

COMPLIANCE AND PERFORMANCE REPORT

SEPTEMBER 2021 HUNTER WATER

Acknowledgement of Country

Hunter Water operates across the traditional country of the Awabakal, Birpai, Darkinjung, Wonaruah and Worimi peoples. We recognise and respect their cultural heritage, beliefs and continuing relationship with the land, and acknowledge and pay respect to Elders past, present and future.

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EXECUTIVE SUMMARY

Hunter Water is dedicated to providing safe, reliable and efficient water and wastewater services to the households and businesses of the Lower Hunter. Our Operating Licence sets out the terms and quality expectations that govern the delivery of those services to the community.¹ This report details our compliance with and performance against the requirements of our Operating Licence and Operating Licence Reporting Manual for 2020-21.²

Quality, safety and reliability are of critical importance to us. As a State-Owned Corporation, we strive to deliver these outcomes efficiently and with due regard to community and environmental values.

Hunter Water performed at a consistent, high standard throughout 2020-21. We are undertaking programs in 2021-22 to ensure that we continue to deliver high quality services to the Lower Hunter. Key performance and operational outcomes during 2020-21 include:

Supply services and performance standards

- Full conformance with the Drinking Water Quality Management System (DWQMS).
- Full conformance with the Recycled Water Quality Management System (RWQMS).
- Full compliance with regulatory requirements for verification monitoring as specified in the Australian Drinking Water Guidelines (ADWG).
- We have prioritised actions to address risks out of appetite in the drinking water quality and recycled water quality improvement plans.
- Continued to consult with NSW Health about implementation of our DWQMS and RWQMS.
- Met system performance standards for water pressure, water continuity and wastewater overflows.

Water conservation & system yield

- Continued to make significant progress in the area of water conservation. This performance is outlined in a separate water conservation report.
- Continued to monitor and review the level of service standards and system yield associated with our water storages. Our draft Lower Hunter Water Security Plan is on public exhibition in August 2021. We expect the plan to be finalised in early 2022.

Organisational systems management

- No major non-conformances with the Asset Management System (AMS) were identified during third party audits or internal audits and certification maintained to ISO 55001:2014 (AS/NZS ISO 55001:2014)
- No major non-conformances with the Environmental Management System (EMS) were identified during third party audits or internal audits and certification maintained to ISO 14001:2015 (AS/NZS ISO 14001:2016).
- No major non-conformances with the Quality Management System (QMS) were identified during third party audits or internal audits and certification maintained to ISO 9001:2015 (AS/NZS ISO 9001:2016)
- Continued to adopt an integrated approach to managing the management systems in the form of an Integrated Management System (IMS). The IMS provides processes, principles and guidelines across the common functions of the AMS, EMS, QMS, Health and Safety Management System

¹ NSW Government 2017, Hunter Water Operating Licence 2017-2022.

² NSW Government 2017, Hunter Water Operating Licence Reporting Manual 2017-2022.

(HSMS) and Information Security Management System (ISMS). No major non-conformances with the IMS were identified during third party audits.

Customer and stakeholder relations

- Regular consultation with our customers through the Customer and Community Advisory Group (CCAG). Consultation was held in accordance with the CCAG Charter and thus matters were raised either for information or to receive feedback from members.
- Actions implemented to improve the effectiveness and timeliness of customer complaint responses.
- Maintained a significant presence at community events to increase awareness and support for our most vulnerable customers. Hunter Water also revised its collection strategies and business rules from mid-March to June 2020 in direct response to COVID-19, to support those customers financially impacted.
- Ongoing membership of the External Dispute Resolution Scheme, through the Energy and Water Ombudsman of NSW (EWON).
- Compliance with the Customer Complaint Management Standard and Guideline, AS/NZS 10002:2014.

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1 INTRODUCTION

Hunter Water is a state-owned corporation that provides safe, reliable, and efficient water and wastewater services to over half a million people in the Lower Hunter region. We also manage trunk stormwater channels in the Newcastle, Lake Macquarie, and Cessnock local government areas. We are governed by the *State Owned Corporations Act 1989* and *Hunter Water Act 1991*. The NSW government regulates Hunter Water's operations through a variety of regulatory bodies and instruments.

Our Operating Licence is the key regulatory instrument that enables and requires us to provide services. The Operating Licence contains terms and conditions that specify how services are to be provided, and quality and performance standards that must be achieved. Through it, we are accountable to the NSW government for our performance. Our adherence to and performance against the Licence is monitored and reviewed by the Independent Pricing and Regulatory Tribunal (IPART).

This Compliance and Performance Report provides detailed information on our performance during 2020-21 with respect to prescribed clauses of the Operating Licence and in accordance with the associated Reporting Manual.^{3,4}

The contents of this report are as follows:

- **Chapter 2** The water quality performance of our drinking water and recycled water systems. We also report our performance against the minimum standards in our Operating Licence for water pressure, water continuity and wastewater overflows system performance.
- **Chapter 3** Our methodology for calculating system yield. We now report on water conservation and efficiency in a separate report Hunter Water's annual Water Conservation Report
- Chapter 4 Performance of our asset, environmental and quality management systems
- Chapter 5 Performance against the customer and stakeholder clauses in our Operating Licence
- Chapter 6 A glossary of technical terms

³ NSW Government 2017, Hunter Water Operating Licence 2017-2022.

⁴ NSW Government 2017, Hunter Water Operating Licence Reporting Manual 2017-2022.

2 SUPPLY SERVICES AND PERFORMANCE STANDARDS

2.1 Drinking water

2.1.1 Overview of drinking water supply systems

Hunter Water supplies high quality drinking water to more than half a million people in the Lower Hunter region of New South Wales: in the local government areas of Newcastle, Lake Macquarie, Maitland, Cessnock, Port Stephens, Dungog and small parts of Singleton.

As required by the Operating Licence our drinking water systems are managed in accordance with the Drinking Water Quality Management System (DWQMS), complemented by our ISO 9001 Quality Management System. Our DWQMS is consistent with the Australian Drinking Water Guidelines 2011 (ADWG) framework for management of drinking water quality.⁵ The framework is based on the application of multiple barriers – preventive measures at all steps in the drinking water system – to ensure that consistently safe drinking water is supplied.

Drinking water systems consist of:

Catchments

Water is collected in the natural landscape by creeks, rivers, and groundwater systems. Water quality in our catchments is protected by regulation that controls the activities that are allowed within them.⁶ We also work closely with the community and stakeholders on land management and development to ensure it is undertaken in a manner appropriate for a drinking water catchment. Figure 1 shows the locations of our drinking water catchments.

• Storages

Water is stored in dams and groundwater sandbeds (aquifers) before we treat it to drinking standards. The drinking water storages that we own are: Chichester Dam, Grahamstown Dam, Tomago Sandbeds and Anna Bay Sandbeds. We also source some water from the Paterson River (via Lostock Dam, which is owned by WaterNSW) and the Allyn River. The locations of our storages are shown in Figure 1 and capacities are provided in Table 1.

• Water treatment plants

We operate six water treatment plants (WTPs) that treat water to a quality suitable to drink safely. These water treatment plants are Dungog WTP, Grahamstown WTP, Lemon Tree Passage WTP, Anna Bay WTP, Nelson Bay WTP, and Gresford WTP. Figure 1 shows the locations of our WTPs.

• Water supply systems

A closed distribution network transports and stores the water we supply. All clear water tanks and storage reservoirs within the distribution system are fully covered and regular inspections are undertaken to ensure we maintain the integrity of the system. Security measures are in place to prevent unauthorised access to water storage facilities. We undertake maintenance and construction activities in accordance with procedures designed to ensure protection of drinking water quality. We have backflow prevention measures in place to minimise the likelihood of backflow of potentially contaminated water from customers' properties into the water supply system. Figure 2 shows the water supply systems. We describe these further in this chapter.

We also supply and receive some drinking water from outside of our area of operations. We supply a small volume of treated water to MidCoast Council in Karuah (4.3 ML in 2020-21) and can also supply and receive bulk treated water from the Central Coast Council area.

During 2020-21, we supplied 2,356.8 ML of water to the Central Coast and received 530 ML from Central Coast Council's water supply system. Central Coast Council maintain a quality assurance program for their water supply systems under the *NSW Public Health Regulation 2012*. We also provided small volumes of

⁵ National Health and Medical Research Council, 2016, Australian Drinking Water Guidelines 2011, – updated Mar 2021

⁶ Hunter Water Regulation 2015, Part 2 – Special Areas.

water to private network operators within the Hunter Water area of operations, including 49 ML to Cooranbong Water, 90.7 ML to Huntlee Water, and 1,359 ML to Kooragang Water.



Figure 1 - Hunter Water's catchments, storages, and water treatment plants

Source: Hunter Water

Table 1 - Capacity of Hunter Water's water storages

Water Source	Maximum Capacity (ML)
Chichester Dam	18,356
Grahamstown Dam	182,305
Tomago Sandbeds	54,000
Anna Bay Sandbeds	14,537
Total storage	269,198



Figure 2 - Hunter Water's drinking water supply systems

Source: Hunter Water

2.1.2 Performance at critical control points

Where practical, we continuously monitor water quality parameters at Critical Control Points (CCPs) monitored using a supervisory control and data acquisition (SCADA) system. Operational limits for CCPs are set at levels that are more stringent than the critical limit. Using SCADA, alarm limits are set so that we can take corrective action before the critical limit is reached.

Exceedance of the critical limit indicates a risk of unacceptable water quality being supplied to customers. If a critical limit is exceeded, an investigation is undertaken and any necessary corrective action(s) are implemented. To minimise the likelihood of exceeding critical limits, we have implemented automatic shutdowns for key water quality parameters at all WTPs.

The performance review is applicable to Hunter Water's CCPs in place during the reporting period. Hunter Water has implemented a revised primary disinfection CCP at each WTP, including revised critical limits for

Chlorine Contact Time (CT) and pH, as agreed with NSW Health. We adopted the revised disinfection CCP from 31 March 2021 for all WTPs except Anna Bay WTP, which we adopted on 30 June 2021.

An outline of each of our water supply zones and performance at CCPs during 2020-21 is set out below. An exceedance of a CCP critical limit does not necessarily indicate that unsafe water quality was supplied to customers, rather it means that the risk threshold was exceeded and a corrective response was required. A brief explanation of each of the water treatment processes referenced in this section is included in the Glossary.

Dungog water supply system

We treat water from Chichester Dam at Dungog WTP. Dungog WTP is a direct filtration plant with a maximum capacity of 90 ML/day. Treatment processes at the plant are:

- raw water chlorination
- powdered activated carbon (PAC) dosing (event-based)
- coagulation / flocculation
- filtration
- pH correction
- disinfection
- fluoridation

The majority of water from the Dungog WTP is fed by gravity trunk main to the Cessnock, Maitland and Newcastle areas. We re-chlorinate water supplied to Maitland and Cessnock at the outlet of Four Mile Creek Reservoir. Water from the Chichester Trunk Gravity Main (CTGM) also gravitates to the Newcastle and Lake Macquarie areas (Grahamstown water supply zone), where it blends with water supplied from Grahamstown WTP. The Dungog water supply system supplies an estimated permanent population of 159,000 people. **Table 2** shows the performance at CCPs within the Dungog system.

Table 2 - Dungog water supply system: CCPs performance 2020-21

Critical control point	Critical limit	Compliant
Dungog WTP coagulation and filtration	Individual filters. Filtered water turbidity must not exceed 0.5 NTU for > 15 consecutive minutes at individual filter outlets	\checkmark
Dungog WTP post- filtration disinfection	Disinfection prior to first customer (Chlorine Contact Time (CT) must not be less than 15 min.mg/L) ^a	\checkmark
	pH at clear water tank outlet must not be less than 6 or greater than 9 for > 15 consecutive minutes	\checkmark
	Free chlorine residual at clear water tank outlet must not exceed 4.5 mg/L for > 15 minutes	\checkmark
Dungog WTP fluoridation	Fluoride concentration at clear water tank outlet must not exceed 1.5 mg/L	\checkmark
Four Mile Creek reservoir chlorinator	Free chlorine residual at water main re-chlorination facilities must not exceed 4.5 mg/L for > 15 consecutive minutes	✓

Notes:

 a) Chlorine Contact time (CT) is calculated using chlorine, flow and Clear Water Tank level data. A surrogate limit of 0.2mg/L free chlorine at the Clear Water Tank outlet applies. A Chlorine Contact Time (CT) critical limit of 4 min.mg/L was in place until 30 March 2021.

Grahamstown water supply system

We treat water from Grahamstown Dam and the Tomago Sandbeds at Grahamstown WTP. The plant has a maximum capacity of 266 ML/day and includes the following treatment processes:

- PAC dosing (event-based)
- aeration (Tomago Sandbeds water only, see below)
- coagulation / flocculation
- sedimentation
- filtration
- pH correction
- disinfection
- fluoridation

We pump treated water from Grahamstown WTP to Newcastle and Lake Macquarie, as well as Medowie, Stockton and Kooragang Island. We re-chlorinate the water at four locations within the Newcastle and Lake Macquarie distribution system to improve the chlorine residual to minimise water quality risk within the distribution system. We pump water from this supply zone to the Tomaree Peninsula to form part of the supply to Port Stephens. The Grahamstown water supply system supplies an estimated permanent population of 406,000 people. **Table 3** summarises performance at CCPs within the water supply system.

Table 3 - Grahamstown water supply system: CCPs performance 2020-21

Critical Control Point	Critical Limit	Compliant
Grahamstown WTP coagulation and filtration	Filtered water turbidity must not exceed 0.5 NTU for > 15 consecutive minutes at individual filter outlets	\checkmark
Grahamstown WTP and mains disinfection	Disinfection prior to first customer (Chlorine Contact Time (CT) must not be less than 15 min.mg/L) ^a	✓
	pH at clear water tank outlet must not be less than 6 or greater than 9 for > 15 consecutive minutes	\checkmark
	Free chlorine residual post re-chlorination must not exceed 4.5 mg/L for > 15 consecutive minutes	\checkmark
Grahamstown WTP fluoridation	Fluoride concentration at clear water tank outlet must not exceed 1.5 mg/L	\checkmark
Cardiff South Chlorinator	Free chlorine residual at water mains re-chlorination facilities must not exceed 4.5 mg/L for > 15 consecutive minutes	√
Elermore Vale Chlorinator	Free chlorine residual at water mains re-chlorination facilities must not exceed 4.5 mg/L for > 15 consecutive minutes	✓
North Lambton Chlorinator	Free chlorine residual at water mains re-chlorination facilities must not exceed 4.5 mg/L for > 15 consecutive minutes	✓
Toronto Chlorinator	Free chlorine residual at water mains re-chlorination facilities must not exceed 4.5 mg/L for > 15 consecutive minutes	×p

Notes:

 a) Chlorine Contact Time (CT) is calculated using chlorine, flow and Clear Water Tank level data. A surrogate limit of 0.7mg/L free chlorine at the Clear Water Tank outlet applies. A Chlorine Contact Time (CT) critical limit of 4 min.mg/L was in place until 30 March 2021.

b) Free chlorine residual recorded at Toronto Bypass Chlorinator exceeded 4.5 mg/L for > 15 minutes on 1 and 2 November 2020. We notified NSW Health and managed the incident in accordance with incident management protocols. Investigation confirmed that a small volume of water was affected and the result was not indicative of the water supplied to customers due to the small volume and dilution within the system. Sampling and analysis confirmed that the water was safe to consume and no customer impacts identified.

Lemon Tree Passage water supply system

We treat water from the Tomago Sandbeds at Lemon Tree Passage WTP. The plant has a maximum capacity of 5 ML/day and includes the following processes:

- aeration
- coagulation / flocculation
- two stage filtration
- pH correction
- disinfection
- fluoridation

We pump treated water from Lemon Tree Passage WTP to Tanilba Bay, Mallabula, Lemon Tree Passage, Swan Bay, and Karuah. This system supplies an estimated permanent population of 9,300 people.

Performance at CCPs within the water supply system is summarised in Table 4.

Table 4 - Lemon Tree Passage water supply system: CCPs performance 2020-21

Critical Control Point	Critical Limit	Compliant
Lemon Tree Passage WTP coagulation and filtration	Filtered water turbidity must not exceed 1 NTU for > 15 consecutive minutes at secondary filter outlets	~
Lemon Tree Passage WTP disinfection	Disinfection prior to first customer (Chlorine Contact Time (CT) must not be less than 15 min.mg/L) ^a	✓
	pH at clear water tank outlet must not be less than 6 or greater than 9 for > 15 consecutive minutes	~
	Free chlorine residual at the clear water tank outlet must not exceed 4.5 mg/L for > 15 consecutive minutes	√
Lemon Tree Passage WTP fluoridation	Fluoride concentration at clear water tank outlet must not exceed 1.5 mg/L	\checkmark

Notes:

 a) Chlorine Contact Time (CT) is calculated using chlorine, flow and Clear Water Tank level data. A surrogate limit of 0.4mg/L free chlorine at the Clear Water Tank outlet applies. A Chlorine Contact Time (CT) critical limit of 4 min.mg/L was in place until 30 March 2021.

Anna Bay and Nelson Bay water supply system

The Anna Bay Sandbeds are located within the protected catchment of the Tomaree National Park and groundwater is naturally filtered within the sandbeds. We extract the water using a network of production bores and treat the water at Anna Bay and Nelson Bay WTPs.

Each WTP can supply a maximum flow of approximately 12 ML/day using the following processes:

- aeration
- pH correction
- disinfection
- fluoridation

Water from the WTPs supplies the Tomaree Peninsula including Anna Bay, Boat Harbour, Salamander Bay, Nelson Bay, Fingal Bay, Shoal Bay, Corlette and Soldiers Point. The system supplies an estimated permanent population of 34,000 people. Water from Grahamstown WTP can also supplement this water supply system. **Table 5** summarises the performance at CCPs within the water supply system.

Table 5 - Anna Bav/	Nelson Bav water si	upply system: CCPs	performance 2020-21

Critical Control Point	Critical limits	Compliant
Anna Bay WTP disinfection	Disinfection prior to first customer (Chlorine Contact Time (CT) must not be less than 15 min.mg/L) ^a	√
	Free chlorine concentration at clear water tank outlet must not exceed 4.5 mg/L for > 15 minutes	~
	pH at clear water tank outlet must not be less than 6 or greater than 9 for > 15 consecutive minutes	\checkmark
	Turbidity at clear water tank outlet must not exceed 5 NTU for > 5 consecutive minutes	\checkmark
Nelson Bay WTP disinfection	Disinfection prior to first customer (Chlorine Contact Time must be less than 15 min.mg/L) ^a	\checkmark
	pH at the clear water tank inlet must not be less than 6 or greater than 9 for > 15 consecutive minutes	✓
	Free chlorine residual at clear water tank outlet must not exceed 4.5 mg/L for > 15 consecutive minutes	\checkmark
	Turbidity at clear water tank outlet must not exceed 5 NTU for > 5 consecutive minutes	\checkmark
Anna Bay/Nelson Bay WTP fluoridation	Fluoride concentration at clear water tank outlet must not exceed 1.5 mg/L	\checkmark

Notes:

a) Chlorine Contact Time (CT) is calculated using chlorine, flow and Clear Water Tank level data. A surrogate limit of 0.8 mg/L and 0.3 mg/L free chlorine applies at the Clear Water Tank outlets, at Anna Bay WTP and Nelson Bay WTP, respectively. A Chlorine Contact Time (CT) critical limit of 4 min.mg/L was in place until 30 March 2021 for Nelson Bay WTP and 29 June 2021 for Anna Bay WTP.

Gresford water supply system

We extract water from the Allyn and Paterson Rivers at Gresford, and treat it at Gresford WTP. The plant has a maximum capacity of 0.5 ML/day and includes the following processes:

- membrane microfiltration
- disinfection

Performance at CCPs within the water supply system is summarised in Table 6.

Table 6 - Gresford water supply system: CCPs performance 2020-21

Critical Control Point	Critical Limit	Compliant
Gresford WTP microfiltration	Filtered water turbidity must not exceed 0.5 NTU for > 15 consecutive minutes at clear water tank inlet	\checkmark
	Calculated pressure decay rate across membranes must not exceed 10 kPA/min	\checkmark
Gresford WTP disinfection	Disinfection prior to first customer (Chlorine Contact Time (CT) must not be less than 15 min.mg/L) ^a	\checkmark
	pH at the clear water tank inlet must not be less than 6 or greater than 9 for > 15 consecutive minutes	\checkmark
	Free chlorine concentration at the clear water tank outlet must not exceed 4.5 mg/L for > 15 minutes	\checkmark

Notes:

 a) Chlorine Contact Time (CT) is calculated using chlorine, flow and Clear Water Tank level data. A surrogate limit of 0.2 mg/L free chlorine at the Clear Water Tank outlet applies. A Chlorine Contact Time (CT) critical limit of 4 min.mg/L was in place until 30 March 2021.

2.1.3 Verification monitoring

The ADWG Drinking Water Quality Framework emphasises a preventive approach, including operational monitoring and process control, combined with verification monitoring to confirm that preventive measures have been effective: ⁷

Verification of drinking water quality provides an important link back to the operation of the water supply system and additional assurance that the preventive measures and treatment barriers in the water supply system have worked, and are working, to supply safe drinking water.

Verification monitoring is based on results of water quality samples that are representative of water supplied to customers' taps. Water quality standards specified in the ADWG are considered safe for people to drink over an entire lifetime. Therefore, licence performance is a statistical analysis of results, based on percentage compliance rather than absolute figures. In 2020-21, we achieved full compliance with regulatory requirements for verification monitoring. The performance and mean results of analysis for key microbiological and physical / chemical parameters are shown in Table 7, Table 8 and Table 9. Descriptions of the parameters are provided in glossary to this report.

⁷ National Health and Medical Research Council, 2016, Australian Drinking Water Guidelines 2011– updated Mar 2021, Element five, Section 9.5, p. 140.

Table 7 - Microbiological water quality 2020-21

Parameter	Health / Aesthetic	Measure of Compliance	Performance Standard	Whole of Hunter Water 12 Months Samples	Compliant
E.coli	Health	% of samples containing < 1 Most Probable Number (MPN) per 100 mL	>98% of samples shall contain <1 MPN per 100 mL	99.83% of samples contained < 1 MPN per 100 mL	~

Table 8 - Key health physical / chemical analytes 2020-21

Analyte	Units of Measure	ADWG health guideline value	Performance standard (assessment over 12 months)	95th Percentile over the last 12 months	Compliant
Fluoride	mg/L	1.5		1.07	\checkmark
Chlorine	mg/L	5	OEth porceptile of test	1.51	\checkmark
Copper	mg/L	2	results less than	0.015	✓
Lead	mg/L	0.01	respective ADWG health	0.001	\checkmark
Manganese	mg/L	0.5		0.009	\checkmark
Trihalomethanes	mg/L	0.25		0.145	\checkmark

Table 9 - Key aesthetic physical / chemical analytes 2020-21

Analyte	Units of Measure	ADWG aesthetic guideline value	Performance standard (assessment over 12 months)	12 month average result	Compliant
Iron	mg/L	0.3	Average of test results	0.021	\checkmark
Aluminium	mg/L	0.2	ADWG aesthetic	0.039	✓
Copper	mg/L	1	guideline value	0.006	\checkmark
Zinc	mg/L	3		0.004	✓
Turbidity	NTU	5		0.2	✓
True colour	HU	15		5	✓
рН	pH units	6.5-9.2	Average of results between 6.5 and 9.2	7.58	\checkmark

2.1.4 Drinking water quality management activities and programs in 2020-21

Improvements to drinking water quality management undertaken or underway during 2020-21 are shown in Table 10. Water quality objectives are aligned to the actions of the ADWG Framework and the strategic objective to maintain the safety of drinking water.

ADW sub-e	G framework element	Water quality objective	Activity / Program	Results / Outcomes
2.3	Hazard Identification and Risk Assessment	Identify and document hazards, sources, and hazardous events.	Grahamstown WTP risk assessment.	Risk assessment conducted and risk management priorities developed.
2.3	Hazard Identification and Risk Assessment	Identify and document hazards, sources, and hazardous events.	Catchment to tap risk assessment guideline.	New guideline applied for recent risk assessments for Gresford WTP and Lemon Tree Passage WTP.
2.3	Hazard Identification and Risk Assessment	Identify and document hazards, sources, and hazardous events.	Drinking Water Quality Management support and guidance for drought response initiatives.	Liaised with NSW Health on key projects including Belmont WTP Drought Response Desalination, Tomago Secondary Aquifer, re-instating retired bore stations and associated coated media manganese removal process.
3.1	Preventive Measures and Multiple Barriers	Seaham weir pool water quality.	Seaham weir pool environment rehabilitation project.	Commenced project planning for Seaham weir pool environment rehabilitation project.
3.1	Preventive Measures and Multiple Barriers	Hygienic water main repair and construction.	Continue implementation of improved hygienic water main repair and construction standards.	Rollout of training program commenced. Web-based system developed to demonstrate compliance.
3.1	Preventive Measures and Multiple Barriers	Improved chlorine residuals across the network.	Disinfection Optimisation Strategy (DOS) Stage 1B.	Design completed and in delivery phase.
3.1	Preventive Measures and Multiple Barriers	Improved barriers to pathogen contamination.	UV upgrade at Grahamstown WTP.	Concept design prepared and in finalisation stages before progressing to next project phase.
3.2	Critical Control Points	Improved monitoring of disinfection critical control points.	Implement revised disinfection CCP at all WTPs.	Revised disinfection CCP has been implemented, as agreed with NSW Health.
8	Community Involvement and Awareness	Promote awareness of drinking water quality issues, two-way communication.	Catchment Management Schools Engagement Project.	Project delivered.
9.1	Investigative Studies and Research Monitoring	Increase understanding of emerging risks to the water supply system.	Investigations to characterise risk of emerging contaminants.	A prioritised list of contaminants of emerging concern (CECs) for the Grahamstown catchment, have been identified based on the land uses in the catchment.
10.1	Management of Documentation and Records	Document information pertinent to all aspects of drinking water quality management.	DWQMS manual update.	The DWQMS manual was updated.

Table 10 - Drinking water quality management activities and programs 2020-21

2.1.5 Proposed drinking water quality management activities and programs

Table 11 outlines proposed activities to improve drinking water quality management in the future. Water quality objectives are aligned to the actions of the ADWG Framework and the strategic objective to maintain the safety of drinking water.

ADW sub-e	G framework lement	Water quality objective	Activity / Program	Scope / Expected Outcomes / Timeframe
2.3	Hazard Identification and Risk Assessment	Identify and document hazards, sources and hazardous events.	Lemon Tree Passage and Gresford WTP risk assessment.	Finalisation of risk assessment update and risk management priorities developed. Timetable – 2021- 22.
2.3	Hazard Identification and Risk Assessment	Identify and document hazards, sources and hazardous events.	Distribution network risk assessment	Review risk assessment according to schedule. Timetable – 2021-22.
2.3	Hazard Identification and Risk Assessment	Identify and document hazards, sources and hazardous events.	Update catchment to tap risk assessment guideline.	Guideline updated with information around water quality data to be reviewed to assess the risk of hazards and hazardous events. Timetable – 2021-22.
2.3	Hazard Identification and Risk Assessment	ldentify and manage existing, new and emerging risks.	Naeglaria Fowleri Strategy.	Continue to implement strategy. Timetable – ongoing.
3.1	Preventive Measures and Multiple Barriers	Water quality in Tomago catchment.	Tomago PFAS Operating Strategy.	Continue to implement strategy. Timetable – ongoing.
3.1	Preventive Measures and Multiple Barriers	Maintain effective secondary disinfection barrier.	Maintain effective chlorine residual throughout the network.	Free chlorine residual >0.2mg/L to at least 90% of customers (rolling 12 month). Timetable – ongoing.
3.1	Preventive Measures and Multiple Barriers	Improved barriers to pathogen contamination.	UV upgrade at Grahamstown WTP.	Project progressed according to program. Timetable – as per delivery program.
3.1	Preventive Measures and Multiple Barriers	Improved barriers to pathogen contamination.	Gresford water quality upgrade.	Project progressed according to program. Timetable – as per delivery program.
3.1	Preventive Measures and Multiple Barriers	Improved chlorine residuals across the network.	Disinfection Optimisation Strategy (DOS) Stage 1B.	Progress project delivery. Timetable – as per delivery program.
6.2	Incident and Emergency Response Protocols	Recording of water quality incidents.	Improve water quality incident management documentation.	Improved documentation to assist with recording water quality incidents as required by the Corporate Emergency Management Plan. Timetable – 2021-22.
10.1	Management of Documentation and Records	Document information pertinent to all aspects of drinking water quality management.	DWQMS manual update.	Manual updated with information around the location of documents and records related to the DWQMS. Timetable – 2021- 22.
11.2	Internal auditing	Maintain reservoir integrity.	Distribution network reservoir inspections for online reservoirs	At least 95% of inspections completed by scheduled due date. Timetable – ongoing.

Table 11 - Proposed drinking water quality management activities and programs

ADWG	framework	Water quality	Activity / Program	Scope / Expected
sub-el	ement	objective		Outcomes / Timeframe
11.2	Internal auditing	Ensure that the system is being implemented correctly and is effective.	Watermain repair hygiene compliance monitoring.	Compliance monitoring. Timetable – ongoing.

2.1.6 Continual improvement of the DWQMS in 2020-21

Senior executives at Hunter Water provide support and oversight focused on management and continuous improvement of our drinking water systems. We document, prioritise, and track drinking water quality improvement initiatives in the drinking water quality improvement plan (DWQIP). Example improvements undertaken in 2020/21 include:

- Review of the Drinking Water Quality Policy, which states our commitment to providing high quality continuously safe drinking water
- Implementation of revised disinfection CCP at all WTPs as agreed with NSW Health
- New 'catchment-to-tap' risk assessment guideline developed
- Hygienic water main repair rollout of training program
- Grahamstown WTP risk assessment

The water quality committee is responsible for ensuring the effective management and implementation of Hunter Water's Drinking Water Quality Management System (DWQMS) in compliance with Hunter Water's Operating Licence. The water quality committee meetings consider factors such as: quality and supply issues, audit outcomes, training, and monitoring and reporting. Findings and actions from the water quality meetings are communicated to and reviewed by senior management on an as required basis.

The Executive Management Team (EMT) reviews, endorses and approves the drinking water quality policy, and regularly reviews water quality performance. The EMT reviews findings, results, and reports from IPART's operational audit. We develop action plans to address recommendations and findings, including the allocation of additional resources as required. Key EMT members are involved in quarterly liaison meetings with NSW Health to review the effectiveness of the DWQMS and discuss operational issues.

We ensure resources are dedicated to the development, review, and implementation of the DWQMS through our water quality committee meetings and a dedicated DWQMS coordinator. All Hunter Water management, employees, and contractors involved in the supply of drinking water are responsible for understanding, implementing, maintaining and continuously improving the DWQMS.

2.1.7 Significant changes to the drinking water quality management system

There were no proposed significant changes to the Drinking Water Quality Management System in 2020-21.

In consultation with NSW Health, Hunter Water has implemented the revised disinfection CCP previously agreed with NSW Health and notified to IPART. The revised disinfection CCP includes:

• A revised concept for monitoring and calculating the product of free chlorine residual and contact time (Ct in mg-mins/Litre) as well as a new critical limit based on a Ct of 15 mg-mins/Litre.

2.1.8 Non-conformances with the Drinking Water Quality Management System

There were no major non-conformances with the Drinking Water Quality Management System in 2020-21.

The following minor non-conformance was identified and addressed during 2020-21:

 Operational audit recommendation REC-HWC-2020-01: By 30 June 2021, Hunter Water should ensure that minor water quality incidents are all recorded as required by the Corporate Emergency Management Plan. Key measures put in place include training and awareness of water operations management and reporting of incidents to the water quality committee. Ongoing refinement of incident triggers and procedures planned as improvements.

2.2 Recycled water

Hunter Water manages its recycled water schemes in a way that protects human health, the environment and complies with customer agreements as well as other relevant regulatory requirements. Our 2017-2022 Operating Licence requires us to maintain and implement a system for managing recycled water quality that is consistent with the *Australian Guidelines for Water Recycling 2006* (AGWR). A key component of complying with the AGWR is the implementation of a risk-based management framework, including critical control points (CCPs).

The AGWR requires that we develop Recycled Water Quality Management Plans (RWQMPs) for all recycled water schemes. A RWQMP is a documented system for managing the production and supply of recycled water and consolidates all essential information about the operation and management of the recycled water system.

We have developed RWQMPs for all our recycled water schemes, addressing the 12 elements described in the AGWR. We undertake a rolling review process for our RWQMPs.

In this section of the report, we describe:

- Hunter Water's recycled water schemes
- Performance at CCPs during 2020-21
- The recycled water quality management activities completed during 2020-21
- Proposed future recycled water quality management activities
- Recycled water management continual improvement activities undertaken during 2020-21
- Significant changes to the Recycled Water Quality Management System (RWQMS) in 2020-21
- Any non-conformances with the RWQMS

2.2.1 Overview of recycled water schemes

During 2020-21, Hunter Water's recycled water schemes provided recycled water to external customers from the Branxton, Cessnock, Clarence Town, Dora Creek, Dungog, Edgeworth, Karuah, Kurri Kurri, Morpeth, and Shortland Wastewater Treatment Works (WWTW) and dual reticulation recycled water from the Morpeth and Farley Recycled Water Treatment Plants (RWTP). Table 12 provides the volume of recycled water provided from each source and Figure 3 shows the location of the recycled water schemes.

Recycled water source	Recycled water use	2020-21 reuse volumes (ML)
Branxton WWTW	Branxton Golf Course and The Vintage Golf Course	142.64
Cessnock WWTW	Cessnock Golf Course	67.11
Clarence Town WWTW	Clarence Town Irrigation Scheme	69.72
Dora Creek WWTW	Eraring Power Station	1,080.65
Dungog WWTW	Local farmer	337.20
Edgeworth WWTW	Waratah Golf Course	82.51
Farley RWTP	Gillieston Heights dual reticulation	50.85
Karuah WWTW	Karuah Irrigation Scheme	132.75
Kurri Kurri WWTW	Kurri Kurri Golf Course and Kurri Kurri TAFE	17.34
Shortland WWTW	Kooragang Water	2,900.08
Morpeth WWTW	Easts Golf Course and local farmer	45.09
Morpeth RWTP	Chisholm dual reticulation	22.96
Total		4,948.9 ^a

Table 12 - Hunter Water's recycled water schemes

b) Total excludes use by Hunter Water onsite at WWTW and indirect agricultural reuse.



Figure 3 - Hunter Water's recycled water schemes

2.2.2 Performance of critical control points

The following sections describe performance at CCPs. A brief explanation of each of the wastewater treatment terms referenced is included in the glossary.

Branxton wastewater treatment works

Branxton WWTW receives wastewater from Branxton East, Branxton, and Greta. Influent entering the system is primarily residential (domestic) with only a small volume of trade waste flows from retail outlets, hotels, and small automotive repair garages.

Branxton WWTW includes the following processes:

- screening and grit removal
- bioreactor
- membrane filtration
- chlorination



We supply recycled water from Branxton WWTW to Branxton Golf Course and The Vintage Golf Course. Table 13 shows performance at CCPs within the Branxton WWTW.

Table 13 - Branxton WWTW: recycled water scheme CCPs performance 2020-21

Critical control point	Critical limit	Compliant
Membranes filtration	Turbidity of permeate at each individual membrane train must not exceed 0.5 NTU for > 120 seconds	\checkmark
Chloringtion system	Chlorine contact time must be at least 8.3 min.mg/L	\checkmark
Chlorination system	pH upstream of chlorine contact tank must not exceed 9	✓

Cessnock wastewater treatment works

Cessnock WWTW receives wastewater from the Cessnock local government area. Influent entering the system is primarily residential (domestic). There are also a number of commercial trade waste customers discharging to the system.

Cessnock WWTW includes the following processes:

- screening
- clarification
- trickling filters
- maturation ponds
- dissolved air floatation
- UV disinfection



We supply recycled water from the Cessnock WWTW to the Cessnock Golf Course. Table 14 shows performance at CCPs within the Cessnock WWTW.

Critical contro	l point	Critical limit	Compliant
Lagoon ponding	Flow rate	<280 L/s for more than 60minutes when supplying recycled water to the customer	✓
UV System	UV operation	UV unit must be on when supplying recycled water to the customer	~
		Bypass valve must be closed when supplying recycled water to the customer	\checkmark
	UV calculated dose	>32mJ/cm ² with UV transmissivity at >40% at ADWF of 12ML/d when supplying recycled water to the customer	✓
	UV lamps	Minimum of 30 lamps operating when supplying recycled water to the customer	✓
	UV flow rate	<140L/s when pumping recycled water to the customer	\checkmark

Table 14 - Cessnock WWTW: recycled water scheme CCPs performance 2020-21

Clarence Town wastewater treatment works

Clarence Town WWTW receives wastewater from the township. Influent entering the system is primarily residential (domestic).

Clarence Town WWTW includes the following processes:

- oxidation ponds
- maturation ponds
- effluent storage ponds.



We supply recycled water from the Clarence Town WWTW to an irrigation scheme. Table 15 shows performance at CCPs within the Clarence Town WWTW.

Table 15 - Clarence Town WWTW: recycled water scheme CCPs performance 2020-21

Critical c	ontrol point	Critical limit	Compliant
Lagoon	Flow rate	<252 kL/d when irrigating at the reuse area	× a
ponding	Valve position	V1102 must be closed	✓
		V1100 must be open when irrigating on the reuse area	\checkmark

Notes:

a) A wet weather event resulted in Clarence Town WWTW receiving high flows in late December 2020 and early January 2021. The Critical Control Point (CCP) condition for Clarence Town WWTW is for flow not to exceed 252 kL/day when irrigation is occurring at the reuse area. Due to previous wet days, reuse had not occurred, however, on 2 January 2021, as weather conditions improved at the site, irrigation was turned on, and the inlet flow was monitored. It was noted that when the accumulative inflow had reached 232 kL for the day, irrigation was ceased, however the final accumulative inflow for 2 January 2021 was 280 kL for the 24hrs, resulting in a technical breach of the CCP. No irrigation took place when the flow exceeded the critical control limit. Corrective actions have been investigated to reduce the likelihood of future non-compliance.

Dora Creek wastewater treatment works

Dora Creek WWTW receives wastewater from Bonnells Bay, Silverwater, Morisset Park, Yarrawonga Park, and Sunshine Brightwaters. Influent entering the system is primarily residential (domestic) with a number of trade waste customers also discharging to the treatment plant.

Dora Creek WWTW includes the following processes:

- screening
- grit removal
- bioreactor
- clarification
- effluent storage dam



We supply recycled water from Dora Creek WWTW to the Eraring Power Station. Table 16 shows performance at CCPs within the Dora Creek WWTW.

Table 16 - Dora Creek WWTW: recycled water scheme CCPs performance 2020-21

Critical control point	Critical limit	Compliant
Secondary treatment process	Flow rate < 367 L/s for more than 60 minutes	\checkmark
Effluent balance dam ponding	Flow rate < 734 L/s for more than 60 minutes	\checkmark

Dungog wastewater treatment works

Dungog WWTW receives primarily residential (domestic) influent into the system. During 2020-2021, the WWTW underwent an upgrade to a Membrane Bioreactor (MBR) plant.



The Dungog WWTW includes the following processes:

- screening
- sedimentation
- trickling filters
- sludge digesters
- maturation ponds
- Upgrade during 2020-21: trickling filter replaced with membrane bioreactor (MBR) and the new process also includes UV disinfection.

We supply recycled water from Dungog WWTW to a local farmer. Table 17 shows performance at the CCP within the Dungog WWTW. We have developed new CCP's for the MBR process and these are awaiting finalisation.

Table 17 - Dungog WWTW: recycled water scheme CCP performance 2020-21

Critical control point	Critical limit	Compliant
Effluent reuse pond	Flow rate < 520kL/d for more than 4 days and reuse customer irrigating	× a
Notes:		

a) A wet weather event resulted in high flows being received at Dungog WWTW in February 2021. For the period between 7 and 10 February 2021 flows were >520kL/d with irrigation occurring. However, at the time of high flows the Dungog WWTW process had been upgraded to a Membrane Bioreactor (MBR) with an updated CCP in consultation with NSW Health. At the time of high flows the MBR process satisfied all recycled water quality guideline limits for the scheme including the updated CCP.

Edgeworth wastewater treatment works

Edgeworth WWTW receives wastewater from the Charlestown, Cardiff and Speers Point wastewater catchment area. Influent entering the system consists primarily of residential (domestic) wastewater. There are also a number of commercial and industrial trade waste customers discharging to the system.

Edgeworth WWTW includes the following processes:

- screening
- bioreactor
- clarification
- UV disinfection



We supply recycled water from the Edgeworth WWTW to the Waratah Golf Course. Table 18 shows performance at CCPs within the Edgeworth WWTW.

Critical control point Critical limit		Critical limit	Compliant
Secondary	Flow rate	<873L/s for more than 60 minutes when pumping to customer	\checkmark
Treatment	Aeration monitoring 0 m ³ /h in either tank for more than 8 hours while customer is taking recycled water		\checkmark
UV System UV operation Must be on when reuse custo water		Must be on when reuse customer is being supplied recycled water	\checkmark
	UV lamps	Minimum of 18 lamps per bank operating when supplying recycled water to the customer	✓
	UV calculated dose	Minimum dose 40 mJ/cm ² with UV transmissivity of 40% when reuse customer is being supplied with recycled water	✓
	UV flow rate	<80L/s per unit for 60 minutes when pumping recycled water to the customer	✓
		<160L/s for both units for 60 minutes when pumping recycled water to the customer	✓

Table 18 - Edgeworth WWTW: recycled water scheme CCPs performance 2020-21

Farley recycled water treatment plant

Farley RWTP receives secondary treated effluent from the Farley WWTW.

Farley RWTP includes the following processes:

- membrane filtration
- UV disinfection
- chlorination



We use the treated recycled water from Farley RWYP to supply the dual reticulation scheme at Gillieston Heights. Table 19 shows performance at CCPs within the Farley RWTP.

Table 13 - I alley NWIT . Tecycleu water Scheine COI S performatice 2020-2	Table 19 -	Farley RWTP	recycled water	scheme CCPs	performance 2020-22
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Critical control point		Critical limit	Compliant
Membrane Turbidity Filtration		Membrane permeate turbidity > 0.15 NTU for > 15 consecutive minutes.	\checkmark
	Rate of decay in pressure differential	The membrane integrity test (MIT) result correlated with 4.0 log10 removal of 3 micron particles is > 3.9 kPa per 5 min at a test pressure of 130 kPa.	\checkmark
UV System	Online UV intensity meter and UV	UV adenovirus RED < 65.3 mJ/cm2 for > 15 consecutive minutes.	✓
	Transmissivity (UVT) analyser	UVT is < 40.1% for > 15 consecutive minutes.	\checkmark
Chlorination	Free chlorine concentration (to meet the Ct requirements)	Ct < 22 min•mg/L for > 15 consecutive minutes.	✓
	pH range	pH > 8.5 for > 15 consecutive minutes.	~

Karuah wastewater treatment works

Karuah WWTW receives wastewater from the Karuah township. Influent entering the system is primarily residential (domestic).

Karuah WWTW includes the following processes:

- screening
- bioreactor
- UV disinfection
- effluent storage dam



We supply recycled water from Karuah WWTW to an irrigation scheme. Table 20 shows performance at CCPs within the Karuah WWTW.

Table 20 - Karuah WWTW: recycled water scheme CCPs performance 2020-21

Critical control point		Critical limit	Compliant
Biological treatment	Inlet flow meter	<48.3 L/s for more than 60 minutes when irrigation is occurring	\checkmark
	Aeration control	No aerators available/running during six consecutive IDEA cycles	\checkmark
UV System	UV operation	UV bank must be on when irrigation is occurring	\checkmark
	UV calculated dose	>35mJ/cm2 with a transmissivity of greater than 55% at 44L/s when irrigation is occurring	√
	UV flow rate	<44L/s when irrigation is occurring	✓

Kurri Kurri wastewater treatment works

Kurri Kurri WWTW receives wastewater from the Kurri Kurri catchment area. Influent entering the system is primarily residential (domestic).

Kurri Kurri WWTW includes the following processes:

- screening
- bioreactor
- clarification
- tertiary filtration (dual media)
- UV disinfection



We supply recycled water from the Kurri Kurri WWTW to the Kurri Kurri TAFE and Kurri Kurri golf course. Table 21 shows performance at CCPs within the Kurri Kurri WWTW.

Critical contro	ol point	Critical limit	Compliant
BiologicalInlet flow<172 L/s for mtreatmentmeterrecycled wate		<172 L/s for more than 60 minutes when the golf course is pumping recycled water	\checkmark
	Aeration process	Air flow rate 0 m3/h for no more than 8hrs when pumping to the Golf course or effluent storage ponds	✓
Media filtration	Filter lift flow	<172 L/s for more than 60 minutes when pumping to the golf course o effluent storage ponds	or 🗸
UV System	UV operation	Must not be off for more than 60 minutes when pumping to the golf course or Kurri TAFE storage pond	✓
	UV lamps	At least 18 lamps per bank must be on when pumping to the Golf course or Kurri TAFE storage ponds	\checkmark
	UV calculated dose	>35mJ/cm2 for 60 minutes when pumping to the golf course or Kurri TAFE storage ponds	\checkmark
	UV flow rate	<400L/s when pumping to the golf course or Kurri TAFE storage pond	s √

Morpeth wastewater treatment works

Morpeth WWTW receives wastewater from Morpeth, Metford, Thornton, Tenambit, Ashtonfield, Beresfield, East Maitland and parts of Maitland. Influent entering the system is primarily residential (domestic).

Morpeth WWTW includes the following processes:

- screening
- bioreactor
- clarification
- UV disinfection
- maturation ponds



We supply recycled water from Morpeth WWTW to a local farmer and golf course. Table 22 shows performance at CCPs within the Morpeth WWTW.

Table 22 - Morpeth WWTW: recycled water scheme CCPs performance 2020-21

Critical control p	oint	Critical limit	Compliant
Secondary treatment processes	Biological treatment flow rate	< 500L/s when valve to maturation pond is open	✓
UV System	UV operation	Must be on when valve to the maturation pond is open	\checkmark
	Flow rate through UV	< 500L/s when valve to maturation pond is opened	\checkmark
	UV calculated dose	>32 mJ/cm ² with UV transmissivity at 40%	✓
	UV operation	Must be at least 48 out of 60 lamps when maturation pond valve is open and reuse customer is pumping	\checkmark
Lagoon ponding	Inlet flow rate	<500 L/s when maturation pond valve is opened	✓

Morpeth recycled water treatment plant

Morpeth RWTP receives secondary treated effluent from the Morpeth WWTW. We use the treated recycled water to supply the dual reticulation scheme at Chisholm.

Morpeth RWTP includes the following processes:

- membrane filtration
- UV disinfection
- chlorination



Table 23 shows performance at CCPs within the Morpeth RWTP.

Table 23 - Morpeth RWTP: recycled water scheme CCPs performance 2020-21

Critical control point		Critical limit	Compliant	
Membrane Filtration	Turbidity	Membrane permeate turbidity > 0.15 NTU for > 15 consecutive minutes.	✓	
	Rate of decay in pressure differential	The membrane integrity test (MIT) result correlated with 4.0 log10 removal of 3 micron particles is > 3.9 kPa per 5 min at a test pressure of 130 kPa.	✓	
UV System	Online UV intensity meter and UV	UV adenovirus RED < 65.3 mJ/cm2 for > 15 consecutive minutes.	\checkmark	
	Transmissivity (UVT) analyser	UVT is < 40.1% for > 15 consecutive minutes.	\checkmark	
Chlorination	Free chlorine concentration (to meet the Ct requirements)	Ct < 22 min•mg/L for > 15 consecutive minutes.	✓	
	pH range	pH > 8.5 for > 15 consecutive minutes.	\checkmark	

Shortland wastewater treatment works

The Shortland WWTW serves the communities of Sandgate, Shortland, Birmingham Gardens and Maryland as well as drawing in effluent from the Burwood catchment via a wastewater pumping stations (WWPS) in Newcastle. Influent entering the system is partly residential (domestic).

Shortland WWTW includes the following processes:

- screening
- activated sludge secondary treatment via two intermittently decanted aerated lagoons (IDAL)
- chlorination
- de-chlorination (prior to environmental discharge)

We supply effluent from Shortland WWTW to the Mayfield West Advanced Water Treatment Plant owned by Kooragang Water. The Shortland WWTW does not have CCP requirements as the additional recycled water treatment is undertaken at the advanced water treatment plant.

2.2.3 Recycled water quality management activities and programs 2020-21

Table 24 describes improvements to recycled water quality management undertaken during 2020-21. Recycled water objectives are aligned to the actions of the AGWR Framework and the strategic objective to maintain the safety of recycled water.

AGV s	VR Framework ub-element	Recycled water objective	Activity / Program	Results / Outcomes
2.4	Hazard identification and risk assessment	Undertake a risk assessment.	Identify and document hazards and hazardous events, estimate the level of risk and determine preventive measures.	An updated risk assessment was undertaken on the dual reticulation schemes for the inclusion of the Thornton North area.
6.2	Incident and emergency response protocols	Test incident protocols.	Perform a mock incident.	A mock incident was performed by Veolia on the dual reticulation incident procedures. The incident related to a CCP failure of the recycled water treatment plant at Farley RWTP. The mock incident identified a number of potential improvements including; identification of an incident controller, communication response with NSW Health and Hunter Water.
7.2	Operator, contractor and end user training	Identify training needs.	Update training for CCP response procedures.	Improved training requirements have been identified and a process to update the procedures has been developed.
10.1	Recycled water quality management plans	Documentation of all aspects of recycled water quality management.	Review and update the Corporate RWQMP.	A new corporate management tool has been developed and will allow for improved corporate visibility of recycled water information.
10.1	Recycled water quality management plans	Documentation of all aspects of recycled water quality management.	Complete the recycled water quality management plans for the Dungog WWTW upgrade.	The Dungog WWTW recycled water quality management plan has been updated to include the new treatment process.
12.2	Recycled water quality improvement plans	Ensure the plan is communicated and implemented and that the improvements are monitored for effectiveness.	Complete the recycled water quality improvement plan actions.	The improvement plan is continually communicated and actions progressed as required.

Table 24 - Recycled water activities and programs 2020-21

2.2.4 Proposed recycled water quality management activities and programs

Table 25 outlines proposed measures to improve recycled water quality management in the future. Recycled water objectives are aligned to the actions of the AGWR Framework and the strategic objective to maintain the safety of recycled water.

A	GWR Framework sub-element	Recycled water objective	Activity / program	Scope / expected outcomes / timetable
1.3	Partnerships and engagement of stakeholders	Identify all agencies with responsibilities.	Identify and document hazards and hazardous events, estimate the level of risk and determine preventive measures.	Updated RACI (Responsibility, Accountable, Consulted, Informed) register to clearly identify roles and responsibilities. Timetable – 2021-22
2.4	Hazard identification and risk assessment	Undertake a risk assessment.	Identify and document hazards and hazardous events, estimate the level of risk and determine preventive measures.	Review and update risk assessments. Timetable – ongoing
6.2	Incident and emergency response protocols	Document procedures.	Review current incident management procedures.	Update current procedures to clarify and define the incident management processes. Timetable – 2021-22
7.2	Operator, contractor and end user awareness	Develop communication procedures.	Establish a communication plan for residential recycled water customers.	Communication plans developed and implemented. Timetable – 2021-22
10.1	Recycled water quality management plans	Documentation of all aspects of recycled water quality management.	Update management plans following risk assessments.	Bring together all aspects of recycled water management. Timetable – 2021-22
12.2	Recycled water quality improvement plans	Ensure the plan is communicated and implemented and that the improvements are monitored for effectiveness.	Complete the recycled water quality improvement plan actions.	Successful completion of improvement actions. Timetable – 2021-22

Table 25 - Proposed recycled water activities and programs
2.2.5 Continual improvement in 2020-21

Recycled water quality improvement initiatives are documented in the Recycled Water Quality Improvement Plan (RWQIP) and prioritised and reported as a standing agenda item through monthly recycled water quality meetings involving key internal stakeholders. Example improvements over this period include:

- Review of the Recycled Water Policy, which states our commitment to support and promote the responsible use of recycled water
- development of the Recycled Water Quality Management System Tool
- development of reporting tools to allow for improved strategic monitoring
- engagement and collaboration with NSW Health to develop the public health risk assessment contextualisation categories.

The monthly recycled water quality meetings consider factors such as:

- quality and supply issues
- audit outcomes
- training
- monitoring and reporting.

Findings and actions from the recycled water quality meetings are communicated to and reviewed by senior management on an as required basis.

The EMT reviews findings, results, and reports from IPART's operational audit. We develop action plans to address recommendations and findings, including the allocation of additional resources as required. Key EMT members are involved in quarterly liaison meetings with NSW Health to review the effectiveness of the RWQMS and discuss operational issues.

We ensure resources are dedicated to the development, review, and implementation of the RWQMS through our recycled water quality meetings and a dedicated RWQMS coordinator. All Hunter Water management, employees and contractors involved in the supply of recycled water are responsible for understanding, implementing, maintaining and continuously improving the RWQMS.

2.2.6 Significant changes to the recycled water quality management system

Hunter Water is proposing one new Critical Control Point (CCP) for the supply of recycled water from Dungog Wastewater Treatment Works. The CCP for the scheme is proposed to be the Membrane Filtration process step. Hunter Water liaised with NSW Health in relation to the development of the CCP and updated the Dungog RWQMP. NSW Health is currently reviewing the RWQMP. The CCP is currently in a draft format – we have not implemented it yet – as NSW Health finalises their review.

2.2.7 Non-conformances with the Recycled Water Quality Management System

There were no major non-conformances with the Recycled Water Quality Management System during 2020-21.

We identified the following minor non-conformances during 2020-21:

- Operational audit recommendation **REC-HWC-2020-02**: By October 2021, Hunter Water should ensure that the quality assurance and validation procedures for sampling are documented in the Recycled Water Quality Monitoring Plan. The AWGR (Box 2.10) requires that quality assurance details are in a monitoring plan.
 - Update: We are currently updating the Recycled Water Quality Monitoring Plan to address this recommendation.
- Operational audit recommendation **REC-HWC-2020-03**: By October 2021, Hunter Water should review the manner in which water quality issues are documented and reported so as to ensure that they are managed and closed out in a consistent manner.

- Update: We are currently reviewing the recycled water quality incident documentation to provide consistency between the documents.
- Operational audit recommendation **REC-HWC-2020-04**: Hunter Water should review the effectiveness of the Recycled Water Quality Management Plan at each Integrated Management System Review meeting. This action should be implemented from the next scheduled Integrated Management Review meeting.
 - Update We have scheduled meetings on a quarterly basis and management systems are discussed in this format.
- Operational audit recommendation **REC-HWC-2020-05**: By March 2021, Hunter Water should ensure that the Recycled Water Quality Management System Improvement Plan is monitored and tasks that are 'at risk' are picked up at an appropriate time to action them before the due date.
 - Update We have developed an improvement plan compliance monitoring tool to provide improved oversight of the tasks due for completion.

2.3 System performance standards

The Operating Licence sets the service levels that customers can expect from Hunter Water in three core areas: water pressure, water continuity, and wastewater overflows. We describe performance against licence limits below. We present six-year results for these metrics in Figure 4 to Figure 8.

2.3.1 Water pressure standard

Hunter Water must ensure that no more than 4,800 properties experience a water pressure failure in a financial year.⁸



Figure 4 - Water pressure failures

Note: Data for 2017-18 has been revised (from 2,487) due to an error in reporting, and therefore does not align with data reported in Hunter Water's 2017-18 Compliance and Performance Report.

We met the performance requirement of this standard for 2020-21, with 870 properties experiencing low pressure, which is significantly below the limit of 4,800.

The number of properties affected in 2020-21 was lower than the recent average, however increased slightly from the previous year. This was a result of relaxing water restrictions and a warmer summer, resulting in periods of increased consumption and reduced pressure across our network.

Water pressure failures occur for a range of reasons including:

- Customer water usage during periods of high water demand, which can be seasonal (i.e. higher demands in summer compared to winter), diurnal (peak demand periods in morning and evening) and weather-related (e.g. during periods of extreme hot and dry weather).
- Location of customer properties, including properties that are located close to water network reservoirs and therefore do not have sufficient elevation difference between the property and the reservoir.
- Water network design and configuration, such as older parts of the network that were not designed to current standards or areas where water demand has increased over time with increased development ahead of system upgrades.

⁸ NSW Government, 2017, Hunter Water Corporation Operating Licence 2017-2022, Clause 3.3.1

2.3.2 Water continuity standards

Hunter Water must ensure that in a financial year:9

- 1. No more than 10,000 properties experience an unplanned water interruption that lasts more than 5 continuous hours; and
- 2. No more than 5,000 properties experience 3 or more unplanned water interruptions that each lasts more than 1 hour.



Figure 5 - Unplanned interruptions > 5 hours

We met the performance requirement of the water continuity standard for 2020-21, with 3,828 properties experiencing unplanned water interruptions exceeding five hours compared with the limit of 10,000. Our performance in 2020-21 was the lowest result over the last 6 years. Performance can be quite variable from year to year, with the metric being primarily influenced by water main breaks.

Water main breaks can occur because of asset condition and performance as well as weather conditions. The moderate weather conditions resulted in a more stable soil moisture content, which contributes to reduced frequency of breaks. The number of properties impacted by an unplanned water interruption is also influenced by network configuration. The duration of the unplanned water interruption is affected by the location and complexity of the required repair, resource availability, job prioritisation, and the condition of and access to valves.

⁹ NSW Government, 2017, Hunter Water Corporation Operating Licence 2017-2022, Clause 3.3.2





We recorded 940 properties that experienced 3 or more unplanned outages during 2020-21. The result was below our 5-year average for this measure and well below the limit of 5,000.

The reduction in 2020-21 was primarily due to an overall reduction in the number of water main breaks.

We also manage our performance through water mains replacements. We determine the water mains to replace through analysis of water main failure history and modelling, mitigating the likelihood of repeat events.

2.3.3 Wastewater overflow standard

Hunter Water must ensure that in a financial year:10

- 1. No more than 5,000 properties (other than public properties) experience an uncontrolled wastewater overflow in dry weather.
- 2. No more than 45 properties (other than public properties) experience three or more uncontrolled wastewater overflows in dry weather.



Figure 7 - Wastewater overflows

Note: Minor revisions have been made to data for 2015-16 and 2017-18 due to a reporting error, and therefore do not align with data reported in Hunter Water's 2017-18 Compliance and Performance Report.

Dry weather overflows affecting private properties were the lowest in six years. The number of incidents is significantly lower than last year and is significantly lower than the standard.

Factors influencing dry weather overflows include asset condition, as well as periods of extended dry weather where tree roots enter sewerage mains and cause blockages. Regular wet weather events during the year are likely to have reduced the number of blockages due to tree roots. An increased preventative jetting program may also have contributed to this good result.

¹⁰ NSW Government, 2017, Hunter Water Corporation Operating Licence 2017-2022, Clause 3.3.3

Figure 8 - Multiple wastewater overflows



This indicator measures repeat impact to private properties.

Multiple overflows affecting private properties were the lowest in six years. The number of incidents remains significantly lower than the standard.

Factors influencing repeat overflows include preventative jetting programs, the quality of jetting work, and processes to identify pipes for rehabilitation or repair. An increased preventative jetting program has contributed to this good result.

2.4 Changes to Hunter Water's area of operations

There were no changes to Hunter Water's area of operations in 2020-21.

3 WATER CONSERVATION

This chapter reports on Hunter Water's compliance with clause 2 of the Operating Licence Reporting Manual. ¹¹

3.1 Water conservation

Our Operating Licence Reporting Manual (2017-2022) outlines that until Hunter Water has its new Economic Level of Water Conservation (ELWC) method approved by IPART, it must convey its compliance and performance with the Water Conservation target in this report. Since the ELWC method has now been approved, as per section 2.1.1 of the Reporting Manual, Hunter Water publishes a separate annual Water Conservation Report. This separate report meets the Reporting Manual requirements by detailing:

- Hunter Water's performance against its water conservation work program in 2020-21
- Water conservation strategies, targets, options and activities for the next five financial years
- Any changes to the water conservation activities identified in previous reports
- How Hunter Water's water conservation activities relate to the Lower Hunter Water Security Plan
- Information on water leakage, volume of recycled water sourced and the quantity of Drinking Water drawn by Hunter Water from all sources (GL/year)

3.2 Reliable quantity of water available from existing storages (yield)

The Reporting Manual requires Hunter Water to provide an estimate of the maximum reliable quantity of water that Hunter Water can supply each year from existing water storages based on the yield definition and methodology developed as part of the 2014 Lower Hunter Water Plan (LHWP).

The NSW Department of Planning, Industry and Environment (then Metropolitan Water Directorate) led a whole-of-government approach to developing the Lower Hunter Water Plan, released in April 2014. A key driver for the LHWP was to ensure water security during drought and reliable water supplies to meet the needs of a growing population and business activity.

The modelling that underpins the LHWP decision-making process considers all of the relevant factors that are listed in the Operating Licence, being:

- The capacity of the water storages, and the rates of depletion and recovery of water in the water storages at current rates of consumption;
- Climatic data, trends and projections;
- Supply to and/or from areas outside the Area of Operations; and
- Constraints on extraction of water to the water storages, including those imposed by licences and approvals under the Water Act 1912 (NSW), the Water Management Act 2000 (NSW) and conditions in the relevant water sharing plans.

An important part of the LHWP planning process was to define the level of service standards, such as the maximum acceptable frequency and duration of water restrictions and the risk of reaching critically low storage levels. The maximum amount of water that can be supplied each year without exceeding the level of service standards is referred to as the 'yield'.

Since the release of the 2014 Lower Hunter Water Plan, Hunter Water calculates yield in accordance with the methodology that was developed in the LHWP. This methodology was endorsed through the governance structure of the 2014 LHWP.

¹¹ NSW Government 2017, Hunter Water Operating Licence Reporting Manual 2017-2022, clause 2.1.2.

Current modelling indicates that the Lower Hunter storages can supply an average of 76 billion litres of water each year without exceeding the 2014 LHWP level of service standards. The level of service standards were:

- Frequency of restrictions not to be more than once in 10 years on average
- Duration of restrictions to be not more than 5 per cent of the time on average
- The annual risk of reaching 5% storage not more than 1 in 10,000

Hunter Water is working with DPIE to undertake a major review of the LHWP (now referred to as the Lower Hunter Water Security Plan, or LHWSP) which will include consideration of level of service standards, and the associated system yield. The draft LHWSP was published for community consultation in August 2021. The review is scheduled to be complete in early 2022.

4 ORGANISATIONAL SYSTEMS MANAGEMENT

This chapter provides an overview of the performance of three of our management systems in 2020-21: Asset Management System (AMS), Environmental Management System (EMS) and the Quality Management System (QMS). For each management system, we report on the programs and activities completed during the year and the outcomes of these activities. We also report on proposed future programs and activities, any significant changes made to the systems, and any major non-conformances during 2020-21.

4.1 Asset Management System

4.1.1 Overview of Hunter Water's Asset Management System

Our physical assets comprise water, wastewater, recycled water, and stormwater systems that are important in ensuring delivery of effective, efficient, and high quality services. Given the asset-intensive nature of the organisation, asset management is critical in determining the level of service provided to customers, compliance with regulations that aim to protect the environment and human health, the cost of services and our efficiency and financial performance.

The objective of the asset management system is to ensure that we have in place the framework, processes, procedures, and resources needed to effectively manage physical assets to support the achievement of business objectives.

Our 2017-2022 Operating Licence requires that we maintain and implement an AMS to ensure that our assets continue to fulfil their intended functions. The Operating Licence required us to develop an AMS by 31 December 2017 that is consistent with the Australian Standard AS ISO 55001:2014. We were required to fully implement the AMS by 1 July 2018. We accomplished this, as required, during the 2017-18 year, with external verification of this achievement demonstrated by certification.

Hunter Water was the first urban Australian water authority to be certified to the ISO 55001:2014 (AS/NZS ISO 55001:2014) standard. This asset management system provides the framework to optimally manage asset lifecycles to achieve the agreed outcomes for customers, the environment, and the community.

ISO 55001:2014 describes an asset as:

"an item, thing or entity that has potential or actual value to an organisation" and that: "asset management is the coordinated activity of an organisation to realise the value from its assets".

Effective asset management is essential to providing services in the most cost-effective manner and demonstrating this to customers, regulators and other stakeholders. The organisational benefits of asset management include:

- improved governance and accountability
- enhanced service management and customer satisfaction
- improved risk management
- improved financial efficiency and affordability for customers
- sustainable creation and operation of assets

The asset management system is one of five certified management systems within Hunter Water's overall integrated management system, along with safety, environmental, quality and information security. The key elements of ISO 55001 are:

- organisational context and leadership
- planning
- operation
- performance evaluation

• improvement

Both our Asset Management Policy and Strategic Asset Management Plan guide our asset management system. These strategic plans provide guidance on our asset management principles to:

- enable the sustainable growth of the region
- provide safe, high quality and affordable services to the community
- provide a resilient water supply that withstands drought and enables growth
- take a responsible and sustainable approach to protecting the environment and public health
- seek innovative solutions and challenge traditional methodologies across the asset life cycle
- understand customer, consumer and community needs and expectations
- comply with all legislative and regulatory requirements
- minimise customer prices and ensure financial sustainability
- maximise investment grade credit rating
- ensure we have a workforce that embraces learning, innovation and change

The scope of our asset management system incorporates both the physical assets and asset lifecycle processes required to provide water, wastewater, recycled water and stormwater drainage services. The following assets are covered by the asset management system: raw water, treatment, water network, wastewater network, recycled water, stormwater, electrical, and telemetry and SCADA.

4.1.2 Asset management activities and programs, 2020-21

During 2020-21, we successfully completed an ISO 55001:2014 surveillance audit of our certified asset management system. In addition, routine internal auditing for treatment operations maintenance activities is ongoing.

Prior to Hunter Water achieving certification, we have historically implemented asset management activities and have been involved in both water industry assessments (Aquamark and WSAA) and broader asset management industry learnings (Australian Asset Management Council). However, the ISO 55001 transition required movement beyond technical lifecycle activities to a management system approach that involves strategic alignment, document control, competency, communication and awareness.

Therefore, the asset management system initiatives undertaken in 2020-21 include a combination of improved management system, governance and system processes, and procedures. Table 26 describes the key activities and the results/outcomes of these activities.

AMS Initiative	Activity / Program	Results / Outcomes
Asset management	AMS surveillance audit	During 2020-21, we successfully completed an ISO 55001:2014 surveillance audit of our asset management system.
system	IPART Operating licence audit	During 2020-21, we successfully completed the annual IPART Operating Licence audit of our asset management system.
	Asset management leadership	Asset management system review is ongoing by Executive Managers, in which the strategic elements of the AMS are evaluated and improvement initiatives assessed and implemented.
		In addition, the asset management steering committee (comprised of Group Managers) has been maintained and continues to review key areas for improvement at a technical level.
	Strategic directions	Investment priorities clearly link to strategic cases, which are in turn aligned to the drivers set out in our IPART price submission.
	Critical assets program	Hunter Water continued to implement improvements in managing critical assets including updating our Standard, continued categorisation of equipment criticality, development of asset class plans for fatal assets (Fatal Asset Strategy) and development of a Dams Safety Management Manual.
	Capital portfolio	Further refinement of the Capital Portfolio Dashboard.
	Asset management dashboards	Hunter Water has developed various dashboards to improve the monitoring of asset performance against Operating Licence requirements and to assist improvements to planning of maintenance activities.
	Technical change	Technical change management is ongoing to effectively manage risks.
	Enterprise risk management	The AMS has ongoing review and incorporates updated risk appetite statements for the nominated risk profiles and objectives within its approach to asset risk management.
	Stakeholder & community engagement	We are continuing to innovate in our approach to stakeholder, customer and community engagement, with a suite of initiatives. This includes the Love Water program. These initiatives are integrated into the AMS through asset planning/creation and managing operational community and customer impacts.
	Awareness and training	We have revised and updated our asset management awareness and training, which is undertaken through the employee induction process, as well as through staff and contractor training.
	AMS workflow management	Improvements to how AMS non-conformities are managed and aligned to the Integrated Management System (IMS) were completed.
	AMS benchmarking	Hunter Water completed the 5-yearly Water Services Association of Australia (WSAA) asset management benchmarking initiative.
	Dams safety regulations audit	A 'transitional' audit was conducted by the Regulator, Dams Safety NSW, to assess Hunter Water's progress in transitioning to the new Dams Safety Regulations. Focus has been on the development of a Dams Safety Management System, along with continued improvements to emergency and operation and maintenance plans.
	Dams safety planning	The Grahamstown Dam Safety Emergency plan was practised in a desktop exercise in December 2020, with subsequent exercises for all dams scheduled within the Ellipse system. Under the Regulation, declared dams are required to have classroom exercises at least every 3 years and practical exercises involving external stakeholders at least every 5 years.
	Civil maintenance system application upgrade	Hunter Water's Civil Maintenance IT platform is in the process of an upgrade to ensure ongoing reliability and successful linkage to a wider hardware/software information technology services initiative ('Field Service Model (FSM) program').
	Asset Standards	Continuous improvement of standard technical specifications for: SCADA and automation equipment, lifting equipment, pressure equipment,

Table 26: AMS - Activities and programs completed in 2020-21

		chemical storage and delivery systems, work as constructed information, drinking water quality pipeline installations.
	Asset Standards for CMMS (Ellipse)	Reviewed asset information standards in preparation for introduction of the FSM.
Asset planning	Water resilience program	We are improving our planning for water security by expanding the planning philosophy to incorporate adaptive planning, scenario planning, systems thinking and opportunity thinking principles related to water conservation, integrated water cycle management and water source augmentations.
	Sustainable wastewater	We are expanding our traditional wastewater planning to consider medium and long-term opportunities for potential waste to energy solutions, improved biosolids management, recycled water systems and carbon neutrality.
	Climate change adaptation planning	Further development of Climate Change Adaptation risk management and vulnerability planning was progressed.
	Growth plan	Our growth plan is updated annually to reflect the latest connection growth information and development forecasts ensuring that developers, planners and the broader community can reference up-to-date information.
	Climate adjusted demand forecast	We are implementing the updated climate-adjusted demand forecasting to our demand modelling and projections.
	Borefields (groundwater source) management plan	A comprehensive review of our borefields assets (Groundwater Source) was completed, and the Asset Management Plan was updated to reflect lessons learnt following the 2019-20 drought period. This plan includes various activities and preventive maintenance works required to be undertaken to ensure service requirements are able to be met and is being used to support decision-making on future investments for asset renewal.
	AMS internal audit	The asset management planning program has been updated to include a periodic implementation review, where Hunter Water checks the alignment between the Asset Management Plans and the maintenance schedules, and other implementation actions of the plan.
	Asset class plans	Developed or reviewed asset management plans for Fatal Mechanical Assets, Low Voltage Assets, Structural Integrity and Fall Prevention, and Borefields.
Investment management	Strategic planning	Continued implementation of the strategic cases and program business cases, including the use of Investment Logic Maps.
	Investment management	Further development of our program business cases as part of the 2020-24 Price Path.
Asset creation	Resource strategy	The project and contract management forward program is supported by a resource strategy which involves engagement of a program and project management support contract.
	Asset Solutions	Hunter Water's Asset Solutions Group continues to provide support capacity to deliver the capital investment portfolio and improve capability across the business.
	Capital portfolio	Reviewed and prioritised our capital portfolio to meet our combined Towards 2024 Strategy and asset management objectives.

4.1.3 Proposed asset management activities and programs

We will continue to review and improve our asset management system to meet defined asset management objectives. The AMS initiatives planned to be undertaken through 2021-22 include a combination of improved management system governance, processes, and procedures. The key initiatives are described in Table 27.

AMS Initiative	Program	Results / Outcomes	Timetable
Asset management system	Asset management plans	Continue development, rolling review, update and consolidation of our asset management plans including facility plans and asset class strategies, based on asset criticality and in accordance with Hunter Water's document control system.	Ongoing
	Asset Management System Competency Development	Further develop asset management competency definitions and training requirements to ensure that staff possess the various essential skills and competencies in each workplace environment ensuring high levels of customer service and work health safety.	June 2022
	Develop an AMS communication strategy	This initiative is related to the communication of the asset management systems message, and asset management value proposition to the organization and all stakeholders.	June 2022
	Shutdown management	Review, develop and document Hunter Water's shutdown management procedures.	June 2022
	Roles and accountabilities	Review and update the AMS Steering Committee Terms of Reference and RACI Matrix (Responsibility, Accountable, Consulted, Informed).	June 2022
	Leadership	Continue to implement and embed management review through planning & coordination of both the executive management review and asset management steering committee.	Ongoing
	Document management system	AMS documentation will be reviewed, updated and captured through our document control system.	Ongoing
	Stakeholder & community engagement	We are continuing to innovate in our approach to stakeholder, customer and community engagement, with a suite of initiatives. This includes the Love Water program. These initiatives are integrated into the AMS through asset planning/creation and managing operational community and customer impacts.	Ongoing
	Asset standards	Continuous improvement of standard technical specifications and design guidelines/codes.	Ongoing
Asset Planning	Critical assets	Review and update the critical asset program incorporating the enterprise risk management framework and development of asset class plans for operational critical assets.	Ongoing
	Condition Assessment Program	Treatment and network Condition Assessments.	June 2023
	Asset class planning	Hunter Water will articulate the alignment of its asset management objectives with specific asset class objectives and the appropriate risk and opportunity mitigation actions within new asset class plans.	June 2022
	Growth Plan	Continuous improvement of Hunter Water's Growth Plan with addition of dashboard tools.	Ongoing
	Water resilience program	We are improving our planning for water security by expanding the planning philosophy to incorporate adaptive planning, scenario planning, systems thinking and opportunity thinking principles related to water conservation, integrated water cycle management and water source augmentations.	Ongoing

Table 27: AMS - Proposed activities and programs

	Sustainable wastewater	We are expanding our traditional wastewater planning to consider medium- and long-term opportunities for potential waste to energy solutions, improved biosolids management, recycled water systems, and carbon neutrality.	Ongoing
Asset Information	Information standards & process	A review of our asset information standards and collection processes is ongoing and part of continuous improvement.	Ongoing
	Asset management dashboards	Hunter Water will continue developing various dashboards to improve the monitoring of asset performance against operating licence requirements and to assist improvements to planning of maintenance activities.	Ongoing
	Drawing management system upgrade	A planned upgrade and replacement of Hunter Water's digital drawing file management system will be completed.	June 2022
	GIS Strategy 2020-24	Develop a strategy for the Geospatial Information System (GIS) to align with business drivers.	Dec 2021
	GIS and CMMS (Ellipse) data synchronisation	Synchronisation of the GIS and computerised maintenance management systems (CMMS) for creation of linear assets within Ellipse from the GIS.	Dec 2021

4.1.4 Significant changes to the Asset Management System in 2020-21

During 2020-21 (July 2020), our AMS was recertified to ISO 55001:2014 (AS/NZS ISO 55001:2014). Subject to annual surveillance audits, the certification will run until 9 July 2023. A surveillance audit was completed in May 2021.

There have been no other significant changes to Hunter Water's AMS in 2020-21.

4.1.5 Non-conformances in the Asset Management System and planned actions to resolve

There were no major non-conformances with our asset management system in 2020-21. However, one minor non-conformance identified in the previous year was carried over pending further confirmation of closure. This has been incorporated as an improvement initiative for 2021-22. Specifically, Hunter Water will:

• Review the alignment of its asset management objectives with the appropriate risk and opportunity mitigation actions within asset management plans.

4.2 Environmental Management System (EMS)

Clause 4.2 of our Operating Licence stipulates that Hunter Water must maintain and implement an environmental management system that is consistent with the Australian Standard AS/NZS ISO 14001:2016 Environmental Management Systems – requirements with guidance for use.

Our Environmental Management System (EMS) provides a framework for developing, implementing, monitoring, and reviewing our objectives, actions, and targets in relation to our commitment to the community and environment. We have been externally audited and certified against the ISO Standard, demonstrating our compliance with Clause 4.2 of our Operating Licence.

4.2.1 Environmental Management Plan

The development and implementation of an Environmental Management Plan (EMP) is a key component of our EMS. The EMP outlines our environmental objectives, program of actions and targets to manage risk as well as drive environmental improvements for the organisation.

Hunter Water's Board of Directors approved our current 2018-2020 EMP in February 2018.

A new EMP is being prepared and will be finalised in 2021. The new EMP will align with Hunter Water's Sustainability Framework. Many of the programs and activities in the 2018-20 EMP were of continuing relevance and carried over to 2020-21; therefore we continue to report against the 2018-20 EMP.

The 2018-2020 EMP is publicly available on our website and has 21 key environmental objectives. These objectives guide organisational improvement and address our key responsibilities to the environment and community. Against each objective are one or more actions/programs, and set targets/indicators. The environmental objectives have been categorised into one of four categories, as follows:

- water service initiatives
- wastewater service initiatives
- stormwater service initiatives
- business practice initiatives

4.2.2 Environmental management activities and programs, 2020-21

The activities and programs undertaken in 2020-21, separated into the four categories previously described, are outlined in the following tables.

Water service initiatives

Table 28: EMS -	Activities	and j	programs	complete	ed in 2020-21
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EMS Objective	Activity / Program	Results / Outcomes
1. Protection of drinking water catchments	Catchment management plan	• Assessment of development applications for proposed activities in drinking water catchments and liaison with approval authorities to mitigate potential risks to water quality.
		 Liaison with recreation groups on Grahamstown Dam to ensure risks to water quality are clearly understood and appropriately managed. New agreement signed to 2025.
		• Ongoing catchment surveillance and compliance enforcement in response to unauthorised access and related impacts, such as recreational activities, vehicle use, rubbish dumping.
		 Schools Engagement project in partnership with Hunter Local Land Services (HLLS), which provided continuity to the existing project where education was delivered to local schools to improve awareness of the water cycle and the need to protect catchments. Some community groups are also included in the program.

		 Sustainable Agricultural project in partnership with HLLS, which continued the existing collaboration to engage with farmers in drinking water catchments. In 2020-21, the project again focussed on contributing funds to the HLLS incentives grant program, where interested farmers can apply for grant funding to deliver farm upgrades that demonstrate benefits for water quality. Continuation of establishment work on the Tillegra Riparian Improvement Project, which involves delivery of a five year program of works to establish a riparian buffer zone on a 24 km section of the Williams River. Project activities in 2020-21 focussed on weed management. Seaham weir pool erosion management, where planning for riverbank rehabilitation works was undertaken ahead of consultation with landowners and the community on the works.
2. Sustainable use of water resources	Compliance with water supply works and water use approvals	 Over the reporting period, we operated in accordance with the water access and environmental flow requirements of our Water Supply Works and Water Use Approval Licence. Actions to facilitate the continual improvement of compliance include: Hydro-generator upgrade at Chichester to be variable speed and more easily match inflow Trial of aerial technology to monitor algal blooms in Grahamstown Dam.
	Implementation of water efficiency programs	Hunter Water's Water Conservation Report contains details on the implementation of our water efficiency programs.
	Lower Hunter Water Security Plan to define the long term strategy for water security and drought response	 Continued work on the development of the second edition of the Lower Hunter Water Plan (now called the Lower Hunter Water Security Plan, or LHWSP) which is on track to be completed in early 2022. This work included finalising analysis of water supply and demand options including consideration of technical, environmental and social impacts. Options were then combined into groups or portfolios which were then assessed using a decision support framework including cost benefit analysis (CBA). Implementation of a community engagement strategy continued to be rolled out. This included Phase 3 consultation in late 2020 / early 2021 which sought feedback on preliminary portfolios. The main Phase 3 activity was undertaken using an online survey platform due to the ongoing COVID pandemic situation. The outcomes of the Phase 3 consultation were combined with results of
		the CBA and other qualitative analysis to inform development of the draft plan.
	Reductions in non-revenue water	 Hunter Water has a program to reduce non-revenue water. It was reduced to 8.4 GL during 2020-21. This was an improvement of approximately 0.8 GL on the previous year. Activities included: Active leak detection work for over 6,400 kilometres of the water network Optimisation of Grahamstown WTP to reduce water losses District Metered Areas were expanded to cover 45% of the water network enabling events such as leaks and breaks to be detected Active management and replacement of under-reading large customer meters Implementation of recycled water upgrades at wastewater treatment plants
3. A reduction in environment and community impacts from watermain breaks	Water asset plan for watermain breaks	A Program Business Case was prepared and approved.

Wastewater service initiatives

EMS Objective	Activity / Program	Results / Outcomes
4. Undertake wastewater activities in a sustainable	Operate treatment plants in accordance with EPA licence requirements	• Completed monitoring and reporting via annual returns and monthly website publishing. There was no adverse compliance or enforcement action undertaken by the regulator.
manner	Sustainable	The following initiatives have been undertaken:
	wastewater strategy	 Evaluation of recycled water investments in the Lower Hunter Water Security Plan
		 Development of recycled water options and assessment in the Hunter River Estuary Masterplan
		 Identifying and investigating recycled water opportunities for agriculture, urban irrigation, industrial and residential uses
		 Business case approval for the Lake Macquarie recycled water irrigation scheme
		 Working with customers, community, and stakeholders to understand attitudes and preferences towards sustainability and wastewater recycling
5. Reduce environmental and community impacts from wastewater	Wet weather overflows reduction	 Completed modelling of ecological response and pathogen modelling of Lake Macquarie by NSW Office of Environment and Heritage (now DPIE). This project is investigating the impacts on Lake Macquarie of wet weather wastewater discharges compared to impacts from stormwater inflows as part of an Effects Based Assessment study.
overflows		 Development of an inflow/infiltration reduction strategy for the Dungog wastewater system has been endorsed.
		 A successful flow-monitoring project has been undertaken in Dungog at a much finer resolution than typical to improve identification of wet weather inflow sources.
		• A flow-monitoring project has been completed in Belmont North, which has identified likely sources of inflow and infiltration of stormwater.
		 Reduced the impact of wet weather overflows affecting the community in Belmont, Warners Bay, and Edgeworth through network modifications
		 Wet weather overflow reduction program for 2020-21 to 2023-24 endorsed
		 Funding approved and allocated for planning an upgrade to Wallsend 2 stormflow pump station. This project will reduce wet weather overflows and improve rising main reliability.
	Dry weather overflows reduction	 Installed 21 level sensors in the wastewater network at key overflow locations
		 Preventative sewer pipe maintenance, more than 160 pipe lines refurbished and 1,350 pipes cleaned to avoid overflows
		 Completed an advanced analytics project to improve the prediction of repeat blockages. Predictions indicated improved performance to the current preventive jetting model.
		 Technology scan of options to provide an early warning of leaks and breaks on wastewater rising mains.
		 Gravity sewer network overflow receiving environment route tracing – Mapped the overflow route of a simulated blockage from every gravity sewer pipe to the ultimate receiving environment to prioritise future maintenance and monitoring programs.
		The SCADA team implemented a mass balancing calculation on 75 WWPS using existing SCADA systems
	Wastewater management	Community was engaged to understand how and where they use the Hunter River Estuary.

Table 29: EMS - Activities and programs completed in 2020-21

	masterplan – Hunter River estuary model	 Based on the long-list of options and community values, a range of portfolios that target improvements of different community values and deliver the project objectives were developed, modelled, and assessed. The portfolio assessment indicated that Hunter Water has the greatest influence on water quality in the freshwater zone and Swamp Creek tributary. A second group of portfolios has been developed that will form the final Masterplan. These will be modelled and assessed during 2021-22. Government stakeholders were engaged to understand how to work
6. Monitor the health of our	Beachwatch program	 Carried out sample collection and testing to provide data to the Beachwatch program
waterways and beaches		 Reviewed and provided input into the preparation of the annual Beachwatch report.
7. Improved performance against environmental compliance obligations	Environmental compliance improvement program	 Annual control plans are prepared to address areas of environmental risk that sit outside of the risk appetite thresholds that have been set by Hunter Water's Board of Directors. Good progress in completing actions was achieved during 2020-21. This included: Continuing to reduce risks associated with chemical spills and dry weather overflows. There has also been a strong focus on capital delivery programs that will improve ongoing compliance. During the reporting period, there were no incidents or events that resulted in EPA enforcement or penalties Compliance-related environmental training was delivered for staff
8. A reduction in carbon emissions from wastewater treatment activities	Renewable energy from wastewater	 The following actions were undertaken: Continued consultation with industry stakeholders including technology providers, councils and other water authorities Continued sponsorship of a three-year PhD project on zero-emission sludge lagoons Commenced participation in (and sponsorship of) Water Research Australia (WaterRA) Project #2703 "Carbon sink or swim: biochar winwin-win?" (Biochar trial) Commenced participation in (and sponsorship of) ARC Training Centre for the Transformation of Australia's Biosolids Continued development of a business case for centralised biosolids treatment with energy recovery Co-digestion trial at Cessnock WWTW remains on hold due to COVID-19.
	Renewable energy strategy	 99.7kW solar PV at Branxton WWTW commissioned. Rehabilitation of 110kW hydro generator at Chichester Dam commissioned. A joint Power Purchase Agreement (PPA) Request for Information in partnership with Councils in the Hunter to inform electricity procurement and carbon strategies completed in late 2020-21.

Stormwater service initiatives

EMS Objective	Activity / Program	Results / Outcomes
9. Improved environmental outcomes from stormwater assets	Implementation of asset class stormwater management plans	 Actions included: Work undertaken for stormwater critical main, stormwater condition assessment, and stormwater fencing programs included assessment and rehabilitation work at No 1 Sportsground, fencing at Alder Park and ongoing electronic condition monitoring of a culvert at Macquarie Street, Mayfield Munibung Creek rehabilitation detailed design underway. Ongoing maintenance of stormwater assets including floating booms, silt traps, tidal gates, stormwater treatment devices and mowing Removal of a small portion of mangroves within Lower Throsby Creek that were growing on a sediment bank and starting to block up the creek Commencement of the design engagement for the Stormwater Major Upgrade Program. Work on Turton Rd commenced Throsby Creek Mangrove Management Study underway Stormwater education work commenced
		Winding Creek Detention Basin 3 design for the upgrade to the embankment commenced
	Water-sensitive urban design	 Hunter Water is investigating a stormwater harvesting scheme that could provide irrigation water for parks and sporting fields in the Newcastle LGA Planning is underway for stormwater amenity improvements and
		 A 'Holistic Development Servicing for Growth Areas' Framework was development and pilot investigations undertaken in the Maitland LGA. The study considered integrated water and land use planning options that support greenspace amenity, improve water quality and mitigate urban heat.
	Investigations into opportunities to naturalise stormwater assets	 During 2020-21 the following works were completed to undertake amenity works around stormwater assets: Lower Cottage Creek amenity works detailed design completed and working with Hunter and Central Coast Development Corporation (HCCDC) to deliver amenity works both north and south of Honeysuckle Bridge. Ongoing updates as required to meet Newcastle Port community grant funding requirements. Commencement of the design engagement for the Stormwater Amenity Improvement Program

Table 30: EMS - Activities and programs completed in 2020-21

Business practice initiatives

EMS Objective	Activity / Program	Results / Outcomes
10. The establishment of a work place culture that values sustainable work practices	Sustainability • plan • •	A Sustainability Framework was developed to provide a consistent and cohesive organisational perspective on sustainability The Hunter Water Environmental Management Plan is being updated to align with the Sustainability Framework A draft Corporate Sustainability Strategy was developed Hunter Water signed the Hunter Region Collaboration Memorandum to participate in the Hunter Region Sustainable Development Goal Task Force
11. Improved environmental work practices	Implement continual improvements programs for the Environmental Management System (EMS)	System improvements are being made with the recent acquisition of a new software platform for integrated management of data and workflows across all of Hunter Water's management systems, concerning risks, hazards, incidents and non-conformances A new Environmental Management Plan has been prepared and is with stakeholders for consultation. This new plan will establish new goals, objectives, activities, and improvements for the next 4 years. The EMS was externally audited in May 2021 against ISO 14001:2015 (AS/NZS ISO 14001:2016)
12. Relevant community and stakeholder consultation on environmental matters	Informing the community about Hunter Water's activities and impacts on the environment	Ongoing consultation with the community and stakeholders when developing major projects including through our website and targeted consultation. We continued to use <i>Your Voice</i> , our community engagement platform (<u>www.yourvoice.hunterwater.com.au</u>), encouraging community participation in initiatives across our entire organisation.
	Love Water • Campaign •	This year the Love Water campaign introduced 'Smart Water Choices' as our permanent water conservation rules. Our campaign focused on areas in the community using advocates to share how we love water and used a range of advertising mediums. Our Love Water community grants program was the largest to date, providing 34 community groups and organisations with a share of
	Awareness •	approximately \$200,000 to assist with their water conservation projects Our schools engagement and broader community engagement activities
	programs •	continued to drive behaviour change at scale More than 3,200 primary and pre-school students learned about water from our Love Water Show which incorporates tips on how to love water and how they can individually conserve water Hunter Water attended community events across our area of operations where possible to advocate simple water saving tips. COVID-19 affected
	•	events and school engagement activities during this time. We have developed various new digital educational resources in response to COVID-19. This allowed us to run programs either virtually or face-to- face over the year. This has included animations on the urban water cycle, water treatment process and at school and at home water use audits.
	•	We engaged directly with 1,000 students through our education program. This reach was significantly impacted by COVID-19. We had almost 8,000 views to our schools webpage.
	Annual • community sponsorship program	Hunter Water undertakes a variety of community sponsorship programs and partnerships
	Willingness to • pay studies - preparation for	Hunter Water completed two surveys of our customers to understand their trade-offs between price and service levels in relation to water supply interruptions, low-water-pressure events and dry-weather wastewater

Table 31: EMS - Activities and programs completed in 2020-21

 Hunter Water Regulation 2015 Hunter Water and Department of Primary Industry and Environment (DPIE) requested an additional 1 year deferral of the regulation remake to 1 September 2022. Engagement with internal stakeholders commenced with the formation of a steering committee in January 2021, which meets to discuss current regulation issues. Avoid environmental impact assessments ensure the efficient use of construction Hunter Water and Department of Primary Industry and Environment (DPIE) requested an additional 1 year deferral of the regulation remake to 1 September 2022. Engagement with internal stakeholders commenced with the formation of a steering committee in January 2021, which meets to discuss current regulation issues. New and upgraded infrastructure requires Environmental Impact Assessments (EIAs) to be prepared unless they are minor works and meet exempt development standards. The majority of EIAs undertaken for the delivery of new infrastructure were Review of Environmental Factors which are self determined by Hunter Water. State Significant Infrastructure which are self determined by Hunter Water. State Significant Infrastructure
13. AvoidEnvironmental impactNew and upgraded infrastructure requires Environmental Impactenvironmental impacts and ensure the efficient use ofassessments and constructionNew and upgraded infrastructure requires Environmental Impact Assessments (EIAs) to be prepared unless they are minor works and mee exempt development standards. The majority of EIAs undertaken for the delivery of new infrastructure were Review of Environmental Factors which are self determined by Hunter Water. State Significant Infrastructure environmental Factors
 (SIS) requires the preparation of an Environmental impact Statement (EIS). The proposed Belmont Desalination Plant is SIS due to its capital value. The EIS was exhibited in 2019 and a response to submissions on the EIS and an amendment report were exhibited in late 2020. The Department of Planning, Industry and Environment was assessing the SIS application during the year. Construction contractors prepared construction environmental management plans for all relevant contracts. This included demonstrating how mitigation measures from EIA approvals would be implemented during construction.
 Waste avoidance and reduction Request for Information process run with the market for waste and recycling services to understand local market offerings and to shape a tender process Resource Recovery Order and Exemption application completed with NSW EPA to enable increased spoil reuse opportunities Continued Plastic Police soft plastics and Simply Cups coffee cup recycling programs Waste review undertaken at Tarro depot identifying potential opportunities
Asset management activities
14. Create a sustainable supplyA sustainable supply chainSustainable Procurement Improvement Plan developed and endorsed by the EMT•Sustainable Procurement Working Group formed. The Group tracks
 Supplier Partnership Principles (SPP) developed and launched – includes sustainability criteria covering environmental, social, and economic factors Training rolled out to staff on the SPP including the sustainability assessment schedules Modern slavery clauses inserted in to Hunter Water's new contract suite
15. Sustainable land management value of operational land
Management of land contaminationKey programs progressed during the reporting year have included: • Reporting and notification of groundwater contamination at some of our wastewater treatment plants
Groundwater monitoring at Swansea in response to a chemical spill at a WWPS in 2013

	Bushfire management Weed management	 Implementation of Hunter Water's Bushfire Management activities continued during 2020-21. Actions undertaken include: New Bushfire Management Plan developed Additional vegetation asset protection zones at two critical wastewater sites have been implemented. Bushfire resilience infrastructure improvements to 15 critical sites A map of named and signposted fire trails through Hunter Water freehold lands, and started upgrading the fire trails accordingly Weed management programs have been implemented at Stockton, Grahamstown and along Crawchie Creek, which is located at the back of the Shortland WWTW Weed management has continued for the Tillegra Riparian Improvement Project Hunter Water has been actively involved in the Regional Weeds
		 Committee, which has been looking at the best way to ensure that the requirements of the <i>Biosecurity Act 2015</i> are fulfilled More than 100ha of pine trees have been cleared in catchments that will reduce the invasion potential of this species and mitigate bushfire risk. Weeds will be controlled as native vegetation returns.
16. Reduce water consumption, wastewater generation and stormwater impacts	Water Cycle Management Plan	 Hunter Water engaged with its largest customers in the development and implementation of water efficiency management plans Potential recycled water schemes and stormwater harvesting opportunities have been identified with the aim to achieve potable water savings, reduced effluent discharges and improved liveability outcomes
17. Effective contingency planning and management of environmental	Pollution Incident Response Management Plans	• Hunter Water has 17 specific Pollution Incident Response Management Plans as required by the <i>Protection of the Environment Operations Act</i> 1997. These cover each of our EPA licenced systems and assets. The plans are tested and updated every 12 months, and reviewed after any pollution incident
emergencies	Environmental incident investigations	• We formally investigate the root cause of all major environmental incidents. Corrective actions are implemented and system changes made to ensure continual improvement of our activities undertaken in accordance with the EMS.
	Hazardous chemical management	 A Chemical Containment and Safety Upgrade Project was progressed in 2020-21. The project was split into various packages dependant on the risk profile of the site, prioritising the highest risk sites first. The replacement of the iron chloride dosing system was commissioned at Raymond Terrace WWTW Work progressed on the detailed design for chemical upgrades at Kurri Kurri WWTW. Construction has commenced. Concept design development for chemical upgrades was progressed for Cessnock WWTW, Grahamstown WTP and Shortland WWTW. Concept design development progressed for lime dosing systems at Morpeth WWTW, Lemon Tree Passage WTP and Anna Bay WTP. A number of chemical dosing units were constructed for the wastewater patients.
18. Conserve cultural heritage	Conservation of cultural heritage	 Hunter Water commenced the review of its Heritage and Conservation Register
19. To be climate resilient	Climate change adaptation strategy	• During 2020-21, our climate change adaptation strategy was reviewed and further developed. As a result of the review, vulnerability assessments for our network are being designed and planned for the 2021-22 period.

20. To reduce greenhouse gas emissions	• reduction studies	Hunter Water continued development of a Carbon Strategy that identifies emissions reduction pathway options and their strategic implications. The strategy will incorporate the existing investigations into purchased renewable energy and/or Large Scale Generation Certificates (LGCs), onsite renewable energy, including floating solar, and opportunities to reduce carbon emissions attributable to wastewater treatment. We have continued to pursue energy efficiency opportunities such as
		Smart integrated Pump Scheduling
	Energy • monitoring and reporting framework	Hunter Water measures and verifies energy savings initiatives (both financial and GWh), to track performance on a monthly basis. During the reporting year the Energy Management System transitioned across to a new online platform that will facilitate automation and dash-board capabilities for much of the measurement and verification process calculations.
21. Improve environmental performance through the acquisition of applied knowledge	Research and evelopment	Continued implementation of the R&D Strategy which aligns R&D projects with corporate priorities and strategic objectives and targets a leverage funding ratio of at least 1:5 in order to maximise the value of research to the organisation. R&D priority areas for 2020-2021 included algae, emerging contaminants, pipe breaks, new ways of working, ecological health of our dams and climate change. Examples of projects with an environmental focus that Hunter Water was involved in include projects aimed at screening wastewater and biosolids for emerging contaminants and those aimed at improving our understanding of algal bloom development and dynamics, including through the use of remote sensing technologies.

4.2.3 Proposed environmental management activities and programs

We will continue to review and improve our EMS to meet its defined management objectives. The EMS initiatives planned through 2021-22, separated by category, are outlined in the following tables.

Water service initiatives

Table 32: EMS – Propos	ed activities and	programs
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EMS Objective	Activity / Program	Results / Outcomes	Timetable
1. Protection of drinking water catchments	Catchment management plan	 Preparation of the next catchment management plan Development of a catchment model ('Source') for the Williams River / Grahamstown Dam water supply system 	2021-22
		 Continuation of the Schools Engagement and Sustainable Agriculture projects, in collaboration with Hunter Local Land Services 	
		 Commence delivery of erosion management works in the Seaham weir pool 	
	Collection and assessment of water quality data	• The second round of water quality monitoring in the Williams River is currently underway and will be completed in 2021-2022, subject to the occurrence of rainfall events suitable for event-based sample collection	2021-22
		 Long term water quality reporting will continue in 2021-2022, with a focus on the Grahamstown and Chichester catchments 	2021-22
3. Sustainable use of water resources	Compliance with water supply works and water use approvals	 We continue to plan for continuous improvements in our systems supporting the management of our water management licence compliance. The next major improvement will be the design and 	2021-22

	Implementation of	construction of a new fishway at Seaham Weir to allow increased fish passage up the Williams River.	
	water efficiency programs	 Details on the implementation of our water enciency programs can be found in Hunter Water's Water Conservation Report 	
	Lower Hunter Water Security Plan to define the long term strategy for water security and drought response	 Work will continue to finalise the LHWSP The draft plan is being exhibited for public comment from August 2021, before being submitted to Cabinet for approval in early 2022 	2021-22
	Reductions in non- revenue water	 The delivery of initiatives will include: implementing the water loss reduction strategy including active leak detection, further increases in District Metered Area monitoring, network pressure management and progressing the replacement of aging assets further development of customer meter replacement strategy and management of under-reading large customer meters ongoing implementation of recycled water upgrades at wastewater treatment plants. 	Ongoing
3. A reduction in environment and community impacts from watermain breaks	Water asset plan for watermain breaks	 A capital investment program to improve safety, environmental or service performance by improving assets, or replacing assets that have failed, or are at risk of failure 	2021-24

Wastewater service initiatives

Table 33: EMS – Proposed activities and programs

EMS Objective	Activity / Program	Results / Outcomes	Timetable
4. Undertake wastewater	Operate treatment	 Continue to operate treatment plants in accordance with EPA licence requirements 	Ongoing
activities in a sustainable manner	plants in accordance with EPA	 We are upgrading multiple treatment plants to provide capacity and improved effluent quality to meet EPA requirements 	
	requirements	 We continue to monitor and report performance of treatment plants via annual returns and publishing monthly on the website 	
	Sustainable wastewater	 Work with stakeholders to assess the viability of recycled water schemes 	Ongoing
	strategy	 Continue to explore opportunities for new recycled water schemes or the expansion of existing schemes 	
		 Work with customers, community, stakeholders and government agencies to continue to understand the value of recycled water in the urban environment and identify recycling opportunities 	
		 Deliver the Lake Macquarie recycled water scheme for the supply of irrigation to parks and playing fields by June 2024 	
5. Reduce environmental and		Developing a wet weather overflow abatement strategic framework	2021-22

community impacts from wastewater	Wet weather overflows	 Implementing an inflow/infiltration reduction plan for Dungog 	2021-22 – 2022-23
oveniows	reduction –	Developing and implementing an inflow/infiltration reduction plan for Belmont North.	2021-22 – 2022-23
	_	Upgrading a wastewater pump station in Dungog to reduce wet weather overflows. Construction has commenced.	2021-22
	_	 Planning works are underway for upgrades in the East Maitland, Medowie and Cooranbong areas to reduce wet weather overflows 	2021-22
	_	 Concept and detailed design for a stormflow pump station upgrade at Wallsend to reduce wet weather overflows and improve rising main reliability 	2021-22
		 Hunter Water will develop a strategy to improve management of wet weather system performance for the Lake Macquarie wastewater system based on the outcomes of DPIE modelling and consultation with key stakeholders over the next 12 months. This will be followed by developing a plan that will describe how the targets identified in the strategy will be achieved. 	2021-22 – 2022-23
	Dry weather overflows reduction Wastewater management masterplan – Hunter River Estuary Model	 Extend the mass balance system to an additional 75- 125+ WWPS Implement phase 2 of the wastewater monitoring program, expected to install a combination of level monitoring and overflow alert sensors Validate the updated blockage prediction model and modify preventive jetting program to incorporate the improved model Undertake a project to apply machine learning to SCADA data to provide an early warning of an upstream blockage or WWPS pump deterioration Trial novel systems to detect rising main leaks and breaks using new sensors and data analytics Continue preventive sewer network works, including approximately 200 lines scheduled for lining refurbishing The Hunter River Estuary wastewater masterplan will be finalised in 2021-22. The masterplan explores nutrient offsets, infrastructure upgrades, reuse schemes and regulatory frameworks. Combinations of options will be evaluated through an effects-based framework, a resilience framework and 	Ongoing 2021-22
		effects-based framework, a resilience framework and an economic and financial assessment. Stakeholders will be engaged to provide feedback and to align goals for potential future collaboration to enable better outcomes for the estuary.	
6. Monitor the health of our waterways and beaches	Beachwatch program	 Involvement in the Beachwatch program will continue in the future. We plan to review our current sample collection and testing schedule to ensure the program continues to be fit for purpose in matching program requirements. 	Ongoing
7. Improved performance against environmental	Environmental compliance improvement program	 Risk reviews, risk control plans, audits, environmental inspections, preventative maintenance and capital works all form a key component of environmental compliance improvement and an integral part of the EMS. Proactive environmental 	2021-22

compliance obligations		improvement programs will also form a key part of the new EMP which is in development.	
8. A reduction in carbon emissions from wastewater treatment activities	Renewable energy from wastewater	Completion of the business case for renewable energy from biosolids	2021-22
	Renewable energy	The following is proposed to be undertaken in relation to the renewable energy strategy:	
	strategy	 Procurement complete and work underway for Stages 1 and 2 of the Onsite Renewable Energy Project (2.35MW across 9 sites) 	Ongoing in stages 2021- 22_2022-23
		 Progression of Stage 3 that will involve up to 1.25MW of floating solar PV constructed on wastewater treatment ponds. 	22, 2022-23
		 Progression of Stage 4 that will consist of a 2.5MW ground mounted solar farm at Balickera water pumping station 	
		 We will consider opportunities for expanding the renewable energy program where feasible 	
		 Investigating battery storage potential to augment the Onsite Renewable Energy Project other energy efficiency, demand response, and electricity procurement 	

Stormwater service initiatives

Table 34: EMS – proposed activities and programs

EMS Objective	Activity / Program	Results / Outcomes	Timetable	
9. Improved environmental outcomes from stormwater assets	Implementation of asset class stormwater management	 Hunter Water will roll out the works identified under stormwater critical main, stormwater condition assessment, and stormwater fencing annual provision 2020-2024 	Ongoing to June 2024	
	plans • Hun undo 2024	• Hunter Water will roll out the works identified under Stormwater Major Upgrade Program 2020- 2024.	2024	
		 Finalise design for the upgrade to the embankment Winding Creek Detention Basin 3. Undertake construction. 	June 2023	
		 Finalise the Throsby Creek Mangrove Management Study 	Oct 2021	
		Stormwater Education	Ongoing	
		Hunter Water will continue to work on the design of the Munibung Creek rehabilitation.	Ongoing	

		•	Undertake survey and modelling of Lower Throsby Creek to determine when dredging of sediment might be required.	Dec 2022
	Water sensitive urban design	•	Development of programs of work for recycled water for urban irrigation and stormwater amenity improvements, for delivery over the next three years.	Ongoing to June 2024
	Investigations into opportunities to naturalise stormwater assets	•	Hunter Water will roll out the works under the Stormwater Amenity Improvement Program 2020-2024.	Ongoing to June 2024 Dec 2021
		•	Construction of the Lower Cottage Creek Amenity Works to be finalised by Dec 2021.	200 2021
		assets •	Undertake investigations about further potential stormwater amenity projects.	Dec 2022

Business practice initiatives

٦	Table	35:	EMS	– P	ropo	sed	a	ctiv	vities	and	progra	ams
						-			-			

EMS Objective	Activity / Program	Results / Outcomes	Timetable
10. The establishment of a work place culture that values sustainable work practices	Sustainability plan	 We will continue to implement the Sustainability Strategy We will continue to undertake community and stakeholder consultation to improve our understanding of their sustainability priorities 	2021-22 and 2022- 23
11. Improved environmental work practices	Implement continual improvements programs for the Environmental Management System (EMS)	We are progressively delivering strategies to improve water and wastewater network performance to reduce environmental risks	Ongoing
12. Relevant community and stakeholder consultation on environmental matters	Informing the community about Hunter Water's activities and impacts on the environment	 We will continue to consult with the community and stakeholders when developing and delivering major projects including through our website and targeted consultation We will also continue to use Your Voice, our community engagement platform (www.yourvoice.hunterwater.com.au) encouraging community participation in initiatives across our entire organisation, and looking at innovative applications and online tools to improve our engagement reach and outcomes, such as interactive mapping and online forums 	2021-22
	Love Water Campaign	 Over the 2021-22 reporting period, we will continue to develop and promote the messages of the Love Water campaign. The strength of the Love Water brand will be used to further encourage water conservation and sustainability across our community in a positive and empowering way. 	2021-22
	Awareness programs	• We will continue to focus on residential water efficiency projects, schools education and awareness programs. We plan to expand this to include non-residential customers to improve their education about these initiatives and drive behaviour change.	Ongoing

		 We will continue to build relationships with Aboriginal and Torres Strait Islander peoples and organisations, environmental groups, young people and the business and development community to seek their views and advocate for water conservation. We are looking at opportunities to improve water literacy through education; both through our schools program and wider community education/events. This will be in an effort to increase the connection and understandings about our catchments, networks and their functions. We are also looking to boost the education program by revamping and reviewing the current programs offered and adjusting it so it more closely meets the updated 	
	Preparation for 2023 price path submission	 School curriculum and reflects our strategic direction A customer engagement strategy is being developed to improve Hunter Water's understanding of customer and community preferences, so that these can be reflected in business decision making. The customer engagement topics may include environmental services. A subset of the qualitative and/or quantitative activities will be used to establish cost-service level trade-offs for the outcomes important to customers. 	2021-22
	Hunter Water Regulation 2015	• Actions to be undertaken include engagement with external stakeholders, preparation of Regulatory Impact Statement in accordance with the Better Regulation Principles, liaison with the Portfolio Minister with respect to proposed changes, public exhibition of changes and consideration of public submissions, and finalisation of regulation.	2021-22
13. Avoid environmental impacts and ensure the efficient use of resources	Environmental impact assessments and construction management	Hunter Water will continue to undertake environmental impact assessments for the delivery of all new infrastructure	Ongoing
	Waste avoidance and reduction	 Tender process and implementation of new waste and recycling contracts with resource recovery KPIs Develop and communicate Intranet site for Hunter Water employees about waste and recycling. It would be a waste and recycling hub for employee FAQs and provide guidance on waste and recycling. Explore waste avoidance opportunities from our Tarro Waste Review report Review and update waste EMS documentation and procedures Consider development of Hunter Water waste and sustainable Materials Strategy 	2021-22
	Asset management activities	• We maintain and implement an Asset Management System (AMS) consistent with ISO 55001. Further details on the AMS are provided in section 4.1.	Ongoing
14. Create a sustainable supply chain	A sustainable supply chain	 Implement our sustainable procurement improvement plan Review and revise key performance indicators for sustainable procurement Engage with suppliers about our supplier partnership principles and sustainability assessment schedules 	2021-22

15. Sustainable land management	Management of land contamination	Continue to undertake contamination assessments and monitoring	2021-22
	Water quality in Tomago catchment	Continue to adhere to the PFAS Operating Strategy with the oversight of NSW Health.	2021-22
	Bushfire management	 Continue implementing strategic fire management plans and develop and commission remaining plans for Hunter Water Catchments and large land holdings 	2021-23
		• Conduct further bushfire threat assessment inspections of assets on the critical asset register and prioritise actions to ensure ongoing vegetation management and improved infrastructure resilience	
		 Catchment fencing will be improved to reduce the risk of illegal access and arson or accidental fire 	
		 Continue to liaise with the rural fire service (RFS) and bushfire management committees, and ensure Hunter Water's bushfire risk reduction activities are included in their bushfire risk management planning 	
	Weed management	Weed management on Hunter Water land will continue to be a strong focus	2021-23
		The weed management programs commenced in 2020- 21 will continue with additional sites included that target priority weeds	
16. Reduce water consumption,	Water Cycle Management	 We will continue to engage with stakeholders, such as with councils via the Councils working group 	20201-22
wastewater generation and stormwater impacts	Plan	We will undertake further option development for the most feasible recycled water and stormwater harvesting opportunities	
17. Effective contingency planning and management of environmental emergencies	Pollution Incident Response Management Plans	 We review plans annually as well as immediately after any operational incident, to ensure any incident can be responded to appropriately and to prevent an incident recurring 	2021-22
	Environmental incident investigations	We track and report on progress until actions are closed out	Ongoing
	Hazardous chemical management	Continue to progress and implement the project to improve the safety of chemical containment	Ongoing
18. Conserve cultural heritage	Conservation of cultural heritage	Continue to review management of moveable heritage and maintain our Section 170 Heritage Register	2021-22
19. To be climate resilient	Climate change adaptation strategy	 Further develop our climate change adaptation planning including vulnerability assessments planned for our network in the 2021-22 period 	2021-22
20. To reduce greenhouse gas emissions	Carbon reduction studies	• Continue to develop our carbon strategy, in coordination with our energy strategy. The first iteration will be developed by December 2021.	
		We will refine our estimates of Hunter Water's scope 3 carbon emissions	2021-22
		Continue to pursue, measure and verify energy savings.	
	Energy monitoring	• Continue to pursue, measure and verify energy savings.	Ongoing

	and reporting framework		
21. Improve environmental performance through the acquisition of applied knowledge	Research and development (R&D)	• Update the R&D strategy to align with our Towards 2024 Business Plan and review our R&D priorities. Examples of R&D activities with an environmental slant that we will progress in 2021-2022 include projects to develop tools to systematically evaluate drinking water catchment health and investigating passive sampling approaches to pesticide monitoring in Hunter Water's drinking water catchments.	2021-22

4.2.4 Significant changes to the EMS in 2020-21

During 2020-21 (July 2020), our EMS was recertified to ISO 14001:2015 (AS/NZS ISO 14001:2016). Subject to annual surveillance audits, the certification will run until 9 July 2023. A surveillance audit was completed in May 2021.

There have been no other significant changes to Hunter Water's EMS in 2020-21.

4.2.5 Non-conformances with the EMS in 2020-21

No major or minor non-conformances with the EMS were identified during third party certification audits or internal audits during 2020-21.

4.3 Quality Management System (QMS)

This section describes Hunter Water's quality management performance. We report on compliance with clause 4.3 of our Operating Licence and in doing so, detail the quality management programs and activities completed during 2020-21, and the proposed programs and activities for 2021-22. We also report on any non-conformances with, and significant changes made to, our quality management system.

4.3.1 Overview of Hunter Water's QMS

Hunter Water's Quality Policy Statement outlines that Hunter Water is committed to maintaining high levels of customer and community satisfaction through consistently providing safe, reliable, and efficient services with a focus on the needs of the community, throughout its area of operations.

To put this statement into practice, Hunter Water has implemented and maintains a Quality Management System (QMS). The system consists of systematic processes to manage the core functions of the organisation. We implement the system to ensure the organisation consistently meets all of its product and service requirements, addresses its risks and opportunities, and provides high levels of customer satisfaction while meeting regulatory requirements.

We have adopted an integrated approach to operating our management systems in the form of an Integrated Management System (IMS). The IMS provides processes, principles, and guidelines across common functions of the different management systems. Individual management systems provide the subject matter expertise and inputs to the integrated processes. Elements of the ISO 9001 quality requirements are managed via the integrated processes, systems and data in Hunter Water's IMS and others are managed directly via the QMS.

We achieved initial certification to ISO 9001 in August 2015. We have continuously maintained our certification and passed our most recent, external, annual surveillance audit in May 2021. Recertification dates are now aligned across all ISO Management Systems to improve the efficiency of the audit process.

These standards include ISO 9001 Quality, ISO 14001 Environment, 27001 IT Security, 45001 Health and Safety and ISO 55001 Asset Management – all of which were audited in May 2021. No new non-conformances were recorded against any of the certification standards.

Because of the integrated approach, only quality-specific requirements are managed directly by the QMS. In addition, the requirements of the Australian Drinking Water Guidelines (ADWG) and Australian Guidelines for Water Recycling (AGWR) form two of the many requirements that we must comply with in providing our products and services. So, whilst they can be described in isolation, in practice they form part of the overall QMS for Hunter Water. In section 2 of this report, we describe our DWQMS and RWQMS.

The objectives of our IMS and QMS are:

- reliable, high quality water and wastewater service delivery
- customer satisfaction
- compliance
- continuous improvement
- meet stakeholder needs





4.3.2 QMS - activities and programs completed during 2020-21

Table 36 describes the activities and programs completed in 2020-21 to meet the IMS/QMS objectives.

IMS/QMS Objective	Activity / Program	Results / Outcomes
IMS		
Continuous improvement	Tender process and contract award for an integrated incident and risk management application, Watershed, to capture and manage governance, risk, compliance and incident information.	The business case for this system was approved with the Watershed project incorporated into our Go Digital work program for 2020-24. The contract has been awarded for this project and project implementation is underway.
	Combined Assurance Project. A systematic approach to assurance activities applying the Lines of Defence model to optimise the benefits from a whole of business perspective	 Mapping of procedural controls and assurance activities that we currently have in place is underway. The aim is to ensure that where we are conducting assurance and audits, that are adding the maximum value by: mapping our existing assurance activities in one place determining the level of desired assurance relative to our business risks assessing gaps and overlaps providing clear vision to the Executive Management Team and Board Audit and Risk Committee to base decisions around
	Second Line of Defence (2LOD) audit program	changes to levels of activity. Audit process revised to adopt lines of defence approach and provide flexibility about changing risk profiles
	Interim Document Control Solution	Hunter Water's previous Document Control system was no longer fit for purpose. An interim solution has been implemented to address this issue and provide a platform for data cleansing prior to the introduction of a long-term solution as part of Watershed.
	Systems resourcing changes	Asset Management, Drinking Water and Recycled Water Management systems moved to report to Audit, Assurance and Management systems to facilitate a more integrated approach in line with our Towards 2024 plan.
	Quality Policy Update	Quality policy updated to reflect Hunter Water's updated organisational values; in particular Trust and Learning and the adoption of a collaborative approach to systems improvement.
Compliance	Document key processes and data input requirements to ensure correct information management for the Watershed management project	Business and solution requirements have been documented as necessary to ensure that a quality product is acquired.
QMS		
Continuous improvement	Ongoing Improvement Initiative	The QMS will complement the DWQMS/RWQMS through ongoing organisational improvements that include document control and compliance management.
	Review of resourcing plan	A new Integrated Systems Manager (encompassing the QMS) was appointed. This role provides for

Table 36 IMS/QMS - activities and programs completed in 2020-21

IMS/QMS Objective	Activity / Program	Results / Outcomes
		ongoing monitoring and continual improvement of our management systems.
	New billing system	Hunter Water implemented a new billing system in November 2021, removing the risk of an unsupported system being used for customer billing. Enhanced audit functionality has already benefited the business, and further improvements are expected as understanding of the system's functionality increases. These improvements are captured under the new initiative for 2021-22- Velocity Enhancement Program.
	Service and experience program	We have improved functionality of our website by introducing a range of online forms to replace existing paper forms and have launched our new faults and outage interactive map. Phase 1 of the Developer Self Service project rebuilding the existing developer application and implementing a Developer Portal for customer self-service was launched to our customers in December 2020. To date we have received over 7,800 building and development applications through the new portal with nearly 1,700 customers registered within the new system. Phase 2 of the project will be launched in August 2021.
Meet stakeholder needs	Customer engagement programs.	Our Contact Centre is the primary contact channel for customers, managing over 200,000 customer interactions last year and delivering a variety of functions and services e.g. phone, social media, digital processing and SMS. We also provide face- to-face service to customers via our Newcastle Customer Support Centre. Face to face interactions include complex application support, customer enquiry management, and account payments. Regular customer experience monitoring shows that our customers are highly satisfied with the performance of these services, and that Hunter Water is easy to do business with.
	Voice of Customer (VoC) Program	 We have defined our customers more clearly, and are developing a deeper understanding of their needs and expectations. Hunter Water's leaders have been pivotal in this process and in refining the proposed program of VoC activities. Insights gained from the voice of customer have supported the organisation operationally through the development of new online channels and services. The VoC working group, established in October 2020, has continued to meet each month. Group members, made-up of people representing all divisions in Hunter Water, are advocates for VoC and act as a sounding board for implementation of new initiatives and activities. A detailed service blueprint (customer journey map) was developed in January 2021 for the service fault process. The purpose was to identify opportunities to streamline and improve customer communication processes. Mapping of the end to end customer journey involved people from across Hunter Water's operational areas and included consultation with affected customers.

4.3.3 Proposed IMS and QMS activities and programs

Hunter Water works on a process of continual improvement to progressively develop and enhance the IMS / QMS. Future proposed activities and programs to meet the objectives of the QMS/IMS are described in Table 37

Objective	Activity / Program	Results / Outcomes	Timetable
Continuous improvement	Service and experience program	Phase 2 of the project will be launched in August 2021, focused on automating back-end support processes, integration to Hunter Water's existing systems, as well as building digital based workflows to remove low value manual tasks from our business processes. We will commence our Digital web applications project aimed at developing an additional customer self-service portal for our plumbing and hydraulic customers, this will include creating a secure payment gateway for all our online applications, a workflow hub for processing plumbing applications, automating our Section 47 process and upgrading the "Your Voice" community engagement platform	Ongoing
	Progressive delivery of the Go Digital ICT project	Implementing Watershed to enable enterprise-wide management of areas such as risks, incidents and audit activities	June 2022 / Ongoing
	Incident & non- conformance and corrective action process improvement.	Integration analysis and improvement project across all areas of the business to standardise processes and maximise continuous improvement outcomes on a whole of business basis. This process will be carried in conjunction with the Watershed project and will continue beyond the initial software implementation	Ongoing
	Document Control Improvement Project – Phase 2	Data analysis and cleansing of IMS controlled document data to facilitate the IMS Improvement Project	February 2022
	IMS Improvement Project	Simplified and improved system structure, processes, awareness, user adoption and overall compliance	Ongoing
	QMS/DWQMS/RWQMS Alignment	Enhance alignment between the ISO9001 based QMS and the Drinking Water and Recycled Water Quality Management Systems	June 2022
	Velocity Enhancement Program	Over the course of the 2021-22 financial year, a program of improvements and enhancements will be completed in our new billing system (implemented in November 2020). The program is expected to enable major improvements to customer experience, including e-billing and developer web application integration. The upgrades will also include improvements to the system's functionality.	Ongoing
Meeting stakeholder needs	Voice of Customer (VoC) Program	Awareness workshops commenced in July 2021 to help embed VoC principles in planning and decision making processes for Hunter Water teams. We plan to implement recommended process improvements resulting from customer journey mapping in August 2021. In June, as a VoC initiative, robotic process automation (RPA) was trialled for two key customer services processes. The result was reduced average	Ongoing

Table 37 IMS/QMS - Proposed quality management activities and programs
QMS / IMS Objective	Activity / Program	Results / Outcomes	Timetable
		errors. We plan to implement these into production systems by the end of the next quarter. Hunter Water has launched a program of activities, including information sessions and internal communications, to build awareness and desire for VoC and develop a better understanding of how customer information feedback loops can improve both operational and strategic decision making.	
	Mystery Shopper and customer experience monitoring	Hunter Water has continued participating in a nationally recognised Mystery Shopping program for Customer Experience. At the end of the 2020-21, Hunter Water was ranked 1 st position for the Water Utility category, and ranked 2 nd overall across all 195 organisations. We will continue to participate in this program. In addition, we regularly monitor customer experience across many touchpoints e.g. phone, face to face, complaints, field services and developer services, to ensure customers are highly satisfied and that Hunter Water is easy to engage with. Results are used to feed continuous improvement initiatives.	Ongoing
Compliance	On-going relationship with Internal Management System Audit Provider	To enable continuous monitoring, review and improvement of management systems. Audit reports have been enhanced to include improved visual aids and assist with stakeholder engagement.	Ongoing

4.3.4 Significant changes to the IMS/QMS in 2020-21

During 2020-21 (July 2020), our QMS was recertified to ISO 9001:2015 (AS/NZS ISO 9001:2016). Subject to annual surveillance audits, the certification will run until 9 July 2023. A surveillance audit was completed in May 2021.

There have been no other significant changes to Hunter Water's QMS in 2020-21.

4.3.5 Major non-conformances in the QMS and actions taken to resolve them

There have been no major non-conformances with the QMS during 2020-21. Our external management system provider, Bureau Veritas, completed a surveillance audit across all of our management systems. We are addressing identified observations and opportunities for improvement to ensure continuous improvement and that our systems progressively mature.

5 CUSTOMER AND STAKEHOLDER RELATIONS

In this chapter, we describe the activities and achievements of our Customer and Community Advisory Group during 2020-21 and demonstrate our compliance with the Group's charter. We also identify underlying complaint drivers and describe the actions taken to resolve root causes for complaints.

We also outline any changes that were made to the following key documents or procedures:

- customer contract
- procedures for payment difficulties and actions of non-payment
- charter for customer and community advisory group
- internal complaints handling procedures
- external dispute resolution scheme

5.1 Customer and Community Advisory Group (CCAG)

Our Operating Licence requires that we maintain and regularly consult with our customers through a customer advisory group. We fulfil this requirement through our Customer and Community Advisory Group (CCAG).

5.1.1 Compliance with the Customer and Community Advisory Group Charter

We demonstrate our compliance with the CCAG Charter in Table 38.

Mandatory content	Charter reference	Charter requirement	Compliance
Role	Section 2 – Role of the Customer and Community Advisory Group	Section 2.1, 2.2 and 2.3 - To provide advice on the interests of customers and consumers of Hunter Water, the Customer Contract and other key issues related to Hunter Water's planning an operations.	Compliance with the requirements of this section is demonstrated by the range of topics discussed at CCAG during 2020-21. Minutes for all meetings (including actions taken by Hunter Water) are available at: <u>https://yourvoice.hunterwater.com.au/ccag</u>
How members and the Chair of the customer advisory group will be appointed	Section 3 – How members and the Chair of the Customer and Community Advisory Group will be appointed	A person representing each of the groups nominated in section 3.1 are included on the forum where practicable. The requirements of members are outlined in Section 3.2.	The CCAG includes representation from each of the required groups.
		The selection process is outlined in Section 3.3 and 3.4. Section 3.5 addresses membership vacancies.	
Membership term	Section 4 – the term for which members are appointed	Section 4 provides for four year terms, with allowance for one renewal.	All members have term limits.

Table 38 - Compliance with the requirements of our Customer and Community Advisory Group's charter in 2020-21

Mandatory	Charter	Charter requirement	Compliance
content	reference	Charter requirement	Compliance
Operations	Section 5 – Operations	Section 5.1 - meetings will be held at least four times per year.	Three meetings were held in 2020-21, in August and December 2020, and March 2021. A meeting originally proposed for June 2021 was delayed due to COVID-19, and to coincide with the public exhibition of the Lower Hunter Water Security Plan (August 2021). Technical compliance with this clause will
			still be achieved. The CCAG met 4 times in calendar year 2020, and it is scheduled to meet 4 times in calendar year 2021 (March, August, September and December 2021).
		Section 5.2 – Chairperson – Hunter Water will appoint an Independent Chair	The CCAG has an independent Chair, Cr Paul Le Mottee. Cr Le Mottee's term is due to expire in September 2021.
		Section 5.3 – Attendance at meetings	The invite list to CCAG meetings is restricted to CCAG members, Hunter Water staff and invited guests.
		Section 5.4 – Quorum	All meetings held in 2020-21 satisfied the quorum requirement.
		Section 5.5 – Meeting papers	CCAG members are provided with meeting notice in advance of meetings, which includes the opportunity to help shape the meeting agenda. Meeting papers were then distributed in advance of each meeting.
		Section 5.6 - Authority	The CCAG acted as an advisory committee for the full year.
		Section 5.7 – Conflict of Interests	A standing item on each CCAG agenda is an opportunity to declare conflicts of interest. Any declarations made are recorded in the minutes.
		Section 5.8 – Sub- committees/working parties	Nil working parties/sub committees were formed or held in 2020-21.
Procedures for monitoring issues raised at meetings	Section 6 – Monitoring and reporting on issues raised at the Customer and Community Advisory Group	Section 6.1 – Minutes – requires Hunter Water to maintain minutes of each meeting.	Minutes of each meeting are recorded, and tabled for adoption at the next meeting of the CCAG. Adopted minutes are published on the CCAG website.
			Minutes for CCAG meetings held during 2020-21 are available on the CCAG website.

Mandatory content	Charter reference	Charter requirement	Compliance
Types of matters raised and mechanisms	Section 7 – Matters to be considered by the Customer and Community Advisory Group	Hunter Water will liaise with members to assemble the agenda and distribute in advance of meetings. Matters include: Performance objectives, consultation strategies, programs and activities, current and emerging issues.	Members are invited to submit items for the agenda, both in the form of substantive topics for inclusion and Questions on Notice. CCAG Members are also able to raise any topics (without notice) during General Business. Questions are documented in the Minutes, and actions recorded. Key matters raised in 2020-21 are described in Section 5.1.2, below.
Communicating meeting outcomes	Section 8 – Communicating the outcomes of the Customer and Community Advisory Group to the Public	Section 8.1 outlines Hunter Water's reporting responsibilities including publication of adopted meeting minutes will be published on Hunter Water's website. A summary of the Forum's work will be included in Hunter Water's Annual Report. Forum activities are to be included in newsletters to Hunter Water employees.	Meeting minutes are available on Hunter Water's website. (see https://yourvoice.hunterwater.com.au/ccag) A summary of meetings will also be included in Hunter Water's 2020-21 Annual Report. Updates on the Group were included in the employee newsletters.
Procedures for amending the charter	Section 10 – Charter Section 11 - Approvals	Section 10.1 – The CCAG's charter will be updated at least once every four years. The Charter is to be approved by Hunter Water's Board of Directors.	Hunter Water commenced a review of the CCAG in February 2018, with the University of Technology Sydney being engaged to undertake a strategic review session with members. In May 2018, the CCAG adopted a series of recommendations from the strategic review to improve CCAG operations, including a commitment to refresh the Group's Charter. In August 2018, Hunter Water presented a draft updated Charter to the CCAG. This was endorsed by members. The endorsed Charter was subsequently approved by Hunter Water's Board of Directors in September 2018. The new Charter is a living document, and is required to be reviewed by no later than September 2022.
Funding and resourcing	Section 9 – Funding and resourcing of Customer and Community Advisory Group	Hunter Water will provide a venue and secretarial support for the CCAG. Members of the CCAG are paid a sitting fee consistent with the Premier's Memorandum (M2012-18 Classification and Remuneration Framework for NSW Government Boards and Committees). Hunter Water will reimburse members reasonable out of pocket expenses.	Hunter Water ensured appropriate venue and secretarial support was provided for each meeting. All CCAG members were provided with an option to collect the sitting fee for each meeting they attended in 2020-21. These fees were paid into the bank accounts nominated by members, or where nominated, paid to their organisation or a charity of their choice. Nil costs were reimbursed during 2020-21, however, this option remains available to members if required.

Source: Hunter Water's 2017-2022 Operating Licence, CCAG Charter. Hunter Water analysis

5.1.2 Customer and Community Advisory Group activities and achievements

In 2020-21, the CCAG considered a range of issues, including those recommended by Hunter Water, and self-generated topics that are of interest to members of the group. In accordance with the Charter, matters were raised either for information or to receive feedback from members. It should be noted that the matters outlined in the following sections were relevant to the time they were raised, however further progress and/or changes may have resulted since that time.

Key matters and achievements in 2020-21

Hunter Water's Strategic Direction (including corporate performance)

At each meeting, as part of the Managing Director's report, Hunter Water provided an update on corporate performance, including against the 2017+3 Strategic Direction and Towards 2024 Strategy, and quarterly Corporate Scorecard results. Performance against the National Performance Report indicators was also considered and reported.

Drought

At each meeting, Hunter Water provided an update on current water storage levels, and drought impacts, both within its area of operations and across the broader region. This included discussion about the integrated 'Love Water' water conservation campaign, Water Restrictions (both Level 1 and Level 2), support for business and residential customers, the role of Community Water Officers, the drought tankering program with local councils, and providing water donations to the broader Hunter community.

Lower Hunter Water Security Plan (LHWSP)

At each meeting, the Group received a presentation on the Lower Hunter Water Security Plan, including customer and community engagement processes and results, and phased investigations. This included discussions about community engagement, across the development of the plan.

Recycled Water

Members nominated the topic of recycled water for discussion. Hunter Water led a discussion on recycled water opportunities, including purified recycled water. Members provided guidance and advice on recycled water in their respective communities, including partnership opportunities with local authorities and other water users.

Hunter Water's Levels of Service

Prior to the August 2020 CCAG meeting, members were requested to complete a Service Levels Survey, regarding community perception and expectations of the service levels provided by Hunter Water. The Survey, undertaken as part of a broader statistically representative survey of Hunter Water customers, was designed to understand customer expectations about 'value for money'. The results of the research are being used to inform the review of Hunter Water's Operating Licence, routine pricing reviews, and regulatory framework.

Hunter River Estuary Wastewater Masterplan

Hunter Water is developing a Hunter River Estuary Wastewater Masterplan to inform how we manage our five treatment plants that release wastewater into the Hunter River Estuary over the next 30 years. Hunter Water wants to understand how its investment in these plants can help deliver on the aspirations for our region shared by the community and multiple government agencies.

Biosolids Management and Renewable Energy

Hunter Water led a discussion with CCAG members on biosolids and renewable energy generation. This included a presentation introducing biosolids, explaining their value as a natural resource, and the opportunities to deliver improved environmental, social, and economic outcomes, including improving crop production, soil health, and reducing erosion.

5.2 Actions taken to resolve root causes of complaints

The ongoing analysis of complaints is a key component of our corporate Voice of Customer Program, which is focused on understanding and utilising information about the expectations, preferences and pain points of our customers and acting to improve overall customer experience and community outcomes. We undertake regular working group sessions using customer complaint information to prioritise customer journey map development, refine customer communication and education and feed into longer-term customer and community strategy development.

In 2020-21, total water and sewerage complaints decreased 39% compared to 2019-20.

Billing and account complaints decreased by 56% in 2020-21, driven by fewer meter-reading complaints. This improvement was largely driven by better billing accuracy through advanced meter reading software that uses photos to confirm higher or lower than normal meter readings. In addition, our new billing system, implemented in November 2020 enables us to validate bills more proactively, leading to more accurate billing.

Water quality complaints decreased by 35% in 2020-21, due to ceasing the operation of Tomago Borefields in early 2020 when drought restrictions eased. Water provided from the Tomago Borefields has different characteristics (including taste and odour) and higher natural levels of iron and manganese, which typically leads to more 'discoloured water' complaints than water from our other sources. Other water service complaints decreased by 33% in 2020-21 due to fewer unplanned water interruptions and easing of drought conditions.

Overall, sewer service complaints decreased by 26% in 2020-21. Sewer odour complaints were 25% lower, mainly due to higher rainfalls throughout the year. More rainfall results in wastewater spending less time within our wastewater network and higher flows flushing out biofilms from within the network.

We have continued to focus on improving customer complaint responsiveness and closing longer-term outstanding complaints more efficiently. This has been driven by a new system, business processes and a live complaint dashboard for complaint management. Across 2020-21, 94% of complaints were resolved within 10 working days.

Complaints cannot always be resolved within a short timeframe and require delivery of long-term project works such as capital upgrades to our water or wastewater system. These projects aim to improve the performance of our system and the services we provide to our customers. To ensure ongoing focus and progress, we track the projects via our customer commitment tracker, with progress regularly reported to our Customer Case and Service Level Committee, with issues escalated to the Executive Management Team as required.

A project dedicated to reducing repeat customer impacts (i.e. hotspots) is underway to look at short term and long terms options for improving service for these customers.

5.3 Changes to customer and stakeholder documentation and procedures

Hunter Water's Operating Licence Reporting Manual requires it to report any changes to the following documents and procedures.

5.3.1 Customer Contract

Our Operating Licence includes a Customer Contract that clarifies the relationship between Hunter Water and our customers and consumers. The Customer Contract:

- provides clarity on the rights and obligations of each party
- describes the services we provide to our customers
- describes payment terms and assistance options for customers experiencing financial hardship
- provides information on enquiries, complaints and disputes.

There were no changes to the Customer Contract in 2020-21.

5.3.2 Procedure for payment difficulties and actions for non-payment

In 2020-21, we focused on supporting customers financially impacted by the COVID-19 pandemic. Hunter Water reacted quickly, adapting our support options, hardship practices and business rules in recognition of the pressures our customers were facing. We ceased all collection actions, and removed any flow restrictions that we may have placed on properties prior to the pandemic, ensuring all customers had access to adequate water for hygiene and other purposes.

With insights from frontline staff and customer segmentation data, we refined the application of our hardship policy to include non-residential customers and remove the need for third party referrals to access our Payment Assistance Support (PAS). This improved our customer's ability to access support. During the pandemic, the number of customers on our Account Assistance Program doubled.

We continue to see success with our outreach strategy. Hunter Water's 'All in this Together' campaign increases community awareness about our payment assistance and support programs. We maintained our strong partnership with EWON (Energy and Water Ombudsman NSW) to support vulnerable customers, using our virtual Bring Your Bill Day (BYBD) event to ensure customers continue to have access to these services.

We recommenced collection actions in May 2021, with the support of our external collection agent. We adapted our collection approach, ensuring that capacity to pay assessments were undertaken in an empathic and collaborative way before moving forward with each customer. We also recommenced our home (field) visits, initiating contact with customers that may not have engaged or made a payment within the last 12 months, in order to provide a more personalised approach and solution.

As part of our new billing system, customers can set up bill smoothing via our 'Easy Pay' option. This allows them to make smaller, more regular payments to better manage their household budget and water bills. Information and training have been rolled out with frontline staff to allow them to appropriately offer this option at first point of contact, to further support our customers in avoiding debt accrual. We will continue using a range of engagement channels to communicate with our diverse customer base, ensuring that we identify hardship early and understand how we can provide flexible support options for customers who may be experiencing short and/or long-term payment difficulty.

5.3.3 Customer Advisory Group Charter

In May 2018, Hunter Water engaged the University of Technology Sydney's Institute for Sustainable Futures to assist in a strategic review of the Customer and Community Advisory Group (CCAG). The review was initiated following the change of scope in the CCAG in line with the 'advisory group' status of the CCAG codified in the Operating Licence (the CCAG's predecessor was the Community Consultative Forum).

The updated Charter was developed in close collaboration with the membership, and has been re-ordered to better match with the Operating Licence requirements. The updated Charter was endorsed by the Committee, prior to formal adoption by Hunter Water's Board of Directors.

No changes were made to the CCAG charter during 2020-21.

A copy of the charter is available on the Group's website: www.yourvoice.hunterwater.com.au/ccag

The Charter is next due for review in September 2022.

5.3.4 Internal complaints handling procedure

We have an approved Customer Complaint Management Standard and internal Complaint Handling Guideline that is compliant with AS/NZS 10002:2014 in place. The Standard was revised in May 2021 to ensure that associated strategies and initiatives are supported, implemented and compliant with regulatory requirements and in line with the guiding principles of the Australian/New Zealand Standard AS / NZS 10002 – 2014 Guidelines for Complaint Management in Organisations, and aligns with our Privacy Management Framework.

The Customer Complaint Management Standard is Hunter Water's commitment to the effective management and resolution of customer complaints and is reviewed every two years.

5.3.5 External dispute resolution scheme (EWON)

Hunter Water is a member of the Energy and Water Ombudsman of NSW (EWON), with 100% of cases referred by (EWON) being responded to efficiently within two business days. Escalated complaints referred to the Ombudsman decreased by 8% in 2020-2021, compared to 2019-20. Across the last 12 months, Hunter Water and EWON have regularly engaged, via monthly round table sessions, as a way to build knowledge, understand insights and collaborate more effectively to achieve better customer outcomes. This engagement focus will continue moving forward.

We make it easy and clear for customers to understand our complaint handling process and how they can contact EWON should they need to.

https://www.hunterwater.com.au/documents/assets/src/uploads/documents/Customer-Information/Brochures/Complaints Handling and EWON.pdf

https://www.hunterwater.com.au/contact-us/compliments-complaints.

There were no changes to our external dispute resolution scheme in 2020-21.

6 GLOSSARY

6.1 Acronyms

Process	Description
AWTP	Advanced Water Treatment Plant
ADWG	Australian Drinking Water Guidelines
AGWR	Australian Guidelines for Water Recycling
AMS	Asset Management System
СТ	Contact time
CTGM	Chichester Trunk Gravity Main
CCP	Critical control point
DOS	Disinfection Optimisation Strategy
DWQMS	Drinking Water Quality Management System
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA	NSW Environment Protection Authority
ERM	Enterprise Risk Management
EWON	Energy and Water Ombudsman of NSW
HU	Hazen unit
ILI	Infrastructure Leakage Index
IMS	Integrated Management System
IPART	Independent Pricing and Regulatory Tribunal
ISMS	Information Security Management Systems
ISO	International Organization for Standardization
LHWP	Lower Hunter Water Plan
ML/day	Megalitres per day – one megalitre is a measure of volume equal to one million litres
MPN	Most probable number
NCR	Non-compliance report
NPR	National Performance Report
NTU	Nephelometric Turbidity Units
NWI	National Water Initiative
OEH	NSW Office of Environment and Heritage
PFAS	Per- and poly-fluoroalkyl substances
QMS	Quality Management System
RWQMP	Recycled Water Quality Management Plan
RWQMS	Recycled Water Quality Management System
SCADA	Supervisory control and data acquisition
WELS	Water Efficiency Labelling and Standards Scheme
WHS	Work Health and Safety
WSAA	Water Services Association of Australia – peak industry body for the Australian water industry
WTP	Water Treatment Plant
WWTW / WWTP	Wastewater Treatment Works / Wastewater Treatment Plant

6.2 Water treatment terminology

Process	Description
Aeration	Aeration is typically used as a first step in the treatment of groundwater. The main function is to remove carbon dioxide and hydrogen sulphide from water, and to add oxygen, which assists in iron removal. Water extracted from Anna Bay Sandbeds and treated at Anna Bay and Nelson Bay Water Treatment Plants is naturally very low in iron and hydrogen sulphide. Aeration at these plants is essentially to remove carbon dioxide and add oxygen.
Coagulation / Flocculation	During coagulation, liquid aluminium sulphate (alum) and/or polymer is added to untreated water (raw water). When mixed with water, this causes tiny particles that are naturally present in source water, when extracted, to stick together or coagulate. The heavier/larger coagulated material ('floc') is easier to remove by settling or filtration.
Disinfection	Water is disinfected before it enters the distribution system to ensure that any disease-causing bacteria, viruses, and parasites are destroyed. Chlorine is used because it is a very effective disinfectant, and residual concentrations can be maintained to guard against possible biological contamination in the water distribution system. CT values are used to calculate disinfectant dosage for the chlorination of drinking water. The CT value is the product of the concentration of chlorine and the contact
	time with the water being disinfected. It is expressed in units of min.mg/L.
Filtration	Water flows through a filter designed to remove particles in the water. The filters are made of layers of sand and gravel, and in some cases, crushed anthracite. Filtration collects the suspended impurities in water and enhances the effectiveness of disinfection. The filters are routinely cleaned by backwashing.
	through a microporous membrane.
Fluoridation	Water fluoridation is the treatment of community water supplies for the purpose of adjusting the concentration of the free fluoride ion to the optimum level sufficient to reduce dental decay. Hunter Water is required to fluoridate in accordance with the NSW <i>Fluoridation of Public Water Supplies Act 1957</i> .
Membrane microfiltration	Membrane microfiltration is a type of physical filtration process where water is passed through a special pore-sized membrane to separate microorganisms and suspended particles from the raw water.
Powdered activated carbon (PAC) dosing (event based)	Powdered Activated Carbon (PAC) dosing is used to remove organic compounds from the water supply such as Geosmin and Methyl-Isoborneol (MIB) that periodically occur in surface waters. Geosmin and Methyl-Isoborneol (MIB) are naturally occurring compounds that have a musty, earthy taste and odour.
pH Correction	Lime is added to the filtered water to adjust the pH and stabilise the naturally soft water in order to minimise corrosion in the distribution system, and within customers' plumbing.
Sedimentation	As the water and the floc particles progress through the treatment process, they move into sedimentation basins where the water moves slowly, causing the heavy floc particles to settle to the bottom. Floc which collects on the bottom of the basin is called sludge, and is piped to drying lagoons.
Two-stage filtration (Lemon Tree Passage Water Treatment Plant)	Flocculation occurs within roughing filters (also referred to as adsorption clarifiers) before separation is achieved. In the roughing filter the coagulated water is fed upwards through a bed of granular plastic media where the flocs are trapped within the filter media and the filter overflow exits for further treatment. Final polishing of water from the roughing filters occurs within the dual media (ie coal/sand) rapid gravity filters.

6.3 Wastewater treatment terminology

Process	Description
Bioreactor	A bioreactor is a device that supports an aerobic or anaerobic biological environment.
Chloramine dosing	The application of chlorine and ammonia to water to form chloramines for the purpose of disinfection.
Chlorination	The application of chlorine to wastewater, generally for the purpose of disinfection, but frequently for accomplishing other biological or chemical results - aiding coagulation or controlling odours or sludge bulking in wastewater.
Clarification	Any process or combination of processes the main purpose of which is to reduce the concentration of suspended matter in a liquid.
Dissolved air floatation	Dissolved air flotation is a water treatment process where wastewater is clarified by the removal of suspended matter such as oil or solids. Air is dissolved under pressure in wastewater and then released at atmospheric pressure in a tank. The released air forms tiny bubbles which stick to the suspended matter causing it to float to the surface, where it is removed by a skimming device.
Grit removal	Grit removal is accomplished by providing an enlarged channel or chamber that causes the flow velocity to be reduced and allows the heavier grit to settle to the bottom of the channel where it can be removed.
Maturation pond	A shallow pond that ensures sunlight penetrates the full depth for photosynthesis to occur. Oxygen is provided by algae during photosynthesis and wind-aided surface aeration. These ponds are often mixed by recirculation to maintain dissolved oxygen throughout their entire depth.
Membrane filtration	Membranes are thin and porous sheets of material able to separate contaminants from water when a driving force is applied. They are used to remove bacteria and other microorganisms, particulate material, micropollutants, and natural organic material.
Microfiltration	A pressure-driven membrane filtration process that separates particles down to approximately 0.1 µm diameter from influent water using a sieving process.
Oxidation ponds	A man-made body of water in which waste is consumed by bacteria.
Reverse osmosis	The Reversed Osmosis (RO) process uses a semi-permeable membrane to separate and remove dissolved solids, organics, pyrogens, submicron colloidal matter, viruses, and bacteria from water. The process is called 'reverse' osmosis since it requires pressure to force pure water across a membrane, leaving the impurities behind.
Screening	Screening removes gross pollutants from the wastewater stream to protect downstream operations and equipment from damage. The screen has openings that are generally uniform in size. It retains or removes objects larger than the openings. A screen may consist of bars, rods, wires, gratings, wire mesh, or perforated plates.
Secondary treatment	Typically, a biological treatment process that is designed to remove approximately 85% of the biological oxygen demand and influent suspended solids. Some nutrients may incidentally be removed, and ammonia may be converted to nitrate.
Sedimentation	The process of settling and depositing of suspended matter carried by water or wastewater. Sedimentation usually occurs by gravity when the velocity of the liquid is reduced below the point at which it can transport the suspended material.
Sludge digesters	Tank in which complex organic substances like sewage sludges are biologically dredged. During these reactions, energy is released and much of the sewage is converted to methane, carbon dioxide, and water. These changes take place as microorganisms feed on sludge in anaerobic or aerobic digesters.
Tertiary filtration (dual media)	Filtration is used to separate nonsettleable solids from water and wastewater by passing it through a porous medium. Dual media filters use two media, commonly crushed anthracite coal

Process	Description
	and sand. Tertiary treatment is the final cleaning process that improves wastewater quality before it is reused, recycled or discharged to the environment.
Total Nitrogen	Excessive amounts of Total Nitrogen may lead to low levels of dissolved oxygen, therefore load limits are set to protect downstream water quality from algal blooms.
Trickling filters	Trickling filters are processes that use a static medium such as rocks for growing a film or biomass and then trickling the wastewater over this medium.
UV disinfection	Ultraviolet irradiation achieves disinfection by inducing photobiochemical changes within microorganisms. When ultraviolet radiation is absorbed by the cells of microorganisms, it damages the genetic material in such a way that the organisms are no longer able to grow or reproduce, thus ultimately killing them.

6.4 Key physical, chemical and microbiological drinking water quality parameters

Water Quality Parameter	Description
Aluminium	Aluminium occurs naturally in untreated water in the form of silts and clays. Aluminium sulphate (alum) is also used as a flocculent to remove unwanted colour and turbidity from water supplies. Research has shown that aluminium in drinking water does not make up a substantial proportion of aluminium ingested, and that aluminium in drinking water is no more bio-available than any other source.
Chlorine	Chlorine is used as a disinfectant in water treatment. It controls potentially harmful micro- organisms to ensure the safety of drinking water.
Colour	Colour is measured in Hazen Units (HU). Colour can originate from organic matter in the soil through, or over, which the water has passed.
Copper	Copper is naturally present in both treated water and throughout the distribution system. However, soft water in contact with copper plumbing systems can on occasion give higher concentrations of copper at the customer tap. The incidence of high copper concentrations within Hunter Water's area of operation is very low, and customer complaints are infrequent.
E. coli	<i>Escherichia coli</i> is an indicator bacteria, that is, bacteria which are not normally harmful in themselves, but may indicate the presence of other pathogenic (disease-causing) micro-organisms. <i>E. coli</i> is a type of thermo-tolerant coliform bacteria, and is nearly always present in the faeces of humans and other warm-blooded animals. <i>E. coli</i> is generally regarded as the most specific indicator of faecal contamination, and therefore an important indicator for public health.
Fluoride	In accordance with the <i>Fluoridation of Public Water Supplies Act 1957</i> , fluoride is added to the water to help prevent tooth decay and generally improve dental health.
Iron and Manganese	Iron and manganese may occur naturally at low levels in the water and may be responsible for taste and staining problems with the water.
Lead	Lead levels in Hunter Water's distribution system are typically less than the 0.001 mg/L limit of detection and well below the health guideline of 0.01 mg/L. Lead levels in customer plumbing can occasionally be elevated where water has lengthy residence time in contact with brass plumbing fittings. These contain small quantities of lead, and leaching into the water can occasionally occur. However this is very unlikely to cause continually elevated lead levels. Note that within the area serviced by Hunter Water, there is little or no lead pipework left in the plumbing systems.
рН	pH is a measure of the hydrogen ion concentration of water. A pH of 7 is neutral, greater than 7 is alkaline, and less than 7 is acidic. pH is important because it can affect the disinfection process.
Trihalomethanes	THMs are formed during the disinfection process by reaction between chlorine and mainly naturally-occurring organic substances. Treatment processes are controlled to minimise their production.
Turbidity	Turbidity refers to the cloudiness or dirtiness of water, and is measured by a light scattering technique. Turbidity is measured in Nephelometric Turbidity Units (NTU).
Zinc	As with other heavy metals, treated and reticulated water supplied by Hunter Water contains only very low levels of naturally occurring zinc. Some elevated levels in customer plumbing can be caused by old galvanised pipes and some leaching ("dezincification") from older style brass fittings. Newer plumbing systems do not use galvanised steel, and brass fittings are normally "dezincification resistant", so levels of zinc at the tap are rarely elevated.

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