DRINKING WATER QUALITY MANAGEMENT PLAN ANNUAL REPORT - 2017/18 FINANCIAL YEAR

DEC 2018

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DOCUMENT CONTROL

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NOTATIONS AND ABBREVIATIONS

Acronym	Definition
ADWG	Australian Drinking Water Guidelines, 2011. Published by the National Health and Medical Research Council of Australia
AS	Australian Standard
BAU	Business As Usual
CCP	Critical Control Point (as defined by HACCP)
CGC	City of Gold Coast
Council	Logan City Council
CRM	Customer Relationship Management (system)
DEWS	Department of Energy and Water Supply, *now known as Department of Natural Resources, Mines & Energy (DNRM&E)*
DNRM&E	Department of Natural Resources, Mines and Energy
DSS	Desired Standards of Service
DWQMP	Drinking Water Quality Management Plan
E. coli	Escherichia coliform, a bacterium which is considered to indicate the presence of faecal contamination and therefore potential health risk
EPI	Eastern Pipeline Interconnector
ERP	Emergency Response Plan
FY	Financial Year
Grid	South East Queensland Water Supply Network Grid
HACCP	Hazard Analysis Critical Control Point
HLZ	High Level Zone
IDM	Infrastructure Demand Model
IMP	Incident Management Plan
KPI	Key Performance Indicator
LIMS	Laboratory Information Management System
LLZ	Low Level Zone
LOD	Limit of Detection
LOR	Limit of Reporting
LWIA	Logan Water Infrastructure Alliance
mg/L	Milligrams per litre
MPN/100mL	Most Probable Number per hundred millilitres
NMDP	Network Maintenance Disinfection Program
NATA	National Association of Testing Authorities
RMIP	Risk Management Improvement Plan
SAMMS	Strategic Asset Maintenance Management Systems
SCADA	Supervisory Control and Data Acquisition
SEQ	South East Queensland
SOP	Standard Operating Procedure
SRWP	Southern Regional Water Pipeline
THM	Trihalomethane
WGM	Water Grid Manager
WH&S	Workplace Health and Safety
WOP	Work Operating Procedure
WPR	Water Planning and Regulation (formally QLD Office of the Water Supply Regulator)

WSZ	Water Supply Zone
WTP	Water Treatment Plant
WWETT	Water and Wastewater Event Tracking Tool

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TABLES

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1 INTRODUCTION

This Drinking Water Quality Management Plan (DWQMP) Annual Report has been developed to meet the requirements of section 95 of the *Water Supply (Safety and Reliability) Act 2008 (the Act)*. The purpose of *the Act* is to provide safe and reliable drinking water supply throughout Queensland.

This DWQMP Annual Report documents the following for the 2017-18 Financial Year (FY)[1]:

- The water quality performance of Logan City Council's (Council) drinking water supply; and
- Actions taken to implement the Drinking Water Quality Management Plan.

This report assists the Queensland Water Supply Regulator (Department of Natural Resources, Mines and Energy (DNRM&E)) to determine compliance with the currently approved DWQMP and relevant approval conditions.

This report has been prepared in accordance with the Water Quality and Reporting Guideline for a Drinking Water Service September 2010 and the Drinking Water Quality Management Plan report template.

This report is available to the public via the Logan City Council website, and copies may be provided to members of the public upon request.

[1] 1st July 2017 to 30th June 2018 relates to the 2017–18 FY.

2 OVERVIEW OF OPERATIONS

2.1 Council's Drinking Water Supply System

Logan City Council (Council) is a water service provider which distributes water that is sourced and treated by the bulk water supplier, Seqwater.[2]

Seqwater is the Queensland Government Authority responsible for ensuring safe, secure and reliable drinking water supply for South East Queensland (SEQ). Key responsibilities of Council and Seqwater are summarised in Table 1.

Table 1 – Key Seqwater and Council Responsibilities

Seqwater's Responsibilities	*Logan City Council's Responsibilities*
▪ Catchment management. ▪ Raw water treatment (including fluoridation). ▪ Clear water storage. ▪ Bulk water transport to defined transfer points. ▪ Monitoring of raw and treated water supply, including fluoridation.	▪ Receipt of bulk treated water from Seqwater at defined transfer points. ▪ Delivery to customers through Council's water distribution network. ▪ Operation and maintenance of the distribution network, reservoirs, pump stations and a number of secondary disinfection facilities. ▪ Monitoring of drinking water quality performance throughout the distribution network.

2.2 SEQ Water Supply Network Grid

Logan City Council is supplied treated drinking water through the SEQ Water Supply Network Grid (the Grid), which is managed and operated by Seqwater, as shown in Figure 1. Water may be sourced from various sources throughout the Grid, dependent on operational supply requirements, for example; treated water may be supplied via the Eastern Pipeline Interconnector (EPI) and may flow west to supply Logan City Council or east to supply Redlands City Council.

Both Seqwater and Council undertake extensive water quality monitoring to confirm that safe drinking water is supplied to the community.

[2] Further information on Seqwater can be accessed at http://www.seqwater.com.au/

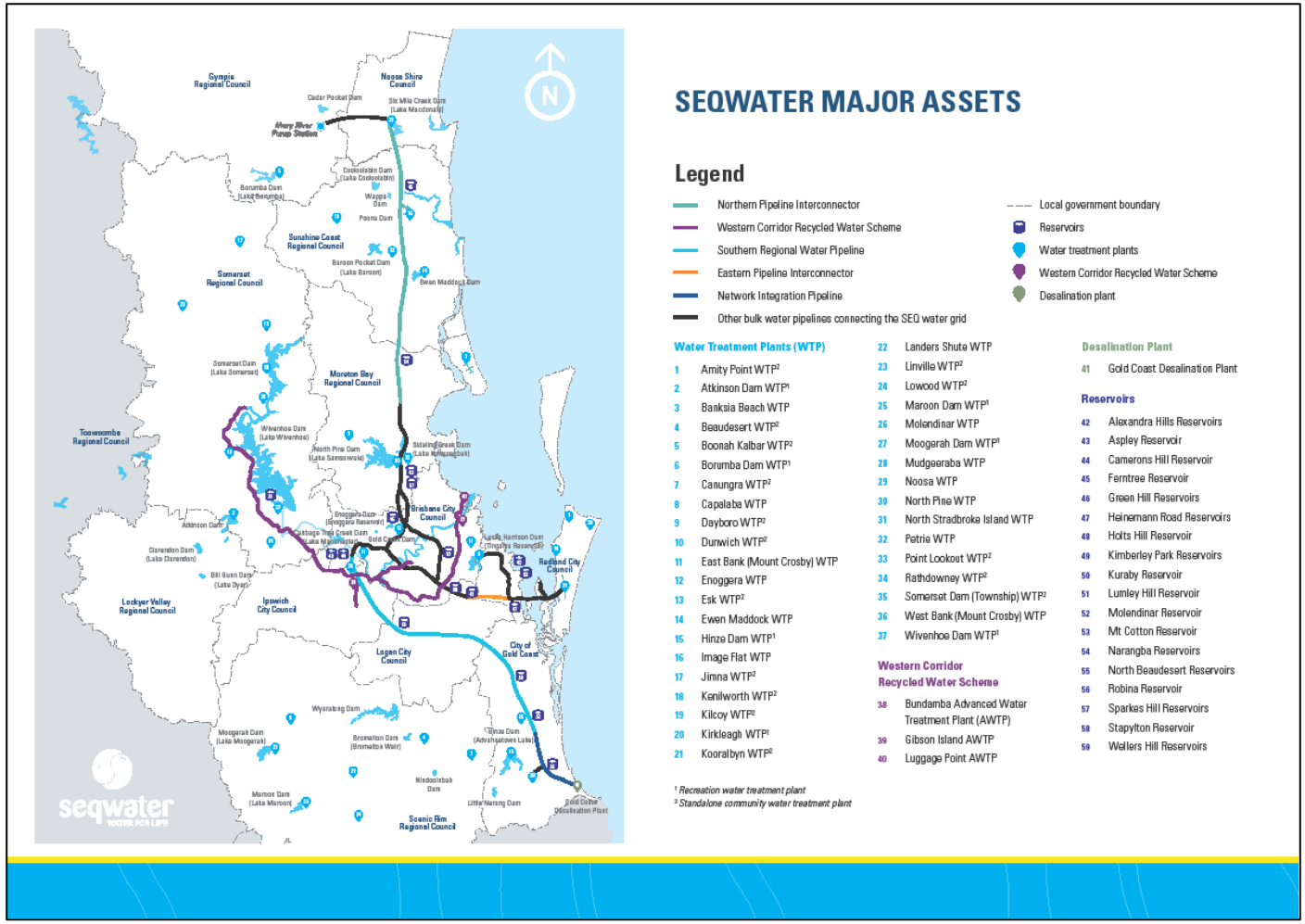

Figure 1 - South East Queensland Water Grid

2.3 Council's Drinking Water Supply Network

An overview of Council's drinking water supply network key features is provided in Table 2, including the number of water supply connections and treated source water.

Table 2 – Overview of the Logan City Council's Drinking Water Supply

Overview	*Description*
City's Area	957 square kilometres
City's Population	319,652[3]
Population connected to the drinking water supply network	302 909[4]
Seqwater's Primary Water Treatment Plants (WTP) & respective water catchments[5].	Mt Crosby (Wivenhoe Dam via Brisbane River), North Stradbroke Island (North Stradbroke Island Bores), Capalaba (Tingalpa Dam), Molendinar (Hinze Dam), Gold Coast desalination plant (seawater off Tugun, Gold Coast)
Bulk Supply Points (transfer points)	**1.** Compton Road meter via Kuraby Reservoir inlet main; **2.** Trinder Park pump station via Kuraby Reservoir; **3.** Eastern Pipeline Interconnector (EPI) supply via Kimberly Park Reservoir; **4.** Southern Regional Water Pipeline (SRWP) supply via Teviot Road Offtake; **5.** SRWP supply via New Beith Offtake (Pub Lane offtake); and **6.** Gold Coast Supply via Stanmore Pump Station (contingency supply only).

2.4 Drinking Water Disinfection

The Australian Drinking Water Guidelines (ADWG) emphasise the importance of preventing microbial contamination of the drinking water supply. An effective way to achieve this is by chemical disinfection, such as chlorination. Disinfection may kill or inactivate a wide range of harmful micro-organisms, and has been used in the water industry for over 80 years.

Council manages and controls disinfectant levels within the drinking water network in accordance with our approved Drinking Water Quality Management Plan.

Key features of Council's disinfection program include:

- Either chloramine or chlorine can be used as the disinfectant;
- Operation of secondary disinfection facilities (i.e. boosters and breakpoint dosing facilities) to consistently maintain optimal levels of disinfectant throughout the network;
- Constant management and control of effective disinfectant levels throughout its network, which aims to maintain levels between 0.2 and 2 mg/L (mg/L = parts per million). This is

[3] Source: Logan City Council Community Profile (https://profile.id.com.au/logan/home)

[4] Population and demand forecast information, based on current Desired Standards of Service (DSS) and adopted Infrastructure Demand Model (IDM), current as of 30/06/2017.

[5] This refers to the Seqwater WTPs that may supply commonly supply Logan City Council water supply network only. For information on all of the Seqwater WTPs please visit www.seqwater.com.au

sufficient to protect customers against potential contamination of the drinking water supply, and may assist to maintain the cleanliness of the network; and

- Extensive monitoring of disinfectant levels within the water supply and monitoring of Escherichia coli (*E. coli*) to confirm that disinfection is effective.

E. coli is used in the water industry as an indicator of recent faecal contamination of the water supply. Of itself, a positive *E. coli* detection does not necessarily indicate that the water supply is unsafe.

However, as human pathogens are often associated with faecal contamination, it is likely that if pathogens were present that *E. coli* would also be detectable.

If Council detects *E. coli*, immediate corrective action is taken to protect public health.

2.5 Council's Drinking Water Quality Zones

Council operates six defined Water Quality Zones (WQZ). A WQZ can be defined as an area of the water distribution network with shared bulk water supply sources and the same disinfectant type (i.e. chloramine or chlorine). WQZs are used when undertaking medium to long term water quality trend analysis and regulatory reporting.

A summary of Council's suburbs by WQZ is shown in Table 3, under general operating conditions.

Table 3 – Logan City Council's Water Quality Zones and Associated Suburbs

WQZ	*Main Suburbs*	*Partial Suburbs*
Greenbank	Browns Plains, Boronia Heights, Forestdale Greenbank, Heritage Park, Hillcrest, Park Ridge Regents Park	Berrinba, Chambers Flat, Crestmead, Logan Reserve, Munruben, Park Ridge South
Kimberley Park	Carbrook, Cornubia, Loganholme, Shailer Park, Tanah Merah	Slacks Creek
Marsden	Crestmead, Logan Reserve, Loganlea, Marsden, Meadowbrook, Waterford West	Berrinba, Heritage Park, Kingston, Park Ridge
Springwood	***Springwood High Level Zone*** Priestdale, Rochedale South, Underwood	
	Springwood Low Level Zone Berrinba, Daisy Hill, Eagleby, Kingston, Logan Central Slacks Creek, Springwood, Woodridge	Loganholme, Marsden, Shailer Park, Tanah Merah, Underwood
Logan East	Bannockburn, Bahrs Scrub, Beenleigh, Belivah, Bethania, Edens Landing, Holmview, Windaroo, Waterford, Wolffdene, Mount Warren Park	Eagleby
Logan South	Cedar Grove, Cedar Vale, Chambers Flat, Jimboomba Logan Village, Mundoolun, Munruben, New Beith North Maclean, Park Ridge South, Maclean, Stockleigh, Veresdale Scrub, Woodhill, Yarrabilba	Greenbank

The SEQ water supply network grid, described in Section 2.2, may supply Council from a number of WTPs operated by Seqwater. In practice, the vast majority of treated water is supplied from the Mt Crosby WTP. An overview of the Council's supply sources, disinfection type and WQZs is provided in Table 4.

Table 4 - Logan City Council Water Source Summary

WSA	WQZ	WSZ	Disinfection Type	Blended	Approximate Water Supply from each Source			
					Mt Crosby (Kuraby)	Mt Crosby (SRWP)	Redland City (EPI)	City of Gold Coast (SRWP)
Logan North	Greenbank	Greenbank	Chloraminated[A]	Yes	85%	10%	-	5%
	Kimberly Park	Kimberly Park	Chloraminated[A]	Yes	90%	-	10%	-
	Marsden	Marsden	Chloraminated[A]	No	100%	-	-	-
	Springwood High	Springwood	Chloraminated	No	100%	-	-	-
	Springwood Low		Chloraminated	No	100%	-	-	-
Logan East	Logan East	Logan East	Chloraminated (winter) Chlorinated (summer)	No	100%	-	-	-
Logan South	Round Mountain	Logan South	Chloraminated (winter) Chlorinated (summer)	Yes	-	90%	-	10%
	Spring Mountain	Logan South	Chloraminated (winter) Chlorinated (summer)	Yes	-	90%	-	10%
	Travis Road	Logan South	Chlorinated	Yes	-	90%	-	10%
	Woodhill	Logan South	Chlorinated	Yes	-	90%	-	10%

^ Chlorinated during Network Maintenance Disinfection Program (generally occurs every 2 years).

3 ACTIONS TAKEN TO IMPLEMENT THE DWQMP

3.1 Progress in Implementing the Risk Management Improvement Plan

3.1.1 Risk Management Improvement Plan Process

Council strives for continual improvement in Drinking Water Quality Management, in accordance with *Best Practice* Principles. Council's Risk Management Improvement Plan (RMIP) is the key document used to capture opportunities for improvements to reduce contamination risks associated with the supply of drinking water.

Opportunities for improvements are captured in the RMIP and are identified from the following:

- Risk Assessments – *high risks;*
- DWQMP Reviews and Audits – *non-conformances and general improvements;*
- Drinking Water Incidents – *long term actions*; and
- Regulator feedback.

To ensure the RMIP is communicated, implemented and monitored for effectiveness, Council conducts annual reviews of the RMIP progress.

3.1.2 Implementation of the RMIP

The following section summarises the progress of the key RMIP actions with details found in Appendix B. This section is categorised according to the 12 element framework of the National Health and Medical Research Council (NHMRC) Australian Drinking Water Guidelines (2011):

Element 1 – Commitment to Drinking Water Quality Management

Action Status: The current Drinking Water Quality Policy Statement will be reviewed during the 2018-19FY.

Element 2 – Assessment of the Drinking Water Supply System

Action Status: Online water quality monitoring systems now have associated alarming via SCADA. Reviews will occur via the regular Critical Control Point (CCP) review process.

Drinking water risk assessments are undertaken for each major system change, such as a new dosing system being planned and commissioned. During 2016, a 'whole of system' drinking water risk assessment was undertaken with key stakeholders. The next risk assessment is scheduled during 2018-19FY.

Element 3 – Preventative Measures for Drinking Water Quality

Action Status: The following dosing facilities were designed and constructed to improve water quality disinfection residuals in the Logan South and Logan East water supply network.

- Logan South - Round Mountain reservoir electro-chlorinator (commissioned);
- Logan East - Two chlorine booster dosing facilities (commissioned)
- Logan North – One breakpoint and chlorine booster dosing facility (currently undergoing commissioning activities).

Additional chlorine booster dosing facilities will continue to be designed, built and commissioned during the 2018-19FY, to help improve drinking water safety within Logan, particularly during the summer periods.

Review of the Critical Control Points (CCPs) process commenced during 2017 will continue during the 2018-19FY, as new dosing systems are commissioned, including improved corrective action reporting. This will also address one of the external audit recommendations.

Reservoir security enhancements commenced during 2017/18FY as part of the water and wastewater Infrastructure Security Strategy plan development. These activities will continue during the 2018-19FY. This will also address one of the external audit recommendations.

Element 4 – Operational Procedures & Process Control

Action status: Disinfection of tools is now well established and operational procedures updated to incorporate disinfection of parts and improved hygiene practises to reduce the risk of contamination and dirty water ingress during main repairs. Tool-box talks were undertaken during 2017 and a formalised “Hy5” hygienic work practices “hands-on” training module was developed during the 2017-18FY with implementation planned for the 2018-19FY.

A CAPEX proposal to design and replace ageing sampling taps was successfully submitted during the 2017-18FY, with implementation expected to be completed during the 2018-19 FY. Together with improved prompt reporting protocols, this will help provide more effective monitoring of Council’s drinking water quality for the community.

Reservoir roof upgrades continue as part of the Infrastructure renewals program to ensure safe access to inspect reservoirs and ensure secure storage of drinking water. Formalised reservoir inspection training to be implemented during the 2018-19FY.

Element 5 – Verification of Drinking Water Quality

Action status: Council plans to integrate the numerous customer complaint systems into one Customer Relationship Management (CRM) system, likely post implementation of the Strategic Asset Maintenance Management System (SAMMS).

Improved notification of drinking water health exceedances was implemented, by automating ADWG health limit alerts in Council’s Lab Information Management System (LIMS). This has addressed one of the external audit recommendations.

Investigations continue during the 2018-19FY, to update the LIMS alert system to include key aesthetic limits.

Element 6 – Management of Incidents & Emergencies

Action status: Council’s *Incident Response* intranet page has been updated to include additional tools such as an “*E. coli* Action Plan” flowchart together with key contacts to help improve incident management. A review of Council’s Incident Management Plan (IMP) and associated training was undertaken during the 2017-18 FY.

Element 7 – Employee Awareness & Training

Action status: Drinking water awareness training is now captured via the Water Operations certificate training. The DWQMP and *Water Supply (Safety & Reliability) Act* awareness training will continue to be delivered annually to senior staff and management, as part of internal audit review process.

Formalised and WH&S safety training is well captured however a system to best capture and record ‘on-the-job’ training is still to be developed.

Additional to the “Hy5” hygienic work practices training, drinking water safety awareness training will continue to be developed and implemented across Council’s water branches.

Element 8 – Community Involvement & Awareness

Action status: Council continues to provide drinking water fact sheets and useful drinking water information via the public website (www.logan.qld.gov.au). Examples include updated information on water hardness settings for dishwashers, upcoming network maintenance disinfection works, and our 'Don't Rush to Flush' campaign.

Element 9 – Research & Development

Action status: A *Reservoir Strategy and Function Specification* was developed during the 2016-17 FY, to improve reservoir design. Reservoir condition audits were also undertaken, which resulted in a reservoir renewal Capital Expenditure (CAPEX) program to repair and upgrade a number of reservoirs during the next 5 years. This will help reduce contamination risks.

To help address long term effective disinfection residual throughout SEQ, a SEQ Disinfection Optimisation Strategy team was established, including key stakeholders from a number of water service providers including Seqwater and Logan City Council. This specialist team identified two areas within Logan where priority chlorine dosing facilities (CDF) should be established. Planning for these facilities continues into the 2018-19 FY.

Appropriate maintenance scheduling of drinking water assets will be integrated with the new Strategic Asset Maintenance Management System (SAMMS), currently under development. This will also address one of the external audit recommendations.

Element 10 – Documentation & Record Keeping

Action status: All of Council's DWQMP Annual Reports are displayed on Council's public website.

A document control system framework is still being investigated, which will continue during the 2018-19 FY, as part of an integrated management system. This will also address one of the external audit recommendations.

Element 11 – Evaluation & Audit

Action status: The Process Improvement Team, established in 2014, continues to focus on reviewing long term trends and effectiveness of implemented drinking water quality improvement projects. Progress on long-term action status continues. Through these activities Council aims to provide consistent and reliable safe drinking water to the community.

Council will continue to undertake annual internal audits to help identify non-conformances and opportunities for improvement. These findings are captured in the RMIP (Appendix B).

The software for a Water Quality Information Management System (WIMS), to help with effective medium/long term trend analysis, commenced development during the 2017-18 FY with implementation to continue during 2018-19FY.

Element 12 – Review & Continual Improvement

Action status: Aspects of the RMIP have now been integrated into the Business Planning process.

Investigations found that Intelex was deemed as the best tool to help better manage long term actions associated with incidents, non-conformances and high risks. Intelex development commenced during 2017-18 FY and implementation to continue during 2018-19FY.

Identification and management of any new high risks from the whole of system risk assessment and recent audit findings will continue during the 2018-19 FY.

3.2 Operational Monitoring Program Revisions to Maintain Water Quality Compliance

No additional revisions were made to the Operating Monitoring Program to those already included in the improvements described in the current RMIP (Section 3.1 and Appendix B).

3.3 Amendments made to the DWQMP

A review of the DWQMP Rev5.2 was undertaken during the 2016-17FY with the key amendments included in the DWQMP Annual Report 2016-17FY.

The revised DWQMP Rev5.3 was submitted to the Water Supply Regulator November 2017 and approved February 2018.

4 COMPLIANCE WITH WATER QUALITY CRITERIA

4.1 Compliance Summary

To determine drinking water compliance, the verification monitoring program results are assessed against:

- Water quality criteria specified by the Regulator in the Water Quality and Reporting Guideline for a Drinking Water Service;
- Health guideline values in the Australian Drinking Water Guidelines (ADWG); and
- Drinking water quality criteria from the *Public Health Regulation 2005.*

During the 2017-18FY there were five (5) instances of non-compliance with the water quality criteria for Council's verification monitoring program. There were three (3) additional non-compliances however they were detected from a THM management project, a new mains installation project and a customer complaint investigation. The five verification monitoring non-compliances are summarised briefly below in Table 5 and described in more detail in section 5.1. Non-verification monitoring exceedances are described in section 5.1.2.

Table 5 - Verification Monitoring Program Non-compliance Events Summary 2017-18 FY

#	Date	Location	WSZ	Parameter	Result	ADWG (health) limit	Units
1	27/11/2017	Travis Road Reservoir (DSP054)	*Logan South*	*THM*	0.28	<0.25	mg/L
2	4/12/2017	Kimberley Park elevated reservoir, Kimberley Park (DSP033)	*Kimberley Park*	*E. coli*	1	<1	MPN/100mL
3	26/02/2018	Old Bluff Road reservoir, Woodhill (DSP077)	*Logan South*	*E. coli*	5	<1	MPN/100mL
4	7/03/2018	Peacock Avenue, Beenleigh (DSP040)	*Logan East*	*E. coli*	1	<1	MPN/100mL
5	21/03/2018	Tallagandra Court, Beenleigh (DSP052)	*Logan East*	*E. coli*	12	<1	MPN/100mL

4.2 Monitoring Program Overview

Monitoring of drinking water quality in Logan City is undertaken to:

- Verify drinking water quality meets regulatory requirements;
- Verify the safety of the drinking water along with the effectiveness of the network operation and system integrity;

- Facilitate review of water quality performance; and
- Identify potential emerging water quality issues.

Monitoring during the 2017-18 FY was carried out in accordance with Council's current Verification Monitoring Plan (DM#9486600).

4.3 Lab reporting changes

During the 2017/18 year, changes in reporting methodology were implemented at Logan City Council's NATA laboratory. This included:

- Heterotrophic Plate Count
  - maximum reporting qualified at >300cfu/mL
  - minimum reporting qualified at <10 CFU/mL
- Turbidity minimum reporting qualified at <0.5NTU

These changes are being reviewed by the Water Product Quality and the Laboratory during 2018/19. The data summary presented in Appendix A contains the current maximum and minimum values.

4.4 Data Analysis Methodology

Table 6 summarises the methodology employed to analyse the data used in the Water Quality Performance Summary for 2017-18 FY. This methodology is consistent with the ADWG guidance provided on statistical principles (Information sheet 3.3).

Table 6 - Data Analysis Methodology

Data subject	*Methodology*	*Reference*
Outliers	All outliers are included in the analysis.	ADWG information sheet 3.3
Less than values (<)	Less than values (<) are substituted with a value equivalent to half the Limit of Reporting (LOR). For example a result of <1 is considered 0.5 for the purposes of data analysis.	ADWG information sheet 3.3
Data exclusions	Data from repeat samples, project, emergency or investigative sampling are not included in the data analysis.	DEWS Water Quality Reporting Guideline 2010

The summary of water quality data, found in Appendix A, is presented in six separate tables representing each of the six Water Quality Zones (WQZ).

Also included, is a summary of compliance results for *E. coli* undertaken during drinking water verification monitoring. *E. coli* results are displayed in this report for the whole of Logan City (i.e. all WQZs combined – refer to Appendix A (Table 15 and Table 16).

5 NOTIFICATIONS TO THE REGULATOR UNDER SECTIONS 102 AND 102A OF THE ACT

During the 2017-18 FY, there were eight instances where the Regulator was notified under sections 102 and/or 102A of *the Act*.

Notifications include any limits exceeding the ADWG Health Limits and/or if there was reason to believe public health was potentially at risk. During ADWG health exceedances, Logan City Council initiates their Incident Management team and works closely with Qld Health and the DNRM&E to ensure actions undertaken protect public health.

5.1 Non-Compliances with Water Quality Criteria

Of the five notifications detected via Council's routine Verification Monitoring program, four were related to the detection of *E.coli* and one to the detection of Trihalomethanes (THM).

The other three non-verification monitoring notifications were detected:

- during a THM monitoring project (*E.coli*);
- during the installation of new mains by contractors (*E.coli*); and
- From a customer complaint (high chlorine).

E. coli is used in the water industry as an indicator of recent faecal contamination of the water supply. A positive *E. coli* detection does not necessarily indicate that the water supply is unsafe. However, as human pathogens are often associated with faecal contamination, it is likely that if pathogens were present that *E. coli* would also be detectable.

THMs are present in drinking water principally as the result of disinfection using chlorination or, to a much lesser extent, chloramination. Once produced, trihalomethanes can be removed with air stripping or adsorption onto granular activated carbon. Action to reduce THMs is undertaken, but this action must not compromise disinfection, as non-disinfected water poses significantly greater risk than THMs.

A summary of the notification findings with the corrective and preventative actions undertaken is summarised below.

5.1.1 Non-compliant Events - Verification Monitoring Program

5.1.1.1 Detection of THM (Travis Road Reservoir, Logan Village – Logan South WSZ)

Incident Description

THM was detected above the health guideline limit in a sample collected on the 27th November 2017 from the Travis Road reservoir sample tap. The THM value was 0.28mg/L which exceeded the health limit of 0.25mg/L. Increased values of THM were present within the Logan South water supply zone, particularly where secondary chlorine dosing occurs. This was as a result of increased organics in the raw water due to rainfall in a certain catchment and re-chlorination within the Logan South area.

Corrective and Preventative Actions

In consultation with Qld Health, DNRM&E and Seqwater the following actions effectively reduced THMs to below the health limits:

- Seqwater implemented their THM strategy plan at the Mt Crosby water treatment plant to help reduce the organics in the treated water supplied to Logan City Council;
- Logan City Council also implemented:
  - Reservoir aeration;

- Network flushing;
- Reduction in chlorine targets; and
- Increased water quality monitoring.

A SEQ THM Strategy team was established, consisting of representatives from QLD Health, Seqwater, DNRM&E and SEQ water service providers. This team developed a proactive and consistent approach to proactively manage the THM challenges that occur intermittently during rainfall events in key catchments within SEQ and minimise THM health exceedances.

5.1.1.2 Detection of *E.coli* (Kimberley Park Elevated Reservoir, Kimberley Park – Kimberley Park WQZ)

Incident Description

E. coli was detected in a sample collected on the 4th December 2017 from the Kimberley Park Elevated reservoir sample tap, which is sampled weekly. The *E. coli* result was 1 MPN/100mL with a total chlorine residual of 0.19mg/L. There was no *E. coli* present in the surrounding area and it was raining heavy on the day of testing.

Corrective and Preventative Actions

Seqwater's Kimberley Park ground reservoir which feeds into Council's Kimberley Park Elevated reservoir was inspected with no ingress found and previous results met ADWG health guidelines. Council's Kimberley Park Elevated reservoir was also inspected and dosed with liquid sodium hypochlorite with the surrounding network flushed to draw chlorine residual through the network. Repeat testing resulted in no *E.coli* present. A reservoir hatch leak was found during the inspection, which was immediately sealed to prevent further ingress.

Long term preventative actions includes reservoir upgrades as part to of the Infrastructure CAPEX renewals program and reservoir inspection refresher training to occur during the 2018-19FY. Network disinfection clean to occur every second year to help improve chlorine residuals.

5.1.1.3 Detection of *E. coli* (Old Bluff Road Reservoir, Woodhill - Logan South WQZ)

Incident Description

E. coli was detected in a sample collected on the 26th February 2018 from the Bluff Road reservoir sample tap, which is sampled weekly. The *E.coli* result was 5 MPN/100mL with a total chlorine residual of 0.15mg/L. No *E.coli* was present in the other verification samples collected from the surrounding area.

Corrective and Preventative Actions

Bluff Road reservoir supplying the area was inspected and dosed with liquid sodium hypochlorite with the surrounding network flushed to draw chlorine residual through the network. Repeat testing resulted in no *E.coli* present. Reservoir roof hatch gaps found during the inspection were sealed to prevent further ingress.

Long term preventative actions includes manually dosing the reservoir with liquid chlorine to maintain effective chlorine residual until improvements are made to Woodhill auto-dosing facility during the 2018-19 FY. Additionally reservoir upgrades continue as part to of the Infrastructure CAPEX renewals program and reservoir inspection refresher training to occur during the 2018-19FY.

5.1.1.4 Detection of *E. coli* (Peacock Avenue, Beenleigh - Logan East WQZ)

Incident Description

E. coli was detected in a sample collected on the 7th March 2018 from the Peacock Avenue reticulation verification sample tap. The *E.coli* result was 1 MPN/100mL with a total chlorine residual of 0.14mg/L. No *E.coli* was present in the other verification samples collected from the surrounding area. As part of the hydrant replacement program for Council, a contractor was performing works during a heavy rain event resulted in contaminated soil entering the reticulation network. Investigation found this was due to insufficient preventative measures.

Corrective and Preventative Actions

Extensive flushing of the surrounding network was undertaken drawing chlorinated water from the nearby Logan River dosing facility. Results from repeat testing post corrective actions indicated in no *E. coli* present. Council's Alliance partners and associated contractors undertook hygienic works practises training and incorporated improved systems in their works program (i.e. hygienic works practises, weather radar checks, use of pipe end caps & improved communications with Council).

Long term preventative actions includes training all contractors in Council's newly developed Hy 5 program (i.e. best practise hygienic work practises including drinking water risks) commencing during the 2018-19 FY.

5.1.1.5 Detection of *E. coli* (Tallagandra Court, Beenleigh - Logan East WQZ

Incident Description

E. coli was detected in a sample collected on the 21st March 2018 from the Tallagandra verification reticulation sample tap. The *E.coli* result was 12 MPN/100mL with a total chlorine residual of 0.14mg/L. No *E.coli* was present in the other verification samples collected from the surrounding area.

Corrective and Preventative Actions

Wuraga elevated reservoir was inspected and dosed with liquid sodium hypochlorite with the surrounding network flushed to draw chlorine residual throughout the network. Results from repeat testing pre and post corrective actions indicated in no *E.coli* present. The reservoir inspection found no gaps nor evidence of ingress hence source of contamination was inconclusive.

Despite no likely cause of contamination, Council will continue to implement long term preventative actions including reservoir upgrades as part to of the Infrastructure CAPEX renewals program, reservoir inspection refresher training and main repairs hygienic work practices to occur during the 2018-19FY.

5.1.2 Non-compliant Events – Non Verification Monitoring

(THM project monitoring, New Mains Connections & Customer Complaint)

5.1.2.1 Detection of *E. coli* (Spring Mountain Reservoir, Spring Mountain – Logan South WQZ

Incident Description

E. coli was detected in a sample collected on the 18th December 2017 from the Spring Mountain reservoir sample tap. This was part of additional sampling to manage high THMs experienced in the Logan South water quality zone, otherwise this site is sampled weekly. The *E.coli* result was 1 MPN/100mL with a total chlorine residual of 0.13mg/L. No *E.coli* was present in the other verification samples collected from the surrounding area.

Corrective and Preventative Actions

Spring Mountain reservoir supplying the area was inspected and dosed with liquid sodium hypochlorite with the surrounding network flushed to draw chlorine residual through the network.

Results from repeat testing indicated in no *E.coli* present. Minor reservoir roof gap and vent mesh was found compromised which was immediately repaired to prevent further ingress.

Long term preventative actions includes reservoir upgrades as part to of the Infrastructure CAPEX renewals program and reservoir inspection refresher training to occur during the 2018-19FY.

5.1.2.2 Detection of *E. coli* (Riverhill Road / Cowper Avenue, Eagleby - Logan East WQZ)

Incident Description

Council was informed by an external contractor on the 6th February 2018 of a positive *E. coli* result from a sample taken as part of a new main connection at Riverhills Road adjacent to Cowper Avenue, Eagleby. The *E.coli* result was 2 MPN/100mL with total chlorine residual of 0.15mg/L. The sample was taken via an existing ball valve connection to a temporary valve located very close to ground level. Council's verification monitoring results from a nearby sample tap on the same road indicated no *E.coli* present in Council's water supply network during the same period.

Corrective and Preventative Actions

Council conducted immediate flushing of the isolated mains together with localised flushing of the existing mains as a precautionary measure. Repeat sampling indicated no *E.coli* present. As a preventative action, Council discussed with the Alliance partner and associated contractor improved sampling tap location selection and sampling methodology, including tap disinfection prior to sampling, to reduce the risk of sampling contamination.

The contractor was contacted to confirm that appropriate methods of disinfection and sampling were being undertaken in new mains installation and commissioning.

5.1.2.3 Detection of High Chlorine (Eagleby - Logan East WQZ)

Incident Description

Council was informed by a customer on the 28th May 2018 of a high chlorine taste in their drinking water. Lab sampling undertaken at their property and surrounding area indicated chlorine levels were well within the ADWG health limits. The following morning the nearby wastewater treatment plant staff also indicated high chlorine odour in their drinking water. This time sampling indicated the total chlorine was 72mg/L, which was well above the ADWG health limit of 5mg/L. Council's Alliance partners were undertaking works in the area with a new mains replacement program.

The most probable cause of the high chlorine event was failed backflow prevention, incorrect dose and insufficient flushing during disinfection of a temporary service line to facilitate mains replacement. This released a slug of highly chlorinated water into the network.

Corrective and Preventative Actions

Council conducted immediate localised flushing and Alliance partners conducted door knocking and a letter box drop within the area to contact Council if they still experienced high chlorine. Repeat sampling within the area indicated chlorine levels were well within the ADWG health limits.

Preventative actions included procedural update to avoid high concentrated hypochlorite on work sites, improved backflow prevention devices to be used and hypochlorite awareness training and associated risks in drinking water.

Long term preventative actions includes training all contractors in Council's newly developed Hy 5 program (i.e. best practise hygienic work practises including drinking water risks) continuing during the 2018-19 FY.

6 CUSTOMER COMPLAINTS RELATED TO DRINKING WATER QUALITY

6.1 Community Engagement

Consumer satisfaction is a critical aspect in the verification of drinking water quality. The monitoring and analysis of customer complaints is considered a key part of Logan City Council's (Council) drinking water quality verification program. At all times, Council encourages customers to lodge complaints about their water quality if they feel their drinking water is unsatisfactory or if they believe their health is at risk.

Encouraging customers to lodge complaints establishes a link between the service provider and the customer and may provide a real time indicator of water quality performance.

6.1.1 Key Projects

A Network Maintenance Disinfection Program was undertaken in the Kimberley Park WQZ from July to September 2017. This program was undertaken to reduce nitrification in the Kimberley Park network and improve chlorine disinfection effectiveness. As part of community engagement, a letter-box drop was carried out in the affected area. Fact sheets and public notices were made available via Council's website and the local newspaper. Information was also posted on social media, informing the community of the proposed changes. Council received a number of customer complaints during this period, which is discussed in proceeding sections.

In addition, a new breakpoint chlorination facility was commissioned in the Logan South WQZ during late October 2017. Based in New Beith, the Round Mountain chlorine dosing facility supplied free chlorine into the Logan South WQZ from late October until early June 2018. Many parts of the Logan South WQZ received chlorinated water for the first time, so the project included a communication strategy to advise customer of changes to their water supply.

6.2 Customer Complaints

Customer complaints are closely linked to the performance of the water supply system.

Council aims to:

- Respond directly to the customer making the complaint;
- Investigate the complaint;
- Rectify the condition;
- Address the root cause; and
- Mitigate risks to public health effectively.

During this process, information is collected which assists with future improvement activities. Establishment of this process is crucial in driving Council's process improvement activities.

Council classifies customer complaints according to the following categories:

- Water Quality - Suspected Health
- Water Quality – Appearance
- Water Quality - Taste and Odour

Council received a total of 358 drinking water complaints for the 2017-18 FY, equating to 3.27 complaints per 1000 water connections.

Of the complaint types Appearance (272) was the highest followed by Taste and Odour (59) and Suspected Health (27).

A breakdown percent of customer complaints by category is shown in Figure 2.

The number of customer complaints received by Council per category for each Water Quality Zone (WQZ) is shown in Figure 3 and Table 7 with complaints per connection shown in Table 8.

The calculation of complaints per 1000 connections allows for comparisons to be made between Water Quality Zones (WQZ). The number of connections is based on the number of properties currently connected to Council's drinking water network by WQZ.

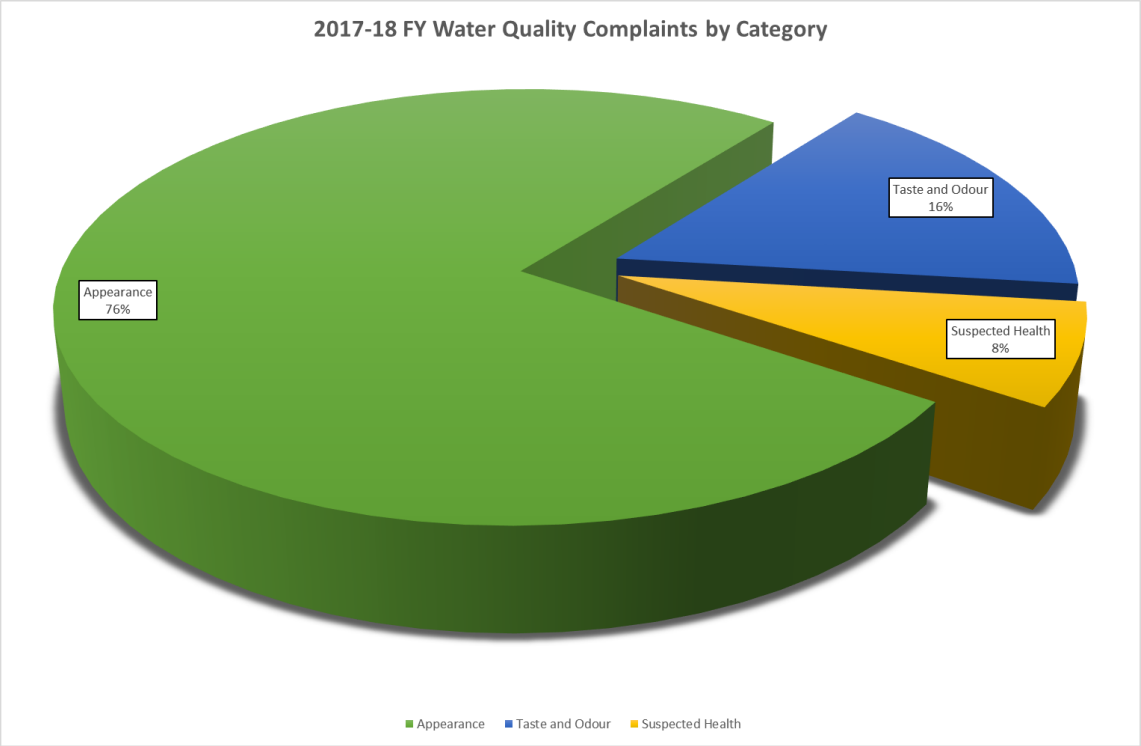

Figure 2 - Summary of Water Quality Complaints by Category

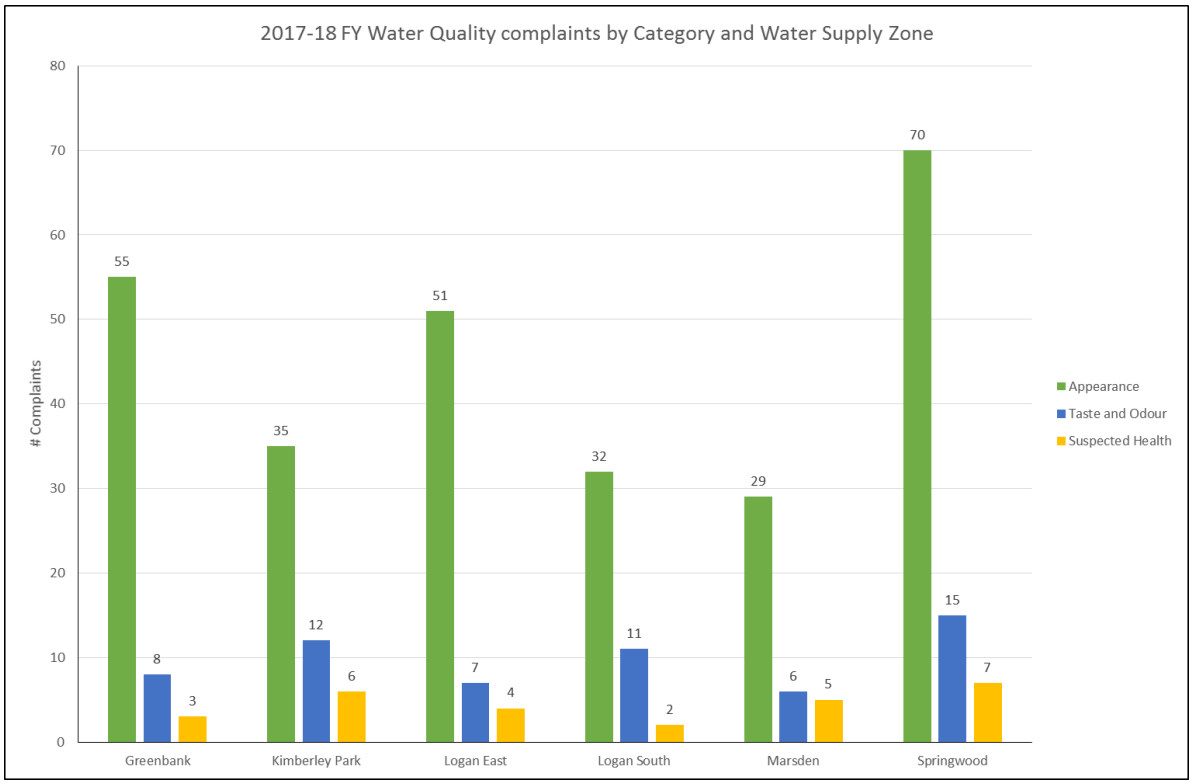

Figure 3 - Water Quality Customer Complaints by Category and Zone

Table 7 - Water Quality Complaints Summary 2017-18FY

2017-18 FY Total Water Quality Complaints				
Water Supply Zone	***Appearance***	***Taste/Odour***	***Suspected Health***	***Total***
Greenbank	55	8	3	66
Kimberley Park	35	12	6	53
Logan East	51	7	4	62
Logan South	32	11	2	45
Marsden	29	6	5	40
Springwood	70	15	7	92
Total	272	59	27	358
% of Total	76%	16%	8%	100%

Table 8 - Water Quality Customer Complaints per 1000 connections

2017-18 FY Customer complaints/1000 connections					
Water Supply Zone	***# Connections[6]***	***Appearance***	***Taste/Odour***	***Suspected Health***	***Total***
Greenbank	16,387	3.36	0.49	0.18	***4.03***
Kimberley Park	8,815	3.97	1.36	0.68	***6.01***
Logan East	16,507	3.09	0.42	0.24	***3.76***
Logan South	10,923	2.93	1.01	0.18	***4.12***
Marsden	17,175	1.69	0.35	0.29	***2.33***
Springwood	39,924	1.75	0.38	0.18	***2.30***
All Zones Total	109,731	2.48	0.54	0.25	***3.27***

6.2.1 Suspected Health

Complaints are occasionally received from customers concerned that their drinking water may be causing illness and these are thus categorised as *Suspected Health* complaints.

During the 2017-18 FY, Council received a total of 27 suspected health complaints. Test results confirmed that the drinking water supplied to the customer's homes met the ADWG health related guideline limits and regulated values.

[6] Number of connections based on water connected property GIS layer extracted 24/07/2018.

All complaints were actioned and closed out following appropriate consultation with the customer. No operational changes were implemented as a result of the suspected health complaints during the 2017-18 FY.

Fuel/chemical tasting complaints (i.e. hydrocarbon related) can be received either as a Suspected Health or Taste & Odour complaint. In this report they have been categorised in the Taste & Odour section (Section 6.2.3.3).

6.2.2 Appearance

Appearance of drinking water (*Appearance*) was the most frequently recorded complaint type for the 2017-18 FY reporting period. Of the 358 total complaints 272 were related to the appearance of the water (76% of all water complaints received).

Springwood WQZ returned the most *Appearance* complaints (70 complaints, 1.75 complaints per 1,000 connections) representing 20% of all appearance complaints received. However, analysis of complaints per 1000 connections showed that Kimberley Park WQZ had the highest rate of complaints (35 complaints, 3.97 complaints per 1,000 connections), followed closely by Greenbank WQZ (55 complaint, 3.36 complaints per 1,000 connections)

All water *Appearance* complaints received were investigated with the most common remedial action being flushing of water mains.

There are two sub-sets to Appearance, being the following, with further descriptions below:

- Dirty Water; and
- Milky and/or White Water.

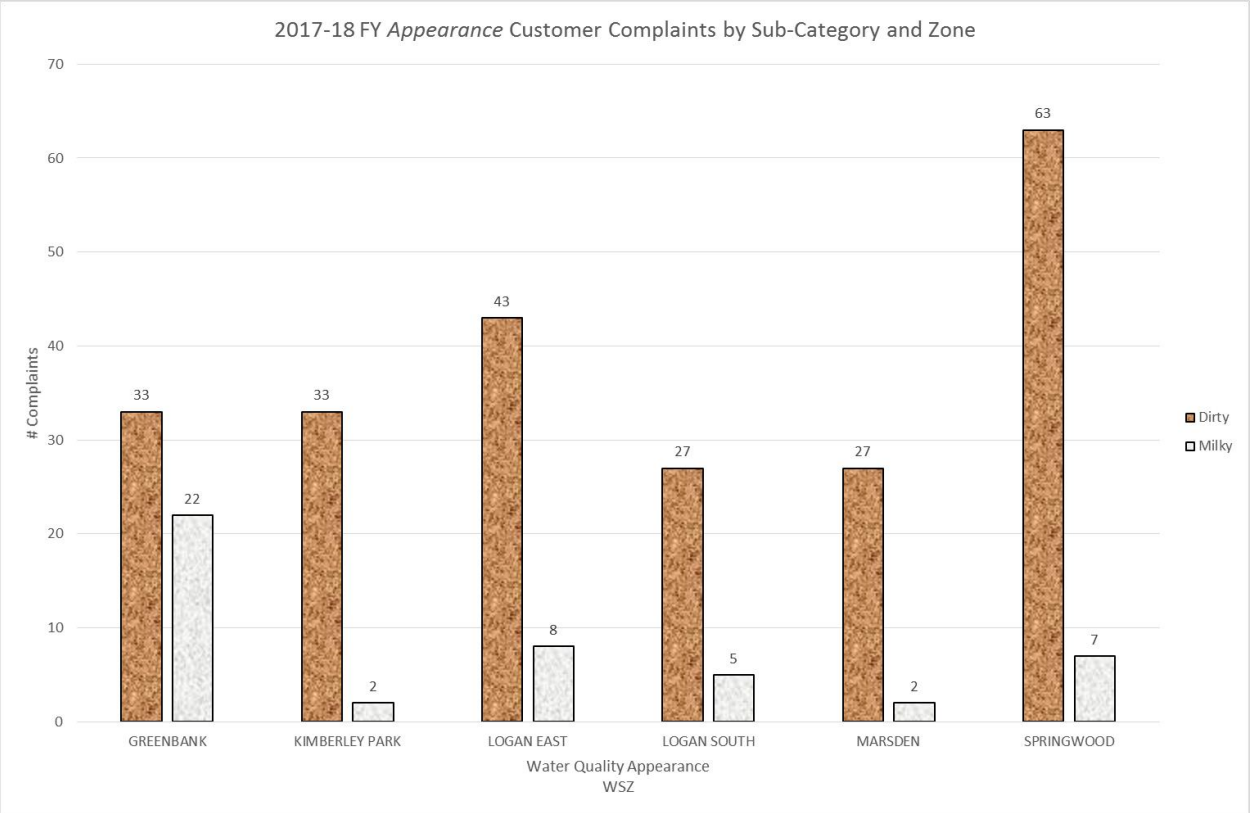

Figure 4 - *Appearance* Customer Complaints by Sub-Category and Zone

6.2.2.1 Dirty Water

Dirty Water is a sub-set of water appearance complaints and is typically associated with brown or turbid water. In total, there were 226 dirty water complaints, contributing to 83% of all water appearance complaints across the City.

As can be seen in Figure 4, Springwood WQZ returned the highest number of dirty water complaints (63). Kimberley Park WQZ network maintenance disinfection project was undertaken from late July to early September 2017. There were a number of dirty water complaints which are likely to have been caused by this program (12). The previous Kimberley Park disinfection conducted from July – August 2015 recorded 18 dirty water complaints. While there is an increased number of customer complaints during these projects, the benefits in terms of network health and resulting water quality performance are considerable.

The remaining complaints are generally related to unplanned broken mains or main repairs.

Implementation of the Hy5 hygienic work practices program commenced during the 2017-18FY, with Water Operations supervisors having completed the training. This program includes training on minimising ingress and adequate flushing techniques when working on main repairs (refer to Section 3.1.2 – Element 4). This activity may reduce the number of dirty water complaints received in future.

6.2.2.2 Milky and/or White Water

The majority of *Milky and/or White Water* complaints were suspected to be associated with mains repairs, resulting in air in the line.

A total of 46 *Milky and/or White Water* complaints were received during the reporting period, 17% of the Appearance complaints.

Greenbank WQZ returned the highest number (22) as shown in Figure 4.

As part of the customer complaint management process, complaints lodged by customers for white or milky water are first investigated to see if air entrainment is the cause. This is done by requesting the customer to perform a settling test and observing if the water clears after a defined time period. All complaints that were not rectified by a settling test, had nearby mains flushed along with sampling and additional testing for further investigation.

No operational changes were implemented as a result of investigations into these complaints over the 2017-18 FY.

6.2.3 Taste and Odour

Taste and Odour complaints are characterised by an objectionable taste or odour noticed by customers. Typical descriptions from customers include earthy, metallic, chlorine or a chemical / petrol taste in the water. Thus Taste and Odour complaints are generally categorised into the following sub-sets:

- Chlorine;
- Musty / Earthy / Stale; and
- Hydrocarbons / Chemical / Petrol

The third category, *Hydrocarbons / Chemical*, is included to account for water quality complaints where the water reportedly “smells or tastes like petrol or chemicals”. Occasionally, a taste and odour complaint may accompany a claim of illness, thus these complaints are often treated in the same manner as “suspected health” related complaint types.

During the 2017-18 FY reporting period, there were 59 *Taste and Odour* complaints received. Figure 5 shows the Taste and Odour subset complaints per WQZ, with Springwood WQZ having the highest number of complaints (15) however in relation to complaints per 1000

connections Kimberley Park WQZ had the highest being 1.36 compared to Springwood WQZ being 0.38)

All these complaints were attended to and flushed with customers on occasion being supplied bottled water, whilst investigation and remedial activities were undertaken.

Figure 5 - *Taste and Odour* Complaints by Sub-Category and Zone

6.2.3.1 Chlorine

Whilst most of Logan City has chloramine as the residual disinfectant, some WQZs can at times have free chlorine in the water as the residual disinfectant.

When consuming water, customers typically detect chlorine more easily than chloramine. The ADWG advises that customers may notice the taste of chlorine at levels as low as 0.6 mg/L however this will vary between people. The ADWG health limit for chlorine is 5 mg/L (as total chlorine) however Council aims to operate well below this limit. Council aims to manage network chlorine levels which provide customers with safe treated drinking water that is also pleasant to drink.

During the reporting period, 10 of the Taste and Odour complaints were associated with a chlorine taste or odour (17%).

As can be seen in Figure 5, the majority of *Chlorine* complaints were from the Logan South WQZ (5) followed by Kimberley Park WQZ (3). These chlorine complaints appear to be related to the commissioning of the Round Mountain reservoir electrochlorinator discussed in Section 3.1.2 Element 3 and the Kimberley Park WQZ Network Disinfection Maintenance Program.

Review of the effectiveness of the Network Maintenance Disinfection Program, along with consumer satisfaction, is ongoing. As discussed in Section 6.1.1, fact sheets were developed

and included on Council's website, as part of the program's comprehensive communication strategy.

No operational changes have been implemented by Council as a result of these complaints.

6.2.3.1 Musty / Earthy / Stale

Musty, Earthy or Stale tasting water can be due to a number of factors including:

- Odours from sink drains being mistaken for odour from taps;
- Stale water in the pipes in areas of low water usage or stale water in residence's pipes when they have been away for a long period; or
- High rainfall in the Seqwater catchment area which can increase the amount of organics and minerals in the raw water which can impact taste even after water treatment.

As shown in Figure 5, the majority of *Musty, Earthy or Stale* complaints were from the Greenbank and Springwood WQZs (both 8), followed by Kimberley Park (7) with Marsden WQZ returning the lowest number (4).

All complaints were investigated and in cases where samples were collected and analysed, the customer was informed of the water quality results, of which all met the ADWG health guidelines. Generally flushing was also carried out by Water Operations.

No operational changes have been implemented by Council as a result of these complaints.

6.2.3.2 Hydrocarbons / Chemical / Petrol

Whilst not common, residents do occasionally use pesticides or leaking petrol / oil on their property which seeps through the soil into their service line, contaminating their water supply.

During the 2017-18 FY, Council received 12 hydrocarbon / chemical *Taste & Odour* complaints[7]. Investigations were undertaken, including thorough sampling and testing from both Council's water supply to the property and directly from the affected property, and in some cases neighbouring properties. Of these, five were confirmed by laboratory testing as containing the common hydrocarbon chemicals benzene, toluene, ethylbenzene and xylene (commonly referred to as *BTEX*). In each case the results concluded:

- That Council's water supply met ADWG health guideline requirements and there was no detection of hydrocarbons in the water supply to the property; and
- That contamination occurred within the owner's property, impacting their drinking water and exceeding the ADWG limits.

As a result, Council provided the water quality results together with advice on appropriate corrective and preventative actions that should be undertaken, including a fact sheet (*How to Avoid Chemical Contamination of Your Water Supply*) to all affected customers. This fact sheet can also be found on Council's website.

No operational changes have been implemented by Council as a result of these complaints.

[7] Please note that all hydrocarbon complaints have been classified 'Taste and Odour' for the purposes of this report (i.e. none are classified in the health complaints category).

7 FINDINGS AND RECOMMENDATIONS OF THE DRINKING WATER QUALITY MANAGEMENT PLAN AUDITOR

One of the conditions of having an approved DWQMP is to undertake an external DWQMP audit within 4 years of an approved DWQMP. Council's DWQMP was originally approved December 2013, which has had amendments since then.

The last external audit was undertaken on the DWQMP Rev 5.2 during the 2016-17FY with key findings included in the DWQMP Annual Report 2016-17FY.

Key recommendations for improvements from this external audit have been captured in the Risk Management Improvement Plan (RMIP).

The next external audit is due 30th June 2021.

8 OUTCOME OF THE REVIEW OF THE DRINKING WATER QUALITY MANAGEMENT PLAN

The purpose of DWQMP review is to ensure that the DWQMP remains relevant and current, with regards to the operation of the drinking water service.

In accordance with the requirement of Section 99 (2)(b) and 106 of *the Act*, Council's next internal review is due by the 30th June 2019, during the 2018-19 FY, which will include review of the currently approved DWQMP Rev 5.3.

There were no new hazards or hazardous events that affected the drinking water quality during the 2017-18 FY, which were not already addressed in the RMIP.

APPENDIX A - SUMMARY OF COMPLIANCE WITH WATER QUALITY CRITERIA

The results from the verification monitoring program have been assessed against the water quality criteria specified by the Regulator in the Water Quality and Reporting Guideline for a Drinking Water Service. The reporting period was 1st July 2017 – 30th June 2018 (2017-18 FY). A summary of performance by Water Quality Zone is included on the proceeding pages.

Please refer to Section 4.2 for further descriptions of the monitoring program regime and statistical analysis principles adopted for the analysis.

Reticulation Verification Monitoring

Table 9 – Greenbank water quality zone verification monitoring summary

Greenbank Water Quality Zone														
#	**PARAMETER**	**UNITS**	**FREQUENCY**	**TOTAL NO. OF SAMPLES COLLECTED**	**NO. OF SAMPLES IN WHICH PARAMETER WAS DETECTED**	**NO. OF SAMPLES EXCEEDING WATER QUALITY CRITERIA (HEALTH)**	**MIN**	**MAX**	**MEAN**	**95TH PERCENTILE**	**AUSTRALIAN DRINKING WATER GUIDELINE (HEALTH)**	**MET ADWG HEALTH LIMIT?**	**LOR**	**LABORATORY NAME**
MICROBIAL														
1	*E. coli*	MPN/100mL	WEEKLY	290	0	0	<1	<1	<1	<1	<1	✓***c***	1	LCC
2	Heterotrophic Plate Count	CFU/mL	WEEKLY	183	183	***a***	1	>300	54	219	***a***	***a***	10	LCC
3	Total Coliforms	MPN/100mL	WEEKLY	290	47	***a***	<1	980	7	23	***a***	***a***	1	LCC
CHEMICAL / PHYSICAL														
4	Alkalinity as $CaCO_3$	mg/L	EACH PERIOD	34	34	***a***	55	92	84	90	***a***	***a***	1	LCC
5	Aluminium, Total	mg/L	EACH PERIOD	67	67	***a***	0.03	0.08	0.06	0.08	***a***	***a***	0.01	LCC
6	Ammonia-N	mg/L	EACH PERIOD	183	183	***a***	<0.1	0.6	0.1	0.2	***a***	***a***	0.1	LCC
7	Arsenic, Total	mg/L	EACH PERIOD	67	67	0	<0.001	0.001	<0.001	0.001	0.01	✓	0.001	LCC
8	Barium, Total	mg/L	EACH PERIOD	67	67	0	0.006	0.030	0.025	0.029	2	✓	0.001	LCC
9	Beryllium, Total	mg/L	EACH PERIOD	67	67	0	<0.001	<0.001	<0.001	<0.001	0.06	✓	0.001	LCC
10	Bismuth	mg/L	EACH PERIOD	67	67	***a***	<0.001	0.004	<0.001	<0.001	***a***	***a***	0.001	LCC
11	Boron, Total	mg/L	EACH PERIOD	67	67	0	0.02	0.22	0.05	0.19	4	✓	0.01	LCC
12	Cadmium, Total	mg/L	EACH PERIOD	67	67	0	<0.001	<0.001	<0.001	<0.001	0.002	✓	0.001	LCC
13	Calcium Hardness	mg/L	EACH PERIOD	67	67	***a***	44	73	63	72	***a***	***a***	1	LCC
14	Calcium, Total	mg/L	EACH PERIOD	67	67	***a***	18	29	25	29	***a***	***a***	1	LCC
15	Chloride	mg/L	EACH PERIOD	67	67	***a***	16.5	105.0	60.3	76.9	***a***	***a***	0.1	LCC
16	Chlorine, Free	mg/L	WEEKLY	290	290	0	<0.05	0.99	0.123	0.34	5	✓	0.05	LCC
17	Chlorine, Total	mg/L	WEEKLY	290	290	0	<0.05	2.50	0.893	2.15	5	✓	0.05	LCC

18	Chromium, Total	mg/L	EACH PERIOD	67	67	0	<0.001	<0.001	<0.001	<0.001	0.05	✓	0.001	LCC
19	Cobalt, Total	mg/L	EACH PERIOD	67	67	***a***	<0.001	<0.001	<0.001	<0.001	***a***	***a***	0.001	LCC
20	Colour, Apparent	Hazen	EACH PERIOD	67	67	***a***	<1	50	3	5	***a***	***a***	1	LCC
21	Colour, True	Hazen	EACH PERIOD	67	67	***a***	<1	2	<1	<1	***a***	***a***	1	LCC
22	Conductivity	µS/cm	EACH PERIOD	183	183	***a***	199	713	459	626	***a***	***a***	1	LCC
23	Copper, Total	mg/L	EACH PERIOD	67	67	0	0.002	0.054	0.010	0.043	2	✓	0.001	LCC
24	Fluoride	mg/L	EACH PERIOD	67	67	0	<0.1	0.8	0.3	0.8	1.5	✓	0.1	LCC
25	Iron, Total	mg/L	EACH PERIOD	67	67	***a***	0.004	0.810	0.028	0.045	***a***	***a***	0.003	LCC
26	Lead, Total	mg/L	EACH PERIOD	67	67	0	<0.001	0.001	<0.001	0.001	0.01	✓	0.001	LCC
27	Lithium, Total	mg/L	EACH PERIOD	67	67	***a***	<0.001	0.001	<0.001	<0.001	***a***	***a***	0.001	LCC
28	Magnesium, Total	mg/L	EACH PERIOD	67	67	***a***	2	16	12	15	***a***	***a***	1	LCC
29	Manganese, Total	mg/L	EACH PERIOD	67	67	0	0.001	0.016	0.005	0.012	0.5	✓	0.001	LCC
30	Molybdenum, Total	mg/L	EACH PERIOD	67	67	0	<0.001	0.001	<0.001	0.001	0.05	✓	0.001	LCC
31	Nickel, Total	mg/L	EACH PERIOD	67	67	0	<0.001	0.001	<0.001	0.001	0.02	✓	0.001	LCC
32	Nitrate (NO_3-N)	mg/L	EACH PERIOD	67	67	0	0.2	4.4	1.9	3.4	50	✓	0.1	LCC
33	Nitrite (NO_2-N)	mg/L	EACH PERIOD	67	67	0	0.2	1.3	0.5	1.0	3	✓	0.1	LCC
34	pH	pH Units	EACH PERIOD	183	183	***a***	7.3	8.4	7.7	7.9	***a***	***a***	1	LCC
35	Potassium, Total	mg/L	EACH PERIOD	67	67	***a***	2	4	3	4	***a***	***a***	1	LCC
36	Selenium, Total	mg/L	EACH PERIOD	67	67	0	<0.01	<0.01	<0.01	<0.01	0.01	✓	0.01	LCC
37	Sodium, Total	mg/L	EACH PERIOD	67	67	***a***	19	72	39	60	***a***	***a***	1	LCC
38	Sulphate	mg/L	EACH PERIOD	67	67	***a***	10	61	26	38	***a***	***a***	1	LCC
39	TDS, Calculated	mg/L	EACH PERIOD	150	150	***a***	121	433	281	381	***a***	***a***	1	LCC
40	Temperature	°C	WEEKLY	290	290	***a***	17.0	31.2	24.3	30.1	***a***	***a***	***b***	LCC
41	Thallium, Total	mg/L	EACH PERIOD	67	67	***a***	<0.001	<0.001	<0.001	<0.001	***a***	***a***	0.001	LCC
42	THM Total	mg/L	EACH PERIOD	34	34	0	0.05	0.12	0.08	0.11	0.25	✓	0.02	LCC

43	Total Hardness	mg/L	EACH PERIOD	67	67	***a***	53	130	113	128	***a***	***a***	1	LCC
44	Turbidity	NTU	EACH PERIOD	183	183	***a***	<0.5	4.2	<0.5	<0.5	***a***	***a***	0.5	LCC
45	Zinc, Total	mg/L	EACH PERIOD	67	67	***a***	<0.01	0.02	<0.01	<0.01	***a***	***a***	0.01	LCC

a - An Australian Drinking Water Guidelines 2001 health guideline does not exist for this parameter

b - Temperature does not have a limit of reporting

c - *The Public Health Regulation 2005* requires that at least 98% of samples contain no *E. coli* over a 12 month period

Table 10 – Kimberley Park water quality zone verification monitoring summary

Kimberley Park Water Quality Zone														
#	**PARAMETER**	**UNITS**	**FREQUENCY**	**TOTAL NO. OF SAMPLES COLLECTED**	**NO. OF SAMPLES IN WHICH PARAMETER WAS DETECTED**	**NO. OF SAMPLES EXCEEDING WATER QUALITY CRITERIA (HEALTH)**	**MIN**	**MAX**	**MEAN**	**95TH PERCENTILE**	**AUSTRALIAN DRINKING WATER GUIDELINE (HEALTH)**	**MET ADWG HEALTH LIMIT?**	**LOR**	**LABORATORY NAME**
MICROBIAL														
1	*E. coli*	MPN/100mL	WEEKLY	167	***1***	***1***	<1	***1***	<1	<1	<1	✓***c***	1	LCC
2	Heterotrophic Plate Count	CFU/mL	WEEKLY	119	119	***a***	<10	>300	17	60	***a***	***a***	10	LCC
3	Total Coliforms	MPN/100mL	WEEKLY	167	5	***a***	<1	26	<1	<1	***a***	***a***	1	LCC
CHEMICAL / PHYSICAL														
4	Alkalinity as $CaCO_3$	mg/L	EACH PERIOD	24	24	***a***	39	89	74	89	***a***	***a***	1	LCC
5	Aluminium, Total	mg/L	EACH PERIOD	39	39	***a***	0.03	0.13	0.06	0.08	***a***	***a***	0.01	LCC
6	Ammonia-N	mg/L	EACH PERIOD	119	119	***a***	<0.1	0.4	<0.1	0.2	***a***	***a***	0.1	LCC
7	Arsenic, Total	mg/L	EACH PERIOD	39	39	0	<0.001	0.001	<0.001	0.001	0.01	✓	0.001	LCC
8	Barium, Total	mg/L	EACH PERIOD	39	39	0	0.007	0.029	0.022	0.028	2	✓	0.001	LCC
9	Beryllium, Total	mg/L	EACH PERIOD	39	39	0	<0.001	<0.001	<0.001	<0.001	0.06	✓	0.001	LCC
10	Bismuth, Total	mg/L	EACH PERIOD	39	39	***a***	<0.001	0.004	<0.001	0.002	***a***	***a***	0.001	LCC
11	Boron, Total	mg/L	EACH PERIOD	39	39	0	0.01	0.04	0.03	0.04	4	✓	0.01	LCC
12	Cadmium, Total	mg/L	EACH PERIOD	39	39	0	<0.001	<0.001	<0.001	<0.001	0.002	✓	0.001	LCC
13	Calcium Hardness	mg/L	EACH PERIOD	39	39	***a***	47	73	61	70	***a***	***a***	1	LCC
14	Calcium, Total	mg/L	EACH PERIOD	39	39	***a***	19	29	25	28	***a***	***a***	1	LCC
15	Chloride	mg/L	EACH PERIOD	39	39	***a***	22.2	97.8	58.9	86.0	***a***	***a***	0.1	LCC
16	Chlorine, Free	mg/L	WEEKLY	167	167	0	<0.05	1.89	0.28	1.25	5	✓	0.05	LCC
17	Chlorine, Total	mg/L	WEEKLY	167	167	0	<0.05	1.92	0.59	1.56	5	✓	0.05	LCC
18	Chromium, Total	mg/L	EACH PERIOD	39	39	0	<0.001	0.001	<0.001	0.001	0.05	✓	0.001	LCC

19	Cobalt, Total	mg/L	EACH PERIOD	39	39	***a***	<0.001	<0.001	<0.001	<0.001	***a***	***a***	0.001	LCC
20	Colour, Apparent	Hazen	EACH PERIOD	39	39	***a***	<1	5	2	4	***a***	***a***	1	LCC
21	Colour, True	Hazen	EACH PERIOD	39	39	***a***	<1	1	<1	<1	***a***	***a***	1	LCC
22	Conductivity	µS/cm	EACH PERIOD	119	119	***a***	177	663	415	589	***a***	***a***	1	LCC
23	Copper, Total	mg/L	EACH PERIOD	39	39	0	0.001	0.101	0.012	0.036	2	✓	0.001	LCC
24	Fluoride	mg/L	EACH PERIOD	39	39	0	<0.1	0.9	0.4	0.8	1.5	✓	0.1	LCC
25	Iron, Total	mg/L	EACH PERIOD	39	39	***a***	0.008	0.072	0.021	0.047	***a***	***a***	0.003	LCC
26	Lead, Total	mg/L	EACH PERIOD	39	39	0	<0.001	0.002	<0.001	0.002	0.01	✓	0.001	LCC
27	Lithium, Total	mg/L	EACH PERIOD	39	39	***a***	<0.001	0.001	<0.001	0.001	***a***	***a***	0.001	LCC
28	Magnesium, Total	mg/L	EACH PERIOD	39	39	***a***	2	16	10	15	***a***	***a***	1	LCC
29	Manganese, Total	mg/L	EACH PERIOD	39	39	0	0.001	0.010	0.005	0.009	0.5	✓	0.001	LCC
30	Molybdenum, Total	mg/L	EACH PERIOD	39	39	0	<0.001	0.006	0.001	0.001	0.05	✓	0.001	LCC
31	Nickel, Total	mg/L	EACH PERIOD	39	39	0	<0.001	0.003	<0.001	0.001	0.02	✓	0.001	LCC
32	Nitrate (NO_3-N)	mg/L	EACH PERIOD	39	39	0	0.9	4.4	2.2	3.5	50	✓	0.1	LCC
33	Nitrite (NO_2-N)	mg/L	EACH PERIOD	39	39	0	0.2	1.3	0.5	1.0	3	✓	0.1	LCC
34	pH	pH Units	EACH PERIOD	119	119	***a***	7.0	7.9	7.5	7.8	***a***	***a***	1	LCC
35	Potassium, Total	mg/L	EACH PERIOD	39	39	***a***	1	4	3	4	***a***	***a***	1	LCC
36	Selenium, Total	mg/L	EACH PERIOD	39	39	0	<0.01	<0.01	<0.01	<0.01	0.01	✓	0.01	LCC
37	Sodium, Total	mg/L	EACH PERIOD	39	39	***a***	13	68	36	61	***a***	***a***	1	LCC
38	Sulphate	mg/L	EACH PERIOD	39	39	***a***	4	60	25	58	***a***	***a***	1	LCC
39	TDS, Calculated	mg/L	EACH PERIOD	104	104	***a***	109	403	251	353	***a***	***a***	1	LCC
40	Temperature	°C	WEEKLY	167	167	***a***	17.5	32.1	24.2	30.0	***a***	***a***	**b**	LCC
41	Thallium, Total	mg/L	EACH PERIOD	39	39	***a***	<0.001	<0.001	<0.001	<0.001	***a***	***a***	0.001	LCC
42	THM Total	mg/L	EACH PERIOD	25	25	0	0.01	0.12	0.07	0.11	0.25	✓	0.02	ALS/CGC
43	Total Hardness	mg/L	EACH PERIOD	39	39	***a***	54	134	104	129	***a***	***a***	1	LCC

44	Turbidity	NTU	EACH PERIOD	119	119	***a***	<0.5	0.5	<0.5	<0.5	***a***	***a***	0.5	LCC
45	Zinc, Total	mg/L	EACH PERIOD	39	39	***a***	<0.01	0.02	<0.01	0.02	***a***	***a***	0.01	LCC

a - An Australian Drinking Water Guidelines 2001 health guideline does not exist for this parameter

b - Temperature does not have a limit of reporting

c - *The Public Health Regulation 2005* requires that at least 98% of samples contain no *E. coli* over a 12 month period

Table 11 – Logan East water quality zone verification monitoring summary

Logan East Water Quality Zone														
#	**PARAMETER**	**UNITS**	**FREQUENCY**	**TOTAL NO. OF SAMPLES COLLECTED**	**NO. OF SAMPLES IN WHICH PARAMETER WAS DETECTED**	**NO. OF SAMPLES EXCEEDING WATER QUALITY CRITERIA (HEALTH)**	**MIN**	**MAX**	**MEAN**	**95th PERCENTILE**	**AUSTRALIAN DRINKING WATER GUIDELINE (HEALTH)**	**MET ADWG HEALTH LIMIT?**	**LOR**	**LABORATORY NAME**
MICROBIAL														
1	*E.coli*	MPN/100mL	WEEKLY	319	***2***	***2***	<1	***12***	<1	<1	<1	✓***c***	1	
2	Heterotrophic Plate Count	CFU/mL	WEEKLY	116	116	***a***	<10	>300	32	195	***a***	***a***	10	LCC
3	Total Coliforms	MPN/100mL	WEEKLY	319	57	***a***	<1	730	8	38	***a***	***a***	1	LCC
CHEMICAL / PHYSICAL														
4	Alkalinity as $CaCO_3$	mg/L	EACH PERIOD	12	12	***a***	64	88	82	88	***a***	***a***	1	LCC
5	Aluminium, Total	mg/L	EACH PERIOD	76	76	***a***	0.02	0.10	0.05	0.07	***a***	***a***	0.01	LCC
6	Ammonia-N	mg/L	EACH PERIOD	116	116	***a***	<0.1	0.2	<0.1	0.2	***a***	***a***	0.1	LCC
7	Arsenic, Total	mg/L	EACH PERIOD	76	76	0	<0.001	0.001	<0.001	0.001	0.01	✓	0.001	LCC
8	Barium, Total	mg/L	EACH PERIOD	76	76	0	0.010	0.029	0.024	0.028	2	✓	0.001	LCC
9	Beryllium, Total	mg/L	EACH PERIOD	76	76	0	<0.001	<0.001	<0.001	<0.001	0.06	✓	0.001	LCC
10	Bismuth, Total	mg/L	EACH PERIOD	76	76	***a***	<0.001	0.003	<0.001	0.001	***a***	***a***	0.001	LCC
11	Boron, Total	mg/L	EACH PERIOD	76	76	0	0.02	0.16	0.04	0.12	4	✓	0.01	LCC
12	Cadmium, Total	mg/L	EACH PERIOD	76	76	0	<0.001	<0.001	<0.001	<0.001	0.002	✓	0.001	LCC
13	Calcium Hardness	mg/L	EACH PERIOD	76	76	***a***	40	77	66	75	***a***	***a***	1	LCC
14	Calcium, Total	mg/L	EACH PERIOD	76	76	***a***	16	31	26	30	***a***	***a***	1	LCC
15	Chloride	mg/L	EACH PERIOD	76	76	***a***	17.5	107.0	63.2	89.9	***a***	***a***	0.1	LCC
16	Chlorine, Free	mg/L	WEEKLY	321	321	0	<0.05	1.27	0.10	0.41	5	✓	0.05	LCC
17	Chlorine, Total	mg/L	WEEKLY	321	321	0	<0.05	1.75	0.34	1.05	5	✓	0.05	LCC
18	Chromium, Total	mg/L	EACH PERIOD	76	76	0	<0.001	<0.001	<0.001	<0.001	0.05	✓	0.001	LCC

19	Cobalt, Total	mg/L	EACH PERIOD	76	76	***a***	<0.001	<0.001	<0.001	<0.001	***a***	***a***	0.001	LCC
20	Colour, Apparent	Hazen	EACH PERIOD	76	76	***a***	<1	14	3	5	***a***	***a***	1	LCC
21	Colour, True	Hazen	EACH PERIOD	76	76	***a***	<1	2	<1	1	***a***	***a***	1	LCC
22	Conductivity	µS/cm	EACH PERIOD	116	116	***a***	200	676	455	578	***a***	***a***	1	LCC
23	Copper, Total	mg/L	EACH PERIOD	76	76	***a***	0.001	0.023	0.006	0.012	2	✓	0.001	LCC
24	Fluoride	mg/L	EACH PERIOD	76	76	0	<0.1	0.9	0.3	0.8	1.5	✓	0.1	LCC
25	Iron, Total	mg/L	EACH PERIOD	76	76	***a***	0.004	0.170	0.017	0.036	***a***	***a***	0.003	LCC
26	Lead, Total	mg/L	EACH PERIOD	76	76	0	<0.001	0.002	0.001	0.002	0.01	✓	0.001	LCC
27	Lithium Total	mg/L	EACH PERIOD	76	76	***a***	<0.001	0.001	0.001	0.001	***a***	***a***	0.001	LCC
28	Magnesium, Total	mg/L	EACH PERIOD	76	76	***a***	4	16	12	15	***a***	***a***	1	LCC
29	Manganese, Total	mg/L	EACH PERIOD	76	76	0	0.001	0.074	0.005	0.011	0.5	✓	0.001	LCC
30	Molybdenum, Total	mg/L	EACH PERIOD	76	76	0	<0.001	0.002	<0.001	0.001	0.05	✓	0.001	LCC
31	Nickel, Total	mg/L	EACH PERIOD	76	76	0	<0.001	0.001	<0.001	0.001	0.02	✓	0.001	LCC
32	Nitrate (NO_3-N)	mg/L	EACH PERIOD	76	76	0	0.2	3.5	2.1	3.1	50	✓	0.1	LCC
33	Nitrite (NO_2-N)	mg/L	EACH PERIOD	76	76	0	0.2	1.0	0.3	0.8	3	✓	0.1	LCC
34	pH	pH Units	EACH PERIOD	116	116	***a***	7.1	8.2	7.7	8.0	***a***	***a***	1	LCC
35	Potassium, Total	mg/L	EACH PERIOD	76	76	***a***	2	4	3	4	***a***	***a***	1	LCC
36	Selenium, Total	mg/L	EACH PERIOD	76	76	0	<0.01	<0.01	<0.01	<0.01	0.01	✓	0.01	LCC
37	Sodium, Total	mg/L	EACH PERIOD	76	76	***a***	18	70	40	63	***a***	***a***	1	LCC
38	Sulphate	mg/L	EACH PERIOD	76	76	***a***	16	61	27	58	***a***	***a***	1	LCC
39	TDS, Calculated	mg/L	EACH PERIOD	52	52	***a***	121	410	279	365	***a***	***a***	1	LCC
40	Temperature	°C	WEEKLY	321	321	***a***	17.8	31.8	24.5	30.0	***a***	***a***		LCC
41	Thallium, Total	mg/L	EACH PERIOD	76	76	***a***	<0.001	<0.001	<0.001	<0.001	***a***	***a***	0.001	LCC
42	THM Total	mg/L	EACH PERIOD	149	149	0	0.03	0.17	0.10	0.15	0.25	✓	0.02	LCC
43	Total Hardness	mg/L	EACH PERIOD	76	76	***a***	56	133	115	131	***a***	***a***	1	LCC

44	Turbidity	NTU	EACH PERIOD	116	116	***a***	<0.5	1	<0.5	<0.5	***a***	***a***	0.5	LCC
45	Zinc, Total	mg/L	EACH PERIOD	76	76	***a***	<0.01	0.02	<0.01	0.02	***a***	***a***	0.01	LCC

a - An Australian Drinking Water Guidelines 2001 health guideline does not exist for this parameter

b - Temperature does not have a limit of reporting

c - *The Public Health Regulation 2005* requires that at least 98% of samples contain no *E. coli* over a 12 month period

Table 12 – Logan South water quality zone verification monitoring summary

Logan South Water Quality Zone														
#	**PARAMETER**	**UNITS**	**FREQUENCY**	**TOTAL NO. OF SAMPLES COLLECTED**	**NO. OF SAMPLES IN WHICH PARAMETER WAS DETECTED**	**NO. OF SAMPLES EXCEEDING WATER QUALITY CRITERIA (HEALTH)**	**MIN**	**MAX**	**MEAN**	**95TH PERCENTILE**	**AUSTRALIAN DRINKING WATER GUIDELINE (HEALTH)**	**MET ADWG HEALTH LIMIT?**	**LOR**	**LABORATORY NAME**
MICROBIAL														
1	*E.coli*	MPN/100mL	WEEKLY	634	***1***	***1***	<1	***5***	<1	<1	<1	✓***c***	1	LCC
2	Heterotrophic Plate Count	CFU/mL	WEEKLY	418	418	***a***	<10	301	49	<300	***a***	***a***	10	LCC
3	Total Coliforms	MPN/100mL	WEEKLY	634	42	***a***	<1	73	<1	1	***a***	***a***	1	LCC
CHEMICAL / PHYSICAL														
4	Alkalinity as $CaCO_3$	mg/L	EACH PERIOD	81	81	***a***	52	96	84	95	***a***	***a***	1	LCC
5	Aluminium, Total	mg/L	EACH PERIOD	147	147	***a***	0.03	0.13	0.07	0.11	***a***	***a***	0.01	LCC
6	Ammonia-N	mg/L	EACH PERIOD	419	419	***a***	<0.1	0.2	<0.1	0.1	***a***	***a***	0.1	LCC
7	Arsenic, Total	mg/L	EACH PERIOD	147	147	0	<0.001	0.001	<0.001	0.001	0.01	✓	0.001	LCC
8	Barium, Total	mg/L	EACH PERIOD	147	147	0	0.002	0.031	0.024	0.029	2	✓	0.001	LCC
9	Beryllium, Total	mg/L	EACH PERIOD	147	147	0	<0.001	<0.001	<0.001	<0.001	0.06	✓	0.001	LCC
10	Bismuth, Total	mg/L	EACH PERIOD	147	147	***a***	<0.001	0.003	<0.001	<0.001	***a***	***a***	0.001	LCC
11	Boron, Total	mg/L	EACH PERIOD	147	147	0	0.02	0.28	0.05	0.21	4	✓	0.01	LCC
12	Cadmium, Total	mg/L	EACH PERIOD	147	147	0	<0.001	<0.001	<0.001	<0.001	0.002	✓	0.001	LCC
13	Calcium Hardness	mg/L	EACH PERIOD	147	147	***a***	42	90	70	80	***a***	***a***	1	LCC
14	Calcium, Total	mg/L	EACH PERIOD	147	147	***a***	17	36	28	32	***a***	***a***	1	LCC
15	Chloride	mg/L	EACH PERIOD	147	147	***a***	12.6	114.0	66.9	97.2	***a***	***a***	0.1	LCC
16	Chlorine, Free	mg/L	WEEKLY	635	635	0	<0.05	2.30	0.26	1.03	5	✓	0.05	LCC
17	Chlorine, Total	mg/L	WEEKLY	635	635	0	<0.05	2.50	0.61	2.14	5	✓	0.05	LCC
18	Chromium, Total	mg/L	EACH PERIOD	147	147	0	<0.001	0.001	<0.001	0.001	0.05	✓	0.001	LCC

19	Cobalt, Total	mg/L	EACH PERIOD	147	147	***a***	<0.001	<0.001	<0.001	<0.001	***a***	***a***	0.001	LCC
20	Colour, Apparent	Hazen	EACH PERIOD	147	147	***a***	<1	17	3	6	***a***	***a***	1	LCC
21	Colour, True	Hazen	EACH PERIOD	147	147	***a***	<1	2	<1	1	***a***	***a***	1	LCC
22	Conductivity	µS/cm	EACH PERIOD	419	419	***a***	186	696	474	614	***a***	***a***	1	LCC
23	Copper, Total	mg/L	EACH PERIOD	147	147	0	0.001	0.130	0.005	0.012	2	✓	0.001	LCC
24	Fluoride	mg/L	EACH PERIOD	147	147	0	<0.1	0.9	0.4	0.8	1.5	✓	0.1	LCC
25	Iron, Total	mg/L	EACH PERIOD	147	147	***a***	<0.003	0.116	0.016	0.050	***a***	***a***	0.003	LCC
26	Lithium, Total	mg/L	EACH PERIOD	147	147	0	<0.001	0.001	<0.001	0.001	0.01	✓	0.001	LCC
27	Lead, Total	mg/L	EACH PERIOD	147	147	***a***	<0.001	0.002	<0.001	0.001	***a***	***a***	0.001	LCC
28	Magnesium, Total	mg/L	EACH PERIOD	147	147	***a***	2	16	11	15	***a***	***a***	1	LCC
29	Manganese, Total	mg/L	EACH PERIOD	147	147	0	0.001	0.032	0.005	0.017	0.5	✓	0.001	LCC
30	Molybdenum, Total	mg/L	EACH PERIOD	147	147	0	<0.001	0.005	<0.001	0.001	0.05	✓	0.001	LCC
31	Nickel, Total	mg/L	EACH PERIOD	147	147	0	<0.001	0.001	<0.001	0.001	0.02	✓	0.001	LCC
32	Nitrate (NO_3-N)	mg/L	EACH PERIOD	147	147	0	<0.01	0.2	2.6	3.5	50	✓	0.1	LCC
33	Nitrite (NO_2-N)	mg/L	EACH PERIOD	147	147	0	<0.01	0.2	0.3	0.9	3	✓	0.1	LCC
34	pH	pH Units	EACH PERIOD	419	419	***a***	7.3	8.8	8.1	8.5	***a***	***a***	1	LCC
35	Potassium, Total	mg/L	EACH PERIOD	147	147	***a***	1	4	3	4	***a***	***a***	1	LCC
36	Selenium, Total	mg/L	EACH PERIOD	147	147	0	<0.01	<0.01	<0.01	<0.01	0.01	✓	0.01	LCC
37	Sodium, Total	mg/L	EACH PERIOD	147	147	***a***	17	69	44	65	***a***	***a***	1	LCC
38	Sulphate	mg/L	EACH PERIOD	147	147	***a***	8	63	28	56	***a***	***a***	1	LCC
39	TDS, Calculated	mg/L	EACH PERIOD	356	356	***a***	113	423	289	378	***a***	***a***	1	LCC
40	Temperature	°C	WEEKLY	635	635	***a***	16.0	32.2	23.4	28.4	***a***	***a***		LCC
41	Thallium, Total	mg/L	EACH PERIOD	147	147	***a***	<0.001	<0.001	<0.001	<0.001	***a***	***a***	0.001	LCC
42	THM Total	mg/L	EACH PERIOD	159	159	***1***	<0.02	0.28	0.12	0.24	0.25	×	0.02	LCC
43	Total Hardness	mg/L	EACH PERIOD	147	147	***a***	49	140	116	137	***a***	***a***	1	LCC

44	Turbidity	NTU	EACH PERIOD	419	419	***a***	<0.5	1.3	0.1	0.0	***a***	***a***	0.5	LCC
45	Zinc, Total	mg/L	EACH PERIOD	147	147	***a***	<0.01	0.02	<0.01	0.01	***a***	***a***	0.01	LCC

a - An Australian Drinking Water Guidelines 2001 health guideline does not exist for this parameter

b - Temperature does not have a limit of reporting

c - *The Public Health Regulation 2005* requires that at least 98% of samples contain no *E. coli* over a 12 month period

Table 13 - Marsden water quality zone verification monitoring summary

Marsden Water Quality Zone														
#	**PARAMETER**	**UNITS**	**FREQUENCY**	**TOTAL NO. OF SAMPLES COLLECTED**	**NO. OF SAMPLES IN WHICH PARAMETER WAS DETECTED**	**NO. OF SAMPLES EXCEEDING WATER QUALITY CRITERIA (HEALTH)**	**MIN**	**MAX**	**MEAN**	**95TH PERCENTILE**	**AUSTRALIAN DRINKING WATER GUIDELINE (HEALTH)**	**MET ADWG HEALTH LIMIT?**	**LOR**	**LABORATORY NAME**
MICROBIAL														
1	*E.coli*	MPN/100mL	WEEKLY	212	0	0	<1	<1	<1	<1	<1	✓***c***	1	LCC
2	Heterotrophic Plate Count	CFU/mL	WEEKLY	89	89	***a***	<10	190	9	31	***a***	***a***	10	LCC
3	Total Coliforms	MPN/100mL	WEEKLY	212	4	***a***	<1	150	1	<1	***a***	***a***	1	LCC
CHEMICAL / PHYSICAL														
4	Alkalinity as $CaCO_3$	mg/L	EACH PERIOD	13	13	***a***	68	90	86	90	***a***	***a***	1	LCC
5	Aluminium, Total	mg/L	EACH PERIOD	51	51	***a***	0.04	0.08	0.06	0.08	***a***	***a***	0.01	LCC
6	Ammonia-N	mg/L	EACH PERIOD	89	89	***a***	<0.1	0.3	0.1	0.2	***a***	***a***	0.1	LCC
7	Arsenic, Total	mg/L	EACH PERIOD	51	51	0	<0.001	0.001	<0.001	0.001	0.01	✓	0.001	LCC
8	Barium, Total	mg/L	EACH PERIOD	51	51	0	0.024	0.030	0.026	0.029	2	✓	0.001	LCC
9	Beryllium, Total	mg/L	EACH PERIOD	51	51	0	<0.001	<0.001	<0.001	<0.001	0.06	✓	0.001	LCC
10	Bismuth	mg/L	EACH PERIOD	51	51	***a***	<0.001	0.002	<0.001	<0.001	***a***	***a***	0.001	LCC
11	Boron, Total	mg/L	EACH PERIOD	51	51	0	0.03	0.07	0.03	0.06	4	✓	0.01	LCC
12	Cadmium, Total	mg/L	EACH PERIOD	51	51	0	<0.001	<0.001	<0.001	<0.001	0.002	✓	0.001	LCC
13	Calcium Hardness	mg/L	EACH PERIOD	51	51	***a***	58	71	64	68	***a***	***a***	1	LCC
14	Calcium, Total	mg/L	EACH PERIOD	51	51	***a***	23	29	26	27	***a***	***a***	1	LCC
15	Chloride	mg/L	EACH PERIOD	51	51	***a***	49.3	105.0	66.6	102.0	***a***	***a***	0.1	LCC
16	Chlorine, Free	mg/L	WEEKLY	212	212	0	<0.05	0.92	0.14	0.36	5	✓	0.05	LCC
17	Chlorine, Total	mg/L	WEEKLY	212	212	0	0.11	2.40	1.11	2.16	5	✓	0.05	LCC
18	Chromium, Total	mg/L	EACH PERIOD	51	51	0	<0.001	<0.001	<0.001	<0.001	0.05	✓	0.001	LCC

19	Cobalt, Total	mg/L	EACH PERIOD	51	51	***a***	<0.001	<0.001	<0.001	<0.001	***a***	***a***	0.001	LCC
20	Colour, Apparent	Hazen	EACH PERIOD	51	51	***a***	<1	6	3	5	***a***	***a***	1	LCC
21	Colour, True	Hazen	EACH PERIOD	51	51	***a***	<1	2	<1	2	***a***	***a***	1	LCC
22	Conductivity	µS/cm	EACH PERIOD	89	89	***a***	362	713	468	636	***a***	***a***	1	LCC
23	Copper, Total	mg/L	EACH PERIOD	51	51	0	0.002	0.015	0.006	0.008	2	✓	0.001	LCC
24	Fluoride	mg/L	EACH PERIOD	51	51	0	<0.1	0.8	0.3	0.8	1.5	✓	0.1	LCC
25	Iron, Total	mg/L	EACH PERIOD	51	51	***a***	<0.003	0.073	0.013	0.026	***a***	***a***	0.003	LCC
26	Lithium	mg/L	EACH PERIOD	51	51	0	<0.001	<0.001	<0.001	<0.001	0.01	✓	0.001	LCC
27	Lead, Total	mg/L	EACH PERIOD	51	51	***a***	<0.001	0.002	<0.001	0.001	***a***	***a***	0.001	LCC
28	Magnesium, Total	mg/L	EACH PERIOD	51	51	***a***	11	16	13	16	***a***	***a***	1	LCC
29	Manganese, Total	mg/L	EACH PERIOD	51	51	0	0.001	0.027	0.006	0.014	0.5	✓	0.001	LCC
30	Molybdenum, Total	mg/L	EACH PERIOD	51	51	0	<0.001	0.002	0.001	0.001	0.05	✓	0.001	LCC
31	Nickel, Total	mg/L	EACH PERIOD	51	51	0	<0.001	0.001	<0.001	0.001	0.02	✓	0.001	LCC
32	Nitrate (NO_3-N)	mg/L	EACH PERIOD	51	51	0	0.2	3.5	1.8	2.7	50	✓	0.1	LCC
33	Nitrite (NO_2-N)	mg/L	EACH PERIOD	51	51	0	0.2	1.0	0.5	1.0	3	✓	0.1	LCC
34	pH	pH Units	EACH PERIOD	89	89	***a***	7.3	7.9	7.7	7.9	***a***	***a***	1	LCC
35	Potassium, Total	mg/L	EACH PERIOD	51	51	***a***	3	4	3	4	***a***	***a***	1	LCC
36	Selenium, Total	mg/L	EACH PERIOD	51	51	0	<0.01	<0.01	<0.01	<0.01	0.01	✓	0.01	LCC
37	Sodium, Total	mg/L	EACH PERIOD	51	51	***a***	35	72	42	66	***a***	***a***	1	LCC
38	Sulphate	mg/L	EACH PERIOD	51	51	***a***	19	61	29	59	***a***	***a***	1	LCC
39	TDS, Calculated	mg/L	EACH PERIOD	51	51	***a***	219	433	286	384	***a***	***a***	1	LCC
40	Temperature	°C	WEEKLY	212	212	***a***	17.4	31.6	24.4	30.2	***a***	***a***		LCC
41	Thallium, Total	mg/L	EACH PERIOD	51	51	***a***	<0.001	<0.001	<0.001	<0.001	***a***	***a***	0.001	LCC
42	THM Total	mg/L	EACH PERIOD	13	13	0	0.06	0.12	0.08	0.11	0.25	✓	0.02	LCC
43	Total Hardness	mg/L	EACH PERIOD	51	51	***a***	107	131	118	130	***a***	***a***	1	LCC

44	Turbidity	NTU	EACH PERIOD	89	89	***a***	<0.5	0.8	<0.5	<0.5	***a***	***a***	0.5	LCC
45	Zinc, Total	mg/L	EACH PERIOD	51	51	***a***	<0.01	0.01	<0.01	0.01	***a***	***a***	0.01	LCC

a - An Australian Drinking Water Guidelines 2001 health guideline does not exist for this parameter

b - Temperature does not have a limit of reporting

c - *The Public Health Regulation 2005* requires that at least 98% of samples contain no *E. coli* over a 12 month period

Table 14 – Springwood water quality zone verification monitoring summary

Springwood Water Quality Zone														
#	**PARAMETER**	**UNITS**	**FREQUENCY**	**TOTAL NO. OF SAMPLES COLLECTED**	**NO. OF SAMPLES IN WHICH PARAMETER WAS DETECTED**	**NO. OF SAMPLES EXCEEDING WATER QUALITY CRITERIA (HEALTH)**	**MIN**	**MAX**	**MEAN**	**95th PERCENTILE**	**AUSTRALIAN DRINKING WATER GUIDELINE (HEALTH)**	**MET ADWG HEALTH LIMIT?**	**LOR**	**LABORATORY NAME**
MICROBIAL														
1	*E.coli*	MPN/100mL	WEEKLY	368	0	0	<1	<1	<1	<1	<1	✓***c***	1	LCC
2	Heterotrophic Plate Count	CFU/mL	WEEKLY	165	165	***a***	<10	301	16	43	***a***	***a***	10	LCC
3	Total Coliforms	MPN/100mL	WEEKLY	368	6	***a***	<1	3	0	<1	***a***	***a***	1	LCC
CHEMICAL / PHYSICAL														
4	Alkalinity as $CaCO_3$	mg/L	EACH PERIOD	24	24	***a***	66	90	85	89	***a***	***a***	1	LCC
5	Aluminium, Total	mg/L	EACH PERIOD	86	86	***a***	0.03	0.14	0.06	0.09	***a***	***a***	0.01	LCC
6	Ammonia-N	mg/L	EACH PERIOD	165	165	***a***	<0.1	0.3	0.1	0.2	***a***	***a***	0.1	LCC
7	Arsenic, Total	mg/L	EACH PERIOD	86	86	0	<0.001	0.001	<0.001	0.001	0.01	✓	0.001	LCC
8	Barium, Total	mg/L	EACH PERIOD	86	86	0	0.023	0.031	0.026	0.029	2	✓	0.001	LCC
9	Beryllium, Total	mg/L	EACH PERIOD	86	86	0	<0.001	<0.001	<0.001	<0.001	0.06	✓	0.001	LCC
10	Bismuth, Total	mg/L	EACH PERIOD	86	86	***a***	<0.001	0.004	<0.001	<0.001	***a***	***a***	0.001	LCC
11	Boron, Total	mg/L	EACH PERIOD	86	86	0	0.02	0.06	0.03	0.06	4	✓	0.01	LCC
12	Cadmium, Total	mg/L	EACH PERIOD	86	86	0	<0.001	<0.001	<0.001	<0.001	0.002	✓	0.001	LCC
13	Calcium Hardness	mg/L	EACH PERIOD	86	86	***a***	58	77	65	73	***a***	***a***	1	LCC
14	Calcium, Total	mg/L	EACH PERIOD	86	86	***a***	23	31	26	29	***a***	***a***	1	LCC
15	Chloride	mg/L	EACH PERIOD	86	86	***a***	53.1	104.0	64.7	92.6	***a***	***a***	0.1	LCC
16	Chlorine, Free	mg/L	WEEKLY	367	367	0	<0.05	1.90	0.17	0.48	5	✓	0.05	LCC
17	Chlorine, Total	mg/L	WEEKLY	367	367	0	<0.05	2.60	1.13	2.20	5	✓	0.05	LCC
18	Chromium, Total	mg/L	EACH PERIOD	86	86	0	<0.001	<0.001	<0.001	<0.001	0.05	✓	0.001	LCC

19	Cobalt, Total	mg/L	EACH PERIOD	86	86	***a***	<0.001	<0.001	<0.001	<0.001	***a***	***a***	0.001	LCC
20	Colour, Apparent	Hazen	EACH PERIOD	86	86	***a***	<1	33	4	9	***a***	***a***	1	LCC
21	Colour, True	Hazen	EACH PERIOD	86	86	***a***	<1	3	<1	<1	***a***	***a***	1	LCC
22	Conductivity	µS/cm	EACH PERIOD	165	165	***a***	313	702	468	611	***a***	***a***	1	LCC
23	Copper, Total	mg/L	EACH PERIOD	86	86	0	0.002	0.109	0.020	0.085	2	✓	0.001	LCC
24	Fluoride	mg/L	EACH PERIOD	86	86	0	<0.1	0.9	0.3	0.8	1.5	✓	0.1	LCC
25	Iron, Total	mg/L	EACH PERIOD	86	86	***a***	0.004	1.140	0.043	0.109	***a***	***a***	0.003	LCC
26	Lead, Total	mg/L	EACH PERIOD	86	86	0	<0.001	0.003	<0.001	0.002	0.01	✓	0.001	LCC
27	Lithium, Total	mg/L	EACH PERIOD	86	86	***a***	<0.001	0.001	<0.001	0.001	***a***	***a***	0.001	LCC
28	Magnesium, Total	mg/L	EACH PERIOD	86	86	***a***	11	15	13	15	***a***	***a***	1	LCC
29	Manganese, Total	mg/L	EACH PERIOD	86	86	0	0.001	0.099	0.008	0.020	0.5	✓	0.001	LCC
30	Molybdenum, Total	mg/L	EACH PERIOD	86	86	0	<0.001	0.005	0.001	0.001	0.05	✓	0.001	LCC
31	Nickel, Total	mg/L	EACH PERIOD	86	86	0	<0.001	0.001	<0.001	0.001	0.02	✓	0.001	LCC
32	Nitrate (NO_3-N)	mg/L	EACH PERIOD	86	86	0	0.2	4.0	1.8	3.1	50	✓	0.1	LCC
33	Nitrite (NO_2-N)	mg/L	EACH PERIOD	86	86	0	0.2	1.3	0.4	1.0	3	✓	0.1	LCC
34	pH	pH Units	EACH PERIOD	165	165	***a***	7.2	8.2	7.7	7.9	***a***	***a***	1	LCC
35	Potassium, Total	mg/L	EACH PERIOD	86	86	***a***	3	4	3	4	***a***	***a***	1	LCC
36	Selenium, Total	mg/L	EACH PERIOD	86	86	0	<0.01	<0.01	<0.01	<0.01	0.01	✓	0.01	LCC
37	Sodium, Total	mg/L	EACH PERIOD	86	86	***a***	35	70	41	64	***a***	***a***	1	LCC
38	Sulphate	mg/L	EACH PERIOD	86	86	***a***	20	61	27	55	***a***	***a***	1	LCC
39	TDS, Calculated	mg/L	EACH PERIOD	103	103	***a***	190	426	286	373	***a***	***a***	1	LCC
40	Temperature	°C	WEEKLY	367	367	***a***	17.3	33.3	24.6	30.4	***a***	***a***		LCC
41	Thallium, Total	mg/L	EACH PERIOD	86	86	***a***	<0.001	<0.001	<0.001	<0.001	***a***	***a***	0.001	LCC
42	THM Total	mg/L	EACH PERIOD	49	49	0	0.05	0.17	0.09	0.12	0.25	✓	0.02	LCC
43	Total Hardness	mg/L	EACH PERIOD	86	86	***a***	106	134	118	128	***a***	***a***	1	LCC

44	Turbidity	NTU	EACH PERIOD	165	165	***a***	<0.5	3.1	<0.5	<0.5	***a***	***a***	0.5	LCC
45	Zinc, Total	mg/L	EACH PERIOD	86	86	***a***	<0.01	0.02	<0.01	0.02	***a***	***a***	0.01	LCC

a - An Australian Drinking Water Guidelines 2001 health guideline does not exist for this parameter

b - Temperature does not have a limit of reporting

c - *The Public Health Regulation 2005* requires that at least 98% of samples contain no *E. coli* over a 12 month period

WATER QUALITY SUMMARY: *E. coli*

Council's verification monitoring performance for key microbial indicator *E. coli* is summarised in Table 1 below.

Table 15 – Whole of Logan region *E. coli* water quality summary

MICROBIAL PARAMETER	Units	Number of Samples Collected	Number of Detections	% Samples which met Compliance	ADWG Guideline (Health)	ADWG Compliance (Health)
E.coli	MPN/100mL	1919	***4***	99.90%	98.0%	✓[8]

[8] *The Public Health Regulation 2005* requires that at least 98% of samples contain no *E. coli* over a 12 month period

E. coli Verification Monitoring

Table 16 – Logan City Council *E. coli* Verification Monitoring 2017-18

WHOLE OF LOGAN CITY - ALL ZONES	2017-18 FY											
Month	**July**	**August**	**September**	**October**	**November**	**December**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**
No. of samples collected	162	171	152	179	146	124	187	138	155	164	182	159
No. of samples collected in which E. coli is detected (i.e. a failure)	0	0	0	0	0	***1***	0	***1***	***2***	0	0	0
No. of samples collected in previous 12 month period	1692	1703	1729	1774	1774	1794	1838	1860	1877	1896	1891	1887
No. of failures for previous 12 month period	2	2	2	2	2	3	2	3	5	4	4	4
% compliance for previous 12 month period	99.88%	99.88%	99.88%	99.89%	99.89%	99.83%	99.89%	99.84%	99.73%	99.79%	99.79%	99.79%
Compliance with 98% annual value	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
% compliance for a month	100.00%	100.00%	100.00%	100.00%	100.00%	99.19%	100.00%	99.33%	98.59%	100.00%	100.00%	100.00%

APPENDIX B - IMPLEMENTATION OF THE RISK MANAGEMENT IMPROVEMENT PROGRAM

The Risk Management Improvement Plan (RMIP) summarises the progress of the proposed actions undertaken as part of the current RMIP.

Item No.	Priority (1, 2 or 3)	G-General Improvement (Review or Audit OFI) R-Risk Assessment NC-Non-conformance(*health exceedance or Audit finding*)	ISSUES / RISKS	KEY ACTIONS	CURRENT STATUS COMMENTS (JUNE 2018)	LEAD POSITION (Branch)	LEAD Program Leader	ORIGINAL TARGET DATE	TARGET DATE	% COMPLETE (JUN'18)	STATUS
E1 : Commitment to Drinking Water Quality Management											
E2: Assessment of Drinking Water Supply Systems											
2.00	1	**Res 1.10 Res 1.11 Dis 8.1 Dis 9.1 & 9.2 Net 4.1**	Backup online chlorine monitoring system required if Seqwater disinfection systems failed (i.e. dosing and monitoring).	Undertake "Online Water Quality Monitoring Strategy" - online instrumentation with SCADA alarms as backup to Seqwater system.	Online Water Quality Monitoring prioritisation - Preliminary Planning & Design and Installation - **completed** ✓ SCADA alarming & validation to be completed 2017/18FY**- completed** ✓	Product Quality Program Leader (Water Business)	Chris PM	Jun-17	Jun-18	100%	**COMPLETE**
2.01_18	2	**Ext Audit (1,8)**	#8 Ensure Risk Assessment maintains currency. #1 Reservoir Security Plan to consider exceptions, as each site is different.	Undertake whole of system Risk Assessment during 2018/19FY to include exceptions in Reservoir Security Plan and include new hazards to be managed.	**NEW**	Water Quality Coordinator (Water Business)	Natasha G	Jun-19	-	-	**NEW**
Element 3: Preventive Measures for Drinking Water Quality											
3.00	3	**4.1 (G) Net 1.1 & 1.2**	Poor disinfection residual, particularly during Summer periods.	**Strategy & Planning Investigation outcome** to help with implementation of routine network chlorination and chlorine dosing systems as required. Install two chlorine booster stations in Logan East.	CAPEX approved for two booster stations in Logan East 2015/16FY- **completed** ✓ Delivery & construction (end 2016) - **completed** ✓ Commissioned summer **2017/18 - completed** ✓	Product Quality Program Leader (Water Business)	Chris PM	Dec-16	May-18	100%	**COMPLETE**
3.01	3	**Net 1.1 & 1.2**	Poor disinfection residual, particularly during Summer periods.	**Strategy & Planning Investigation outcome** to help with implementation of routine network chlorination and chlorine dosing systems as required. Install chlorination system at Round Mt Reservoir. Requires construction of additional outlet main.	CAPEX approved and planning completed for electro-chlorinator system at Round Mt Reservoir 2015/16FY- **completed** ✓ Constructed & commenced commissioning **Oct'17.** **- completed** ✓	Product Quality Program Leader (Water Business)	Chris PM	Dec-17	Mar-18	100%	**COMPLETE**

Item No.	Priority (1, 2 or 3)	G-General Improvement (Review or Audit OFI) R-Risk Assessment NC-Non-conformance(*health exceedance or Audit finding*)	ISSUES / RISKS	KEY ACTIONS	CURRENT STATUS COMMENTS (JUNE 2018)	LEAD POSITION (Branch)	LEAD Program Leader	ORIGINAL TARGET DATE	TARGET DATE	% COMPLETE (JUN'18)	STATUS
3.03	1	**DIS 3.1** **DIS 5.5**	Internal audit identified that not all CCPs are easily visible on SCADA system to confirm limits. CCP limits are hard coded. Inconsistency of CCP SCADA limits vs CCP chart limits.	**Undertake workshop to ensure CCP limits are relevant, SCADA updated to reflect this and ensure visibility of CCP limits on SCADA.** Associated WOPs to be updated & training undertaken, to ensure effective implementation.	a). CCP & Operational workshops commenced with Logan River breakpoint dosing systems CCP charts & associated SCADA updated **- completed** ✓ b). Remaining dosing CCPs identified & charts developed - **completed** ✓	Water Quality Coordinator (Water Business) & Mech & Elec Operations Program Leader (WaterOperations)	Natasha G & Darshan U	Jun-17	Jun-17	100%	**COMPLETE**
3.04	2	**NC** **DIS 3.1** **DIS 5.5** **Ext Audit (2,3)**	Internal audit identified that not all CCPs are easily visible on SCADA system to confirm limits. CCP limits are hard coded. Inconsistency of CCP SCADA limits vs CCP chart limits.	Undertake workshop to ensure CCP limits are relevant, SCADA updated to reflect this and ensure visibility of CCP limits on SCADA. **Associated CCP WOPs to be updated & training undertaken, to ensure effective record keeping & implementation.**	a). Dosing site procedure gap analysis tool developed with audit review tocommence, including importance of record keeping **- completed** ✓ b). Procedures to be updated & associated training implemented, post procedure audit review. c). Undertaken annual audit review of CCP vs SCADA .	Senior Water Quality Scientist (Water Business) & Mech & Elec Operations Program Leader (WaterOperations)	Natasha G & Darshan U	Jun-18	Jun-19	20%	**MONITOR**
Element 4: Operational Procedures and Process Control											
4.02	2	**NC** **Net 4.1**	Risk Assessment: No formal potable water hygiene practises WOP exists.	Review & potentially develop formal Potable Water Hygiene Practises WOP and incorporate into future inductions and sign off (Staff & Contractors).	Hygiene practises incorporated into WOP as part of document review process to align with 5xC's philosophy **- completed** ✓	Network Maintenance Program Leader & Senior Water Operations Engineer (Water Operations)	Angus H & Murray E	Jun-17	Jun-17	100%	**COMPLETE**
4.02b	2	**NC** **Net 4.1**	Risk Assessment: No formal potable water hygiene practises WOP exists.	Review & potentially develop formal Potable Water Hygiene Practises WOP and incorporate into future inductions and sign off (Staff & Contractors).	Develop awareness training material and implement hygiene practises training to align with 5xC's philosophy **-completed** ✓ **Implement with the mains break "hands-on" training Ref. 4.03b.**	Network Maintenance Program Leader & Senior Water Operations Engineer (Water Operations)	Angus H & Murray E	Dec-18	Jun-18	100%	**COMPLETE**
4.03a	1	**NC** **Net 4.1**	Risk Assessment: Need to confirm what flushing system is used when main has been not used for some time and can result in *E.coli* incident if not effectively implemented.	Undertake further **WOP review** in light of incident & internal audit findings: a). Flushing & Scouring of mains; b). Mains Repairs; and c). Minor Works (incl. Sampling Taps).	Further review included "key improvements" to WOPs such as improved valve isolation identification processes, hygiene practises and equipment disinfection, incorporating 5xCs philosophy. Changes communicated via toolbox meetings.	Network Maintenance Program Leader & Senior Water Operations Engineer (Water Operations)	Angus H & Murray E	Mar-17	Mar-17	100%	**COMPLETE**

Item No.	Priority (1, 2 or 3)	G-General Improvement (Review or Audit OFI) R-Risk Assessment NC-Non-conformance(*health exceedance or Audit finding*)	ISSUES / RISKS	KEY ACTIONS	CURRENT STATUS COMMENTS (JUNE 2018)	LEAD POSITION (Branch)	LEAD Program Leader	ORIGINAL TARGET DATE	TARGET DATE	% COMPLETE (JUN'18)	STATUS
4.03b	2	**NC** **Net 4.1**	Risk Assessment & Audit: Need to confirm what flushing system is used when main has been not used for some time, or not effectively disinfected during mains repairs or reporting of significant events, and can result in *E.coli* incident if not effectively implemented.	Develop and **implement "on-the-job" training** for the following WOPs to ensure effective implementation: a). Flushing & Scouring of mains that have been offline for some time; b). Mains Repairs; and c). Minor Works (incl. Sampling Taps). d). Reporting of 'Events' that could impact customers health.	a). WOPs updated & tool box meetings undertaken regarding revised WOPs - **completed** ✓ b). "On-the-job" training materialdeveloped & trailled with supervisors -**completed Aug'18**✓ c). Implementation of "on-the-job" training to be rolled-out during 2018/19FY.	Network Maintenance Program Leader & Senior Water Operations Engineer (Water Operations)	Angus H & Murray E	Dec-18	Jun-19	30%	**MONITOR**
4.04	1	**NC** **Net 4.3**	Risk Assessment: Need to confirm what flushing system is used when mains has been not used for some time and can result in *E.coli* incident if not effectively implemented.	Undertake further WOP review in light of incident: a). Recommissioning assets such as mains that have been out of service for a period (> 4 weeks), including both planned and 'hot standby' due to emergency re-instatement. b). Recommissioning reservoirs that have been out of service for a period (> 4 weeks), including both planned and 'hot standby' due to emergency re-instatement.	**a).** Recommissioning assets such as mains that have been out of service for a period (> 4 weeks) **- under final review.** **b).** Recommissioning reservoirs that have been out of service for a period (> 4 weeks) **- under final review.**	Mech & Elec Operations Program Leader (WaterOperations) & Senior Water Operations Engineer (Water Operations)	Darshan U & Murray E	Jun-17	Jun-19	70%	**MONITOR**
4.05b	2	**NC** **Net 4.3**	Internal audit identified that routine flushing ceased 2014 post Marsden/Greenbank Disinfection project. This was a preventative measure in the previous Risk Assessment hence needs review. Additionally, with network changes since 2012 a review is warranted to identify changed/new hot spots.	Finalise analysis to help develop an appropriate flushing program for hot spots.	Initial analysis, post network disinfection cleans, identified hot spots whichcontinued to experience dirty water complaints, noting a 50-75% reduction in dirty water complaints post network cleans. Investigate technologies available.	Network Maintenance Program Leader & Senior Water Operations Engineer (Water Operations)	Angus H & Murray E	2018/19FY	2018/19FY	5%	**ON TRACK**
4.06a	1	**NC**	There have been a number of non-conformances relating to re-instatement of sampling taps which have either been newly installed or been out of service for some time. **Also refer to Items 4.03, 4.04 & 4.08 which are related.**	Review Verification Sampling Tap installation & repair WOP to ensure disinfection of all parts and best practise Tap design, to minimise contamination risks.	Tap installation process including disinfection of parts, incorporated into Minor Works WOP, to ensure no accidental contamination of parts **Ref 4.03. completed** ✓	Network Maintenance Program Leader & Senior Water Operations Engineer (Water Operations)	Angus H & Murray E	Jun-17	Jun-17	100%	**COMPLETE**
4.06b	1	**NC**			Investigated best practise Verification Sampling Tap design which is to be incorporated into 2017/18FY CAPEX **completed** ✓	Network Maintenance Program Leader & Senior Water Operations Engineer (Water Operations)	Angus H & Murray E	Jun-17	Jun-17	100%	**COMPLETE**

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4.07	3	**NC**	-	Submit CAPEX 2017/18FY Plan for new sampling tap and ensure design to fabricate and install for 2017/18FY.	a). CAPEX submitted - **completed** ✓ b). Installation commenced 2017/18FY with completion expected 2018/19FY.	Water Asset Management Program Leader (Water Business) & Water Business/Water Operations	Darren M, Natasha G & Murray E	2017/18FY	Jun-19	50%	**MONITOR**
4.08a	2	**NC** **Ext Audit (6)**	Internal audit identified slow response to alert Water Operations &/or WPQ of unusually high turbidity &/or metals, delaying prompt response to address unexpected events. External audit found inadequate timely reporting of *E.coli* health exceedance to key internal stakeholders. **Ref Item 4.08b - linked.**	a) Review & update procedures to ensure prompt reporting of health exceedance to key internal stakeholders. b) Improve response time from Verification Monitoring to promptly inform Water Operations &/or WPQ of "unusual results" for "lead indicators" such as high turbidity, colour, pH or key metals.	**a)** Lab systems & procedures updated to ensure prompt reporting of 'health' exceedances and unusual sampling observations - **completed** **b) (addressed Ext Audit (6))** Key aesthetics parameters to follow. **Notification automation to initiated with WQIMS implementation (Ref. 11.00).**	Product Quality Program Leader (Water Business)	Chris PM	Dec-17	Jun-19	70%	**MONITOR**
4.08b	1	**NC**	There have been two non-conformances relating to re-instatement of sampling taps which have either been newly installed or been out of service for some time. **Also refer to Items 4.03, 4.04, 4.06, 4.07 & 4.08a which are related.**	Investigate formalised drinking water sampling NATA accredication, currently undertaken by NATA accredited laboratory to ensure consistencey & key observations reported.	Sampling proposal submitted to NATA approved.	Product Quality Program Leader (Water Business)	Chris PM	Dec-17	Dec-17	100%	**COMPLETE**
4.09	2	**Net 4.4**	**2012RMIP (G6)** To reduce the risk of contamination from properties without backflow prevention devices.	**2012RMIP (G6)** Residual project from Allconnex period where exisiting properties were mainly located in Gold Coast areas. Investigate if project still required. Undertake project to identify the unmetered properties & install a meter with backflow prevention (ongoing project).	All new propeties require backflow prevention and there is a regulatory requirement for commercial operations. All new properties are now metered with compliant backflow prevention - **completed** ✓ **Post 2015 amalgamation**	Network Maintenance Program Leader (Water Operations)	Angus H	Jun-14	Jun-18	100%	**COMPLETE**
4.11	2	**5.2 (G)**	No clear **operational monitoring** program currently in place. Develop and show how to link to **corrective actions** by operations. Also relate to SCADA. Informal operational monitoring occurs as part of the Lab's routine Verification Monitoring program (i.e. HPC, etc) and ad hoc SCADA trend reviews.	Formalise operational monitoring with training and use of Water Information Management System (WIMS).	a) **Refer to Item 3.03 & 3.04:** CCP & OCP reviewed with associated WOP to be developed and implemented. b) Implementation will be assisted with the development of Water Quality Information Management System (WQIMS) which requires development and implementation. **Pending WQIMS implementation (Ref.11.00) and TechOne (SAMMS project)**	Product Quality Program Leader (Water Business) & Network Operations Program Leader (Water Operations)	Chris PM & Darshan U	2017/18 FY	Jun-19	70%	**MONITOR**

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4.12	3	**5.2 (G)**	No formal **corrective action** system currently exists. Documented WOPs for corrective action to control excursions in operational parameters required. Needs to align with updated LCC IMP.	Establish effective drinking water Corrective Action system with associated responsibilties and WOP to be developed. Consider implementation process across all 3 Water Branches required.	Drinking water health incidents currently managed via IMP, with reporting to Regulator and long term actions captured via RMIP ✓ Intelex recently implemented for WH&S incidents ✓ **Intelex system** investigated as best tool for Corrective Actions, including drinking water near miss incidents, to allow for communication trail & status reporting. Commenced development of Intelex Audit tool however delays due to provider Gabba ceased operations. Investigator new provider. **Ref. Item 12.00b.**	Product Quality Program Leader (Water Business)	Chris PM	Dec-17	TBC	50%	**MONITOR**
4.15	2	**Res 1.5, 1.6 & 1.7**	Internal Audit (2013) - large gaps and dirt close to vent holes found at reservoir. Gaps were repaired.	**Long Term:** Develop and implement Reservoir Inspection training to operational staff. Investigate on-going refresher training.	Water Quality Distribution training workshop delivered by QLD Water Directorate, including reservoir inspections **- Jul'15** ✓ "on-the-job" reservoir inspection training undertaken - **Nov'16** ✓ Investigate Reservoir Inspection "refresher" training.	Water Quality Coordinator (Water Business)	Natasha G	Dec-17	Jun-19	60%	**MONITOR**
4.21	1	**NC Dis 4.1, 4.2 & 4.3**	Internal audit review highlighted improvements required in the process to evaluate the quality of chemicals & products supplied (i.e. hypochlorite) to ensure AS4020 compliance, suitable for use in drinking water.	a) Develop new hypochlorite WOP for procurement, which includes quality criteria.	Testing for salt impurities was undertaken as part of Round Mt dosing facility commissioning (salt chlorinator).	Nework Operations Program Leader	Darshan U	Jun-18	Jun-19	5%	**MONITOR**
4.22	2	**NC Dis 4.1, 4.2 & 4.3**	Internal audit review highlighted improvements required in the process to evaluate the quality of chemicals & products supplied (i.e. hypochlorite) to ensure AS4020 compliance, suitable for use in drinking water.	b) Implement new hypochlorite WOP for procurement, which includes quality criteria.	-	Nework Operations Program Leader	Darshan U	Jun-18	Jun-19	0%	**NOT STARTED**
4.23	3	**NC Res 1.5 & 1.6**	*E.coli* incident was a result of **poor reservoir condition & design** with low chlorine residual.	CAPEX Asset Renewals Program Reservoir renewals program (roof, hatches, ingress preventation).	Capital Works Asset Renewals Program (*subject to funding to Yr2022)* - Mt Warren Park, Woodhill, Greenbank & Bluff Rd reservoir roof replacement (2017-2019FY)	Water Asset Management Program Leader (Water Business)	Darren M	2017-2022FY	Ongoing	20%	**ON TRACK**

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4.24	2	**NC Res 1.6 Res 4.4 Dis 12.1 & 12.2**	*E.coli* incident was a result of poor reservoir condition & design with **low chlorine residual.**	Chlorine tablets were trialled however deemed only effective for small reservoirs. Audto dosing systemrequired.	Designed, built and installed new dosing system at Hideaway Mt reservoir. **Completed** ✓	Network Operations Program Leader	Darshan U	Jun-17	Jun-17	100%	**COMPLETE**
E5: Verification of Drinking Water Quality											
5.01	3	**6.2 (G) 6.4 (G)**	Various "disjointed" customer complaint systems exist (i.e. pathways, WWETT, various CM database (emails/letters), etc). Internal audit found incorrect Priority assignment to health related customer complaints in WWETT.	**Short term:** WWETT system developed to replace UMD. **Long term:** investigation is taking place to look at "one" Customer Relationship Management System (CRM) integrated with other systems such as SAMMS.	WWETT system implemented **- completed** ✓ Water Branch CRM system now to be **investigated & developed** as **interim** solution, until SAMMS implemented (limited by Corporate initiatives) -**SAMMS Ref Item 9.02.** Delays as Council wide CRM system now being investigated hence Water Branch investigate interim solution such as Power-BI. **Proposed implementation 2018/19FY.**	Business & Customer Mgt Program Leader (Water Business)	Ben S	Dec-17	2018/19 FY	90%	**MONITOR**
Element 6: Management of Incidents and Emergencies											
6.03	2	**NC**	Audit highlighted requirement for regular review of IMP & associated training requirements.	Update incident response tools website to include *E.coli* incident flow chart and key stakeholder contacts. Ensure IMP review and updates undertaken including training requirements implemented.	Incident response website updated to include additional tools & contact details - **completed** ✓ IMP reivew and associated training undertaken **completed** ✓	Business & Customer Mgt Program Leader (Water Business)	Ben S	Jun-18	Jun-18	100%	**COMPLETE**
Element 7: Employee Awareness and Training											
7.00	3	**8.1 (G)**	Internal audit review highlighted that some staff were still unsure of the DWQMP & clarity of Drinking Water Policy.	Develop & deliver DWQMP & Policy awareness/toolbox training to all Water Branch staff and possibly include in future Induction Program.	a). Policy endorsed & displayed.✓ b). Annually awareness trainingdelivered to senior management .✓ c). Investigate DWQMP & Policy awareness training material to be developed & implemented to all Water Branch staff, eventually via inductions.	Business & Customer Mgt Program Leader & Water Quality Coordinator (Water Business)	Ben S & Natasha G	2018/19 FY	TBC	20%	**ON TRACK**
7.02	3	**8.1 (G)**	Recent audit identified external & OH&S training well documented however internal "on-the-job" training is not.	Develop and implement appropriate tool to document "on-the-job" training.	-	Water Branch Managers	All Managers	TBC	TBC	0%	**NOT STARTED**
Element 8: Community Involvement & Awareness											
Element 9: Research & Development											

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9.01	3	**10.3 (G)**	Document the design approaches used to ensure appropriate equipment deployed.	Document the design approaches used to ensure appropriate equipment deployed.	Dosing system design standardisation specification commenced. Workshop identified key requirements.✓ Development likely 2018/19FY.	Product Quality Program Leader (Water Business)	Chris PM	Jun-17	Jun-19	20%	**MONITOR**
9.02	3	**5.4 (G)**	Recent internal audit found reservoir inspections and cleans were overdue (i.e. 2 yearly cleans up to one year overdue).	Strategic Maintenance Management System (SAMMS) to have effective schedule systems to ensure associated escalations if due dates not met.	The Water Branch as part of the whole of Council's approach to implement **SAMMS** hence timeline dependant on Cooperate progress. Works order management in development to be tested 2018/19FY.	Water Asset Management Program Leader (Water Business)	Darren M	Jun-18	Jun-19	80%	**MONITOR**
9.04a	2	**NC** **Res 1.7 & 1.8**	*E.coli* incidents were a result of **poor reservoir condition & design** with low chlorine residual.	**RESERVOIRS** LWIA to investigate replacement of Brosnahan reservoir.	Investigation to replace Brosnahan reservoir completed. ✓	Water Asset Management Program Leader (Water Business)	Darren M	Jun-17	May-17	100%	**COMPLETE**
9.04b	3	**NC** **Res 1.7 & 1.8**	*E.coli* incidents were a result of **poor reservoir condition & design** with low chlorine residual.	**RESERVOIR** Brosnahan reservoir to be decommissioned and replaced with suitable pumps.	Design for reservoir replacement with new pumps completed. ✓ Reservoir demolition planned 2018/19FY.	LWIA & Water Asset Management Program Leader (Water Business)	Rajindar S & Darren M	Jun-17	Jun-18	100%	**COMPLETE**
9.05a	2	**BUL 1.2 & 1.3** **Res 1.14** **Res 4.1, 4.2 & 4.3** **Dis 2.1, 2.2 & 2.3**	*E.coli* incidents were a result of poor reservoir condition & design with **low chlorine residual.**	Develop SEQ Disinfection Strategy to investiate long term solution to improve network residuals for Logan.	SEQ Disinfection Strategy developed to investiate long term solution to improve network residuals for Logan.✓ Breakpoint dosing identified for Greenbank reservoir site. ✓	Product Quality Program Leader (Water Business)	Chris PM	Dec-16	May-17	100%	**COMPLETE**
9.05b	3	**BUL 1.2 & 1.3** **Res 1.14** **Res 4.1, 4.2 & 4.3** **Dis 2.1, 2.2 & 2.3**	*E.coli* incidents were a result of poor reservoir condition & design with **low chlorine residual.**	Implement SEQ Disinfection Strategy long term solution to improve network residuals for Logan.	a). Seqwater engaged consultant to develop delivery package to improve Logan's network residuals. **Complete** ✓ b). Greenbank breakpoint dosing facility designed **Complete** ✓ c). Constructed and commissioned 2018/19FY.	Product Quality Program Leader (Water Business)	Chris PM	Jun-18	Dec-18	80%	**ON TRACK**
		Element 10: Documentation & Reporting									
10.00	3	**11.1 (G)** **NC** **Ext Audit (4)**	Internal audit identified changed or out dated document DM# used. Various doc mgt approaches exist across the various Water Branches since Allconnex dissolution. DWQMP has documented WOPs known to date.	Establish Document Control Framework Principles. Water Ops & Lab have an established but different system.	IMS coordinator recently engaged to develop Intergrated Management system plan (IMS) . ✓ Current Document Control system reviewed with recommendations to be presented to management.✓ Document Control to be developed as part of IMS functions.	Product Quality Program Leader (Water Business)	Chris PM	Dec-17	2018/19 FY	40%	**MONITOR**

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		Element 11: Evaluation of Audit									
11.00	2	**12.1 (G)**	Long term data is not fully evaluated or documented.	Establish Process Improvement team to commence review of medium/long term trends & identify opportunities for improvements. Investigate an integrated Water Information Quality Management System (WQIMS) with links to other systems (i.e. LIMS, SCADA, field data, etc) to enable effective long term trends.	a). Process Improvement team established reviewing trends, improvement opportunities & action effectiveness ✓ b). WQIMS tender awarded. Development and implementation required to broaden trend analysis capability.✓ c). Software purchased. Server requirements finalised.✓ d). Stakeholder development commenced with implementation planned for 2018/19FY.	Product Quality Program Leader (Water Business)	Chris PM	Dec-17	Jun-19	75%	**MONITOR**
11.01	3	**12.2 (G)**	Internal audit undertaken & presented 2013, however processes for annual audit not yet established.	Establish internal annual audit review process. Investigate use of Intellex system and **WSA-AQuality** audit tool.	Established annual internal audits over next 4 years using external provider ✓ Investigate capacity & capability to undertake internal audits by LCC staff by 2018.✓ Decision to continue to engage external provider to undertake annual internal audits. Ad-hoc audits can be undertaken by internal staff. ✓	Water Quality Coordinator (Water Business)	Natasha G	Jun-18	Jun-18	100%	**COMPLETE**
		Element 12: Review & Continual Improvement									
12.00a	2	**13.1 (G)**	Identify RMIP "none actions" which could impact the Business by RMIP annual review, which includes high risks, internal audit non-conformances and long term actions to address drinking water health incidents.	Program Leaders responsible to ensure RMIP actions implemented such as incorporation into appropriate Water Branch Plans.	Evidence of some RMIP actions incorporated into Water Branch Plans **- completed** ✓ DWQMP (ADWG Component) facilitators assigned to help Program Leaders facilitate actions **- completed** ✓ Intelex investigated as the most appropriate tool to assist with RMIP action implementation and status reporting **- completed** ✓	Water Branch Managers	Natasha G	Jun-17	Jun-18	100%	**COMPLETE**
12.00b	3	**13.1 (G) Ext Audit (7)**	Identify RMIP "none actions" which could impact the Business by RMIP annual review, which includes high risks, internal audit non-conformances and long term actions to address drinking water health incidents.	Program Leaders responsible to ensure RMIP actions implemented such as incorporation into appropriate Water Branch Plans. Intelex tool to be developed to assist with RMIP status reporting.	Audit & Inspection module development commenced. Corrective Action intelex module required once Audit module implemented. Delays - due to Intelex provider ceased operation, continue with current excel system until further notice.	Water Branch Managers	Chris PM	Dec-18	TBC	20%	**MONITOR**
12.02	2	**13.2 (A)**	Ensure RMIP is kept up to date by incorporating any new actions to address risks or non-conformances identified via external Regulagory Audit.	Update RMIP to include actions to address non-conformances from Regulatory Audit and address any outstanding items from Risk Assessment.	RMIP updated.	Water Quality Coordinator (Water Business)	Natasha G	Jun'18	Jun-18	100%	**COMPLETE**