contamination of a drinking-water supply distribution zone



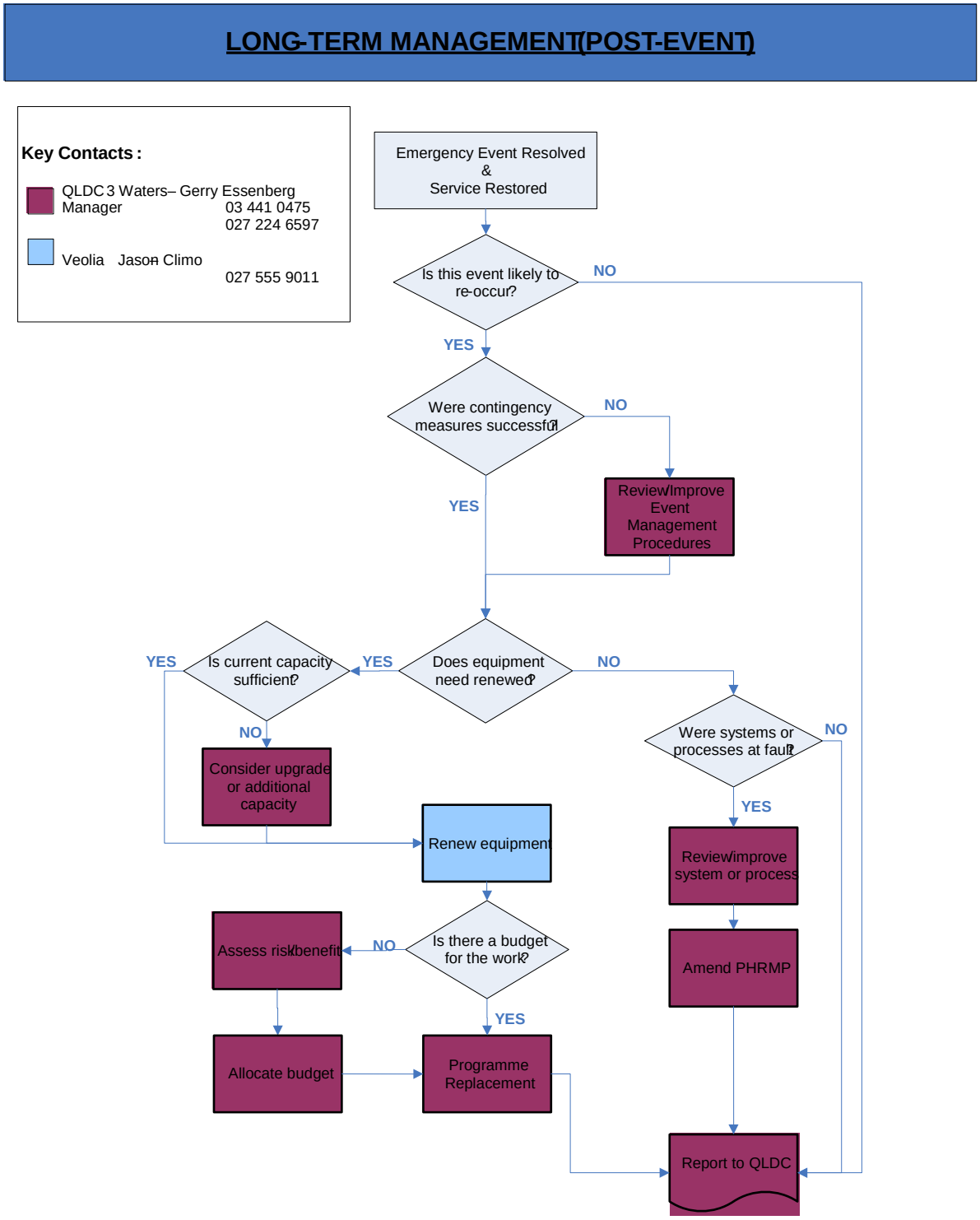
Contaminated Water Supply



6.3 Loss of Water Contingency Plan



6.4 Long-Term Management (Post-event)



7 Performance Review

7.1 Auditing the PHRMP

The PHRMP will be reviewed every 12 months for the first two years and every three or four years thereafter. Responsibility for driving the review process will lie with the QLDC Three Waters Manager. In order to facilitate a robust audit of the PHRMP a reporting template has been developed to review progress made on the PHRMP. The reporting template covers the following items:

- Assessment of whether reporting lines, roles and responsibilities are still valid and in place for the supply;
- Identification of any modifications, additions or changes made to the supplies since the last PHRMP was completed, and any new or reduced risks arising from these changes.
- Review of the day to day operation of the Queenstown Lakes District Council water supplies by:
  - Checking records and compliance with DWSNZ (2005);
  - Reviewing the incident records for the supply and learning lessons from the incidents;
  - Checking that regular checks and scheduled maintenance are being undertaken as per the PHRMPs.
- Determination if satisfactory progress has been made against the Improvement Plans.

During the review process the District Health Board will be consulted to determine whether or not sufficient progress has been made to meet their regulatory requirements, or if the grade of the water supply has been affected.

Integration of the PHRMP into the Activity Management Plan (AMP) through one 'portal' will ensure information across these Council documents are consistent and up to date. As the information provided in the AMP provides the basis for activities included in the Long Term Plan (LTP), this integration of documents will ensure that the PHRMP, AMP and LTP are never at odds with one another. Any changes or additions to infrastructure, processes and procedures are captured in one location, which will allow the risks and improvements to be addressed and reviewed in a more satisfactory manner.

Ultimately, this will help ensure that the high quality water supply currently provided to the water supply is maintained.

The following key areas have been identified and have been used to check progress of the PHRMP. Information that supports each key area has also been listed below.

Table 7-1 Source Information

Key Area	Supporting Documents / Source Information
➢ General	
a. PHRMP Document Maintenance	Three Waters Manager
b. Tracking New Assets, Upgrades or Information	Hansen Asset Register / SharePoint
c. Management Have roles or responsibilities changed in the last 12 months? Have personnel and/or qualifications changed in the last 12 months?	Three Waters Manager Veolia Annual Report
d. Training	Veolia correspondence
➢ Drinking Water Standards Compliance	WINZ / SharePoint
➢ Tracking Incidents Have there been any incidents affecting the water supply in the last 12 months?	Request for Service Data VEOLIA Monthly Reports
➢ Tracking Operations a. Essential Checks & Monitoring Have the 'What to check' and 'Corrective actions' (Operational Procedures) identified in the PHRMP been added to the appropriate manual or operational contract?	Veolia Annual Report / Hansen Database Veolia Planned Maintenance Schedule Veolia correspondence
➢ Tracking Improvements a. Capex Have the Improvements identified in the PHRMP been included in the LTP and/or actioned?	Long Term Plan 2012-22 (draft)
b. Procedural Have the Improvements identified in the PHRMP been included in the Planned Maintenance Schedule and/or actioned through QLDC ?	Three Waters Manager Veolia Contract Manager

Appendix A Definition of Terms and Glossary

The following abbreviations are be used in the report.

Abbreviation	
PHRMP	Public health risk management plan
QLDC	Lakes District Council
DWSNZ	Drinking water standards for New Zealand
MoH	Ministry of Health
O&M	Operations and maintenance
Maintenance Contractor	The current maintenance contractor is Veolia
VEOLIA	Veolia Water Ltd
ORC	Otago Regional Council

The following key terms are adopted throughout the PHRMP process:

Term	Definition
Risk:	The chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and likelihood.
Risk Assessment:	The overall process of risk analysis and risk evaluation
Risk Management:	The culture, processes and structures that are directed towards the effective management of potential opportunities and adverse effects.
Supply Element:	A physical or operational component of a water supply. Supply elements act together to determine the quantity and quality of the water received by the consumer.
Hazard:	A microbiological or chemical determinant that may cause sickness.
Event:	An incident or situation which may introduce a hazard (or hazards) into the water.
Cause:	The situation, action or inaction resulting in an event.
Preventive Measure:	An action taken, process implemented, or equipment installed to reduce the likelihood of an event occurring.
Corrective Action:	The action taken if preventative measures fail and an event occurs.
Transgression	A transgression occurs when levels of a determinant in a sample of drinking water exceed the Max Allowable Value (MAV). When a transgression is detected this indicates that the water supply is non-compliance and that a direct response is needed.

Contingency Plan:	The plan that comes into effect if corrective actions are insufficient to stop an event occurring. Contingency plans are devised in order to help the Council understand the process to be undertaken if matters escalate beyond their control

Appendix B Management Systems – Additional Information

Data Management

Over the last three years there has been emphasis made on increasing the abilities of the contractor and gaining a thorough understanding of the assets of the Council. As a result there has been an improvement in record keeping, as each item of work is required to be accompanied by supporting documentation, and improved knowledge as the contractor has revised Operation and Maintenance Manuals. With the revision of the manuals has come the identification of risks and deficiencies and subsequent remedial or programmed improvement work.

The latest version of the main contract has based the Planned Maintenance work on the Hansen asset database and thus ensures that the work flow is driven by the asset and not the contractor.

The Contract is clearly separated into the main activities of contract management, planned maintenance and reactive maintenance.

The requirement to enter all activities into the Hansen asset database will ensure that the next version/renewal of this contract overcomes the requirements to make assumptions on quantities of reactive maintenance, renewals and capital works.

In addition, QLDC also hold data within the following

Database	Comment
SCADA (supervisory control and data acquisition)	A program for process control, where data is gathered in real time from remote locations in order to control equipment and conditions.
GIS (Geographic Information System)	Electronic as-built data, pipe asset register, aerial photography, property information (QLDC).
Hansen 8 (Asset Management System)	Electronic as-built data, facility and pipe asset register, including detail around condition and financial data.
RFS (Request for Service)	A record of customer complaints (KBase). This has the potential to be managed within Hansen.
Works Order Database (MAXIMO)	Actions undertaken by Veolia to interface with QLDC AMS Hansen.
CS-VUE	Inventory of resource consents issued by the Otago Regional Council held by QLDC.
Data Warehouse	A large database designed to link all AM data into one place for ease of reporting.
TRIM	A records management system.
SharePoint	The 2011 update of the AMP has taken place through Microsoft SharePoint. SharePoint offers web-based document collaboration to manage multiple inputs from stakeholders. SharePoint is also used as the platform for reporting all AM data from the Data Warehouse.
WINZ	Information on water quality parameters for compliance with the New Zealand Drinking Water Standards (NZDWS). WINZ is held by the Ministry of Health.
EpiSurv Database	EpiSurv collates notifiable disease information on a real-time basis from the Public Health Services (PHS) in New Zealand.

Asset Register (Hansen 8)

The purpose of the 3-Waters Hansen 8 Asset Register is to be sufficiently comprehensive to;

- allow for a component level asset valuation,
- enable work history to be tracked against an individual asset,
- enable inspections and condition assessments to be planned against assets,
- allow managers access to key asset information at their desktop,
- provide export data to hydraulic models.

The Asset Register commenced development in 2008 as part of the Hansen 8 AMS configuration with input, review and consultation from numerous parties including; Queenstown Lakes District Council (QLDC), Lakes Engineering, Rationale Ltd., MWH, Veolia, Tonkin and Taylor and Connell Wagner.

The Asset Register provides;

- standards for unique asset reference numbering and descriptor (e.g. VLV10001 etc),
- a catalogue of standard asset types (valves, pumps etc),
- required asset attribution information (what data to store against an asset).

In very general terms the register covers two distinct asset groups:

1. **Distributed Assets** -those held spatially in the GIS.
2. **Facility Assets** (Plant Equipment) - assets within a facility which are not spatially represented in the GIS.

Contractor Response Times

The *Contractor* is required to provide a service which will respond to urgent situations and correct faults in a timely and efficient way. The following stated target response times must be achieved in accordance with the specified level of service for the individual utilities. The target response times are considered to commence once the *Contractor* is informed of or becomes aware of the specified situation.

Table 7-2 Contractor Response Times – Water Supply

Work Item	Initial Response Time T = 'X' Attend Incident on Site (See note 2 below)		Resolution Response Time T = Y (Note 'Y' includes 'X')	
	Routine	Urgent	Routine	Urgent
Water - Hydrant marker posts Replacement	1 Day	0	1 Week	0
Water - Hydrant/Valve Box Adjustment	3 Days	0	1 Week	0
Water - Leak	1 Day	1hr	3 Days	4 hrs
Water - No Water	0	1 hr	2 hrs	2 hrs
Water - Pipe Repairs (Other than leak)	3 Days	1 day	1 Week	2 days
Water - Plant and Equipment Fault	1 Day	1 hr	1 Week	4 hrs
Water - Relocation of Services	3 Days	1 hr	1 Week	1 Day
Water - Toby Fault	1 Day	1 hr	1 Week	4 hrs
Water - Valve marker posts - Replacement	3 Days	0	1 Week	0
Water - Water Pressure	3 Days	0	1 Week	0
Water - Water Quality	1 hr	1hr	1 Day	2 hrs
General - Damage Repair (Other)	1 Day	1 hr	1 Week	1 Day
General - Grounds Maintenance	3 Days	1 hr	1 Week	1 Day
General - Location Requests	0	0	1 Week	2 hrs
General - Missing Covers	1 hr	1 hr	1 Day	2 hrs
General - Surface Reinstatement	1 Day	1 hr	1 Week	1 Day

Work Item	Initial Response Time T = 'X' Attend Incident on Site (See note 2 below)		Resolution Response Time T = Y (Note 'Y' includes 'X')	
	Routine	Urgent	Routine	Urgent
SCADA - Pump Station Alarm	0	1hr	0	1 day
SCADA - Water Low/High Reservoir Alarm	0	1hr	0	2 hrs
SCADA - Mains Failure	0	1hr	0	1 Day
SCADA - Communications Failure	0	1 day	0	2 days

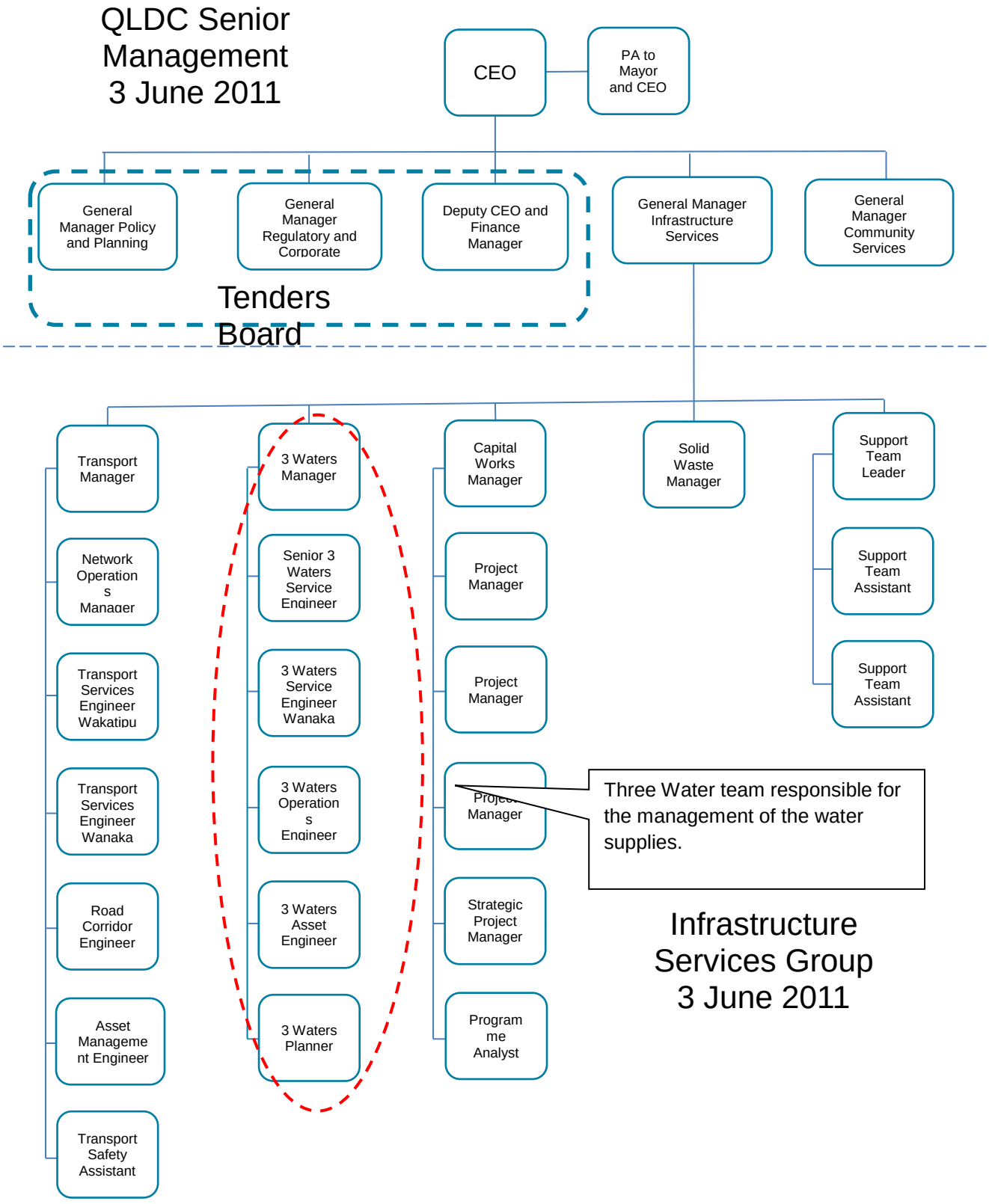
Source: Contract QLDC 11-013

Notes:

- T = "X' relates to Routine Call Out. Urgent call outs require immediate attendance.
- Where response time is greater than 1 day, then days shall be considered as 'working days'.
- Where response time is equal to 1 day, then the period shall be considered as 24 hours irrespective of "working days".
- Response times defined as number of hours shall be continuous hours from time of notification
- Response times to telemetry activated alarms will vary for each call out activity (expected to range between 15min and 1day) and will be developed with the *Contractor* over the initial 3 month Contract Establishment Period.

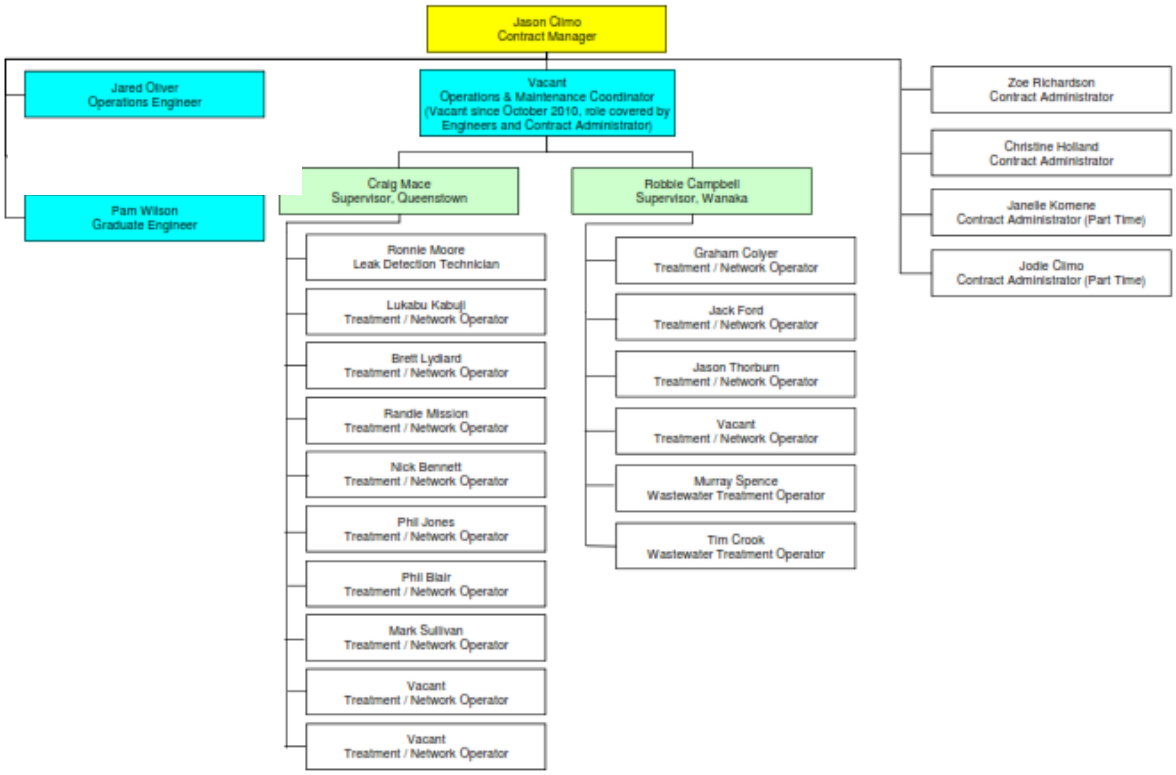
Appendix C Staff Qualifications

QLDC Organisational Structure – Senior Management and Infrastructure Services



An organisation chart showing Veolia's staff in place in the Queenstown Lakes contract as of 30 June 2011 is shown below.

Organisational Chart – Veolia



Veolia Staff Designations and Qualifications

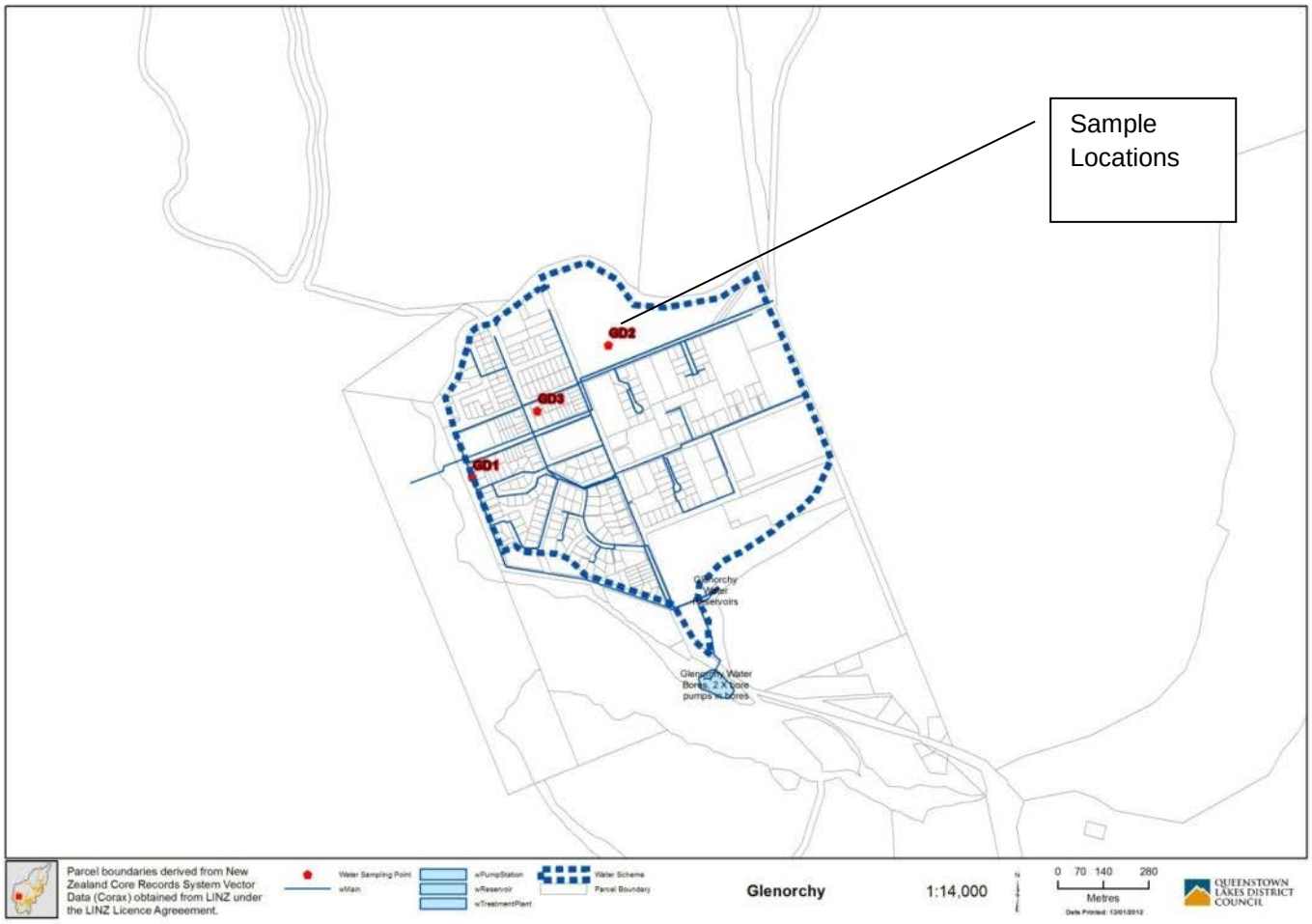
Staff Member	Designation / Role	Relevant Qualifications Held
Jason Climo	Contract Manager	Diploma in Drinking Water (B) (Credits for Diploma acheived, diploma not completed) National Certificate in Wastewater Treatment (C) National Certificate in Water Treatment (C) Introduction to Water / Wastewater Orica Chemical Safety Awareness Seminar
Stuart Pile	Operations Engineer	BSc Environmental Geochemistry Powerlink General, Programming, Reporting, Hardware Courses Engineers Development & Business Skills Workshop Confined Spaces and Breathing Apparatus Training Aspex Screen Training Course Chlorine Awareness Training Control Valve Training
Pamela Wilson	Operations Engineer	Bachelor of Engineering (Civil) Workplace First Aid Engineers Development & Business Skills Workshop Confined Spaces and Breathing Apparatus Training Chlorine Awareness Training Control Valve Training
Robbie Campbell	Supervising Operator – Wanaka area	Cert in Self Contained Breathing Apparatus (SCBA) Cert of Achievement Chlorine Gas Drum Connection and Disconnection NC Water Reticulation Module 1

Staff Member	Designation / Role	Relevant Qualifications Held
		NC Water Reticulation Module 2 NC Water Reticulation Module 5 Approved Chemical Handler Workplace First Aid plus refresher course Chlorine Handler Certificate Dangerous Goods Transport Chlorine Awareness Training Control Valve Training
Craig Mace	Supervising Operator – Queenstown area	National Certificate in Water Treatment Approved Chemical Handler Workplace First Aid plus refresher course Confined Spaces and Breathing Apparatus Training Chlorine Awareness Training Control Valve Training
Phil Jones	Operator	National Certificate in Water and Wastewater Reticulation Level 1 Basic Traffic Controller Workplace First Aid Chlorine Handler Certificate Confined Space Training Breathing Apparatus Training Chlorine Awareness Training Control Valve Training
Phil Blair	Operator	Plumbing Installation Theory Workplace First Aid National Certificate in Water Reticulation –Module 2 Confined Spaces and Breathing Apparatus Training National Certificate in Water Reticulation – Module 1 Chlorine Awareness Training Control Valve Training
Lukabu Kabuji	Operator	Cert in SCBA Cert in Chemical Handling training National Certificate Water Treatment National Certificate Waste Water Chlorine Handler Certificate Level 1 Basic Traffic Controller Workplace First Aid plus refresher course Chlorine, pH, Turbidity Calibration Training Confined Space Training Dangerous Goods Transport Confined Spaces and Breathing Apparatus Training Chlorine Awareness Training Control Valve Training
Ronnie Moore	Operator	Confined Space Training NC Water Reticulation Module 2 NC Water Reticulation Module 5 Chlorine Awareness Training Control Valve Training Breathing Apparatus Training
Brett Lydiard	Operator	Cert in Chlorine Awareness Training Cert of Achievement Chlorine Gas Drum Connection and Disconnection Cert of Attendance Orica Chemnet Chemical Safety Awareness Seminar National Certificate in Water and Wastewater Reticulation Traffic Controllers (L1TC), Workplace First Aid plus refresher course Chlorine Handler Certificate Approved Chemical Handler Breathing Apparatus Training Chlorine Awareness Training

Staff Member	Designation / Role	Relevant Qualifications Held
		Control Valve Training
Randie Mission	Operator	Cert in SCBA Dip Mechanical Technology Cert of Achievement Chlorine Gas Drum Connection and Disconnection Cert of Attendance Orica Chemnet Chemical safety Awareness Seminar Workplace First Aid plus refresher course Chlorine Handler Certificate Confined Space Training Dangerous Goods Transport Confined Spaces and Breathing Apparatus Training Chlorine Awareness Training Control Valve Training
Nick Bennett	Operator	Workplace First Aid NC Water Reticulation Module 1 NC Water Reticulation Module 2 Confined Space Training Breathing Apparatus Training Dangerous Goods Driver Training Chlorine Awareness Training Control Valve Training
Mark Sullivan	Operator	Dangerous Goods Transport Workplace First Aid National Certificate in Water Reticulation –Module 2 Confined Spaces and Breathing Apparatus Training Chlorine Awareness Training Control Valve Training
Graham Colyer	Operator	Confined Space Training Approved Chemical Handler Chlorine Handler Certificate Confined Space Training Workplace First Aid NC Water Reticulation Module 2 NC Water Reticulation Module 5 Chlorine Awareness Training Control Valve Training
Jason Thorburn	Operator	Trade Cert and advanced cert in Mechanical Engineering Cert of Achievement Chlorine Gas Drum Connection and Disconnection Cert of Attendance Orica Chemnet Chemical safety Awareness Seminar NC Water Reticulation Module 2 NC Water Reticulation Module 5 Confined Space Training Approved Chemical Handler Chlorine Handler Certificate Confined Space Training Workplace First Aid Chlorine, pH, Turbidity Calibration Training Chlorine Awareness Training Control Valve Training
Murray Spence	Operator	Cert in SCBA Cert of Achievement Chlorine Gas Drum Connection and Disconnection Cert of Attendance Orica Chemnet Chemical Safety Awareness Seminar National Certificate in Water and Wastewater Reticulation National Certificate Waste Water Approved Chemical Handler

Staff Member	Designation / Role	Relevant Qualifications Held
		Chlorine Handler Certificate Confined Space Training Dangerous Goods Transport Workplace First Aid Chlorine Awareness Training Control Valve Training
Jack Ford	Operator	National Certificate Water Treatment Approved Chemical Handler Chlorine Handler Certificate Confined Space Training Dangerous Goods Transport Workplace First Aid Chlorine, pH, Turbidity Calibration Training Chlorine Awareness Training Control Valve Training
Tim Crook	Wastewater Treatment Operator	National Certificate in Wastewater Treatment – Block 2 Confined Spaces and Breathing Apparatus Training Chlorine Awareness Training Control Valve Training

Appendix D Sample Location Map



Appendix E Catchment Risk Categorisation Form

Glenorchy

WATER SUPPLY	
WINZ SOURCE CODE	G 00313 (two bores)
Abstraction point:	easting _____ northing _____
Catchment area:	52km^2
	(estimate % of catchment area)
LAND USE	
Protected catchment	0
Bush/forest	58
Arable (cropping) land	1
Upland pasture	30
Lowland pasture	25
Urban	<1
	(estimate numbers in catchment)
LIVESTOCK	
Beef cattle	2,000
Dairy cows	150
Sheep	20,000
Deer/goats	1000
Pigs	200
	(estimate population served)
HUMAN WASTES	
Primary-treated sewage	0 (river/land discharge)
Secondary-treated sewage	0 (river/land discharge)
Septic tanks	300
	(number in catchment)
ANIMAL WASTES	
Meatworks	0
Cattle feedlot	0
Piggeries	0
Dairy effluent ponds	0
	(yes/no) Estimate of coverage/comment
MANAGEMENT PRACTICES	
Riparian management	Yes 5%
Tile drains	No
Livestock access to waterway	No
Animal bridge/ford crossings	No
	(yes/no) Data held by:
AVAILABLE DATA	
Faecal coliforms/*E. coli*	Yes QLDC and on WINZ
Crytosporidium	No
Giardia	No
Provider's contact details	Stewart Webster c/- MWH Dunedin Phone 03 470 3334

Low intensity pastoral farming only

Some domestic and feral

Drinking-water Standards for New Zealand 2005 (Revised 2008) 137

Appendices

Appendix F Risk Assessment Definitions

Table 7-3: Likelihood Rating Scale

Likelihood	Possible Descriptions
Almost certain	Occurs like clockwork Occurs every week, month, or season
Likely	Has occurred more than once before Expected to occur every year
Possible	Has occurred before Expected to occur every 2–5 years
Unlikely	Has never occurred before, but expected to occur every 5–10 years
Rare	Has never occurred before, and expected to occur less than once every 10 years

Table 7-4: Consequence Rating Scale

Consequence	Possible descriptions
Insignificant	No illness expected in the community
Minor	Very few of the community ill
Moderate	Some of the community ill
Major	Most of the community ill
Catastrophic	All of the community ill Anticipate some deaths

Table 7-5: Risk Rating (Likelihood x Consequence)

		Consequence				
		Insignificant (I)	**Minor (Mi)**	**Moderate (Mo)**	**Major (Ma)**	**Catastrophic (Ca)**
Likelihood	**Almost Certain (AC)**					
	Likely (Li)					
	Possible (Po)					
	Unlikely (Un)					
	Rare (Ra)					
Overall Risk Rating Key		Ins	Lo	Mod	Hi	Ex
		1	**2**	**3**	**4**	**5**