2 Service levels

Technical Paper 2

- We have categorised our service levels into five broad areas as a way of describing what we provide, or propose to provide, for the price our customers pay.
- Our activities and service levels are set through a combination of regulatory requirements, critical risk reduction, understanding what our customers' value, and are willing to pay for, and achieving efficiency improvements.
- We aim to be easy to deal with and ensure that our customers are satisfied with the service provided.
- We provide safe and reliable services that meet the requirements set out in our Operating Licence, customer contract and other regulations.
- We provide sufficient water to meet our customers' needs while valuing water as a precious resource.
- We treat wastewater to an appropriate quality and ensure that all our operations are undertaken in an environmentally responsible manner.
- We provide safe, high quality drinking water that looks and tastes appealing to customers.

Contents

1. Introduction

Our service levels are set through a combination of regulatory requirements, understanding what our customers and communities value, risk reduction, and achieving efficiency improvements. The first two drivers are covered in detail in other Technical Papers. In Technical Paper 1, our customers and community are characterised and we provide insights into lessons from engagement activities. In Technical Paper 10, we provide a description of the legislative and regulatory environment in which we operate. In the following section, we describe the evolution and maturing of our Enterprise Risk Management Framework and how it is being used to target investment that improves service levels.

In the remainder of this Technical Paper we describe current and proposed service levels and outcomes, along with the activities and initiatives that we are undertaking to achieve this performance. We have categorised service levels into five broad areas for ease of description.

1.1 Reporting of service levels and performance

As a regulated, monopoly service provider, we extensively report and publish our performance in:

- An annual report submitted to shareholders and presented to the Parliament of New South Wales. The annual report is published on our website.
- The National Performance Report (NPR) published by the Bureau of Meteorology. The NPR provides comparative data for analysing Hunter Water's service levels and performance relative to urban water utilities across Australia and over time (see Box 1).
- An operating licence compliance and performance report submitted to IPART each September. We publish the compliance and performance report on our website.
- An annual independent audit of our operating licence performance. Operational audits are undertaken by IPART and the results are reported to the NSW Minister for Water, Property and Housing. The report is also published on IPART's website.
- Annual returns provided to the NSW Environment Protection Authority (EPA) that detail performance against Environment Protection Licences (EPLs). The performance data is available to the public via the EPA website.
- Periodic reports of water quality monitoring results. We publish a monthly water quality monitoring report on our website. Exception reports are provided to NSW Health.

This Technical Paper includes a snapshot of recent results from these reports, as a means of examining Hunter Water's service level performance. As IPART is either the recipient or originator of most of the performance reports outlined above, and most of the referenced reports are publicly available, we have only sought to provide highlights of the reports rather than comprehensively reproducing content.

Box 1 - The National Performance Report (NPR)

The *National Performance Report: urban water utilities* compares the performance of 80 utilities and councils (utilities) and five bulk water authorities providing urban water services to over 20 million people across Australia. The NPR is published by the Bureau of Meteorology using information provided by utilities via their state regulators, in accordance with the Council of Australian Governments' agreement on the National Water Initiative.

The NPR is divided into two parts:

- Part A of the report provides commentary and analysis for 18 key indicators,
- Part B of the report contains data for the full set of 166 indicators reported on by utilities and bulk water authorities for all reporting years.

The 2017-18 NPR is the latest version to be published (March 2019). The NPR provides a useful source of information that allows Hunter Water to benchmark its performance and service against other utilities, particularly our cohort of other major utilities servicing more than 100,000 properties.

There is no one utility that performs well across all NPR measures. Performance is influenced by a number of factors including: weather, temperature, water source, utility size, geography, population density and regulatory environment. There may also be differences in utilities' reporting methodologies and interpretation of indicator definitions.

1.2 Risk management

During the current price period, we undertook a comprehensive review of our Enterprise Risk Management (ERM) Framework. This work has driven re-assessment of our investment priorities. An overview of our ERM Framework, and a description of how it is being used to inform decision-making, is provided in the following sections.

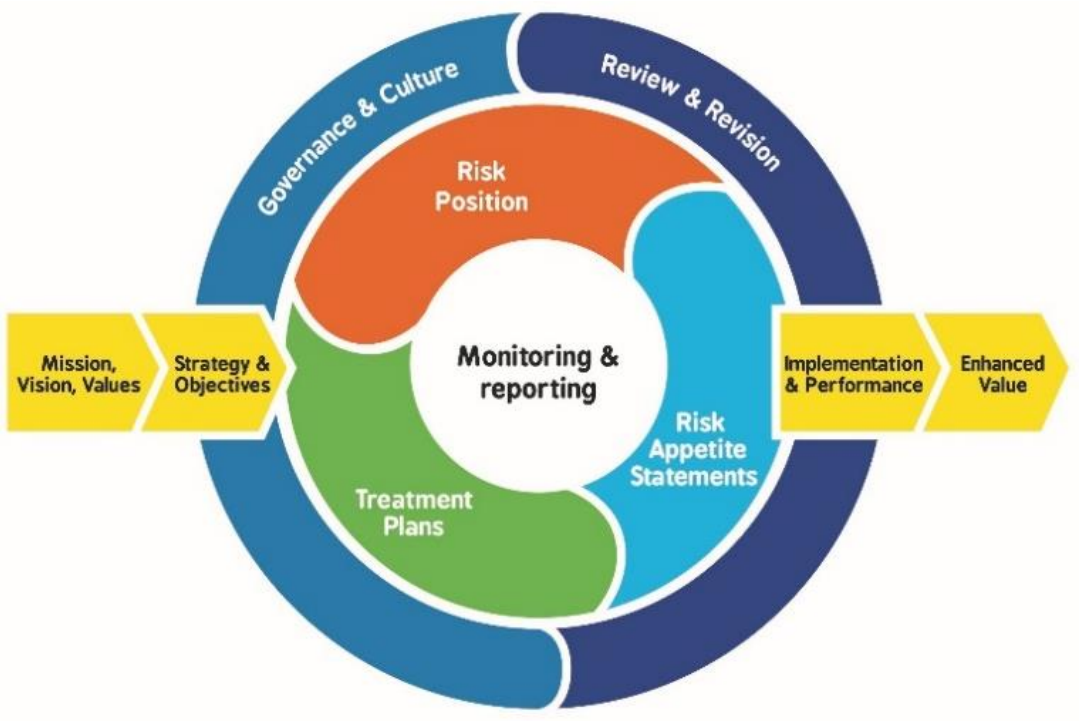
1.2.1 Overview of our Enterprise Risk Management Framework

Our risk management model is represented conceptually in Figure 1.1.

To support comparability of risks across the organisation, Hunter Water adopts a risk framework that aligns with *ISO 31000:2018 – Risk management* and utilises the standard risk rating tools of consequence, likelihood and risk matrix. The risk rating tools have been customised to enable consideration of consequences relevant to the achievement of the strategic objectives of a state-owned water utility.

Our ERM Framework is practical to implement, supports transparent and fully informed decision-making and enables comparable assessment across a range of issues.

Figure 1.1 Conceptual diagram of Hunter Water's Enterprise Risk Management model



Source: Hunter Water.

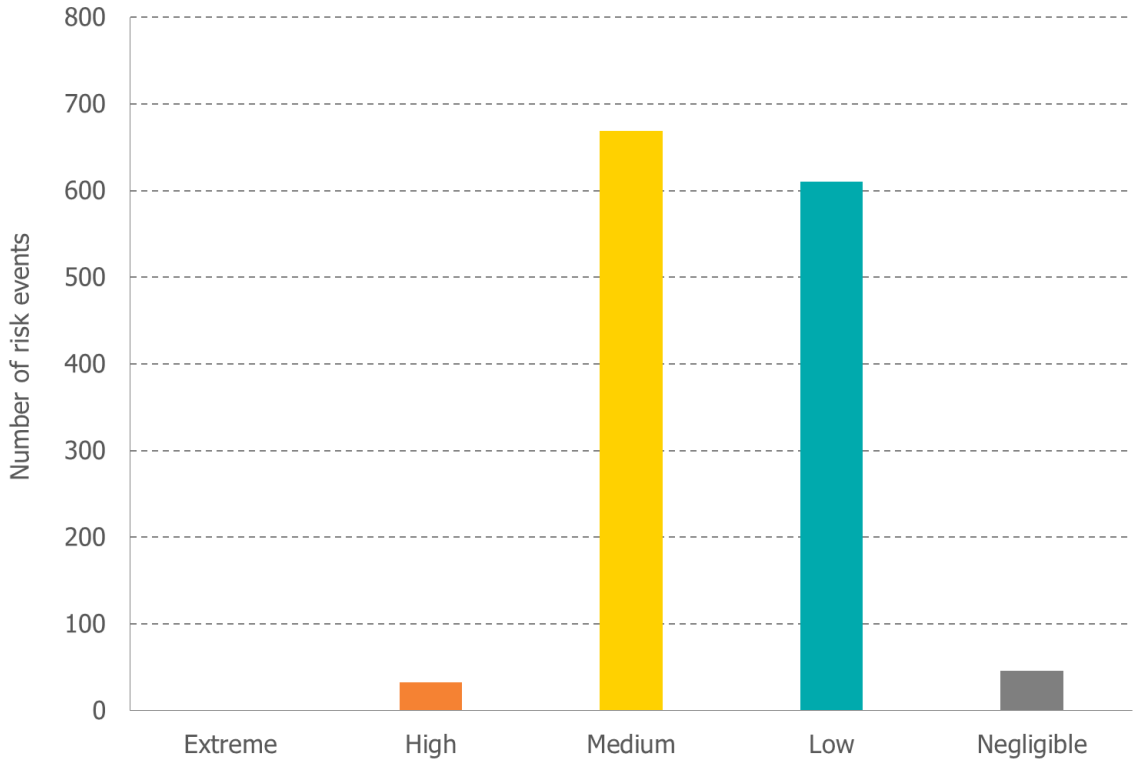
1.2.2 Our risk position

Our corporate risk profile identifies 21 key risk areas. Detailed risk analyses are conducted to support the management of our corporate risk profile. Currently around 1,300 risk driver events have been identified and assessed. The spread of current risk events by risk level is shown in Figure 1.2. High corporate risk areas are currently identified as: safety, critical asset failure and non-compliance with environmental legislation. Actions to address these risks are considered in light of risk appetite statements, as well as affordability impacts on customers and impacts on our financial sustainability (further described in sections 1.2.3 and 1.2.4).

We have a risk-management culture. Each key risk area has an Executive 'owner'. Risk partners from across the business at group manager level ensure business risk events are appropriately identified and managed. These partners form a network of risk champions, sharing risk intelligence and ensuring consistency in the application of our ERM Framework.

We maintain ongoing visibility of our risk position, with all corporate risk events and the associated risk treatment plans reviewed annually. High risks are reviewed quarterly and reported to the Board Audit and Risk Committee with risk trajectory charts indicating anticipated future risk movement.

Figure 1.2 Corporate risk events by risk level



Source: Hunter Water.

1.2.3 Risk appetite

Prior to our comprehensive review of the ERM Framework, we accepted a medium level of risk across our operations, irrespective of the risk event or consequence level. Now, our maturing ERM Framework includes a suite of nuanced risk appetite statements across 14 risk areas that articulate the Board of Directors' expectations in managing each risk area.

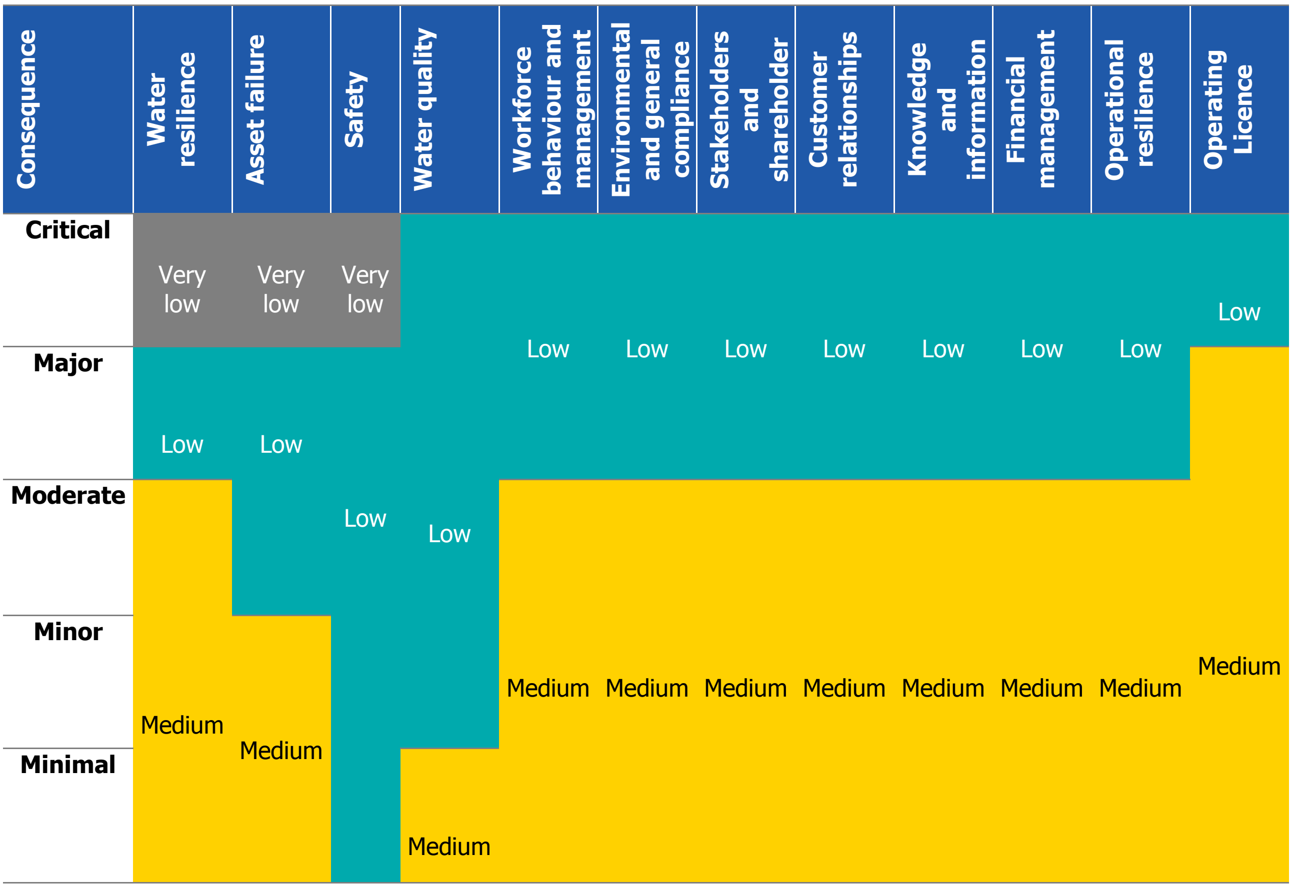
Each risk appetite statement is aligned with a target risk level that is calibrated to the ERM risk ranking matrix (Extreme, High, Medium, Low or Very Low). The range of appetite levels allows for differentiation between risks to be avoided (Very Low), and those that can be managed to specified levels (Medium and Low). A representation of the statements across consequence levels is provided in Figure 1.3.

As an essential service provider, owner and operator of critical infrastructure, and with a workforce exposed to high hazard work environments, Hunter Water has established a Very Low risk appetite for running out of water and for critical safety risks. Infrastructure management and resourcing decisions are made to reflect the need to ensure that asset failures do not result in critical or major safety consequences for workers or the community, workplace environment and behaviours do not result in critical or major safety incidents, and that drinking water source capacity is always sufficient to meet customer needs.

A balanced approach is taken to all other risks. Events with the potential for the highest level impacts have been targeted for a Low risk appetite, whilst recognition is given to the financial and customer impacts of investments by applying a Medium risk appetite to the remaining events.

The appetite statements are a key component of the ERM Framework and are a key factor in driving our investment decisions. The statements allow us to target our investments and resources to manage specific risk types and levels, while taking a balanced view to lower consequence events. Consideration of risk appetites has been integrated into decision-making across all aspects and levels of the business, including our strategic planning process, Board deliberations, and business case templates.

Figure 1.3 Indicative risk appetite statement spread across consequence levels



Source: Hunter Water.

1.2.4 Risk treatment plans and tolerance

Risk treatment plans are developed for all risks that are outside of appetite. The plans aim to identify an action (or suite of actions) to efficiently bring the risk down to appetite levels, or as far as reasonably practicable. The treatment plans articulate the impact of the action in addressing the gap between current and target risk state, at what cost and over what time period. They take into account interdependencies between risks and actions, resulting in improved decision outcomes as more integrated and innovative solutions are developed.

In developing the treatment plans we have been mindful of the bill impacts for customers and are proposing to tolerate a longer timeframe to reduce less critical risks.

Example

An example of the use of our ERM framework and risk appetite statements is the treatment plant chemical systems program. The program business case includes Table 1.1 which outlines the gap between current risk position and risk appetite in the areas of compliance with environmental legislation, safety risks, and water quality risks.

Table 1.1 Enterprise Risk Management example

Risk Event	Consequence Category	Controlled Risk Rating	Risk Appetite Statement	Risk Appetite	Treatment	Projected Risk Rating
Loss of chemical containment	Environmental	High	Breach of environmental legislation leading to prosecution	Low	Upgrade/renew chemical systems	Low
WHS	Safety	Medium	Safety risks associated with our activities (minor injuries)	Low	Upgrade chemical systems	Low
Public health	Water quality	Medium	Water quality event likely to result in impact on public health	Low	Upgrade chemical systems	Low

Source: Hunter Water.

2. Customer experience

Our customer engagement activities enable us to understand our customers and better deliver services that meet their needs and preferences. In this chapter, we describe our service levels in relation to customer's experience and our current and proposed improvement activities.

2.1 Process improvement and efficiency

Our customer-facing teams are continually transforming to meet customer-needs more efficiently and effectively. A focus on process improvement has driven efficiencies in the delivery of services. Achieving these efficiencies has allowed us to place a greater emphasis on customer experience. This means ensuring that customers:

- Find Hunter Water easy to do business with
- Have their queries, requests and issues successfully resolved
- Leave their interactions with a positive sentiment about their experience with Hunter Water, and
- Are satisfied with the service provided.

For example, we have reflected efficiencies in the considerable reductions that we propose for the majority of miscellaneous and ancillary charges for discrete, one-off customer and development-related services (described in Technical Paper 9). Customers benefit directly through lower charges and also by receiving better service more promptly.

2.2 Customer experience measurement

During the current price period we have established several systems that capture data and generate a range of performance measures for our customer-facing areas: contact centre, development services, billing, customer care, and field employees. These include:

- Internal measures and targets relating to service performance and service outputs
- Our mystery shopper program (described in Technical Paper 1), and
- Monitoring of several dimensions of customer experience through a customer experience portal (described in Technical Paper 1).

These measures provide valuable insights into our performance and are helping us to better understand customer needs and assist with troubleshooting customer pain points to improve service delivery processes.

In the following sections, we describe our customer experience measures and report our performance.

2.3 Contact centre

Our call centre is the primary contact channel for customers, receiving over 150,000 incoming calls per year and fulfilling a variety of functions.

We also provide face-to-face service to customers via the front-counter customer service team in Newcastle, Lake Macquarie and Maitland. This team receives applications, answers customer enquiries, processes payments and updates data in our system (customer details for instance).

We offer customers the opportunity to indicate their satisfaction with the interaction at the end of all phone calls with our contact centre.

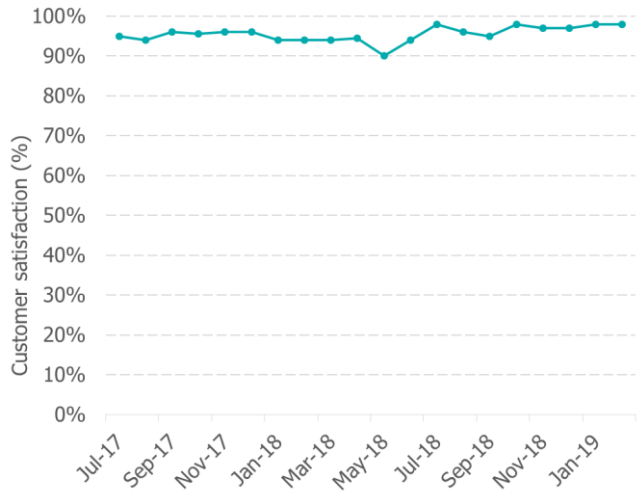
Customer experience monitoring shows that our customers are highly satisfied with the performance of the contact centre and that Hunter Water is easy to do business with.

We achieve these results by focusing on effective resolution and customer experience rather than speed and traditional performance metrics. We are driving continuous improvement in contact centre performance by converting insights from the mystery shopper program into quality training and coaching. The contact centre performs strongly in all sub-measures relating to customer satisfaction and ease.

Source: Hunter Water.

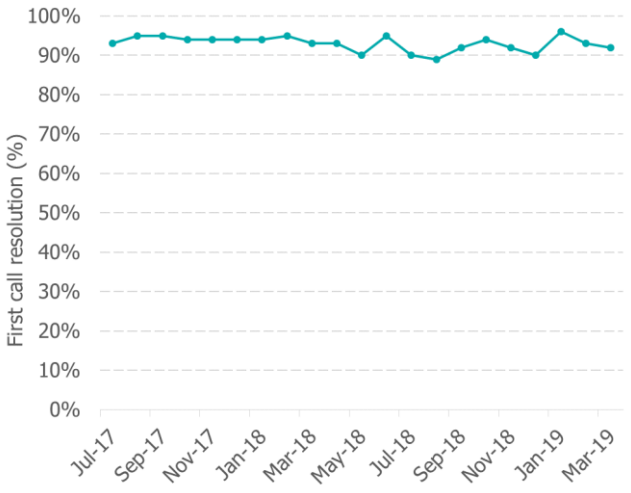
Consistently, average customer satisfaction ratings exceed 90 percent (Figure 2.1). This strong performance is helped by the fact that the majority of customer contacts are resolved on the first call (Figure 2.2).

Figure 2.1 Customer satisfaction reported at end of call



Source: Hunter Water.

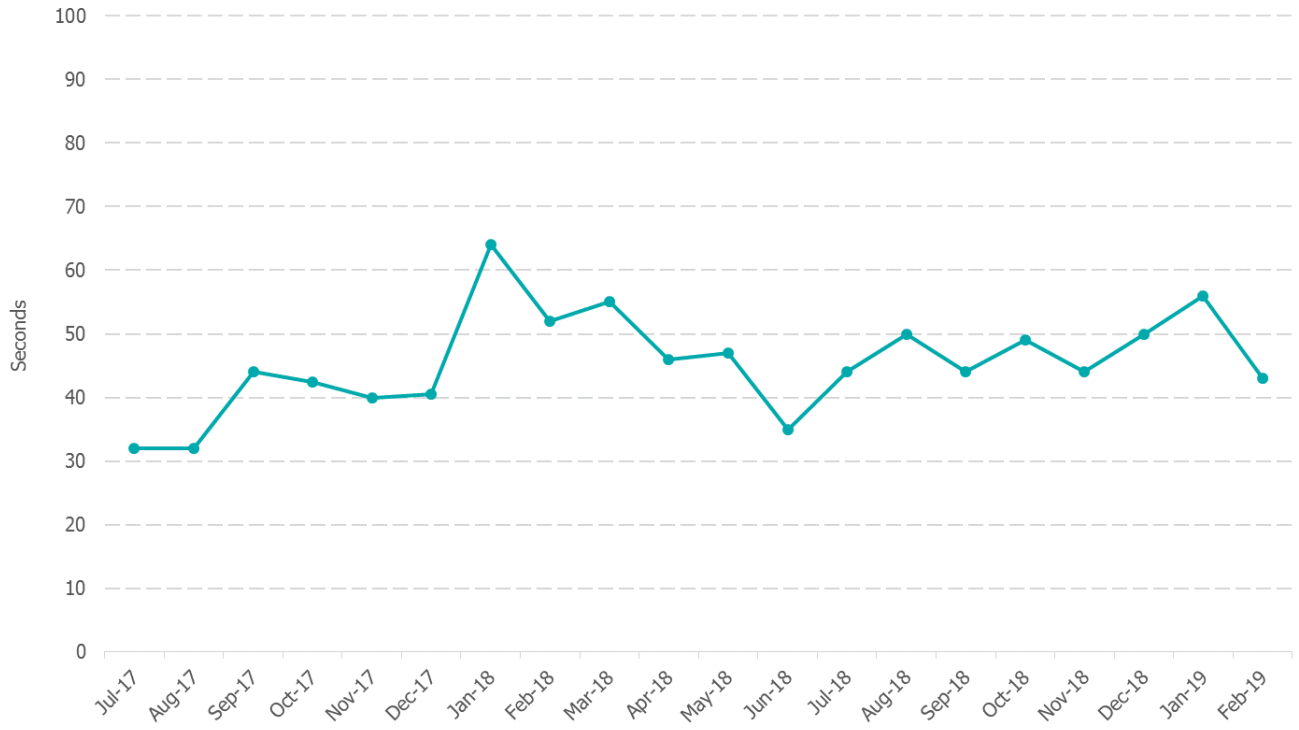
Figure 2.2 First call resolution - how often we resolve a call on first attempt



Source: Hunter Water.

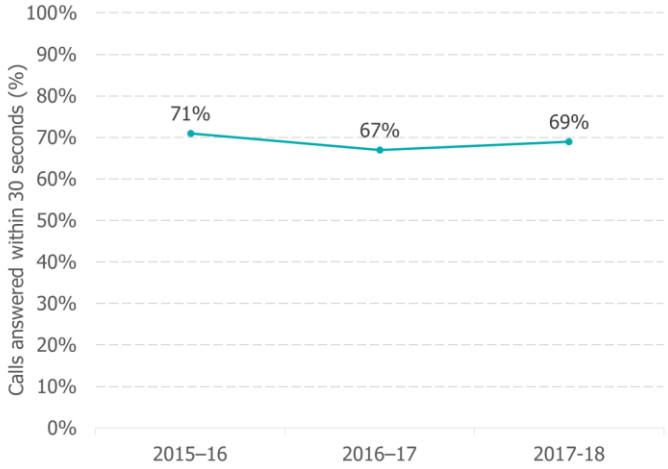
Our focus on delivering an outstanding customer experience is not compromising our performance against traditional output measures: we are answering calls promptly (Figure 2.3 and Figure 2.4) and experiencing low call abandonment rates (Figure 2.5).

Figure 2.3 How long we take to answer incoming calls: average speed of answer (seconds)



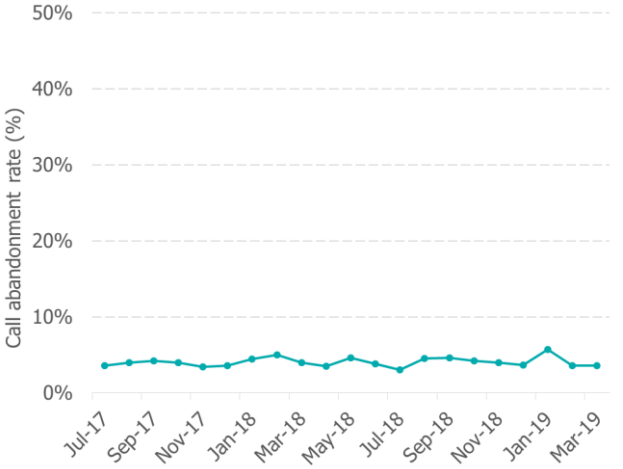
Source: Hunter Water.

Figure 2.4 NPR indicator C14: Calls answered within 30 seconds (percentage %)



Source: National Performance Report 2017-18.

Figure 2.5 Call abandonment rate



Source: Hunter Water.

2.4 Complaints

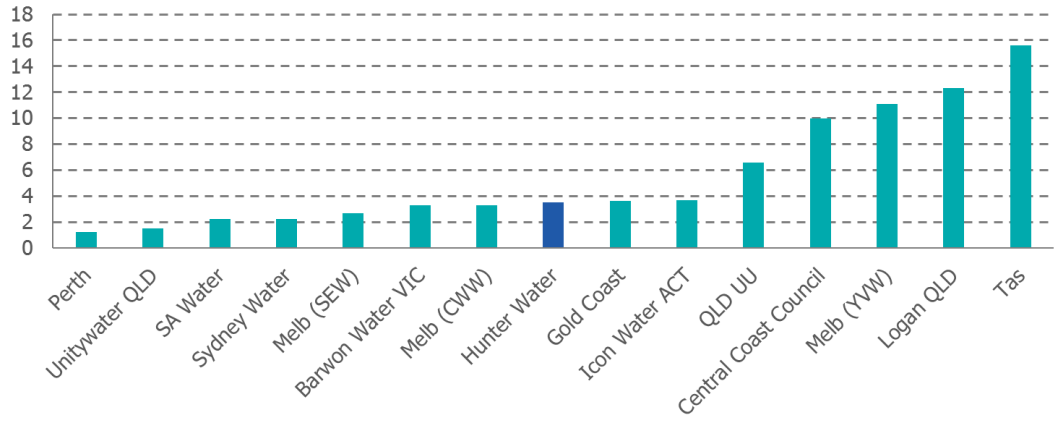
Our Operating Licence requires that we maintain and implement an internal complaints handling procedure consistent with the Australian Standard AS/NZS 10002:2014. Complaints are a quantitative indicator of the quality of customer interactions. A complaint can be a written or verbal expression of dissatisfaction made about an action, a proposed action or a failure to act, by our employees and contractors.

We track our overall level of complaints, as well as analysing trends by topic to identify any systemic issues that need addressing. For example, we have worked to reduce our billing complaints through improvements: to bill presentation, the broader roll-out of bill smoothing as a payment option,[1] the continuation of the account assistance program, outreach visits to engage with customers directly and promote the account assistance program.

Our overall level of complaints is about average (middle of the pack) when compared against our cohort of 15 major utilities with more than 100,000 connected properties (Figure 2.6).[2]

[1] Bill smoothing is currently only available to customers experiencing financial hardship. The Billing System Refresh project will enable this service to be offered to most customers.
[2] BOM, 2019, National Performance Report for Urban Water Utilities, 2017-18, Indicator C13 Total water and wastewater complaints per 1,000 customers.

Figure 2.6 Complaints per 1,000 properties for major Australian water utilities



Source: National Performance Report 2017-18.

Our service levels are improving, leading to fewer complaints being lodged with us. So far this price period, we have nearly halved the total number of water and wastewater complaints per 1,000 properties (Figure 2.7 and Figure 2.8).

Figure 2.7 Complaints over time

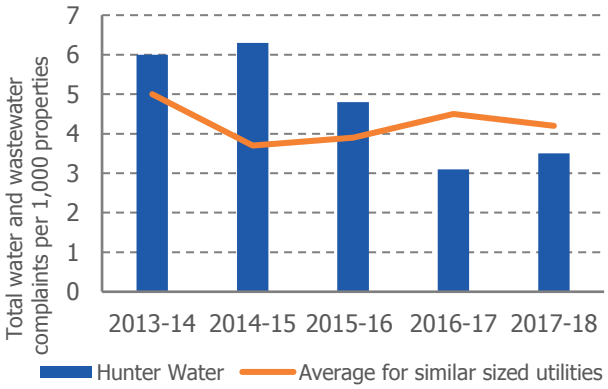
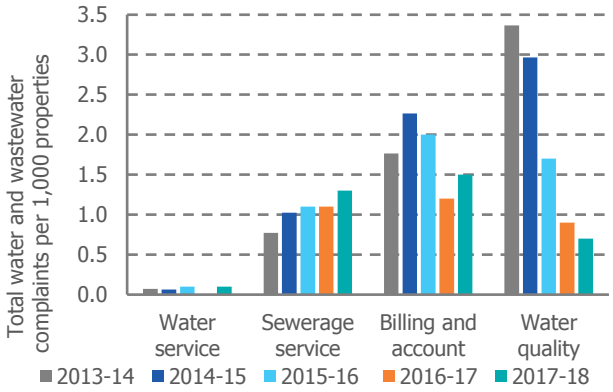


Figure 2.8 Reasons for complaints



Source: National Performance Report 2017-18. Hunter Water analysis.

EWON receives about 100 complaints from our customers each year. The number of complaints has been quite stable over the current price period, even though EWON reported a general increase in complaints across electricity, gas and water in 2017-18. Overall, only a small proportion of complaints to EWON (3%) related to NSW water providers.[3] We are taking a proactive approach to planned and unplanned outages to help keep our customers better informed and therefore reduce these types of complaints.

Our customer care team handles, assesses, reviews and coordinates responses to customer complaints. They also provide a range of customer care and support services, including coordination and response to operational incidents with significant community impact and managing compensation and non-liability related claims. We target to resolve 85 per cent of complaints within 10 days and have been outperforming this target (Figure 2.9).

Hunter Water supports the operation of the Energy and Water Ombudsman of NSW (EWON) which is an independent complaint resolution organisation. This scheme provides customers with access to an external dispute resolution body offering an independent review of complaints – if required.

Energy & Water Ombudsman NSW

[3] Energy and Water Ombudsman NSW, 2018. Strengthening consumer protections: Annual report 2017-18, p. 8.

Figure 2.9 Percentage of complaints resolved within 10 days

Source: Hunter Water.

Customer experience monitoring shows that we are handling complaints well. Overall, the ratings are lower than for other customer-facing areas of our business. This reflects the difficult nature of the customer contact - resolving issues with dissatisfied customers.

Source: Hunter Water

2.5 Customer service in the field

Our field employees interact directly with customers and the community when undertaking a range of planned and unplanned work. These employees play an important role in providing a positive customer experience. We have improved the focus of our service delivery teams, including operations and maintenance, on delivering outcomes to benefit customers.

We survey our customer's experience as measured by their satisfaction, ease, communication and quality of their interaction with Hunter Water during planned and unplanned interruptions. The results show that we are managing to minimise the inconvenience caused and undertake required work in a way that delivers a positive customer experience.

2.5.1 Planned interruptions

Customer experience results for planned interruptions show that there is potential for us to improve how we communicate with customers whilst the work is being carried out.

Source: Hunter Water.

2.5.2 Unplanned interruptions

Where an unplanned interruption to a customer's water service occurs, our customers tell us that we are doing a great job of rectifying the situation. However, the 2017-18 NPR show that the average time we take to resolve the unplanned interruption is longer than other major utilities (see Figure 3.7).

Source: Hunter Water.

2.6 Customer billing

For many customers, their only interaction with Hunter Water is the bill that they receive. We are focused on improving customer satisfaction with the billing services that we provide. The overall number of complaints related to billing and accounts is trending down over time (see Figure 2.8).

Meter-reading inaccuracies are the source of 59 per cent of billing and accounts complaints. To address this complaint driver, we are:

- Implementing a new meter reading system and handheld devices that provide improved in-field read validations and utilise photo technology.
- Developing a more rigorous set of service level agreements and performance measurements for our meter reading contractors.
- Introducing digital meters to our fleet, on selected non-residential and high-rise multi-dwelling residential properties (e.g. apartments), that will remove the need for manual meter reads.

Other planned improvements related to our billing include:

- A new billing system
- Introduction of electronic billing
- Self-service functionality allowing customers to manage their account and bills online
- Improvements to bill presentation by making the bill easier to understand and incorporating improved messaging to drive water efficiency
- Timelier billing for tankered wastewater customers (described in Technical Papers 1 and 9), and
- Increased billing frequency (quarterly billing).

Our account assistance programs assist customers in hardship or with difficulty paying their bills. These programs are described in our Pricing Proposal.

2.6.1 New customer billing system

Hunter Water is implementing a new customer billing system with standardised and streamlined underlying processes. The improved processes will increase Hunter Water's efficiency and effectiveness and reduce ongoing support and maintenance costs associated with maintaining the existing customised system as it approaches end-of-life.

The new system will provide increased capability to meet our evolving customer expectations including customer self-service. Data management and audit controls have been strengthened in the new system to ensure that customer billing is accurate.

2.6.2 Quarterly billing

We are proposing to transition from triannual to quarterly billing. This will bring Hunter Water's billing frequency in line with that of almost all other similar services (including other water utilities, electricity, gas and council rates). Receiving a bill more frequently improves customers' ability to budget effectively by reducing bill shock and by allowing the customer to manage smaller outstanding amounts. More frequent billing also helps identify any water leaks sooner (in customers' property service or Hunter Water's infrastructure). Providing customers with more frequent information on water usage is also expected to improve their ability to conserve water and potentially help to defer the next required major water source augmentation.

2.6.3 Metering replacement

Hunter Water is obligated under the *National Measurement Act 1960* to ensure that all in-service water meters conform to a level of accuracy outlined in the *National Trade Measurement Regulations 2009*. Our Customer Contract also requires a working meter be used to measure usage on all properties connected to our network. Our customers have an expectation their water usage charge will be generated by an accurate meter.

Work is underway to ensure our meters deliver true and accurate recordings of water usage. We expect to replace over 60,000 water meters this price period.

Our proposed water meter replacements program is based on addressing these obligations and ensuring each customer's water usage charge is accurate. We have developed a recommended replacement point for each meter size, in recognition that a meter will degrade in accuracy with increased through-put. These replacement points enable us to schedule replacement of meters before they are expected to significantly under-register usage, in order to: ensure accurate bills, improve fairness, and avoid the poor customer experience of a sharp spike in water usage when a severely under-registering meter is replaced. Throughout the course of the price period these replacement points will be validated by a testing program to ensure our investment in replacement remains at an economic level.

Hunter Water has installed data loggers on water meters of large non-residential customers. This is providing better visibility of customer water use and aiding in the development of Water Efficiency Management Plans that help to conserve water and lower customer bills. We intend to implement digital metering into our non-residential fleet more over the next five years, in order to improve the knowledge a customer has on their water usage and address unnecessary usage through leaks. Digital metering will also be implemented on multi-dwelling residential properties (e.g. apartments), ensuring these customers receive a water usage charge based on their actual usage, rather than one based on the size of their dwelling (unit entitlement).

2.6.4 Privacy and information

Hunter Water treats customer's personal information according to the provisions of the *NSW Privacy and Personal Information Protection Act 1988* (PIPPA). To ensure the privacy of our customers when they contact us, a series of verification questions are asked prior to any request being actioned on a customer's account. Calls are recorded and internal quality assurance checks are carried out to ensure this process is being followed.

Hunter Water intends to adopt a domestic violence policy to guide our interactions with customers. This policy will include further protections against inappropriate access to customer's accounts and account information.

2.6.5 E-billing

Currently we print and send 250,000 bills to customers each billing cycle via post. Printing and posting bills is a high-cost channel for Hunter Water. These costs are expected to rise as postage unit costs continue to increase.

70%

customers surveyed indicating preference to receive bill electronically

We are seeking to send bills electronically in the future to better meet the needs and expectations of our customers:

- We aim to achieve a 50 per cent uptake rate in electronic billing by 2025.
- This will create considerable cost savings for Hunter Water.
- We will offer customer choice by retaining the traditional postage channel for customers who prefer to receive their bill this way.

125,000

fewer bills printed and posted each bill cycle (by 2025)

We are also proposing to add more self-service functionality for our customers by providing a secure online self-service portal that allows customers to manage their account outside normal business hours. This functionality is consistent with other major water utilities and would allow customers to: view current and past bills, manage payments (e.g. pay bill, direct debit, payment extension, payment plans), and update contact and account information.

This will increase the ease of which customers do business with Hunter Water and align with customer expectations for these services. We expect that there will be efficiencies for Hunter Water through lower call volumes. We have factored savings into our proposed operating expenditure.[4]

2.7 Digital interaction

We have recently implemented, and propose to implement, several digital improvements that increase the efficiency of our service delivery. These improvements also improve customer experience by increasing customer satisfaction and ease for customers in doing business with Hunter Water.

2.7.1 Social media

We have expanded our social media presence to include Instagram, LinkedIn and YouTube, as well as Twitter and Facebook, giving customers and the community more options to interact with us than ever before. This also allows us to reach our customers with important information, such as outage details, on the channels they prefer.

[4] See Technical Paper 5.

Social Media Statistics May 2018 – April 2019:

3,462,153	21,083	8,207
Total impressions	Total engagements	Total followers
↑ 655%	↑ 291%	↑ 59%

2.7.2 Website refresh

In line with changes in preferences and evolving technology, our website is becoming a primary communication and service channel for customers and the community. We communicate a variety of information promptly and effectively via our website. This includes details of: major operational incidents, planned and unplanned service interruptions, and our account assistance programs.

The importance of the website as a communication channel is reflected in Hunter Water's current Operating Licence and Customer Contract, within which it stipulates that regulatory information must be made available publicly on our website.

Website traffic is continuing to increase by up to 5 percent per month, receiving an average of 1,000+ visitors per day. We have used data and analytics, real-user testing, industry analysis and community engagement to better understand how customers interact with our existing website, discovering that:

- The website is hard to navigate and important information is difficult to locate
- Existing website content was considered confusing and technical, and
- It was difficult for users to complete specific tasks.

1,000+	12/16
daily visitors to our website	User testing: tasks rated moderate-hard to complete

We will soon launch a new web platform that will be faster and easier to use. Planned improvements include: increased functionality, refreshing content so that it is clear and concise, improving navigation, and ensuring the website works across all mobile and tablet devices. We aim to ensure that users are able to self-resolve issues and complete tasks with ease, reducing the need for customers to contact us via the phone or another channel that was not their original preference.

2.7.3 Online forms and web applications

Online forms

In July 2018, Hunter Water launched a variety of website forms for high-volume customer activities including: direct debit, pensioner rebate applications, lodging a complaint, advising of a water leak, and short term payment plan requests.

These additions have improved customer convenience by providing access for customers wherever they are, at any time of the day. We have received approximately one-third of all direct-debit and pensioner rebate applications via online forms since July 2018. Call volumes have also decreased by about 15 per cent over this time, with a concurrent increase in online activity.

Online development assessment application lodgement

In May 2018, Hunter Water launched online lodgement of development assessment applications:

- There has been impressive uptake. As of March 2019, 70 per cent of all applications are now lodged via a web-based channel.
- This change has provided significant benefits to our customers who no longer have to travel to customer centres to submit and pay for a development assessment application.
- The web-based channel also reduces the amount of paper handling, scanning and administration associated with setting up development assessment applications.
- Each application and the associated documentation is saved in our document management system providing more reliable information flow within Hunter Water.

70%

of development-related applications lodged via web-based channel

The high levels of customer interest in web-based systems has encouraged further development of digital web applications. These applications will improve overall customer experience and provide efficiencies for Hunter Water by ensuring that our services are fast and easy. Providing web-based services is a customer expectation in today's business environment.

Tankering customers can now submit their tankered waste information online, rather than completing a paper docket at the wastewater treatment plant. This improves customers' ease of interaction with Hunter Water. A new administration portal to support the web application allows the operations team to view a live feed of electronic dockets being submitted, and a dashboard of key statistics and operational reports to facilitate invoicing. In the first month we achieved strong uptake: approximately 700 of 1,000 dockets were received electronically (70 per cent uptake).

Accredited backflow plumbers will no longer be reliant on paper-based forms for managing compliance reports. These customers will process required information online with improved back-end administration processes for our employees.

2.8 Better servicing the development community

One of Hunter Water's 2017+3 strategic priorities is to facilitate good development. During the current price period we have made a range of changes to drive improvement in efficiency, customer satisfaction, and ease of doing business. As a result, our processing times have halved for key services. We intend to continue to focus on this area and are proposing a range of further improvements.

2.8.1 Developer-delivery of works

We have recently implemented a new tiered model for the creation of developer-funded network infrastructure that provides more autonomy for the development community in the delivery of infrastructure where the associated risks are relatively low. We continue to have higher levels of involvement in more technically challenging infrastructure projects or complex works.

The new certification model facilitates the design and construction of relatively simple network infrastructure and has delivered a number of benefits to the sector and Hunter Water. Accredited suppliers engaged by the developer can progress the asset creation process without the need to stop work and wait for our approvals in order to move to the next step.

We continue to audit the performance of developers and accredited suppliers, while being able to focus our effort towards progression of relatively more complex infrastructure works that have higher operating and environmental risks.

The key benefits of this change are:

- Asset quality is maintained with less involvement by us. This speeds up the asset creation process.
- Industry professionals build proficiency. Designers and constructors work more closely together to improve constructability, with future designs benefitting from lessons learnt.
- We are able to direct our efforts away from relatively simple infrastructure to more complex infrastructure (e.g. wastewater pump stations) to share our knowledge and better mitigate risks relating to design, construction, operating, safety and the environment.

2.8.2 Growth plan

We publish an annual Growth Plan that provides a central point of information on Hunter Water's planning processes, capital works program and growth projections. The Growth Plan:

- Shows how and where Hunter Water is investing in capital works projects that enable future growth in new connections (both residential customers and employment lands).
- Includes detailed growth maps showing those local areas where Hunter Water anticipates new development within our area of operations over the next ten years.
- Includes land polygons indicating approximate timing of growth (one to five years, and six to ten years).

2.8.3 Engagement strategy

For key improvement initiatives, Hunter Water has engaged with peak industry bodies representing the sector, using a much more interactive and collaborative approach, yielding favourable feedback and encouragement to continue on this engagement path. Key partners include the Urban Development Institute of Australia (UDIA), the Housing Industry Association (HIA) and the Property Council of NSW (of which we are members).

We plan to continue to listen, seek to understand and act on developer concerns in relation to our activities, performance and policies. We have moved away from a 'one size fits all' communication approach, tailoring the engagement approach for each stakeholder. We are engaging with stakeholders including the development community via:

- A dedicated periodic electronic industry newsletter
- Periodic round-table discussions on key strategic topics in the water sector that may influence future directions
- Increasing website information for developers
- Hosting an annual developer forum, and
- Establishing a publically available training calendar for accredited suppliers.

2.8.4 Development services transformation

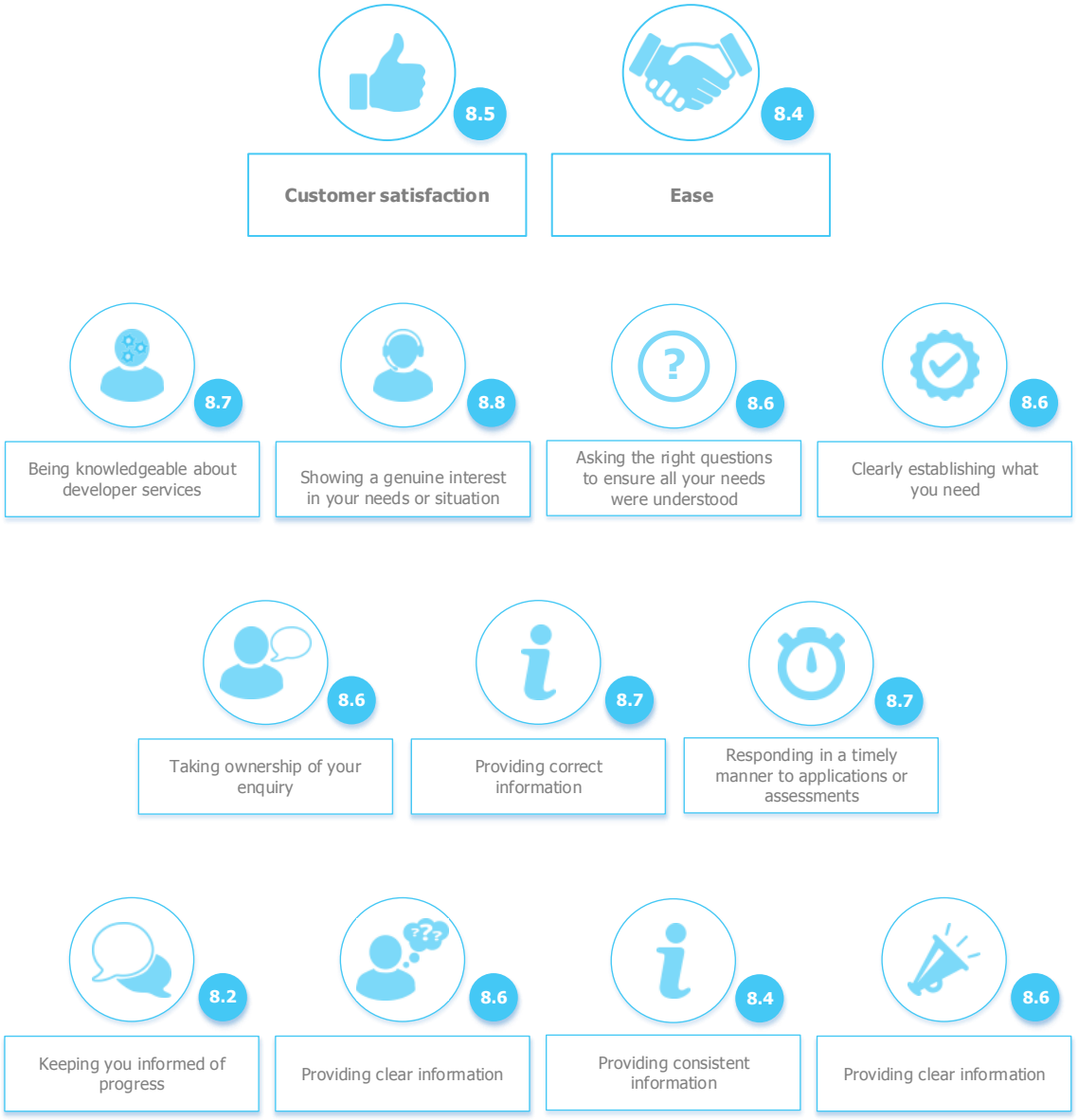
During this price period, our development services group has undergone a transformation that is focused on being more efficient and delivering improved customer experience. Initiatives that have been undertaken to drive the improvement include:

- Forming a new development services group that consolidated key processes and people that provide input into our development-related services.
- Mapping, analysing and redesigning all end-to-end key processes. This involved clearly defining roles and eliminating tasks that added low or no value.
- Modifying and improving the existing workflow system to support streamlining of activities.
- Developing a knowledge centre 'Wiki' including Frequently Asked Questions (FAQ) to reduce call interruptions and improve first call resolution.
- Using short interval control processes in order to problem solve when process issues arise.
- Creating visual management boards to improve day-to-day workload management, manage performance and report internally.
- Optimising efficiency by digitising activities where possible.
- Implementing a new network capacity review process.
- Creating standard operating procedures for all core processes.

The focus on continuous improvement has successfully delivered a halving of average processing times to 10 days for development assessment and (typically) 5 days for issuing a Section 50 Compliance Certificate (as at March 2019).

2.8.5 Developer experience

The benefits of transforming Hunter Water's development services are reflected in the strong results for developer experience in relation to satisfaction and ease of doing business with us.



Source: Hunter Water.

2.8.6 Proposed improvements

Further improvements that we propose include:

- Revamping the 'Notice of Requirements Letter' (that sets out our development assessment requirements) to improve readability and understanding for all developers, while reducing the number of inbound call enquiries handled by our contact centre and other specialist staff.
- Implementing a new development assessment application process for low complexity development and speeding up assessment of simple development proposals (see Box 2).
- Additional web-based tools and support systems:
    - Moving to an online service environment where the customer may gain real-time development assessment advice for relatively simple development types.
    - A self-service portal to retrieve prior notices and access ancillary services, for instance application tracking to provide updates to customers on the status of their applications.
    - Provide access to GIS asset information to licenced end-users.

Box 2 - Low complexity development assessment process

Hunter Water currently has a single process for all development assessment applications.

Up to 20 per cent of development applications (approximately 400) per year are low complexity developments (e.g. minor change of use, granny flats and developments that have no impact on Hunter Water assets).

These applications eventually result in no requirements being placed on developers, yet still undergo the full assessment process.

We are currently developing a new process for these low complexity assessments that will:

- Improve ease of doing business with Hunter Water by reducing customer effort and wait times.
- Increase efficiency and productivity by reducing Hunter Water's effort on low-complexity applications. The efficiency gains will be redirected to better assessing higher complexity (more technical) development applications.

We will measure the success of this initiative by customer uptake and the number of applications assessed through the new process. We will also use the development satisfaction and ease scores, to see if these metrics are positively impacted by the new process.

3. Safe and reliable services

3.1 Introduction

Hunter Water's Operating Licence (2017-2022) and Customer Contract set out our obligations to deliver reliable water, wastewater and stormwater services to customers. The obligations relate to the provision of services, rectification of issues and minimum system performance standards for water pressure, water continuity and wastewater overflows. We are also required to pay financial rebates to customers if we fail to deliver reliable services, as measured through the occurrence of specific events.

Providing reliable services requires significant ongoing operating and capital expenditure. As a competent operator with regard for bill affordability, we do not 'gold-plate' assets and we aim to meet regulatory obligations at the lowest possible lifecycle cost. Service reliability is influenced by a number of factors including weather, asset condition, asset configuration and operational practices.

Our assets and operations also have the potential to pose a risk to the safety of the community and our employees. It is necessary that adequate controls are in place to manage these safety risks to an acceptable level.

Box 3 – Hunter Water's control centre

Our dedicated control centre operates 24 hours a day, 7 days a week. It is purposed with monitoring and controlling all operations across our catchments, dam and network assets. The control centre is responsible for a variety of tasks, including:

- Identifying, triaging and actioning alarms, events and issues through customer calls, SCADA and job management systems.
- Logging, issuing and tracking work orders for maintenance staff to prevent and resolve faults and disruptions to services.
- Providing operational support and assistance to ensure compliance with our regulatory obligations and the best outcomes for customers and the community.
- Optimising system configuration and performance in real time to ensure reliable and efficient services are provided to customers.
- Technical problem solving, calculation and analysis in order to understand system performance, optimise operations and minimise the impact of system failures.
- Undertaking system trend analysis and investigations to identify irregularities and inefficiencies in operation of assets and networks.
- Preparing, implementing and managing plans to minimise impacts to services and manage operational interruptions and events.

Centralising these functions has led to improved outcomes:

- Reducing the customer impact of system issues through better response and rectification.
- Consolidating technical skills, knowledge and support, leading to higher levels of competency and more effective management of system performance and operational incidents.
- Efficiencies provided by integrated overall oversight of systems and operations, including ensuring appropriate triaging and prioritisation of incidents, and efficient allocation of planned and reactive maintenance work.

3.2 Operating licence system performance standards

Hunter Water's operating licence contains five prescriptive system performance standards that have been in place since 2010. These standards are set so that a high proportion of customers receive a suitable level of service relating to water pressure, water continuity and wastewater overflows. The following sections outline each system performance standard, factors affecting performance, and an assessment of our compliance with the standards this price period.

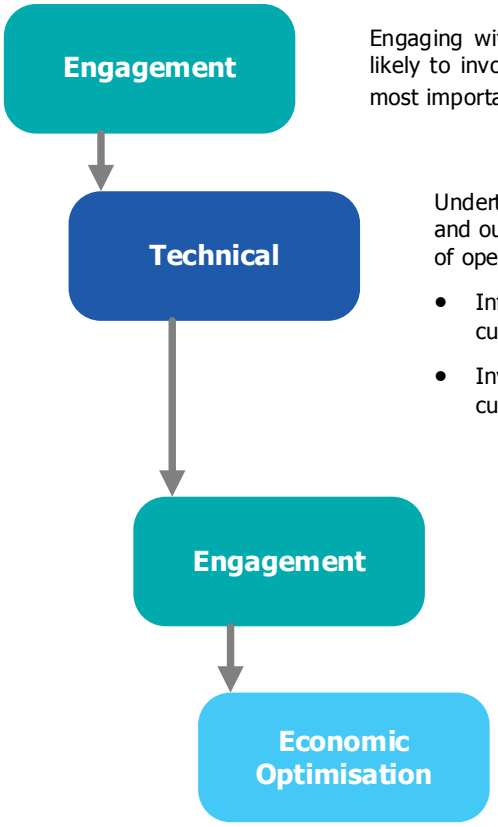
In the 2016 end of term review of Hunter Water's operating licence, IPART considered whether the existing system performance standards are driving the right level of investment in service reliability. IPART noted: [5]

There are trade-offs between the standard of service provided by Hunter Water and the costs of providing that service. The challenge is to meet customers' expectations and minimum requirements whilst not exceeding their willingness to pay.

IPART formed the view that there was insufficient data to recommend any changes to the system performance standards at that time, but recommended a new licence condition be added to ensure sufficient information on customer values and preferences is available for the next review of our Operating Licence:

Hunter Water must survey its customers by 30 June 2020 for the purpose of informing a review of system performance standards and rebates.

We envisage meeting this requirement through a combination of traditional customer engagement, technical engineering work and an economic willingness to pay survey.



Engaging with customers to understand their priorities and preferences. This is likely to involve identifying the aspects of service delivery that customers consider most important and the types of service failures that cause the most inconvenience.

Undertaking technical work to establish the relationship between the costs and outcomes of service delivery. This is likely to involve investigating a range of operational strategies that could:

- Influence the expected number and severity of service outages that affect customers, given the operating environment.
- Involve Hunter Water incurring opex and capex, which would increase customer bills.

Surveying customers to understand the value they place on service continuity. This is likely to involve a survey of customers' willingness to pay to avoid increases in the frequency or severity of services interruptions.

Determining optimal system performance standards , whereby the social costs for service provision are minimised. That is, identifying the optimal performance level where the costs to Hunter Water, customers and society are minimised.

[5] IPART 2017, Final Report - Hunter Water operating licence review 2017-2022, p. 46.

This information would help Hunter Water and IPART to ensure that any future mandatory performance standards are driving Hunter Water to deliver an appropriate level of service reliability that reflects customer's preferences and willingness to pay.

Due to the uncertainty of any changes to future system performance standards, we have assumed that the existing standards must be met throughout the duration of the next price period. This assumption underpins the capital and operating expenditures that we propose in this price submission, which are detailed in Technical Papers 4 and 5.

3.3 Water pressure

Hunter Water's Customer Contract requires Hunter Water to use reasonable endeavours to ensure drinking water is provided at a minimum of 20 metres head of pressure at the connection point of each property to the water supply system. Changes made to customer rebates following the 2016 review of Hunter Water's customer contract made it easier for customers to receive a rebate as compensation for receiving low drinking water pressure.

The ability to deliver adequate water pressure to a property is influenced by a number of factors:

System demand

High water demand can lead to lower water pressure. System demand is heavily influenced by weather conditions (i.e. hot and dry weather increases demand).

Location and topography

Properties that are elevated above, or located far away from, water pump stations and storage reservoirs, or at the extremities of the water network, are more likely to receive lower water pressure.

Growth

Growth in population increases water demand, which leads to lower water pressure.

Our Operating Licence (2017-2022) requires that a minimum system performance standard is met for a high proportion of properties across our system:

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

Operational activities to ensure adequate water pressure is delivered to customers include:

- Monitoring the water network using SCADA and other systems to detect, respond to and rectify low pressure events promptly and effectively.
- Responding to customer enquiries and complaints about low water pressure by analysing SCADA data and undertaking field tests to investigate the issue and determine an appropriate response.
- Working with customers to determine the reason for low pressure including issues related to the customers' internal plumbing.
- Installing pressure loggers across the network to monitor pressure in areas where there may be recurrent low pressure events.
- Optimising pressure across the network through the configuration and operation of network infrastructure. Examples include:
    - Utilising pump station controls to adjust water delivery pressure
    - Opening and closing valves to rezone supply areas, thus modifying water flows and pressure in localised areas of the network, and
    - Increasing reservoir water levels to prepare for times of high demand.
- Undertaking hydraulic modelling to better understand system performance and identify opportunities for improving pressure across the network.
- Adequately resourcing maintenance crews in order to attend and rectify low pressure issues.
- Temporary activation of infrastructure (e.g. water pump stations) when water demand is high.

We also invest in our water network infrastructure including storage reservoirs, water pump stations, trunk mains and distribution mains to improve water pressure performance by: building new assets and expanding the capacity of existing assets. Many of these capital improvements are managed through the network water pressure program (see Box 4).

Box 4 - Network water pressure program

The network water pressure program aims to deliver projects that ensure compliance with Operating Licence obligations relating to water pressure.

A number of projects to improve water pressure have been identified across the network. These projects are prioritised annually based on a review that considers the latest growth projections, updated hydraulic models and risk analysis.

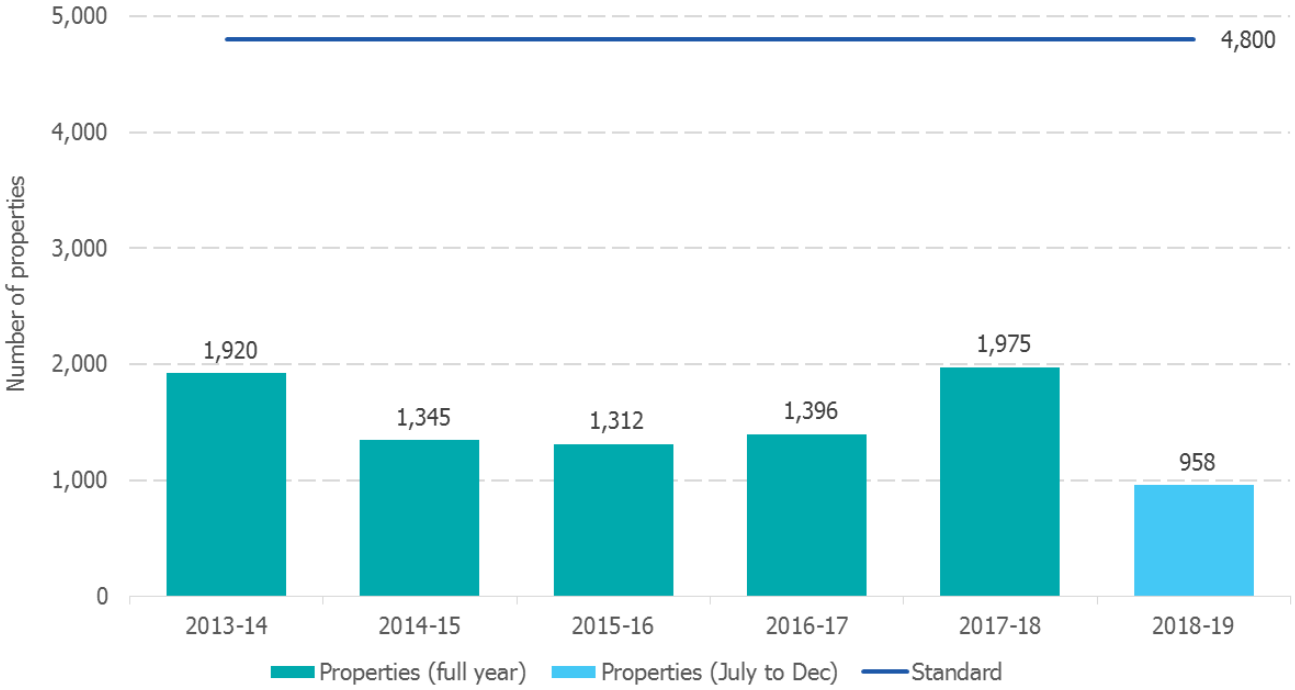
Recently completed projects include: upgrading Telarah water pump station and augmenting the trunk main connecting a reservoir and water pump station at Lochinvar.

We are proposing to invest $32 million in the network water pressure program during the next price period. Planned projects include constructing a new reservoir at Cameron Park and a trunk main upgrade in Cessnock.

Some of the projects in the network water pressure program may also improve water continuity.

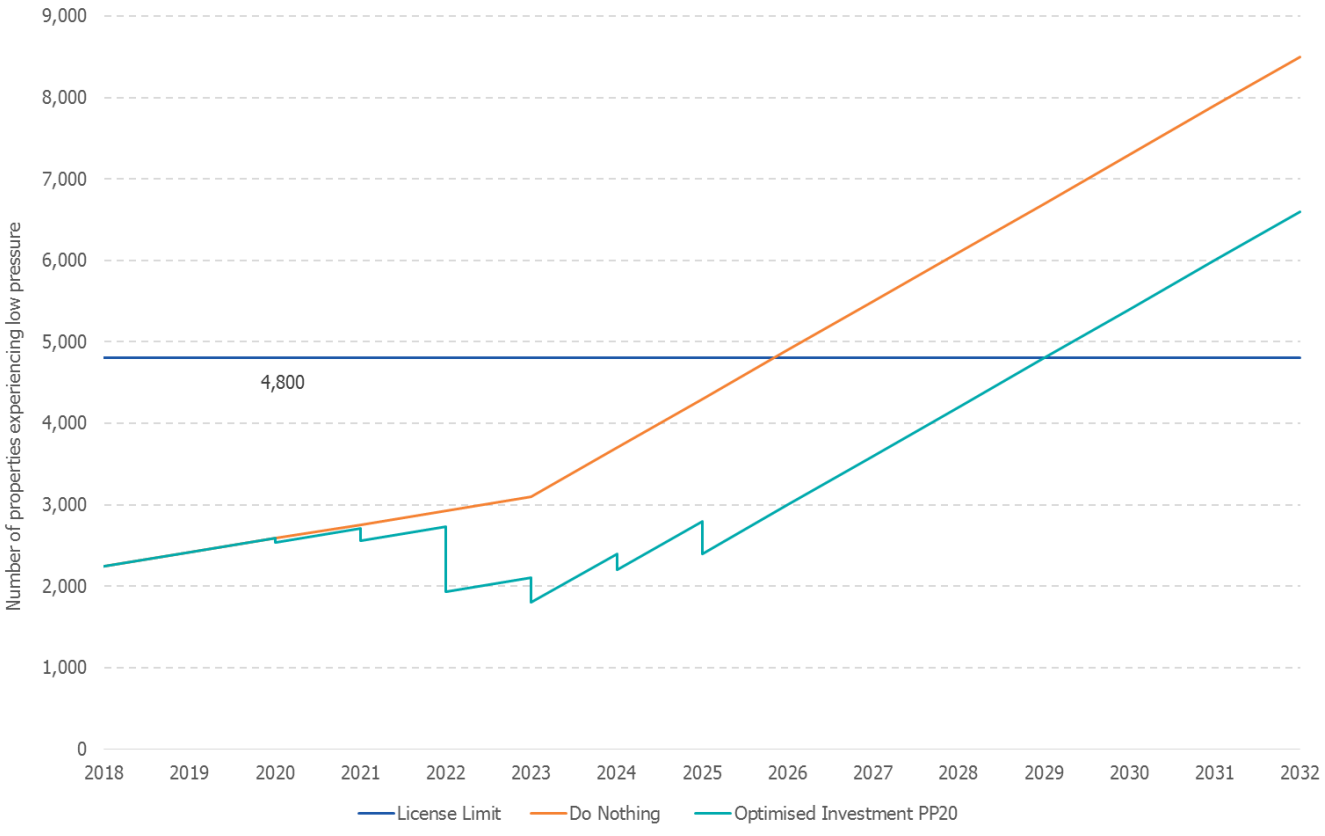
Hunter Water continues to meet the water pressure system performance standard (Figure 3.1). Figure 3.2 provides a forecast of the low pressure Operating Licence count, in 2019-20 and throughout the next price period. Without further investment, we anticipate a breach of the licence obligation by 2026.

Figure 3.1 Water pressure standard performance



Source: Hunter Water.

Figure 3.2 Projected performance against low pressure operating licence



Source: Hunter Water.

Maintaining sufficient headroom under the licence limit (4,800 properties) is important to allow a buffer for several uncertainties including: the population growth rate, actual summer water demand, system performance, delivery and construction of low pressure investments, and modelling assumptions and limitations.

There are a number of customers across our area of operations that receive permanently low water pressure due to a range of factors including the property's physical location in the water network. The investment required to provide more than 20 meters head of pressure to all these properties is estimated to be $10 million. We have not proposed to make this investment in the next price period as there is not a mandatory regulatory driver to do so. We intend to use our planned survey on system performance standards and rebates to better understand customer's preferences about water pressure and willingness to pay for delivering improved water pressure for these customers.

3.4 Water continuity

Water continuity means a reliable and continuous supply of water to customers. There may be times where customers experience temporary interruptions to the supply of water. These interruptions may be planned or unplanned (reactive). We provide customers with financial rebates when the interruption(s) meet thresholds for durations and frequencies defined in the Customer Contract.

Ensuring the continuous supply of water to customers involves managing the reliability of extraction from our water sources, reliable treatment processes and a reliable water reticulation network.

3.4.1 Planned and unplanned interruptions

We may temporarily interrupt customers' water service when undertaking planned work to allow us to modify and maintain our infrastructure. For planned interruptions, the Customer Contract requires that customers are provided adequate notification and that reasonable endeavours are used to reinstate water service within five hours. Where a customer does not receive adequate notification of a planned interruption, including if the interruption extends beyond the notified time period, an unplanned interruption is deemed to have occurred.

Unplanned interruptions typically occur due to failures in infrastructure, such as water main breaks. When these interruptions occur, the Customer Contract requires that reasonable endeavours are used to restore the services as quickly as possible, minimising the inconvenience to customers of supply interruption.

The frequency and duration of unplanned water interruptions are influenced by:

Breaks in trunk and distribution mains

Interruptions to water supply are primarily driven by water main breaks. These failures can occur due to asset condition and are influenced by weather conditions.

Reservoir storage capacity

Whether asset failures lead to interruptions in customers' water supply is influenced by the volume of water held in storage reservoirs that can be 'drawn down' until the asset failure is rectified.

Response and rectification

Our speed and performance in attending and resolving infrastructure failures, such as water main breaks, affects the duration of water interruptions. This is influenced by the complexity of the repair and the number of customers within the area isolated to enact the repair.

Alternative supply

In many cases we can respond to a water main break and provide continuous supply to customers by relying on flexibility to reconfigure our water network.

The Operating Licence (2017-2022) requires that two minimum system performance standards are met for properties across our system. Hunter Water must ensure that in a financial year:

No more than 10,000 properties experience an unplanned water interruption that lasts more than five continuous hours.

And

No more than 5,000 properties experience three or more unplanned water interruptions that each last more than one hour.

To ensure that our Operating Licence and Customer Contract obligations are met, we:

- Notify customers in advance of planned work by providing a physical card to each affected property. We have also started using SMS phone notifications (where we have customers' contact details) to provide more efficient and effective notification.
- Provide timely and accurate information to customers in relation to interruptions on Hunter Water's website and via SMS notification.
- Aim to complete planned works by preventing interruptions or minimising the duration of interruptions by:
    - Reconfiguring the network by operating valves and rezoning supply areas
    - Filling network storage reservoirs ahead of planned work, and
    - Utilising new technologies that allow work to be undertaken without a network shutdown.
- Plan interruptions so that they occur outside of peak periods to minimise inconvenience to customers.
- Monitor the water network to ensure that we identify system issues as soon as possible and are ready to promptly respond. We also monitor numerous communication channels (including social media) to identify issues as soon as possible.
- Efficiently manage and dispatch work crews and allocate appropriate labour and equipment in order to complete the required work as quickly as possible. Work crews have a focus on minimising inconvenience to customers.
- Work closely with customers and the community to meet the needs of critical customers, businesses and other customers that are heavily reliant on a continuous water service. This may involve setting up water stations or alternative water supply, where appropriate.

We also invest in our water network infrastructure including storage reservoirs, water pump stations and trunk and distribution mains to improve water continuity performance by building new assets and renewing the condition of existing assets.

During the current price period we are upgrading a section of the Chichester Trunk Gravity Main (CTGM) from Duckenfield to Tarro in order to reduce the risk of a major water discontinuity in the case of failure of the pipeline (see Box 5).

The Swansea channel crossing and Hunter River tunnel are other examples of challenging infrastructure projects completed during the current price period targeted at ensuring the reliable supply of water services.

Box 5 - Chichester Trunk Gravity Main: Duckenfield to Tarro

The Chichester Trunk Gravity Main (CTGM) is an 85km pipeline conveying water from Chichester Dam to water supply systems in the Lower Hunter.

The CTGM supplies approximately 80 ML per day or 38 per cent of Hunter Water's average water demand.

The 8km single pipeline section of the CTGM from Duckenfield to Tarro was constructed in 1923 of lead-jointed above ground pipe and is one of only three remaining sections of this type and vintage that remain in use on the CTGM.

The condition of Duckenfield to Tarro pipeline section had deteriorated to the extent that it posed an unacceptable risk due to:

- Risk of catastrophic failure and major or critical customer discontinuity during peak demands,
- Risk of catastrophic failure from a Hunter River flood displacing large sections of pipeline.

The existing pipeline contains lead joints and the replacement of which will eliminate safety and environmental risks associated with continuing operation and maintenance of the existing pipeline.

We are replacing the section of the CTGM between Duckenfield and Tarro with a new buried pipeline adjacent to the ageing existing pipeline. This involves upsizing the pipe, removing the existing above ground pipeline corridor.

The new pipeline: increases capacity, delays the timing of a future upgrade to Grahamstown water treatment plant, reduces the risk of major water supply discontinuity, reduces WHS risks, reduces environmental risks, reduces financial costs associated with the increasing maintenance, and reduces water loss.

Hunter River Tunnel

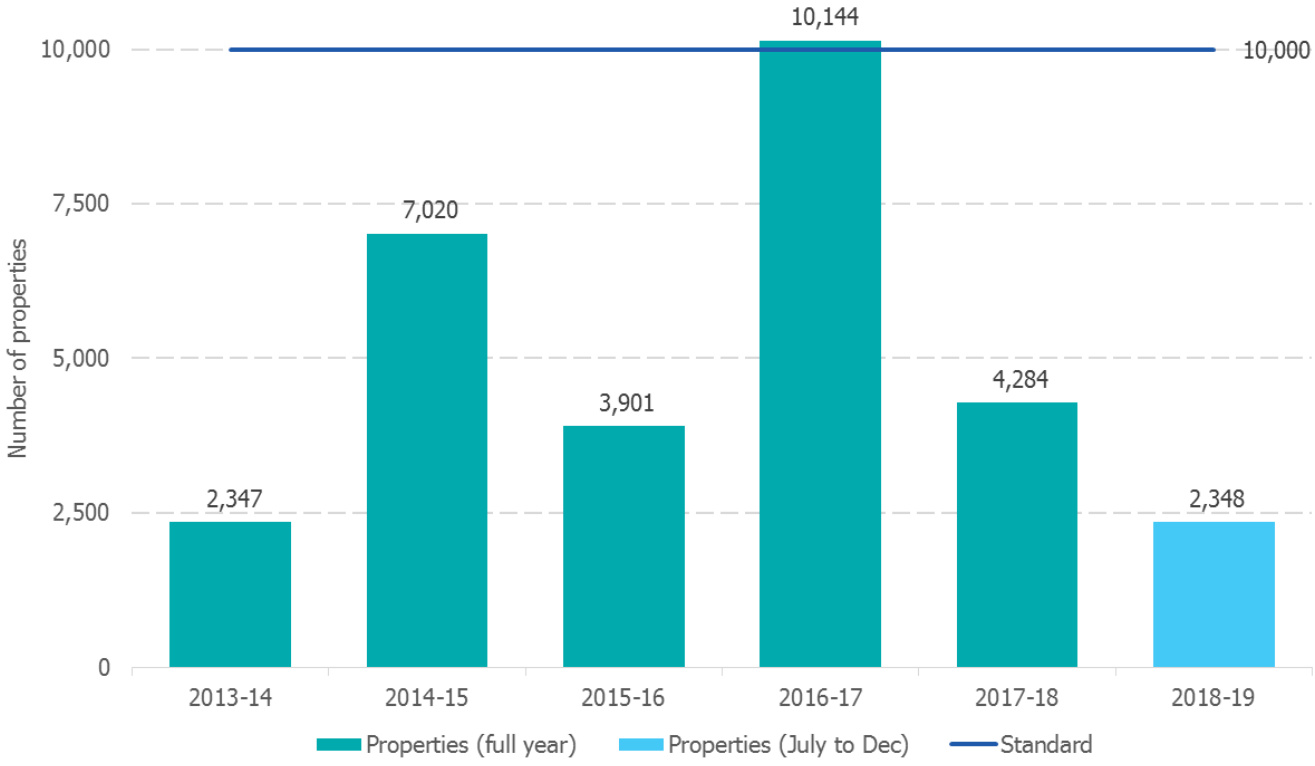
- The Chichester Trunk Gravity Main, including the Hunter River Tunnel, is the sole supply link between Chichester Dam and the distribution network and has a critical role in the distribution of water to the region.
- The condition of the tunnel, pipework and associated valving posed an unacceptable risk of major or critical supply discontinuity impacts in the event of pipeline failure.
- The tunnel was replaced with two parallel trenchless below-river crossings.

Swansea channel crossing

- We constructed a second water main beneath Swansea channel to ensure secure water supply to customers south of Swansea channel.
- This area previously received water from a single water main that was laid on the channel floor beneath the Swansea Bridge opening navigable span. The main would have been extremely difficult to repair if failure occurred.
- Directionally drilling a second water main supply crossing beneath Swansea channel improves the reliability of water supply and security for customers into the future.

Our historical performance against the two water continuity system performance standards is shown in Figure 3.3 and Figure 3.4. In 2016-17, 10,144 properties experienced an unplanned water interruption, exceeding the performance standard. This exceedance was driven by failures in large trunk mains, which can occur without warning. One such break occurred on a weekend in a remote area of the water network, impacting 5,000 properties as it took some time to locate, isolate and repair the issue. Performance in 2017-18 was more consistent with the historical average.

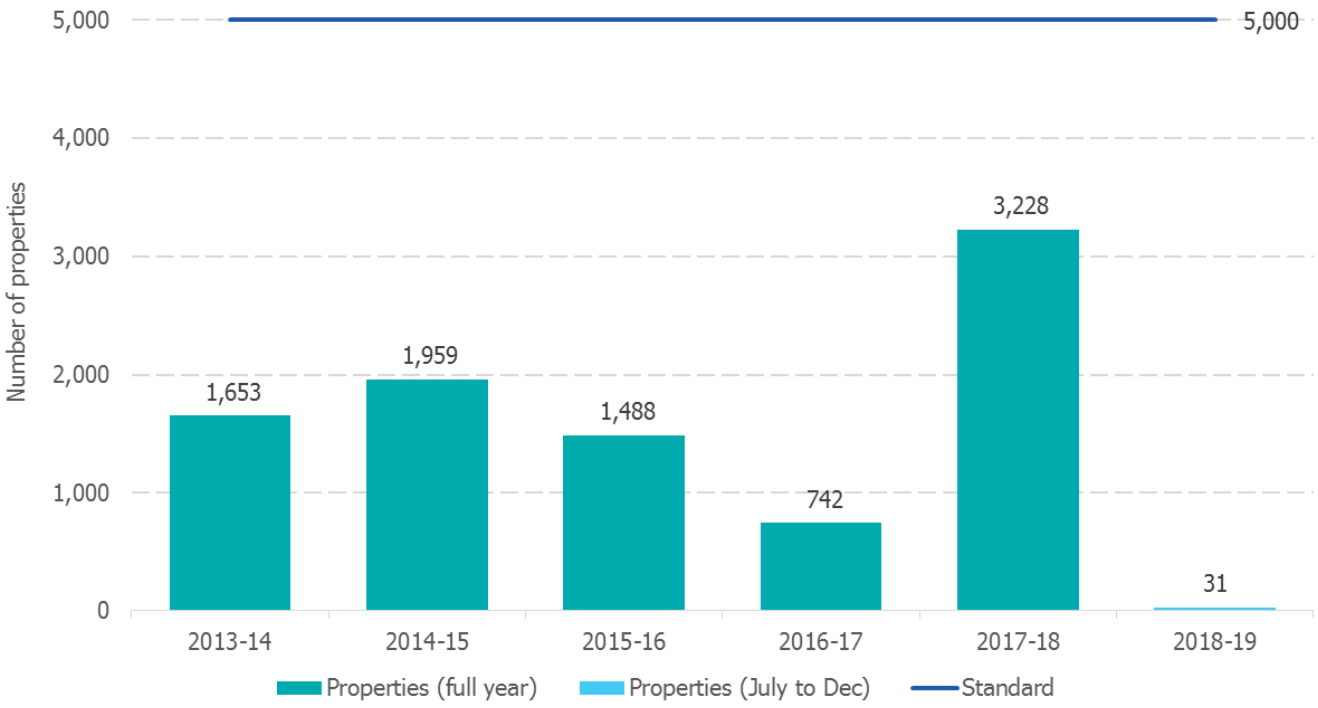
Figure 3.3 Water continuity standard performance – 1 or more interruption



Source: Hunter Water.

Hunter Water forecasts compliance with the performance standards for water continuity in 2018-19, 2019-20 and throughout the next price period, based on our proposed operating and capital expenditures. The critical mains renewal program is one of our proposed investment programs that would help us to meet obligations relating to water continuity.

Figure 3.4 Water continuity standard performance – 3 or more interruptions



Source: Hunter Water.

Box 6 - Renewal of critical mains

Critical water mains are defined as a having a failure consequence of major or critical, impacting on water supply continuity or operational safety, environmental or financial performance.

We have identified and managed critical water mains with a combination of condition assessments, maintenance, reliability and risk assessment strategies and programs over the past 20 years. Our critical water main renewals program forms part of a range of actions and investment requirements to effectively manage existing risks.

Hunter Water understands water main failures will occur, and has a medium risk tolerance for individual minor or moderate discontinuity events not directly impacting our performance against the operating licence system performance standards.

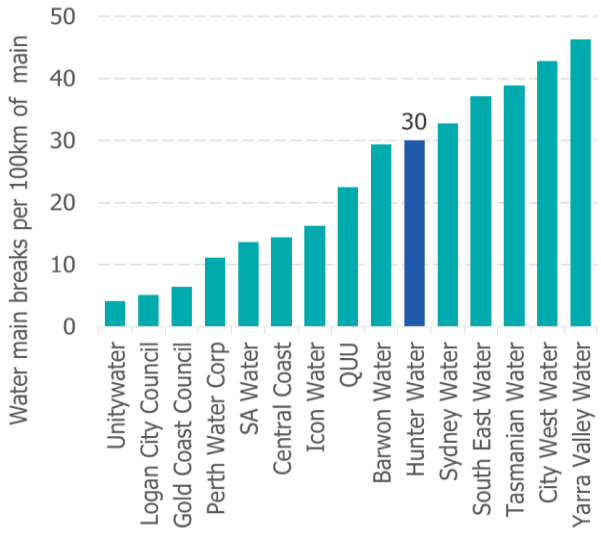
We aim to minimise the costs related to infrastructure operations and planning. Decisions on management actions, water main renewal or re-lining works are made on a case by case basis for each identified critical main.

The NPR provides comparative data that is useful to benchmark Hunter Water's performance for indicators that influence or relate to water continuity, including: the frequency of water main breaks (indicator A8), the duration of water service interruptions (indicator C15) and customer complaints relating to water service (indicator C10).

In 2017-18, we had a higher number of water main breaks than the median utility in our cohort, experiencing 30 water main breaks per 100km of water mains (see Figure 3.5). Our performance deteriorated in 2017-18 (see Figure 3.6), driven by hot and dry weather conditions that created movement and stress in soils, increasing the chance of water main failures.

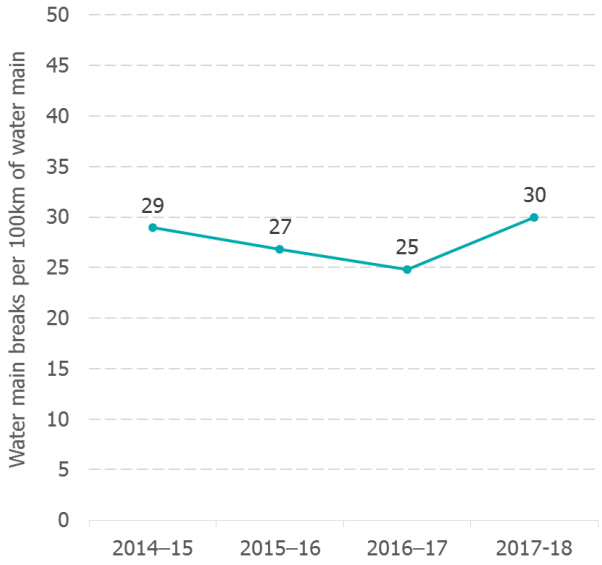
We took an average of 149 minutes to resolve unplanned water interruptions in 2017-18 (see Figure 3.7). This is longer than the median performing utility in our cohort. Our performance in 2017-18 was better than in two of the three previous years (Figure 3.8).

Figure 3.5 NPR 2017-18 – Indicator A8: Water main breaks per 100km of main



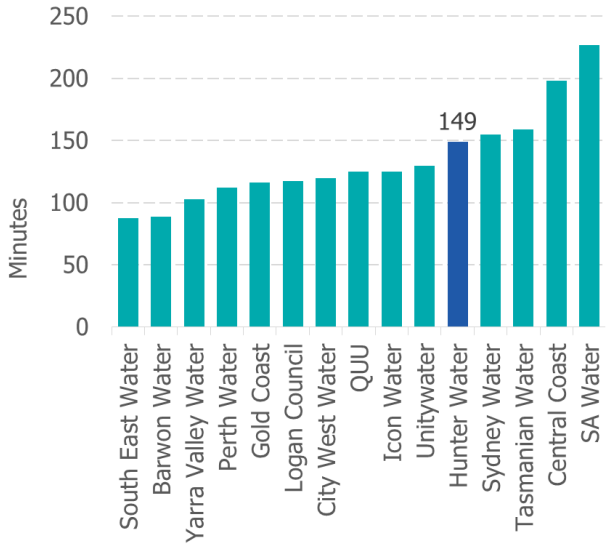
Source: National Performance Report 2017-18.

Figure 3.6 NPR – Indicator A8: Hunter Water's performance over time



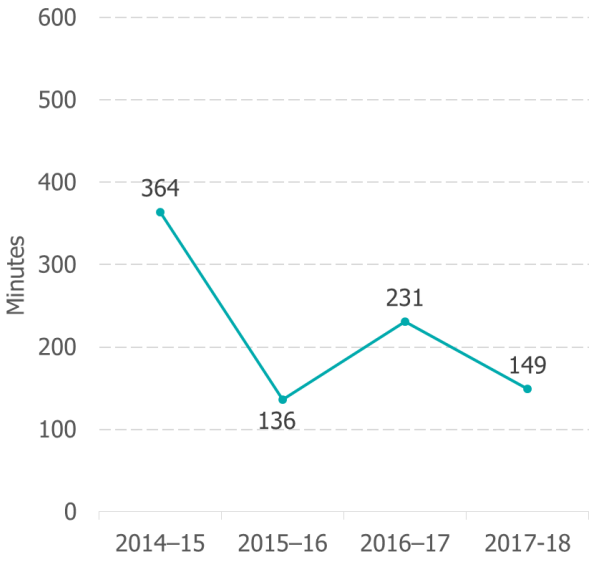
Source: National Performance Report 2017-18.

Figure 3.7 NPR 2017-18 – Indicator C15: Average duration of an unplanned interruption



Source: National Performance Report 2017-18.

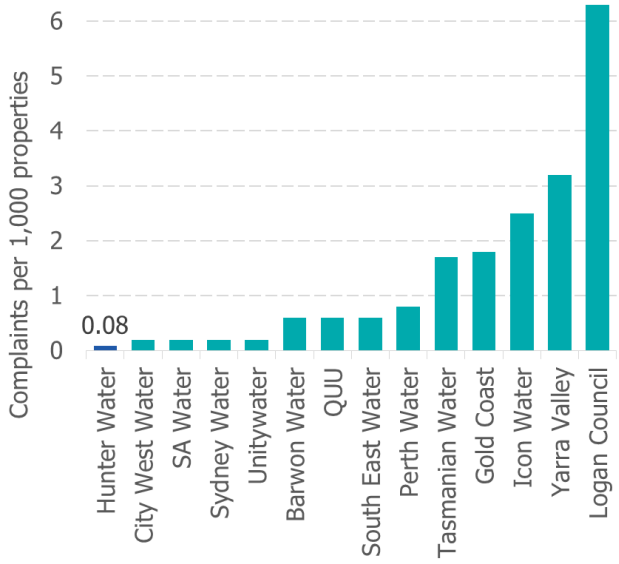
Figure 3.8 NPR – Indicator C15: Hunter Water's performance over time



Source: National Performance Report 2017-18.

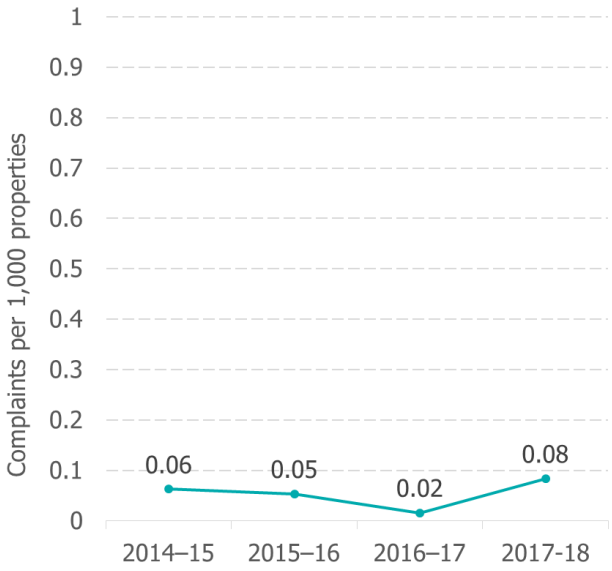
We continue to experience a low number of customer complaints related to our water service and are the leading utility within our cohort (Figure 3.9 and Figure 3.10).

Figure 3.9 NPR 2017-18 – Indicator C10: Water service complaints per 1,000 properties



Source: National Performance Report 2017-18.

Figure 3.10 NPR – Indicator C10: Hunter Water's performance over time



Source: National Performance Report 2017-18.

3.4.2 Reliable water source supply and treatment capacity

Providing reliable and continuous water service extends beyond our management of network assets. It is essential that we maintain reliable treatment capacity and continuous and resilient supply from water sources.

Lower Hunter Water Plan

Hunter Water participated in development of the 2014 Lower Hunter Water Plan (LHWP), working closely with government agencies and stakeholders. The LHWP identified a mix of water supply and demand measures that will ensure water security in drought, as well as reliable supplies to meet the region's longer-term needs. Hunter Water is responsible for implementing many of the actions of the LHWP and is currently working with stakeholders on the next iteration of this plan.

Central Coast transfer capacity upgrade

The Central Coast inter-regional water transfer project is an important part of the LHWP to increase the two way transfer scheme's system yield capacity up to 30 ML per day between Central Coast Council and Hunter Water and also improve the quality of shared water. The project benefits are:

- Improved drought resilience for both Hunter Water and Central Coast Council
- Lower risk of water supply discontinuity by providing an additional source of supply
- Increased operational flexibility during incidents (e.g. water main breaks and pump station failure), and
- Improved water quality for western Lake Macquarie.

Grahamstown water treatment plant (WTP) sludge rakes

Grahamstown WTP is Hunter Water's largest water treatment plant. The treatment plant's sludge rakes are designed to drag settled sludge along the sedimentation tank floor into hoppers for removal from the treatment process. The condition of the rakes is deteriorated and they do not operate reliably. This has reduced the reliable capacity of the Grahamstown-Dungog water supply system, presenting a risk to meeting demand for water during an extended hot dry period (extreme demand).

The project involves replacement of the existing sludge rakes with a modern sludge vacuum system. The proposed upgrade will improve treatment plant reliability, deferring the need for a major upgrade in plant capacity. The upgrade will also reduce water losses through more efficient sludge removal and by providing an opportunity for repair of leaking joints.

Grahamstown WTP clear water tank

During high demand periods, process failures at Grahamstown WTP have resulted in the clear water tank level dropping quickly. This can stir up turbidity in the water, resulting in plant shutdowns and inconvenience to customers through reduced water pressure. There is also no redundancy to allow the clear water tank to be taken offline to address water quality issues, repairs or structural failure.

Given the criticality of Grahamstown WTP to our entire water supply systems and the vulnerability outlined above associated with the clear water tank we are proposing to undertake a project that involves installing a new 10 ML clear water tank and refurbishing the existing clear water tank. This project will allow Grahamstown WTP to better meet demand requirements in the network and reduce the likelihood of service disruption.

3.5 Firefighting flows

Urban fire protection is provided through a range of mechanisms such as:

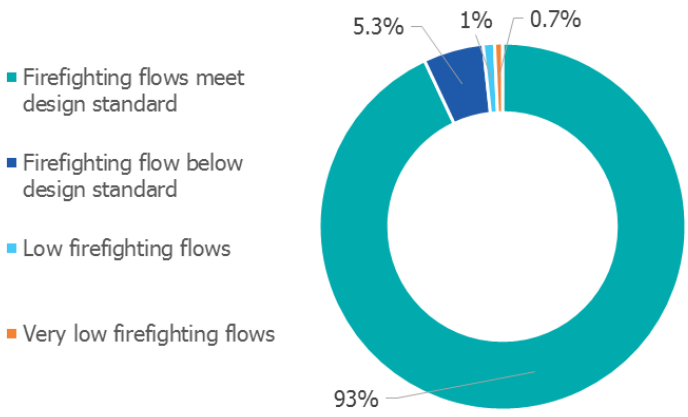
- Building codes and requirements for on-site systems imposed through development approvals
- Firefighting services and capabilities of Fire and Rescue NSW (FRNSW) and the Rural Fire Service, and
- The water supply network.

The full range of mechanisms, and the interactions between them, determine the ability to mitigate consequences of urban fires to properties and the community.

Firefighters rely on water being available, delivered at an adequate flow-rate and pressure in order to contain and extinguish a fire using mains water supply. Hunter Water's ability to deliver water for firefighting is influenced by factors such as water network capacity, pipe sizing and arrangements, hydrant condition and access, and housing density. Hunter Water does not have a performance standard requirement in its operating licence in relation to fire-flow in the water network. However, based on legal advice we use the Australian Standard AS 2419.1 as the basis for our firefighting flow design standards for new developments.

There are approximately 50,000 fire hydrants within Hunter Water's water network, the majority of which meet current firefighting flow design standards. Modelling has identified locations where we do not meet the current standards and the significance of any variations (see Figure 3.11). Hunter Water intends to work with Fire and Rescue NSW to agree on priority areas and the most cost-effective way of meeting fire-fighting requirements in those locations.

Figure 3.11 Firefighting flows delivered to each property



Source: Hunter Water.

3.6 Wastewater overflows

Our customer contract requires that we use reasonable endeavours to minimise the incidence of wastewater overflows on customers' properties due to failures in the wastewater system. In the event that an overflow does occur, we must use reasonable endeavours to:

- Minimise inconvenience and damage by containing the overflow as soon as possible
- Clean up the affected area as quickly as possible at Hunter Water's cost, and
- Inform customers of any forms of redress available.

Customers receive financial rebates if their property experiences a wastewater overflow in dry weather due to a failure in Hunter Water's system. In the unlikely case that a property experiences three wastewater overflows, the rebate received is over $600, reflecting the level of inconvenience that multiple wastewater overflows imposes on customers.

The performance of a wastewater system is influenced by: pipe material and age, network configuration, sewage volumes, soil type, tree root intrusion, management of trade waste, and weather conditions including rainfall.

Wastewater overflows may be caused by:

- Chokes, where a blockage in a wastewater pipe restricts the flow of wastewater, causing it to spill or overflow. Chokes are the primary cause of overflows. Some of the main causes of chokes are:
    - Tree roots that have infiltrated the wastewater pipe seeking moisture, and
    - Build-up of a combination of non-biodegradable material/contaminants (such as wet wipes and rags) and congealed grease/fats.
- Breaks, where a wastewater pipe fails causing wastewater to spill or overflow from the pipe. Some of the main causes of breaks are:
    - Tree roots that have infiltrated the wastewater pipe seeking moisture
    - Weather conditions such as changing temperatures and fluctuating moisture levels that can increase the number of breaks, and
    - Deterioration in the condition of the wastewater pipe.
- Other asset issues such as a malfunction or loss of power to a wastewater pump station.
- Infiltration of stormwater into the wastewater system.

Hunter Water's 2017-2022 Operating Licence requires that two minimum system performance standards relating to wastewater overflows are met for properties across our system. Hunter Water must ensure that in a financial year:

No more than 5,000 properties experience an uncontrolled wastewater overflow in dry weather.

And

No more than 45 properties experience three or more uncontrolled wastewater overflows in dry weather.

Activities undertaken to meet our obligations relating to dry weather wastewater overflows include:

- Remotely monitoring the wastewater system to identify abnormal trends and ensure the optimal operation of assets.
- A range of mitigation activities to manage causal issues so that they do not result in wastewater overflows. For example, using tankers to transport excess wastewater when wastewater pump stations are not fully operational.
- Promptly attending to, and resolving, causal issues or wastewater overflows in order to minimise the customer and environmental impacts.
- Designing and reconfiguring the wastewater network to direct wastewater overflows in a way that minimises customer and environmental impacts. For example, directing wastewater into emergency release structures.
- Undertaking capacity reviews and subsequently amplifying the capacity of wastewater mains to resolve wastewater system constraints.
- Replacing and relining deteriorated wastewater mains.
- Increasing emergency storage capacity at wastewater pump stations.
- Preventative jetting of wastewater mains using CCTV.
- Modelling to better understand the drivers of wastewater overflows and anticipate where and when they are most likely to occur.
- Analysing wastewater overflow data to identify hotspots and develop localised initiatives to improve performance. For example, asset amplification, reconfiguring the network and building emergency release structures.

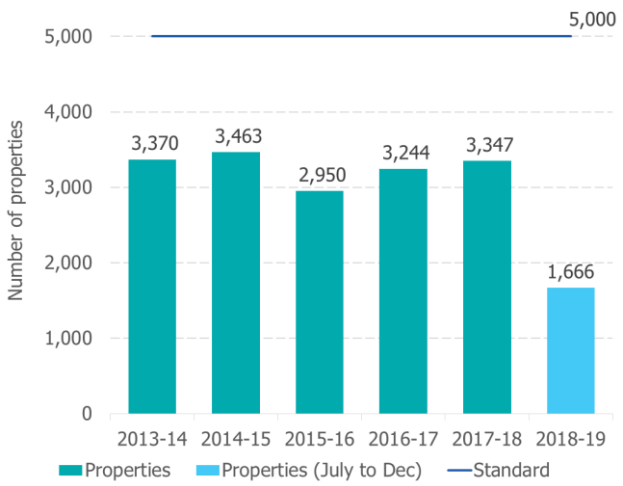
We also undertake capital works to upgrade and renew our wastewater network assets to reduce the incidence of wastewater overflows, particularly dry weather wastewater overflows. [6]

We have historically met the two required system performance standards for wastewater overflows (see Figure 3.12 and Figure 3.13). We forecast that we will continue to meet the wastewater overflow standards in 2018-19, 2019-20 and throughout the next price period, based on our proposed operating and capital expenditures.

The NPR provides comparative data on the frequency of wastewater main breaks and chokes per 100km of wastewater main (see Figure 3.14 and Figure 3.15) and per 1,000 properties (see Figure 3.16 and Figure 3.17). For both these measures, Hunter Water is below the median performer in the major utility cohort. In 2017-18, we performed below the median in the cohort (Figure 3.18) and received more complaints relating to wastewater than in prior years (Figure 3.19).

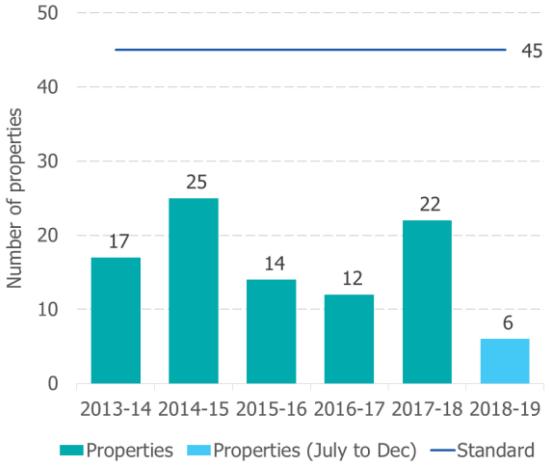
[6] Some of these infrastructure works are described in section 5.3.

Figure 3.12 Wastewater overflow standard performance – 1 or more overflow



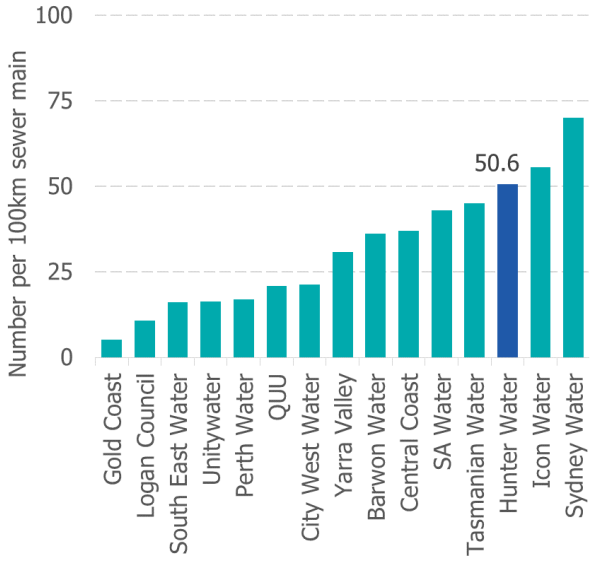
Source: Hunter Water.

Figure 3.13 Wastewater overflow standard performance – 3 or more overflows



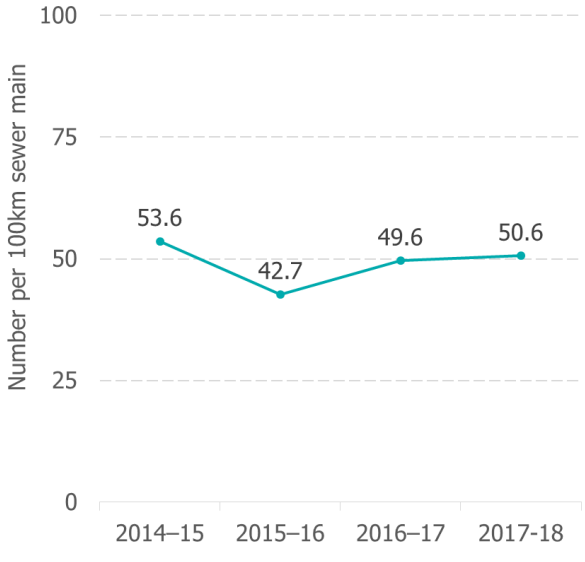
Source: Hunter Water.

Figure 3.14 NPR 2017-18 – Indicator A14: Sewerage mains breaks and chokes (no. per 100km sewer main)



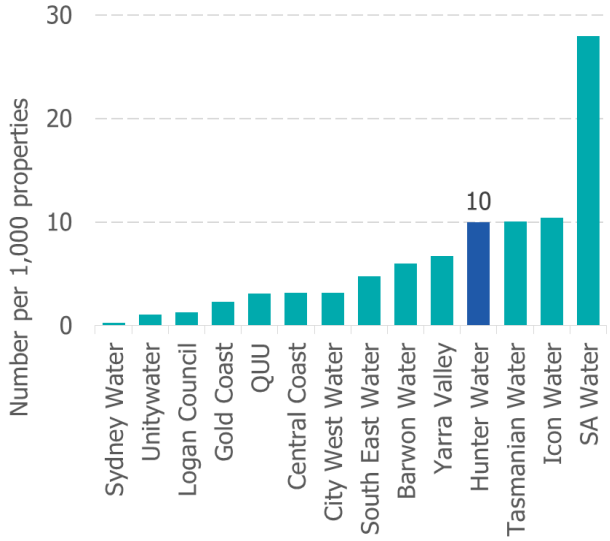
Source: 2017-18 National Performance Report.

Figure 3.15 NPR – Indicator A14: Hunter Water's performance over time



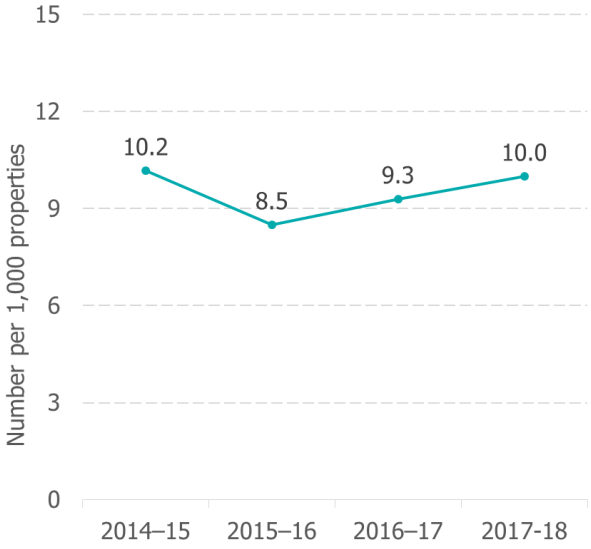
Source: 2017-18 National Performance Report.

Figure 3.16 NPR 2017-18 – Indicator A15: Sewerage mains breaks and chokes (no. per 1,000 properties)



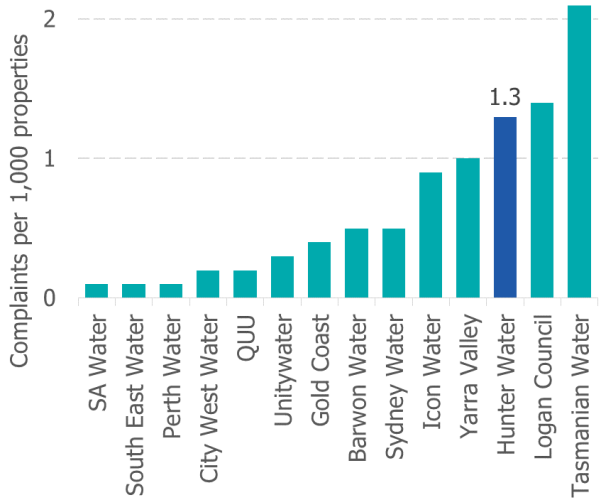
Source: 2017-18 National Performance Report.

Figure 3.17 NPR – Indicator A15: Hunter Water's performance over time



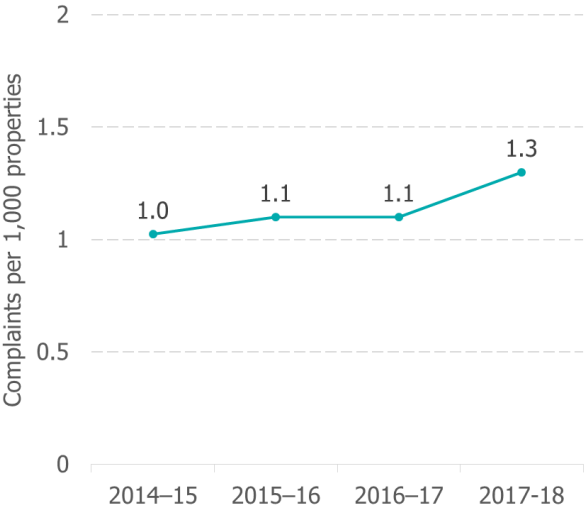
Source: 2017-18 National Performance Report.

Figure 3.18 NPR 2017-18 – Indicator C11: Sewerage complaints (no. per 1,000 properties)



Source: 2017-18 National Performance Report.

Figure 3.19 NPR – Indicator C11: Hunter Water's performance over time



Source: 2017-18 National Performance Report.

3.7 Using technology to improve reliability and performance

We are investing in technology that enables us to efficiently manage our assets, operations and maintenance. This technology is necessary for us to:

- Deliver reliable services
- Improve outcomes for customers
- Meet our regulatory obligations, and
- Reduce risks and costs.

During the current price period we replaced our unreliable supervisory control and data acquisition (SCADA) radio network. We will complete upgrades to our programmable logic controllers (PLCs) and telemetry systems across our water and wastewater networks (see Box 7 and Box 8). In the future we plan to replace our outdated civil jobs management system with a modern equivalent (workforce management project – see Box 9) and invest in technology that will allow better monitoring and control of our assets (intelligent networks – see Box 10).

Box 7 - Programmable logic controllers and telemetry systems

Programmable logic controllers (PLCs) and telemetry systems are computerised control systems that automatically control our pump stations, treatment plants and other assets.

They provide invaluable information on system and asset performance at any moment in time.

Some of the equipment was originally installed in the 1980s. Spare parts are no longer available from the manufacturer, posing a risk that failed units could result in pump stations being unable to operate.

We have commenced upgrading obsolete PLC and telemetry hardware throughout our networks. The project is vital for us to continue to reliably provide water and wastewater services to our customers and meet Operating Licence and environmental regulatory requirements.

Box 8 - SCADA radio network replacement

Operational information from approximately 750 water and wastewater sites (including water reservoirs and pump stations) is transmitted to our SCADA system that we rely on to monitor system performance and deliver reliable services.

The SCADA information is transferred via a radio network. The original radio system was installed in the late 1980s.

The technology and equipment had become unreliable and did not meet new requirements of the Australian Communication and Media Authority. Spare parts were no longer available from the manufacturer, and the technology was incompatible with modern control systems.

We have recently completed a project to upgrade the radio network. This will enable reliable management of the water and wastewater systems into the future.

Box 9 - Workforce management project

We currently use a 20-year old custom-designed software system to log, manage and record civil maintenance work across our operations. We are proposing to replace this system with a contemporary solution that will:

- Maintain our current capability to efficiently identify, plan, report on and complete maintenance work in the field.
- Be written in current programming language, using current conventions and therefore be fully supported, maintained and enable continuous improvement.
- Interface with other information and communication technology systems such as the geographic information system and customer billing system.
- Allow us to achieve efficiencies in work practices and processes. These efficiencies will be used to increase our output of critical maintenance work, while maintaining the minimum resourcing level required to meet core business requirements.

Box 10 - Intelligent networks

We propose to invest in an integrated set of products and systems that improves our ability to continuously monitor and control operational assets. This will provide data that enables us to:

- Better serve customers by improving our prevention, detection and diagnosis of issues that have potential to cause customer inconvenience.
- Optimise asset efficiency, longevity, reliability, maintenance and investment.
- Reduce the risk of breaching our regulatory obligations.

Key initiatives that we are pursuing include:

- Smart Integrated Pump Scheduling – an advanced automation tool that takes real data and information from the water network (via SCADA), predicts water demand and calculates the most cost-effective pump schedule to deliver water to customers, whilst meeting specific operational constraints. There are also benefits for water quality, water network reliability and asset maintenance.
- Wastewater network monitoring – using sensors and analytics to understand real time performance, identify faults and predict faults before customers and the environment are impacted.
- Advanced data analytics – analysing real time data and historical data to develop insights about triggers that cause service interruptions and help us to predict and prevent faults from occurring.

3.8 Community and employee safety

Due to their inherent nature, Hunter Water's assets and activities have the potential to pose safety risks to employees and the community if not managed and carried out appropriately. We have a very low risk appetite for safety risks. We have undertaken, and are proposing to undertake, a number of projects in order to bring risks back within tolerance.

3.8.1 Dam safety

We own, operate and maintain four dams that are prescribed under the *Dams Safety Act 1978 (NSW)*: Chichester Dam, Grahamstown Dam and Winding Creek Detention Basins 3 and 5. The Act is in place to ensure that dams meet a level of safety acceptable to the community. Guidelines relevant to the design, operation and management of dams are produced by the NSW Dams Safety Committee and the Australian National Committee on Large Dams.

We are responsible for ensuring the following activities are undertaken:

- Proper operation, maintenance and surveillance of the dams using trained personnel.
- Ongoing assessment of dam behaviour on the basis of surveillance information.
- Periodic review of each dam's compliance with current Dams Safety Committee requirements. Comprehensive surveillance reports are required to be submitted to the Dams Safety Committee at five yearly intervals.
- Review of all dam information and assessments by experienced personnel.
- Actions, in response to dam assessments, to ensure that the dams are maintained in a safe condition.
- Appropriate dam safety emergency plans in place for dams whose failure could cause loss of life.

In 2018-19, Hunter Water completed the first stage of decommissioning culverts at Campvale. Failure of the culvert would compromise the integrity of the dam wall. The culverts were replaced with pipelines between Campvale Canal and Grahamstown Dam. The second stage of the project, expected to be in 2019-20, involves the grouting of the original culverts in order to significantly reduce the risk of collapse.

We currently have major dam safety investigations underway at Chichester Dam and Grahamstown Dam, which may reveal the need for dam safety upgrades. The scope and timing of upgrades is still to be determined using detailed risk assessments. We anticipate that some level of investment will be required for Chichester Dam, however the need for works at Grahamstown Dam is less clear. Due to the level of uncertainty, we have not included either of these potential projects in our proposed capital expenditure.

3.8.2 Critical main safety program

Over the last 10 years, Hunter Water has experienced a small number of trunk main failures that resulted in significant flooding into residential dwellings, posing risks to community safety. We have developed a trunk main risk assessment process to quantify the community safety risks associated with pipe bursts. The assessment identified pipelines presenting unacceptable risk to the community of major safety consequences associated with the pipe failure.

Flooding from a pipe break usually does not present a safety hazard as the energy from the water is lost as the water spreads. However where the flow of water is concentrated, pipe failures can have the same destructive power as flood waters.

We have the lowest possible appetite for risk of loss of life or serious harm. We propose investing in a program of mitigation measures including detailed site risk assessments, pipeline condition assessments, improvement works and pipeline renewals and lining. This builds upon innovative work initiated in the current price period in which we have targeted the most serious risks first.

3.8.3 Tomago chlorination

Disinfection is a critical process to ensure the safe supply of drinking water to customers. The Tomago mains chlorination system is critical to provide:

- Back-up disinfection capacity if Grahamstown water treatment plant chlorination system fails.
- Additional chlorination capacity during peak demand periods to maintain drinking water quality to the greater Newcastle region.

The project involves replacing the existing system with a new building and chlorine system that will be safer for operators and maintainers to work in and achieve improved compliance with existing WHS and environmental legislation (including the *Protection of the Environment Operations Act*, and *AS/NZS 2927:2001 Storage and Handling of Liquefied Chlorine Gas*).

3.8.4 High voltage network

Hunter Water's high voltage network supplies 33 kV and 11 kV electricity to critical Hunter Water infrastructure from Tomago to Tomaree. This price period we have replaced approximately 100 km of the high voltage network that was over 50 years old. A condition assessment program identified that much of the network was not compliant with current standards and was reaching end of life.

The project included replacement of overhead power lines and installation of additional earthing and lightning protection. The project has now been completed, resulting in:

- Reduced safety risk
- Improved compliance with required standards, and
- A more reliable power supply to operate the water supply system.

3.8.5 Stormwater

Hunter Water's 2017-2022 Operating Licence requires that we provide, operate, manage and maintain a stormwater drainage system within certain declared areas. These assets are critical for transferring stormwater to minimise flooding impacts on the community. Failure of these critical assets can impact on:

- Customers in relation to property damage and continuity of service
- The environment, due to erosion,
- Damage to surrounding infrastructure such as roads and other services.

We are undertaking condition assessments and investing in major and minor rehabilitation and renewal of our stormwater assets to reduce the risk of these impacts. We propose investing in rehabilitating and replacing culverts, pipes and roofs to maintain the structural integrity of our stormwater assets and address fall risks that pose a danger to the community. The works that we undertake will reduce safety risks to the community and provide continuity of stormwater service.

4. Water conservation

Hunter Water has a central role to play in water conservation:

- As a means of helping balance water supply and demand
- To fulfil our region's values in relation to water planning, and
- As a contribution to efficiently delivering affordable services.

Our Operating Licence (2017-2022) and Customer Contract set out our obligations to balance water supply and demand. For example, in our Customer Contract we commit to providing sufficient drinking water to meet the reasonable needs of our customers, unless prevented by events such as operational incidents.[7] The Customer Contract also acknowledges that occasionally it may be necessary to put in place mandatory water restrictions during drought.[8] These two provisions mean that we need to manage water supply and demand to appropriately balance the frequency, duration and severity of restrictions, and the cost of large infrastructure augmentations.

4.1 Community values and preferences

As part of our Water Resilience Program, and review of the Lower Hunter Water Plan with the NSW Department of Industry (Water) and other regional stakeholders, we are engaging with the community using an approach underpinned by learning power principles.

Figure 4.1 Water resilience engagement objectives

Phase 1 engagement involved two deliberative forums held in October 2018, each involving 3.5 hours of direct interaction and discussion.

138 community members

provided insight into their values and aspirations around water services and attitudes towards restrictions

Education and increasing community awareness were mentioned frequently by participants as an important value.

Many participants also expressed a desire for greater use of rainwater tanks, recycled water/ grey water and stormwater.

[7] Hunter Water Customer Contract, 2017, section 3.2 and 8 (see IPART, 2017). The types of events are described in more detail in section 3 of this Technical Paper.
[8] Hunter Water Customer Contract, 2017, section 3.5.

4.2 Integrated water conservation strategy

This is an important time in our water planning. The population in our region is expected to increase by nearly 120,000 over the next 20 years. At this rate of growth, and with current usage patterns, total demand is expected to surpass what we can supply by 2036. By working with our customers to lower demand while reducing leakage across our network, we are extending the time between now and when we would need to make decisions regarding future source augmentation. This provides an opportunity to consider future technologies which could help us save more water and potentially delay the need for a new water source indefinitely.

We aim to:

- Deliver an integrated water conservation strategy across leakage, demand management and water efficiency and water recycling.
- Recognise the value in remaining open to technology and innovations, including investing incrementally.
- Encourage a 'together we can' approach whereby we take action and we enable customers, consumers and the community to play their part.

4.2.1 Economic Level of Water Conservation

IPART has acknowledged the importance of involvement in water conservation by requiring Hunter Water to develop an Economic Level of Water Conservation (ELWC) methodology for assessing the economic viability of water efficiency, leakage management and water recycling activities in the 2017-2022 Operating Licence. We are also required to apply the methodology to develop a rolling five-year water conservation program and report progress against implementation of projects and activities identified in the plan.[9]

IPART's objectives in requiring us to develop and implement an ELWC methodology are to:

- Ensure customers do not have to pay for inefficient supply augmentation projects or face a lack of water supply reliability.
- Avoid overly prescriptive targets or requirements that may result in under-investment or over-investment in water conservation measures.
- Require us to determine our most efficient mix of water conservation activities.
- Allow us to exercise our judgement and the operational flexibility to adapt our water conservation activity to changes in circumstances, promoting innovation and efficiency.
- Promote transparency and accountability around water conservation and planning activities. [10]

Hunter Water's ELWC methodology was conditionally approved by IPART in March 2019.[11] Our proposed water conservation program for 2020-25, and associated ELWC assessments, is summarised in Table 4.1.

[9] Hunter Water 2017-2022 Operating Licence, Part 2. Available on Hunter Water's website at: https://www.hunterwater.com.au/About-Us/Publications/Legislation-and-Governance/Legislation-and-Governance.aspx.
[10] IPART, 2015, End-of-Term Review of Sydney Water's Operating Licence, Appendix C, page 37.
[11] Our proposed ELWC method included the concept of option value, which reflects the value of keeping options open. IPART's approval is conditional on setting the option value of water to zero, and maintaining it at zero, until the concept is better understood and its implications more fully analysed.

Box 11 - ELWC methodology

The ELWC methodology is based on a cost-benefit analysis framework where the costs and benefits are assessed in marginal terms from a societal perspective.

A water conservation measure is considered to be economically viable if the benefits are at least equal to the costs.

- The benefits are assessed in terms of the value of water conserved
- The costs are assessed in terms of the levelised cost of implementing the water conservation measure, and
- The costs and benefits are expressed as present value of dollars per kilolitre of water.

That is, when the cost to society of a water conservation measure is less than the value of water it is expected to save, it is economically viable.

The value of water conserved is based on the marginal cost. Marginal cost is the cost incurred in the production of one extra unit of water supply.

- In the short-run, this cost is usually the operating cost associated with, for example, the additional pumping and chemical treatment of supplying an extra unit of water through the existing network.
- In the long-run all inputs are considered variable and therefore this cost is the cost associated with all actions required to bring supply and demand into balance, including capital expenditure on source augmentations (if necessary).

The value of water conserved depends on the timing and durability characteristics of the water conservation measures being assessed (i.e. short or long-term).

For conservation measures with short-term benefits, the short-run value of water reflects the short-run marginal cost including direct operating costs, the social costs of water restrictions, and the alternative drought measures and supply options.

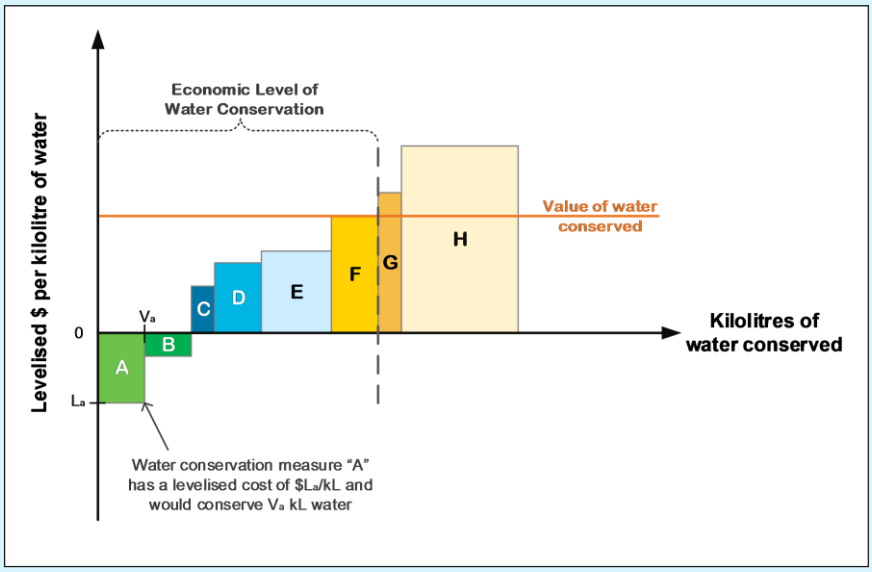
For conservation measures with long term benefits, the long-run value of water reflects the long-run marginal cost plus an option value. The long-run marginal cost is

As described in IPART's Review of recycled water prices for public water utilities, Draft Report (April 2019, p. 50) *"Options value refers to the value of delaying an irreversible commitment to an investment, where it increases the likelihood of delaying or avoiding the need for the investment, or that the cost of the investment would reduce – e.g. as a result of technological progress"*.

The ELWC is calculated by adding the volume of water conserved from all new water conservation measures that are assessed as being economically viable. That is, our investment in new water conservation activities could increase (depending on available projects and funding) until the marginal benefit of saving an extra unit of water is just equal to the marginal cost of supplying an extra unit of water. The economic level of investment is achieved when the marginal values are equal. This can be explained with the assistance of a diagram.

ELWC methodology (continued)

Figure 4.2 Conceptual diagram showing calculation of the Economic Level of Water Conservation



Source: Hunter Water.

The horizontal axis represents the volume of water saved through implementing water conservation measures, while the vertical axis represents the cost per kilolitre. Each new water conservation measure (e.g. A to H) can be characterised by an estimated *volume of water conserved*, which is shown by the horizontal width of each rectangle, and a *levelised cost*, shown by the height of each rectangle. The levelised cost of a water conservation measure can be negative (measures A and B) or positive (measures C to H). A negative levelised cost means the water conversation measure results in a levelised benefit (even before taking into account the value of water conserved). For example, in the diagram water conservation measures A and B have negative levelised costs and are shown below the horizontal axis. Measure A could be a water efficient showerhead giveaway to customers that enables the customer to save more money on electricity costs for water heating than the financial cost to Hunter Water to buy the showerheads.

In this conceptual example, the projects are ordered by increasing levelised cost from left to right. That is, projects towards the left of the figure are more economically beneficial than those towards the right of the figure. Adopting this convention, the shape formed by the levelised costs of all measures assessed is similar to a marginal cost curve - the cost to save one kilolitre of water rises as we try to save more and more water.

The orange horizontal straight line - "value of water conserved" - reflects the marginal costs of supplying water. It is assumed to be constant at a given point in time, under specific assumptions about balancing supply and demand in the short and long terms.

Using the ELWC methodology, all water conservation measures with a levelised cost less than or equal to the value of water are considered to be economically viable. The volume of water that could be saved if Hunter Water implemented all of these measures is the Economic Level of Water Conservation. In Figure 4.2, measures A to F are economically viable. In other words, the vertical height of the rectangles for A to F are all no taller than the orange horizontal line representing the value of water conserved. Reducing water use any further (e.g. implementing measures G and H) would not be economically beneficial.

The ELWC is a forward-looking methodology. That is, only new potential water conservation projects are assessed using the ELWC methodology. We do not assess research, pilot trials or initiatives to drive behavioural change using our ELWC methodology as these types of projects aim to provide us with better information to use in the ELWC methodology, for example to calculate the project costs and water savings.

Table 4.1 Overview of water conservation projects, programs and outcomes for 2020-25

Project/ Program	Expenditure (2020-25)	Levelised cost ($/kL) [1]	Value of water saved	Economically efficient (ELWC method)	Forecast extent (per year)	Water savings potential (ML)
Water efficiency						
Residential						
Plumbing assist plus	$375,000	$0.98/kL (societal)	Long-run	Yes	110 households	340 [3]
Rainwater tank tune-up	$285,000	$0.51/kL (HWC) $2.24/kL (societal)	Intermediate	When storages are below 69% [2]	400 households	340 [3]
Non-residential						
Council water resilience	$60,000	$0.08/kL (HWC) $1.39/kL (societal)	Intermediate	When storages are below 69% [2]	1 council	815 ML [3]
Targeted Industry Program	$200,000	$1.47/kL (HWC) $3.60/kL (societal)	Intermediate	When storages are below 69% [2]	10 medium customers (2-10 ML per year)	210 ML [3]
Large customer water savings program	$1,385,000	$0.55/kL (HWC) $1.99/kL (societal)	Intermediate	When storages are below 69% [2]	30 customers (> 10 ML per year)	1,355 [3]
Leakage management						
Active leak detection	$32.8 million [4]	$0.46/kL	Short-run	Yes	> 2,000 km	570
Pressure management		≤ $2.39/kL	Long-run	Yes	23 sites (over 5 years)	923
District metering		≤ $2.37/kL	Long-run	Yes	100% of network	1,170
Point sources		≤ $2.39/kL	Long-run	Yes	5-8 assets	90
Research and development						
Real estate agent and bulk housing partnerships	$175,000	Not applicable				
Multi-residential fix	$125,000					
Targeted rebates and BASIX optimisation	$50,000					

Notes:

1. In the ELWC method, the levelised cost to be compared with the value of water saved is the levelised cost from a societal perspective (including costs to Hunter Water, program participants and the community). The levelised cost to Hunter Water has only been included for transparency purposes.
2. The life of the project is set by the total length of time that water conservation benefits are expected to be realised from the project investment. In the ELWC method, water conservation projects with a life of 6 to 14 years compared with the 'intermediate' value of water saved. The intermediate value of water saved is a linear interpolation between the short-run value of water (which is based on the prevailing water storage level) and the long-run value of water saved ($2.39/kL in $2019-20). The short-run value of water at 70-79% water storage level is $0.48/kL ($2019-20) and at 60-69% water storage level is $3.57/kL ($2019-20). Therefore, for the levelised cost of the project to be lower than the value of water saved, the water storage level would need to be 69% or lower.
3. Present value across all program participants.
4. Leakage management programs are shown in the Hunter Water AIR/SIR, SIR Capex 3, rows 217 to 220.

Source: Hunter Water.

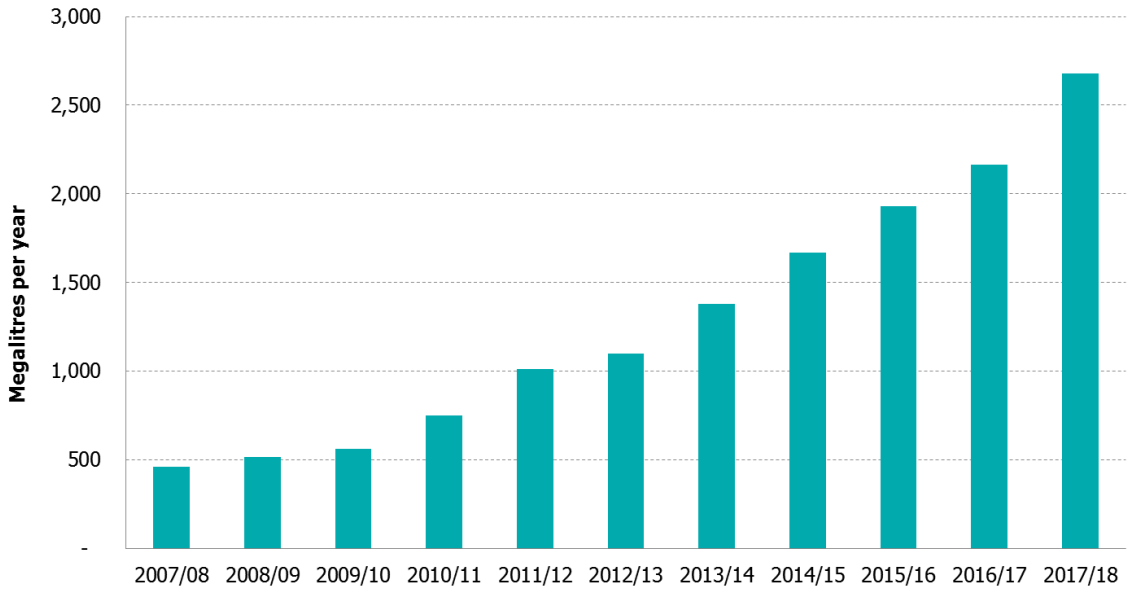
4.3 Water efficiency

Water efficiency means making good use of the water we have – i.e. getting the same benefit but using less water. During the current price period, our focus has been on water savings in the non-residential sector. So far we have:

- Completed 28 Water Efficiency Management Plans for major customers
- Installed data loggers on all major customer billable meters
- Completed detailed large customer audits at Newcastle Jockey Club, Centennial Coal Mandalong, Martins Creek Quarry, Morisset Hospital, Belmont Hospital, Calvary Retirement Village, HMRI and Centennial Coal Cooranbong, identifying savings of 414 ML, and
- Assisted schools and non-residential customers with leaks by installing 52 temporary data loggers, identifying 23 leaks of which 20 leaks were repaired, saving 276 ML of drinking quality water.

In helping our customers to save water, together we are having the biggest impact on demand reduction in the region within past decade (see Figure 4.3). We are proposing to continue, and expand, our water efficiency programs over the next price period.

Figure 4.3 Estimated cumulative savings from water efficiency programs



Source: Lower Hunter Water Plan MERI Evaluation, 2018, Figure 5.3.

Plumbing assist plus

We are proposing to extend the plumbing assistance program that was previously used to support customers experiencing financial hardship, to now also support customers who use more than the average water use at their property. The extended program would proactively rather than reactively work with customers where high consumption or potential leak is identified. The purpose of the program will be to educate the customer on the source of their high water use and how they can either amend their behaviour or install efficient fittings to maximise their water efficiency.

A pilot of this extended program has been running in 18/19FY which has involved the pro-active contact of these high use customers. This program has offered:

- A site visit by a plumber to help investigate the reasons for their high usage (e.g. concealed leak)
- Practical water savings advice, and
- Minor repairs or water efficiency improvements during the site visit.

Where the customers are also experiencing financial distress the assistance may involve establishing a payment plan or assistance with replacing inefficient appliances. During the pilot trial we have found that about 25 per cent of those contacted fully participate in the program, and 50 per cent of these customers had leaks that once repaired have the potential to reduce their water usage by at least one third. By extending this program we hope to increase our highest residential users' knowledge of their water use, but also extend our own knowledge of how our customers use water so that we can refine and develop other water efficiency initiatives.

Rainwater tank tune-up

We estimate that around 17 per cent of the households that we service have rainwater tanks. Studies have found that the water supplied by rainwater tanks can reduce mains water needs by around 42 kL per year (20 to 25 per cent) but only 65 per cent of rainwater tanks are functional due to design and maintenance issues.[12] This means that the rainwater tanks currently installed in the Hunter have the potential to supply 1.7 GL per year but may only be providing 0.8 GL.

Our proposed rainwater tank tune-ups would be rolled out in phases, which could include:

- Do-it-yourself tank audit checklist
- Site visit by a plumber to check functionality and provide a list of rectification actions and their estimated costs, and
- Market-based instrument for allocation of subsidies for rainwater tank repairs and functionality improvements (e.g. silent auction).[13]

In addition to reducing the water usage of program participants, it is expected that the quality of the design and installation of future new installations will improve by engaging with new owners and installers.

Council water resilience

There are 6 local councils in Hunter Water's area of operations consuming around 1.2 GL per year across more than 3,000 sites. It is proposed that we partner with local councils to identify opportunities for improved water efficiency and alternative water source opportunities (e.g. groundwater or stormwater).

Irrigation of public parks and sports fields using drinking quality water is limited under Level 2 Water Restrictions and banned under Level 3 Water Restrictions. In other jurisdictions, this was found to have a significant impact on community liveability outcomes during the Millennium drought.

Assisting councils to improve the resilience of these facilities can both reduce current consumption from irrigation and ensure that the social impact of drought is reduced. A council targeted irrigation and facilities audit program and assistance with building business cases and external funding submissions for water conservation initiatives is proposed.

Large customer water savings program

We propose to work with all large customers to develop new and review existing water efficiency management plans and carry out detailed audits of one quarter of sites with high levels of consumption.

The WEMP aims to continually improve water efficiency and identifies water saving actions in the short, medium and long term.

Targeted industry program

Water efficiencies for particular industries and end uses can be targeted through specialised audits and benchmarking and best practice guidelines. Taking this approach can encourage greater participation and activation of small to medium customers from a similar industry.

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[12] Retamal M, Mukheibir P, Schlunke A, & Prentice E., 2018 Work Package 4: Rainwater, Report prepared by The Institute for Sustainable Futures (University of Technology Sydney) for the Hunter Water Corporation.

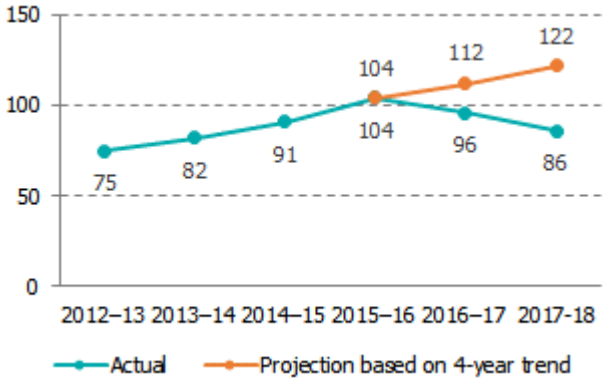
[13] Cheesman, J., Harvey, L. and Walsh, C.J., 2016, Using market based instruments to deliver cost-effective stormwater management outcomes: Outcomes from an innovative pilot study. DOI: https://doi.org/10.21139/wej.2016.039

4.4 Leakage management

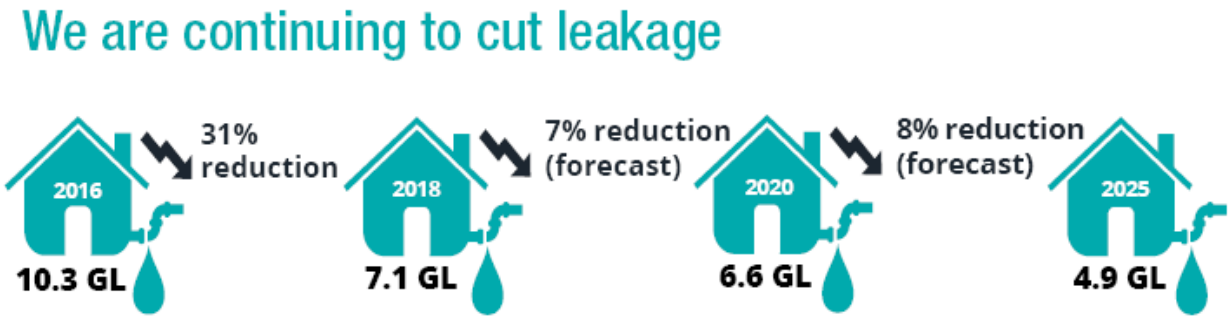
Our water loss improvement program is designed to build the water resilience investigation, capital investment and operational and maintenance initiatives to minimise the volume of water lost within the water network (leaks, breaks or inefficiently used by Hunter Water).

At the start of the current price period, our leakage performance was the worst amongst our cohort of major Australian urban water utilities and leakage per connected property had been increasing each year.[1] As part of our commitment to Love Water, we have made significant inroads in turning around this trend.

We are proposing to continue, and expand, our water leakage management programs over the next price period.



Source: Hunter Water.



Active leak detection

Each year, our contractors physically walk and check all of our network - more than five thousand kilometres of our water mains, which is one hundred kilometres of mains each week. Reducing water lost to leaks is one of our highest maintenance priorities. We use 'listening equipment' to identify hidden leaks and water escaping into the ground, which otherwise may not be found - about 25 new leaks are found each week. A major benefit of the program is finding small leaks, before they get bigger. Large leaks can be inconvenient for our customers due to water supply interruptions and also the possible damage to their property.

Our customers know how important it is for us to find and fix leaks, and save precious water. About 150 customers contact us each week to report a leak they've found. We respond quickly to every single report, and prioritise these repairs along with the leaks identified by our contractors.

Pressure management

High water pressure in our system contributes to water-main leaks and breaks, and the excessive pressure reduces the life of our assets and equipment. Our Operating Licence states we need to provide customers with a minimum pressure of 20 meters, but some parts of our network have water-main pressure greater than 100 meters. Pressure management involves the installation of automated pressure reducing valves to reduce the pressure on the water network and customer fittings, thereby reducing the internal stress and reducing either the quantity of leaks/breaks or the volume lost from leaks/breaks. This price period we have implemented pressure reduction programs in three areas (Argenton, Edgeworth and Charlestown). Next price period we propose to address unnecessarily high pressure in a further 23 areas.

Reducing water pressure extends the life of our water-mains and equipment, reduces leaks and water-main breaks which inconvenience customers.

District metering

District metering involves installing network flowmeters and zone valves to segment the network into smaller 'districts'. Water movement in each district is then monitored and analysed, and any increased water use may indicate a leak in that district. Dividing the network into segments means we can find leaks more quickly, which reduces costs and customer interruptions.

Hunter Water currently has 39 district metered areas with telemetered flow monitoring, which represents 25 per cent of the network. The district meter outputs are incorporated into a software program called Takadu, for hourly monitoring and analysis of system performance changes. We are proposing to increase the number of districted metered areas so that it covers 100 per cent of the network.

Point sources

This important program fixes water lost, or likely to be lost in the near future, at our major assets, including reservoirs and trunk water mains. We have recently rehabilitated and relined the Black Hill Reservoir, which was losing 700,000 litres of water each year. We also lined a reservoir at Bellbird Heights and reduced the leakage by around 90 per cent. We are currently replacing multiple sections of the Chichester Trunk Gravity Main which is 75 km long, with some sections more than 80 years old, and often has leaks.

Box 12 - Rehabilitating Black Hill reservoir

Black Hill 1 Reservoir is a concrete reservoir with 86 ML storage – it was constructed in 1930s and is our second largest reservoir.

The reservoir condition is considerably deteriorated and has a number of leaks. Replacing the reservoir is estimated to cost at least $45 million.

We are undertaking a rehabilitation strategy to extend the life of the reservoir and reduce water loss. This involves eliminating the source of leaks progressively through staged internal relining of the walls, floor and joints.

The work has been ongoing since 2016 and is almost complete. The rehabilitation work has drastically reduced the rate of leakage from 2 ML per day to 0.1 ML per day.

4.5 Water recycling

Integrated water cycle management and recycled water are important tools to help Hunter Water respond to the challenges and opportunities it will face over the next 20 years. When appropriately located, recycled water can be the most efficient means of meeting some customers' water-related needs. Recycled water can also produce broader benefits for all customers, such as building water resilience through diversity of supply, or physical and mental health improvements through increased accessible greenspace. We are committed to recycled water and have been actively exploring opportunities in the Lower Hunter region.

4.6 Research, development and pilot trials

Real estate agent and bulk housing partnerships

Our customer segmentation found that around 22% of the households to whom we provide services are renting privately, and 5% are in public housing (e.g. NSW Housing, Compass Housing, Aboriginal Housing Office or Defence Housing Australia).[14]

[14] Further detail on our customer segmentation is provided in Technical Paper 1.

Currently, tenants are indirect customers of Hunter Water because some landlords may pass on water usage charges for payment by the tenant.[15] However, as water users, residential tenants play an equally important role to other households in helping to balance water demand and supply.

We face two challenges in encouraging water conservation with household tenants:

- Hunter Water has limited ability to identify which customer properties are owner occupied and which are rental properties.
- Tenants can engage in water use behaviour change or purchase more efficient appliances, but they are not in a position to carry out leak repairs or install more water efficient fittings.

We are proposing to develop and implement an engagement program with real estate agents and public housing providers, as a means of reaching both tenants and landlords, so that we can improve water efficiency together. Water demand reductions may be achieved through actions such as better monitoring to identify internal leaks, maintenance, and targeted education programs.

Multi-residential fix

Hunter Water has around 30,000 multi-residential dwellings (e.g. apartments and over 55's lifestyle villages), which often have a single meter for the whole site. There is little incentive for each apartment or dwelling to save water by taking actions like repairing plumbing faults because the water usages charges are pooled. We are interested in scoping a similar program to that offered by Sydney Water, whereby strata buildings with high water use are offered plumber audit and repair services similar to Plumb Assist Plus. The strata body pays no upfront costs, instead repaying costs with the savings achieved. That is, the water bill of the account is held static until the costs of the service are recovered. Sydney Water conducted a pilot program prior to completing a full business case and we consider this approach to also be beneficial for our circumstances.[16]

Ultimately, we encourage the installation of separate water meters on each individual dwelling, where this is a practical option.

Targeted rebates and BASIX optimisation

Studies indicate that the fittings installed under BASIX are not always the most efficient available[17] and that there is potential for a more targeted rebate scheme to encourage the purchase of more efficient appliances and fittings.[18] We propose to undertake further investigation into the feasibility and possible scope of rebate or incentive programs to promote the purchase and installation of higher efficiency fittings and appliances.

4.7 Learning with our community

Learning with our customers and community about ways to save drinking water, through programs such as Love Water, is an important part of our water conversation efforts. Further details of our customer and community engagement activities are provided in Technical Paper 1 (e.g. section 1 and case studies).

[15] According to the Residential Tenancies Act 2010 a landlord can only pass on water usage charges if the rental premises is individually metered and the rental premises meet required 'water efficiency' standards (all internal taps and showers have a maximum flowrate of 9 litres/minute and no leaking taps). The landlord must also provide the tenant with a copy of the water bill setting out the charges, or other evidence of the cost of water used by the tenant.
[16] Sydney Water, 2017-18 Water Conservation Report, p. 11.
[17] Institute for Sustainable Futures (ISF), 2018, "Evaluation of the environmental and economic impacts of the WELS scheme", prepared for the Department of Agriculture and Water Resources.
[18] Urbis 2012, "Evaluation of the NSW home saver rebate program", prepared for the NSW Office of Environment and Heritage.

5. Environmentally responsible

Hunter Water undertakes activities in a way that is environmentally responsible. We work hard to ensure compliance with all applicable environmental legislation, regulations and to meet community expectations about environmental performance. As a provider of wastewater services, our operations provide a substantial net benefit to the environment. We work closely with the EPA and other regulators to ensure positive environmental outcomes related to our assets and operations.

We also pursue objectives relating to ecologically sustainable development (as required under the *State-Owned Corporations Act 1989).* We undertake activities to meet these objectives where it is cost-effective to do so, or we have the demonstrated support of our customers.

5.1 Regulatory obligations

The various legislative requirements that we must follow in relation to protection of the natural environment are shown in Figure 5.1.

Figure 5.1 Environmental legislation

Protection of the Environment Operations Act 1997	Environmentally Hazardous Chemicals Act 1985
Water Management Act 2000	Fisheries Management Act 1994
Water Act 1912	Dangerous Goods (Road and Rail Transport) Act 2008
Environmental Planning and Assessment Act 1979	Heritage Act 1977
Biodiversity Conservation Act 2016	Local Land Services Act 2013
National Parks and Wildlife Act 1974	Marine Estates Management Act 2014
Biosecurity Act 2015	Pesticides Act 1999
Coal Mine Subsidence Compensation Act 2017	Roads Act 1993
Coastal Management Act 2016	Wilderness Act 1987
Contaminated Land Management Act 1997	Environment Protection and Biodiversity Act 1999 (Commonwealth)
Crown Land Management Act 2016	National Greenhouse and Energy Reporting Act 2007 (Commonwealth)

The *Protection of the Environment Operations Act 1997* provides the statutory framework for managing pollution in NSW. It is administered by the EPA and supported by a number of regulations including the *Protection of the Environment Operations (General) Regulation 2009*. The EPA issues EPLs to Hunter Water, providing the conditions under which we may operate and discharge to the environment.

The *Environmental Planning and Assessment Act 1979* and supporting regulation and state environmental planning policies provide the planning framework, including environmental assessment requirements.

The *Water Management Act 2000* sets out requirements for water supply work and water use approvals and includes requirements for water sharing plans. Hunter Water has a package of water licence and approvals under this Act that are regulated by the Natural Resources Access Regulator. Hunter Water is also required to obtain approvals under the *Water Act 1912* for dewatering during construction when certain thresholds are exceeded.

Hunter Water maintains a heritage register in accordance with the *Heritage Act 1977*. Approvals are required to be obtained under the *National Parks and Wildlife Act 1974* for impacts to Aboriginal heritage and under the *Fisheries Management Act 1994* when there are certain triggers that can impact on fish habitat.

The *Biodiversity Conservation Act 2016* applies to assessment of threatened species, ecological communities, and for biodiversity offset schemes and biodiversity certification of land.

5.2 Environmental Management System

Hunter Water's 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. Our Operating Licence requires that we maintain and implement an EMS consistent with the relevant Australian Standard. Our EMS is externally audited and certified against this standard. A key component of the EMS is the Environmental Management Plan that outlines our environmental objectives, program of actions and targets to manage risk and drive environmental improvements.

5.3 Compliance with Environment Protection Licences

EPLs for Hunter Water's treatment plants are issued by the EPA under the *Protection of the Environment Operations Act, 1997*. They cover the entire wastewater system including treatment plants, pump stations and the wastewater transportation system. EPLs aim to minimise the potential harm to human health and the environment from the release of wastewater (treated and untreated) into the environment.

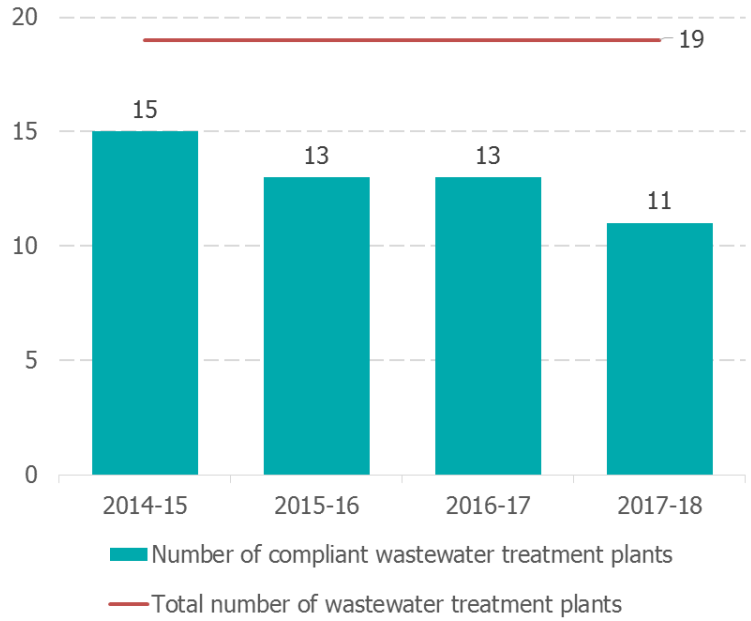
5.3.1 Treatment plant compliance

Wastewater treatment plants

We have EPLs for each of our 19 wastewater treatment plants, covering a range of requirements such as:

- Load and concentration limits for assessable pollutants discharged from the premises
- Volume of liquid discharge to the environment
- Conditions relating to operation and maintenance of the premises including the transportation system
- Monitoring conditions including testing methods
- Reporting conditions including annual reporting and incident reporting, and
- Pollution reduction studies and programs to improve environmental performance.

Figure 5.2 Number of compliant wastewater treatment plants each year



The historical compliance performance of our wastewater treatment plants is shown in Figure 5.2.

In 2017-18, 11 treatment plants were compliant. 'Compliant' is defined here as the treatment plant meeting all conditions set out in the EPL. Non-compliances are described in public annual EPL reporting. The non-compliances reported here are for the financial year. As such, they are not aligned with annual EPL reporting which is based on the licence period (typically not financial year).

Source: Hunter Water.

We aim to be fully compliant with the EPA's conditions. Reasons for non-compliances over recent years have varied, such as equipment malfunction, tightening conditions, biosolids disposal and power failures caused by storms.

Hunter Water has a low risk appetite for any material breach of environmental laws. Seven wastewater treatment plants are currently within appetite (Boulder Bay, Clarence Town, Dora Creek, Edgeworth, Karuah, Kearsley and Paxton). Twelve wastewater treatment plants were assessed as medium risk and outside of risk appetite. Some of these are likely to become high risks in the next 5 to 10 years if not addressed.

We are proposing upgrades to twelve wastewater treatment plants to cater for growth and address EPL compliance risks from 2019-20 to 2024-25 (see **Error! Not a valid bookmark self-reference.**). The project cost of these upgrades in the next regulatory period is approximately $199 million.

Figure 5.3 Proposed capital expenditure to maintain wastewater treatment plant compliance

Project name	Project total ($2019-20)	Obligation / project justification	Outcome
Farley WWTP stage 3B upgrade	$70.5m	Plant will not meet licence load limits with future growth and deteriorating asset condition.	Meet EPL limits for discharge to Fishery Creek and in future to the Hunter River.
Farley WWTP pipeline	$23.6m	Fishery Creek will not have capacity to accept additional loads associated with growth.	Meet EPL limits for discharge to Fishery Creek and in future to the Hunter River.
Raymond Terrace WWTP upgrade	$17.4m	Plant will have insufficient capacity in the inlet works and UV system to reliably meet licence requirements. There are also some minor asset issues.	Reliably meeting licence conditions and growth.
Cessnock WWTP upgrade	$17.2m	Works to address compliance with target ammonia concentrations and the Total Nitrogen load limit on the EPL.	Reliably meeting licence and EIS conditions and growth.
Burwood Beach WWTP stage 3 upgrade	$65.2m	Preliminary treatment system unable to reliably meet licence conditions. Biological process will be unable to meet licence conditions with growth.	Reliably meeting licence conditions and growth.
Morpeth WWTP stage 4 upgrade	$14.9m	Risk to licence compliance in secondary and tertiary processes.	Reliably meeting licence conditions and growth.
Dungog WWTP stage 1 upgrade	$26.1m	Current plant does not reliably meet licence conditions and has aging assets.	Reliably meeting licence conditions and growth.

Note: We are also proposing upgrades to wastewater treatment plants at: Edgeworth, Tanilba Bay, Shortland, Toronto, Dora Creek, and Kurri Kurri.
Source: Hunter Water.

Hunter River Estuary Masterplan

We are developing a masterplan to provide strategic guidance on the best value configuration and technology at the five major wastewater treatment plants that discharge into the Hunter River Estuary. These treatment plants receive wastewater from 25 per cent of our customer base and are projected to breach EPL load limits in the next ten years as growth occurs. The investment required to address compliance may be $200 million to $350 million, so the masterplan is important to inform and optimise our approach.

Water treatment plants

Hunter Water also holds an EPL for Dungog water treatment plant. The EPL covers:

- Administrative and general conditions
- Concentration and volume/mass limits for discharges
- Operating, monitoring, recording and reporting conditions, and
- Pollution studies and reduction programs.

The annual licence reporting period for Dungog water treatment plant is 30 March 2018 to 29 March 2019. We were compliant with all EPL conditions during this period.

5.3.2 Wastewater network compliance

In section 3.6 we discussed wastewater overflows in relation to the impact on customers. Wastewater overflows also have the potential to impact the environment. Wastewater overflows occur more frequently during wet weather due to inflow and infiltration of stormwater into the wastewater system.

Environmental compliance for the wastewater network involves compliance with environmental laws and regulations, including conditions described in EPLs. To meet EPL requirements and satisfy environmental and public health drivers, we must efficiently and competently manage the wastewater network and cater for growth in connections. We must take practical measures to protect the environment and public health and to minimise the frequency and volume of overflows.

Dry weather wastewater overflows

The wastewater network has ongoing dry weather overflow events occurring from blockages and breaks. We manage their occurrence through both preventative and reactive measures, in accordance with the EPLs. The EPLs also do not permit discharges or overflows to the environment from wastewater pumping stations or emergency relief structures in dry weather.

Wastewater network compliance

During 2017-18, there were eight dry weather overflows from emergency relief structures throughout the wastewater network. All of the overflows were due to blockages in gravity mains. Blockages were cleared and appropriate remediation actions were undertaken to address the impact of the overflow on the environment.

Wastewater pump station compliance improvement program

We initiated a wastewater pump station improvement program with an in-depth risk assessment program to identify pump stations that pose a risk to EPL compliance and the environment.

Pump stations that have limited storage time and capacity, previously threatened to overflow, or have failed due to power loss and equipment malfunction/failure were identified and assessed at risk. We identified 38 pump stations as higher risk due to these factors and they are being prioritised within the program.

Solutions and planned works are customised for each site. This will reduce the risks of wastewater discharges to the environment and reduce the risk of non-compliance with our EPL obligations.

Wastewater network upgrades

We use a risk-based approach to manage the risk of pipeline blockages and breaks in the wastewater network. Where the impact of overflow could be significant, we categorise the mains as 'critical'. We undertake planned inspection and monitoring of critical mains to assess performance and to inform programming of planned maintenance activities and renewal. We undertake strategies, analysing and optimising performance in non-critical mains with consideration given to lifecycle costs.

Wet weather wastewater overflows

EPLs set requirements that extensions to the network are planned to prevent as far as practicable discharges to the environment. In some cases EPLs require the system to achieve the performance outcomes outlined in upgrade management plans. All extensions to our network are designed and delivered to Hunter Water and industry standards, whilst Hunter Water continues to upgrade our network to meet the licence guiding principles. Hunter Water uses wet weather overflow abatement strategies to help manage the location, frequency and volume of wastewater overflows.

The EPA expects that Hunter Water continues to reduce wet weather overflows in areas where there are obvious customer, environmental or public health risk. Hunter Water has a number of wastewater network operations improvement programs, including to reduce inflow and infiltration to reduce the frequency and volume of wet weather related wastewater overflows. We annually review wet weather performance of the wastewater system and prioritise specific works.

Lake Macquarie effects-based assessment

In consultation with the EPA, Hunter Water is trialling a science-based approach to model and assess the risks and impacts of the urban stormwater system and wastewater overflows from the wastewater network on Lake Macquarie. A number of complex models developed by the Office of Environment and Heritage are being used including catchment hydrology, lake hydrodynamics, lake pathogen decay, and lake ecological response models. We will use the model outputs to prioritise system upgrades.

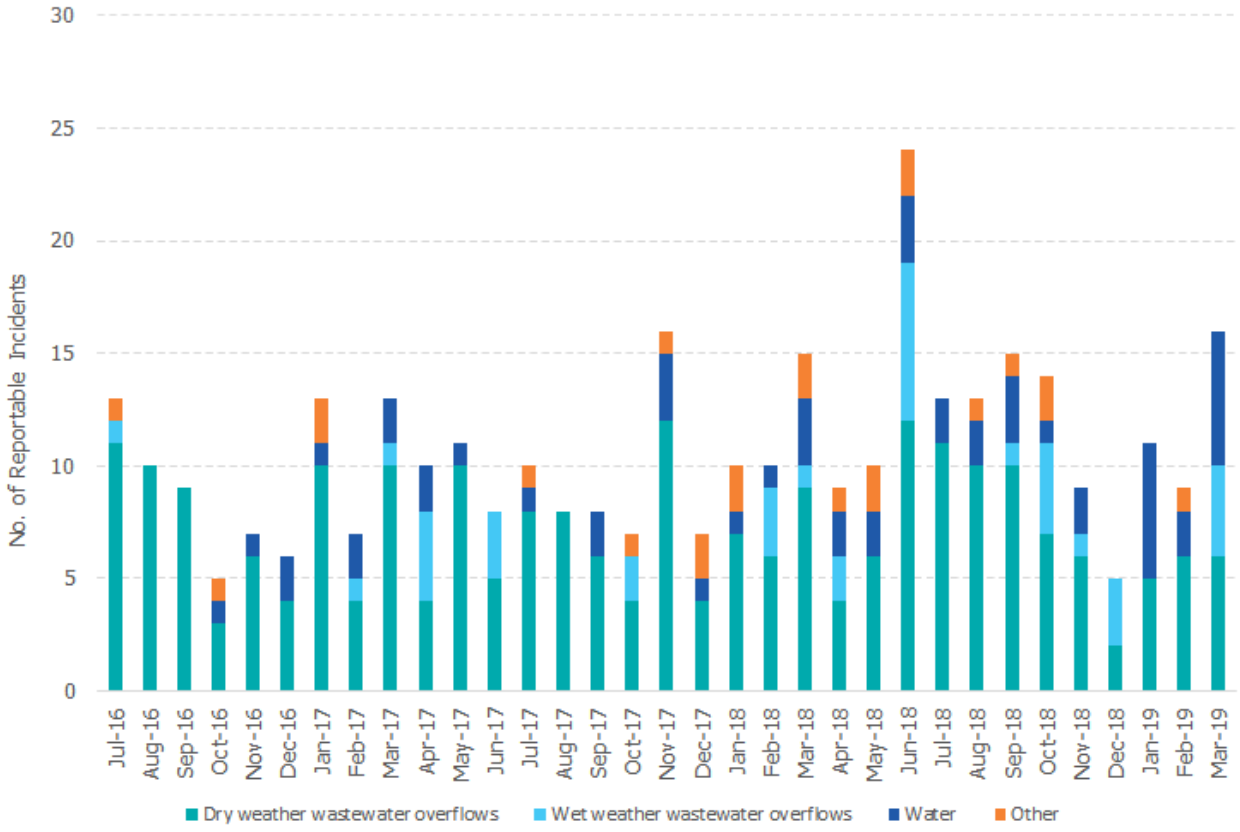
5.4 Environmental incidents

We notify the EPA of environmental incidents when pollution causes, or threatens, material harm to the environment. A person must immediately, after becoming aware of the incident, notify the authority and provide all relevant information. In 2016-17, there were two incidents reported that were categorised as major and in 2017-18 there were three major incidents.

In 2016-17, there were 112 incidents reported and in 2017-18 there were 134 (three categorised as major), as shown in Figure 5.4.

The majority of incidents reported are dry weather overflows. Only a small proportion of the overflows are reportable environmental incidents. The number of properties affected by uncontrolled wastewater overflows in dry weather are provided in section 3.6.

Figure 5.4 Reportable environmental incidents



Source: Hunter Water.

5.5 Chemical containment and dosing

Hunter Water owns and operates various chemical systems in our water and wastewater systems. The functioning of these chemical systems is important for the provision of services and to protect the environment from chemical spills.

We have undertaken a comprehensive review of risks across our operations relating to chemical containment. We have a low risk appetite for any material breach of environmental regulations.

5.5.1 Treatment plant chemical containment

Many of the chemical systems at our treatment plants are reaching the end of their service life and pose environmental and safety risks. We are undertaking a large scale upgrade program to reduce the risks to the environment and to improve safety for operations and maintenance personnel working around these systems.

5.5.2 Wastewater network chemical dosing units

Chemical dosing systems in the wastewater network are used to:

- Reduce unpleasant odours for the community, and
- Reduce corrosion in the wastewater system so that our assets last longer, which reduces costs in the long term.

We have commenced a project to upgrade 20 non-compliant and higher risk chemical dosing systems throughout the wastewater networks, which will protect the environment and improve employee safety.

5.6 Liveability

In our largest ever residential customer survey we sought to better understand our customers' needs and preferences for delivering better liveability outcomes, so that we could incorporate those views into our planning.[19] More than 70 per cent of respondents said they would be willing to pay more in their Hunter Water bills for some liveability services that benefit the community and environment. They judged themselves as able to pay for the projects, taking into account other budget constraints. The customer willingness to pay was contingent on Hunter Water delivering the service, not another provider. Respondents were comfortable for Hunter Water to determine where the additional investments should occur.

Our proposed prices for 2020-25 include $23 million investment in bank work and landscaping of open stormwater channels and providing recycled water for irrigation of public open space. We consider that we have a mandate from our customers to deliver these projects.

5.6.1 Stormwater amenity improvement

Hunter Water owns and maintains approximately 97 kilometres of stormwater assets, of which about 50 kilometres are open stormwater drains. Our stormwater system directs rainwater and surface run-off to creeks, rivers, lakes and oceans.

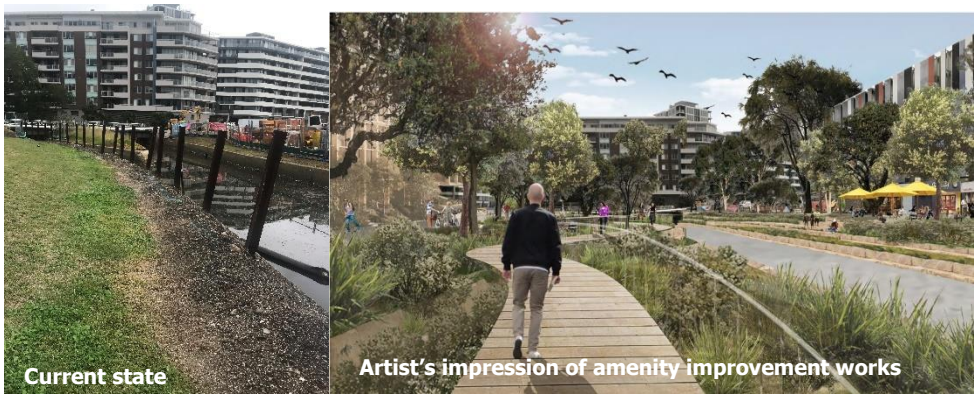
At the moment, about 90 per cent (45 kilometres) of our open stormwater drains are concrete-lined. We can change the way the stormwater drains that we own look by doing things like:

- Planting vegetation around the stormwater open channel to screen it from view, and
- Removing existing concrete walls and replacing them in the same location with more natural material or stepped wall (or lay back the banks) with plantings to tie in with adjacent public open space.

Over recent years, various stakeholders have indicated a preference for naturalisation of Hunter Water's concrete stormwater open channels (rehabilitation of stormwater canals to more natural conditions), to improve waterway health and improve community amenity.[20] We also think that bank work and landscaping around stormwater channels can improve amenity and create a connection with the waterway that can improve liveability.

An example of the type of service that could be provided is shown in Figure 5.5.

Figure 5.5 Example of the stormwater amenity works



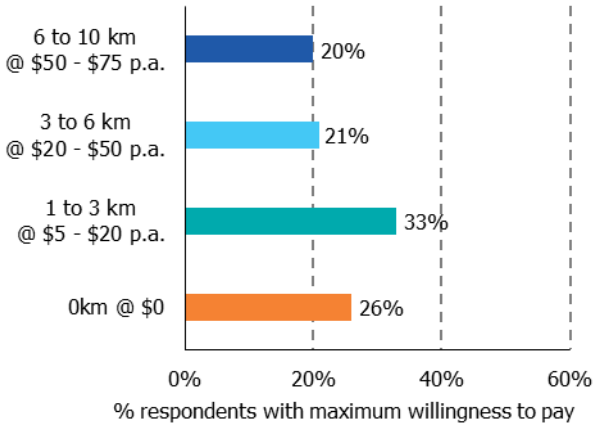
Location: Cottage Creek looking South West. Left: Current state. Right: Artist's impression.

[19] A more detailed description of the willingness to pay survey and how we propose to respond to the findings is provided in Technical Paper 1.

[20] For example, see Total Environment Centre's (2015) submission to IPART's Review of Prices for Hunter Water Corporation from 1 July 2016 and Newcastle City Council's (2016) submission to IPART's End of Term Review of the Hunter Water Corporation Operating Licence 2012-2017.

Our survey found that most respondents were willing to pay more for investment in bank work and landscaping of open stormwater channels. The distribution of willingness to pay was evenly spread across service levels. There was no direct correlation between being liable to pay stormwater drainage charges and willingness to pay to improve the appearance of stormwater open channels through bank work and landscaping, after controlling for other factors.

Most households (62 per cent) are comfortable for Hunter Water to determine where the additional investments should occur.



Source: Marsden Jacob Associates, 2018.

We have undertaken an investigation study on stormwater amenity improvement and worked with local Councils to determine key areas where amenity works would have the most benefit for the community. The areas identified are generally surrounding major parkland or major commercial precincts. The works may include changing materials on the channel banks, laying back banks and stabilisation using rock and planting of native vegetation in and around the channel to improve amenity and reconnect the community with the waterway. The nature and extent of works possible in each areas depends on surrounding land use, other neighbouring infrastructure (above or below ground) and flooding risks. There are relatively few opportunities for full naturalisation.

In planning our future activities, we have taken into account our customers' views. The weighted average willingness to pay was $32 per household per year for at least three kilometres of improvements; which the survey findings indicate would be supported by 41 per cent of people. However, 74 per cent of respondents would be willing to pay the lower amount of $20 per household per year for at least one kilometre of amenity improvement works. This submission includes $12 million of stormwater amenity works based on the lower bill impact with higher levels of customer support. We propose continuing the current collaborative approach in determining the location, nature and extent of the works.

5.6.2 Recycled water for green spaces

Hunter Water explores recycled water opportunities as a substitute for potable water and as a way of managing effluent discharges from wastewater treatment plants. Currently about 5 GL of recycled water is used each year from 16 recycled water schemes (industrial, agricultural and municipal). Approximately half of the recycled water being used replaces the need to use drinking quality water.

The NSW government has developed a 20 year blueprint for the future of the Hunter Region that reflects community and stakeholder aspirations (through the *Hunter Regional Plan 2036* and the *Greater Newcastle Metropolitan Plan*). Its vision is for the Hunter Region to be the leading regional economy with a vibrant new metropolitan city at its heart acknowledged globally for a number of attributes including its excitement of the inner city, and great lifestyles. A key objective is to enhance amenity for quality of life including creating great public spaces.

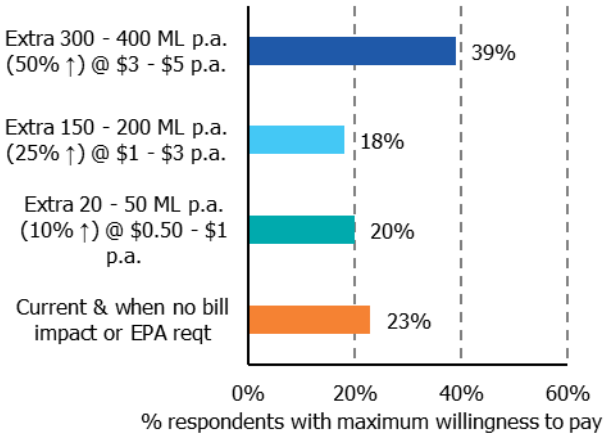
Hunter Water will continue to invest in wastewater recycling schemes for irrigation when they cost less than drinking water[21], or when it is the best way to meet environmental standards for treated discharges from wastewater treatment plants.

We have identified several parks and sporting fields that could use recycled water, which would save drinking water supplies while reducing the amount of effluent discharged to waterways. These parks and sporting fields are in Newcastle and Lake Macquarie.

[21] The assessment of whether recycled water schemes "cost less than drinking water" is made using the Economic Level of Water Conservation Methodology, which is described in section 4.2.1 of this Technical Paper.

Our survey found that most respondents were willing to pay more for investment in 77 per cent of respondents were willing to pay more for Hunter Water to increase the amount of wastewater turned into recycled water for irrigation of parks and sporting grounds. Half of those willing to pay, were willing to pay a maximum amount of $5 per household per year. The weighted average willingness to pay was $2.68 per household per year.

Most households (77 per cent) are comfortable for Hunter Water to determine where the additional investments should occur.



Source: Marsden Jacob Associates, 2018.

This submission includes around $11 million that we propose to spend on recycled water for irrigation of public open space, based on an additional $2 per household per year. We intend to determine the exact location of the irrigated greenspaces based on technical considerations and interest from prospective recycled water end-use customers.

5.7 Pollution reduction programs

Pollution reduction programs (PRPs) are mandatory works or studies imposed on EPL holders by the EPA with the intention of achieving improved environmental outcomes in a negotiated timeframe. We have completed all PRPs on time during the current price period (Figure 5.6).

Figure 5.6 Pollution reduction programs during current price period

Year	Total PRPs	PRPs completed on time	Completion rate
2016-17	31	31	100%
2017-18	13	13	100%

Source: Hunter Water.

Examples of completed PRPs include:

- Burwood Beach wastewater treatment plant was upgraded to include a UV disinfection system in order to further improve effluent quality and protect the health of bathers and board-riders at nearby beaches.
- Flow gauging, modelling and evaluation of system improvements in the Dudley-Charlestown catchment.

5.8 Waterway health - Beachwatch

Water-based recreation is an important part of the lifestyle enjoyed by residents and visitors to the Hunter Region. Hunter Water has a key role to play in enabling that lifestyle by maintaining waterway health. The New South Wales Office of Environment and Heritage (OEH) has monitored recreational water quality in the Beachwatch program since 1989. The results are published annually in the State of the Beaches report. [22]

There are 241 participating locations, of which 38 are located in Hunter Water's area of operations. Many estuarine and lake and lagoon swimming sites do not perform as well as the ocean beaches, being more susceptible to the impacts from wet weather conditions.

Results for 2017-18 show that recreational water quality in our area is excellent (see Figure 5.7, Figure 5.8 and Figure 5.9).

32 of 38 (84%)

of all locations graded good or very good

100%

of ocean beach locations graded good or very good

7

locations improved in 2017-18

0

locations worsened in 2017-18

62%

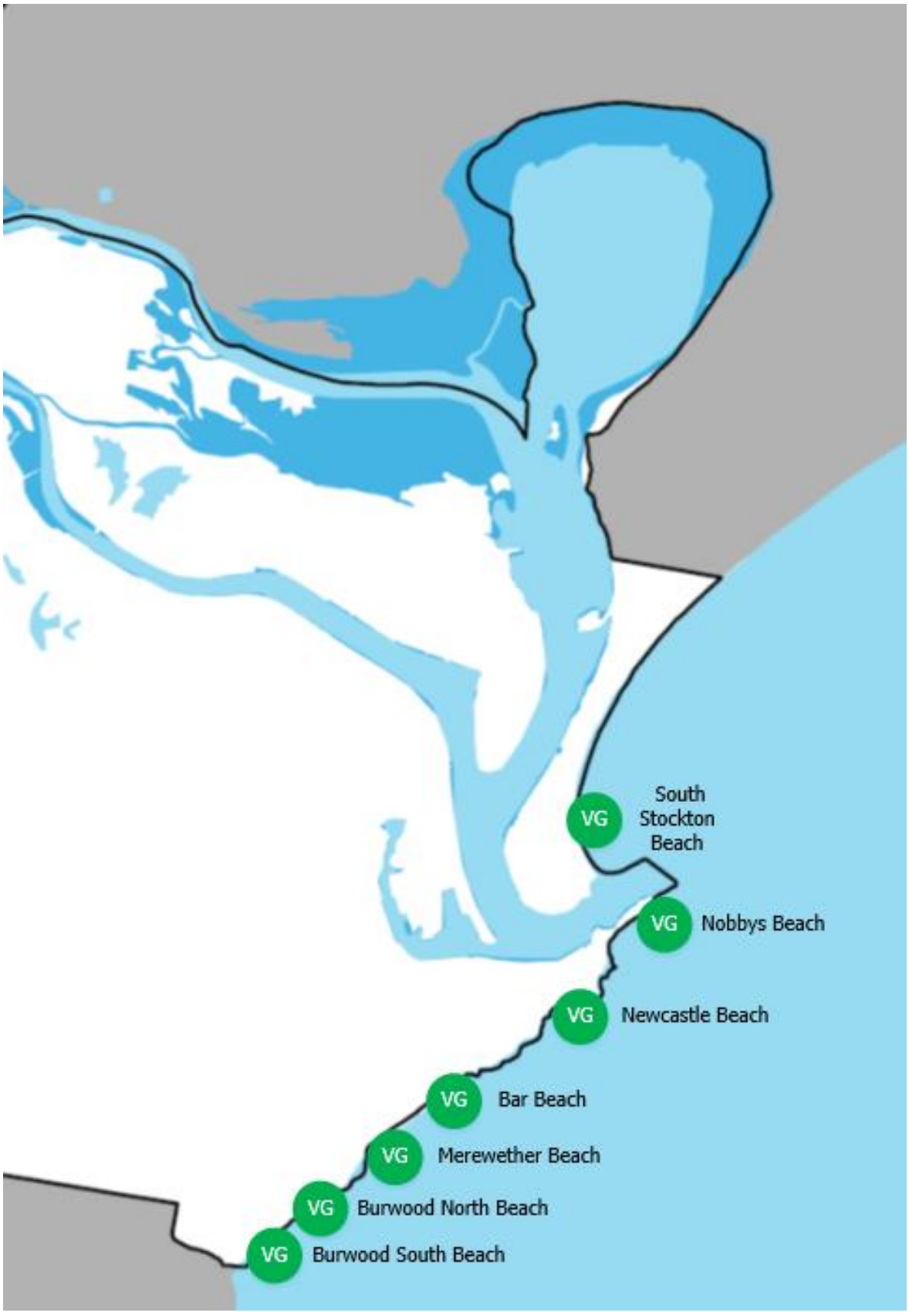
of lake locations rated good or very good (state average = 45%)

With the forecast growth of our region, and deteriorating asset conditions, substantial investment is required to continue to keep our waterways clean. Some of the works that have been undertaken in the current price period, and proposed for next price period, that influence recreational water quality performance are:

- Installing a UV system at Burwood Beach wastewater treatment plant to improve the quality of effluent discharged via an ocean outfall
- Installing storages for wastewater pump stations at Dutchmans Bay and Salamander Bay. The storages provide greater capacity to store wastewater during wet weather and therefore reduce overflows
- The proposed upgrade of Tanilba Bay wastewater treatment plant to meet capacity and EPL requirements
- Continued work on the Lake Macquarie effects based assessment program (described in section 5.3.2), and
- Implementing the wastewater overflow reduction programs described in 5.3.2.

[22] OEH, 2018, State of the beaches 2017-2018, available at: https://www.environment.nsw.gov.au/research-and-publications/publications-search/state-of-the-beaches-2017-2018.

Figure 5.7 Beachwatch 2017-18: Recreational water quality in Newcastle



Source: OEH, State of the beaches 2017-18. Hunter Water analysis.

Figure 5.8 Beachwatch 2017-18: Recreational water quality in Lake Macquarie

Source: OEH, State of the beaches 2017-18. Hunter Water analysis.

Figure 5.9 Beachwatch 2017-18: Recreational water quality in Port Stephens

Source: OEH, State of the beaches 2017-18. Hunter Water analysis.

5.9 Wastewater odour

The wastewater system generates odours due to the breakdown of sulphur dioxide. Odours can be emitted from wastewater treatment plants and wastewater network assets including wastewater pump stations. The strength of wastewater odour can be influenced by:

- Weather conditions (e.g. hot conditions, wind speed and direction)
- Process impacts (e.g. shock influent loads, equipment failures), and
- Septicity and detention times.

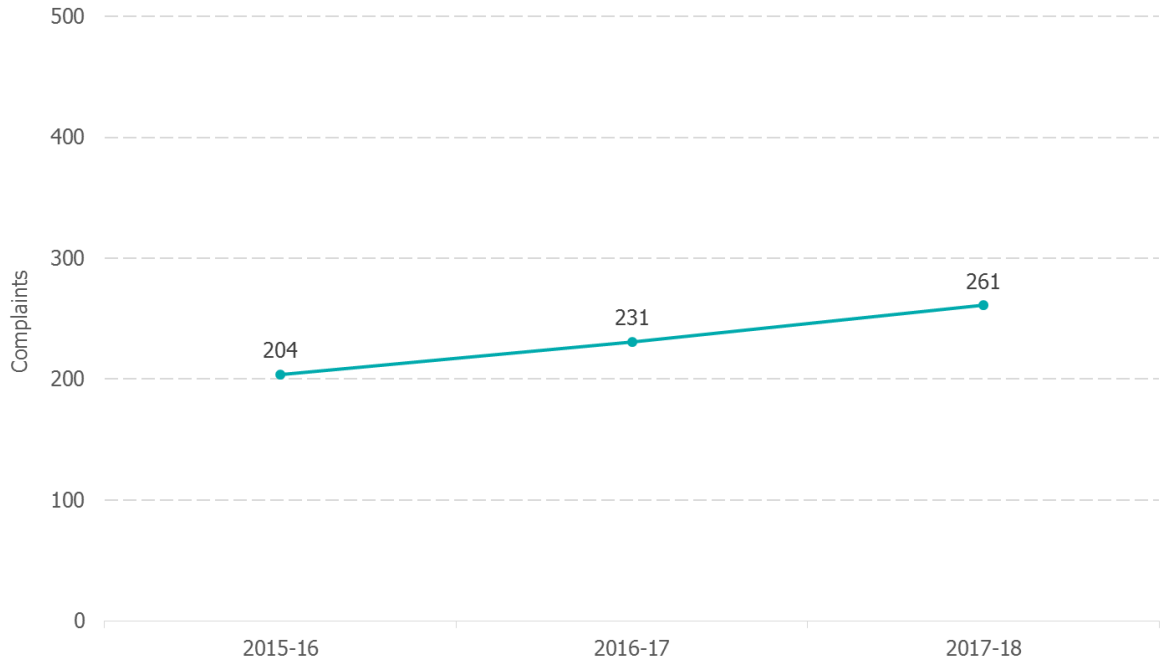
Complaints relating to wastewater odours are a key driver of wastewater complaints. Odour complaints have trended up slightly over the previous three years (Figure 5.10). To reduce wastewater odours, we:

- Add chemicals to wastewater across our wastewater network and wastewater treatment plants
- Carefully manage our wastewater treatment processes to ensure the right amount of dissolved oxygen
- Employ odour control technology at wastewater pump stations and wastewater treatment plants
- Routinely change filter media on odour control units throughout the wastewater network and at wastewater treatment plants, and
- Ensure new designs of wastewater pump stations and wastewater treatment plants employ odour control technology.

Specific investment in reducing odour includes:

- Installing new odour control units at wastewater pump stations located at Dora Creek and Belmont
- Replacing the filter media for eight wastewater treatment plant odour control beds, and
- Maintaining chemical dosing units across the wastewater network.

Figure 5.10 Odour complaints



Source: Hunter Water.

5.10 Greenhouse gas emissions

The total net greenhouse gas (GHG) emissions produced by Hunter Water for the past three financial years are shown in Figure 5.11. We are pursuing a range of energy efficiency projects and investing in renewable energy to reduce our operating costs and reduce greenhouse gas emissions.

Figure 5.11 Net greenhouse gas emissions

	2015-16	2016-17	2017-18
Net tonnes CO_2-equivalent	43,752	40,847	41,033

Source: Hunter Water.

5.10.1 Energy efficiency

Our energy efficiency initiatives are described in detail in Technical Paper 5.

5.10.2 Renewable energy

Our operations consume approximately 81 GWh of energy each year to transport and treat drinking water and wastewater. Our fossil-fuel based energy consumption represents around 70 per cent of our carbon footprint. We are proposing to invest $16 million in behind the meter solar photovoltaic installations. This will reduce electricity consumption and operational costs, and our greenhouse gas emissions. Behind the meter solar energy generation will lower our electricity bills and reduce our greenhouse gas footprint by 15%. We are investigating other ways to reduce our energy costs and reduce greenhouse gas emissions, including energy efficiency projects, power purchasing agreements and waste-to-energy options.

5.11 Recycled water

We deliver high quality recycled water to 14 non-residential customers across our area of operations including golf courses, farmers and heavy industry. In the near future, we plan to deliver recycled water to two residential recycled water schemes, located at Gillieston Heights and Thornton North. Recycled water and effluent reuse can benefit the community and the environment by:

- Reducing demand on the potable water system
- Reducing wastewater effluent that is discharged to the environment, and
- Providing a climate independent water source that improves our resilience to drought.

Hunter Water is investigating future recycled water projects and plans to undertake these where it is cost-effective to do so.

5.12 Other activities to manage our environmental impact

Environmental impact assessments

We undertake environmental impact assessments for the delivery of all new infrastructure.

Construction contractors must implement environmental management plans for all relevant contracts.

Research and development

We have a research and development committee to promote innovation and technical leadership.

We are also developing a research and development strategy.

Biodiversity offsets and stewardship

We have a biodiversity offset working group.

A biobanking agreement has been finalised with the Office of Environment and Heritage for land we own at the Hunter Regional Botanic Gardens.

Contaminated land management

We have a strategy for managing contaminated sites.

Actions include undertaking groundwater contamination assessments at some of our wastewater treatment plants, implementing improvements in the management of hazardous chemicals, and assessing contamination risks for new infrastructure.

Environmental incident investigations

We have procedures in place to respond to incidents and to notify appropriate authorities in the case of an incident.

Major incidents are formally investigated including undertaking root-cause analysis.

Bushfire management

Bushfires pose many risks to Hunter Water's employees, assets and water supply catchments.

We have a bushfire management plan, so that we are prepared, able to respond to, and able to recover from, a bushfire emergency.

Cultural heritage conservation

We maintain a heritage conservation register which contains 45 items including items of state and local heritage significance.

The Newcastle reservoirs (numbers 1 and 2) are listed on the State Heritage Register.

The heritage assets represent a rich history of water supply, wastewater and stormwater management in the region.

Climate change adaptation strategy

Climate change poses potential risks and opportunities to Hunter Water due to changes in the frequency, distribution, intensity and duration of climate-related events.

In order to improve business resilience and preparedness in relation to climate change, we are undertaking a comprehensive review of our climate change risk register.

Sustainable supply chain

We are developing a new sustainability strategy.

We are also working to identify opportunities to improve the sustainability of our procurement activities.

Box 13 - Seaham Weir modifications

Seaham Weir is a key component of the Grahamstown Dam scheme which provides 40 per cent of the drinking water used by Hunter Water customers. It provides a barrier between fresh water flowing down the Williams River and the salt water estuary, thereby enabling Hunter Water to harvest fresh water and pump it into Grahamstown Dam.

The Lower Hunter Water Plan (LHWP) sets out measures to ensure there is enough water to supply the needs of the Hunter Region while also recognising the needs of the environment. To meet the requirements of the LHWP, modifications to Seaham Weir are necessary to:

- Improve flow control; especially to improve environmental releases of water in low-flow conditions and to provide flows more similar to a river's natural flow, and
- Improve fish passage both upstream via the fishway and fish attraction flows, and downstream using the flow control gates.

Hunter Water has developed a concept design to achieve the required modifications. A 10:1 scale model of the design was constructed and hydraulically tested to optimise flow patterns required for fish passage.

The design includes installation of four new three-metre wide overshot gates and a new vertical slot fishway. One or more of the overshot gates will be lowered to release the required amount of water, greatly improving flow control and providing fish attraction flows. Construction is planned to be complete in 2021.

6. Quality drinking water

6.1 Drinking water quality management strategy

Hunter Water's obligations to provide safe, high quality drinking water stem from the Public Health Act 2010 (NSW), Public Health Regulation 2012 (NSW), Fluoridation of Public Water Supplies Act 1957 (NSW), Fluoridation of Public Water Supplies Regulation 2017 (NSW) and our Operating Licence 2017-2022.

Under the Operating Licence, Hunter Water is required to maintain and fully implement a Drinking Water Quality Management System (DWQMS) that is consistent with the Australian Drinking Water Guidelines (ADWG) Framework for Management of Drinking Water Quality and to the satisfaction of NSW Health.

Our drinking water quality management strategy comprises a number of strategic priority areas to ensure ongoing supply of safe and good aesthetic quality drinking water.

The strategy is underpinned by the multiple barrier approach to minimise the risk of poor drinking water quality. A high level description of the barriers in place and activities that we undertake to control risks across our water supply system are presented below.

Our strategic priority areas are discussed in section 6.3. These will guide drinking water quality management improvements at Hunter Water over the next few years.

Water sources

- Protection of drinking water catchments including rules and regulations that control the activities and developments that are allowed within catchments.
- Working closely with the community and stakeholders on land management and development to ensure that it occurs in a manner that is appropriate for a catchment.
- Undertaking works to prevent riverbank erosion, sediment build-up and to improve the turbidity of raw water. Pathogens are able to bond to particulates in turbid water and this can shield the pathogens from disinfection.

Water treatment

- Extensive treatment of source water at our water treatment plants through a variety of water treatment process steps including:
    - powdered activated carbon dosing
    - aeration
    - coagulation/flocculation
    - filtration
    - disinfection
    - pH correction
    - fluoridation
- Monitoring water quality parameters and critical limits at critical control points at treatment plants.

Water distribution

- Monitoring water quality parameters and critical limits at critical control points in the distribution network.
- Adding chlorine to treated water in the distribution network to ensure that the water continues to be disinfected through to the customers' tap.
- Preventing contamination in the distribution network by fully covering storage reservoirs and undertaking regular inspections to ensure that the integrity of the system is maintained.
- Backflow prevention measures in place to minimise the likelihood of backflow of potentially contaminated water from customers' properties into the water supply system.

People

- Safeguarding water quality through security measures to prevent unauthorised access to water storages, water treatment plants, clear water tanks and water network storage reservoirs.
- Undertaking maintenance in accordance with procedures that are designed to ensure that drinking water quality is protected.
- All Hunter Water employees receive water quality awareness training. Employees working more closely with drinking water undertake specialised training.

6.2 Verification monitoring and customer satisfaction

Verification of drinking water quality provides an assessment of the overall performance of the system and the ultimate quality of drinking water being supplied to consumers. This entails both monitoring drinking water quality and assessing consumer satisfaction (ADWG 2011).

Hunter Water undertakes verification monitoring for a wide range of drinking water characteristics. Internal targets have been defined to understand long term performance of each of the key water quality parameters against ADWG guideline values. An overview of the verification monitoring results for key drinking water quality parameters for the first two years of the current price period is provided in Table 6.1 and Table 6.2.

Table 6.1 Verification monitoring results for key public health analytes

			95th percentile of test results		
Analyte	**Unit of measure**	**ADWG health guideline value**	**2016-17**	**2017-18**	**Compliant**
Fluoride	mg/L	1.5	1.02	1.02	✓
Chlorine	mg/L	5	1.24	1.19	✓
Copper	mg/L	2	0.02	0.025	✓
Lead	mg/L	0.01	0.001	0.001	✓
Manganese	mg/L	0.5	0.011	0.013	✓
Trihalomethanes	mg/L	0.25	0.138	0.150	✓

Source: Hunter Water.

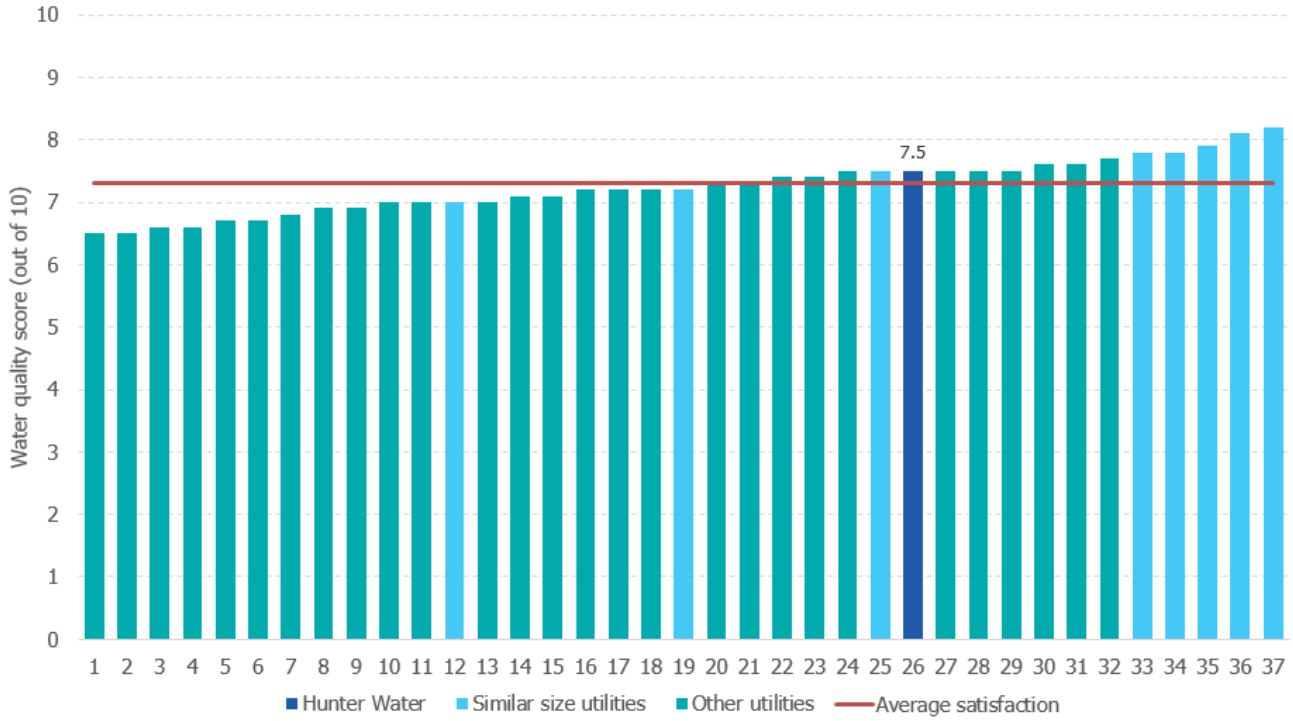
Table 6.2 Verification monitoring results for key aesthetic analytes

			12 month average test result		
Analyte	**Unit of measure**	**ADWG health guideline value**	**2016-17**	**2017-18**	**Compliant**
Iron	mg/L	0.3	0.026	0.023	✓
Aluminium	mg/L	0.2	0.057	0.047	✓
Copper	mg/L	1	0.006	0.008	✓
Zinc	mg/L	3	0.005	0.005	✓
Turbidity	mg/L	5	0.3	0.2	✓
True colour	mg/L	15	5	5	✓

Source: Hunter Water.

The National Customer Perceptions Survey conducted by the Water Services Association of Australia (WSAA) in 2017 showed that Hunter Water customers' satisfaction with water quality is above the average satisfaction for all water utilities (Figure 6.1). Hunter Water ranked 6 out of 9 similar sized utilities.

Figure 6.1 WSAA perceptions survey - customer's water quality satisfaction



Source: Water Services Association of Australia, 2017.

In Hunter Water's monthly automated survey, customers are asked the same question that was asked in WSAA's customer perceptions survey:[23]

Overall, how would you rate your satisfaction with the quality of water that is supplied to your home?

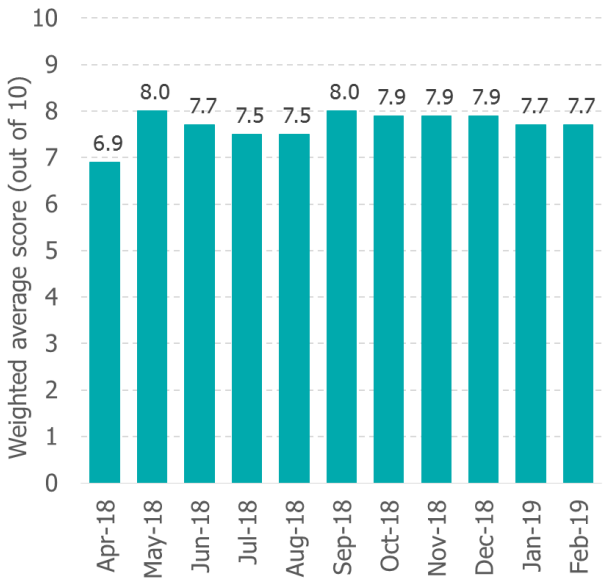
The results of the automated survey are similar to WSAA's national survey and indicate that customers are generally satisfied with the quality of water received (Figure 6.2).

Hunter Water has among the lowest level of water quality complaints in the major utilities cohort, as reported in the NPR (Figure 6.4). .

NPR indicator H3 measures the percentage of total population that is served within water supply system zones where compliance with the microbiological requirements of the water quality guidelines is met during the reporting year. Over the past five years, we have achieved compliance in all water supply system zones, covering 100 per cent of the total population served (Figure 6.3).

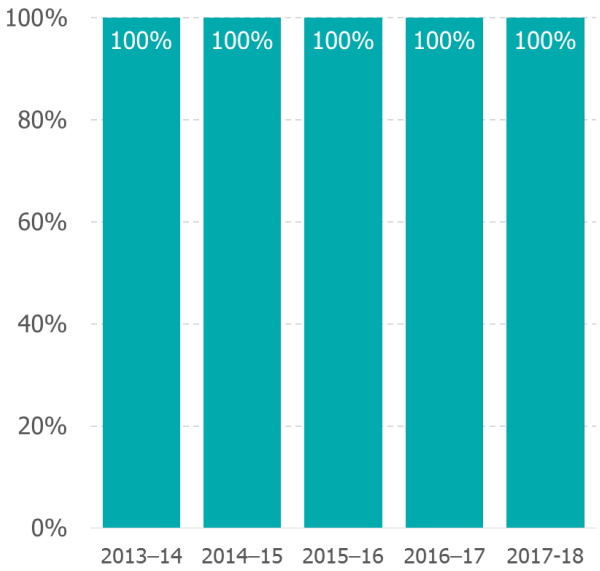
[23] Further details of our monthly automated survey are provided in Technical Paper 1.

Figure 6.2 Monthly water quality satisfaction scores from our automated survey



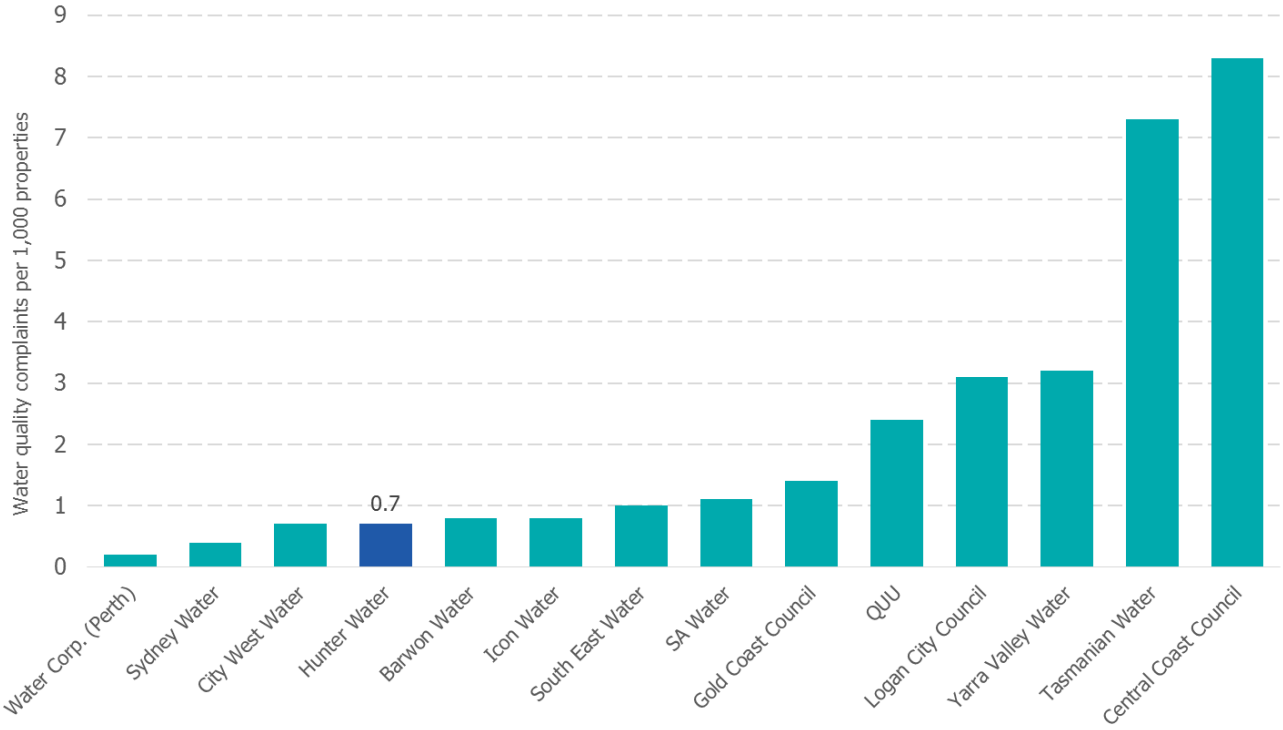
Source: Hunter Water.

Figure 6.3 NPR Indicator H3: Percentage of population where microbiological is compliance achieved



Source: Hunter Water.

Figure 6.4 National Performance Report 2017-18 - Water quality complaints (indicator C9)



Source: National Performance Report 2017-18.

6.3 Strategic priority areas

Hunter Water has identified priority areas that will guide drinking water quality management improvements over the next few years and ensure our drinking water management objectives are met. Priority areas are reviewed over time as the system develops, operating conditions change and other priorities are identified.

Strategic priority areas

- Drinking water management governance
- Catchment management
- Blue-green algae management
- Disinfection
- Network contamination prevention
- Manganese and discoloured water management
- Managing risks associated with emerging contaminants

6.3.1 Drinking water management governance

Hunter Water's DWQMS is consistent with the ADWG Framework for Drinking Water Quality Management. The DWQMS has a continual review and improvement approach to system governance. This helps identify and manage minor shortcomings and opportunities for improvement. Examples of some of the initiatives to improve system governance for drinking water quality management over the next few years include:

- Increasing awareness of drinking water quality management
- Improving the consistency of risk assessments
- Improving CCP performance monitoring
- Improving incident management processes, and
- Improving drinking water quality training.

6.3.2 Catchment management

The ADWG states that the most effective barrier to water contamination is protection of catchments to the maximum degree practicable. In doing so, operating treatment costs are reduced and costly capital upgrades to water treatment plants may be avoided. A number of drinking water catchment management activities initiatives are underway and proposed.

Key issues and initiatives

- Managing erosion in Seaham weir pool and other areas.
- Improving farm management practices, with a focus on properties located close to the Chichester, Paterson and Allyn Rivers. This involves reducing effluent loads and preventing cow/calf access to the river.
- Managing impacts of proposed and existing developments, for instance completing development assessments and environmental compliance inspections.
- Managing public access to catchments.

Box 14 - Tillegra Riparian Improvement Project

The Tillegra Riparian Improvement Project, currently underway, aims to improve source water quality by reducing microbiological risks and decreasing nutrient levels in Grahamstown Dam by creating an exclusion zone on either side of the Williams River using fencing and native trees.

The fenced exclusion zone will cover a 24km section of the river and in total, 150 hectares of land will be protected by the exclusion zone.

Protecting the riverbank will prevent cattle from entering the Williams River as well as preventing erosion and naturally filtering water entering the river. This will help to minimise degradation of water quality prior to the raw water entering Grahamstown Dam.

6.3.3 Blue-green algae management

Blue-green algae inhabit all natural surface waters and become a problem only when present in excessive quantities (known as blooms). Algal blooms are of concern to drinking water due to the toxins and taste and odour compounds that some species can produce. Managing nutrient inputs into source waters can help to reduce the frequency of blooms. Blue-green algal blooms have occurred periodically in Grahamstown Dam and Chichester Dam.

In the last year, Grahamstown experienced its largest ever algal bloom (October 2018) and Chichester Dam also experienced a significant event (December 2018). We are in the process of updating the algal prediction model for Grahamstown Dam to better understand future risks under various scenarios and potential actions to manage those risks.

The following barriers are in place at the WTPs for these two water sources:

- Powdered Activated Carbon (PAC) dosing. PAC is dosed into raw water upstream of the WTP and adsorbs toxins or taste and odour compounds released from algal cells, facilitating removal through settling and/or filtration.
- Settling and/or filtration removes algal cells, including any toxins or taste and odour compounds contained within the cell walls.
- Chlorination in treated water reservoirs provides an additional barrier for destruction of algal toxins.

6.3.4 Disinfection

Chlorine disinfection is used at water treatment plants to manage microbiological risks including bacteria, virus and some forms of protozoa. We are proposing to improve the effectiveness of the disinfection barriers at Grahamstown and Gresford water treatment plants by upgrading the plant.

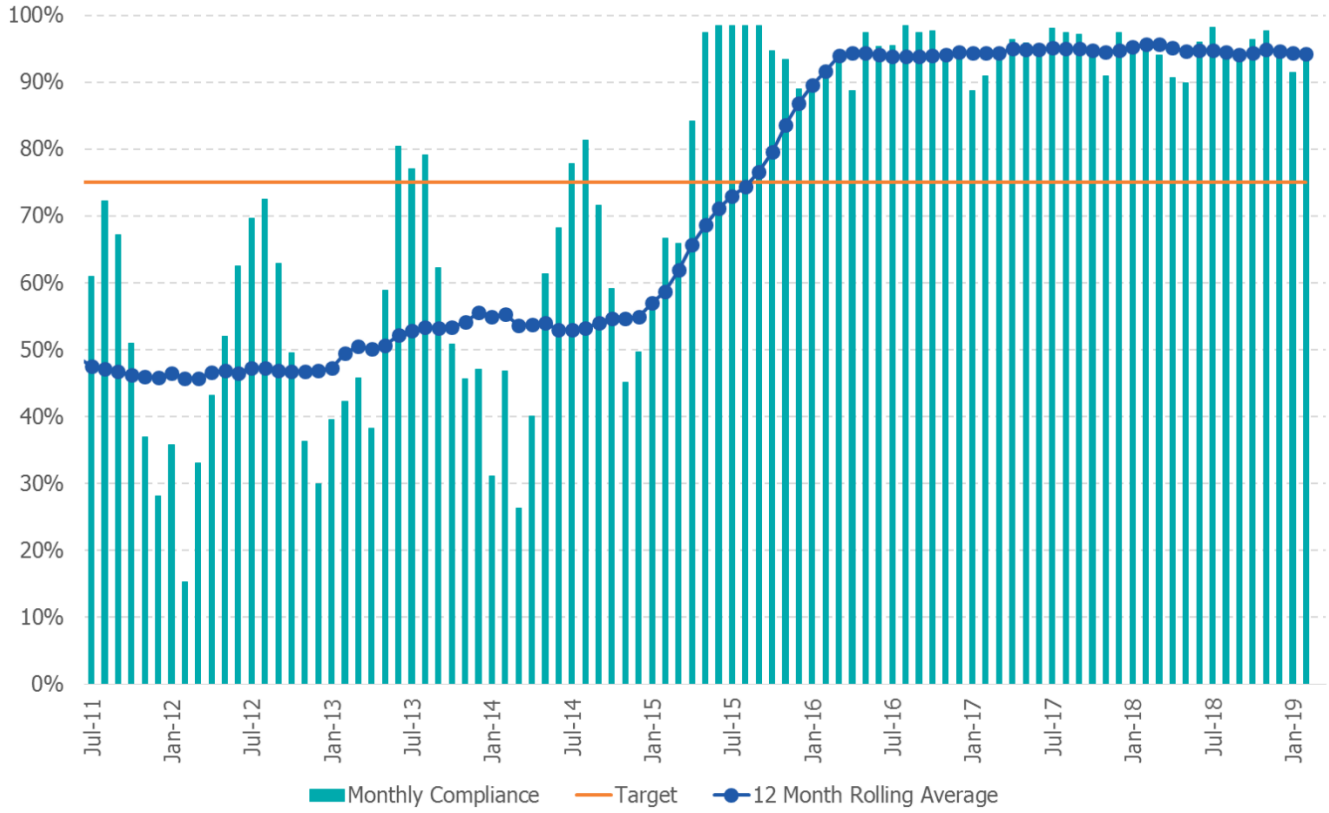
Chlorination is a very effective disinfectant and naturally breaks down. Maintaining a chlorine residual through the water network guards against any microbial contamination, due to re-contamination or regrowth, as the drinking water is distributed. Chlorine is added to the drinking water at various points in the distribution network including some reservoirs and network re-chlorination facilities. The amount of chlorine required to achieve agreed residuals in the distribution network can be influenced by many factors including water age and temperature.

There will be less chlorine residual, the:

- Longer the water stays in the system
- Further the water travels from the disinfection point, and
- Warmer the outside temperature.

A chlorine residual based performance target was agreed with NSW Health in 2014. The target requires that 75 per cent of customers receive water exceeding a chlorine residual of 0.2mg/L. Approximately 95 per cent of customers are typically provided with a chlorine residual that meets this minimum requirement (see Figure 6.5).

Figure 6.5 Estimated percentage (%) of population receiving free chlorine >0.2 mg/L



Source: Hunter Water.

Effective particle removal is also an important factor for maintaining an effective disinfection barrier. We are currently delivering an upgrade to Dungog water treatment plant to improve the particle removal efficiency of the filters and therefore ensure that any microbes that may be present in the raw water from the catchment are not able to proceed through the water treatment plant. The upgrade involves adding capability to divert filtered water away from the clear water storage when monitoring indicates that particle removal is not optimal. This will allow targeting of tighter water quality targets in relation to particle removal.

High levels of chlorine can lead to enquiries and complaints from customers relating to the taste, odour and aesthetics of drinking water. We receive a low rate of reportable complaints relating to the taste and odour of water (0.3 per 1,000 properties in 2017-18). [24]

[24] Hunter Water analysis.

Disinfection Optimisation Strategy (DOS)

The DOS consists of three stages, including:

- Stage 1 – increase chlorine doses at water treatment plants (Stage 1A), and upgrade existing network chlorinators and improve manual tablet dosing at reservoirs (Stage 1B)
- Stage 2 – increase chlorine dose at Dungog water treatment plant and provide chlorine dosing at additional reservoirs

Stage 3 – install additional network chlorinators

Hunter Water has completed Stage 1A and is currently implementing Stage 1B, which is due for completion in 2019-20.

Management of disinfection by-products is another key objective of the DOS.

Note: Disinfection by-products are further discussed in section 6.3.7.

6.3.5 Preventing network contamination

Contamination of drinking water once in the distribution network can potentially occur through reservoirs, cross-connections, standpipe use, installation of new mains, or poor control during repairs.

Key initiatives

- Improving preventative measures for construction procedures such as chlorination/super-chlorination, capping of stored pipes and water quality acceptance testing.
- Developing a risk-based approach to determining requirements around water quality acceptance testing.
- Developing standard operating procedures for hygiene practices.
- Improving training and competency in hygienic water main repair.
- Continuing to ensure that inspection officers are appropriately trained to identify, evaluate and rectify reservoir integrity issues.

Management of water carter operations is another priority area for Hunter Water. Approved operators may fill their water carts from Hunter Water's distribution network to supply water to a third party or re-supplying a different water zone of Hunter Water's system. Operators are required to maintain Quality Assurance Programs as approved by NSW Health. Hunter Water plans to improve existing processes and introduce new processes for ensuring water carters comply with their NSW Health-approved Quality Assurance Programs.

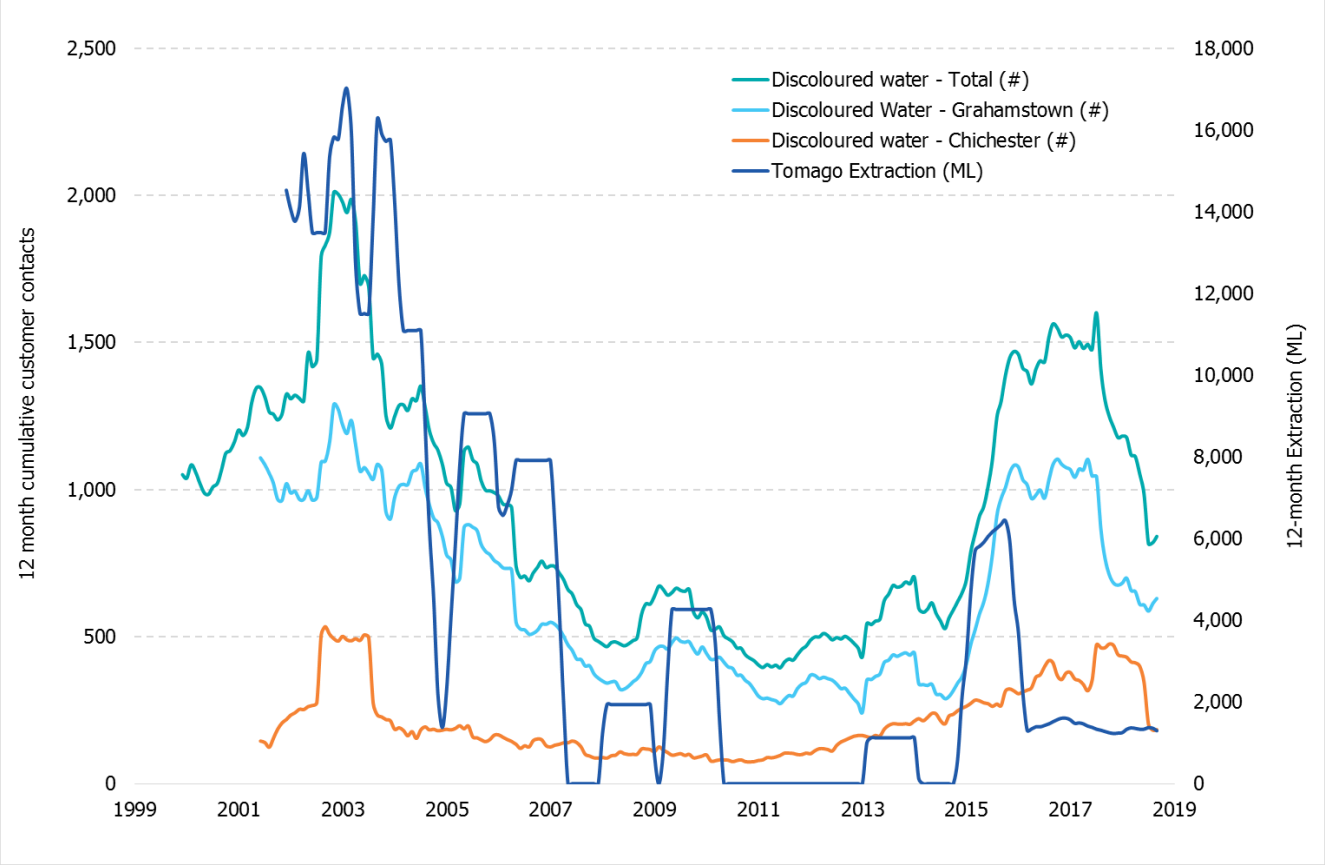
6.3.6 Manganese and discoloured water management

Manganese is a naturally-occurring metal present in source water that can be difficult to remove through water treatment processes. Elevated manganese levels are generally measured in source water extracted from Chichester Dam during warm seasons and from Tomago sandbeds.

Manganese-levels in the distribution network are consistently well below the ADWG health guideline value. However, even at a concentration of 0.02 mg/L manganese will form a coating on pipes that can slough off periodically as a black ooze causing a discoloured water event. To reduce the risks associated with manganese coating pipelines, the ADWG recommends that a discretionary target of 0.01 mg/L manganese be adopted at the treatment plant.

Grahamstown WTP routinely exceeds the discretionary target when the Tomago sandbeds water source is in use. In such cases, there are also increased discoloured water events (see Figure 6.6). There are also periods of increased manganese loading to Dungog WTP associated with in-dam processes at Chichester.

Figure 6.6 Discoloured water customer contacts and Tomago extraction



Source: Hunter Water.

We are investigating various improvement initiatives to reduce manganese loading from the Tomago sandbeds and Chichester Dam source water, such as:

- Investigating options for providing manganese removal capability in Grahamstown WTP when treating water sourced from the Tomago borefields
- Replacement of the Chichester Dam de-stratification system to improve mixing in the dam and reduce the amount of manganese released from sediments, and
- Undertaking pilot plant studies at Dungog WTP to provide manganese removal capability in the treatment process.

Initiatives to improve management of manganese once in the distribution network are also under investigation. These may include water main flushing and more novel approaches like ice pigging. We have previously trialled ice pigging techniques which involve cleaning a water pipe by pumping an ice slurry into the pipe and forcing it along the inside in order to remove sediment and other unwanted deposits. The deposits released from the water main are flushed out of the distribution network as part of the process.

6.3.7 Emerging contaminant management

Emerging contaminants (ECs) are defined as chemicals and pathogens that are new, or have not previously been detected, and/or where the risks to the environment and human health are poorly understood. ECs that may be relevant for Hunter Water include per- and poly-fluoroalkyl substances (PFAS), microplastics, engineered nanomaterials, pharmaceuticals and personal care products, antibiotic resistant bacteria, disinfection by-products and emerging pathogens including thermophilic amoeba.

The by-products of disinfection are formed by reaction between disinfectants used in the water treatment process and naturally occurring organic material from decaying vegetation and animal matter. Of these disinfection by-products, trihalomethanes (THMs) are produced in the highest concentrations. Currently, the ADWG include a guideline value of 0.25mg/L for total THMs. Guideline values elsewhere in the world are significantly lower by comparison (e.g. 0.08mg/L for total THMs in the United States). As international water quality regulation includes other disinfection by-products, it is likely that the ADWG will incorporate these compounds in the future.

By definition, ECs are generally not well understood relative to other well established drinking water quality risks. Changes in the regulatory requirements for ECs (particularly disinfection by-products), may have implications for one or more of Hunter Water's water supply systems and the potential to drive future expenditures.

6.4 IPART operational audit results for water quality

6.4.1 Drinking water quality

Our Drinking Water Quality Management System and implementation of the system is audited by an external independent specialist water quality auditor each year as part of IPART's operational audit. The 2017-18 operational audit was the first audit of Hunter Water's current Operating Licence (2017-2022) and was undertaken using IPART's new audit grade scale (Table 6.3). Audit performance under Hunter Water's previous Operating Licence (2012-2017) is provided in Table 6.4.

Table 6.3 Drinking water quality compliance - current Operating Licence (2017-2022)

Clause #	Operating Licence requirement	2017-18
3.1.1	Maintain Drinking Water Quality Management System	Compliant (minor shortcomings)
3.1.2	Fully implemented system	Compliant

Notes: Compliance grade definitions from *IPART Audit Guideline Public Water Utilities*, September 2018.

1. Compliant - Sufficient evidence is available to confirm that the requirements have been met.
2. Compliant (minor shortcomings) - Sufficient evidence is available to confirm that the requirements have been met apart from minor shortcomings which to date have not compromised the ability of the utility to achieve defined objectives or assure controlled processes, products or outcomes.
3. Non-compliant (non-material) - Sufficient evidence is not available to confirm that the requirements have been met and the deficiency does not adversely impact the ability of the utility to achieve defined objectives or assure controlled processes, products or outcomes.
4. Non-compliant (material) - Sufficient evidence is not available to confirm the requirements have been met and the deficiency does adversely impact the ability of the utility to achieve defined objectives or assure controlled processes, products or outcomes.
5. No requirement - There is no requirement for the utility to meet this criterion within the audit period.

Source: Hunter Water Corporation Operational Audit 2018, Report to the Minister by IPART, March 2019.

Table 6.4 Drinking water quality compliance – previous Operating Licence (2012-2017)

Clause #	Operating Licence requirement	2012-13	2013-14	2014-15	2015-16	2016-17
2.1.1	Maintain Drinking Water Quality Management System	Adequate	Adequate	Full	High	Adequate
2.1.2	Fully implemented system	Adequate	High	Full	High	Adequate

Notes: Compliance grade definitions from IPART, *Audit Guideline – Public Water Utilities*, May 2016.
1. Full compliance - Sufficient evidence to confirm that the requirements have been fully met.
2. High compliance - Sufficient evidence to confirm that the requirements have generally been met apart from very few minor shortcomings which do not compromise the ability of the utility to achieve defined objectives or assure controlled processes, products or outcomes.
3. Adequate compliance - Sufficient evidence to confirm that the requirements have generally been met apart from a number of minor shortcomings which do not compromise the ability of the utility to achieve defined objectives or assure controlled processes, products or outcomes.
4. Non-compliant - Sufficient evidence has not been provided to confirm that all major requirements are being met and the deficiency adversely impacts the ability of the utility to achieve defined objectives or assure controlled processes, products or outcomes.
5. No requirement - The requirement to comply with the licence condition does not occur within the audit period or there is no requirement for the utility to meet this assessment criterion.

Sources: Hunter Water Corporation Operational Audits, Reports to the Minister by IPART.

6.4.2 Recycled water quality

We also deliver high quality recycled water to 14 non-residential customers across our area of operations including golf courses, farmers and industry. In the near future, we plan to deliver recycled water to two residential recycled water schemes, located at Gillieston Heights and Thornton North. Recycled water services are provided according to our Recycled Water Quality Management System, which is also audited by IPART each year. Audit performance under the current Operating Licence (2017-2022) and previous Operating Licence (2012-2017) is shown below in Table 6.5 and Table 6.6, respectively.

Table 6.5 Recycled water quality compliance - current Operating Licence (2017-2022)

Clause #	Operating Licence requirement	2017-18
3.2.1	Maintain Recycled Water Quality Management System	Compliant (minor shortcomings)
3.2.2	Fully implemented system	Compliant

Note: Compliance grade definitions are as per Table 6.3.
Source: Hunter Water Corporation Operational Audit 2018, Report to the Minister by IPART, March 2019.

Table 6.6 Recycled water quality compliance – previous Operating Licence (2012-2017)

Clause #	Operating Licence requirement	2012-13	2013-14	2014-15	2015-16	2016-17
2.2.1	Maintain Recycled Water Quality Management System	Full	High	Full	High	Adequate
2.2.2	Fully implemented system	Adequate	High	High	Adequate	Adequate

Note: Compliance grade definitions are as per Table 6.4.
Sources: Hunter Water Corporation Operational Audits, Reports to the Minister by IPART.

7. Abbreviations

Acronym	Term
ADWG	Australian drinking water guidelines
AIR	Annual information return
CCP	Critical control point
CCTV	Closed-circuit television
CO_2	Carbon dioxide (gas)
CTGM	Chichester trunk gravity main
DOS	Disinfection optimisation strategy
DWQMS	Drinking water quality management system
EC	Emerging contaminant
ELWC	Economic level of water conservation
EMS	Environmental management system
EPA	Environment Protection Authority (NSW)
EPL	Environment protection licence
ERM	Enterprise risk management
EWON	Energy & Water Ombudsman NSW
FAQ	Frequently asked question
GHG	Greenhouse gas
GIS	Geographical information system
GL	Gigalitres (i.e. 1,000,000,000 litres)
GWh	Gigawatt-hours (equal to 1,000,000 kilowatts of power output or consumption for a period of one hour)
IPART	Independent Pricing and Regulatory Tribunal (NSW)
kL	Kilolitre (i.e. 1,000 litres)
kV	Kilovolt (i.e. 1,000 volts)
LHWP	Lower Hunter Water Plan
mg	milligrams (ie. one-thousandth of a gram)
NPR	National Performance Report
OEH	Office of Environment and Heritage (NSW)
PAC	Powdered activated carbon
PFAS	Per- and poly-fluoroalkyl substances
PLC	Programmable logic controller

Acronym	Term
PRP	Pollution reduction program
SCADA	Supervisory control and data acquisition (monitoring system)
SIR	Special information return
THMs	Trihalomethanes
UV	Ultra-violet (light)
WSAA	Water Services Association of Australia
WTP	Water treatment plant
WWTP	Wastewater treatment plant

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