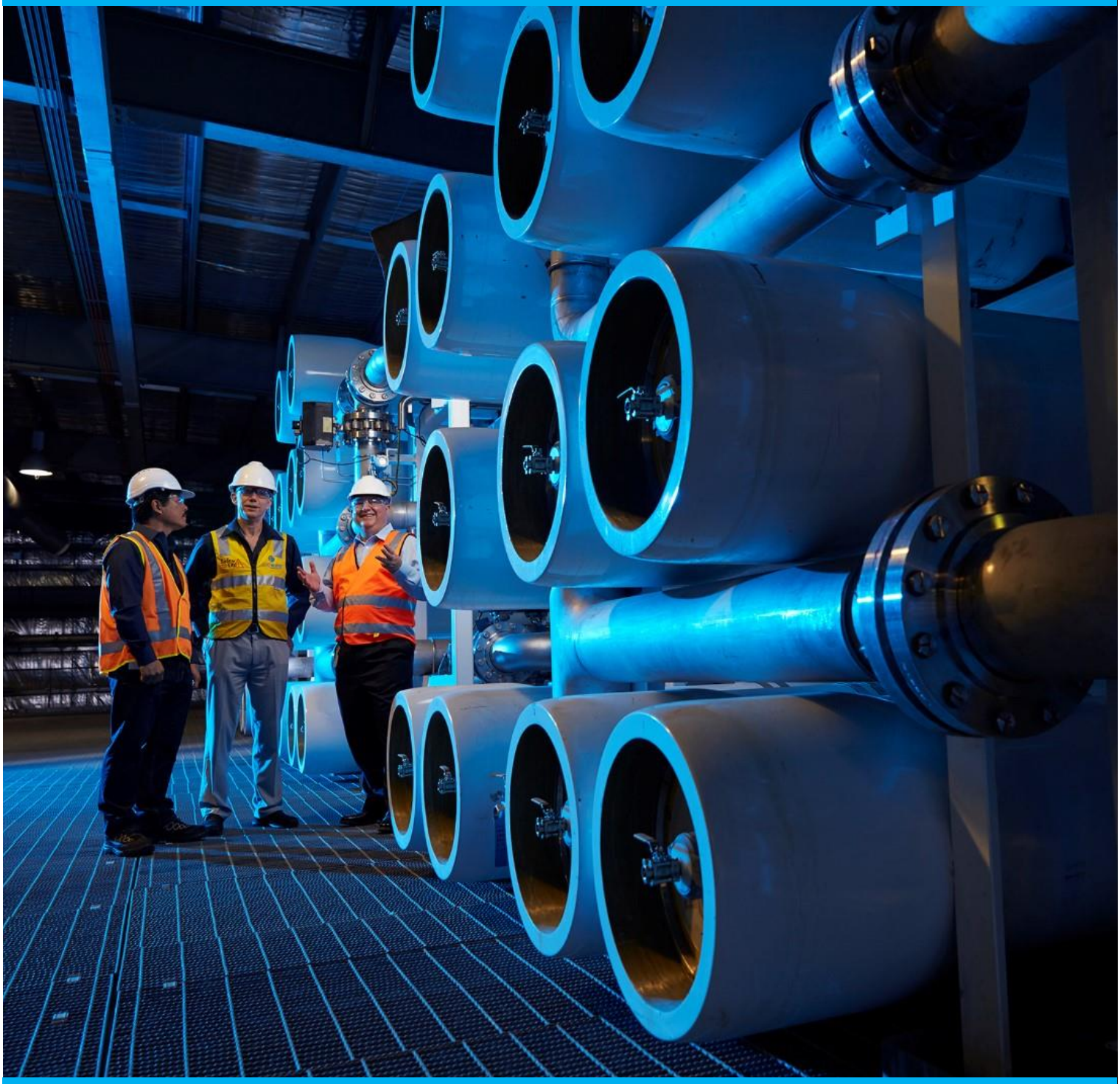
Drinking Water Quality Management Plan
Drinking Water Quality Annual Report 2019-20



Revision 01 | December 2020

seqwater
WATER FOR LIFE

SOURCE STORE SUPPLY

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09 December 2020 | 1:44:01 PM AEST	Matt McCahon	Manager – Technical Support and Improvement.	DocuSigned by: 55B354F5E5094A4...

Contents

Tables

Figures

1 Executive summary

The Queensland Bulk Water Supply Authority trading as Seqwater (SPID 507) is responsible for South East Queensland's bulk water supply arrangements. The bulk water supply system includes: catchments, storages, water treatment plants and bulk distribution along with several small reticulation systems supplying recreation parks.

Seqwater's annual Drinking Water Quality Management Plan Report ('the report") outlines the activities for the management of water quality risk and issues. This report covers the period from 1 July 2019 to 30 June 2020 ("reporting period"), during which Seqwater complied with the approval conditions of its Drinking Water Quality Management Plan (**DWQMP**).

Seqwater's operational and verification monitoring programs have occurred in accordance with the programs documented in the approved DWQMP. Operational monitoring includes online monitoring with process instrumentation and operator testing designed to assess the performance of preventive measures identified for particular hazardous events and to prompt requirements for corrective actions. The verification monitoring involves a sampling and analytical testing program which is predominantly undertaken by an external NATA-accredited laboratory and complemented by Seqwater on-site monitoring and reporting. Verification monitoring undertaken for the reporting period included 28,991 tests of treated water at individual water treatment plants, and 48,278 supply system drinking water tests.

In addition to verification monitoring, Seqwater completed catchment and source water risk characterisation and monitoring activities, including catchment surveys and the use of passive samplers to detect micro-pollutants. These activities aid in identifying changes to the source water risk profile and support Seqwater operations by enabling informed decisions about water security and supply planning.

Water treatment and supply system verification testing against the water quality criteria in the DWQMP detected five individual health-related exceedances - two *E. coli* detections, two chlorate and one high total chlorine. There were also two individual aesthetic exceedances - one turbidity and one acid soluble aluminium. All exceedances were detected within the routine verification monitoring program within the reporting period.

The five health exceedances are explained below:

1. Beaudesert WTP *E. coli:* Positive *E. coli*, 1 MPN/100 mL at Beaudesert Water Treatment Plant (WTP). This was in the presence of high chlorine and no known issues in plant performance.
2. Caloundra Street *WQMP E. coli:* Positive *E. coli,* 2 MPN/100 mL at Caloundra Street Water Quality Management Facility in the presence of high chlorine. Some upstream networks maintenance activities had been undertaken but all work went according to plan and disinfection practices were adhered to. No known issues were identified through follow up operation and laboratory investigation.

   In both cases all analytical indications are indicative of a false positive event due high corresponding disinfectant levels present at the time of sampling.
3. Dayboro WTP Chlorate: A chlorate exceedance associated with water carting. As part of drought response to a standalone community, water was collected from a free chlorinated network for transfer to the community. This water had elevated levels of chlorate present.
4. Wivenhoe WTP Chlorate: A chlorate exceedance at a redosing facility at one of Seqwater's recreation areas. This was due to old sodium hypochlorite that deteriorated due to low usage through COVID-19 lockdowns. When it was brought back online, it had reduced disinfectant strength and increased chlorate concentrations.
5. Heinemann Road WQMF Chlorine: An elevated total chlorine result in the supply system caused by ineffective reservoir mixing.

The two minor aesthetic exceedances are explained below:

1. Tarrant Drive Pump Station Turbidity: An elevated turbidity result in the supply system at Tarrant Drive Pump Station (Robina Mixed Outlet). This was found to be related to the sample point arrangement and were not representative of the actual water quality supplied.
2. North Stradbroke Island WTP Acid Soluble Aluminium: An elevated acid soluble aluminium result at the North Stradbroke Island WTP was found to be related to changes made to the sample point arrangement and was not representative of the actual water quality supplied.

These results indicate the maintenance of consistently low exceedance numbers recently compared with 25-30 exceedances per year during 2012-14. Consistently low numbers of exceedances across a large and complex system reflects the achievements made through the continuous improvement of Seqwater's drinking water assets and drinking water quality management system. All incidents concerning health-related guideline values were reported to the Water Supply Regulator (**WSR or the Regulator**) within the required timeframes. The reported exceedances did not impact Seqwater's compliance with its DWQMP. Seqwater was measured to be compliant during the 2019-20 reporting period for all of its water treatment operations and supply system zones for microbiological, health and aesthetic compliance as per *Public Health Regulation 2018* (Public Health Regulation) definitions and continues to improve its systems and processes to prevent further exceedances.

Other drinking water quality management system improvement activities completed during the reporting period include 26 risk assessment reviews, 25 HACCP team meetings, 28 internal audits of treatment plants and supply system sites, and an external 'regular audit' of the DWQMP. This audit was conducted on behalf of the Department of Natural Resources, Mines and Energy (**DNMRE**) by Water Futures.

These reviews and audits are part of a schedule that covers all of Seqwater's treatment plants and supply system sites. Seqwater has used the findings of these improvement activities to improve its Drinking Water Quality management system and update its DWQMP through an amendment application to the Regulator. The long-term improvement initiatives identified through these assessments and reviews have been captured in a consolidated Drinking Water Quality Improvement Plan.

2 Introduction

This is the 2019-20 annual report for Seqwater, a registered service provider with identification (**SPID**) number SP507. Seqwater is operating under an approved DWQMP to ensure consistent supply of safe, high quality drinking water in order to protect public health. This is achieved through proactive identification and minimisation of public health related risks associated with drinking water.

This DWQMP report includes:

- the activities undertaken over the financial year in operating our drinking water service
- drinking water quality summary
- summary of our performance in implementing our approved DWQMP.

This report is submitted to the WSR to fulfil our regulatory requirement, and is also made available to our customers through our website or for inspection upon request at Seqwater's Head Office.

2.1 Purpose

This annual report has been prepared in accordance with section 142 of the *Water Supply (Safety and Reliability) Act 2008* (Qld) (the Act) (refer to Table 1). The purpose of this annual report is to provide the Regulator with information on the overall performance of the DWQMP for the reporting period 1 July 2019 to 30 June 2020. This report also provides an accountability mechanism to users of the drinking water and to the general public.

Table 1 - Regulated Conditions and Implemented Compliance

DWQMP Report Condition	Seqwater Compliance
Section 142 Drinking water quality management plan reports This section applies for each financial year after a financial year in which a relevant service provider's drinking water quality management plan has been approved. The provider must, unless the provider has a reasonable excuse— • prepare a report (a drinking water quality management plan report) for the financial year complying with this section and, if section 142C(2) applies to the provider, that subsection; and • give the regulator a copy of the report within 120 business days after the financial year ends.	The current report is required to be submitted to the Regulator within 120 business days following the end of the 2019-20 financial year. Accordingly, submission for the current report is due by 17 December 2020. The current report has been prepared in accordance with the approval conditions of the DWQMP and the Regulator's DWQMP report guidance at https://www.business.qld.gov.au/industries/mining-energy-water/water/industry-infrastructure/industry-regulation/drinking-water/annual-report Section 142C(2) is not applicable.
Section 142(3) The report must state or include all of the following—	
• the information required under the latest report requirement given to the provider;	This report provides an update on the implementation of the DWQMP in accordance with the approval conditions of its DWQMP and the above regulatory guidance.

DWQMP Report Condition	Seqwater Compliance
• the actions the provider took to implement the plan;	Refer to Section 3 of this report.
• the outcome of any review of the plan in the financial year and how the provider has addressed matters raised in the review;	Refer to Section 7 of this report. A review of the DWQMP was undertaken in the 2019-20 financial year and further reported on in Section 7.
• if a drinking water quality management plan audit report has been prepared for the financial year—a summary of its findings and any recommendations;	A four-yearly audit was required to be completed during the 2019-20 reporting period. Further information on the audit and its findings is provided in Section 6
• details of any information the provider gave the regulator under sections 102 and 102A in the financial year;	Refer to Section 5 of this report for details of incident/event reporting during the reporting period.
• details of the provider's compliance with water quality criteria for drinking water;	Refer to Sections 3 and 5 of this report. Enclosure 1 provides the 2019-20 Water Quality Data report. This report also includes aesthetic criteria.
• if the provider supplies drinking water to customers— details of any complaints to the provider about the provider's drinking water service.	Seqwater does not supply drinking water directly to customers (as defined under the Act). Consumer complaints are managed by the downstream Water Service Providers (WSPs), with the exception of the small recreation park systems operated by Seqwater where there have been no recorded complaints. Accordingly, complaints are not detailed in this report.

2.2 Plan overview

Seqwater must comply with the DWQMP approved by the Regulator and developed under the Act. The DWQMP forms part of the corporate drinking water quality management system Seqwater has implemented to cover all its drinking water assets and activities that are captured by the Act. The Seqwater water quality management system has been developed to be consistent with the *Drinking Water Quality Management Plan Guideline* (2018) issued under the Act as well as the Framework for the Management of Drinking Water Quality within the *Australian Drinking Water Guidelines* (ADWG, 2011). Accordingly, Seqwater adopts the multi-barrier approach for drinking water quality management.

Seqwater currently has responsibilities across all these barriers, which include:

- Catchments
- Storages and dams
- Water treatment
- Disinfection
- Supply systems

- Distribution systems in recreation areas.

The DWQMP covers the drinking water quality management activities of Seqwater for all drinking water treatment plants and the bulk water supply systems managed by Seqwater. Accordingly, the plan applies to barriers including selective abstraction of the raw water to the management of bulk water supply assets and small distribution networks in Seqwater's recreation areas.

The final barriers in the reticulated distribution system are predominantly managed by downstream WSPs who provide distribution and connections with consumers in all systems except for Seqwater's recreation area systems.

3 Implementation of the DWQMP

Seqwater's amended DWQMP received final approval from the Regulator under Information Notice dated 29 April 2019 (Information Notice). Seqwater's compliance with the conditions in the Information Notice for its approved DWQMP is detailed in Section 3.1 of this report. The DWQMP amendment included:

- the site-based HACCP plan for the new Canungra WTP
- a new site-based HACCP plan for Lake Wivenhoe, included in preparation for potential augmentation of the lake with water from Western Corridor Recycled Water Scheme
- various other minor changes to the DWQMP and associated site-based HACCP plans and procedures.

Additionally, the currency of the DWQMP has been reviewed as detailed in Section 7 of this report.

Amendments to the DWQMP were made in accordance with section 99A of the Act as part of the ongoing continuous improvement of the DWQMP and site-based HACCP plans (sub-plans). The risk assessment reviews completed during the 2019-20 reporting period are detailed in Section 3.2 of this report. Changes to the DWQMP and site-based HACCP plans are detailed in Enclosure 4.

It should be noted that a revised and updated version (11) of Seqwater's DWQMP was submitted to the Regulator on the 11 August 2020, with the regular review being completed on 30 June 2020.

Seqwater maintains an operational monitoring program which supports the multiple-barrier approach to effectively manage drinking water quality as described in Section 3.3. This includes monitoring of key operational parameters by online instrumentation that feed in to Supervisory Control and Data Acquisition (SCADA) systems as well as the operational monitoring performed by Water Treatment Plant operators and in Internal Process Laboratories. The Operator and Process Laboratory monitoring is used to verify the operation of the plant and the accuracy of online instrumentation. There have been no significant revisions to the operational monitoring program during the 2019-20 reporting period. Due to COVID-19 restrictions and associated measures to prevent workplace spread, there was some reduction in the Catchment Water Quality monitoring program.

Seqwater's verification monitoring program covers a wide range of parameters determined using a risk-based approach. These are detailed in the DWQMP. The results of Seqwater's verification monitoring during the 2019-20 reporting period are described in Section 3.4 of this report and a detailed data report in the format prescribed by the Regulator is provided in Enclosure 1. Verification monitoring, including sampling and analysis, was undertaken by an external NATA accredited laboratory and Seqwater on-site field testing. The results are recorded in the Seqwater's Laboratory Information Management System (LIMS). Seqwater reviews the verification monitoring program on a quarterly basis. All raw water, treated water and supply system monitoring was maintained during the reporting period.

Seqwater has continued to improve its drinking water quality management system. Actions in the risk management improvement program, known as the Drinking Water Quality Improvement Plan (DWQIP) were implemented during the 2019-20 reporting period as described in Section 4 of this report. The DWQIP changes during 2019-20 are provided in Enclosure 4 to this report.

3.1 Approval conditions

As outlined above, Seqwater was given final conditional approval of its amended DWQMP on the 29 April 2019 under Information Notice given pursuant to section 99(1)(b) of Act. The approval conditions, and Seqwater's compliance with them, are detailed in Table 2 below.

Table 2 - Conditional Approval and Compliance

Condition	Compliance
No. 1. Water Quality Criteria	
Water quality criteria for drinking water including: The standards for drinking water quality prescribed in a regulation under the Public Health Act 2005 (Qld) (Public Health Act). The criteria in any guideline, if any, made by the Regulator about the quality of drinking water. The criteria for drinking water made in a condition applicable to the DWQMP. For the purpose of (iii), the following applies: All parameters that have health guideline values in the ADWG are deemed to be water quality criteria that apply to this DWQMP. Parameters with only aesthetic guideline values are not considered to be water quality criteria and are not required to be reported. Seqwater is required to implement the verification monitoring program as detailed in the approved DWQMP and report any non-compliance with the water quality criteria for the parameters monitored. Additionally, Seqwater must report any non-compliance with a health guideline value through monitoring or other activity that is not part of this program.	Compliant. Seqwater has reported all non-compliance with relevant criteria including health guideline values in the ADWG and standards in the Public Health Act as identified through its verification monitoring program. A review of the verification monitoring data report (Enclosure 1) found that all such non-compliances were formally reported to the Regulator using the prescribed form. Seqwater has fully implemented its verification monitoring program. Seqwater is not aware of any non-compliance with the health guideline values in the ADWG that could have been identified through other monitoring including research activities.
No. 2. Additional Reporting requirements; (a) events and (b) where a parameter has no water quality criteria	
Additional reporting requirements include: An event including anything that has happened to Seqwater's service which has escalated beyond its ability to control, and Seqwater believes, or is concerned, that public health may be impacted as a result. Where a parameter has no water quality criteria which Seqwater believes cannot be managed under its DWQMP and Seqwater believes, or is concerned, that public health may be impacted. These reporting requirements must be made to the regulator immediately and on the prescribed form within 24 hours.	Compliant. Seqwater has actively reported all events relating to its treatment operations which could have had the potential to impact on public health. Incident reports have included events where there was an increased risk profile. Reporting requirements are compliant.

Condition	Compliance
No. 3. Research projects and additional reporting requirements	
If Seqwater becomes involved in any research activities and becomes aware of a detection that must be reported as: Non-compliance with water quality criteria An event A parameter with no water quality criteria These reporting requirements must be made to the regulator immediately and on the prescribed form within 24 hours.	Seqwater is not aware of any non-compliance with the health guideline values in the ADWG, events that could impact on public health, or detections of parameters without water quality criteria that is identifiable from research activities.
No. 4. Financial outlays	
The State accepts no liability for any financial outlay incurred by you in complying with the drinking water quality management plan and the conditions in this approval	No applicable claims/actions.

3.2 Risk assessment

Seqwater's water treatment operations and supply system were assessed and 26 risk assessment reviews completed during the reporting period. There are 32 water treatment schemes listed in Section 5.1 of the Information Notice for the approved DWQMP including the Gold Coast Desalination Plant and the Supply System. Linville WTP has been commissioned during the report period and has been monitored and reported accordingly.

The findings from the recent risk assessment reviews are consistent with those reported in the previous 2018-19 DWQMP annual report (i.e. the main risks identified did not significantly change, and in most cases, pathogens are the predominant limiting hazard). From these recent reviews, significant risks and improvements were identified to reduce the risk to acceptable levels. Multiple sites have identified opportunities for:

- increased source water and raw water quality information collation to aid in decision-making to optimise source selection of raw water to the WTP
- process assessment and optimisation of coagulant dosing and mixing to optimise flocculation and setting performance
- improved system monitoring and control around filter performance and supernatant management to optimise filter performance and reduce filter breakthrough probability
- improved asset integrity protective measures against animal and stormwater ingress
- improved disinfection, secondary disinfection and network monitoring of disinfectant residuals.

In some cases, the residual (mitigated) risks have been further reduced by capital upgrades to assets as a part of the regular asset management process. Improvements identified through incident management processes including protection from lightning strikes and power interruptions on control systems. Improvements that have been identified through the risk assessment review process include SCADA upgrades, process instrumentation, and interlocks between these instruments and plant operation. These improvements have reduced the risk of non-compliant water leaving WTPs.

The remaining operational WTPs that are yet to have SCADA upgrades have been included in the forward program schedule. Seqwater is continuing to monitor its progress in these areas through its capital works and renewals programs and the implementation of its Monitoring and Control System Asset Class Plan.

Seqwater also reviewed and improved upon the established Pre-requisite Programs (PRPs) and operational Pre-requisite Programs (oPRPs) (Enclosure 4). This approach is consistent with the requirements of AS NZS/ISO22000:2018 Food Safety Management Systems standard to which Seqwater was recently successfully recertified (See Section 6.2 for more details). This occurred outside the 2019-20 reporting period.

3.3 Operational monitoring

3.3.1 Water Treatment Plant operational monitoring

Operational monitoring in water treatment operations includes real-time monitoring through process instrumentation, operator grab sample tests and observations, and analytical laboratory testing undertaken by Seqwater's process laboratories. Operational monitoring programs for each WTP are designed to assess the performance of preventive measures identified for particular hazardous events and to prompt requirements for corrective actions.

Following the recommendations in the ADWG with regards to the reliance on operational monitoring, the site-specific Hazard Analysis and Critical Control Point (HACCP) plans generally specify online monitoring as the Critical Limit monitoring. All potential exceedances are first verified to rule out instrumentation measurement errors, and upon verification are reported to the Drinking Water Quality team within a specified timeframe.

The main preventive measures are well established across all WTPs, with Critical Control Points (CCP) monitored by online instrumentation clearly identified in the process flow diagrams in each site-based HACCP Plan. Where possible, multiple levels of alarms for each online instrument through the SCADA system provide early warning of process control issues and early intervention by Operations staff. Additionally, some alarm set points are interlocked to shut the WTP down before Critical Limits are exceeded.

The HACCP Plan Wall Chart procedures document the Action Limits, Critical Limits and key corrective actions including clear instructions for Operations staff and their supervisors on when the process is to be rated down or shut down as well as reporting requirements. Across Seqwater's treatment operations, the operational monitoring system has worked successfully throughout the year with many improvements implemented (Enclosure 4).

Internal auditing (Section 6) reviews the effectiveness of operational monitoring, alarm set points and the compliance with the CCP procedures. The main preventive measures typical of most WTPs are listed below with an update of the status of the preventive measure and operational monitoring.

Table 3 - Preventive Barriers in Water Treatment

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
Coagulation	Raw water exceeds treatment capability Coagulant dosing failures Low alkalinity Poor pH control Poor or excessive mixing Incorrect dose rates Inadequate coagulation aids	Dose water pH Chemical dosing alarms Observation checks of flocculation and sedimentation	Instrumentation for dosed water pH including alarming is established at all sites using alum as the coagulant and where pH regulation of the dosed water is in place. Additionally, the instrumentation and SCADA upgrade provides settled water turbidity analysers and alarms across all of Seqwater's sites that have a clarification or Dissolved Air Flotation (DAF) process. Operator grab sample monitoring has been compliant with the WTPs HACCP plan which documents operational monitoring.
Filtration	Raw water exceeds treatment capability Coagulation failure Solids carryover Poor backwashing Filtration break-through	Online turbidity for each cell/filter outlet SCADA tools such as head loss, runtime / production For membrane filtration sites - Pressure Decay Test.	Instrumentation is in place for monitoring individual filter filtered water turbidity at all relevant sites. All sites have alarming arrangements that dial-out to the on-call operator's mobile phone. Most sites have interlocks in place to stop operation or activate filter backwash. There is a program of control system upgrades to implement this functionality across all sites where it is achievable. Online instrumentation and Operator grab sample monitoring has been compliant with the WTPs HACCP plan which documents operational monitoring.
Disinfection (by ultraviolet irradiation)	High flows – low contact time Low flows – not enough turbulence to distribute the dose Low UVT – unable to adequately penetrate microorganisms	Online UV intensity and flows UV Dose Ultraviolet Transmittance (UVT).	UV disinfection is typically implemented at sites that require pathogen treatment beyond what is achievable by 'conventional treatment.' This includes Kilcoy, Capalaba, Beaudesert, and Kalbar WTPs. It is also implemented at smaller sites where it forms an efficient primary pathogen treatment process, at Dayboro, Kenilworth and Linville WTPs. UV disinfection has worked effectively at these sites without significant issues/excursions.

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
Disinfection (by chlorination)	Chlorine dosing failures Incorrect dose rates Poor pH control High flows – low contact time Low reservoir levels Contamination to reservoir Filter break-through causing shielding	Online free chlorine after dosing and after contact time Online pH and turbidity after contact time Reservoir levels and flows Chemical dosing alarms	All sites have online instrumentation monitoring free chlorine, pH and flow in the dosed filtered water and treated water. Alarm dial-out to the on-call to mobile phone. At most sites, interlocks are also implemented that stop the WTP process. There is a program of control system upgrades to implement this functionality across all sites where it is achievable. Online instrumentation and operator grab sample monitoring has been compliant with the WTPs HACCP plan which documents operational monitoring.
Fluoridation	Overdosing fluoridation chemical	Online fluoride monitoring pre and post on-site reservoir Operator fluoride monitoring – concentration by lab testing Operator monitoring – daily calculated fluoride dose using product weights and flow meter data. Chemical dosing alarms	The fluoride dosing monitoring arrangements are fully established and documented. Operator testing and checks of the online monitoring system are performed at least daily. Queensland Health periodically audit fluoridation of the water supply at all Seqwater sites with fluoridation systems.
Reticulation (recreation sites)	Ingress or infiltration Corrosion and deterioration of assets	Observation Chlorine residual monitoring Demand monitoring (plant operation hours and reservoir levels) Vermin proofing inspections on reservoirs.	Reticulation systems have been monitored by on-site staff to ensure there is no ingress from vermin or through loss of positive pressure. This is scheduled through preventive maintenance work orders. If leaks occur, they would be detected by these inspections and the draw on the plant's capacity. Chlorine testing on recreation park taps is undertaken and backed up by verification monitoring at the same sample sites.

3.3.2 Supply System operational monitoring

Operational monitoring in the DWQMP includes the planned sequence of measurements and observations to assess and confirm the performance of preventive measures identified for particular hazardous events. Measurements are of operational parameters that will indicate whether processes are functioning effectively. As part of the ADWG Framework, AS NZS/ISO22000 Food Safety Management Systems standard and HACCP standards, these operational measures have been identified and summarised within the supply system DWQMP as CCPs and operational Pre-requisite Programs.

The preventive measures are well established within Seqwater, with CCPs monitored by online instrumentation throughout the supply system. Supply system operation centre staff can react to the supply system exceedances when notified through the SCADA system. Alarming is programmed into the SCADA system at three different incident levels, each defining the severity of the exceedance. Each incident level has a documented contingency and escalation procedure for staff to follow.

Internal auditing and compliance spot-checks monitor the operational Pre-requisite Programs. The principal preventive measures are listed in Table 4. The most common limiting hazard that has been identified is pathogens. Unacceptable risks requiring further treatment are listed in the improvement plan (Section 4) of this report.

Table 4 - Preventive Measures in the Supply System

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
Water Quality considerations as part of the Monthly Operating Supply Schedule (MOSS) & routine meetings with WSPs (Regional Operational Managers Meeting)	Non-compliant water supplied to the Supply System by Bulk Water Suppliers Deterioration of water quality in service reservoirs due to variable water ages	This is issued monthly to the Drinking Water Quality team for review and to provide feedback on any foreseen issues arising from different source waters.	This formalised process continues as the Monthly Operating Supply Schedule (MOSS) at Seqwater. Water quality issues are raised if there are concerns of any localised issues and the MOSS amended accordingly. E.g. Mt Crosby MIB & Geosmin issues.

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
Maintain disinfection residual	Non-potable water or organic matter entering service reservoir or pipeline Contamination to reservoirs by access by third party Contamination to reservoir by vermin entry	Chlorine, pH and temperature parameters are measured online at all Key Interface Points which is representative to each water zone. These signals are transferred and alarmed at the 24/7 operations centre. Operations centre escalation and corrective action procedures are audited routinely. Training is delivered for new operations centre staff.	Established SCADA systems and critical limit alarm levels notify the operations centre of low chlorine residual. Escalation procedures covering different severities of alarms are well established and are followed by operations centre staff. Corrective actions are documented in a procedure and are followed by operations centre staff and supply system operations management. A documented procedure on maintaining chlorine residual is used by operational staff. In addition to the above, as part of the Regional Disinfection Optimisation Program, Seqwater, in conjunction with three of its WSPs (Urban Utilities, Unitywater and Logan City Council) undertook a three-month increased chloramine dosing trial. The aim was to increase secondary disinfection residuals in the WSPs network over summer, when traditionally chloramine decay is elevated and residuals at the customers tap drop off. This is an interim measure until pH correction is implemented to increase chloramine stability. More information can be found in Enclosure 4.
Service Reservoir Inspection Program	Ingress of non-potable water to reservoirs	Service reservoir inspections are carried out monthly using a checklist and photo evidence process. These records are audited routinely to identify any deficiencies. These inspections are	This process and water quality focused culture is now well established within the business. Any issues identified are raised and corrected through the work order system.

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
	Vermin entry to reservoir Corrosion and deterioration of assets	supplemented by annual external inspections using Unmanned Aerial Vehicles (UAV), and three-yearly internal inspections using submersible Remote Operated Vehicles (ROV) combined with specialist software to inspect and track deterioration.	
Mains Hygiene Procedure	Stagnation of reservoirs and pipelines Commissioning new assets and pipelines Maintenance and operational changes to the supply system	This procedure provides the formal process to prevent contamination of pipelines and reservoirs during maintenance activities. It also covers disinfection of assets prior to returning to service. On-site compliance checks are routinely carried out to identify any deficiencies.	This process and water quality focused culture is now well established within the business. Training is delivered during the induction of new field staff. This process is now 'business as usual.'
Locked and alarmed hatches on reservoirs	Contamination to reservoirs by access of third party	All reservoirs hatches are locked, and alarm systems notify the 24/7 operations centre of any unauthorised access to reservoirs. Closed Circuit TV cameras are also in place at some reservoir sites. Security guards routinely patrol the reservoir sites.	The alarming of reservoirs is tested routinely with operations centre staff well versed in the procedures if a security breach occurs. Access to these reservoirs is managed by works access and permit to work procedures.
Maintaining Positive Pressure	Ingress of non-potable water or organic matter to pipelines	Pressure and flow are monitored online at locations throughout the supply system. These are alarmed and notify the 24/7 operations centre of any low-pressure situations.	The operations centre staff are well versed in the procedures to follow in the case that low pressure occurs within the supply system. Planned and unplanned pipeline isolations are managed by the Disinfection of Water Mains Procedure.

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
Optimisation of re-chlorination through automated control systems Maintain or treat to lower DOC/Bromide Levels	Formation of disinfection by-products	All chemical dosing facilities are comprehensively equipped with system redundancies including dual online instruments, UPS, multiple chemical dosing pumps, back-up telemetries with multi-barrier alarming to the 24/7 operations centre.	Control systems are well established and now have proven historical track records. The operations centre has comprehensive documentation to assist in the control of these systems and are well versed in the procedures to operate these stations efficiently and effectively.
Pigging or super-chlorination of pipelines	High flow or changes in flow rate or direction in pipelines	Turbidity and conductivity parameters are measured online at all Key Interface Points.	Routine cleaning programs for reservoirs are in place. However, the existing pipelines do not have a pigging program at this point in time. Biofilm testing has proven biofilms are in low volume and pathogens have not been detected in the samples measured. High flows and direction changes are managed by the control systems and operating manuals by the operations centre.

3.4 Verification monitoring

The results of Seqwater's verification monitoring during the 2019-20 reporting period are summarised below. The detailed data report at Enclosure 1 is in the format prescribed by the Regulator. This program includes:

- the Scheme component (e.g. reticulation, source water)
- parameter
- unit of measure
- total number of samples collected (number of analyses)
- number of samples that did not meet the water quality criteria
- minimum concentration or count
- maximum concentration or count
- average (arithmetic mean) concentration or count.

For all parameters tested more than once a year, the frequency of sampling has been distributed evenly throughout the year (weekly, monthly, quarterly, or 6-monthly).

3.4.1 Analysis of Micro-pollutants using Passive Samplers

The sampling and analysis of micro-pollutants using a passive sampler methodology began in July 2014 for sites in the catchments where the sampling devices could be deployed. The micro-pollutants analysed included pesticides, pharmaceuticals and personal care products.

The passive sampler reports for sampling conducted during the 2019-20 reporting period are provided at Enclosure 2a and 2b. There were no exceedances of the ADWG values for these chemicals observed during the 2019-20 reporting period using passive sampling methodologies. Some parameters have been detected at trace levels, but this has generally been two orders of magnitude below the guideline values.

3.4.2 Compliance with DWQMP and Key Performance Indicators

Drinking Water Quality compliance is measured across supply zones using the methods recommended by the ADWG and the Public Health Regulation. A supply zone is defined as a WTP and if relevant, the connected downstream components of the supply system. For corporate Key Performance Indicator (KPI) reporting, the water quality results from routine monitoring in each supply zone are assessed over a 12-month period against the water quality criteria, with the final report being issued in June each year. The methods are briefly described below:

3.4.2.1 Microbiological compliance

A supply zone is compliant if at least 98% of routinely monitored samples do not exceed the water quality criteria, namely *E. coli* (as per Public Health Regulation).

3.4.2.2 Health related compliance

For parameters sampled eight or more times during the year, the 95th percentile result of each health-related parameter is used for assessment against the water quality criteria. For parameters sampled less than eight times per year, the maximum result is used for assessment against the water quality criteria. If the 95th percentile (or maximum if sampled less than eight times) value is greater than the water quality criteria, then the whole zone is deemed non-compliant.

3.4.2.3 Aesthetic compliance

The average of each parameter is assessed against the water quality criteria only if there are impacts to downstream users. If any value is greater than the water quality criteria, then the whole zone is deemed non-compliant.

Seqwater was measured to be compliant during the 2019-20 reporting period for all of its water treatment operations and supply system zones for microbiological, health and aesthetic compliance.

3.4.3 Water Treatment Plant verification monitoring

Verification monitoring occurred in accordance with the Seqwater Water Quality Verification Monitoring Plan. This was undertaken by the NATA accredited (ISO17025) contracted Laboratory Service Provider at Seqwater's raw water, treated water and recreation park distribution system sample points, covering more than 70 different parameters at various frequencies. The verification program provides the necessary information to validate that the preventive approach to water quality management is effective.

A summary table of verification monitoring of the treated or supply system (bulk) water from 1 July 2019 to 30 June 2020 is provided in Table 5. The statistics from the verification monitoring results for all parameters for both source (raw water) and treated water at each operational site is provided within Enclosure 1. Please note recreational plants will include reticulated monitoring in WTP test count.

Table 5 - WTP Verification Monitoring Summary

Name of scheme component	Number of Analyses Performed	Number of Individual ADWG Health Exceedances	Number of Individual ADWG Aesthetic Exceedances
Amity Point WTP	659	0	0
Beaudesert WTP	786	1	0
Banksia Beach WTP	0	0	0
Boonah-Kalbar WTP	809	0	0
Canungra WTP	882	0	0
Capalaba WTP	791	0	0
Dayboro WTP	679	0*	0
Dunwich WTP	661	0	0
Esk WTP	774	0	0
Ewen Maddock WTP	783	0	0
Hinze Dam WTP	1172	0	0
Image Flat WTP	1622	0	0
Jimna WTP	741	0	0
Kenilworth WTP	621	0	0
Kilcoy WTP	779	0	0
Kirkleagh WTP	1099	0	0
Kooralbyn WTP	812	0	0
Landers Shute WTP	792	0	0
Linville WTP	592	0	0

Name of scheme component	Number of Analyses Performed	Number of Individual ADWG Health Exceedances	Number of Individual ADWG Aesthetic Exceedances
Lowood WTP	766	0	0
Maroon Dam WTP	1003	0	0
Molendinar WTP	767	0	0
Moogerah Dam WTP	1013	0	0
Mt Crosby WTP	1647	0	0
Mudgeeraba WTP	783	0	0
Noosa WTP	1434	0	0
North Pine WTP	971	0	0
North Stradbroke Island WTP	773	0	1
Point Lookout WTP	661	0	0
Rathdowney WTP	763	0	0
Somerset Dam WTP	813	0	0
Tugun Desalination Plant	1147	0	0
Wivenhoe Dam WTP	1396	0*	0
Total	28991	1	1

Notes:

* Both Dayboro and Wivenhoe WTP had exceedances of the Water Quality Criteria for chlorate specified in the DWQMP. The ADWG does not include a guideline value for chlorate and the value set in the DWQMP is based on the World Health Organisation Guideline for Drinking-water Quality. These exceedances are not included in the table above but are discussed below.

3.4.4 Analysis of the Water Treatment Plant verification monitoring data

Through an assessment of the water quality data from the verification program, it was found WTPs were compliant against the ADWG health guideline values for drinking water, with only one health exceedance recorded for individual WTPs during the reporting period. This exemplifies the continued improvement Seqwater has shown in driving excellence in our drinking water quality. There were two drinking water quality events where chlorate levels exceeded the 0.8 mg/L limit specified in the DWQMP but are not reported above as there are no current ADWG limits for chlorate. More information on these events is discussed in Section 5.

Overall, the count of ADWG health-related exceedances over the past few years has remained at a relatively constant low, which is a considerable achievement given the number of diverse schemes and systems. The count of aesthetic exceedances has on average been decreasing with this reporting period being the lowest on record (1) (Figures 1 & 2). The continued improvement is evident in the simple linear trend of total exceedances.

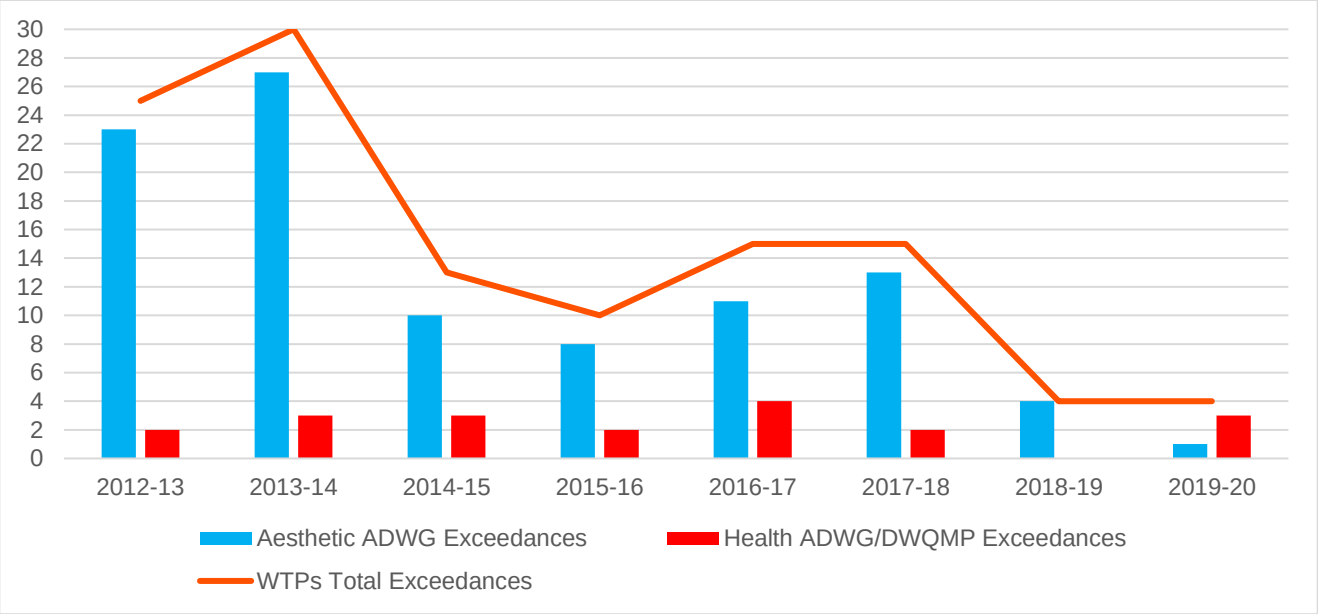

Figure 1 – WTP exceedances over different reporting periods.

Beaudesert WTP E. coli: Routine verification testing undertaken on the Beaudesert verification water quality sample tap on the 18 March, 2020 returned a positive result of 1 MPN/100 mL. Complementary verification monitoring results indicated there was 3.0 mg/L of Free Chlorine, pH of 7.2 and online turbidity of 0.05 NTU. There were no other exceedances in the preceding 12-month period. Investigation and follow up sampling at the plant and in the Urban Utilities network did not find any further positive E. coli results and no further explanation of the result could be determined. More details can be found in Section 5.

Dayboro WTP Chlorate: Routine verification testing undertaken on the Dayboro verification water quality sample tap on 17 February 2020 returned a chlorate level of 1.21 mg/L, above the DWQMP specified limit of 0.8 mg/L. At the time, water was supplied to Dayboro WTP through water carting from the Unitywater network at Samford Valley due to low source water levels in the North Pine River wells at Dayboro. Testing by Unitywater of the Samford Valley reticulated network revealed chlorate of 1.27 mg/L. This supported the investigation assessment that the chlorate was introduced by the water carting process to the Dayboro WTP. More details can be found in Section 5.

Wivenhoe WTP Chlorate: Due to COVID-19 restrictions, the water supply scheme at Lake Wivenhoe and Lumley Hill which supplies several camp grounds was shut down for several weeks, with negligible demand and high water age. Chlorine residuals are maintained using a re-chlorination facility at Lumley Hill reservoir. The high chlorate level (0.87 mg/L) was detected on 19 May 2020 during routine verification monitoring from a sample collected on the 13May 2020. Old Sodium Hypochlorite solution at both the Wivenhoe WTP and the Lumley Hill reservoir re-chlorination facility was replaced, the network was flushed and the issue was quickly resolved.

North Stradbroke Island WTP Acid Soluble Aluminium: On the 28 May 2020 at the North Stradbroke Island WTP, the verification monitoring program returned an Acid Soluble Aluminium result of 0.27 mg/L above the ADWG aesthetic guidelines. The cause of this exceedance is associated with the relocation of the sample tap and a change from continuous flow to running the sample tap only when sampling is required. It appears flushing times and velocity on the new tap were not sufficient to wash out stagnant water and resulted in an unrepresentative water sample. This tap has now been relocated to avoid future issues.

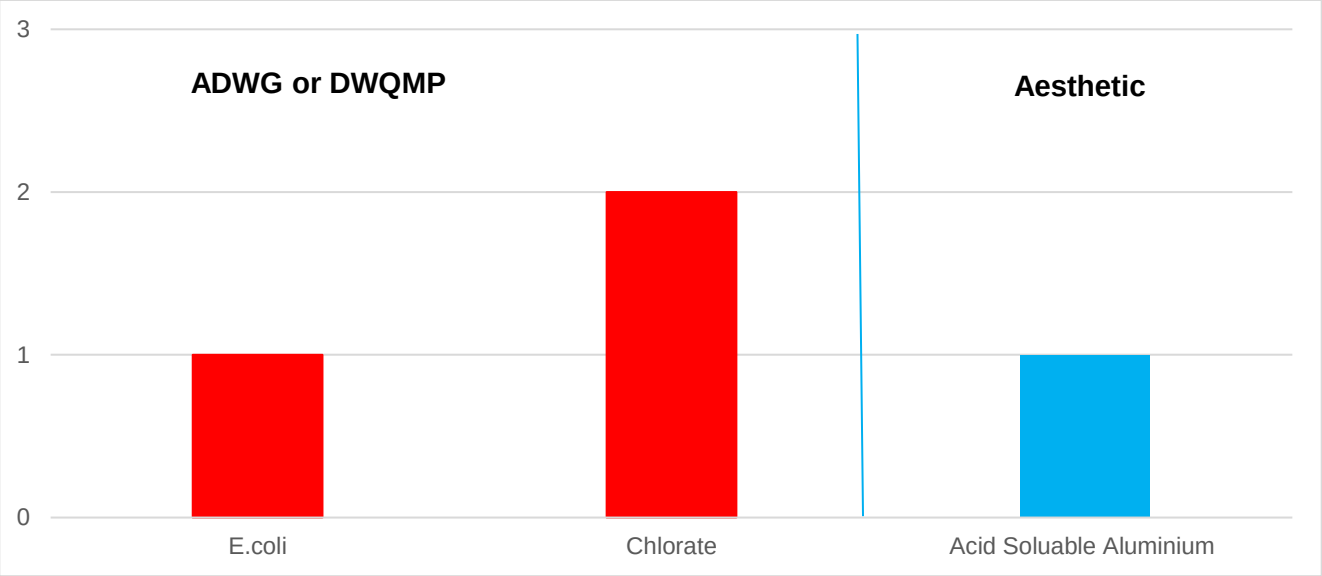

Figure 2 - WTP Exceedances by Parameter for this reporting period.

Seqwater continues to seek and implement improvements for its treatment processes and preventive measures. With regards to continually improving water quality (for example, in accordance with Element 12 of the Framework for Management of Drinking Water Quality), these exceedances are considered in risk assessments and subsequent risk assessment reviews. Where a mitigated risk has been determined to be inadequate, even for aesthetic parameters, an improvement action is recorded in the DWQIP. Subsequent development ensures those improvement actions are addressed appropriately. This currently includes treatment plant upgrades, improved instrumentation, and early intervention by operations staff through changes in process control and improvements in the third-party NATA laboratory performance.

3.4.5 Supply System verification monitoring

Verification monitoring occurred in accordance with the Supply System Water Quality Monitoring Plan. The monitoring plan has been improved over the past five years to adopt a risk-based approach and improve efficiency. Accordingly, the number of analyses for the supply system was reduced from 52,257 tests during 2013-14 to 39,577 tests during 2014-15 but has since been maintained at this level with 43,030 tests during 2017-18, 44,163 tests during 2018-19 and 48,278 tests during 2019-20.

Sampling and on-site field tests were undertaken by Seqwater's field services team and laboratory testing was undertaken by a contracted NATA accredited laboratory service provider. This covered more than 30 different parameters with weekly and monthly routines scheduled in eight different zones. The verification program provides the necessary information to validate the preventative approach to water quality management is working effectively.

The Supply System has been assessed as compliant for all eight zones for microbiological, health and aesthetic compliance. Whilst water quality compliance has been achieved based on the assessment of long-term trends over a 12-month period, some individual exceedances did occur within the Supply System during the 2019-20 reporting period and these are shown in

Table 6.

Table 6 - Supply system verification monitoring summary.

Name of scheme component	Number of Analyses Performed	Number of Individual ADWG Health Exceedances	Number of Individual ADWG Aesthetic Exceedances
Brisbane	16314	0	0
Eastern Pipeline Interconnector (EPI)	2095	0	0
Gold Coast	1420	0	0
Logan	3180	0	0
Network Integration Pipeline (NIP)	2178	0	1
Northern Pipeline Interconnector (NPI)	8737	1	0
Redland	5151	1	0
Southern Regional Pipeline (SRP)	9203	0	0
Total	48278	2	1

3.4.6 Analysis of the Supply System verification monitoring data

There were two ADWG health exceedance and one aesthetic guideline exceedances for the Supply System during 2019-20 reporting period consistent with the low numbers of exceedances for each category in the previous two years. The chart below shows an initial reduction and maintenance of low numbers of exceedances since the 2013-14 reporting period (Figures 3 &4). Although the initial drop may be attributed to the reduction in monitoring when a risk-based approach was adopted, the overall trend supports the continued successful operation of the Supply System to provide safe and high quality drinking water.

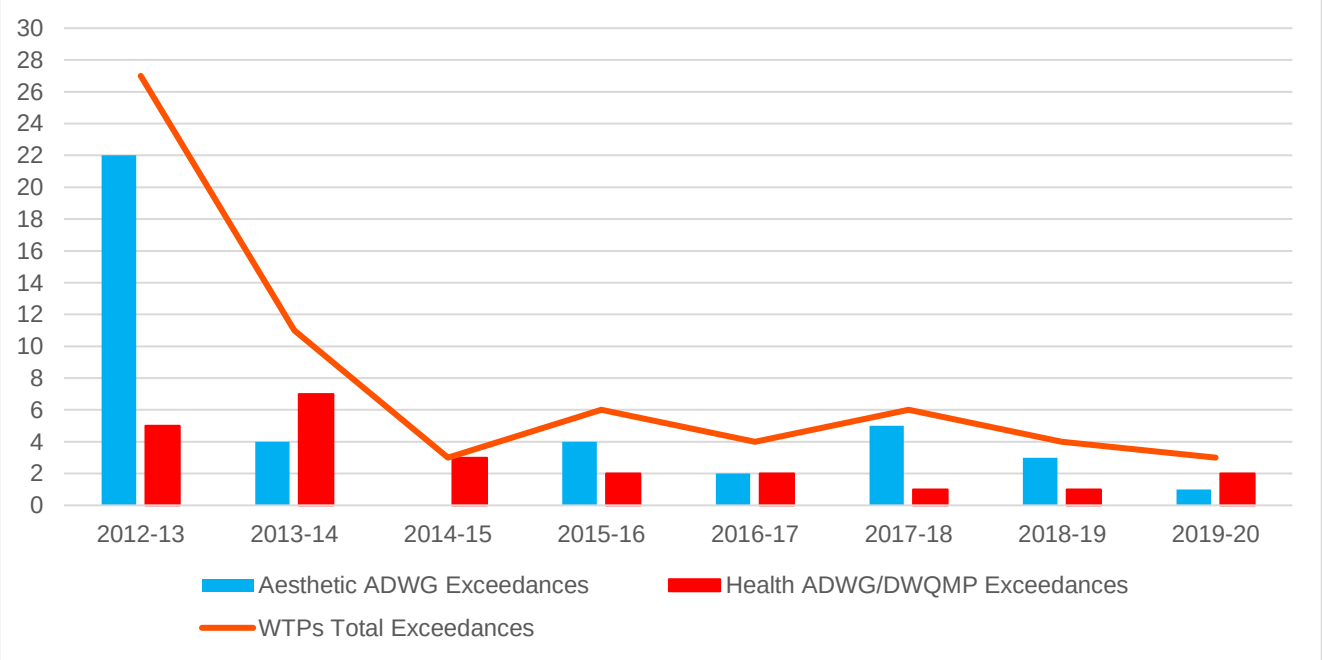

Figure 3 - Supply System exceedances over different reporting periods.

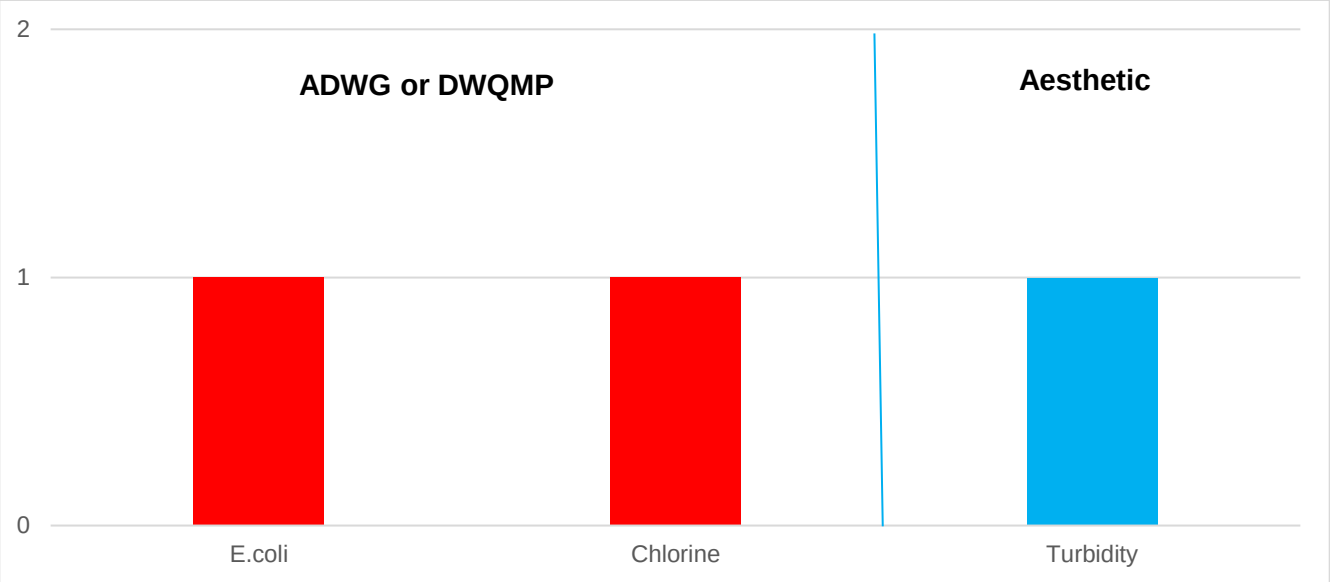

Figure 4 - Supply System exceedances by parameter for this reporting period.

The health guideline exceedances due to routine verification monitoring included one *E. coli* detection and one high chlorine result.

Caloundra Street WQMF *E. coli:* During routine verification monitoring on the 14 November 2019, a positive *E. coli* result of 2 MPN/100mL was returned. Review of upstream and downstream water quality and network activities revealed maintenance work had been undertaken upstream but was conducted as per the disinfection procedures and all sampling was inside specification. The source or cause of the issue could not be further determined. All analytical indications are indicative of a false positive event due high corresponding disinfectant levels present at the time of sampling.

Heinemann Road WQMF Chlorine: During routine verification monitoring at Heinemann Road Reservoirs 2 & 3 Common Outlet, a Total Chlorine dose of 6.5 mg/L was detected. Following investigation, it was discovered the online instrumentation placement and mixing in the reservoir both contributed to the chlorine overdose. Mixers have been installed to better distribute dosed chloraminated waters and monitoring systems are included for upgrade in the improvement plan.

Tarrant Drive Pump Station Turbidity: During routine verification monitoring at Tarrant Drive Pump Station, a Turbidity of 6.1 mg/L was detected. This was found to be due to sub-optimal sample point configuration resulting in sampled water not representative of the water quality in the pipe. When water in the pipe was assessed against SCADA, it was trending well below ADWG aesthetic value.

The minimal number of health and aesthetic exceedances across the Supply System is supported by good operating practice and improved source water conditions.

4 Improvement plan

Improvements continue in accordance with the DWQIP.

The progress made during the 2019-20 reporting period to reduce health related risks and improve reliability in providing safe drinking water supplies is tabled in Enclosure 3 of this report.

Any improvements which are yet to be implemented are reassessed and prioritised through the internal audit and risk assessment review schedule.

The changes to the DWQMP identified in risk assessment reviews, HACCP team meetings and the investigation of incidents, reflect the significant amount of progress Seqwater has made in improving its drinking water quality management system.

The details of these changes are provided in the register of changes to DWQMP, HACCP plans and procedures at Enclosure 4. A summary of significant water quality improvement deliverables in the 2019-20 reporting year are listed below.

Whole of Business:

- Review of management system against ISO 22000:2018 in preparation for certification audit (Recertification was achieved however the audit occurred outside the reporting year)
- Implementation of HACCP certified pest management program
- Improved and renegotiated water quality reporting to Unitywater under the Bulk Water Supply Agreement, in further negotiations with other WSPs to roll out similar reporting
- Under the Partnership Water Quality Management Plan between Seqwater and its WSPs we ran a three-month Increased Chloramine Dosing Trial from December 2019 to February 2020 to assess whether this could assist in improved secondary disinfection residuals within the central chloraminated zone during the summer period when decay rates increase
- Drinking water treatment chemical management systems have matured significantly with updated and robust chemical contracts (including enhanced chemical specifications) implemented for 95%, by quantity, of all chemicals used by Seqwater
- Seqwater operations and support staff adapted quickly to operating efficiently and effectively in a Covid-19 environment
- Water Hygiene and Materials training continues to be delivered to Seqwater staff and our contractors.

Northern Region:

- A new WTP was commissioned at Linville using source water from the adjacent riverine borefield
- Kilcoy WTP changed its UV disinfectant configuration from UV in series to parallel duty/standby UV improving redundancy and operability
- Dayboro WTP had some important riverbank stabilisation work undertaken to protect and maintain the function of the river bank borefield
- Image Flat WTP Clarifier Number 3 was refurbished and soda ash and lime systems upgraded to further improve treatment of difficult source waters
- Ewen Maddock Potassium Permanganate dosing unit was moved closer to raw water to increase chemical reaction time
- Kenilworth WTP free chlorine dosing system improved reliability program was completed

- Noosa WTP had reliability improvements to the raw water pumps at the Mary River offtake as well as BAC biology investigated to identify improved monitoring technique for effective operation
- Landers Shute WTP had its sedimentation basins re-lined.

Central Region:

- East Bank WTP had Stage 1 Filters upgraded, with work now commencing on half of the Stage 2 filters. This program replaced the media and increased dual media filter depth
- ChemScan water quality analysers capable of more accurate chlorine and ammonia speciation were commissioned at Holts Hill, Chambers Flat and Caloundra St Water Quality Management Facilities
- Cameron's Hill No. 2 Reservoir side screen vermin proofing issues corrected
- Duplicate free chlorine analysers now in operation on the outlets of the Cameron's Hill Reservoirs
- Higher purity polyacrylamide implemented at the Mt Crosby WTPs resulting in a reduction in the risk posed by acrylamide monomer in the treated water
- Lowood WTP coagulated water pH meter relocated to improve reliability for monitoring of this CCP. A supernatant return turbidity meter was also installed and commissioned
- New powdered activated carbon dosing trailer located at the Esk WTP enabling treatment of taste and odour when it occurs
- Upgraded SCADA system implemented at Lowood WTP allowing improved alarm and interlock arrangements
- Aspley WQMF commissioned and operational
- Alexandra Hills Reservoirs 1, 2, and 3 roof replacements completed improving vermin control
- Heinemann Road Reservoirs 2 and 3 mixer replacement, improving chlorine residual
- Supply System HACCP Risk Assessment reviewed to provide greater granularity of hazardous events and their preventive measures and risk
- Roof replacement at Sparkes Hill No. 2 Reservoir.

Southern Region:

- Kooralbyn WTP mobile PAC dosing trailer integrated into the treatment train, new reservoir roof installation as well as improvements to online monitoring, new filter roof and roof hatches installed to prevent contaminant or vermin ingress
- Rathdowney WTP coagulant dosing interlock improvement to detect loss of coagulant and interlock WTP
- Maroon Dam WTP upgraded reticulation network installed to better manage water age and disinfectant residual decay
- Moogerah Dam WTP upgraded reticulation network installed to better manage water age and disinfectant residual decay
- Mudgeeraba WTP new filter outlet covers fitted to prevent vermin ingress or other contamination of filtered water
- Molendinar WTP new pest and breather screens and access hatches installed to the chlorine contact tank to prevent vermin ingress to the treated water. Improved valving and interlocks for the chlorine contract tank were also installed further reducing the risk of out-of-specification water leaving site

- North Stradbroke Island WTP improved supernatant and treated water chlorine contact time (CCT) monitoring, interlocks installed for all HACCP critical limits, along with improved filter walkway access to prevent wildlife faecal matter prevalent on ground around site falling into filters from walkway
- Dunwich WTP operational changes to HACCP targets and limits to meet minimum CCT requirements.

5 Drinking water quality incidents

The following section summarises information given to the Regulator detailing:

- Non-compliances with the water quality criteria for drinking water, and the corrective and preventive actions undertaken in response to the non-compliance.
- Prescribed incidents reported during the year include what corrective and preventive actions have been undertaken.
- Comments on the effectiveness of any preventive/control measures.

A summary of incidents at Seqwater's treatment operations and Supply System reportable to the Regulator are shown in the Table 7. All incidents were reported within the required timeframes.

Table 7 - A summary of incidents at Seqwater's treatment operations and Supply System

Incident Number	Name of scheme component	Date Reported	Description of the Event/Incident	Improvements
DWI-507-19-07958	Bulk Water Supply Transmission	09/07/2019	Heinemann Road WQMF Chlorine: During routine verification monitoring at Heinemann Road Reservoirs 2 & 3 Common Outlet, a Total Chlorine dose of 6.5 mg/L was detected. Following an investigation, it was discovered the online instrumentation placement and mixing in the reservoir both contributed to the chlorine overdose.	Mixers have been installed to better distribute dosed chloraminated waters and monitoring systems have been requested to be upgraded.
DWI-507-19-07971	Mt Crosby	07/08/2019	Mt Crosby Free Chlorine: Water supplied from Cameron's Hill No. 2 reservoir is dosed with ammonia and sodium hypochlorite to achieve a chloraminated disinfection residual. Following	An ICAM investigation identified a number of improvements including the modification of all critical valves associated with the chemical dosing system so they can be locked to avoid accidental operation,

Incident Number	Name of scheme component	Date Reported	Description of the Event/Incident	Improvements
			maintenance on service lines, flushing was undertaken using service water with the incorrect valve placement which resulted in service water being pushed into the ammonia dosing tanks. The ammonia was displaced to the top of the tank however dosing occurs from the bottom of the tank. Subsequently dosing pumps were running but service water was being dosed from the pumps resulting in insufficient chemical ratios to achieve chloramination.	numerous improvements to the secondary disinfection monitoring and dosing systems, and improvement to the HACCP documentation and operational procedures to provide clearer instruction to operations staff.
DWI-507-19-08157	Beaudesert WTP	1/11/2019	Beaudesert WTP Siphon: Upon plant shut down, it was discovered a siphon was occurring through a failed check valve at a rate of 40 mL/sec from the clarified settled water channel to the treated water storage tank. The clarified water was yet to pass through media disinfection and UV and at maximum would comprise 2.4% of the total water in the treated water storage tank.	Pipework modified and air gap introduced to make siphon impossible. Failing check valve was also replaced.
DWI-507-19-08173	Bulk Water Supply Transmission	15/11/2019	Caloundra Street WQMF *E.coli*: During routine verification monitoring on the 14 November 2019 a positive *E. coli* result of 2 MPN/100ml was returned. Review of upstream and downstream water quality and activities revealed that maintenance work had been undertaken upstream but it was conducted as per the disinfection procedures and all sampling was within	No additional preventative measures have been implemented. Existing preventative measures such as maintaining a chlorine residual, sanitation and disinfection during maintenance work will continue to be undertaken.

Incident Number	Name of scheme component	Date Reported	Description of the Event/Incident	Improvements
			specification. The source or cause of the issue could not be further determined.	
DWI-507-20-08345	Dayboro WTP	24/02/2020	Dayboro WTP Chlorate: Routine verification testing undertaken on the Dayboro verification water quality sample tap on 17 February, 2020 returned a chlorate level of 1.21 mg/L, above the DWQMP specified limit of 0.8 mg/L. At the time water being supplied to Dayboro WTP via water carting from the Unitywater network at Samford Valley due to low water levels in the Dayboro riverbank wells drawing from the North Pine River. Testing of the Samford Valley water revealed chlorate of 1.27 mg/L supporting the investigation assessment that the chlorate was introduced by the tankering process.	Improvement to risk assessment process for tankering of water.
DWI-507-20-08358	Multiple	29/02/2020	Tetrachloroethene Incorrect Reporting: Multiple sites returned raw water Tetrachloroethene above the limit of detection but below the Health Guideline Value.	None taken as results were below health limits and it was a raw water sample.
DWI-507-20-08378	Beaudesert WTP	19/03/2020	Beaudesert WTP *E. coli*: Routine verification testing undertaken on the Beaudesert verification water quality sample tap on 18 March 2020 returned a positive result of 1 MPN/100 ml.	Treated water verification tap had other services connected to the pipework supplying sample tap including to online analysers and hose. Plumbing was

Incident Number	Name of scheme component	Date Reported	Description of the Event/Incident	Improvements
			Complementary verification monitoring results indicated there was 3.0 mg/L of Free Chlorine, pH of 7.2 and online turbidity of 0.05 NTU. There were no other exceedances in the preceding 12-month period. Investigation of the plant and in the Urban Utilities network did not find any further positive *E. coli* results and no further explanation of the result could be determined	reconfigured to provide a dedicated sample tap line.
DWQ-507-20-08419	Wivenhoe WTP	19/05/2020	Wivenhoe Chlorate: Due to COVID 19 restrictions, the recreational areas around Lake Wivenhoe were closed for approximately four weeks. This event resulted in low water consumption and elevated water age within the Wivenhoe reticulation system. Maintaining a sufficient level of disinfection residual is managed through re-chlorination at the Wivenhoe WTP and Lumley reservoir sites. During routine sampling, a high level of chlorate was detected in the reticulated water system at Logan's Inlet, located after the re-chlorination facility at Lumley reservoir. During that time, the sodium hypochlorite solution was not exchanged by the operators resulting in disinfection solution high in chlorate and low in free chlorine dosed during re-chlorination.	Weekly exchange of sodium hypochlorite solution by operators is sufficient to manage chlorate levels in drinking water during normal operating conditions. This weekly exchange did not occur due to a unique situation, and the learning has been documented for future reference and consideration in disaster and incident recovery planning.

6 Audit of the Plans

6.1 Regular audits

Seqwater must audit its DWQMP at the intervals stated in an Information Notice provided under section 99 of the Act. The Information Notice for the approval of Seqwater's amended DWQMP dated 29 April 2019 specifies the next regular audit of the DWQMP is to be completed prior to 1 March 2020. Further regular audits are required to be completed every four years from that date. Accordingly, the regular audit was conducted by an auditor certified to the Exemplar Global Water Quality Management System Lead auditor program during the 2019-20 reporting period and the summary of the findings are documented below. More information can be found in Enclosure 5.

"Within the scope of the audit, Seqwater complied with its obligations under the Act, Regulations and Audit Guidelines. There was good compliance between the current version of the DWQMP in use by Seqwater and the observations made during the audit. No poor quality or inadequately maintained infrastructure was observed. Therefore, a compliant audit finding has been made by the auditor under the Act on behalf of DNRME."

6.2 Audits – water treatment and Supply System operations

6.2.1 Internal audits – HACCP and Integrated Management System audits

Internal audits have been conducted throughout the year in accordance with Seqwater's HACCP and Integrated Management System audit schedules. The scope of the internal audits includes the relevant site's HACCP plan, wall chart procedure (incorporating the CCPs), operational monitoring plan, and operator and maintenance records. It includes verification of the HACCP flow diagram and process flow schematic by the HACCP Team Leader and available operational staff from the HACCP team. Internal audits have been conducted at 28 WTP and Supply System sites in the reporting year. Seqwater's remaining operational sites are scheduled for the next reporting period (2020-21) as part of an ongoing cycle.

During the 2019-20 reporting period, the audit, risk assessment and document review schedule was altered to improve efficiency. The new schedule begins with an internal audit and is followed by the risk assessment review and consequently the document review. This allows audit findings to be captured directly within risk treatments identified as part of the risk assessment review, and enable a document review that captures both changes to risk and risk treatment. This was introduced in the 2018-19 reporting year but due to a two-year cycle of audits and risk assessment alignment continued in 2019-20 reporting year.

All major and minor non-conformances and opportunities for improvement are delivered through engagement with operations staff and the use of Seqwater's electronic document and record management systems.

6.2.2 External audits – AS NZS/ISO 22000 Re- Certification audits

Seqwater has integrated the AS NZS/ISO22000:2005 Food Safety Management Systems standard into the DWQMP, as many of the requirements of the standard are consistent with or similar to the elements in the DWQMP which is based on the ADWG Framework. This standard promotes greater commitment from all parts of the business during DWQMP implementation and ensures the DWQMP becomes part of the Integrated Management System (IMS).

During the reporting year Seqwater prepared for recertification against AS NZS/ISO 22000:2018. Due to COVID-19, Seqwater delayed this audit to October 2020, which meant there was no external audit in the reporting period. The results of the October 2020 audit will be reported in the 2020-21 DWQMP Annual Report.

The scope of accreditation continues to include Seqwater's DWQMP and its major operational sites including Mt Crosby East Bank and West Bank, Capalaba, North Stradbroke Island, Molendinar, Mudgeeraba, Landers Shute, North Pine, Noosa, Image Flat, Kalbar and Lowood WTPs, and the supply system (i.e. control room and all operational sites).

6.2.3 External audits- Regulated fluoride audit

Seqwater accommodates regulated fluoride audits every two years. The audit period stretches from November to February where every plant with fluoride dosing is checked for compliance with the current *Fluoride Code of Practice* by the regulator. The most recent full audits were conducted in the 2017-18 financial year. Auditing was planned for the 2019-20 reporting period however due to COVID-19 and demands on the Public Health Units that undertake these audits, audits were restricted to Canungra WTP, Molendinar WTP, Mudgerabah WTP and Gold Coast Desalination Plant. The formal reporting of the audits has not yet been released due to COVID-19 related reporting delays in the Department of Health.

7 Regular review of the plans

Pursuant to section 10.1 of the Information Notice for the approval of Seqwater's DWQMP, Seqwater is required to complete a review of its DWQMP before 1 July 2020. The DWQMP review was conducted by stakeholders relevant to each element of the DWQMP through a series of workshops. The elements, or sections of the DWQMP, are based on the 12 Elements of the 'Framework for Management of Drinking Water Quality' outlined in the Australian Drinking Water Guidelines (ADWG). Seqwater's Hazard Analysis and Critical Control Point (HACCP) plans and appendices to the DWQMP were also subject to review through continuous improvement programs. This included reviews of all risk assessments, the review of Critical Limits and risk improvements through 25 HACCP team meetings regularly held across all of the operational sub-regions, incident investigations and the two-yearly internal site audits of the HACCP plans accuracy and implementation.

7.1 Seqwater's review and improvements to the DWQ Management System

The review of the DWQMP was completed by Senior Water Quality staff in the Drinking Water Quality Unit and consisted of both a benchmarking exercise along with currency of material review.

Benchmarking Exercise

Seqwater undertook a benchmarking exercise of the DWQMP with other large water utilities around Australia to determine if there were opportunities for improvement in the document layout and design. The review determined the approach taken by Seqwater was very similar to some states and different to others. The differences were mainly driven by state-based legislative requirements for management plan content. Improvement items from multiple states were integrated into this version of the Drinking Water Quality Management Plan to further improve the quality and content of the DWQMP.

Document and Information Currency Review

The update of the plan considered the following elements:

- Update of state and federal government departments, regulators and policy setters, including Water Service Providers and their abbreviations
- Updated title to Drinking Water Quality Improvement Plan
- Updates to reflect changes in government legislation including changes to Public Health and Fluoride Regulations

Updates to internal team structure and names after internal restructuring at Seqwater.

Major Changes of Note

- Update references and relevant sections for a change from ISO 22000:2005 to ISO 22000:2018 and associated updated standards and requirements
- Inclusion of a purpose statement for the DWQMP to clearly articulate the document's importance
- Additional maps to clearly articulate the chlorinated and chloraminated supply zones and key interface points with our WSP
- Inclusion of Enterprise Risk and the Seqwater Water Quality Strategy
- Increased general discussion and content material about the interaction of Public Health and water supply
- Updates to the preliminary text in Assessment of the Drinking Water Supply System (Element 2)
- Updated catchment description to ensure currency of source water risk characterisations which inform water safety and reliability risk assessment

- Inclusion of automatic trending on raw and treated waters below guideline levels
- Increased information on how online data is used in DWQMP
- Increased information on the risks associated with water carting to small standalone plants
- Change in language used in the uncertainty descriptors in the risk assessment process
- Updates to the preliminary text in Preventative Measures for Drinking Water Quality Management (Element 3) including increased section on barriers for safe water supply
- Revised Critical Control Point Flow Diagrams
- New introduction for Operational Procedures and Process Control (Element 4)
- Inclusion of additional information on Seqwater's Bulk Chemical Standards (chemical specifications, transport, receivals and use) as well as increased focus on materials in contact or in close proximity to water
- More information around short-term evaluation of results (Section 5.3) processes for evaluating short-term changes in data/input signals
- Inclusion of Risk Wizard for the tracking of critical limits, CCP breaches and audit findings and improvements
- Increased information in Employee Awareness and Involvement (Section 7.1) associated with staff onboarding and training requirements at Seqwater including the National Water Industry Operations Training Package
- Significant update to Community Involvement and Awareness (Element 8)
- Significant update to Research and Development (Element 9)
- Update to Documentation and Reporting (Element 10), with the inclusion of key documents table against key elements
- Minor updates to Evaluation and Audit (Element 11), covering internal and external audit requirements.

The review of the DWQMP was completed on 30 June 2020 and outlined the significant amount of progress Seqwater has made in improving its drinking water quality management system. Some minor deficiencies were identified and updated in Version 11 of DWQMP currently under review by the Regulator. The details of the changes made are provided with the amended DWQMP to WSR in a Register of changes to DWQMP, HACCP plans and procedures (for current – see Enclosure 4). In accordance with section 107(2) of the Act, Seqwater must submit an application to the Regulator to amend the approved DWQMP within 30 business days of the completion of the review, where the review indicates the DWQMP requires amendments to reflect changes to the operation of the water service provided by Seqwater.

Seqwater submitted an amended DWQMP for approval on 11 August 2020.

8 Glossary

Term	Definition
ADWG	Australian Drinking Water Guidelines 2011, National Health and Medical Research Council, Commonwealth Government of Australia, Canberra
CCP	Critical Control Point
DWQ	Drinking Water Quality
DWQIP	Drinking Water Quality Improvement Plan
DWQMP	Drinking Water Quality Management Plan
EPI	Eastern Pipeline Inter-connector
HACCP	Hazard Analysis Critical Control Point. A food safety management system based on a set of guiding principles, known as HACCP Principles or Codex Alimentarius.
ISO 22000	ISO 22000:2018 Food Safety Management Systems. International standard for food safety.
LIMS	Laboratory Information Management System
NPI	Northern Pipeline Inter-connector
WSR	Water Supply Regulator
SCADA	Supervisory Communication and Data Acquisitioning (SCADA) system. Human to Process software interface.
Supply System	Previously named the Bulk Distribution Network and formerly operated by LinkWater.
The Act	Water Supply (Safety and Reliability) Act 2008 (Qld)
The Regulator	Queensland Water Supply Regulator
WSAA	Water Services Association of Australia
WSPs	Water Service Providers (Urban Utilities, Unitywater, Logan City Council, Redland City Council and Gold Coast City Council)
WTP	Water Treatment Plant
WQMF	Water Quality Management Facility

9 Enclosures

Enclosure	Name
1	Verification monitoring 2018-2019 Water Quality data report (REX ID: D20/206299)
2a	Catchment and Drinking Water Quality Micropollutant Monitoring Program – QAEHS Passive Sampling Winter 2019 Report (REX ID: D20/206315)
2b	Catchment and Drinking Water Quality Micropollutant Monitoring Program – QAEHS Passive Sampling Summer 2020 Report (REX ID: D20/206320)
3	Drinking Water Quality Improvement Plan (DWQIP) (REX ID: D20/206339)
4	Register of changes to DWQMP, HACCP plans and procedures - 2019-2020 (REX ID: D20/206345)
5	DNRME DWQMP Audit 2020 (REX ID: D20/206352)