



**Gladstone Area  
Water Board**

Drinking Water Quality  
Management Plan

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**ANNUAL REPORT 2015/16**

Gladstone Area Water Board

ABN: 88 409 667 181

Phone: (07) 4976 3000

Fax: (07) 4972 5632

Ground Floor

147 Goondoon Street

Gladstone Q 4680

[www.gawb.qld.gov.au](http://www.gawb.qld.gov.au)

### Gladstone Area Water Board

The Gladstone Area Water Board (GAWB) considers this document contains matters relating to the business and financial affairs of GAWB and its disclosure may be contrary to the public interest under section 49 and Schedule 4 of the *Right to Information Act 2009* (RTI Act). GAWB would therefore be substantially concerned if this document was to be released publicly. Given this, GAWB provides this copy of the Drinking Water Quality Management Plan Annual Report to the recipient agency on the understanding that if the agency receives a Right to Information (RTI) request that captures this document; it will formally consult with GAWB under section 37 of the RTI Act before a decision is made on the RTI request.

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## Glossary of terms

ADWG 2004	Australian Drinking Water Guidelines (2004). Published by the National Health and Medical Research Council of Australia
ADWG 2011	Australian Drinking Water Guidelines (2011). Published by the National Health and Medical Research Council of Australia
<i>E. coli</i>	<i>Escherichia coli</i> , a bacterium which is considered to indicate the presence of faecal contamination and therefore potential health risk
HACCP	Hazard Analysis and Critical Control Points certification for protecting drinking water quality
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
MPN/100mL	Most probable number per 100 millilitres
CFU/100mL	Colony forming units per 100 millilitres
<	Less than
>	Greater than

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## 1 INTRODUCTION

Gladstone Area Water Board’s (GAWB’s) Drinking Water Quality Management Plan (DWQMP), approved on 29 February 2011, addresses the requirements of section 95(3) of the *Water Supply (Safety & Reliability) Act 2008* (WSSRA) to ensure safe drinking water for its customers. The Plan was first reviewed in 2014 and amendments approved on 28th May 2014. The Plan was reviewed again in early 2016, without the need for an amendment.

Gladstone Area Water Board (GAWB) is the bulk water provider for the Gladstone region, supplying drinking water services to the Gladstone Regional Council (GRC) (for reticulation to the city of Gladstone, the towns of Calliope, Tannum Sands, Benaraby and Mt Larcom) and to major industrial facilities located around Gladstone. GAWB also supplies a small number of domestic connections directly off the GAWB trunk mains.

Safe drinking water is essential to sustaining a healthy community. GAWB provides safe drinking water at a cost reasonable to the consumer. GAWB employs a multiple barrier system to ensure safe drinking water for its customers, using risk management methods consistent with the National Health and Medical Research Council’s (NHMRC) Australian Drinking Water Guidelines 2011 (ADWG).

### 1.1 Registered Service Details

GAWB is a registered Water Service Provider (WSP) under the WSSRA, and is regulated by the Chief Executive of the Department of Energy and Water Supply (DEWS). Powers under WSSRA have been delegated to the officers of the Queensland Water Supply Regulator (QWSR) and QWSR is the primary contact for communications regarding the DWQMP, including reporting requirements under the approval terms and conditions.

In addition, pursuant to section 1084 of the *Water Act 2000* (Water Act), GAWB is taken to be a Category 1 Water Authority from 1 July 2000 and is responsible to the Minister for Energy and Water Supply. GAWB operates as a commercialised statutory authority with the function of carrying out water activities and has a key objective to ensure its operations are as efficient as possible, with its prices being cost reflective.

GAWB’s WSP details are provided in Table 1.1 below.

**Table 1.1: Water Service Provider information for Gladstone Area Water Board**

Information Required	Details
<b>SPID</b>	200
<b>Service Provider Name</b>	Gladstone Area Water Board
<b>Contact Details</b>	PO Box 466 Gladstone QLD 4680 147 Goondoon St (p) 07 4976 3000 (fax) 07 4972 5632 <a href="http://www.gawb.qld.gov.au">www.gawb.qld.gov.au</a>
<b>Name of Schemes</b>	Gladstone Water Treatment Plant Scheme Yarwun Water Treatment Plant Scheme



## 1.2 Purpose of this Report

The purpose of this report is to summarise the performance of GAWB against criteria detailed in its DWQMP. As per the Regulator's reporting guidelines, this Report:

- Documents the actions undertaken by GAWB to implement the DWQMP;
- Summarises any non-compliances and incidents under section 102 and 102A of the WSSRA;
- Summarises the results of the verification water quality monitoring program undertaken by GAWB;
- Summarises customer satisfaction and GAWB's response to any complaints regarding drinking water quality; and
- Summarises any reviews of the DWQMP (none required for this reporting period).

## 2 OVERVIEW OF OPERATIONS 2015/16

GAWB operates two drinking water schemes, from which it provides bulk drinking water to the Gladstone Regional Council (GRC) for reticulation to domestic users and to various industrial customers.

The table below details GAWB's potable water customer connections of its two schemes as of 2015/16.

### GAWB's current drinking water connection details

Customer	Number of Metered Connections
<b>Gladstone WTP Scheme</b>	
Boyne Smelters Limited	2
Gladstone Regional Council	8
Queensland Alumina Limited	2
APLNG	1
GLNG	1
QCLNG	2
Non-commercial connections	33
<b>Yarwun WTP Scheme</b>	
Cement Australia	2
Gladstone Regional Council	6
Jemena	1
Orica	1
Aurizon	2
WICET	1
Rio Tinto Aluminium Yarwun	3
<b>TOTAL</b>	<b>62</b>

### 2.1 Gladstone WTP Scheme

Drinking water supplied from the Gladstone scheme is treated at the Gladstone WTP and then distributed to GAWB's customers either directly off the mains or from the outlet of seven service reservoirs. Gladstone WTP services the requirements of the Gladstone Regional Council drinking water reticulation system for the City of Gladstone and surrounding townships (a population of about 64,000), a number of industrial customers and 33 residential customers.

#### *Treatment Process and Delivery Network*

Gladstone WTP conventional water treatment process has a nominal capacity of 55ML per day at 20 hours availability, and consists of parallel up-flow clarification and Dissolved Air Flotation (DAF) processes which can be operated together or independently of one another.



The plant has six operating modes, allowing either or both plants to be run and the filters can be configured in such a way as to keep the process streams separate or run water from either or both plants over all filters. Direct filtration modes on the plant are disabled and can only be operated manually with direct management approval.

Once filtered, water is corrected for pH and disinfected with sodium hypochlorite in two clear water wells, after which the process streams rejoin, fluoridation occurs\* and the fully treated water enters the 2.25ML clear water contact tank.

Water is pumped from GWTP by the low lift and high lift pump sets. The low lift pumps deliver water directly to three GRC-owned reservoirs. The high lift pumps deliver water to GAWB’s distribution network, which includes three reservoirs and three rechlorination facilities.

During 2015/16, GWTP produced approximately 10.5 gigalitres of drinking water, as can be seen in the table below. Average production was approximately half of the capacity of the plant, with maximum day approximately 80% of plant capacity.

**Water quality**

GAWB undertakes comprehensive operational and verification monitoring of water quality. The operational monitoring is concentrated around the quality of source water and the treatment process, and includes daily measurements throughout the plant as well as online monitoring through the process and of re-chlorination facilities. There have been only minor changes to the operational monitoring program since development of the DWQMP.

Filter operation is a Critical Control Point (CCP) in the treatment process and the turbidity of each filter is monitored continuously using online turbidity meters. The target filtrate turbidity is less than 0.1 nephelometric turbidity units (NTU) during normal operation (not including backwash or filter ripening). During the course of 2015/16, the GWTP consistently produced filtered waters of 0.12 NTU (95<sup>th</sup> percentile).

Verification monitoring focuses on the finished product as it leaves the plant and is delivered to customer supply points. This includes weekly monitoring of parameters to verify effective disinfection and less-frequent monitoring of parameters which have been identified as having a lower risk in the drinking water. In terms of water quality, water delivered from the GWTP and transmission network achieved 100% compliance against ADWG health criteria. A full list of parameters and summary results can be found in Appendix A.

Measure	GWTP 2015/16 Performance	
Water production per annum	10,345 ML	
Average daily production	28.3 ML	
Maximum daily production	43.8 ML	20 Jan 2016
Minimum daily production	17.6 ML	6 March 2016
Filtered water turbidity (NTU)	0.12	95 <sup>th</sup> %tile
Water Quality Compliance ADWG	100% compliance	

\*Fluoridation has since ceased on 28<sup>th</sup> August 2016 as per Gladstone Regional Council directive





## 2.2 Yarwun WTP Scheme

Drinking water supplied from the Yarwun scheme is treated at the Yarwun WTP and then distributed to GAWB's customers either directly off the mains or from the outlet of two service reservoirs. GRC reticulates the water to domestic users after the points of supply.

### *Treatment Process and Delivery Network*

The Yarwun WTP, located on Reid Road in the Yarwun Industrial Estate, has a total current design capacity of 5 megalitres per day based on 20hrs availability.

Yarwun WTP conventional treatment is a single stream process with one clarifier and 3 mono-media filters, pH correction, chlorine disinfection and fluoridation. The plant is unattended and operates automatically, with daily operator visits to conduct general duties, monitoring and maintenance. The plant PLC and SCADA control system supervises all necessary functions and will shut the plant down automatically in the event of equipment failure or power loss. Online monitors are used throughout the system to facilitate control of the process.

Yarwun WTP services the requirements of the GRC and a number of industrial customers. Water is pumped from Yarwun WTP to the Mt Miller reservoir and then gravitates to the Boat Creek PS, supplying several industrial customers with process and drinking water. Water is then pumped to East End Reservoir, where it is re-chlorinated and supplied to the GRC for reticulation.

To ensure a disinfectant residual is maintained through to customer supply points GAWB practices supplementary disinfection at the East End Reservoir, where sodium hypochlorite is dosed to a set point in a recirculation stream from the reservoir. The chlorine residual is continuously monitored, with alarms for low and high dose relayed back to the treatment plant.

During 2015/16, YWTP produced approximately 1.4 gigalitres of drinking water, as can be seen in the table below. The average daily production was 3.9 ML/day with maximum day production 5.6ML.

### *Water quality*

GAWB undertakes comprehensive operational and verification monitoring of water quality. The operational monitoring is concentrated around the quality of source water and the treatment process, and includes daily measurements throughout the plant as well as online monitoring through the process and delivery network. There have been only minor changes to the operational monitoring program since development of the DWQMP.

Filter operation is a Critical Control Point (CCP) in the treatment process at YWTP and the combined turbidity of the three filters is monitored continuously using an online turbidity meter. The target filtrate turbidity is less than 0.3 nephelometric turbidity units (NTU) during normal operation (that is, not including backwash or filter ripening). During the course of 2015/16 and under normal operation, the YWTP consistently produced filtered waters of 0.17 NTU (95<sup>th</sup> percentile).



Verification monitoring focuses on the finished product as it leaves the plant and is delivered to customer supply points. This includes weekly monitoring of parameters to verify effective disinfection and less-frequent monitoring of parameters which have been identified as having a lower risk in the drinking water. In terms of water quality, the YWTP and distribution network achieved 100% compliance against ADWG criteria. A full list of parameters and summary results can be found in Appendix A.

Measure	YWTP 2015/16 Performance	
Water production per annum	1,425 ML	
Average daily production	3.9 ML	
Maximum daily production	5.6 ML	9 April 2016
Minimum daily production	1.7 ML	13 August 2015
Filtered water turbidity (NTU)	0.17	95th %tile
Water Quality Compliance ADWG	100% compliance	



### 3 ACTIONS TAKEN TO IMPLEMENT THE DWQMP

During the development of its Drinking Water Quality Management Plan, GAWB identified a number of improvement actions in management of source water, in the treatment process at both of its plants and in the operations of its network, to improve the risks to drinking water quality.

The table below lists the outstanding improvement actions identified during the 2014 review of the DWQMP, target dates for completion and current status. Two of the four actions are still in progress.

Improvement action Y8.3 has been completed. This was a significant project for water quality improvement. The project findings have resulted in a capital project to interconnect the Gladstone and Yarwun systems via a pipeline. This will allow demand on the Yarwun WTP to be reduced significantly to allow essential maintenance works and to meet ongoing demand in the Yarwun Scheme.

Item No.	Scheme Component / Sub-component	Action(s)	Target date	Status	Comments
G 2.1	Coagulation Sedimentation	Chemical jar testing of other treatment chemicals	Ongoing	Complete	Jar testing for chemical optimisation is a business-as-usual activity
G3.1	Filtration	VSD to be installed on pumps to improve flow control.	Dec 2016	Ongoing	VSD to be installed in 2016/17
G7.2	General Maintenance	AMS system to flag potable water assets	Ongoing	Complete	
Y2.1	Backwash Water and Clarifier Waste	Develop project for alternative use of recovered water – dependent on long-term plans for YWTP	July 2015	Ongoing	Alternate use analysed (ie disposal via tradewaste or return to raw water network). UV system to be installed which reduces water quality risk.
Y8.3	General Maintenance	Demand/Supply options analysis for Yarwun Scheme	July 2015	Complete	The project findings have resulted in a capital project to interconnect the Gladstone and Yarwun systems via a pipeline.



## 4 COMPLIANCE WITH WQ CRITERIA FOR DRINKING WATER

The results from the verification monitoring program have been compared against the levels of the water quality criteria specified by the Regulator in the *Water Quality and Reporting Guideline for a Drinking Water Service* and are summarised in Appendix A, Table A1. As can be seen, GAWB drinking water is compliant with the ADWG 2011 and meets the water quality criteria specified by the Queensland Water Supply Regulator

The reported statistics do not include results derived from quality control, blank or repeat samples, or from emergency or investigative samples undertaken in response to an elevated result. Nor does it include results from booster stations not considered to be direct customer offtakes as per recommendation by the DWQMP auditors. All 'less than' results have been analysed as having a value of zero (0), consistent with the quarterly reporting requirements of the QWSR.

There were no deviations from the DWQMP sampling program.

Consistency of monitoring results over the 2015/16 period with previous years demonstrates a level of surveillance consistent and appropriate with the risks to drinking water quality.



## 5 NOTIFICATIONS TO THE REGULATOR

During the 2015/16 year there was one notification to the Regulator under sections 102 and 102A of the Act.. This occurred on 17<sup>th</sup> May 2016, and was related to high fluoride within the plant due to a mechanical fault. Investigations into this incident found a mixing shaft had malfunctioned, resulting in low fluoride levels in treated water for 3 days prior to the incident. After the mixing tank was drained, cleaned and brought back online, elevated fluoride levels were detected in the clear water reservoir. The water in the clear water reservoir was quarantined and slowly diluted. Levels of fluoride in the treated water system remained below guideline value of 0.7mg/l. Preventative actions resulting from this incident included:

- a review of the preventative maintenance schedule
- investigation into feasibility of equipment to detect mechanical problems
- incident added to Water Quality Induction as a case study.

Any further actions were deemed unnecessary as the Gladstone Regional Council voted to remove fluoridation from Gladstones water supply and the plant has since been fully decommissioned. Part B of the report to the regulator was submitted on the 21<sup>st</sup> July 2016 and the incident closed out on 26 July 2016.



## 6 CUSTOMER SATISFACTION

GAWB monitors customer satisfaction of water quality by maintaining a register of complaints. Complaints are reported to the Minister in the 'Key Performance Measures' section of GAWB's Quarterly Reports on its Performance Plan for the financial year. During 2015/16 year, GAWB recorded one water quality complaint from a non-commercial connection. The resident advised that the water was "dirty" on the 22<sup>nd</sup> May 2016. Follow up investigations and sampling concluded water quality to be within all the ADWG. No further actions were required. No complaints were received from GRC or industrial customers on GAWB's network.

The Gladstone Regional Council (GRC) reticulates bulk drinking water produced by GAWB to domestic users. Consumer feedback on quality or supply of drinking water from domestic users is generally managed by the GRC, who maintain a database of customer feedback. In practice, GAWB will assist the regional council with enquiries on water quality where applicable, and escalate issues internally if there is cause. During 2015/16 the GRC did not report any water quality complaints to GAWB.

In general, industrial customers use the bulk of their treated water reservation for process water (e.g. in boilers) and to provide drinking water to their sites. GAWB maintains an open and responsive relationship with its customers. GAWB receives several enquiries each year from current or potential customers for information on the quality of water, to inform the design of processing plant. During 2015/16, GAWB's industrial drinking water customers did not report any water quality complaints to GAWB.



## 7 FINDINGS AND RECOMMENDATIONS OF THE DWQMP AUDITOR

GAWB arranged for Viridis Consultants to conduct a regular audit of the DWQMP on the 24<sup>th</sup> and 25<sup>th</sup> November 2015. The purpose of the audit was to verify the accuracy of the monitoring and performance data provided to the Regulator and assess compliance with the DWQMP. It also aims to assess the relevance of the DWQMP in relation to the service provided. A summary of outcomes of the audit are provided below. Minor non-conformances are highlighted in yellow, while the remainder of the recommendations are opportunities for improvement.

Improvement Recommendation	Status
Restrict access on SCADA system to ensure CCP critical limit set points cannot be changed without authorisation. Lead Operator and above only	Complete
Revise CCP Plants to ensure that report section reflects the current practice ie amber breaches are logged into the daily electronic dairy and red breaches in INX	Complete
Periodically check all CCP limits to ensure they are consistent with the documentation	In progress
Migrate jar test template into Tech One (AMS) system to ensure all jar testing records are maintained	In progress
Ensure calibration stickers are put on all externally calibrated instruments by the contractor	In progress
Develop a framework to guide the decision on the selection of intake level	In progress
Update the DWQMP to make reference to the revised HAB AP 2015	Complete
Review the DWQ EAP (overdue)	Complete
Refer to the WQ Monitoring Manual in the DWQMP. Reproducing the monitoring frequencies and tables in the body of the DWQMP increases the admin in keeping the DWQMP updated.	Complete
Update the DWQMP with the current process to monitor improvement actions	Complete
Develop an Improvement Plan SS to capture and monitor the risk management improvements. Refer to this Improvement Plan SS in the DWQMP as it will reduce admin in keeping body of DWQMP updated	In progress
Investigate the possibility of using tablets/PDA devices for field technicians performing water sampling and for the results to get logged directly into the database/spreadsheet	In progress
Revise the schematics and related infrastructure details to reflect current operations	Complete



## 8 OUTCOME OF THE REVIEW OF THE DWQMP

In general, most changes were minor, in terms of updating demand and quality information to reflect the 2015-16 year, and cross checked with other regulatory documents such as the DWQMP Annual report. All references to secondary or supporting documentation were checked and updated as necessary. All schematics of GAWB's network were updated to the most current available. A full review of GAWB's risk assessment is in progress at time of submission of this annual report to incorporate new process configurations, such as the GWTP interconnection to YWTP.



## Appendix A – Summary of compliance with water quality criteria

The results from the verification monitoring program have been compared against the levels of the water quality criteria specified by the Regulator in the *Water Quality and Reporting Guideline for a Drinking Water Service* and are summarised in Table A1. As can be seen, GAWB drinking water is compliant with the ADWG 2011 and meets the water quality criteria specified by the Office of the Water Supply Regulator

The reported statistics do not include results derived from quality control, blank or repeat samples, or from emergency or investigative samples undertaken in response to an elevated result. All 'less than' results have been analysed as having a value of zero (0), consistent with the quarterly reporting requirements of the QWSR.

Consistency of monitoring results over the 2014-15 period with previous years demonstrates a level of surveillance consistent and appropriate with the risks to drinking water quality.

**Table A1 - Verification monitoring results**

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. samples of which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	95th %tile	Limit of reporting	Laboratory name
Lake Awoonga	Source Water	4.4`-DDD	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	4.4`-DDE	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	4.4`-DDT	µg/L	Q	4	0	0	0	0	0	0	2	ALS
Lake Awoonga	Source Water	Aldrin	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	alpha-BHC	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	alpha-Endosulfan	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	beta-BHC	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	beta-Endosulfan	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	cis-Chlordane	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	delta-BHC	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Dieldrin	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Endosulfan sulfate	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Endrin	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS



Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. samples which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	95th %tile	Limit of reporting	Laboratory name
Lake Awoonga	Source Water	Endrin aldehyde	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Endrin ketone	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	gamma-BHC	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Heptachlor	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Heptachlor epoxide	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Hexachlorobenzene (HCB)	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Methoxychlor	µg/L	Q	4	0	0	0	0	0	0	2	ALS
Lake Awoonga	Source Water	Sum of Aldrin + Dieldrin	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Sum of DDD + DDE + DDT	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Total Chlordane (sum)	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	trans-Chlordane	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Azinphos Methyl	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Bromophos-ethyl	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Carbophenothion	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Chlorfenvinphos	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Chlorpyrifos	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Chlorpyrifos-methyl	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Demeton-S-methyl	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Diazinon	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Dichlorvos	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Dimethoate	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Ethion	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Fenamiphos	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS



Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. samples which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	95th %tile	Limit of reporting	Laboratory name
Lake Awoonga	Source Water	Fenthion	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Malathion	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Monocrotophos	µg/L	Q	4	0	0	0	0	0	0	2	ALS
Lake Awoonga	Source Water	Parathion	µg/L	Q	4	0	0	0	0	0	0	2	ALS
Lake Awoonga	Source Water	Parathion-methyl	µg/L	Q	4	0	0	0	0	0	0	2	ALS
Lake Awoonga	Source Water	Pirimphos-ethyl	µg/L	Q	4	0	0	0	0	0	0	2	ALS
Lake Awoonga	Source Water	Prothiofos	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Dissolved Oxygen	%	W	104	104	0	39.4	91	65.2	82.6	0.1	Internal
Lake Awoonga	Source Water	pH	pH Unit	W	105	105	0	7.6	8.5	7.9	8.3	0.1	Internal
Lake Awoonga	Source Water	Turbidity	NTU	W	105	105	0	0.2	3.2	1.3	2.1	0.1	Internal
Lake Awoonga	Source Water	Hardness	mg/L	Q	8	8	0	79	89	82	87	1	Internal
Lake Awoonga	Source Water	Total Dissolved Solids	mg/L	Q	8	8	0	137	188	155	177	10	ALS
Lake Awoonga	Source Water	Arsenic	mg/L	Q	8	4	0	0.001	0.002	0.001	0.002	0.001	ALS
Lake Awoonga	Source Water	Barium	mg/L	Q	8	4	0	0.010	0.015	0.012	0.014	0.001	ALS
Lake Awoonga	Source Water	Cadmium	mg/L	Q	8	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
Lake Awoonga	Source Water	Chromium	mg/L	M	12	0	0	0.000	0.000	0.000	0.000	0.001	ALS
Lake Awoonga	Source Water	Copper	mg/L	M	12	3	0	0.000	0.001	0.00	0.001	0.001	ALS
Lake Awoonga	Source Water	Lead	mg/L	M	12	0	0	0.000	0.000	0.000	0.000	0.001	ALS
Lake Awoonga	Source Water	Mercury	mg/L	M	12	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
Lake Awoonga	Source Water	Nickel	mg/L	M	12	0	0	0.000	0.000	0.000	0.000	0.001	ALS
Lake Awoonga	Source Water	Selenium	mg/L	Q	4	0	0	0.00	0.00	0.00	0.00	0.01	ALS
Lake Awoonga	Source Water	Zinc	mg/L	Q	4	0	0	0.000	0.000	0.000	0.000	0.005	ALS
Lake Awoonga	Source Water	Cyanide	mg/L	Q	4	0	0	0.000	0.006	0.000	0.005	0.004	ALS
Lake Awoonga	Source Water	Manganese	mg/L	W	101	99	0	0.004	0.085	0.019	0.046	0.001	ALS



Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	95th %tile	Limit of reporting	Laboratory name
Lake Awoonga	Source Water	Cyanobacteria	cells/mL	W	101	101	0	400	69640	14510	43600	1	Ecoscope
Lake Awoonga	Source Water	Escherichia coli	MPN/100 mL	W	101	3	0	0	18	0	0	1	Ecoscope
Lake Awoonga	Source Water	Cryptosporidium	oocysts/L	M	4	0	0	0	0	0	0	1	ALS
Lake Awoonga	Source Water	Giardia	cysts/L	M	4	0	0	0	0	0	0	1	ALS
Lake Awoonga	Source Water	Total PAHs	µg/L	Q	4	0	0	0	0	0	0	1	ALS
GWTP	Treatment Plant	Free Chlorine	mg/L	W	52	52	0	1.5	3.4	2.5	3.3	0.1	Internal
GWTP	Treatment Plant	Dissolved Oxygen	%	W	52	52	0	78	97.8	89.1	96.1	0.1	Internal
GWTP	Treatment Plant	pH	pH Unit	W	52	52	0	7.1	7.8	7.4	7.7	0.1	Internal
GWTP	Treatment Plant	Turbidity	NTU	W	52	52	0	0.0	0.2	0.1	0.1	0.1	Internal
GWTP	Treatment Plant	Colour	PCU	M	24	24	0	2	7	5	7	1	ALS
GWTP	Treatment Plant	Hardness	mg/L	Q	4	4	0	76	89	83	88	1	ALS
GWTP	Treatment Plant	Total Dissolved Solids	mg/L	Q	4	4	0	154	178	164	176	10	ALS
GWTP	Treatment Plant	Aluminium	mg/L	M	12	12	0	0.02	0.07	0.04	0.06	0.01	ALS
GWTP	Treatment Plant	Arsenic	mg/L	Q	4	4	0	0.000	0.000	0.000	0.000	0.001	ALS
GWTP	Treatment Plant	Barium	mg/L	Q	4	4	0	0.010	0.012	0.011	0.011	0.001	ALS
GWTP	Treatment Plant	Cadmium	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
GWTP	Treatment Plant	Chromium	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
GWTP	Treatment Plant	Copper	mg/L	Q	4	0	0	0.000	0.002	0.002	0.002	0.001	ALS
GWTP	Treatment Plant	Lead	mg/L	Q	4	0	0	0.000	0.000	0.000	0.000	0.001	ALS
GWTP	Treatment Plant	Mercury	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
GWTP	Treatment Plant	Nickel	mg/L	Q	4	0	0	0.000	0.000	0.000	0.000	0.001	ALS
GWTP	Treatment Plant	Selenium	mg/L	Q	4	0	0	0.00	0.00	0.00	0.00	0.01	ALS
GWTP	Treatment Plant	Zinc	mg/L	Q	4	1	0	0.000	0.004	0.001	0.003	0.001	ALS



Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. samples which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	95th %tile	Limit of reporting	Laboratory name
GWTP	Treatment Plant	Cyanide	mg/L	Q	4	0	0	0.000	0.000	0.000	0.000	0.004	ALS
GWTP	Treatment Plant	Iron	mg/L	M	15	0	0	0.00	0.00	0.00	0.00	0.05	ALS
GWTP	Treatment Plant	Manganese	mg/L	M	50	10	0	0.000	0.002	0.000	0.001	0.001	ALS
GWTP	Treatment Plant	Fluoride	mg/L	M	14	11	0	0.0	0.7	0.4	0.7	0.1	ALS
GWTP	Treatment Plant	Trihalomethanes	µg/L	M	12	12	0	6	22	16	21	5	ALS
GWTP	Treatment Plant	Cyanobacteria	cells/mL	W	50	22	0	0	120	21	80	1	Ecoscope
GWTP	Treatment Plant	Escherichia coli	MPN/100 mL	W	51	0	0	0	0	0	0	1	Ecoscope
GWTP Distribution	Transmission	Free Chlorine	mg/L	W	695	695	0	0.31	4.5	1.5	2.2	0.1	Internal
GWTP Distribution	Transmission	Dissolved Oxygen	%	W	685	685	0	80	130	93	101	0.1	Internal
GWTP Distribution	Transmission	pH	pH Unit	W	687	687	0	7.2	8.2	7.6	8.0	0.1	Internal
GWTP Distribution	Transmission	Turbidity	NTU	W	695	695	0	0.0	4.6	0.1	0.1	0.1	Internal
GWTP Distribution	Transmission	Colour	PCU	M	330	330	0	2.0	9.0	5.4	7.8	1.0	ALS
GWTP Distribution	Transmission	Aluminium	mg/L	M	165	165	0	0.01	0.09	0.04	0.05	0.01	ALS
GWTP Distribution	Transmission	Arsenic	mg/L	Q	58	0	0	0.000	0.000	0.000	0.000	0.001	ALS
GWTP Distribution	Transmission	Barium	mg/L	Q	58	58	0	0.010	0.014	0.011	0.013	0.001	ALS
GWTP Distribution	Transmission	Cadmium	mg/L	Q	58	0	0	0.00000	0.00000	0.00000	0.00000	0.00005	ALS
GWTP Distribution	Transmission	Chromium	mg/L	Q	58	0	0	0.000	0.000	0.000	0.000	0.001	ALS
GWTP Distribution	Transmission	Copper	mg/L	Q	58	58	0	0.001	0.015	0.009	0.010	0.001	ALS
GWTP Distribution	Transmission	Lead	mg/L	Q	58	29	0	0.000	0.001	0.000	0.001	0.001	ALS
GWTP Distribution	Transmission	Mercury	mg/L	Q	58	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
GWTP Distribution	Transmission	Nickel	mg/L	Q	58	0	0	0.000	0.000	0.000	0.000	0.001	ALS



Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	95th %tile	Limit of reporting	Laboratory name
GWTP Distribution	Transmission	Selenium	mg/L	Q	58	2	0	0.00	0.00	0.00	0.00	0.01	ALS
GWTP Distribution	Transmission	Zinc	mg/L	Q	58	8	0	0.000	0.021	0.006	0.014	0.001	ALS
GWTP Distribution	Transmission	Iron	mg/L	M	141	104	0	0.00	0.120	0.005	0.080	0.002	ALS
GWTP Distribution	Transmission	Manganese	mg/L	M	165	29	0	0.000	0.005	0.000	0.000	0.001	ALS
GWTP Distribution	Transmission	Fluoride	Mg/l	M	41	41	0	0.09	0.72	0.50	0.90	0.01	ALS
GWTP Distribution	Transmission	Trihalomethanes	µg/L	M	165	165	0	30	138	80	115	5	ALS
GWTP Distribution	Transmission	Escherichia coli	MPN/100 mL	W	611	0	0	0	0	0	0	1	Ecoscope
YWTP	Water Treatment	Free Chlorine	mg/L	W	52	52	0	2.0	3.8	2.7	3.5	0.1	Internal
YWTP	Water Treatment	Dissolved Oxygen	%	W	52	52	0	77.40	95.10	87.29	93.50	0.1	Internal
YWTP	Water Treatment	pH	pH Unit	W	52	52	0	7.1	7.9	7.4	7.6	0.1	Internal
YWTP	Water Treatment	Turbidity	NTU	W	52	52	0	0.0	0.2	0.0	0.1	0.1	Internal
YWTP	Water Treatment	Colour	PCU	M	24	24	0	2	8	5	7	1	ALS
YWTP	Water Treatment	Hardness	mg/L	Q	4	4	0	79	83	81	83	1	ALS
YWTP	Water Treatment	Total Dissolved Solids	mg/L	Q	3	3	0	161	170	166	169	10	ALS
YWTP	Water Treatment	Aluminium	mg/L	M	13	13	0	0.04	0.17	0.07	0.14	0.01	ALS
YWTP	Water Treatment	Arsenic	mg/L	Q	4	0	0	0.000	0.000	0.000	0.000	0.001	ALS
YWTP	Water Treatment	Barium	mg/L	Q	4	4	4	0.008	0.011	0.010	0.011	0.001	ALS
YWTP	Water Treatment	Cadmium	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
YWTP	Water Treatment	Chromium	mg/L	Q	4	0	0	0.000	0.000	0.000	0.000	0.001	ALS
YWTP	Water Treatment	Copper	mg/L	Q	4	4	0	0.003	0.007	0.004	0.006	0.001	ALS
YWTP	Water Treatment	Lead	mg/L	Q	4	1	0	0.000	0.008	0.000	0.000	0.001	ALS
YWTP	Water Treatment	Mercury	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
YWTP	Water Treatment	Nickel	mg/L	Q	4	0	0	0.000	0.000	0.000	0.000	0.001	ALS



Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. samples which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	95th %tile	Limit of reporting	Laboratory name
YWTP	Water Treatment	Selenium	mg/L	Q	4	0	0	0.00	0.00	0.00	0.00	0.01	ALS
YWTP	Water Treatment	Zinc	mg/L	Q	4	2	0	0.001	0.002	0.001	0.002	0.001	ALS
YWTP	Water Treatment	Cyanide	mg/L	Q	4	0	0	0.000	0.000	0.000	0.000	0.004	ALS
YWTP	Water Treatment	Iron	mg/L	M	15	0	0	0.00	0.00	0.00	0.00	0.05	ALS
YWTP	Water Treatment	Fluoride	mg/l	M	11	11	0	0.1	0.7	0.5	0.7	0.1	ALS
YWTP	Water Treatment	Manganese	mg/L	M	51	45	0	0.000	0.006	0.000	0.003	0.001	ALS
YWTP	Water Treatment	Trihalomethanes	µg/L	M	12	12	0	13	30	19	25	5	ALS
YWTP	Water Treatment	Cyanobacteria	cells/mL	W	51	9	0	0	80	7	60	1	Ecoscope
YWTP	Water Treatment	Escherichia coli	MPN/100 mL	W	51	0	0	0	0	0	0	1	Ecoscope
YWTP Distribution	Transmission	Free Chlorine	mg/L	W	247	247	0	0.1	3.3	1.3	1.9	0.1	Internal
YWTP Distribution	Transmission	Dissolved Oxygen	%	W	247	247	0	82.9	111.4	91.7	97.8	0.1	Internal
YWTP Distribution	Transmission	pH	pH Unit	W	247	247	0	7.2	8.7	7.9	8.6	0.1	Internal
YWTP Distribution	Transmission	Turbidity	NTU	W	242	242	0	0.0	0.3	0.0	0.1	0.1	Internal
YWTP Distribution	Transmission	Colour	PCU	M	118	118	0	2	8	5	8	1	ALS
YWTP Distribution	Transmission	Aluminium	mg/L	M	59	59	0	0.04	0.08	0.05	0.07	0.01	ALS
YWTP Distribution	Transmission	Arsenic	mg/L	Q	20	0	0	0.000	0.000	0.000	0.000	0.001	ALS
YWTP Distribution	Transmission	Barium	mg/L	Q	20	20	0	0.008	0.013	0.010	0.012	0.001	ALS
YWTP Distribution	Transmission	Cadmium	mg/L	Q	20	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
YWTP Distribution	Transmission	Chromium	mg/L	Q	20	6	0	0.000	0.001	0.000	0.001	0.001	ALS
YWTP Distribution	Transmission	Copper	mg/L	Q	20	18	0	0.000	0.014	0.004	0.009	0.001	ALS
YWTP Distribution	Transmission	Lead	mg/L	Q	20	14	0	0.000	0.004	0.000	0.002	0.001	ALS
YWTP Distribution	Transmission	Mercury	mg/L	Q	20	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS



Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. samples which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	95th %tile	Limit of reporting	Laboratory name
YWTP Distribution	Transmission	Nickel	mg/L	Q	20	0	0	0.000	0.000	0.000	0.000	0.001	ALS
YWTP Distribution	Transmission	Selenium	mg/L	Q	20	0	0	0.00	0.00	0.00	0.00	0.01	ALS
YWTP Distribution	Transmission	Zinc	mg/L	Q	20	12	0	0.000	0.015	0.002	0.005	0.001	ALS
YWTP Distribution	Transmission	Iron	mg/L	M	59	20	0	0.00	0.18	0.00	0.01	0.05	ALS
YWTP Distribution	Water Treatment	Fluoride	mg/l	M	24	24	0	0.11	0.90	0.60	0.80	0.01	ALS
YWTP Distribution	Transmission	Manganese	mg/L	M	59	48	0	0.000	0.003	0.001	0.002	0.001	ALS
YWTP Distribution	Transmission	Trihalomethanes	µg/L	M	59	59	0	0	125	57	99	5	ALS
YWTP Distribution	Transmission	Escherichia coli	MPN/100 mL	W	246	0	0	0	0	0	0	1	Ecoscope



Tables A2 and A3 summarise the monthly results for all *E. coli* verification monitoring undertaken in the Gladstone and Yarwun systems.

**Table A2 - Reticulation *E. coli* verification monitoring in Gladstone WTP Distribution**

<b>Gladstone WTP Distribution 2015/16</b>												
<b>Month</b>	<b>Jul-15</b>	<b>Aug-15</b>	<b>Sep-15</b>	<b>Oct-15</b>	<b>Nov-15</b>	<b>Dec-15</b>	<b>Jan-16</b>	<b>Feb-16</b>	<b>Mar-16</b>	<b>Apr-16</b>	<b>May-16</b>	<b>Jun-16</b>
<b>No. Samples collected</b>	55	54	61	63	48	64	48	61	73	49	53	33
<b>No samples collected in which <i>E. coli</i> was detected</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>No samples collected in previous 12 month period</b>	60	51	55	50	46	60	32	40	54	60	53	67
<b>No samples in which <i>E.coli</i> detected for previous 12 month period</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>% samples that comply</b>	100	100	100	100	100	100	100	100	100	100	100	100
<b>Compliance with 98% annual value</b>	100	100	100	100	100	100	100	100	100	100	100	100

Table A3 - Reticulation *E. coli* verification monitoring in Yarwun WTP Distribution

Yarwun WTP Distribution 2015/16												
Month	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16
No. Samples collected	22	24	29	23	30	24	24	24	25	22	30	20
No samples collected in which <i>E. coli</i> was detected	0	0	0	0	0	0	0	0	0	0	0	0
No samples collected in previous 12 month period	34	27	26	34	25	39	20	22	27	24	27	34
No samples in which <i>E.coli</i> detected for previous 12 month period	0	0	0	0	0	0	0	0	0	0	0	0
% samples that comply	100	100	100	100	100	100	100	100	100	100	100	100
Compliance with 98% annual value	100	100	100	100	100	100	100	100	100	100	100	100