



**Gladstone Area
Water Board**

Drinking Water Quality
Management Plan

ANNUAL REPORT 2013/14

Gladstone Area Water Board

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Gladstone Area Water Board

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Document Status					
Date	Revision	Description	Author	Checked	Approved
24/11/2014	V1	Issued for internal review	Sarah Lunau		
08/12/2014	v2	Internal review	Mark McKeon		
11/12/2014	Final	Final	Sarah Lunau		Sarah Lunau

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.

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
SPID	200
Service Provider Name	Gladstone Area Water Board
Contact Details	PO Box 466 Gladstone QLD 4680 147 Goondoon St (p) 07 4976 3000 (fax) 07 4972 5632 www.gawb.qld.gov.au
Name of Schemes	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 the latest review of the DWQMP.

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2 OVERVIEW OF OPERATIONS 2013/14

GAWB operates two registered 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 2013/14.

GAWB's current drinking water connection details

Customer	Number of Metered Connections
Gladstone WTP Scheme	
Boyne Smelters Limited	2
Gladstone Regional Council	8
Queensland Alumina Limited	2
APLNG	1
QCLNG	1
Non-commercial connections	33
Yarwun WTP Scheme	
Cement Australia	3
Gladstone Regional Council	5
Jemena	1
Orica	1
Queensland Rail	2
Rio Tinto Aluminium Yarwun	3
TOTAL	62

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 2013/14, GWTP produced approximately 10.8 gegalitres 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 close to 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 no revisions of 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 2013/14, the GWTP consistently produced filtered waters of 0.16 NTU (95th 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 GWTP and transmission network achieved 100% compliance against ADWG criteria. A full list of parameters and summary results can be found in Appendix A.

Measure	GWTP 2013/14 Performance	
Water production per annum	10,813 ML	
Average daily production	29.6 ML	
Maximum daily production	48.0 ML	11 Nov 2013
Minimum daily production	18.2 ML	21 July 2013
Filtered water turbidity (NTU)	0.16	95 th %tile
Water Quality Compliance ADWG	100% compliance	



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 2013/14, YWTP produced approximately 1.5 gegalitres of drinking water, as can be seen in the table below. The average daily production was 4.0 ML/day with maximum day production 5.8ML.

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 no revisions of 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 2013/14 and under normal operation, the YWTP consistently produced filtered waters of 0.24 NTU (95th 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 2013/14 Performance	
Water production per annum	1,471 ML	
Average daily production	4.0 ML	
Maximum daily production	5.8 ML	13 Nov 2013
Minimum daily production	2.2 ML	5 Dec 2013
Filtered water turbidity (NTU)	0.24	95th %tile
Water Quality Compliance ADWG	100% compliance	

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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 improvement actions identified during the development of the DWQMP, target dates for completion and current status. Twenty-one of the twenty-four action items have been complete. Of the outstanding actions:

- G2.1 and G7.2 - Chemical jar testing optimisation and population of the AM system will continue to be ongoing improvement actions; and
- Y2.1 – Future of recovered water at YWTP is subject to options study of the plant.

Item No.	Scheme Component / Sub-component	Action(s)	Target date	Status as at 30/9/14	Comments
S1	Source Water - Land Management	Develop Land Management Plan	Jun-14	Complete	
S2.1	Source Water - Water Abstraction	Connect water quality profiler to telemetry network to allow real time monitoring of water quality	Jun-12	Complete	
G1.1	GWTP - Pre-treatment	PAC system upgrade	Jul-11	Complete	
G2.1	GWTP - Primary solids removal	Chemical jar testing of other treatment chemicals	Ongoing	Ongoing	Use of specialised coagulants in emergency situations (high turbidity/low alkalinity) subject to ongoing jar tests and emergency preparedness
		Clarifier shade-roof project	Jul-12	Complete	Project will not go ahead based on cost benefit considerations



Item No.	Scheme Component / Sub-component	Action(s)	Target date	Status as at 30/9/14	Comments
G2.4	GWTP - Primary solids removal	Mechanical & chemical optimisation, including investigation of tachometer on DAF rollers, automated sludge removal, alternate chemical jar testing	Jul-12	Complete	Optimisation investigations complete. Changes made to mechanical mixing of coagulant and coagulant aid resulting in improved turbidity's from DAF units. Automated sludge removal requires major plant upgrade: decision deferred until next major plant augmentation. To be identified as new item in 2014 review of DWQMP.
G3.1	GWTP - Filtration	Plant operating philosophy - Improve flow rate control & implement soft start on plant. Investigate VSD on pump sets	Jul-11	Complete	Flow rate control and soft starts implemented. VSDs project in 5 year capital plan with target commissioning date end 2016.
		Review filter ripening parameters	Jul-12	Complete	Filter ripening parameters incorporated into quarterly filter inspections
G6.1/Y7.1	GWTP - Distribution and delivery	Mains break/repair procedures	Jul-12	Complete	SOP developed for mains break including disinfection of equipment and returning system to service
	GWTP - Distribution and delivery	Pipeline pressure monitoring and recording via telemetry	Oct-11	Complete	Pressure monitoring implemented. Ongoing improvements will be automatic alarming for pressure/flow discrepancy
G6.6	GWTP - Distribution and delivery	Investigate control for filling GRC reservoirs from low lift system	Jul-12	Complete	Flow control ramps have reduced sudden shear through filters. VFD project will results in further reduction in plant ramp speeds. Filters performing at <0.1NTU consistently
G7.1	GWTP - Chemical procedures	Develop Chemical Acceptance and Handling SOP for all chemicals	Jul-11	Complete	All chemical batches subject to documented chemical acceptance procedure.
		Certificate of Analysis in future chemical contracts	Oct-11	Complete	
G7.2	GWTP - General Maintenance	Sanitary work methods in site induction and contracts	Jul-11	Complete	Contractor handbook includes requirement to use sanitary methods to protect water quality. Water quality considered and incorporated in all new contracts.



Item No.	Scheme Component / Sub-component	Action(s)	Target date	Status as at 30/9/14	Comments
		AM system to flag potable water assets	Ongoing	Ongoing	Ongoing population of AM system captures requirements for drinking water assets
G7.3	GWTP - Emergency	Communication of significant risks to GRC	Dec-11	Complete	Communicated through dissemination of DWQMP .
		Development of a multi-stakeholder DWQ Emergency Action Plan	Jul-12	Complete	Ongoing scenario testing now in progress
		Pipe line pressure monitoring and recording via telemetry	Oct-11	Complete	Future continuous improvements to include alarms on pressure drops through network
Y2.1	YWTP - Recovered Water	Develop project for alternative use of recovered water	Jul-12	Ongoing	YWTP subject to new capacity study which includes recovered water system
Y3.1	YWTP - Primary solids removal	Clarifier shade-roof project	Jul-13	Complete	Project will not go ahead based on cost benefit considerations
Y4.1	YWTP - Filtration	Install turbidity meters on outlet of each filter	Jul-11	Complete	Ongoing work required to make these reliable
Y7.3	YWTP - Distribution	Discrete inlet and outlet on Mt Miller Reservoir so that water cannot bypass reservoir	Jul-12	Complete	
General	GAWB processes	Migrate DWQ risks into CURA risk management software to allow streamlined tracking of risks	Jul-12	Complete	Risk management software populated with water quality risks.



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. All 'less than' results have been analysed as having a value of zero (0), consistent with the quarterly reporting requirements of the QWSR.

Deviations from the sampling program proposed in the DWQMP include:

- *E. coli* sampling not undertaken in the week following Christmas due to closure of laboratories.

Consistency of monitoring results over the 2013/14 period with previous years demonstrates a level of surveillance consistent and appropriate with the risks to drinking water quality. Sampling for manganese from the WTP inlets and outlets at both plants has been increased to weekly. This was undertaken to remove the risk to operators from having to handle the cyanide-based reactant used for in-house manganese testing in operational monitoring.

5 NOTIFICATIONS TO THE REGULATOR

During the 2013/14 year there were no notifications to the Regulator.

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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 2013/14 GAWB did not record any complaints about water quality from its customers, including GRC, industrial customers or the small number of reticulation 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 2013/14 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 2013/14, GAWB's industrial drinking water customers did not report any water quality complaints to GAWB.

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7 FINDINGS AND RECOMMENDATIONS OF THE DWQMP AUDITOR

No audit was required for the period of 2013/14.

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8 OUTCOME OF THE REVIEW OF THE DWQMP

A regular review of the DWQMP was conducted between January and March 2014 and incorporated all new information since the submission of the original DWQMP in February 2012. The purpose of the review was to ensure that the DWQMP remains relevant, having regard to the operation of GAWB's drinking water service. The review was lead by:

- Sarah Lunau – Operations & WQ Superintendent; and
- Eric Saffy – Lead Operator,

with input from the Operations Team, Maintenance Team, Land Management Team and O&M Manager during risk assessments.

8.1 Summary of Update

In general, most changes were minor, in terms of updating demand and quality information to reflect the 2012/13 year, and cross checked with other regulatory documents including the SAMP Annual Report and 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. Appendix B provides further detail on the review of the hazard analysis.

The more substantial changes include:

Part 4 Source Water –

- The impact of the 2013 flooding event on the quality of source water discussed;
- All summary data was updated to reflect the latest results; and
- The inclusion of results from the metal bioaccumulation study on GAWB's understanding of source water.

Part 5 Gladstone Supply -

- The addition of the Curtis Island Booster Station, pipelines, reservoirs and chlorine dosing facilities to the information presented;
- Updated information on the new chemical dosing systems including the PAC and polyelectrolyte plant upgrades;
- All summary data updated to reflect 2012/13 results and discussed where appropriate in text;
- For the process hazard analysis, the reductions in residual risk at a number of process steps for hazards related to:
 - BGA metabolites, based on upgrade to PAC system
 - Pathogens, based on demonstrated turbidity of less than 1 NTU on plant 1 clarification process



- Pathogens, based on demonstrated turbidity results of less than 0.1 NTU through filtration, as a result of improvements including soft starts/stops to plant operations and filter inspections
- Chemical contaminant from treatment chemicals, based on Maximum Impurity Concentration Levels in treatment chemical supply contracts
- The addition of Curtis Island infrastructure to risk assessment, which results in nil overall change to network water quality risks;
- The streamlining of target limits for all re-chlorination CCP sites for operational ease; and
- The improvement actions for the Gladstone plant and network were updated to reflect those actions closed out since the last review. No new improvement actions were identified.

Part 6 Yarwun Supply -

- All summary data updated to reflect 2012/13 results and discussed where appropriate in text;
- The inclusion of a summary of the 2013 turbidity event and impact on operations;
- For the process hazard analysis, the addition of newly identified hazardous events including:
 - The impact of increased demand for water on GAWB's ability to take the YWTP off-line to complete maintenance tasks. This has been assigned a residual risk of 8 (Significant) and represents a significant new risk for the YWTP.
 - The impact of the large turbidity event on ability to produce potable water. This has been assigned a residual risk of 6 (Moderate), based on the likelihood of occurrence.
- A new improvement action for YWTP addresses the impact of demand, as described above. GAWB is undertaking a substantial project examining a number of demand and supply options for the Yarwun Scheme. This is a focal project for GAWB.

8.2 Amendments

An amendment application was made to the Regulator to include new information in the following sections:

Section 5.4 – the addition of new infrastructure to the Gladstone Network including Curtis Island Booster Station, pipelines, reservoirs and chlorine dosing facilities.

Section 6.9.2 – a new improvement action for YWTP addresses the impact of demand, as described above.

YWTP Hazard Analysis – Appendix K – Whole of System Processes – 8.1 – the impact of increased demand for water on GAWB's ability to take the YWTP off-line to complete maintenance tasks. This has been assigned a residual risk of 8 and represents a significant new risk for YWTP.

The table below details the amendments to these sections.

Contents	Section Title	Amendments
Section 5.4 Gladstone Distribution		
5.4.1	Drinking Water Mains	Included Curtis Island mains
5.4.2	Drinking Water Reservoirs	Included Curtis Island reservoirs
5.4.3	Drinking Water Pump Stations	Included Curtis Island Pump Station
5.4.4	Supplementary Disinfection Stations	Included Curtis Island Pump Station and Reservoir disinfection stations
Figure 5.4.1	Schematic of Gladstone Distribution	Latest schematic includes addition of Curtis Island network
Table 5.4.2	Summary of drinking water mains, Gladstone distribution	Updated to include Curtis Island pipeline
Table 5.4.3	Summary of drinking water reservoirs, Gladstone distribution	Updated to include Curtis Island Reservoirs and information on water age for Curtis Island
Table 5.4.4	Summary of drinking water pump stations, Gladstone distribution	Updated to include Curtis Island booster pump station to list
Table 5.4.5	Supplementary chlorine disinfection in the Gladstone distribution	Updated to include Curtis Island booster pump station and reservoirs to list
Section 6.9 Yarwun Supply Risk Management Improvement Programme		
6.9.2	Demand /Supply Options for Yarwun Scheme	Current demand on YWTP is a considerable risk in terms of difficulty in taking YWTP offline for major maintenance. This is been addressed by a review of demand and supply options for the Yarwun Scheme. This is a major project for GAWB.
Appendix K Yarwun Supply Risk Assessment		
Whole of system processes 8.1	General Maintenance	Addition of new hazardous event: High demand makes it difficult to take plant offline for major maintenance. The inherent risk is significant 9 and residual risk is 8. This is a significant newly identified risk and GAWB are advanced in examining demand/supply options for the Yarwun scheme

The amendment of GAWB's DWQMP was approved on 28 May 2014, as per information notice received by GAWB from the Regulator.

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.

Deviations from the sampling program proposed in the DWQMP include:

- *E. coli* sampling not undertaken in the week following Christmas due to closure of laboratories.

Consistency of monitoring results over the 2013-14 period with previous years demonstrates a level of surveillance consistent and appropriate with the risks to drinking water quality. Sampling for manganese from the WTP inlets and outlets at both plants has been increased to weekly. This was undertaken to remove the risk to operators from having to handle the cyanide-based reactant used for in-house manganese testing in operational monitoring.

Table A1 - Verification monitoring results

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	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	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	Source Water	cis-Chlordane	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. 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
Awoonga													
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
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	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	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	Source Water	Chlorpyrifos-	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. 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
Awoonga		methyl											
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
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	0.0	0.0	2	ALS
Lake Awoonga	Source Water	Parathion	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	2	ALS
Lake Awoonga	Source Water	Parathion-methyl	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	2	ALS
Lake Awoonga	Source Water	Pirimphos-ethyl	µg/L	Q	4	0	0	0.0	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	46.4	104.0	74.7	96.0	0.1	Internal
Lake Awoonga	Source Water	pH	pH Unit	W	104	104	0	7.3	8.9	7.9	8.3	0.1	Internal
Lake Awoonga	Source Water	Turbidity	NTU	W	104	104	0	0.87	26.3	4.8	22.1	0.1	Internal
Lake Awoonga	Source Water	Hardness	mg/L	W	7	7	0	53.0	76.0	70.4	76.0	1	Internal
Lake Awoonga	Source Water	Total Dissolved Solids	mg/L	M	7	7	0	131	171	155	170	10	ALS
Lake Awoonga	Source Water	Arsenic	mg/L	M	3	2	0	0	0.002	0.001	0.002	0.001	ALS
Lake Awoonga	Source Water	Barium	mg/L	M	3	3	0	0.01	0.02	0.01	0.016	0.001	ALS
Lake	Source Water	Cadmium	mg/L	M	7	0	0	0	0	0	0	0.0001	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
Awoonga													
Lake Awoonga	Source Water	Chromium	mg/L	M	4	0	0	0	0	0	0	0.001	ALS
Lake Awoonga	Source Water	Copper	mg/L	M	4	3	0	0	0.001	0.001	0.001	0.001	ALS
Lake Awoonga	Source Water	Lead	mg/L	M	4	0	0	0	0	0	0	0.001	ALS
Lake Awoonga	Source Water	Mercury	mg/L	M	4	0	0	0	0	0	0	0.0001	ALS
Lake Awoonga	Source Water	Nickel	mg/L	M	4	0	0	0	0	0	0	0.001	ALS
Lake Awoonga	Source Water	Selenium	mg/L	M	4	0	0	0	0	0	0	0.01	ALS
Lake Awoonga	Source Water	Zinc	mg/L	M	4	0	0	0	0	0	0	0.005	ALS
Lake Awoonga	Source Water	Cyanide	mg/L	M	7	0	0	0	0	0	0	0.004	ALS
Lake Awoonga	Source Water	Manganese	mg/L	W	98	97	0	0	0.07	0.02	0.04	0.001	ALS
Lake Awoonga	Source Water	Cyanobacteria	cells/mL	W	98	81	0	0	79800	8563	41180	1	Ecoscope
Lake Awoonga	Source Water	Cylindrospermopsin	µg/L	W	98	73	0	0	36700	5889	26620	0.2	Ecoscope
Lake Awoonga	Source Water	Escherichia coli	MPN/100 mL	W	101	14	0	0	6	0.3	2	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	72	0	0	0	0	0	0	1	ALS
Lake Awoonga	Source Water	Benzo(a)pyrene	µg/L	Q	4	0	0	0	0	0	0	0.5	ALS
GWTP	Treatment Plant	Free Chlorine	mg/L	W	52	52	0	1.17	3.7	2.4	3.2	0.1	Internal
GWTP	Treatment Plant	Dissolved Oxygen	%	W	53	53	0	85.5	112.3	95.1	103.2	0.1	Internal
GWTP	Treatment Plant	pH	pH Unit	W	53	53	0	7.05	7.91	7.45	7.8	0.1	Internal

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	Treatment Plant	Turbidity	NTU	W	53	53	0	0.06	0.22	0.12	0.19	0.1	Internal
GWTP	Treatment Plant	Colour	PCU	M	10	10	0	1.0	8.0	4.8	7.0	1	ALS
GWTP	Treatment Plant	Hardness	mg/L	Q	4	4	0	56	76	69.5	75.7	1	ALS
GWTP	Treatment Plant	Total Dissolved Solids	mg/L	Q	4	4	0	151	179	163	177.6	10	ALS
GWTP	Treatment Plant	Aluminium	mg/L	M	12	12	0	0.01	0.11	0.13	0.08	0.01	ALS
GWTP	Treatment Plant	Arsenic	mg/L	Q	4	1	0	0	0.003	0	0	0.001	ALS
GWTP	Treatment Plant	Barium	mg/L	Q	4	4	0	0.01	0.13	0.04	0.11	0.001	ALS
GWTP	Treatment Plant	Cadmium	mg/L	Q	4	0	0	0	0	0	0	0.0001	ALS
GWTP	Treatment Plant	Chromium	mg/L	Q	4	0	0	0	0	0	0	0.001	ALS
GWTP	Treatment Plant	Copper	mg/L	Q	4	2	0	0	0.003	0	0.003	0.001	ALS
GWTP	Treatment Plant	Lead	mg/L	Q	4	0	0	0	0	0	0	0.001	ALS
GWTP	Treatment Plant	Mercury	mg/L	Q	4	0	0	0	0	0	0	0.0001	ALS
GWTP	Treatment Plant	Nickel	mg/L	Q	4	0	0	0	0	0	0	0.001	ALS
GWTP	Treatment Plant	Selenium	mg/L	Q	4	0	0	0	0	0	0	0.01	ALS
GWTP	Treatment Plant	Zinc	mg/L	Q	4	0	0	0	0	0	0	0.001	ALS
GWTP	Treatment Plant	Cyanide	mg/L	Q	4	0	0	0	0	0	0	0.004	ALS
GWTP	Treatment Plant	Iron	mg/L	M	12	1	0	0	0.003	0	0.002	0.05	ALS
GWTP	Treatment Plant	Manganese	mg/L	M	61	4	0	0	0.02	0	0.001	0.001	ALS
GWTP	Treatment Plant	Trihalomethanes	µg/L	M	12	10	0	0	26	15.3	25.5	5	ALS
GWTP	Treatment Plant	Cyanobacteria	cells/mL	W	51	16	0	0	2520	100	420	1	Ecoscope
GWTP	Treatment Plant	Escherichia coli	MPN/100 mL	W	51	0	0	0	0	0	0	1	Ecoscope

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	Free Chlorine	mg/L	W	621	621	0	0.22	5.4	1.5	2.65	0.10	Internal
GWTP Distribution	Transmission	Dissolved Oxygen	%	W	606	606	0	81.9	110.5	95.4	103.9	0.10	Internal
GWTP Distribution	Transmission	pH	pH Unit	W	620	620	0	7.10	8.48	7.61	8.02	0.10	Internal
GWTP Distribution	Transmission	Turbidity	NTU	W	633	633	0	0.04	0.67	0.14	0.26	0.10	Internal
GWTP Distribution	Transmission	Colour	PCU	M	156	156	0	1.0	12.0	5.2	8.0	1.0	ALS
GWTP Distribution	Transmission	Aluminium	mg/L	M	117	93	0	0	0.42	0.03	0.05	0.01	ALS
GWTP Distribution	Transmission	Arsenic	mg/L	Q	40	0	0	0	0	0	0	0.001	ALS
GWTP Distribution	Transmission	Barium	mg/L	Q	40	40	0	0.01	0.01	0.01	0.01	0.001	ALS
GWTP Distribution	Transmission	Cadmium	mg/L	Q	40	0	0	0	0	0	0	0.0001	ALS
GWTP Distribution	Transmission	Chromium	mg/L	Q	40	4	0	0	0.005	0	0.001	0.001	ALS
GWTP Distribution	Transmission	Copper	mg/L	Q	40	38	0	0	0.04	0.01	0.03	0.001	ALS
GWTP Distribution	Transmission	Lead	mg/L	Q	40	2	0	0	0.001	0	0.001	0.001	ALS
GWTP Distribution	Transmission	Mercury	mg/L	Q	54	0	0	0	0	0	0	0.0001	ALS
GWTP Distribution	Transmission	Nickel	mg/L	Q	14	0	0	0	0	0	0	0.001	ALS
GWTP Distribution	Transmission	Selenium	mg/L	Q	14	0	0	0	0	0	0	0.01	ALS
GWTP Distribution	Transmission	Zinc	mg/L	Q	14	13	0	0	0.01	0.008	0.017	0.001	ALS
GWTP Distribution	Transmission	Iron	mg/L	M	40	30	0	0	0.26	0.01	0.03	0.05	ALS
GWTP Distribution	Transmission	Manganese	mg/L	M	40	7	0	0	0.007	0.015	0.002	0.001	ALS
GWTP Distribution	Transmission	Trihalomethanes	µg/L	M	156	156	0	17.0	134.0	76.3	119.3	5	ALS
GWTP Distribution	Transmission	Escherichia coli	MPN/100 mL	W	633	0	0	0	0	0	0	1	Ecoscope

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
YWTP	Water Treatment	Free Chlorine	mg/L	W	52	52	0	1.31	5.50	2.64	3.8	0.10	Internal
YWTP	Water Treatment	Dissolved Oxygen	%	W	52	52	0	80.9	105.3	96.3	101.6	0.10	Internal
YWTP	Water Treatment	pH	pH Unit	W	52	52	0	7.10	8.21	7.90	7.90	0.10	Internal
YWTP	Water Treatment	Turbidity	NTU	W	52	52	0	0.05	0.76	0.18	0.55	0.10	Internal
YWTP	Water Treatment	Colour	PCU	M	12	12	0	2	7	4.6	6.45	1	ALS
YWTP	Water Treatment	Hardness	mg/L	Q	4	4	0	67	75	70.3	74.6	1	ALS
YWTP	Water Treatment	Total Dissolved Solids	mg/L	Q	4	4	0	159	181	171	180.3	10	ALS
YWTP	Water Treatment	Aluminium	mg/L	M	12	12	0	0.01	0.22	0.09	0.20	0.01	ALS
YWTP	Water Treatment	Arsenic	mg/L	Q	4	0	0	0	0	0	0	0.001	ALS
YWTP	Water Treatment	Barium	mg/L	Q	4	3	0	0.01	0.01	0.01	0.01	0.001	ALS
YWTP	Water Treatment	Cadmium	mg/L	Q	4	0	0	0	0	0	0	0.0001	ALS
YWTP	Water Treatment	Chromium	mg/L	Q	4	0	0	0	0	0	0	0.001	ALS
YWTP	Water Treatment	Copper	mg/L	Q	4	3	0	0.002	0.004	0.003	0.003	0.001	ALS
YWTP	Water Treatment	Lead	mg/L	Q	4	1	0	0	0.002	0	0.002	0.001	ALS
YWTP	Water Treatment	Mercury	mg/L	Q	4	0	0	0	0	0	0	0.0001	ALS
YWTP	Water Treatment	Nickel	mg/L	Q	4	1	0	0	0.001	0	0.001	0.001	ALS
YWTP	Water Treatment	Selenium	mg/L	Q	4	0	0	0	0	0	0	0.01	ALS
YWTP	Water Treatment	Zinc	mg/L	Q	4	2	0	0	0.017	0.005	0.015	0.001	ALS
YWTP	Water Treatment	Cyanide	mg/L	Q	4	0	0	0	0	0	0	0.004	ALS
YWTP	Water Treatment	Iron	mg/L	M	12	3	0	0	0.06	0.01	0.03	0.05	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
YWTP	Water Treatment	Manganese	mg/L	M	52	21	0	0	0.10	0.01	0.06	0.001	ALS
YWTP	Water Treatment	Trihalomethanes	µg/L	M	12	12	0	15	31	23	29.4	5	ALS
YWTP	Water Treatment	Cyanobacteria	cells/mL	W	48	15	0	0	660	67	391	1	Ecoscope
YWTP	Water Treatment	Escherichia coli	MPN/100 mL	W	50	0	0	0	0	0	0	1	Ecoscope
YWTP Distribution	Transmission	Free Chlorine	mg/L	W	307	307	0	0.41	4.60	1.66	2.7	0.1	Internal
YWTP Distribution	Transmission	Dissolved Oxygen	%	W	307	307	0	85.2	110.8	95.9	104.8	0.1	Internal
YWTP Distribution	Transmission	pH	pH Unit	W	307	307	24	7.38	8.71	7.99	8.54	0.1	Internal
YWTP Distribution	Transmission	Turbidity	NTU	W	307	307	0	0.04	0.69	0.18	0.46	0.1	Internal
YWTP Distribution	Transmission	Colour	PCU	M	57	57	0	2	7	4.8	6	1	ALS
YWTP Distribution	Transmission	Aluminium	mg/L	M	57	57	0	0.01	0.17	0.07	0.15	0.01	ALS
YWTP Distribution	Transmission	Arsenic	mg/L	Q	20	0	0	0	0	0	0	0.001	ALS
YWTP Distribution	Transmission	Barium	mg/L	Q	20	20	0	0.01	0.02	0.01	0.01	0.001	ALS
YWTP Distribution	Transmission	Cadmium	mg/L	Q	20	0	0	0	0	0	0	0.0001	ALS
YWTP Distribution	Transmission	Chromium	mg/L	Q	20	2	0	0	0.003	0	0.001	0.001	ALS
YWTP Distribution	Transmission	Copper	mg/L	Q	20	15	0	0	0.006	0.003	0.005	0.001	ALS
YWTP Distribution	Transmission	Lead	mg/L	Q	20	0	0	0	0	0	0	0.001	ALS
YWTP Distribution	Transmission	Mercury	mg/L	Q	20	0	0	0	0	0	0	0.0001	ALS
YWTP Distribution	Transmission	Nickel	mg/L	Q	20	0	0	0	0	0	0	0.001	ALS
YWTP Distribution	Transmission	Selenium	mg/L	Q	20	0	0	0	0	0	0	0.01	ALS
YWTP Distribution	Transmission	Zinc	mg/L	Q	20	1	0	0	0.005	0	0.0005	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
YWTP Distribution	Transmission	Iron	mg/L	M	57	0	0	0	0	0	0	0.05	ALS
YWTP Distribution	Transmission	Manganese	mg/L	M	57	9	0	0	0.003	0.004	0.004	0.001	ALS
YWTP Distribution	Transmission	Trihalomethanes	µg/L	M	57	57	0	34	115	61.9	107	5	ALS
YWTP Distribution	Transmission	Escherichia coli	MPN/100 mL	W	295	295	0	0	0	0	0	1	Ecoscope

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Tables A2 and A3 summarise the monthly results and rolling 12 month compliance with ADWG for all *E. coli* verification monitoring undertaken in the Gladstone and Yarwun systems.

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

Gladstone WTP Distribution 2013/14												
Month	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14
No. Samples collected	53	45	52	70	56	57	53	59	61	71	52	57
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	35	28	27	35	29	22	35	20	28	35	28	28
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

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

Yarwun WTP Distribution 2013/14												
Month	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14
No. Samples collected	35	21	42	28	27	21	28	28	28	32	28	27
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	35	25	22	31	27	21	32	7	24	28	33	26
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

Appendix B - 2014 Review of GAWB DWQMP

Table B1. Register of Changes – Source Water Process Hazard Assessment

SOURCE WATER PROCESSES		Changes	Summary of Changes	Detail
Catchment	S1.1 Cattle feedlot DA - stringent requirements for capturing & treating waste on site	Y	Residual risk rated as Not Applicable at this time	There are no current DA or active feedlots. Assessment team agreed to keep this as an open, dormant risk in case of future DA for feedlots, therefore residual risk rated as Not Applicable at this time
	S1.2 Cattle grazing (approx 60% of catchment ranging from light to medium)	N		
	S1.3 One dairy in mid Boyne River, just downstream of Norton Ck confluence. Note Dairy is located above 40m LA level	Y	No change to risk rating	Change to wording to include milk spills which occurred in 2012 and 2013
	S1.4 Cattle dips, estimated 219 including 4 submerged secure capped. GAWB registers all dips found on GAWB controlled land.	Y	Highest residual risk for accidental spill reduced from low 4 to low 3	Accidental spill consequence downgraded from 4 to 3 due to dilution factor. Uncertainty has improved from 4 to 3 due to data availability demonstrating former point.
	S1.5 Cropping - (E.g. Lucerne)	Y	Highest residual risk for cropping contributing to pathogen risk reduced from low 4 to low 3	Run-off from cropping contributing to pathogen load consequence downgraded from 4 to 3 due to good farming practices, localised impact and distance from main lake body
	S1.6 Mining - Gold & Limestone, Shale oil & coal seam exploration	N		
	S1.7 Builyan Saw Mill (Active)	Y	Highest residual risk for NOM reduced from low 4 to low 2	Likelihood of natural organic matter from mill impacting water quality is rare, this has been reduced from 2 to 1 resulting in downgrade of overall risk rating
	S1.8 Residential townships	N		
	S1.9 Septic tanks	N		

SOURCE WATER PROCESSES		Changes	Summary of Changes	Detail
S1.10	Plantation/ Forestry/ National Park/State Forest Management Practices	Y	Highest residual risk for NOM reduced from mod 6 to mod 5	Consequence of natural organic matter expected to be only localised due to location of forestry- consequence decreased from 3 to 2
S1.11	Feral animals - pigs & brumbies	Y	Highest inherent risk for pathogens reduced from extreme 9 to sig 8; residual risk sig 7	Consequence and L/hood from pathogens downgraded to 4 and 3 respectively. Impact expected to be localised. L/hood for nutrients reduced to 3.
S1.12	Native animals (macropods)	Y	Highest inherent risk for pathogens reduced from extreme 9 to sig 8; residual risk sig 7	Consequence and likelihood from pathogens downgraded to 4 and 3 respectively. Impact expected to be localised. Likelihood for nutrients reduced to 3.
S1.13	Camping/bushwalking/picnicking	Y	Highest inherent risk for pathogens reduced from sig 8 to sig 7; residual risk sig 7	Likelihood for all reduced from 3 to 2 - unlikely to impact WQ beyond localised impact
S1.14	Fishing/Boating	Y	Highest inherent and residual risk reduced from mod 6 to low 3 for spills and accidents respectively	Fuel leaks from spills and accidents likely to be low consequence and data shows rare l/hood. Ratings reduced from 3 to 2 consequence and 3 to 1 l/hood
S1.15	Swimming	Y	Highest inherent and residual risk reduced from sig 8 to sig 7	Consequence of faecal contamination reduced from 5 to 4 - impacts localised. Likelihood remains the same
S1.16	Four-wheel driving	Y	Highest inherent and residual risk reduced from mod 6 to low 4	Turbidity l/hood reduced from 2 to 1 - rare to cause problems; hydrocarbons reduced consequence from 3 to 1 and likelihood 3 to 2 - impacts expected to cause no operational disruption and be localised; chemical likelihood reduced from 3 to 2 - unlikely to impact WQ.
S1.17	Illegal dumping of waste	Y	Highest inherent and residual risk reduced from mod 5 to low 4	Consequence reduced from 2 to 1, dumping has reduced since removal of bins from camping spots.
S1.18	Blue-green algae life cycle	N		
S1.19	Bushfire - low/ high intensity	N		
S1.20	Mixing processes in storage	N		

SOURCE WATER PROCESSES		Changes	Summary of Changes	Detail
	S1.21 Climatic conditions (wind, storms, cyclones, cold snaps)	N		
	S1.22 Inundation of dry land	N		
	S1.23 Water weed control	N		
Storage & abstraction	S2.1 Intake towers - Main and auxiliary intake towers with variable depth	Y	Highest inherent and residual risk for pathogen reduced from extreme 10 to sig 8	Likelihood for short circuiting and circulation processes reduced from 5 to 3 as likelihood is it may occur more than once per year but not more than once per month.
Transmission	S3.1 Transmission of raw water through mains	Y	Highest residual risk for pathogen reduced from sig 8 to sig 7	Residual likelihood for backflow or deliberate pipe break reduced to 1 based on pipe break data and certificate of backflow prevention . Residual likelihood of accidental pipe break in part of network that could impact water for treatment reduced to 2 based on pipe break data
	S3.2 Storage -2 x 50ML Reservoir	N		

Table B2. Register of Changes – GWTP Process Hazard Assessment

GWTP PROCESSES		Changes	Summary of Changes	Detail
Pretreatment	1.1 Powder activated carbon (PAC) dosed intermittently for removal algal toxins, T&O compounds and DOC.	Y	Highest residual risk reduced from mod 6 to mod 5	Reduction in residual I/hood from PAC contact time optimisation study complete and PAC dosing upgrade to increase contact time has resulted in reduction NOM and T/O causing issues, demonstrated in recent data
	1.2 PAC chemical selection/delivery/storage/batching	Y	Highest residual risk reduced from sig 7 to mod 6	Reduction in residual I/hood of incorrect PAC chemical been delivered, used or batched based on several years of data demonstrating correct delivery and batching of correct chemical.
Primary Solids Removal	2.1 Plant 1 Coagulation/ Flocculation with aluminium sulphate and polyelectrolyte	Y	Highest residual risk reduced from sig 8 to sig 7	Reduction in residual I/hood of insufficient contact time for removal of pathogen, BGA, turbidity and NOM based on data consistently demonstrating <1NTU on clarified water. Also changes to uncertainty with more data available from WQ monitoring and CMMS
	2.2 Plant 1 Sedimentation	Y	Highest residual risk reduced from sig 8 to sig 7	Reduction in residual I/hood of insufficient contact time for removal of pathogen, BGA, turbidity and NOM based on data consistently demonstrating <1NTU on clarified water. Also changes to uncertainty with more data available from WQ monitoring and CMMS
	2.3 Plant 1 Clarifier de-sludging	Y	No change to risk rating	Changes to uncertainty from 4 to 3 based on data in CMMS for preventative maintenance cleaning and reactive maintenance
	2.4 Plant 2 Coagulation/ Flocculation	N		
	2.5 Plant 2 Dissolved Air Flotation	N		
	2.6 Aluminium sulphate Selection/Delivery/Storage	N		
	2.7 Polyelectrolyte Selection/Delivery/Storage	N		
	2.8 Maintenance Plant 1	N		
2.9 Maintenance Plant 2	N			

GWTP PROCESSES		Changes	Summary of Changes	Detail
Secondary Solids Removal	3.1 Filtration through dual media of anthracite and sand	Y	No change to highest residual risk rating of sig 7; residual risk reduced from mod 6 to mod 5 for BGA breakthrough	Residual l/hood of mudballs forming reduced from 3 to 2 based on filter inspection and maintenance program tracked in CMMS; reduction in l/hood of hydraulic shock causing shearing through filter from 4 to 3 based on SCADA data, due to soft starts/stops on plant.
	3.2 Filter backwash	Y	Highest residual risk reduced from sig 7 to mod 6	Residual l/hood of broken rosettes/valve jam open reduced from 3 to 2 based on filter inspection and maintenance program tracked in CMMS; Mode 4 (direct filtration) disabled so residual l/hood reduced to 1; BGA breakthrough from hydraulic shock reduced from 4 to 3 based on WQ verification data and soft start/stop on plant
	3.3 Filter Ripening water	Y	Highest residual risk reduced from sig 8 to sig 7	Reduction in residual l/hood from 3 to 2 of filter ripening water causing problems - online filter turbidity data demonstrates consistently short ripening periods; Mode 4 (direct filtration) disabled so residual l/hood reduced to 1;
Disinfection	4.1 Sodium hypochlorite dosing into clear water well	N		
	4.2 Hypo Chemical Selection /Delivery /Storage	Y	No change to highest residual risk rating of mod 6; residual risk reduced from mod 5 to low 4 for chemical contaminants	Reduction in residual l/hood of chemical contaminants from 2 to 1 - MICL and CoAs required in chemical supply contract; chlorates considered rare at primary disinfection
Post Treatment Processes	5.1 pH correction with soda ash	N		
	5.2 Soda Ash Chemical Selection/Delivery/Storage	Y	Highest residual risk reduced from mod 5 to low 4 for chemical contaminants	Reduction in residual l/hood of chemical contaminants from 2 to 1 - MICL and CoAs required in chemical supply contract;
	5.3 Fluoridation	N		
	5.4 Fluoride chemical Selection/Delivery/Storage	Y	Highest residual risk reduced from mod 5 to low 4 for chemical contaminants	Reduction in residual l/hood of chemical contaminants from 2 to 1 - MICL and CoAs required in chemical supply contract;
Distribution	6.1 Distribution of TW through mains	N		

GWTP PROCESSES		Changes	Summary of Changes	Detail
	6.2 Rechlorination - Toolooa PS - start/stop flow signal control system, direct injection into pipeline	N		
	6.3 Rechlorination - Golegumma Reservoir - dose controlled by chlorine analyser feedback in recirculation line from reservoir	Y	Highest residual risk rating reduced from sig 8 to sig 7 for chlorination failure; Residual risk of chlorate production reduced from sig 8 to low 4 based on restocking with fresh hypo each week	Change to l/hood of fault in analyser reduced from 3 to 2 and uncertainty from 4 to 3 based on history of failure in INX and data in CMMS for preventative maintenance cleaning and reactive maintenance
	6.4 Rechlorination - Calliope PS start/stop flow signal control system, direct injection into pipeline	Y		
	6.5 Rechlorination- Curtis Island PS - dose controlled by chlorine analyser feedback in recirculation line from pipeline	Y	New process step	New process step, risk ratings similar to other PS re-chlorination locations
	6.6 Rechlorination- Curtis Island Reservoir - dose controlled by chlorine analyser feedback in recirculation line from reservoir	Y	New process step	New process step. This system is dormant at present. Will be bought online when low flows expected in Curtis Island supply area
	6.7 Delivery to customer - South Gladstone Reservoir outlet	Y	No change to risk rating	Process step number change from 6.5 to 6.7
	6.8 Delivery to bulk customer - GWTP outlet low lift main	Y	No change to risk rating	process step number change from 6.6 to 6.8
	6.9 Delivery to bulk customer - Boyne Island Reservoir outlet	Y	No change to risk rating	Process step number change from 6.7 to 6.9
	6.10 Delivery to bulk customer - Golegumma Reservoir outlet	Y	No change to risk rating	Process step number change from 6.8 to 6.10
	6.11 Delivery to bulk customer - Mt Elizabeth Reservoir inlet	Y	No change to risk rating	Process step number change from 6.9 to 6.11

GWTP PROCESSES		Changes	Summary of Changes	Detail
	6.12 Delivery to bulk customer - Calliope PS outlet	Y	No change to risk rating	Process step number change from 6.10 to 6.12
	6.13 Delivery to domestic customers through mains	Y	No change to risk rating	Process step number change from 6.11 to 6.13. Includes Curtis Island customers now.
Whole System Processes	7.1 General Maintenance	N		
	7.2 Emergency	N		

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Table B3. Register of Changes – YWTP Process Hazard Assessment

YWTP PROCESSES		Changes	Summary of Changes	Other Information
Pretreatment	1.1 Powder activated carbon (PAC) dosed intermittently for removal algal toxins, T&O compounds and DOC.	N		
	1.2 PAC chemical selection/delivery/storage/batching	N		
Recovered Water	2.1 Recovered Water - returned head of plant at 5% of flow	N		
Primary Solids Removal	3.1 Coagulation/ Flocculation with aluminium sulphate and polyelectrolyte	N		
	3.2 Sedimentation	N		
	3.3 Clarifier de-sludging	N		
	3.4 Aluminium sulphate Selection/Delivery/Storage	N		
	3.5 Polyelectrolyte Selection/Delivery/Storage	N		
	3.5 Maintenance	N		
Secondary Solids Removal	4.1 Filtration through mono media of sand	N		
	4.2 Filter backwash	N		
	4.3 Filter Ripening water	N		
Post Treatment Processes	5.1 pH correction with soda ash	N		
	5.2 Soda Ash Chemical Selection/Delivery/Storage	N		
	5.3 Fluoridation	N		
	5.4 Fluoride chemical Selection/Delivery/Storage	N		
Disinfection	6.1 Sodium hypochlorite dosing into clear water	N		
	6.2 Chemical Selection /Delivery /Storage	N		

YWTP PROCESSES		Changes	Summary of Changes	Other Information
Distribution	7.1 Distribution of TW through mains	N		
	7.2 Rechlorination- East End Reservoir - flow-paced with Cl analyser feedback into recirculation line from reservoir	N		GAWB has assigned budget to undertake investigation of alternate disinfection at sites which may have chlorate problems in the future
	7.3 Delivery to customer - Mt Miller Reservoir outlet	N		
	7.4 Delivery to bulk customer - East End Reservoir outlet	N		
	7.5 Delivery to industry customer - various	N		
	7.6 Delivery to customers through mains -	N		
Whole System Processes	8.1 General Maintenance	Y	Addition of new hazardous event: High demand makes it difficult to take plant offline for major maintenance. The inherent risk is significant 9 and residual risk is 8.	This is a significant newly identified risk and GAWB are advanced in examining demand/supply options for the Yarwun scheme
	8.2 Emergency	Y	Addition of High inflow event results in poor water quality. The inherent risk is significant 7 and residual risk is 6.	This was added because of the poor water quality event of 2013 which resulted in declaring the system non-potable for a number of weeks until the process was brought back under control.