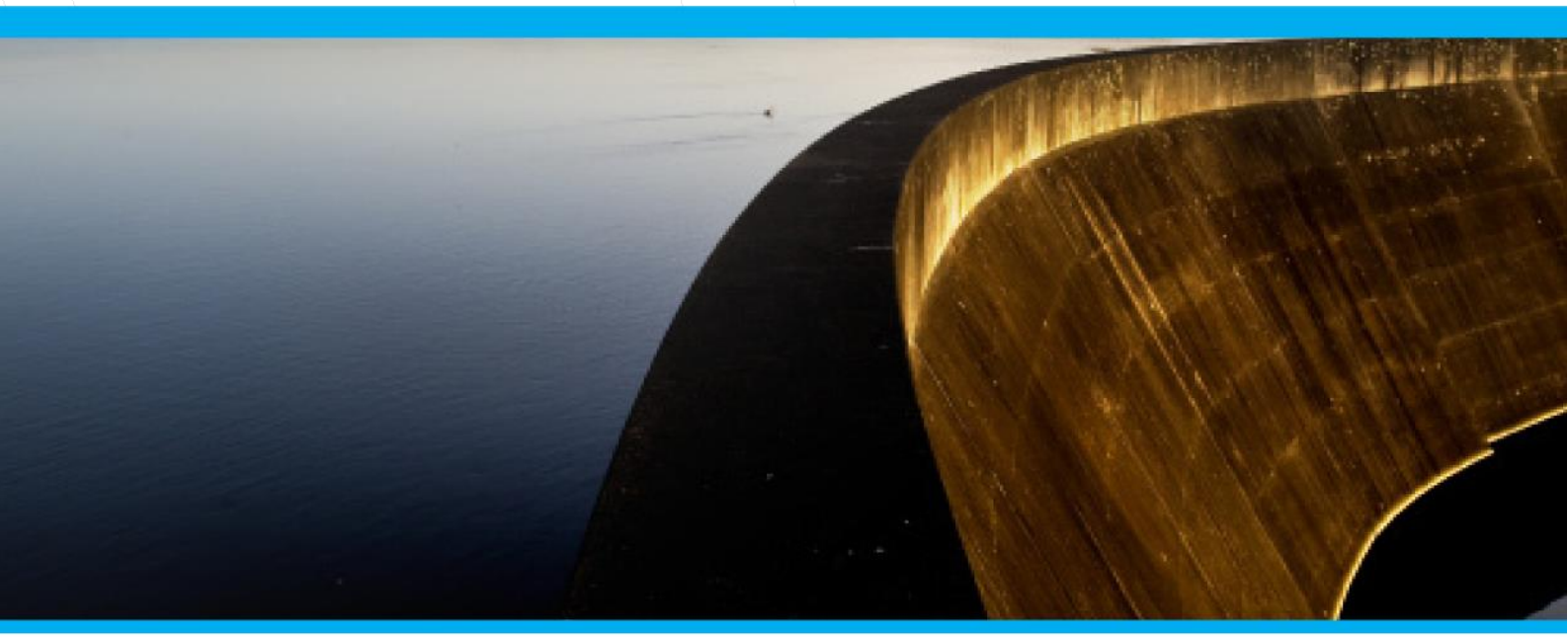
Drinking Water Quality Management Plan Report 2017-18

Seqwater (SP507) Drinking Water Quality Management Plan



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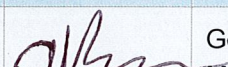
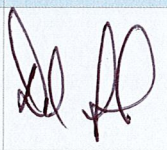
[0]	Report	Manager Technical Support and Improvement	A Roux		General Manager Operations	D Spiller	14/12/18	

Contents

1. Executive summary

The Queensland Bulk Water Supply Authority, trading as Seqwater (**Seqwater**) is responsible for Southeast Queensland's bulk water supply arrangements. This includes catchments, storages and water treatment plants and several small reticulation systems supplying recreation parks.

Seqwater's annual *Drinking Water Quality Management Plan Report* (**DWQMP report**) outlines the activities for the management of water quality risk and issues. This report covers the period 1 July 2017 – 30 June 2018 ("reporting period") during which Seqwater complied with the approval conditions for its DWQMP.

Seqwater's operational and verification monitoring programs have occurred in accordance with the programs documented in the approved DWQMP. Operational monitoring includes 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-certified laboratory. Verification monitoring included 26,742 treated water analyses, and 43,030 Supply System drinking water analyses. Additionally, catchment and source water monitoring including catchment surveys and the use of passive samplers to detect micro-pollutants (for example, pesticides and pharmaceuticals) are undertaken to support operations and to identify changes for the risk assessment process.

Water treatment and supply system operations recorded three individual health-related exceedances and 18 individual aesthetic exceedances against the water quality criteria identified in the DWQMP for the reporting period. This represents the maintenance of relatively low exceedance numbers compared with earlier years (e.g. 25-30 exceedances per year during 2012-14). The result reflects the achievements made through the continuous improvement of Seqwater's drinking water assets and drinking water quality management system.

Seqwater reported all incidents concerning health related guideline values to the Regulator within the required timeframes. These incidents were investigated by an expert who specialises in the field of the identification and elimination of microbial contamination in systems. Further planned improvements relating to the sampling processes and improvements to the sanitary integrity of drinking water storage and transfer assets is expected to deliver the desired outcome of zero *E. coli* exceedances in the future.

The remaining health incidents related to a parameter (chlorate) that was detected but does not currently have a set guideline value in the Australian Drinking Water Guidelines. This included chlorate levels above Seqwater's criteria specification which was later identified by the laboratory as a 'false positive'. Additionally, an event relating to a coagulant dosing failure resulted in a public notification and the supply of bottled water to the affected water supply area.

There were 13 minor aesthetic exceedances identified and these relate to source water conditions in certain catchments that contribute to elevated hardness or pH levels that are not able to be sufficiently treated in Seqwater's water treatment plants

in regional locations. The five aesthetic exceedances for iron and turbidity in the supply system are likely to be related to the aging sampling tap arrangements at two sites. The investigation of these exceedances indicated that these are not reflective of the actual quality of the water. Seqwater continues to improve its systems and processes to prevent further exceedances.

Other drinking water quality management system improvement activities completed during the reporting year included 32 risk assessment reviews, 40 HACCP team meetings, 19 internal audits of treatment plants and supply system sites, and 16 external (SAI Global™) audits for AS NZS/ISO 22000:2005 certification. Fluoride audits have been completed by Queensland Health Environmental Health Officers in all operating fluoride dosing plants (19 plants) including the Gold Coast Desalination Plant.

These reviews and audits are part of a schedule that covers all Seqwater's treatment plants and supply system sites. Seqwater has used the findings of these improvement activities to improve its DWQ 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

2.1 Purpose

This annual report has been prepared in accordance with section 142 of the *Water Supply (Safety and Reliability) Act 2008* (**the Act**) (refer to the Table below). The purpose of this annual report is to provide the Water Supply Regulator (**WSR or the Regulator**) with information on the overall performance of the DWQMP for the period 1 July 2017 to 30 June 2018.

DWQMP Report Condition	Seqwater Compliance
Section 142 Drinking water quality management plan reports (1) 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. (2) The provider must, unless the provider has a reasonable excuse— (a) 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 (b) give the regulator a copy of the report within 120 business days after the financial year ends.	The current report meets these requirements. It is required to be submitted to the Regulator within 120 business days following the end of the 2017−18 financial year. Accordingly, submission for the current report is due by 18 December 2018. The current report has been prepared in accordance with the approval conditions of the DWQMP and the Regulator's guidance at https://www.dews.qld.gov.au/water/regulation/drinking/dwqmp-report Section 142C(2) is not applicable.
Section 142(3) The report must state or include all of the following—	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. Seqwater has not received any additional report requirements during the current reporting period.
(a) the information required under the latest report requirement given to the provider;	
(b) the actions the provider took to implement the plan;	Refer to Section 3 of this report.
(c) the outcome of any review of the plan in the financial year and how the provider has addressed matters raised in the review;	A review of the DWQMP was not required to have been completed during the 2017-2018 reporting year.
(d) 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 Regular audit was not required to have been completed during the 2017-2018 reporting year.
(e) 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 2017-2018 reporting year.

DWQMP Report Condition	Seqwater Compliance
(f) 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 2017-18 Water Quality Data report. This report also includes aesthetic criteria.
(g) 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 distribution and retail entities, 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 Seqwater (SP507) Drinking Water Quality Management Plan (DWQMP) approved by the Regulator. The Seqwater DWQMP was developed under Chapter 2, Part 4, Division 1 of the Act. The DWQMP forms part of the corporate drinking water quality management system that Seqwater has implemented to cover all of 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 (2010)* 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 barriers, which include:

- Catchments, storages and dams
- Water treatment
- Disinfection
- Supply systems
- Distribution systems in recreation areas.

The Seqwater (SP507) 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 distribution system are predominantly managed by downstream water service providers 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 18 March 2014 (**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. 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 2017-18 reporting year are detailed in section 3.2 of this report. Changes to the DWQMP and site-based HACCP plans are detailed in Enclosure 4 to this report.

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 the operational monitoring performed by the operators of the Water Treatment Plants. This monitoring is used to verify the operation of the plant and the accuracy of any online instrumentation available, the various Supervisory Control and Data Acquisition (SCADA) tools available at the Water Treatment Plants, and the Internal Process Laboratory results of key operational parameters. There have been no significant revisions to the operational monitoring program during the 2017-18 reporting year.

Seqwater's verification monitoring plan covers a wide range of parameters that have been determined using a risk-based approach and have been detailed in the DWQMP. The results of Seqwater's verification monitoring during the 2017-18 reporting year are described in section 3.4 of this report and a detailed data report in the format prescribed by the Regulator is provided in the spreadsheets at Enclosure 1. Verification monitoring, including sampling and analysis, was undertaken by an external NATA accredited laboratory and the results are recorded in the Seqwater's Laboratory Information Management System (**LIMS**). Seqwater reviews the verification monitoring program on a quarterly basis.

Seqwater has continued to improve its drinking water quality management system and implement the actions in the risk management improvement program (known as the Drinking Water Quality Improvement Plan (**DWQIMP**)) during the 2017-18 reporting year as described in section 4 of this report. The DWQIMP changes during 2017-18 are provided in Enclosure 3 to this report.

3.1 Approval conditions

Seqwater received final conditional approval of its amended DWQMP on the 18 March 2014 under sections 99(1)(b) and 100(3) of the Act. A summary of the approval conditions, and Seqwater's compliance with them, is provided in the following table.

Condition	Compliance
No. 1. Water Quality Criteria	
Water quality criteria for drinking water including: i. The standards for drinking water quality prescribed in a regulation under the *Public Health Act 2005*. ii. The criteria in any guideline, if any, made by the regulator about the quality of drinking water. iii. 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. 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 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 2005* as identified through its verification monitoring program. A review of the verification monitoring data report (Enclosure 1) found that all such non-compliances were covered by formal reports 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: (a) An event including anything that has happened to Seqwater's service which has escalated beyond it ability to control, and Seqwater believes, or is concerned, that public health may be impacted as a result. (b) 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.	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. Seqwater routinely reports parameters which have no water quality criteria such as bromide, a potential contaminant resulting from the desalination treatment process.

Condition	Compliance
These reporting requirements must be reported to the regulator immediately and followed up in writing using the prescribed form within 24 hours.	Reporting requirements are compliant.
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 The detection must be reported to the regulator immediately and followed up in writing using 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 Seqwater in complying with the drinking water quality management plan and the conditions in this approval	—

3.2 Risk assessment

In accordance with the ISO 22000: 2005 requirements Seqwater established several prerequisite programs which are designed to assist in the control of the likelihood of introducing a water quality hazard.
The table below states the current programs and their status of implementation.

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
PRP1 Source Water management	Change in raw water may trigger a deviation of water treatment practices including inability to treat water to standard	Remote Physiochemical Catchment Monitoring Early Warning Station, Passive sampler monitoring program Catchment Monitoring Program	Implemented and well controlled.
PRP- 2 Pest Management	Attraction of pests Vermin infestation including rodents, birds, insects	Tactical maintenance plans • Pest management contractors • Site inspections and defects rectification program Monitoring of disinfection residue and E. coli according to the requirements of the verification monitoring plan	The effectiveness of the preventive measure is currently under review
PRP- 3 Management of sanitary integrity	Ingress of contaminants into the water treatment process leading to out of specification product. 1. Asset deterioration 2. Project work commissioning assets/ Returning assets to service 3. Natural events	Tactical maintenance plans • Site inspections and defects rectification program • Reservoir structural and sanitary integrity assessment program Disinfection procedures for sanitary requirements during project work	The effectiveness of the sanitary inspection program is currently under review.
PRP- 4 Bulk chemicals supply control including product selection delivery and storage	Contamination of process/ drinking water due to unspecified chemicals Material emits chemicals into process and treated water over a long period of time causing public health issues Cross contamination Chemical deterioration	Chemical specifications Commercial Services- Chemical Panel List Register Chemical Delivery Procedures	Chemical specifications are finalized and in agreement with the stakeholder the implementation follows in due course.
PRP-5 Management of WQ Online Instruments	Inadequate chemical dosing leading to out of specification product Under and overdosing treatment chemicals	Tactical maintenance plan Management of Water Quality Online Instruments Operations site inspection checklist	Procedure rollout and trainings program are underway.

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
PRP-6 Management of chemical dosing equipment	Inadequate chemical dosing leading to out of specification product Under and overdosing treatment chemicals	Asset Class Plan(s) According to operational Prerequisite Programs definitions in HACCP plans Tactical maintenance plans • Operations site inspection checklist	The definition of operational prerequisite programs for the WTP operations are ongoing and an important part of the risk assessment process.
PRP-7 Management of Maintaining the Disinfection Residual	Deterioration of water quality in service reservoirs and balance tanks as a result of variable residence times Water age in extremities	Supply system operational Prerequisite Programs.	Implemented and well controlled.

Seqwater completed a project to consolidate its DWQ risk assessments into a single file known as *Risk Assessment Dashboard*. The dashboard was implemented in May 2017 and Seqwater completed the site-based risk assessment review process.

The findings from the recent risk assessment reviews are consistent with those reported in the 2016-17 DWQMP Report, i.e. the main risks identified did not significantly change and in most cases pathogens are the predominant limiting hazard. The following presents a summary of the significant risk management improvements that have been identified from these recent reviews:

- In some cases, the residual (mitigated) risks have been further reduced by capital upgrades to assets as part of the regular asset management process.
- 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 the WTP.
- The remaining operational WTPs that are yet to have SCADA upgrades have been included in the 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* project.

3.3 Operational monitoring

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 Water Treatment Plant (**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.

Internal auditing (section 5) 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 measures and operational monitoring.

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 is providing settled water turbidity analysers and alarming 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 WTP's 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 headloss, runtime / production	The instrumentation and SCADA upgrade is providing filtered water turbidity alarming across Seqwater's sites which consist of an interlock to plant operation or activate back washing, and dial-out to the on-call operator's mobile. Operator grab sample monitoring has been compliant with the WTP's HACCP plan which documents operational monitoring.

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
Disinfection (by Ultraviolet irradiation)	• UV dosing failure • Raw water exceeds treatment capability • Coagulation failure • Filter break-through causing shielding	• Online monitoring for UV intensity and flow • UV transmittance (online or grab sample) monitoring • Observation checks of the UV system status	This is only applicable to sites that have insufficient pathogen treatment barriers for their catchments. This includes: Kilcoy, Kenilworth, Dayboro, Capalaba, Beaudesert and Kalbar WTPs where UV disinfection has worked effectively without significant issues/excursions.
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	The instrumentation and SCADA upgrade is providing filtered water turbidity alarming across Seqwater's sites which consist of an interlock to plant operation or activate back washing, and dial-out to the on-call operator's mobile. Operator grab sample monitoring has been compliant with the WTP's 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.

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
Reticulation (recreation sites)	• Ingress or infiltration • Corrosion and deterioration of assets • High water age within the network	• 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 that 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.

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, ISO22000 and HACCP standards, these operational measures have been identified and summarized within the Supply System DWQMP as Critical Control Points and Operational Pre-requisite Programs.

The preventive measures are well established within the business, with CCPs monitored by online instrumentation throughout the Supply System. Operation Centre staff are able to react to the Supply System exceedances when notified through the SCADA system. Alarming is programed into the SCADA system at three different incident levels, each defining the severity of the exceedance. Each incident level has documented contingency and escalation procedures for staff to follow. The overall operational monitoring system has worked successfully throughout the reporting year.

Seqwater monitors the Operational Pre-requisite Programs through internal auditing and compliance spot-checks. The main preventive measures are listed below, including an update of the status of each measure, with the main limiting hazard in most instances being pathogens. Risks requiring further treatment are listed in the improvement plan – refer to section 4 of this report.

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
Water Quality considerations as part of the Monthly Operating Supply Schedule (MOSS) & routine meetings with Supply Partners (Regional Operational Managers Meeting)	• Non-compliant water supplied from the Bulk Water Supply System • Deterioration of water quality in service reservoirs due to variable water ages	Draft is issued monthly to the Drinking Water Quality team for review and to provide feedback on any issues arising from different source waters.	This formalised process continues. Water Quality issues are raised if there are concerns of any potential or emerging localised issues and the MOSS amended accordingly. This occurred in the case at Mt Crosby involving MIB & Geosmin issues.
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 are representative for each water zone. In some locations SUVA instruments are in place to provide further data. These signals are transferred and alarmed at the 24/7hrs attended operations center. Operations center escalation and corrective action procedures are audited routinely. Training is delivered for new operations center staff.	Established SCADA systems and critical limit alarming levels notify the operations center of low chlorine residual. Escalation procedures covering different severities of alarms are well established and are followed by operations center staff. Corrective actions are documented in a procedure and are followed by operations center staff and Supply System operations management. A documented procedure is allocated to maintaining chlorine residual and is used as a guideline for operational staff.

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
Service Reservoir Inspection Program	• Ingress of non-potable water to reservoirs • Vermin entry to reservoir • Corrosion and deterioration of assets	Service reservoir inspections are carried out monthly using a checklist and photo evidence process. These records are audited routinely to identify any deficiencies. A project trialing the use of Unmanned Aerial Vehicles (UAV), submersible Remote Operated Vehicles (ROV) and specialist software to inspect and track deterioration commenced in March 2017.	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. Checklists and photos are checked monthly by Drinking Water Quality staff.
Mains Hygiene Procedure	• Stagnation of reservoirs and pipelines • Commissioning new assets and pipelines • Maintenance and operational changes	This formalized procedure provides the process to prevent contamination of pipelines and reservoirs during maintenance activities. It also covers disinfection of assets prior to returning to service. Onsite 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 by third party	All reservoirs are locked, and alarm systems notify the 24/7hr operations center of any unauthorized access to grid 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 center 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 grid. These are alarmed and notify the 24/7 operations center of any low pressure situations.	The operations center 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 Mains Hygiene procedure.

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
Optimization 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, backup telemetries with multi-barrier alarming to the 24/7 operations center.	Control systems are well established and now have proven historical track records. The operations center has comprehensive documentation to assist in the control of these systems and is 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. Biofilm testing in pipelines has proven that 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 center.

3.4 Verification monitoring

The results of Seqwater's verification monitoring during the 2017-18 reporting year are summarized 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 (mean) concentration or count.

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. In the summer 2018 reporting period Seqwater also undertook passive sampler testing of a suite of PFAS chemicals as well as Glypohsate and its break down products.The 'passive sampler' reports for sampling conducted during the 2017-18 reporting year are provided at Enclosure 2.

There were no exceedances of the ADWG values for these chemicals observed during the 2017-18 reporting year using either grab sampling or passive sampling methodologies. Some parameters have been detected at trace levels, but this has generally been two orders of magnitude below the guideline values.

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 2018* (**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 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:

- **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).

- **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 reading is used for assessment against the water quality criteria. If any value is greater than the water quality criteria, then the whole zone is deemed non-compliant.

- **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 greater than the water quality criteria, then the whole zone is deemed non-compliant.

Seqwater was assessed as compliant during the 2017-18 reporting year for all of its water treatment operations and supply system zones for microbiological, health and aesthetic compliance.

Water Treatment Plant verification monitoring

Verification monitoring occurred in accordance with the Seqwater Water Quality Verification Monitoring Plan. This was undertaken by the contracted NATA certified Laboratory Service Provider at Seqwater's raw water, treated water and recreation park distribution system sample points, covering up to 89 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 2017 to 30 June 2018 is provided below. The statistics from verification monitoring results for all parameters for both source (raw) and treated water at each operational site are provided at Enclosure 1.

Name of scheme component	Number of Analyses Performed	Number of Individual ADWG/DWQMP Health Exceedances	Number of Individual ADWG Aesthetic Exceedances
Amity Point WTP	602	0	0
Atkinson Dam WTP / Recreation Park	150	0	0
Beaudesert WTP	687	0	2
Boonah-Kalbar WTP	767	0	0
Borumba Dam WTP / Recreation Park	99	0	0
Canungra WTP	630	0	0
Capalaba WTP	740	0	0
Dayboro WTP	662	0	0
Dunwich WTP	602	0	0
Esk WTP	699	0	0
Gold Coast Desalination Plant	1119	0	0

Name of scheme component	Number of Analyses Performed	Number of Individual ADWG/DWQMP Health Exceedances	Number of Individual ADWG Aesthetic Exceedances
Hinze Dam WTP / Recreation Park	1123	1	0
Image Flat WTP	1489	0	0
Jimna WTP	671	0	0
Kenilworth WTP	609	0	0
Kilcoy WTP	733	0	0
Kirkleagh WTP / Recreation Park	1193	0	1
Kooralbyn WTP	795	0	2
Landers Shute WTP	723	1	0
Linville WTP	351	0	1
Lowood WTP	709	0	0
Maroon Dam WTP / Recreation Park	936	0	4
Molendinar WTP	695	0	0
Moogerah Dam WTP / Recreation Park	1005	0	1
Mt Crosby WTP	1438	0	0
Mudgeeraba WTP	692	0	0
Noosa WTP	886	0	0
North Pine WTP	827	0	0
North Stradbroke Island WTP	666	0	0
Petrie WTP	925	0	0
Point Lookout WTP	601	0	0
Rathdowney WTP	717	0	1
Somerset Dam Township WTP	862	0	1
Wivenhoe Dam WTP /	1339	0	0

Name of scheme component	Number of Analyses Performed	Number of Individual ADWG/DWQMP Health Exceedances	Number of Individual ADWG Aesthetic Exceedances
Recreation Park			
Total	**26,742**	**2**	**13**

Notes:

(1) Banksia Beach WTP remained offline in 'cold standby' during the 2017-18 reporting year and was not subject to verification monitoring whilst off-line.

(2) Linville WTP which supplies a stand-alone community remained off-line and supply was achieved by tankering water supplies from a nearby scheme. Treated water continued to be monitored at these sites.

Analysis of the Water Treatment Plant and Recreation Site verification monitoring data

Through an assessment of the water quality data from the verification program it was found that the WTPs complied with the ADWG health guideline values for drinking water. However, there were single detections of *E.coli* at Hinze Dam WTP (incident report number: DWI-507-000107) and Lander's Shute WTP (DWI-507-00106). Additionally, there was an elevated chlorate concentration at the Point Lookout WTP (1.3 mg/L) exceeding Seqwater's specification (0.8 mg/L) and, whilst no ADWG guideline exists, this was reported to WSR as required in Seqwater's DWQMP (DWI-50700109). The event related incident at the Wivenhoe WTP (DWI-7-507-00104) was linked to a coagulant dosing failure.

All health-related exceedances were notified to the Regulator in accordance with section 102 of the Act.

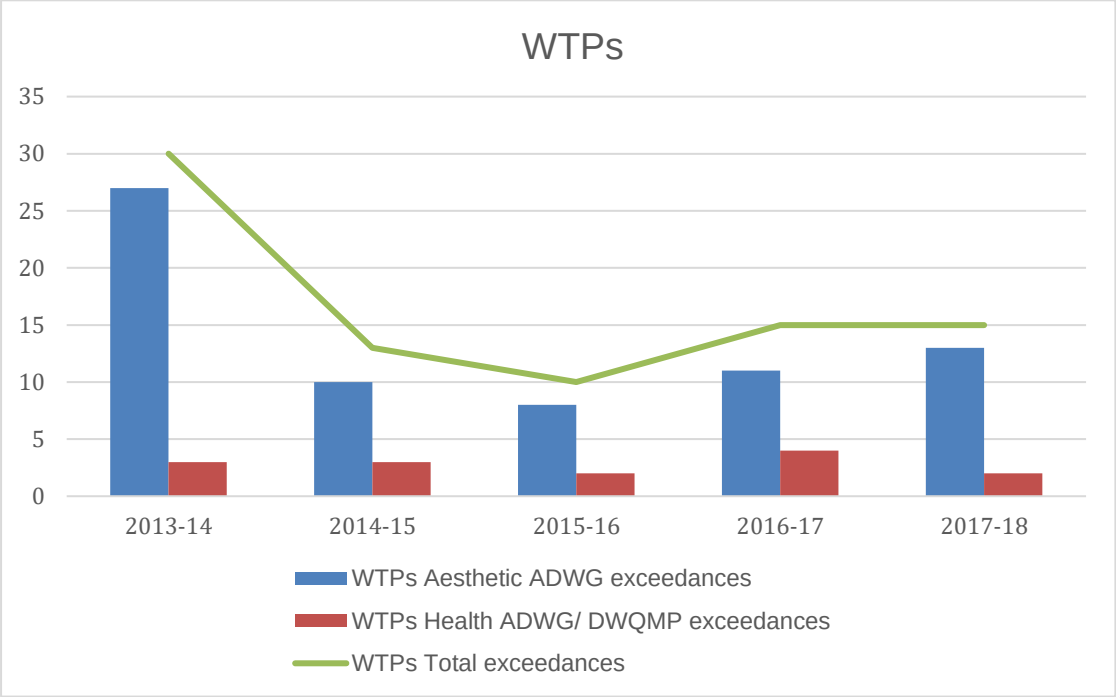
There was a low level of confidence in the analysis process relating to the chlorate exceedance at Point Lookout on 15 May 2018. Following confirmatory tests, it was determined that the result for chlorate was due to carry- over from the previous sample that was tested in the same analytical suite and therefore it was appropriate to exclude this result from the monitoring database.

The following chart shows an ongoing significant reduction in the number of exceedances since the 2013- 2014 reporting year. Overall, ADWG health related exceedances over the past five years have remained consistently low, between 2 – 4 exceedances per year, which is a considerable achievement given the number of diverse schemes and systems.

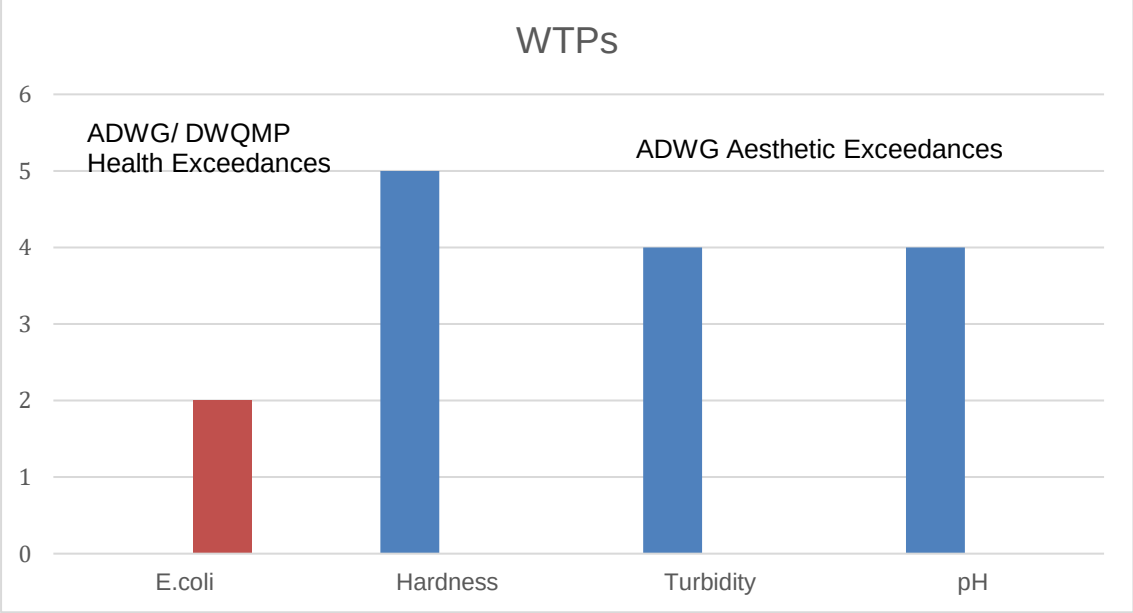
Most health-related exceedances observed in the past concerned the detection of *E. coli* in the presence of significant chlorine residuals in the supplied water. In June 2016, Seqwater established a Field Services Team and quality control during sampling and on-site testing became the responsibility of Seqwater. This has supported the reduction of the number of health-based exceedances further compared with previous reporting years given that these *E. coli* detections were likely to be related to sampling issues or the transportation of samples.

The number of aesthetic exceedances has been consistent with recent years, such as 13 exceedances in 2016-17, 8 exceedances in the 2015-16 and 10 exceedances in the 2014-15. In the current report, all exceedances had been due to raw water

conditions where the aesthetic parameter (pH or hardness) had exceeded the treatment capability of the plant. These results are in improvement earlier reporting periods, such as 27 exceedances in 2013-14 and 23 exceedances in 2012-13. Exceedances due to operational issues at the WTPs have been reduced to zero or near zero events.



The following chart details the exceedances according to the parameter and whether they were health or aesthetic based.



The isolated instances of ADWG health exceedances are not believed to be the result of HACCP failures. The two *E. coli* detections, as mentioned earlier in the report, were in the presence of significant residual chlorine concentrations and no operational disturbances were observed.

The aesthetic exceedances predominantly relate to hardness or pH in treated water produced from the Beaudesert, Kooralbyn and Maroon WTPs all of which have been affected by an event-related change in conditions in the same source water, the Logan River. The treatment process does not have the ability to treat parameters such as hardness. Elevated turbidity in the reticulated water at Moogerah, Kirkleagh and Somerset is likely due to aging infrastructure of the pipe system. Consequently, there have been short periods of time during the year when these individual instances have exceeded the maximum ADWG aesthetic values, while still meeting the compliance targets over the annual 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 mitigation of a risk has been determined to be inadequate (even for aesthetic parameters), an improvement action is recorded, and its progress is regularly reviewed through Seqwater's Drinking Water Quality Improvement Plan.

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 40,363 tests during 2015-16 and 43,030 tests during 2017-18.

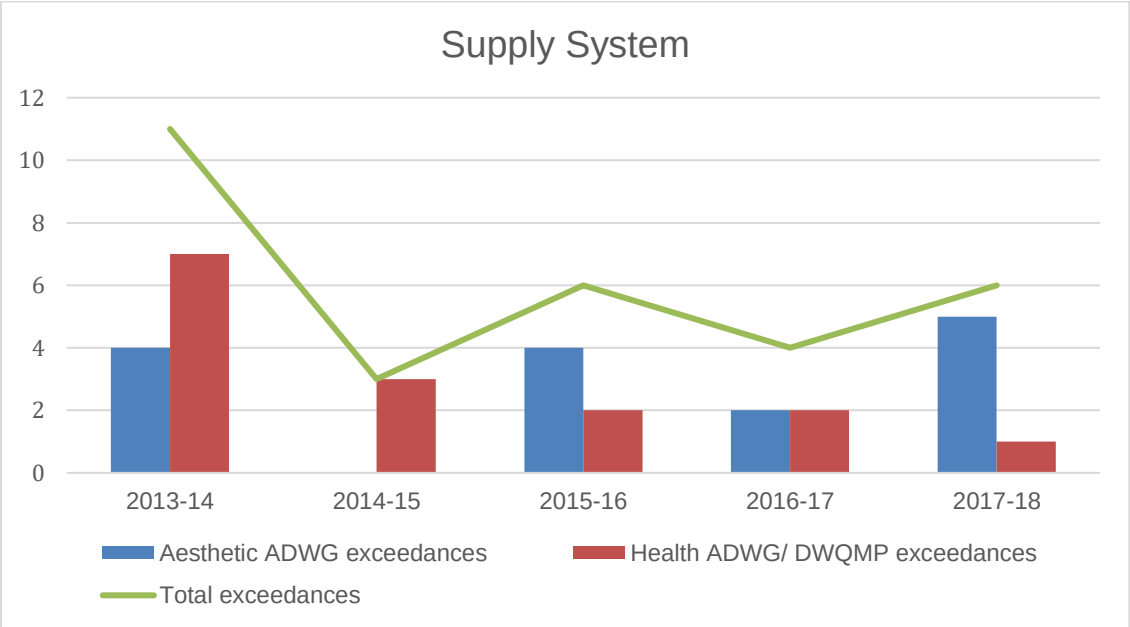
Sampling and on-site field tests were undertaken by Seqwater's field services team and laboratory testing was undertaken by a contracted NATA-certified Laboratory Service Provider. This covered 31 different parameters with weekly and monthly routines scheduled in eight different zones. The verification program provides the necessary information to validate that the preventive 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 2017-18 reporting year and these are shown in the following table.

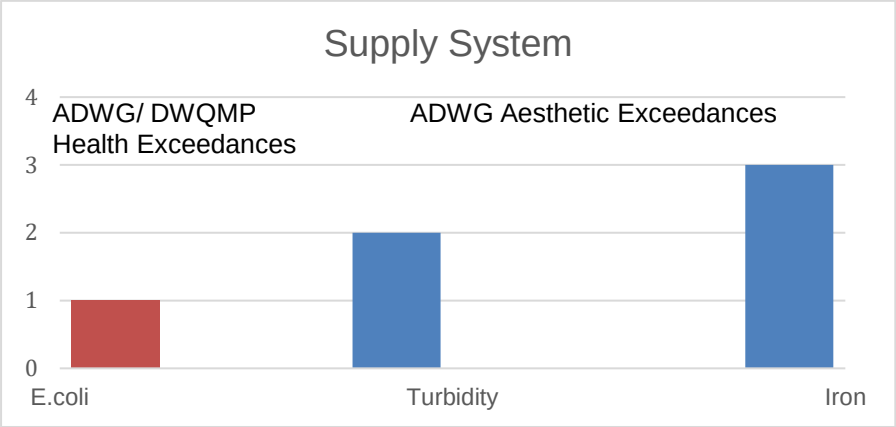
Name of scheme component	Number of Analyses Performed	Number of Individual ADWG Health Exceedances	Number of Individual ADWG Aesthetic Exceedances
Brisbane	13988	0	0
Eastern Pipeline Interconnector (EPI)	2051	0	0
Gold Coast	1407	0	0
Logan	3434	1	0
Network Integration Pipeline (NIP)	2136	0	0
Northern Pipeline Interconnector (NPI)	8215	0	2
Redlands	5704	0	0
Southern Regional Pipeline (SRP)	6095	0	3
Total	**43,030**	**1**	**5**

Analysis of the Supply System verification monitoring data

There was one ADWG health exceedance and five aesthetic guideline exceedances for the supply system during 2017-18 reporting year consistent with the low numbers of exceedances for each category in previous two years. The chart below shows an initial reduction and maintenance of low numbers of exceedances since the 2013-14 reporting year. Although this trend is partly supported by a reduction in monitoring to adopt a risk-based approach and improve efficiency, this improvement trend also demonstrates a successful year of operation.



The following chart details the exceedances according to the parameter and whether they were health or aesthetic based.



The health guideline exceedances included one *E. coli* detection. The cause for the *E. coli* detections investigated and, consistent with the detections in the past, there were significant chlorine levels present which indicate potential issues with the sample collection and analysis method.

An investigation into the iron detection at Morayfield (NPI) and Chamber's Flat (SRWP) found recurring issues with the plumbing of the sample tap which is likely to result in the implementation of an improved sample tap design. The minimal number of 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 Drinking Water Quality Improvement Plan.

The progress that has been made during the 2017-18 reporting year to reduce health related risks and improve reliability in providing safe drinking water supplies is tabled in the spreadsheets at Enclosure 3 of this report.

Any improvements which are yet to be implemented are reassessed and prioritized 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 that 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.

5. Drinking water quality incidents

The following section summarises incidents notified to the Regulator in accordance with sections 102 and 102A of the Act, detailing:

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

A summary of incidents at Seqwater's treatment operations and supply system that are reportable to the Regulator are shown in the following table. All incidents were reported within the required timeframes.

Incident No.	Name of scheme component	Date	Description of the Event/Incident	Improvements
DWI-507-00104	Wivenhoe Dam WTP	09/01/2018	Human error during routine maintenance activities on the alum dosing system caused the undetected dosing failure over a period of two days. Alum dosing was successfully reinstated at scheduled inspection. Relevant stakeholders were contacted to advise not to drink or use the water for food preparation. Training was provided to the relevant team and the incident including lessons learnt were communicated business wide during scheduled HACCP team meetings.	Wivenhoe Dam WTP supplies the nearby recreation areas which are owned by Seqwater. Temporary signage advising to 'do not drink' were placed on all park taps and in offices. Bottled water was provided until the incident was resolved.

Incident No.	Name of scheme component	Date	Description of the Event/Incident	Improvements
DWI-507-00105	Alexandra Hills reservoirs-common outlet north	22/02/2018	A suspected 'compromised' water sample returned a positive *E.coli* detection at the reservoir's northern common outlet. Investigation into the cause of an increased *E.coli* detection in various systems at the same time resulted in the identification of opportunities in the sampling and sanitary reservoir integrity management.	The implementation of associated improvement processes is in progress.
DWI-507-00106	Lander's Shute WTP Fluoride analyzer outlet	26/02/2018	A suspected 'compromised' water sample returned a positive *E.coli* detection at the fluoride analyzer outlet. As above: Investigation into the cause of an increased *E.coli* detection in various systems at the same time resulted in the identification of opportunities in the sampling and sanitary reservoir integrity management.	The implementation of associated improvement processes is in progress.
DWI-507-00107	Hinze Dam WTP treated water sample tap	26/02/2018	A suspected 'compromised' water sample returned a positive *E.coli* detection at the treated water sample tap. As above: Investigation into the cause of an increased *E.coli* detection in various systems at the same time resulted in the identification of opportunities in the sampling and sanitary reservoir integrity management.	The implementation of associated improvement processes is in progress.

Incident No.	Name of scheme component	Date	Description of the Event/Incident	Improvements
DWI-507-00108	Lowood WTP	17/03/2018	Filter breakthrough caused elevated filtered water turbidity. Incident Cause Analysis Methodology (ICAM) investigation was undertaken.	Filtered water turbidity incident was communicated to the regulator. Improvements identified from the ICAM included the installation of a coagulant flow meter, upgrades to the control system and staff training. *This incident was determined non-reportable by the regulator.*
DWI-507-00109	Point Lookout WTP	15/05/2018	Investigation indicated that the responsible laboratory analysed a false positive sample.	No further action

6. Audit of the plans

6.1 Audits – water treatment and supply system operations

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, Summary wall-chart, Critical Control Point procedures, Operational monitoring plan, and operator and maintenance records. It includes verification of the HACCP flow diagram and process flow diagram by the HACCP Team Leader and available operational staff from the HACCP team.

Internal audits have been conducted at 19 WTPs and 4 supply system sites. Seqwater's remaining operational sites are scheduled for the next reporting year (2018-19) as part of a two-yearly cycle.

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).

Seqwater has been AS NZS/ISO 22000 re-certified during the 2017-18 reporting year. Seqwater is obligated to undergo re-certification audits conducted by SAI Global every two years. A total of 16 audits were conducted across 12 WTPs and the four Supply System sites in May 2018 with no major non-conformances were identified.

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).

External audits- Regulated fluoride audit

Seqwater accommodates regulated fluoride audits every two years. The audit period stretches from November to February where every Fluoride plant is checked for compliance with the current *Fluoride Code of Practice* by the regulator. The audits confirmed a high level of compliance with legislative requirements and the Water Fluoridation Code of Practice. No regulatory breaches were identified.

All 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 and the Drinking Water Quality Improvement Plan processes.

7. Regular review of the plans

Pursuant to section 11.1 of the *Information Notice* for the approval of Seqwater's DWQMP (2014), Seqwater needed to complete a review of its Drinking Water Quality Management Plan (DWQMP) before 1 July 2018. Seqwater achieved this obligation and completed this review on 30 June 2018.

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 have also been subject to review through continuous improvement programs. This has included reviews of all Risk Assessments in 2015, the review of Critical Limits and risk improvements through 46 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.

Seqwater's review and improvements to the DWQ Management System

The DWQMP review found that the drinking water quality management system is implemented. The main improvements that have been achieved by Seqwater that were reflected in the application to amend the DQWMP following this review or identified for further improvement of the management system included:

- The ongoing conduct of risk reviews through an integrated *Risk Dashboard* which displays the results of previous risk assessment reviews back to 2013.
- HACCP plans, procedures and flow diagrams that provide an understanding of the system were updated to reflect any operational changes or infrastructure upgrades.
- A complete review of incidents over the last two years along with long-term data was conducted as part of every risk assessment review.
- The Lake Wivenhoe HACCP plan was added as a sub-plan to the DWQMP.
- Seqwater's Research programs were updated to reflect the improved connectivity with business needs and research-related organisations.
- The development and implementation of engineering and commissioning standards across the organisation.
- The development and implementation of operational manuals and expanding coverage of operational procedures

The changes to the DWQMP identified in the current review reflect the significant amount of progress that 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. In accordance with section 107(2) of the Act, Seqwater submitted an application to the Regulator to amend the approved DWQMP within 30 business days of the completion of this review.

8. Glossary

ADWG	*Australian Drinking Water Guidelines 2011*, National Health and Medical Research Council, Commonwealth Government of Australia, Canberra
COP	Code of Practice
CCP	Critical Control Point
DWQ	Drinking Water Quality
DWQMP	Drinking Water Quality Management Plan
EPI	Eastern Pipeline Inter-connector
ICAM	Incident Cause Analysis Methodology
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.
AS NZS/ISO 22000	*AS NZS/ISO 22000:2005 Food Safety Management Systems*. International standard for food safety.
LIMS	Laboratory Information Management System
NIP	Network Integration Pipeline
NPI	Northern Pipeline Inter-connector
SCADA	Supervisory Communication and Data Acquisitioning (SCADA) system. Human to Process software interface.
SRP	Southern Regional Pipeline
Supply System	Previously named the Bulk Distribution Network and formerly operated by LinkWater.
SUVA	Specific UltraViolet Absorbance
The Act	*Water Supply (Safety and Reliability) Act 2008*

The Regulator	Water Supply Regulator
WSAA	Water Services Association of Australia
WSR	Water Supply Regulator
WTP	Water Treatment Plant
2017-18 reporting year or 2017-18 reporting period	Means the period 1 July 2017 to 30 June 2018.

9. Enclosures

1 – Verification monitoring 2017-2018 Water Quality data report (REX ID: D18/152148)

2a – Catchment and Drinking Water Quality Micropollutant Monitoring Program – Entox Passive Sampling Winter 2017 Report (TRIM ID: D18/155584)
2b – Catchment and Drinking Water Quality Micropollutant Monitoring Program – Entox Passive Sampling Summer 2018 Report (TRIM ID: D18/152150)

3 – Drinking Water Quality Improvement Plan – Progress with health-related risk improvements (REX ID: D18/152150)

4 – Register of changes to DWQMP, HACCP plans and procedures - 2017-2018 (REX ID: D18/15249)